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Report of Health Care **Original Article**
Volume 2, Issue 3, 2016, p. 35- 41

Effect of Aqua Training on Cortisol and Plasma Insulin in Patients with Panic Disorder

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Received: 17 February 2016

Accepted: 21 June 2016

Published online: 1 July 2016

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Competing interests: The authors declare that no competing interests exist.

Citation: Olamazadeh Sh, Ebrahim Kh, Ghazalian F, Barekatain M. Effect of aqua training on cortisol and plasma insulin in patients with panic disorder. Report of Health Care. 2016; 2 (3): 35- 41.

Abstract

Introduction: Cortisol is reported to be a factor for the hypothalamic–pituitary–adrenal axis (HPA axis) in patients affected by panic disorders. On the other hand, HPA disorders can increase insulin resistance. The effect of intense aerobic exercise on the cortisol levels has also been reported on the patients with mental disorders. However, no study has yet investigated the effects of exercises in water on the cortisol and blood insulin levels in the patients affected by panic disorder. Hence, the purpose of this article was to review the effects of aqua training on cortisol and insulin levels of patients with panic disorder.

Methods: Thirty six women affected by panic disorder with the average (age 38.6 ± 6.45 years and weight 70.64 ± 11.04 kg) were randomly divided in two groups of aqua training group (n=18) and the control group (n=18).The aqua training group participated in a 12-week program for water exercises (three sessions a week, each session lasting one hour, and with the intensity of 50- 85 % of maximum heart rate) and the control group continued their normal life. Pretest and posttest blood samples were taken for measuring the cortisol and blood insulin levels. Data were statistically analyzed by independent and paired sample t tests ($p \leq 0.05$).

Results: The results showed that aqua training has significant effect on reduction of insulin of patients with panic disorder ($p=0.001$), nevertheless it has no significant effect on cortisol of patients with panic disorder ($p=0.52$).

Conclusion: It appears that aqua training could improve the insulin levels of patients with panic disorder.

Keywords: Training, Cortisol, Insulin, Panic Disorder

Introduction

The intense and acute anxiety disorder together with the imminent feeling of death is called the “panic disorder”. The main feature of panic is the periodic attacks of intense fear that its frequency includes multiple attacks in a day or a year (1). The prevalence of this disease in women is two or three times more than men (2). Panic is the most prevalent disorder among the mental disorders, involving a great range of about 1.7 to 5% of the people (1- 2). Panic disorder is accompanied by cognitive and physical symptoms (3), such that it leads to principle disabilities and many people are hospitalized because of it (4). However, physiotherapy mechanisms of panic disease are not still known, although some studies have shown that reducing the sensitivity of 5-HT18 receivers in specific areas of the neural network and reducing the ability of bonding with serotonin can be the main reasons for this disease (5). Moreover, researchers have stated that due to the great deal of stress experienced by these patients, the strong activation of adrenal-pituitary- hypothalamus route (HPA) can be expected in such patients (4). However, the studies that analyzed the cortisol level of blood in panic patients have not reported any appropriate pattern in this regard. For instance, in a study that measured the cortisol level during the ordinary attacks, it was shown that the level of plasma cortisol hormone had no specific changes, or had only a little increase

(6). In contrast, another study showed that the plasma cortisol level had a significant increase during the attacks (7). Moreover, there are contradictory reports about the increase (8) or the lack of increase (9) in the cortisol levels. On the other hand, the abnormal pressure increase on the body may damage the HPA via the immune system, affecting the glucose homeostasis that can result in insulin resistance (10, 11). Since cortisol is known as an antagonist for the insulin function that encourages the experience of glycogen, it is possible that it prevents insulin activity (13). However, although the pharmacological and non-pharmacological therapeutic methods such as cognitive-behavioral therapy are used for the treatment of panic disease, it can be seen that physical activities can improve the signs of panic disorder via behavioral and physiological changes (15, 16). One of the physical activities is considered as the aquatic exercises, by which the person deals with physical exercises, sport activities, physical readiness, and aerobics in the deep or shallow parts of the swimming pools, in such a way that three main therapeutic principles of aquatic exercises (buoyancy, viscosity, and thermodynamic aspects) make it distinct to the air sports and land sports. It has also been shown that aquatic exercises can improve the neurological performance, which significantly affects the daily activities, maintaining health, safety, and also the quality of life (17), such that in a study, wrestling had no significant effect on the cortisol and insulin levels in the prominent wrestlers, while sauna significantly reduced the insulin level in these athletes (18). Thus, regarding the existing discrepancies in the results of previous studies and since no comprehensive study was found before this research about aquatic exercises by the women affected by panic disorder, and considering cortisol as a factor for the HPA activities and the cortisol and insulin relations (10, 11), the question to be regarded is whether 12 weeks aqua training can help the treatment of panic disorder, thus, the current study aimed to review the effects of aqua training on cortisol and insulin levels of patients with panic disorder

Methods

The statistical population of this semi-experimental study included female patients diagnosed with the panic disorder, going to the hospitals or private offices of psychiatrics for the required treatments in Isfahan. Forty women affected by panic disorder were selected. The selection of the participants was in such a way that following the confirmation of the specialist physician based on definite panic attacks by the patients, they were invited to collaborate in the exercise plan, and after a week of coordination, the participants were completely notified about the plan, purposes, and the methodology of the study. They had no previous sport experiences, and they also submitted their letter of consent about the study. They were asked to prevent consumption of anything affecting the dependent variables. It is to note that the plan for the study was approved by the moral committee of Tehran Science and Research Medical Science University, and the participants were assured that the obtained information from them were confidential, and they could withdraw from the study any time they wanted. A week before starting the study, the demographic features including height, weight, body mass index, and w***aist to hip ratio (***WHR) were measured and recorded, and analyzed before and after the study. Accordingly, forty women were selected and categorized into two aqua training and control groups of 20 people. The subjects in the exercise group did the aqua training in 60 minutes by walking and running (10- 15 min warming up, 35- 40 min the main aqua training, and 10- 15 min cooling down) with the intensity of 50- 80 % of maximum heart rate (the control was performed by the polar beats) (water temperature 28- 30 C) for 12 weeks (3 days per week) (19), while the patients in the control group participated in no

exercises during research period. It should be noted that 4 people (2 persons from each group) were excluded from the study due to the life problems, working occupation, and did not participate in the measurements for the considered subjects, and thirty six people (18 in the aqua training group and 18 in the control group) were selected as the statistical samples. The first blood samples were taken in fasting condition, 24 hours before the 12-week training period and the second blood samples were taken 24 hours after last session from the right hand elbow front vein. About 5 cc of blood sample was taken each time from the subjects, placed in the special test tubes for preparing the serum, and centrifuged for 10 min. with 3000 rev. per min. The resulted serums were delivered to a laboratory and kept in -80 °C until the required time for measuring the indices. It is to note that all the procedures were done in homogeneous and standard conditions from 8:0 a.m. to 10:00 a.m. Obtaining the cortisol and insulin was done by special kits from Pars Azmoun Co. by the auto-analyzer device (Hitachi 902) made in Japan. The normal distribution of the data was first examined by Shapiro- Wilk test. Then, using the central indices and the data dispersion (mean and standard deviation), the paired sample t- test was used to compare the data in each group in pre and posttest, and independent t- test was applied to analyze the difference between the groups. All the statistical operations and calculations were done by SPSS 21 software at ($p \leq 0.05$).

Results

The demographic characteristics and pre and post levels of insulin and cortisol of aqua training and control groups presented in Table 1 and 2, respectively. The results about before and after the changes of cortisol from the paired t-test indicate that no significant changes were observed in any of the groups (aqua training group (p=0.53) and control group (p=0.49). However, the findings related to the insulin level showed a significant reduction in the aqua training group (p=0.001), although no significant changes were observed in the control group (p=0.36). Moreover, the results about the mean difference of the indices obtained from the independent t test indicate that a significant difference exists between the groups regarding the insulin level (p=0.001). However, no significant difference was observed between the groups for the cortisol level (p=0.52). Hence, we can conclude that the 12-week aqua training with 50- 80% of maximum heart rate significantly reduced insulin level in patients affected to the panic disorder.

Table 1. Demographic characteristics of aqua training and control groups subjects

Variables	control group (n=18)	aqua training group (n=18)
Age (year)	37.7 ± 7.5	40.5 ± 1.4
Height (cm)	158.5 ± 8.2	160.9 ± 6.3
Weight (kg)	68.10 ± 25.85	73.11 ± 4.2
BMI(kg/m^2)	27.4 ± 7.6	26.4 ± 65.7
WHR	0.85 ± 0.07	0.85 ± 0.5

Table 2. The results of independent and paired sample t tests for review the changes of cortisol and insulin in aqua training and control groups

Variable	Group	Pretest	Posttest	Paired sample t- test	Independent sample t- test
Cortisol (mg/dL)	Aqua training	7.60±4.7	10.10±4.40	P=0.53	P=0.52
	control	6.70±4.7	9.10±3.70	P=0.49	
Insulin (µIu/ml)	Aqua training	17.03±2.57	11.60±2.53	P=0.001	P=0.001
	control	16.90±5.30	18.50±6.00	P=0.36	

Discussion

The findings showed that despite increasing the rate of plasma cortisol after 12 weeks of aqua training in the aqua training and control groups, no significant changes were observed in the groups (intergroup and intragroup), and it was in conformity with the findings of Iwase *et al.* (2013), Pilch *et al.* (2013), and Strohle *et al.* (2009) (15, 20, 21). Iwase et al reported that after taking sauna, the cortisol level had no significant changes at 70 °C (20). In another study, Pilch *et al.* reported that taking sauna after running in the runners increased the cortisol level significantly (21). According to the results, physical exercises have had no significantly effects on the cortisol level even in healthy individuals. Strohle *et al.* also reported that aqua training had no significant effects on the plasma cortisol level in the patients affected by panic disorder. Thus, regarding the increase in the cortisol level and although measuring the blood cortisol level has been suggested as a criterion for the hyperactive HPA axis in the patients with mental disorders (15) and despite the fact that the ordinary feature of stress response is the releasing of adrenocorticotropic (ACTH) and cortisol hormones in the blood as the result of the HPA axis activation (4), but the involvement of the HPA axis is not still clear in the pathophysiology of panic disorder. On the other hand, various studies have used different methods and different intensity of the disease have reported different results after measuring the free cortisol in the sputum and plasma (22), such that they have suggested aerobic exercises as a non-medicinal approach towards treating the panic disorders (23, 24). For instance, numerous studies have analyzed the effects of aerobic exercises on the clinical responses of panic affected patients, and their results showed that 10 weeks of aerobic activities reduced the intensity of anxiety symptoms in the patients affected by panic disorder (23 -25). Anxiolytic reducing effects by aerobic exercises is reported in the studies by Esquivel *et al.* (2008) and Iwase *et al.* (2013) (16, 20). By the way, aqua training showed no significant effect on the cortisol level, in this study, and it seems that reduction in anxiety by the aerobic exercises was not due to reducing the cortisol level, as it is also shown in different studies that wrestling in healthy people has no significant effect on the cortisol level (26, 27). Moreover, various studies have reported that the sampling time after physical exercises can have significant effects on the cortisol density (28). Thus, it can generally be said that reducing the anxiety level by physical exercises has not been due to reducing the cortisol level, and it can be due to other means in the central nervous system. Regarding the insulin level, the findings showed that despite the significant reduction of plasma insulin after 12 weeks of aqua training, no significant changes were observed in the control group which is in conformity with the results obtained by Sadegh & Golestany, Kasprzak *et al.*, and Aggon *et al.* (18, 29, 30). Sadegh & Golestany reported that 12 weeks of aerobic exercises in water significantly reduced the level of insulin serum, as compared to the control group in the patients affected by MS (29). Regarding the effect of aqua training on the overweight women Kasprzak *et al.* showed that aqua training significantly reduce the insulin level (30). In another study Aggon *et al.* reported that wrestling had no significant effects on the insulin level in the top wrestlers, while taking sauna by these athletes significantly reduced the insulin level (18). In general, the studies have shown that regular physical exercises improve the sensitivity to insulin by increasing the glucose transport related to muscular contraction (31, 33), or via the muscular blood flow (34) as well as expression and translocation of the glucose transporter "GLUT-4" and encoding mRNA (35). Also, McGee and Hargreaves (2006) reported that physical exercises increase the activity of phosphatidylinositide-3-kinase in the substrate 1 of the insulin receiver, hence, increasing the inclination towards the receivers. Although

according to this study, the mechanism of insulin reduction by the aquatic exercises is not quite clear, it can be considered with regards to the earlier pointed mechanisms (36). However, it is reported that hyperactivity of the HPA axis has significant effects on the glucose homeostasis, which in turn, increases the insulin resistance and leads to diabetes type II (10, 37). Thus, aqua training can reduce insulin resistance and prevent diabetes in the patients affected by the panic disorder.

Conclusion

Aqua training reduced the insulin level significantly, but had no significant effect on the cortisol level of the patients with panic disorder. However, the mechanism for reducing insulin in this study is not via affecting the cortisol. Briefly speaking, the results of the present study indicates that aquatic exercises can reduce the insulin resistance in the patient affected by panic disorder and prevent the onset of diabetes. However, further studies are required in order to discuss and conclude with great certainty about the effective factors on increasing and reducing the factors and the applications in sports fields.

Ethical issues

Not applicable.

Authors' contributions

All authors equally contributed to the writing and revision of this paper.

Acknowledgements

The present study is a part of the findings in PhD thesis on the sport physiology in cardiovascular and respiratory field by Ms. Shiva Olamazadeh, supervised by Dr. Khosro Ebrahim and consulted by Dr. Farshad Ghazalian and Dr. M. Barakatain from Tehran Science and Reseach University, which has been approved by the ethical committee of that university. We hereby appreciate all the participating patients in this study and also the personnel of Setareh swimming pool for their appropriate collaborations.

References

1. Skapinakis P, Lewis G, Davies S, Brugha T, Prince M, Singleton N. Panic disorder and subthreshold panic in the UK general population: epidemiology, comorbidity and functional limitation. Eur Psy. 2011; 26 (6): 354- 362.
2. Grant BF, Hasin DS, Stinson FS, Dawson DA, Goldstein RB, Smith S, et al. The epidemiology of DSM-IV panic disorder and agoraphobia in the United States: results from the National Epidemiologic Survey on Alcohol and Related Conditions. J Clin Psy. 2006; 67 (3): 363-374.
3. Kaiya H, Sugaya N, Iwasa R, Tochigi M. Characteristics of fatigue in panic disorder patients. J Psy Clin Neur. 2008; 62 (2): 234- 237.
4. Jakuszkowiak- Wojten K, Landowski J, Wiglusz MS, Cubała WJ. Cortisol as an indicator of hypothalmic-pitituary-adrenal axis dysregulation in patients with panic disorder: a literature review. Psyc Dan. 2015; 27 (1): 445- 451.
5. Nash JR, Sargent PA, Rabiner EA, Hood SD, Argyropoulos SV, Potokar JP et al. Serotonin 5-HT1A receptor binding in people with panic disorder: positron emission tomography study. Br J Psy. 2008; 193: 229- 234.
6. Siegmund A, Koster L, Meves AM, Plag J, Stoy M, et al. Stress hormones during flooding therapy and their relationship to therapy outcome in patients with panic disorder and agoraphobia. J Psy Res. 2011; 45: 339- 346.
7. Goldstein S, Halbreich U, Asnis G, Endicott J, Alvir J. The hypothalamic (pituitary) adrenal system in panic disorder. Am J Psy. 1987; 144: 1320-1323.
8. Bandelow B, Wedekind D, Sandvoss V, Broocks A, Hajak G, Jutta P, et al. Diurnal

variation of cortisol in panic disorder. Psy Res .2000; 95: 245- 250.
9. Uhde TW, Joffe RT, Jimerson DC, Post RM. Normal urinary free cortisol and plasma MHPG in panic disorder: Clinical and theoretical implications. Bio Psy.1988; 6 (23): 575- 585.
10. Bauer M, Jeckel CMM, Luz C .The role of stress factors during aging of the immune system. Ann NY Sci. 2009; 1153: 139- 152.
11. Pauli R, Souza L, Rogatto G, Gomes R, Luciano E .Glicocorticóides e síndrome metabólica: aspectos favoráveis do exercício físico nesta patofisiologia. Rev Port Cien Desp. 2006; 6: 217- 228.
12. Watts M. Endosulfan pesticide action network. Asia Pacific. 2008; 1- 41.
13. Ehlert U, Gaab J, Heinrichs M. Psychoneuroendocrinological contributions to the etiology of depression, posttraumatic stress disorder, and stress-related bodily disorders: The role of the hypothalamus- pituitary- adrenal axis. Bio Psy. 2001; 57: 141- 152.
14. Pull CB, Damsa C. Pharmacotherapy of panic disorder. Neu Dis Tre. 2008; 4 (4): 779- 795.
15. Strohle A, Graetz B, Scheel M, Wittmann A, Feller C, Heinz A, et al. The acute antipanic and anxiolytic activity of aerobic exercise in patients with panic disorder and healthy control subjects. J Psy Res. 2009; 43 (12): 1013- 1017.
16. Esquivel G, Dı´az-Galvis J, Schruers K, Berlanga C, Lara-Mun˜oz C, Griez E. Acute exercise reduces the effects of a 35 % CO2 challenge in patients with panic disorder. J Aff Dis. 2008; 107 (1-3): 217- 220.
17. Frohman AF, Okuda DT, Beh S, Treadaway K, Mooi C, Davis SL, et al. Aquatic training in MS: neurotherapeutic impact upon quality of life. Ann Clin Tra Neur. 2015; 2 (8): 864- 872.
18. Aggon E, Kiyici F, Ucan I, Colak M, Agirbas O, Hackney AC. The effect of wrestling training and sauna practice on cortisol and insulin hormones. Adv Phys Edu. 2016; 7: 303- 310.
19. Ketabi Pour M. The effect of an aerobic exercise course on cysteine and cardiovascular risk factors on postmenopausal women. MSc Thesis. Shiraz University. 2010.
20. Iwase S, Kawahara Y, Nishimura N, Takada H, Nagata M, Niimi Y, Miwa C. Effects of dry and mist saunas on circulatory and thermoregulatory functions in humans. Hea J. 2013; 5: 267- 273.
21. Pilch W, Pokora I, Szyguła Z, Pałka T, Pilch P, Cisoń T, et al. Effect of a single finnish sauna session on white blood cell profile and cortisol levels in athletes and non- athletes. Jou Hum Kin. 2013; 39: 127- 135.
22. Staufenbiel SM, Pennix BW, Spijker AT, Elzinga BM, van Rossum EF. Hair cortisol, stress exposure, and mental health in humans: a systematic review. Psy J. 2013; 38: 1220- 1235.
23. Rhardt A, Ising M, Unschuld PG, Kern N, Lucae S, Putz B, et al. Regulation of the hypothalamic-pituitary- adrenocortical system in patients with panic disorder. Neu Psy. 2006; 31: 2515- 2522.
24. Gomes RM, Sardinha A, Soares de Arau Jo CG, Nardi AE, Deslandes AC. Aerobic training intervention in panic disorder: a case-series study. Med Xpr. 2014; 1 (4): 195- 201.
25. Broocks A, Bandelow B, Pekrun G, George A, Meyer T, Bartmann U, et al. Comparison of aerobic exercise, clomipramine, and placebo in the treatment of panic disorder. Am J Psy. 1998; 155 (5): 603- 609.
26. Wedekind D, Sprute A, Broocks A, Huther G, Engel K, Falkai P, et al. Nocturnal urinary cortisol excretion over a randomized controlled trial with paroxetine vs. placebo combined with relaxation training or aerobic exercise in

panic disorder. Cur Pha Des. 2008; 14 (33): 3518- 3524.
27. Wedekind D, Broocks A, Weiss N, Engel K, Neubert K, Bandelow B. A randomized, controlled trial of aerobic exercise in combination with paroxetine in the treatment of panic disorder. Wor J Bio Psy. 2010; 11 (7): 904- 913.
28. Ratamess NA, Hoffman JR, Kraemer WJ, Ross RE, Tranchina CP, Rashti SL, Faigenbaum AD. Effects of a competitive wrestling season on body composition, endocrine markers, and anaerobic exercise performance in NCAA collegiate wrestlers. Eur J App Phys. 2013; 113: 1157- 1168.
29. Sadegh S, Golestany A. Effects of 10 weeks of aerobic training in water on chemerin and insulin resistance in women with multiple sclerosis. Hor Med Sci J. 2016; 23: 229- 234.
30. Kasprzak Z, Pilaczyńska-Szcześniak L. Effects of regular physical exercises in the water on the metabolic profile of women with abdominal obesity. J Hum Kin. 2014; 41:71- 79.
31. Roemmich JN, Sinning WE. Weight loss and wrestling training: effects on growth-related hormones. J App Phy. 1997; 82: 1760- 1764.
32. Daly W, Seegers C, Timmerman S, Hackney AC. Peak cortisol response to exhausting exercise: effects of blood sampling schedule. Med Spo. 2004; 8: 17-20.
33. Santos JM, Ribero SB, Gaya AR, Appell HJ, Duarte JA. Skeletal muscle pathways of concentration-enhanced glucose uptake. Int J Spo Med. 2008; 29 (10): 785- 794.
34. Farese RV. Function and dysfunction of a PKC isoforms for glucose transport in insulin-sensitive and insulin resistance states. Am J Phy End Met. 2002; 283: E1-E11.
35. Fuerger PT, Bracy DP, Malabanan CM, Pencek RR, Wasermann DH. Distributed control of glucose uptake by working muscles of conscious mice: role of transport and phosphorylation. Am J Phy End Met. 2004; 286: 77- 84.
36. McGee SL, Hargreaves M. Exercise and skeletal muscle glucose transporter 4 expression: molecular mechanisms. Clin Exp Pha Phy. 2006; 33 (4): 395- 399.
37. Pauli R, Souza L, Rogatto G, Gomes R, Luciano E .Glicocorticoides e sindrome metabolica: aspectos favoraveis do exercise fisico nesta patofisiologia. Rev Port Cien Desp. 2006; 6: 217- 228.