International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Impact of Visualization Technique on Cortisol Levels in National Level Table Tennis Players

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Abstract
This study aimed to investigate the effectiveness of visualization techniques in reducing stress levels among National-Level male Table Tennis players. The sample consisted of 20 players, evenly divided into an experimental group (n=10) and a control group (n=10). Over a twelve-week period, the experimental group engaged in visualization training three days per week, while the control group received no such intervention. Stress levels were assessed through serum cortisol measurements taken before and after the intervention. Analysis of Covariance (ANCOVA) was employed to compare post-intervention cortisol levels between the two groups, with pre-test cortisol levels included as a covariate to control for baseline differences. The results demonstrated that visualization training significantly reduced cortisol levels in the experimental group compared to the control group, indicating that visualization can be an effective technique for stress regulation in high-performance athletes. These findings suggest that incorporating visualization practices into athletic training regimens could enhance athletes' stress management and overall performance.

Keywords: Visualization, Cortisol, Stress, Serum

Introduction

Psychological skills are critical in enhancing physiological conditions, particularly in sports, exercise, and rehabilitation. Mental skills assist individuals in maintaining focus during workouts or competitions, resulting in better technique execution and performance (Rothlin et al., 2016). Psychological skills can help to reduce stress and anxiety, which can have a negative impact on physiological responses such as heart rate and muscular tension. Individuals with psychological skills are better able to set and maintain achievable goals. This encourages consistent effort and dedication to training regimens, resulting in improved physiological outcomes. Mental toughness promotes resilience, which allows people to deal with setbacks and injuries. A positive mindset can help with recovery and general well-being. Psychological strategies can assist individuals in managing and tolerating pain, allowing them to overcome physical obstacles and improve performance. Understanding and improving the relationship between mind and body can benefit one's overall health. Visualization is one of the psychological interventions used in this study to determine its impact on the body's cortisol level and whether the use of this technique helps the players regulate their stress levels.

Visualization Technique involves imagining sensory experiences that resemble the actual event (Suinn, 1997). It is widely used in psychology, sports, and wellness to improve performance, reduce anxiety, and promote relaxation. Visualization can improve stress levels, including cortisol (Nicolson et al., 2020).

Athletes who use visualization techniques have lower levels of pre-competition anxiety and stress, which may correlate with lower cortisol levels (Cumming J, & Williams S, 2012). Mental imagery, or visualization, can help reduce anxiety and stress among athletes. By engaging in positive visualization techniques, athletes can create mental scenarios that promote relaxation, which may help lower cortisol levels (Vealey R.S, 2007)

Cortisol is a steroid hormone produced by the adrenal glands, which is found on top of the kidneys. Cortisol regulates metabolism by influencing how the body uses fats, proteins, and carbohydrates. It also has anti-inflammatory properties that help regulate the immune response. Cortisol, known as the "stress hormone," is released in response to stress, especially during the "fight or flight" response. When the hypothalamus detects a threat, it signals the pituitary gland to release adrenocorticotropic hormone (ACTH), which stimulates the adrenal glands to release cortisol. Elevated cortisol levels can boost energy and focus, allowing the body to respond to immediate challenges. Chronic stress, on the other hand, can cause consistently high cortisol levels, which can lead to a variety of health problems, such as weight gain, high blood pressure, sleep disturbances and weakened immune response.

The aim of this study was to identify whether the psychological intervention used (Visualization technique) helped in regulating the cortisol levels of the Table Tennis players.

Objective

To assess whether Visualization training has helped the experimental group in regulating their cortisol level as compared to the control group.

Hypothesis

There will be no significant difference between the control and the experimental groups' cortisol level post the Visualization training.

Method

Sample

An academy was selected in Guwahati city based on convenience. A simple random technique was used in the selection of the sample (lottery method). The sample of the study consisted of 20 National level Table Tennis players. Male players, aged between 19-25 years and willing to give consent were included.

Procedure

Prior to the beginning of the current research, an academy was selected in Guwahati city according to convenience sampling. Permission was then taken from its Head Coach for the conduction of the study. 20 male players were selected by lottery method using simple random sampling technique and were equally divided into two groups- control group and experimental group. Those selected were explained the nature and objectives of the study. After that, the players along with their parents were asked to give consent and only after getting their consent to participate in the study they were assessed with a demographic datasheet. Following that, all 20 players underwent a serum cortisol test performed by a lab professional in the stadium itself. A twelve-week Visualization training program was conducted for 30 minutes three days a week for the experimental group. Post the intervention program, the cortisol level of both groups was again tested through a blood test. Obtained data were analyzed in the SPSS software system.

Training Intervention

The visualization training consisted of three phases:

1. Relaxation: The first phase focused on using breathing techniques to calm the mind and the body of the players.
2. Visualization of Videos and Photos: After reaching a certain level of calm and relaxation, the players were asked to watch videos and photos of themselves and elite players to identify areas for improvement.
3. Mental Rehearsal: Players in the final phase mentally practiced correcting their mistakes based on the visual feedback they received in the previous phase.

Statistical Analysis

To determine the homogeneity of the variances, Levene's test was used. ANCOVA was then used to compare the experimental group and the control group, with pre-test scores as a covariate.

Results

To determine the homogeneity of variances, Levene's test of Equality was used. The test yielded a p-value of 0.341, greater than 0.05 as shown in Table No 1. This indicated that the assumption of variance homogeneity has been met. The post-test scores have equal variances across groups.

Table No 1: Levene's Test to determine homogeneity of variances

Levene's Test of Equality of Error Variances	
F	Sig.
.956	.341

Table 2 showed the mean Post-Test score to be higher for the Visualization group (M = 5.70) compared to the Control group (M = 4.30). The standard deviations however were relatively similar (Visualization Group = 2.263, Control Group = 2.003) showing that the variability within each group is comparable.

Table No 2: Differences in post test scores

Descriptive Statistics			
Groups	Mean	Std. Deviation	N
Visualization Group	5.70	2.263	10
Control Group	4.30	2.003	10

The ANCOVA results indicate a significant effect of group membership (Visualization vs. Control) on post-test scores, controlling for pre-test performance F (1, 17) = 23.547, p < .001, partial η^2 = 0.581, suggesting that visualization training positively impacted post-test outcomes. The pre-test scores also significantly predicted post-test scores, F (1, 17) = 135.319, p < .001, partial η^2 = 0.888, indicating that initial performance was a strong predictor of final performance. The model explained 90% of the variance in post-test scores. Adjusted R^2 = 0.889, showed a high overall fit. The intercept was not significant, p = 0.841, indicating that the baseline score did not contribute to the model independently. These results

collectively demonstrate that visualization training had a substantial positive effect on performance, even when accounting for pre-test scores.

Table No 3: ANCOVA for the two groups on Cortisol levels

Tests of Between-Subjects Effects						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	82.826[a]	2	41.413	76.740	.000	.900
Intercept	.022	1	.022	.042	.841	.002
PreTest	73.026	1	73.026	135.319	.000	.889
Groups	12.707	1	12.707	23.547	.000	.581
Error	9.174	17	.540			
a. R Squared = .900 (Adjusted R Squared = .889)						

Discussion

The results demonstrated that the visualization technique had a significant positive impact on the post-test cortisol levels of the players, even after controlling for pre-test cortisol levels. This finding suggests that visualization can influence physiological markers of stress, supporting the notion that mental rehearsal techniques extend benefits beyond skill acquisition to include stress regulation. The significant effect of the Pre-Test on Post-Test scores also highlights that baseline cortisol levels are highly predictive of post-intervention outcomes, underscoring the importance of accounting for initial physiological states when evaluating the impact of interventions.

The substantial difference in Post-Test cortisol levels between the Visualization and Control groups suggests that the visualization intervention led to better stress regulation compared to no intervention group. This is further supported by the model's high explanatory power, with 90% of the variance in post-test scores being explained by the model. Such a high R-squared value indicate that visualization is a meaningful factor in understanding changes in cortisol levels, likely due to its ability to engage the body's relaxation response and help Table Tennis player manage stress more effectively.

These findings are consistent with previous studies that have shown visualization techniques to be effective in reducing cortisol levels. For instance, Dawson et al. (2014) found that mental imagery focused on calming scenes activated the body's relaxation response, fostering inner peace and reduced cortisol levels. Similarly, Coelho et al. (2014) observed significant reductions in salivary cortisol concentration following mental training programs, reinforcing the notion that visualization can influence physiological stress markers. This body of evidence, along with the current findings, suggests that visualization could be an effective tool for sportsperson not only to prepare mentally for performance but also to mitigate stress-related physiological responses.

Practical Implications

The results have important practical applications for coaches, sports psychologists, and sportsperson, particularly in high-stakes, stress-inducing sports like table tennis. By integrating visualization techniques into regular training, sportsperson may be better equipped to manage competition-related stress,

potentially enhancing performance and overall well-being. The findings also indicate that visualization can be a valuable addition to pre-competition routines, helping sportsperson enter a calm, focused state conducive to peak performance. This suggests that organizations and training programs should consider including mental training modules focused on stress reduction.

Limitations and Future Directions

While the findings are promising, the study's relatively small sample size limits the generalizability of the results. Future research should aim to replicate these findings with larger and more diverse samples, potentially across different sports, to establish the broader applicability of visualization for stress reduction. Additionally, longitudinal studies could explore the long-term effects of visualization on cortisol levels and performance outcomes, examining whether sustained use of visualization leads to cumulative benefits in stress management and sports performance.

Conclusion

The twelve-week visualization program significantly improved the cortisol level of national-level Table Tennis players in the experimental group as compared to the control group. The study's results support the use of visualization as a psychological training tool in competitive sports. This study will help to educate Table Tennis players and coaches about the use of psychological interventions to enhance performance and deal with mental stress. It also helps to understand the significance of prioritizing both players' physical and psychological well-being. It further helps in developing appropriate training programs for players who want to achieve excellence.

Research Ethical Approval: This study was approved by the Research Ethics Committee at LNIPE, NERC Guwahati, and informed consent was obtained from all participants.

Conflict of Interest: The authors declare that there are no conflicts of interest regarding the publication of this paper. The study was conducted independently, and no financial or personal interests influenced the research outcomes.

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