Effect of 4-week cup stacking training on stress levels in e-sports players

Efecto de un entrenamiento de apilamiento de vasos de 4 semanas sobre los niveles de estrés en jugadores de e-sports

Authors

Khongrassame Manatsiri [1]
Jomkokkruad Narong [1]
Lertwanlop Srisaphonphusitti [2]
Phangkul Manoch [2]
Hiruntrakul Ashira [3]
Phonthee Sirisuda [3]
Jansupom Charee [1]

[1] Rajamangala University of Technology Isan (Thailand)
[2] Surindra Rajabhat University (Thailand)
[3] Khon Kaen University (Thailand)

Corresponding author:
Jansupom Charee
charee.ch@rmuti.ac.th

Received: 01-05-26
Accepted: 30-05-26

How to cite in APA

Khongrassame, M., Jomkokkruad, N., Srisaphonphusitti, L., Phangkul, M., Hiruntrakul, A., Phonthee, S., & Jansupom, C. (2026). Effect of 4-week cup stacking training on stress levels in e-sports players. *Retos, 81*, 883-889. https://doi.org/10.47197/retos.v81.119594

Abstract

Introduction: The rapid growth of the e-sports industry presents many new challenges that e-sports athletes may face, including levels of anxiety and their impact on mental health.
Objective: This experimental study used pre-and post-intervention assessments to examine the effect of 4-week cup stacking training on stress levels.
Methodology: The sample consisted of 20 male e-sports players from Surindra Rajabhat University, aged 18-25, who were training for competition. The group was randomly divided into two groups: an experimental group (n = 10; height 173.40 ± 6.45 cm; weight 65.54 ± 12.01 kg; experience 4.16 ± 1.51; stress levels 51.20 ± 7.25 KU/L) that performed in cup stacking 3 days a week for 4 weeks and a control group (n = 10; height 173.90 ± 5.70 cm; weight 68.81 ± 12.69 kg; experience 3.97 ± 1.63 years; stress levels 46.20 ± 7.57 KU/L) that performed with a normal e-sports program. Pre-and post-test, all participants were tested for stress levels to assess the concentration of salivary alpha-amylase using the Cocoro meter saliva amylase samples.
Results: After the experiment, it was found that the experimental group had a significantly reduced stress level than before the experiment. When comparing between groups, it was found that the experimental group had a significantly different stress level than the control group ($p < 0.05$).
Discussion: The results of this study indicate that the experimental group, which received cup stacking training, was able to better control and reduce their stress levels than the control group after 4 weeks.
Conclusions: The training model used in this study can be applied to help e-sports players self-regulate emotions and reduce potential long-term stress levels.

Keywords

Cup stacking training; amylase concentration; stress levels; e-sport

Resumen

Introducción: El rápido crecimiento de la industria de los deportes electrónicos plantea numerosos desafíos para los atletas, incluyendo los niveles de ansiedad y su impacto en la salud mental.
Objetivo: Este estudio experimental utilizó evaluaciones pre y post-intervención para examinar la efectividad del entrenamiento de apilamiento de vasos en los niveles de estrés.
Metodología: La muestra consistió en 20 jugadores masculinos de deportes electrónicos de la Universidad Surindra Rajabhat, de entre 18 y 25 años, que se estaban entrenando para competir. El grupo se dividió aleatoriamente en dos grupos: un grupo experimental (n = 10; altura 173,40 ± 6,45 cm; peso 65,54 ± 12,01 kg; experiencia 4,16 ± 1,51; niveles de estrés 51,20 ± 7,25 KU/L) que realizó apilamiento de vasos 3 días a la semana durante 4 semanas y un grupo de control (n = 10; altura 173,90 ± 5,70 cm; peso 68,81 ± 12,69 kg; experiencia 3,97 ± 1,63 años; niveles de estrés 46,20 ± 7,57 KU/L) que realizó un programa normal de deportes electrónicos. Antes y después de la prueba, se evaluó el nivel de estrés de todos los participantes para determinar la concentración de alfa-amilasa salival utilizando muestras de amilasa salival con el medidor Cocoro.
Resultados: Tras el experimento, se observó que el grupo experimental presentaba un nivel de estrés significativamente menor que antes del experimento. Al comparar ambos grupos, se encontró que el grupo experimental tenía un nivel de estrés significativamente diferente al del grupo de control ($p < 0,05$).
Discusión: Los resultados de este estudio indican que el grupo experimental, que recibió entrenamiento en apilamiento de vasos, pudo controlar y reducir su nivel de estrés mejor que el grupo de control después de 4 semanas.
Conclusiones: El modelo de entrenamiento utilizado en este estudio puede aplicarse para ayudar a los jugadores de deportes electrónicos a autorregular sus emociones y reducir los posibles niveles de estrés a largo plazo.

Palabras clave

Entrenamiento de apilamiento de vasos; concentración de amilasa; niveles de estrés; Jugadores de e-sport.

Introduction

E-sports is a rapidly growing global sport, with a reported global audience of 921 million in 2022, generating annual revenues of up to US$ 1.4 billion (Abbott, 2022). This rapid growth in the e-sports industry brings with it a number of new challenges that e-sports athletes may face, with specific needs and health challenges (Pereira et al., 2021; Schary et al., 2022). Previous studies have demonstrated the impact of anxiety on mental health in e-sports athletes, with age, gender, and the type of game played being the primary factors. This is because e-sports athletes are generally younger than other athletes, and male players experience higher stress levels than females when playing video game simulations with higher levels of complexity, such as strategy, combat, and multiplayer play, with more pronounced emotional and behavioral responses. This, coupled with the unique anxiety inherent in e-sports environments, may pose a risk to athletes' mental health (Bonnaire, 2019; Brunborg, 2014; Greitemeyer, 2015). Anxiety can be analyzed by salivary amylase levels, with a scale indicating the level of stress occurring: 0 to 30 KU/L is relaxed, 31 to 45 KU/L is normal, 46 to 60 KU/L is mildly anxious, and 61 KU/L or higher is highly anxious (Higo & Kuruma, 2021). A review of past literature on mental health in e-sports, although still in its infancy, shows that approximately 37 percent of e-sports athletes experience depression and anxiety, and approximately 45 percent experience insomnia (Pereira et al., 2021; Lee et al., 2021). Furthermore, it was found that the increased incidence of depression in e-sports athletes is significantly associated with insomnia and gaming addiction (Schary et al., 2022; Kuss & Griffiths, 2012). These important preliminary studies suggest that mental health problems such as anxiety are common in e-sports athletes and that the increase in problems may be comparable to the incidence rates seen in general athletes (Gouttebarge et al., 2019), and that research in psychology in general is often limited by considering well-being as a vague, positive feeling factor (Lundqvist & Andersson, 2021).

Cup stacking is a fun and engaging activity for players of all ages. It's a unique game that uses specially designed plastic cups to stack them in a predetermined pattern. It's fun and engaging, and helps develop hand-eye coordination and motor skills (Udermann et al., 2004; Gibbons et al., 2007). Cup stacking can improve motor skills such as directionality, perceptual motor functioning, and hand-eye coordination (Mortimer et al., 2011; Yang et al., 2024). In addition, systematic cup stacking practice, as reported in studies, found that practicing cup stacking twice a week for six weeks improved players' attention, emotional regulation, executive function, and anxiety (Fatemi, 2024). However, the importance of clearly defined mental health in e-sports athletes remains a matter of continued future research to assess anxiety levels and reduce anxiety in e-sports athletes during high-intensity competition. Therefore, the purpose of this study is to promote future research and initiate the application of data focused on key topics to help reduce anxiety in e-sports athletes, enabling them to effectively manage their emotions and anxiety during competition.

Method

Participants

This experimental study used pre- and post-intervention assessments with a sample of 20 e-sports athletes from Surindra Rajabhat University, aged 18-25 years, who were training for competition. All participants provided written informed consent. Inclusion criteria were: at least 1 year of competitive experience, passing the Physical Activity Readiness Questionnaire (PAR-Q), and no prior exposure to the training used. Literature review (Udermann et al., 2004) to obtain the sample size using the G Power V 3.1.9.2 program with a power value = 0.8 and an effect size d = 1.44, with a statistical significance level of 0.05. The sample size was 14 people. To prevent the dropout of the sample group, the sample size was increased by 20 percent. The sample group in this study was 20 people and was divided into two groups: the experimental group, which performed cup stacking training (n = 10), and the control group, which performed the e-sports program as usual. This study was approved by the Human Ethics Committee of Surindra Rajabhat University, Thailand. This research proceeds in accordance with the guidelines related to the Declaration of Helsinki, The Belmont Report, CIOMS Guideline, and International Conference on Harmonization in Good Clinical Practice (No. HE 672067, approved on September 12, 2025). Data from 20 e-sports athletes participating in this study show no differences in age, height, weight, experience, and stress levels between the experimental and control groups pre-test, as shown in Table 1.

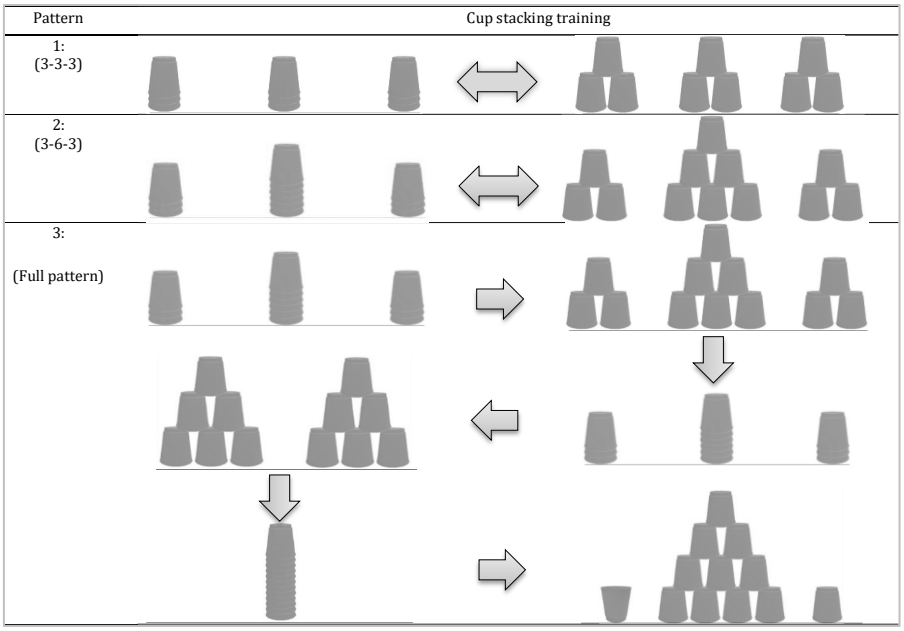
Table 1. Baseline data of the experimental and control groups

Data	Experimental group (n = 10)	Control group (n = 10)
Age (y)	20.80 ± 1.50	19.50 ± 1.58
Height (cm)	173.40 ± 6.45	173.90 ± 5.70
Weight (kg)	65.54 ± 12.01	68.81 ± 12.69
Experience (y)	4.16 ± 1.51	3.97 ± 1.63
Stress levels (KU/L)	51.20 ± 7.25	46.20 ± 7.57

Procedure

This study conducted a 4-week cup stacking training intervention for the experimental group in conjunction with their usual e-sports training program. The control group completed their usual e-sports training program. Participants were briefed on all procedures used in this study and signed a written informed consent prior to the experiment. Both groups underwent a stress level test to assess their anxiety levels using a Cocoro mete salivary amylase test (Higo & Kuruma, 2021), pre- and post-test. The intervention used cup stacking training, delivered 3 times per week for 30 minutes each for 4 weeks. The cup stacking patterns consisted of three, 10-minute patterns: Pattern 1, 3-3-3 cup stacking training; Pattern 2, 3-6-3 cup stacking training, and Pattern 3, full cup stacking training (Figure 1).

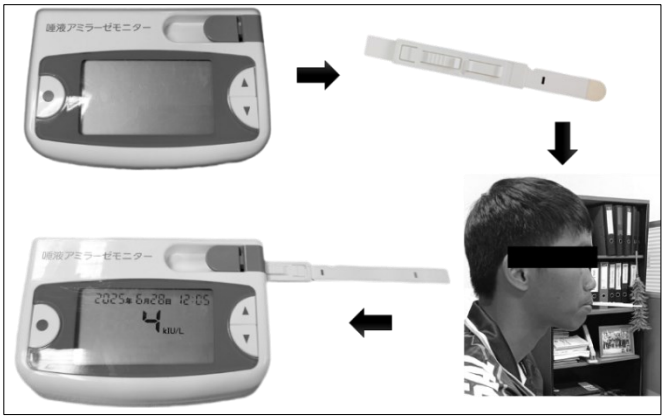
Figure 1. Cup tracking training.



Stress level test

This study conducted a stress test using a Cocoro meter (Nipro Co, Osaka, Japan) to collect salivary alpha amylase samples.7 This instrument provides information reflecting the level of individual anxiety. It has 4 levels of indicators: 0–30 KU/L indicates a relaxed range, 31–45 KU/L indicates a normal range, 46–60 KU/L indicates a slight anxiety, and 61 KU/L or higher indicates a high level of anxiety. All participants were requested to abstain from alcohol, caffeinated beverages, and fruit juices containing vitamin C, and to avoid strenuous activities for at least 24 hours pre-test. Participants were asked to collect saliva samples by holding a Cocoro meter saliva collection chip in their mouth for 5 seconds. The research supervisor then analyzed the saliva collection chip for stress levels (Figure 2).

Figure 2. Show stress level test with Cocoro meter.



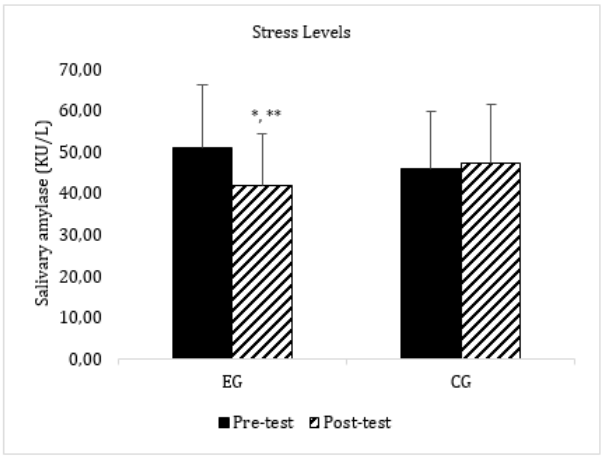
Data analysis

Statistical data analysis was performed using SPSS software, version 22. Data were presented as mean ± standard deviation (Mean ± SD). Data were tested for normality using the Shapiro-Wilk Normality Test. Differences in variables within groups were tested using the Paired samples t-test, and differences in variables between groups were tested using the independent samples t-test, pre- and post-test for the fourth week of the experiment. Statistical significance was determined at $p < 0.05$.

Results

Data from the stress test of e-sports athletes in the experimental group that received the cup stacking intervention showed that post-test, the stress level was significantly reduced (41.90 ± 4.28 KU/L, p = 0.01) from the pre-test (51.20 ± 7.25 KU/L). In the control group, the stress level post-test (47.40 ± 6.19 KU/L, p = 0.127) was not found to be different from the pre-test (46.20 ± 7.57 KU/L). It was found that post-test, the experimental group (41.90 ± 4.28 KU/L, p = 0.03) had a significantly reduced stress level than the control group (47.40 ± 6.19 KU/L) when comparing between groups (Figure 3).

Figure 3. Stress levels in experimental group (EG) and control group (CG).



Significant differences: from pre-test *p < 0.05, between group **p < 0.05.

Discussion

This study aimed to determine the effectiveness of cup stacking training on stress levels before and after the 4-week intervention. The study sample consisted of male e-sports athletes who were training for competition. The experimental group received the cup stacking training intervention in addition to their usual e-sports training program. Twenty participants were tested for stress levels using a Cocoro meter to collect salivary alpha amylase samples. Three cup stacking training formats were used in this study (Naidoo & Moodley, 2018), starting from patterns 1 to 3, with each training duration of 10 min (Figure 1). The results of the study indicated that the experimental group, who received cup stacking training, had a significantly reduced mean stress level (~ 9.3 KU/L) post-test, which was different from pre-test. In the control group, the mean stress level post-test was not different from the pre-test. Moreover, the stress level in the control group tended to increase (~ 1.2 KU/L) from pre-test. When comparing the data between groups in this study, it was found that the e-sports athletes who received cup stacking training for 4 weeks were able to reduce their stress levels significantly better than the control group who trained in the usual e-sports program. It can be seen that the experimental group had a decrease in salivary amylase concentration of ~ 9.3 KU/L, while the control group had an increase in salivary amylase concentration of ~ 1.2 KU/L.

Previous studies have reported that more than 80 percent of e-sports athletes experience increased mental fatigue from focusing on continuous gaming for a long time alone, which directly affects the athletes' stress levels and emotional control (Poulus et al., 2023; Luo et al., 2022; Trotter et al., 2021), and in the long term, may lead to health problems such as heart disease, obesity, cerebrovascular disease, depression, and reduce the athletes' physical performance (Hammen, 2005; Strike & Steptoe, 2003). As the current post-hoc data in the control group showed an increase in salivary alpha-amylase levels, which may be due to prolonged gaming activity leading to increased stress rates. Conversely, in the experimental group, 30 minutes of cup stacking activity between e-sports training programs at least 3 days per week significantly reduced salivary alpha-amylase concentrations compared to pre-test and between groups (Figure. 3). This suggests that 4 weeks of cup stacking supplementary training enriched the athletes' enjoyment, improved hand-eye coordination (Gibbons et al., 2007; Udermann et al., 2004), enhanced perceptual motor functioning (Mortimer et al., 2011; Yang et al., 2024), and led e-sports athletes to alter the activity of the autonomic nervous system, which consists of the sympathetic and parasympathetic nervous systems, which respond to internal and external stimuli and facilitate the continuous and balanced monitoring of physiological variability signals, enabling the experimental e-sports athletes to regulate their emotions and reduce their stress levels over time (Fatemi, 2024; Poulus et al., 2022b; Leis et al., 2022; Smith et al., 2019).

Suggestion for future research

Future studies should examine the interaction between male and female athletes to investigate differences in social and gender factors, including gender role stress, inequality in sports, imposter syndrome, and social pressure on women regarding body image and weight stigma. The study showed a reduction in stress levels after a four-week intervention. However, further studies at six and eight weeks are needed to investigate the long-term persistence of these effects. Finally, the training methodology used in this study can be applied to various competitive video game sports; stress-reduction techniques are applicable to all video game formats when adapted to each specific sport.

Conclusions

Key findings from this study demonstrate that a four-week, enjoyable cup stacking activity intervention effectively improved salivary alpha-amylase response to prolonged training and resulted in reduced stress levels in e-sports athletes. E-sports coaches and trainers can therefore apply the findings from this study to enhance athletes' emotional self-regulation and potentially reduce long-term stress levels.

Acknowledgements

We would like to thank all participants in this study and Surindra Rajabhat University for providing the venue and equipment for this research. We would also like to thank the Research and Development Division of the Sports Authority of Thailand for their generous support of this research.

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

References

Abbott, C., Watson, M., & Birch, P. (2022). Perceptions of effective training practices in league of legends: a qualitative exploration. J. Electron. Gaming Esports, 1(1), 1-11. https://doi.org/10.1123/jege.2022-0011

Bonnaire, C., & Baptista, D. (2019). Internet gaming disorder in male and female young adults: The role of alexithymia, depression, anxiety and gaming type. Psychiatry Res, 272, 521–530. https://doi.org/10.1016/j.psychres.2018.12.158

Brunborg, G. S., Mentzoni, R. A., & Froyland, L. R. (2014). Is video gaming, or video game addiction, associated with depression, academic achievement, heavy episodic drinking, or conduct problems? J Behav Addict, 3(1), 27–32. https://doi.org/10.1556/JBA.3.2014.002

Fatemi, S. M., Abdoshahi, M., & Miletic, V. (2024). The effect of online training of competitive domino and cup stacking games on mindfulness, emotion regulation and executive functions of children. J Motor Control Learn, 6(2), e148666. https://doi.org/10.5812/jmcl-148666

Gibbons, E., Hendrick, J. L., & Bauer, J. A. (2007). Distribution of practice on cup stacking performance. Research Quarterly for Exercise and Sport, 78(1), A46-A47.

Gouttebarge, V., Castaldelli-Maie, J. M., Gorczynski, P., Hainline, B., Hitchcock, M. E., Kerkhoffs, G. M., Rice, S. M., & Reardon, C. (2019). Occurrence of mental health symptoms and disorders in current and former elite athletes: a systematic review and meta-analysis. Br. J. Sports Med. 53(11), 700–706. https://doi.org/10.1136/bjsports-2019-100671

Greitemeyer T. (2015). Everyday sadism predicts violent video game preferences. Pers Individ Dif, 75, 19–23. https://doi.org/10.1016/j.paid.2014.10.049

Hammen, C. (2005). Stress and depression. Annu Rev Clin Psychol. 1, 293-319. https://doi.org/10.1146/annurev.clinpsy.1.102803.143938

Higo, Y., & Kuruma, H. (2021). Effects of lower-limb muscle fatigue cardiopulmonary fatigue and brain fatigue tasks on one-legged landing motion. Phys Ther Res, 24(3), 264-271. https://doi.org/10.1298/ptr.E10104

Kuss, D. J., & Griffiths, M. D. (2012). Internet gaming addiction: a systematic review of empirical research. Int. J. Ment. Health Addict, 10, 278–296. https://doi.org/10.1007/s11469-011-9318-5

Lee, S., Bonnar, D., Roane, B., Gradisar, M., Dunican, I. C., Lastella, M., Maisey, G., & Suh, S. (2021). Sleep characteristics and mood of professional esports athletes: a multi-national study. Int. J. Environ. Res. Public Health, 18(2), 1–14. https://doi.org/10.3390/ijerph18020664

Leis, O., Lautenbach, F., Birch, P. D., & Elbe, A. -M. (2022). Stressors, perceived stress responses, and coping strategies in professional esports players: A qualitative study. International Journal of Esports, 3(3), 1-22. https://www.ijesports.org/article/76/html

Lundqvist, C., & Andersson, G. (2021). Let's talk about mental health and mental disorders in elite sports: a narrative review of theoretical perspectives. Front Psychol, 12(700829), 1-9. https://doi.org/10.3389/fpsyg.2021.700829

Luo, Y., Hutchinson, J. C., O'Connell, C. S., & Sha, Y. (2022). Reciprocal effects of esport participation and mental fatigue among chinese undergraduate students using dynamic structural equation modeling. Psychology of Sport and Exercise, 62(102251), 1-7. https://doi.org/10.1016/j.psychsport.2022.102251

Mortimer, J., Krysztofiak, J., Custard, S., & Mckune, A. J. (2011). Sport stacking in auditory and visual

attention of grade 3 learners. Perceptual and Motor Skills, 113(1), 98-112. https://doi.org/10.2466/05.11.25

Naidoo, R., & Moodley, K. (2018). The short-term effects of a sport stacking intervention on the cognitive and perceptual motor functioning in geriatrics: a pilot study. S Afr J Sports Med, 30(1), 1-6. http://doi.org/10.17159/2078-516X/2018/v30i1a4267

Pereira, A. M., Costa, J. A., Verhagen, E., Figueiredo, P., & Brito, J. (2022). Associations between esports participation and health: a scoping review. Sport. Med, 52, 2039–2060. https://doi.org/10.1007/s40279-022-01684-1

Pereira, A. M., Teques, P., Verhagen, E., Gouttebarge, V., Figueiredo, P., & Brito, J. (2021). Mental health symptoms in electronic football players. BMJ Open Sport Exerc. Med, 7(e001149), 1-9. https://doi.org/10.1136/bmjsem-2021-001149

Poulus, D. R., Coulter, T. J., Trotter, M. G., & Polman, R. (2022b). Longitudinal analysis of stressors, stress, coping and coping effectiveness in elite esports athletes. Psychology of Sport and Exercise, 60(102093), 1-11. https://doi.org/https://doi.org/10.1016/j.psychsport.2021.102 093

Poulus, D. R., Bennett, K. J., Swann, C., Moyle, G. M., & Polman, R. C. (2023). The influence of an esports-adapted coping effectiveness training (E-CET) on resilience, mental health, and subjective performance among elite league of Legends players: A pilot study. Psychology of Sport and Exercise, 69(102510). https://doi.org/10.1016/j.psychsport.2023.102510

Schary, D. P., Jenny, S. E., & Koshy, A. (2022). Leveling up esports health: current status and call to action. Int. J. Esports 1(1), 1–16. https://www.ijesports.org/article/70/html

Smith, M. J., Birch, P. D. J., & Bright, D. (2019). Identifying stressors and coping strategies of elite esports competitors. International Journal of Gaming and Computer-Mediated Simulations, 11(2), 22–39. https://doi.org/10.4018/IJGCMS.2019040102

Strike, P. C., & Steptoe, A. (2003). Systematic review of mental stress-induced myocardial ischaemia. European heart journal, 24(8), 690-703. https://doi.org/10.1016/s0195-668x(02)00615-2

Trotter, M. G., Coulter, T. J., Davis, P. A., Poulus, D. R., & Polman, R. (2021). Social support, self-regulation and psychological skill use in e-athletes. Frontiers in Psychology, 12(722030), 1-10. https://doi.org/10.3389/fpsyg.2021.722030

Udermann, B. E., Murray, S. R., Mayer, J. M., & Sagendorf, K. (2004). Influence of cup stacking on hand-eye coordination and reaction time second-grade students. Perceptual and Motor Skills, 98(2), 409-414. https://doi.org/10.2466/pms.98.2.409-414

Yang, Z., Yang, J., Doris, S. F. Y., Liu, D., & Ding, F. (2024). Effects of sport stacking on cognition in patients with mild alzheimer' s disease and MCI: Preliminary findings of randomized controlled trial. Journal of Geriatric Psychiatry and Neurology, 37(1), 24-38. https://doi.org/10.1177/08919887231195227

Authors' and translators' details:

Khongrassame Manatsiri	manatsiri.kh@rmuti.ac.th	Author
Jomkokkruad Narong	narong.jo@rmuti.ac.th	Author
Lertwanlop Srisaphonphusitti	lertwanlop.s@srru.ac.th	Author
Phangkul Manoch	phangkul.ma@gmail.com	Author
Hiruntrakul Ashira	hashir@kku.ac.th	Author
Phonthee Sirisuda	sirisupho@kku.ac.th	Author
Jansupom Charee	charee.ch@rmuti.ac.th	Author
Full name	correo@electronico.com	Translator