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Thermococcus thioreducens' Inorganic Pyrophosphatase Purification

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The Effect of Familiar Location on Upper Body Strength Testing Using the 1RM Bench Press

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***Abstract* –** Scientific literature has indicated that academic performance improves in the same environment that it is learned in. This implies that memory depends on physical context cues, which refers to the physical surroundings in which an event occurs. No literature thus far has shown how environmental cues could relate to performance in terms of upper body muscular strength. The purpose of this study was to see how the environmental reinstatement effect affects upper body strength. It was hypothesized that participants would achieve a higher one rep max (1 RM) score in the location they are familiar with than the location they are unfamiliar with. Twenty university students (18-30 years old) were assessed in upper body strength using the 1 RM bench press test. Students were split into two groups, based on the location: Spragins Hall (SH) and the University Fitness Center (UFC). One session took place in their familiar location and the other in the non-familiar location, with one week apart. The order of testing location was randomized, and the best 1 RM score for the participant was recorded. There were no significant differences in the 1 RM score within the two locations ($p = .897$). However, both groups did achieve a higher average 1 RM score in their familiar location. Although the results were nonsignificant, this knowledge can help in professional and non-professional sports testing. This information allows us to be confident that upper body strength testing can be administered in a setting unfamiliar to the test takers, and it should not be detrimental to their score.

I. Introduction

Scientific literature has indicated that academic performance improves in the same environment that it is learned in. Smith (1979) calls this the 'environmental reinstatement effect.' His research confirmed that environmental context information is a source of retrieval cues useful for recalling information learned in that context. This implies that memory depends on physical context cues, which refers to the physical surroundings in which an event occurs, including location, size of room, objects and persons present, odors, sounds, temperature, lighting, and so on. In addition, Franks, et al. (2000) posits that individuals demonstrate transfer-appropriate processing, which is the ability of individuals to be more efficient in performing a task on a stimulus when there has been previous experience in performing that same task on the same stimulus.

Though there have been similar tests for other components of fitness, such as reaction speed and coordination (Heinen, et al., 2017), no literature thus far has shown how environmental cues could relate to performance in terms of upper body muscular strength. Research in sport often shows the effects of a 'home advantage' (Pollard & Gomez, 2012). 'Home advantage' is the consistently better performance seen by teams in various sporting contexts when playing at home than playing away (Neave & Wolfson, 2003). According to Neave and Wolfson (2003), one explanation for this phenomenon could result from familiarity with the home venue, leading to increased spatial awareness. Therefore, using this theory could result in a 'home advantage' in upper body muscular strength testing.

In the field of strength and conditioning and sports science, the ability to perform an accurate fitness test is important for coaches and researchers. A fitness test allows the professional to accurately prescribe a fitness program (Haff & Triplett, 2008). In order for the program to be accurate and to encourage the client to achieve their full potential in a safe way, we need the fitness test to be as accurate as possible. Therefore, if we find that there is a similar correlation in terms of upper body strength and environmental cues, then this study could be used to get more accurate results within exercise prescription and fitness testing.

According to government statistics, there are 36,540 health clubs and fitness centers in the USA (Statista, 2016). In addition to this, the American College of Sports Medicine (ACSM) Health and Fitness Journal has found an increase in the trend of fitness activities (Thompson, 2014). This shows how much the health and fitness industry has grown. With such a substantial volume of people engaging in fitness, it is vital that they have an appropriate exercise prescription that is safe for them to follow. By having more information on the validity and reliability of the 1 RM testing for upper body bench press, we can help this population receive maximum benefits from training while ensuring safety. The 1 RM is defined as the maximum amount of weight that an individual can lift for one repetition (Haff & Triplett, 2008). This is the most common way of identifying upper body strength. This study benefits the population by providing information about the relationship between the environmental spatial cues and the outcome of their performance, which can help develop training programs to enhance their ability to achieve muscular strength. It also benefits the population to provide a safe 1 RM test and to present the participants with their score.

The purpose of this study was to see how the environmental reinstatement effect impacts upper body 1 RM scores. The issue being investigated was whether individuals would achieve a higher 1 RM value in a setting that was familiar to them or in a setting that was unfamiliar to them. When an individual knows their 1 RM score, it can be used to calculate a target set and repetition quantity in order to get the best results out of training.

According to Smith (1979), individuals may attend to their environment in a more anxious way in novel situations, which could manifest as a performance decrement. His more recent meta-analysis showed that environmental context effects are reliable and the use of non-contextual cues during learning and testing can reduce the effect of environmental manipulations (Smith & Vela, 2001). Therefore, with support from previous literature, we hypothesized that upper body 1 RM strength would be greater in the location that was familiar to the participant than one that they had never trained in.

II. Part 2

Participants

Our sample size consisted of 20 participants (males = 11, females = 9) from the university community divided into two groups. One group consisted of student-athletes who routinely train at Spragins Hall (SH). The other group consisted of university students who routinely train at the University Fitness Center (UFC). They had experience in a 1 RM bench press test, participated in regular resistance training (muscular strengthening/endurance activities 3-5 times a week), and had taken part in a regular resistance training schedule for at least three months prior to the data collection, which added to the reliability of the study (Riiti-Dias, et al., 2011). The inclusion criteria were monitored through screening upon application in order to participate in the research. By using this population, we helped educate the participants on the procedures of the 1 RM test protocol and presented them with their 1 RM value, so they could better prescribe their exercise protocols for the future.

Measurements/ Instrumentation

Our instruments included the equipment needed for a bench press exercise. An Olympic bar, standard weight plates, and a bench that participants laid on were utilized. All of these instruments had high validity and reliability (ICC = 0.997) (Goodman, et al., 2008). According to Levinger, et al. (2009), "The test-retest reliability of the 1 RM demonstrates high intra-class correlation coefficients (ICC > 0.99)." Levinger, et al. (2009) goes on to say that the 1 RM test is increasingly gaining acceptance as the gold standard for assessing muscle strength. We measured 1 RM in terms of kilograms to the closest tenth of a kg.

Procedures

First, we selected participants based on training location (SH or UFC). We advertised our study by hanging flyers around campus and by asking individuals who regularly exercise at both locations. Once recruited, participants were sent an email with a set of instructions, and we arranged a day and time for them to come participate in a familiarization session. The familiarization session consisted of the participants meeting us at the location of testing, going over procedures, allowing them to ask any questions, and giving them the forms to sign.

The instructions informed the participants to abstain from exercise 48 hours prior to the test, including the day they came in for the test. Participants were asked to record the food they had eaten 48 hours prior to the test on the diet log, so it could be repeated for the next test. The instructions also asked them to record the exercise they had participated in two days prior to abstaining from exercise for the test, so they could try to mimic those exercises before the next test. Lastly, the instructions explained what would take place on the day of the test, the instructions for the 1 RM test, the benefits of the test, and the risks of the test.

Before the day of the test, we randomized whether participants would test in their familiar or unfamiliar setting first. On the day of the test, we had participants come in and engage in a quick non-weight bearing warm up. After this, NSCA guidelines for 1 RM testing were followed (Haff & Triplett, 2008). These guidelines allowed the participant three attempts to warm up with a low weight on the bar and then five attempts to achieve their 1 RM score.

One week later, participants reported to the other setting and repeated the 1 RM procedures. We encouraged participants to continue regular sleeping patterns. This allowed us to see if there were any outside factors for a potential difference in scores. We also tested participants at the same time of day to avoid the confounding effects of metabolic factors.

Study Design

Performing the 1 RM protocol from previous studies (Levinger, et al., 2009, Headley, et al., 2011), we assessed the values using a within-subjects design to see whether there was a difference in muscular strength performance in familiar and unfamiliar locations. This experiment utilized quantitative data by objectively measuring an individual's 1 RM score. This was a quasi-experimental design due to the absence of a control group. We had a within-subjects design as the participants were being compared to themselves and we utilized a cross-sectional approach by measuring individuals at two separate times.

III. Statistical Analysis

An analysis of variance (ANOVA) was used to compare the means of the two sets of data for the groups. The ANOVA has been used in similar studies to analyze results such as measuring the effect of competition location on individual athlete performance and psychological states (Bray & Martin 2003), the ability to recall a list of words in the same environmental context (Smith 1979), the reliability of the 1 RM strength test for untrained middle-aged individuals (Levinger, et al., 2009), and the contribution of visuo-spatial factors in representing a familiar environment (Meneghetti, et al., 2017). The data were analyzed using SPSS (v23, SPSS Inc., Chicago, IL). A univariate two-way ANOVA with the session and group being random factors and the 1 RM score being the dependent variable was analyzed to determine significance ($p < 0.05$) and to assess the means.

IV. Results

A total of 10 participants from SH (Age = 21.6 ± 1.43 years, height = 175.744 ± 13.87 cm, weight = 73.678 ± 11.87 kg; males = 4, females = 6) and 10 participants from the UFC (Age = 23.2 ± 2.69 years, height = 176.75 ± 6.12 cm, weight = 78.984 ± 9.43 kg; males = 7, females = 3) completed the study (**Table 1**). The groups were not significantly different for height and weight ($p \geq .117$), although there was a significant difference between groups for age ($p = .024$). The interaction between group and session were non-significant and had a low effect size ($F = .020$; $p = .887$; $\eta^2 = .001$). There was no significant difference for session, lifting in a familiar environment compared to a non-familiar environment ($F = .017$; $p = .897$; $\eta^2 < .001$). There was also no significant difference in 1 RM performance between groups, although there was a medium effect size ($F = 2.663$; $p = .111$; $\eta^2 = .069$).

The mean 1 RM for the SH group in their familiar location was higher than the mean 1 RM in their unfamiliar location (**Table 2**). We also found higher mean 1 RM scores for the UFC group testing in their familiar location than in their unfamiliar location.

Group	Age (years)	Height (cm)	Weight (kg)
Spragins	21.6 ±1.43	175.744 ± 13.87	73.678 ±11.87
UFC	23.2 ±2.69	176.75 ± 6.12	78.984 ± 9.43

Table 1. *Participant Characteristics Mean* (±SD)

Group	1 RM in Familiar Location (kg)	1 RM in Unfamiliar Location (kg)
Spragins	60.9 ± 9.1	60.773 ± 9.1
UFC	76.9 ± 9.1	74.4 ± 9.1

Table 2. *Average one repetition maximum (1RM) for Spragins and UFC group in kilograms (kg)* (±SD)

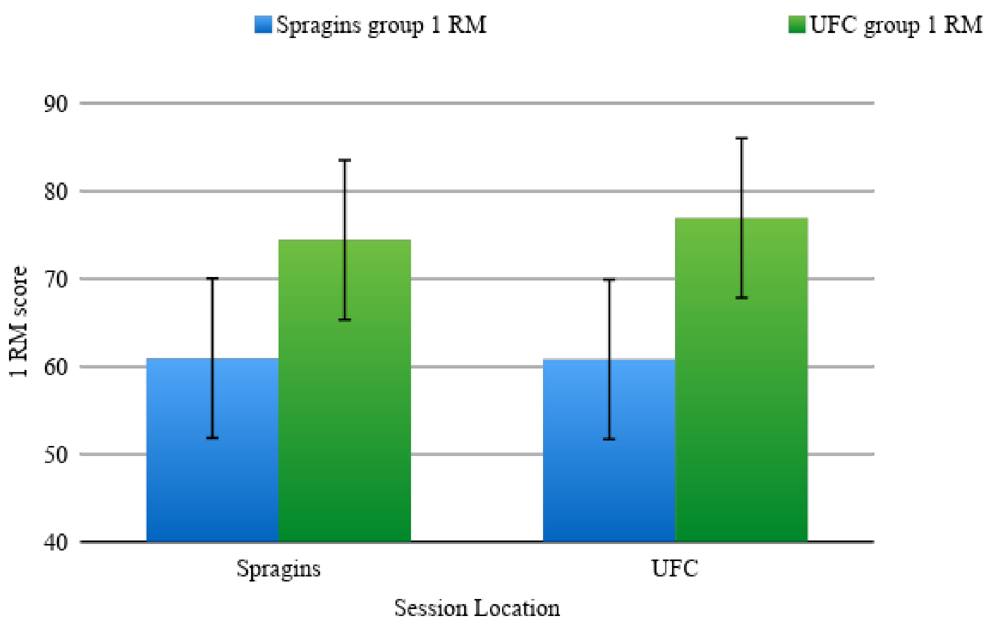

Figure 1. *Average one repetition maximum (1RM) values for Spragins and UFC group in kilograms (kg)*

V. Discussion

The purpose of this study was to determine whether performing a 1 RM test in a familiar environment-an environment in which individuals usually weight train in-would yield higher upper body strength test scores than an environment that is unfamiliar – one which they had never trained in. The hypothesis was that participants would attain higher 1 RM scores in the familiar environment versus the unfamiliar environment. The results did not support this hypothesis with statistical significance. However, there were differences in the participants' means in the familiar and unfamiliar environments. The mean scores show that student-athletes who are accustomed to weight training in SH had higher 1 RM scores when tested in their familiar environment than their unfamiliar environment. Furthermore, the results show that participants who were familiar with the UFC showed higher 1 RM scores in their familiar environment compared to performance when being tested in their unfamiliar environment. These results could indicate that participants were more comfortable lifting in their familiar environment. The student-athletes' scores from the SH group were .18% (0.2 kg) higher in their familiar environment, and the participants' scores from the UFC group were 3.21% (2.5 kg) higher in their familiar environment. This could suggest that the student athletes lifting at SH were less affected by the changes in the environment.

One potential rationale for the SH group being less affected by changes in the environment could be that athletes may be more resilient to change when performing in different environments because they do it on a regular basis. This is a skill necessary for athletes playing away games.

Our results also could demonstrate that being around similar stimuli may have helped them lift a heavier weight. Franks, et al. (2000) stated that transfer appropriate processing takes place with an individual being able to perform better in a similar environment due to familiarity. Other research has shown that it could also be linked to testosterone levels. Neave and Wolfson (2003) explain that testosterone has been linked to dominance and competitiveness in humans. In their study, they found that male soccer players had significantly higher levels of salivary testosterone in their system when performing at home versus performing away. This could be a possible explanation of the higher mean 1 RM scores of our subjects in their familiar environments, since it is where they are used to training. However, interpretations cannot be inferred due to the use of both genders in the current study and the use of only males in Neave and Wolfson's (2003) study. It would be beneficial for future research to investigate this effect on females. Consistent with the current study, Bray and Martin (2003) also did not find a significant difference ($p > 0.05$) in familiar versus unfamiliar environments. They hypothesized that when competing at home, skiers would perform better than away due to more positive mood states, higher confidence levels, and less anxiety before the game. However, they found that there was no difference in psychological state anxiety in skiers when at home or away competing.

Alternatively, the study carried out by Heinen, et al. (2017) found significant results when testing gymnasts' ability to use perceptual information for a strategy to time and regulate a movement in an event. Similar to our study, their results are intended to help coaches develop training programs to help athletes utilize this information when in unfamiliar environments during training and competition. Although we saw scores improve slightly from the first to the second session, the two sessions were not statistically significantly different ($p = .927$). This indicates that the order of testing of familiar or non-familiar first did not significantly affect the results of this study.

Limitations of this research include a small sample size. Due to the time frame and location of recruitment, we were limited in the number of subjects recruited. Future research should consider obtaining a larger sample size in order to test for more significant results. A second limitation involves controlling for sleep. Although participants were encouraged to keep a consistent sleep pattern between the testing days, this was not recorded. Antunes, et al. (2017) found that individuals who had seven or more hours of quality sleep presented better performance during an incremental Wingate test with higher values of maximum power output ($p = .043$), maximal aerobic power ($p = .034$), and lower values of maximum heart rate ($p = .01$), compared to individuals who lad less than seven hours of sleep. Future research could control for sleep to ensure this does not impact the results. A third limitation could be the amount of weight that we were able to place on the bench press bar. We were only able to increase the amount of weight by 1.1 kg at the least amount, so if a subject wanted to only increase the weight by .05 kg, there was no way to do this. So, the subject either had to keep the smaller weight that they had already achieved, or they had to increase it by more than what they wanted to try to lift, which resulted in a failed attempt most of the time. It would be beneficial for future research to consider equipment that allows the weight to be manipulated by the smallest amount possible in order to test for more significant results.

VI. Conclusion

The results of this study indicate that testing in an unfamiliar environment might result in slight decreases in 1 RM tests scores for the upper body bench press. This could be taken into consideration in future fitness testing in professional and college sport environments. If athletes are tested in the same location in which they train, they could yield higher, more accurate results which could better represent the athlete. However, the differences were very minimal from this study, so professionals can be fairly confident that testing in an unfamiliar environment could provide accurate test results as well.

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References

Antunes, B., Campos, E., Parmezzani, S., Santos, R., Franchini, E., & Lira, F. (2017). Sleep quality and duration are associated with performance in maximal incremental test. *Physiology & Behavior,* 177, 252–256.

Bray, S. R., & Martin, K. A. (2003). The effect of competition location on individual athlete performance and psychological states. *Psychology of Sport and Exercise*, 4(2), 117-123

Franks, J. J., Bilbrey, C. W., Lien, K. G., & McNamara, T. P. (2000). Transfer-appropriate processing (TAP). *Memory & Cognition*, 28(7), 1140-1151.

Goodman, C. A., Pearce, A. J., Nicholes, C. J., Gatt, B. M., & Fairweather, I. H. (2008). No difference in 1 RM strength and muscle activation during the barbell chest press on a stable and unstable surface. *The Journal of Strength & Conditioning Research*, *22*(1), 88-94.

Haff, G. G., Triplett, N. T. (2008). Essentials of Strength Training and Conditioning. Champaign, IL: *Human Kinetics.*

Headley, S. A., Henry, K., Nindl, B. C., Thompson, B. A., Kraemer, W. J., & Jones, M. T. (2011). Effects of Lifting Tempo on One Repetition Maximum and Hormonal Responses to a Bench Press Protocol. *Journal of Strength and Conditioning Research*,25(2), 406-413. doi:10.1519/jsc.0b013e3181bf053b

Heinen, T., Brinker, A., Mack, M., & Hennig, L. (2017). THE ROLE OF POSITIONAL ENVIRONMENTAL CUES IN MOVEMENT REGULATION OF YURCHENKO VAULTS IN GYMNASTICS. *Science of Gymnastics Journal*, 9(2).

Levinger, I., Goodman, C., Hare, D. L., Jerums, G., Toia, D., & Selig, S. (2009). The reliability of the 1 RM strength test for untrained middle-aged individuals. *Journal of Science and Medicine in Sport,*12(2), 310-316. doi:10.1016/j.jsams.2007.10.007

Meneghetti, C., Muffato, V., Toffalini, E., & Altoè, G. (2017). The contribution of visuo-spatial factors in representing a familiar environment: The case of undergraduate students at a university campus. *Journal of Environmental Psychology,* 54, 160-168.

Neave, N., & Wolfson, S. (2003). Testosterone, territoriality, and the “home advantage.” *Physiology & Behavior,* 78(2), 269–275. https://doi.org/10.1016/S0031-9384(02)00969-1

Number of gyms in the US (health/fitness center) 2000-2016 | Statistic. Retrieved March 22, 2018, from https://www.statista.com/statistics/244922/us-fitness-centers-und-health-clubs/

Pollard, R., & Gómez, M. A. (2012). Comparison of home advantage in mens and womens football leagues in Europe. *European Journal of Sport Science*,14(Sup1). doi:10.1080/17461391.2011.651490

Riiti-Dias, R. M., Avelar, A., Salvador, E. P., & Cyrino, E. S. (2011). Influence of Previous Experience on Resistance Training on Reliability of One-Repetition Maximum Test. *Journal of Strength and Conditioning Research,*25(5), 1418-1422. doi:10.1519/jsc.0b013e3181d67c4b

Smith, S. M. (1979). Remembering in and out of context. *Journal of Experimental Psychology: Human Learning and Memory*, 5(5), 460.

Smith, S. M., & Vela, E. (2001). Environmental context-dependent memory: A review and meta-analysis. *Psychonomic bulletin & review*, 8(2), 203-220.

Thompson, W. R. (2014). Worldwide Survey Reveals Fitness Trends for 2015. *ACSMs Health & Fitness Journal,*10(6), 8-14. doi:10.1249/01.fit.0000252519.52241.39