

ORIGINAL SCIENTIFIC PAPER

Effects of Bodypump Exercise on the Emotions and Life Satisfaction among Women during the Coronavirus Pandemic

Ayed Zureigat¹, Osama Abdel Fattah² and Alaa Elayyan¹

¹University of Jordan, Faculty of Physical Education, Amman, Jordan, ²The Ministry of Education, Amman, Jordan

Abstract

The study aimed to investigate the effect of the Bodypump exercise on women's emotions and life satisfaction during the coronavirus epidemic. To achieve this, we used the quasi-experimental approach on a sample consisting of (34) untrained healthy women, divided into two groups (17) as a control group and (17) as the experimental group. Because of the home quarantine and, in order to face-to-face interaction, we used a questionnaire to measure the emotions and life satisfaction level using the Google Forms web tool. The study tool consisted of 40 paragraphs divided into 20 paragraphs for emotions and 20 paragraphs for life satisfaction. Before applying the experiment, the emotions and life satisfaction were measured among the study sample; next, the experimental group applied the Bodypump exercise programme. Also, the study results have shown that the level of life satisfaction and positive emotions among the two groups came with a low average in the pre-measurement, as well as the emotional stability domain that was the most affected in a negative way through the coronavirus epidemic. Additionally, statistically significant differences existed between the pre and post-measurement in the emotions and life satisfaction among the two groups and in favour of the experimental group.

Keywords: emotions, life satisfaction, bodypump, female, coronavirus

Introduction

It is normal for individuals to feel fear, stress and high anxiety during the coronavirus outbreak; this virus is new, and there is no vaccine at the time the present paper is being written (Woods, 2020). Also, people cannot receive medical care in health facilities for fear of contracting the virus. Furthermore, the fear of loss of livelihoods, social isolation, and social relationships leads to boredom and loneliness (Mohammed, Sheikh, & Gidado, 2015; Kinsman, 2012). Wang et al. (2020) indicate that 53.8% of the sample study in China during the coronavirus outbreak had moderate to severe psychological effects, 16.5% had moderate to severe depression, 28.5% had moderate to severe anxiety, and 8.6% suffered from moderate to severe stress. Therefore, the high psychological indicators

may affect the efficiency and effectiveness of their immune system, as it is affected by many variables, including social life, mood, depression and anxiety (Woods, Lu, Ceddia, & Lowder, 2000). Studies indicate that people with high-stress levels are more likely to be infected due to imbalances in hormone secretion regulation, which may reduce their immune response (Schmidt, Lichtblau, Minkwitz, Chittka, & HormDnn, 2014).

In general, physical activity at least three times a week for 30 minutes reduces stress and symptoms of depression. Furthermore, this facilitates the release of the endorphin hormone, which is linked to the immune system, as the immune cells are able to produce this hormone; this reflects the bilateral relationship between the nervous system and the immune system, which can be improved in response to physical activity



Correspondence:

O. A. Fattah
The Ministry of Education, Amman, Jordan
E-mail: samhsaf.2811@gmail.com

(Jonsdottir, 2000). Physical activity improves self-confidence, reduces the risk of depression and improves mood (Tesarz, Schuster, Hartmann, Gerhardt, & Eich, 2012). Furthermore, it contributes to controlling the level of cortisol in the body, which contributes to reducing stress and anxiety, as well as the risk of depression (Bao & Swaab, 2010). There is no question about the positive role of regular physical activity on brain health and thus improved motor communication enetworks (Alicia, 2015). Additionally, physical activity is associated with improving various psychological aspects, such as self-esteem and social interactions, and reducing symptoms of depression (Eime, Young, Harvey, Charity, & Payne, 2013).

The Bodypump exercises consist of a group of exercises divided into nine tracks; each track includes a group of different exercises in terms of weight, range of motion, speed of movement, volume and intensity of the exercise, which are performed for 70-100 repetitions in each track; thus, the total repetitions in the training unit reach 800 repetitions, which last from 30-60 minutes (Harber, Fry, Rubin, Smith, & Weiss, 2004; O'Connor & Lamb, 2003). It is a programme designed to use low weights with high repetitions, and it is the key to improving muscle endurance and increasing metabolic efficiency. This programme mainly aims to reduce obesity and inactive lifestyles by burning calories and fat and improving aerobic fitness (Pritchett, 2014; Les Mills, 2013).

Studies also indicate that many positive psychological benefits can be achieved through this programme, including the emergence of high levels of satisfaction, pleasure and happiness, improved social interaction and low negative feelings and high levels of psychological well-being (Ho, 2000; Lythe, Pfitzinger, & Ho, 2000; Lythe, 2001). Furthermore, satisfaction with life reflects positively on the ability of the individual to confront the situations that interfere with his daily life so that he is less anxious and stressed; this marks it as one of the signs of positive mental health, also an indicator of psychological well-being (Suldo & Huebner, 2006). Empirical evidence indicates that people who enjoy a high level of satisfaction with life have a high level of psychosocial performance, as well as successful social relationships with others, and have fewer behavioural problems with others (Gilman & Huebner, 2006; Suldo & Huebner, 2006; Proctor, Linley, & Maltby, 2010). Additionally, these exercises positively affect the psychological aspects of the practitioners and reduce their mood swings (Les Mills, 2013).

Through the review of many previous studies related to Bodypump exercises, we found that many of them focus on these exercises' physiological effects, such as their effect on the heart, VO_2 max, and blood lactate (Pritchett, 2014). Some of them dealt with its effect on obesity, metabolic processes

and the calories expended during the performance of these exercises (Les Mills, 2013). The researchers note a decrease in studies that deal with its effect on the psychological aspects among individuals, which is an urgent necessity during the coronavirus pandemic and the accompanying social distancing. Accordingly, this study aimed to identify the level of life satisfaction and positive and negative emotions among women during the coronavirus pandemic, in addition to the effect of practising Bodypump exercises on these psychological aspects; therefore, the results of this study may contribute to improving their productive ability and developing their communication skills. These findings inform future research and offer insights for policies and interventions aimed at caring for people's psychological well-being during epidemics.

Methods

Patients and study design

To achieve the objectives of the study, we have been using the quasi-experimental approach and Bodypump programme on (34) untrained healthy women. Divided into two groups, each with 17 members: a control group (age, 22.3 ± 2 years; height, 164 ± 5.2 cm; body mass, 63.5 ± 3.8 kg) and an experimental group (age, 24.5 ± 2 years; height, 160 ± 8.2 cm; body mass, 61.8 ± 3.8 kg). The members of the study sample did not suffer from any disease, and they had never practised these exercises.

The experiment

Due to the curfew in Jordan and to reduce face-to-face interactions, we built a study tool consisting of a set of questions by using the Google Forms web tool, which consists of 20 paragraphs to measure the level of life satisfaction (psychological stability, social interaction, optimism and emotional stability) and 20 paragraphs to measure the positive and negative emotions by sending the link by the WhatsApp application, where the study sample was confirmed after completing the questionnaire, by pressing "send". The study tool consisted of five paragraphs associated with psychological stability, five paragraphs associated with social interaction, five paragraphs associated with optimism, and five paragraphs associated with emotional stability. An additional 10 paragraphs were associated with positive emotions, and 10 paragraphs were associated with negative emotions.

Before applying the experiment, the level of life satisfaction, the positive and negative emotions were measured among the study sample (for two groups), then the Bodypump programme was sent to the experimental group through the WhatsApp application; it included warm-up exercises, squat, back, shoulders, triceps, biceps and abdomen exercises. It was

Table 1. Exercise programme for the BodyPump group (release no.83)

Music no.	Exercise	Volume (reps)
1 Warming-up Straight leg	deadlift, rowing, shoulder press, squat, lunges and biceps curl	88
2 Leg	Squat	95
4 Back	Rowing, stiff-legged deadlift, clean & press and power press	75
5 Triceps	French press, triceps press, pullover and overhead triceps press	78
6 Biceps	Biceps curl	68
7 Leg	Squat, lunges and squat jump	72+24 jumps
8 Shoulders	Push-up, lateral raise, rowing and shoulder press	76+36 push up
9 Abdominals	Sit-ups, sit-ups to the side and side-plank	51+30 seconds

emphasized that these exercises should be practised for a period of (30-60) minutes, three days per week for six weeks. This programme can be purchased from the Less Mills company and includes special exercises and music (Les Mills, 2013; O'Connor & Lamb, 2003). The application of the gradual principle in training was taken into account, since the study sample had not practised these exercises previously (Table 1).

The study sample was contacted during the performance of the experiment through the Zoom and Skype applications. The experiment was applied from 20 March to 5 May, 2020). Taking into account the gradual expansion of the number of the exercise repetitions, all safety and security instructions were sent to the study sample, including wearing comfortable sportswear for movement and sweating, wearing comfortable athletic shoes, and drinking water and other liquids. The study sample had not previously practised these exercises, and the study aimed to identify the effect of these exercises on some psychological aspects; therefore, these exercises were done while listening to music, which determines the time for each muscle group, and the focus was on exercises that can be per-

formed without bench and tools.

Scoring

Positive Affect score: Add the scores on items 1, 3, 5, 9, 10, 12, 14, 16, 17, and 19. Scores can range from 10 to 50, with higher scores representing higher levels of positive affect. Mean Scores: 33.3 (SD±7. 2). Negative Affect score: Add the scores on items 2, 4, 6, 7, 8, 11, 13, 15, 18, and 20. Scores can range from 10 to 50, with lower scores representing lower levels of negative affect. Mean Score: 17.4 (SD ± 6.2) (Watson, Clark, & Tellegen, 1988).

Scientific coefficients of the study tool

To verify the study tool's validity, we presented it to a committee of five arbitrators with the competence and experience of the faculty members at the University of Jordan to determine the suitability of paragraphs of this questionnaire and its ability to achieve the goals of the study. In addition, we used a triple Likert scale to measure how participants feel about each paragraph (Table 2)

Table 2. The estimation scale of the study sample responses

Tools	The response	Degree	Average	Level
Life satisfaction	Completely applies to me	5	More than 4.20	Very high
	Greatly applies to me	4	3.40- less than 4.20	High
	Moderately applies to me	3	2.60- less than 3.40	Moderate
	Low applies to me	2	2.60- less than 1.80	Low
	Never applies to me	1	Less than 1.80	Very low
Emotions	Not at all	1	Scores can range from 10 to 50, with higher scores representing higher levels of positive affect. Mean Scores: Weekly 33.3 (SD 7.2). Also, lower levels of negative affect. Mean Score: Weekly 17.4 (SD 6.2)	
	A little	2		
	Moderately	3		
	Quite a bit	4		
	Extremely	5		

To verify the reliability of the study tool, we used Cronbach's Alpha coefficient, whose value reached 0.80 for the life satisfaction

paragraphs and 0.82 for the emotions; these values are considered a high indicator of the stability among study tool (Table 3).

Table 3. Results of Cronbach's Alpha coefficient

Domain	Cronbach's Alpha coefficient	Reliability level
Life satisfaction	0.80	Good
Emotions	0.82	Good

Ethical considerations

The participants' rights were protected by explaining the purpose and significance of the study. The clients were informed that their participation in the study would remain anonymous and that their privacy was respected. They were provided with a comprehensive explanation that their involvement in the study was voluntary and that they could withdraw at any time, and written approval was obtained from all study participants. As no blood samples were taken, and the experiment was limited to doing the Bodypump programme and answering the paragraphs of the study tool, the Ethics Committee's approval was not required.

Study variables

Independent variable: Bodypump programme; Dependent

variables: life satisfaction (psychological stability, social interaction, optimism and emotional stability) and 20 paragraphs to measure the positive and negative emotions

Statistical analysis

To achieve the objectives of the study and answer its questions, the researchers used means, standard deviations, paired and independent sample T-tests to identify the differences between the pre and post measurements for one group and the two groups by using SPSS version 24 with a confidence level of 95% ($p < 0.05$).

Results

Table 4 indicates the mean of life satisfaction and emotions domains in the pre and post-measurement.

Table 4. Results of paired sample T. test for Life satisfaction and emotions among the control and experimental groups (n=34)

Groups	Variables	Pre-measured	Post-measured	p
		Mean±SD	Mean±SD	
Control	Psychological stability	2.20±0.78	2.74±0.28	0.062
	Social interaction	2.27±0.69	2.58±0.71	0.362
	Optimism	2.30±0.78	2.42±0.13	0.717
	Emotional stability	2.18±0.93	2.30±0.93	0.861
	Life satisfaction	2.24±0.99	2.51±0.69	0.582
	Negative emotions	35.2±2.9	31.4±2.6	0.781
	Positive emotions	16.2±1.8	18.3±1.7	0.532
Experimental	Psychological stability	2.25±0.7	3.85±0.76	0.000*
	Social interaction	2.34±0.76	4.10±0.55	0.025*
	Optimism	2.2±0.82	3.75±0.70	0.028*
	Emotional stability	2.15±0.87	3.65±0.81	0.007*
	Life satisfaction	2.23±0.69	3.84±0.72	0.011*
	Negative emotions	36.4±2.8	23.5±2.15	0.021*
	Positive emotions	15.6±1.9	32.2±1.82	0.000*

Legend: * - p<0.05

Table 5 indicates the results of the independent sample T. test for Life satisfaction and emotions among the control and experimental groups in post measurement.

Table 5. Results of independent sample T - test for Life satisfaction and emotions among the control and experimental groups in post-measurement (n=34)

Variables	Mean		t	p
	Control	Experimental		
Life satisfaction	2.51	3.84	2.42	0.006*
Negative emotions	31.4	23.5	2.98	0.021*
Positive emotions	18.3	32.2	2.78	0.011*

Discussion

The corona pandemic required all countries to take many strict procedures, such as social distancing and lockdown, which have many negative effects, such as physical isolation, loneliness, inability to go to physical fitness centres and high levels of anxiety, stress, and negative feelings. By reviewing the values of means among the control and experimental groups in the pre-measurement of satisfaction of life domains, we see that they ranged between 2.15 and 2.34 with a low degree, and the emotional stability domain has the lowest average (2.15-2.18). In contrast, the average of positive emotions in the pre-measurement was 15.6–16.2 and 35.2–36.4 for negative emotions. This reflects the negative effects of lockdown among the individuals. Schyns, Roefs, and Jansen (2020) indicate that lockdown is a tense and anxious time because of the distance from friends and lack of clarity about when normal life can resume. This explains the reason for the increasing demand of individuals for counselling from psychiatrists online.

The coronavirus pandemic is seen as a stressful experience in all aspects (psychological, social and economic). The coronavirus outbreak and the absence of a vaccine accompanied by preventive measures such as curfews contributed to increased social spacing (Brooks et al., 2020), as shown by the results of the study in which the social communication domain in pre-measurement was at a low degree (2.27-2.34). It is normal

for individuals to feel fear, stress and high anxiety during the coronavirus outbreak; this virus is new, and there is no vaccine at the time the present paper is being written. Also, many factors contribute to increased psychological pressure among women, such as fear of the future, low material income, not going to the training centers, not moving freely, and the prolonged incubation period for this virus (Woods, 2020). Also, it can adversely affect the bilateral relationship between the nervous system and the immune system.

Similarly, the concern is that women may have more free time than before. Studies indicate that people with a high level of stress are more likely to be infected due to imbalances in hormone secretion regulation, which reduces their immune response as high cortisol levels discourage this response (Schmidt et al., 2014). Also, the coronavirus outbreak is accompanied by the high average of negative emotions, which indicates a decrease in well-being and a positive outlook towards the future. The levels of some negative psychological indicators are related to the behaviour of individuals. Negative feelings are a combination of high uneasiness and high excitement and include many feelings, such as nervousness and sadness, and thus decrease the degree of flexibility of individuals in their ability to overcome psychological pressures effectively. Positive emotions are associated with different areas of life such as work, physical health and personal relationships, and

are linked to the degree of satisfaction with life, as it reflects an individual's perception of the situation he or she lives based on goals, expectations, values and interests (Lythe et al., 2000). The problem here is that some individuals may resort to increased eating to escape stress, which doctors and specialists call "emotional eating". Nutritionists indicate that there is a strong correlation between exposure to stress and weight gain, which an increase in the stress level can explain is accompanied by an increase in the cortisol hormone level in the body, and this contributes to raising the appetite level in individuals and thus may lead to the accumulation of fat in the body, and the metabolism process becomes slower.

Referring to the results of the study, we see that the means of the study sample responses of the satisfaction of life among the experimental group came at a high level and an average (3.84) in the post-measurement, where the social interaction domain achieved the highest level of improvement and average (1.76). There were also statistically significant differences between the pre and post-measurement in the satisfaction-of-life level among the experimental group and in favour of post-measurement, with a marked rise in the average positive emotions and a decrease in the negative emotions' average. The researchers believe that many factors contributed to this positive effect of Bodypump exercises through increased visual, audio, and read communication between the study sample and researchers. These exercises also contributed positively to spending free time and the process of working online. As the regular practice of physical activities, in general, has contributed to reducing stress, symptoms of depression and removing toxins resulting from stress, it is a way to get rid of anger and enhance feelings of self-esteem and self-efficacy and thus increase the ability of individuals to deal with the pressures imposed by the process of home quarantine. Additionally, there was an improvement in the life satisfaction and emotions level among the control group, but it was not statistically significant. The researchers believe that with the passage of time, an adaptation to stresses occurs, and the procedures taken by the state may have contributed to this.

In general, physical activity at least three times a week for 30 minutes reduces stress and symptoms of depression. It also improves self-confidence and reduces the risk of depression, and improves mood (Tesarz et al., 2012). Furthermore, it con-

tributes to controlling the level of cortisol in the body, which contributes to reducing stress, high anxiety, and the risk of depression (Bao & Swaab, 2010). Also noteworthy is the positive role of regular physical activity on brain health and thus improved motor communication networks (Alicia, 2015). Additionally, physical activity is associated with improving various psychological aspects such as self-esteem and social interaction and reducing symptoms of depression (Eime et al., 2013).

These exercises also facilitate the release of the hormone endorphin, which is linked to the immune system and its role in improving the secretion of serotonin. Also, it helps to control the level of the hormone cortisol in the body, which reduces stress and the risk of depression while improving self-confidence and general mood. All of this can improve metabolism and weight maintenance by burning calories from high repetitions of these exercises, reaching up to 800 per training unit. Furthermore, the positive role of regular physical activity on brain health and improved motor communication networks is not overlooked. Studies also indicate many positive psychological benefits that can be achieved through this programme, such as high levels of satisfaction, pleasure and happiness, improved social interaction, decreased negative emotions and a higher level of psychological well-being. Life satisfaction reflects positively on the ability of the individual to face difficult situations in daily life so that the individual is less anxious and stressed. Empirical evidence indicates that people with a high level of satisfaction in life enjoy a high level of psychosocial performance and have more successful social relations.

The corona pandemic has forced nations to take a range of preventive measures, including home quarantine, accompanied by many effects, including social isolation and increased leisure time, which had a negative impact on individuals' emotions and satisfaction-of-life level. This requires following new strategies and applying them in order to enrich the research aspect in this area. The main point in the present research is that women's exercises have contributed positively to reducing the level of negative emotions and the high average positive emotions they have. Furthermore, the exercises positively affected the satisfaction-of-life level and thus can help in overcoming negative life events, such as psychological pressures and improving their outlook on life by raising the level of life satisfaction and investing positively in their leisure time.

Acknowledgements

There are no acknowledgements.

Conflict of Interest

The authors declare that there are no conflicts of interest.

Received: 27 August 2020 | **Accepted:** 15 October 2020 | **Published:** 01 June 2021

References

- Alicia, G. F. (2015). Psychological Benefits of Sports and Physical Activities. *British Journal of Education, Society & Behavioural Science*, 11(4), 1-7.
- Bao, A. M., & Swaab, D. (2010). Corticotropin releasing hormone and arginine vasopressin in depression focus on the human postmortem hypothalamus. *Vitam Horm*, 82, 339-65. doi.org/10.1016/S0083-6729.(10)82018-7
- Balkhi, F., Aamna, N., Arham, Z., & Ramsha, R. (2020). Psychological and Behavioral Response to the Coronavirus (COVID-19) Pandemic. *Cureus*, 12(5), e7923. doi10.7759/cureus7923
- Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., & Greenberg, N. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet*, 395(10227), 912-920. doi.org/10.1016/S0140-6736(20)30460-8.
- Eime, R. M., Young, J. A., Harvey, J. T., Charity, M. J., & Payne, W. R. (2013).

- A systematic review of the psychological and social benefits of participation in sport for children and adolescents: Informing development of a conceptual model of health through sport. *International Journal of Behavioral Nutrition and Physical Activity*, 10(1), 98-119. doi.org/10.1186/1479-5868-10-98.
- Gilman, R., & Huebner, E. S. (2006). Characteristics of adolescents who report very high life satisfaction. *Journal of Youth and Adolescence*, 35(3), 311-319. doi.org/10.1007/s10964-006-9036-7
- Harber, M. P., Fry, A. C., Rubin, M. R., Smith, J. C., & Weiss, L. W. (2004). Skeletal muscle and hormonal adaptations to circuit weight training in untrained men. *Scand J Med Sci Sports*, 14, 176-185. doi.org/10.1111/j.1600-0838.2003.371.x.
- Ho, D. L. (2000). *The physical and psychological response to 13 weeks of structured group-fitness exercise in untrained individuals*. Auckland: Unit Sports Centre for Sport Performance.
- Jonsdottir, I. H. (2000). Special feature for the Olympics: Effects of exercise on the immune system: Neuropeptides and their interaction with exercise and immune function. *Immunol Cell Biol*, 78, 562-70. doi.org/10.1046/j.1440-1711.2000.00961.x
- Kinsman, J. (2012). "A time of fear": local, national, and international responses to a large Ebola outbreak in Uganda. *Global Health*, 8, 15. https://doi.org/10.1186/1744-8603-8-15
- Les Mills (2013). BODYPUMP. Retrieved 8 April, 2014, from Les Mills Southeast: www.lesmills.com.

- Lythe, J. (2001). *Excess Post-Exercise Oxygen Consumption following BODYPUMP™*. Unit Sports Centre for Sport Performance, University of Auckland.
- Lythe, J., Pfitzinger, P., & Ho, D. (2000). *The physical and psychological response to 18 weeks of structured group-fitness exercise in untrained individuals*. Unit Sports Centre for Sport Performance, University of Auckland.
- Mohammed, A., Sheikh, T. L., & Gidado, S. (2015). Psychiatric treatment of a health care worker after infection with Ebola virus in Lagos. *Nigeria Annals of Psychiatry*, 172, 222–4. doi.org/10.1176/appi.ajp.2014.14121576
- O'Connor, T. E., & Lamb, K. L. (2003). The effects of body max high repetition resistance training on measures of body composition and muscular strength in active adult women. *J Strength Cond Res*, 17, 614–620. doi.org/10.1519/00124278-200308000-00031
- Pamela, K. (2017). *Eating Disorders*. 2ed, Oxford University Press.
- Pritchett, M. (2014). "Body pump and the rep effect: An Instructor's Evaluation of the Low-Weight, High-Repetition Group Exercise Program". Senior Theses.
- Proctor, C., Linley, P. A., & Maltby, J. (2010). Very happy youths: Benefits of very high life satisfaction among youths. *Social Indicators Research*, 98(3), 519–532. doi:http://dx.doi.org/10.1007/s11205-009-9562-2
- Schmidt, F. M., Lichtblau, N., Minkwitz, J., Chittka, T., & HormDnn, J. (2014). Cytokine levels in depressed and non-depressed subjects, and masking effects of obesity. *Journal of Psychiatric Research*, 55, 29–34. doi.org/10.1016/j.jpsychires.2014.04.021
- Schyns, G., Roefs, A., & Jansen, A. (2020). Tackling sabotaging cognitive processes to reduce overeating; expectancy violation during food cue exposure. *Physiol Behav*, 222, 112924. doi.org/10.1016/j.physbeh.2020.112924.
- Suldo, S. M., & Huebner, E. S. (2006). Is extremely high life satisfaction during adolescence advantageous? *Social Indicators Research*, 78(2), 179–203. doi.org/10.1007/s11205-005-8208-2.
- Tesarz, J., Schuster, A. K., Hartmann, M., Gerhardt, A., & Eich, W. (2012). Pain perception in athletes compared to normally active controls: A systematic review with meta-analysis. *153*, 1253–62. doi.org/10.1016/j.pain.2012.03.005.
- Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., & Ho, R. C. (2020). Immediate Psychological Responses and Associated Factors during the Initial Stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the General Population in China. *International journal of environmental research and public health*, 17(5), 1729. https://doi.org/10.3390/ijerph17051729
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of personality and social psychology*, 54(6), 1063. doi.org/10.1037/0022-3514.54.6.1063.
- Woods, J., Lu, Q., Ceddia, M. A., Lowder, T. (2000). Special feature for the Olympics: Effects of exercise on the immune system. *Exercise induced modulation of macrophage function*, 78, 545–53. doi.org/10.1111/j.1440-1711.2000.t01-9-x.
- Woods, J. (2020). Should. How can, exercise be done during a coronavirus crisis? *Journal of Sport and Health Science*, 9, 105–107. doi:10.1016/j.jshs.2020.01.005