European Proceedings of
Social and Behavioural Sciences
EpSBS

www.europeanproceedings.com
e-ISSN: 2357-1330

DOI: 10.15405/epsbs.2021.05.50

ISCKMC 2020

International Scientific Congress «KNOWLEDGE, MAN AND CIVILIZATION»

MODIFICATION OF PSYCHOPHYSIOLOGICAL STATUS OF MIDDLE-AGED TEACHERS THROUGH AQUAFITNESS

Valentina Ivanovna Dolgova (a)*, Natalya Vladimirovna Mamylina (b),
Natalya Anatolyevna Belousova (c),
*Corresponding author

South Ural State Humanitarian Pedagogical University, 69, Lenin ave., Chelyabinsk, Russia, dolgovavi@cspu.ru
(b) South Ural State Humanitarian Pedagogical University, 69, Lenin ave., Chelyabinsk, Russia, mamylinanv@cspu.ru
(c) South Ural State Humanitarian Pedagogical University, 69, Lenin ave., Chelyabinsk, Russia, belousovana@cspu.ru

Abstract

There is a growing interest from specialists towards the issue of modifying the mental strain experienced by middle-aged teachers. The paper analyzed a psychophysiological state of middle-aged female teachers (50–55 years old) during a school year (at the beginning of the school year (background level) and following three and nine months of professional activity). The psychophysiological status was evaluated against the state of typological nervous indicators, including human personality, level of state anxiety, etc., and stress resistance. A circadian rhythm was determined in 1-minute estimation test. Stress resistance or state anxiety of teachers was evaluated using the test of Ch. Spielberg, Yu. Khanin; individual personality traits were typified using the Eysenck personality questionnaire (form A). A "1-minute" test was carried out in two options: 1) each subject counted for 1-minute time under the control of a stopwatch, trying to stay within one environmental minute; 2) using a stopwatch, a 1-minute span was estimated by the subjects counting from 1 to 60. One of the verified characteristics is stress resistance that is viewed as a kind of complex visual-motor reaction. In order to modify mental strain during the academic year, the teachers of the experimental group were offered a program of aquafitness classes. The results showed that the classes contributed to lower mental strain and state anxiety, modified psycho-emotional state and stress resistance, and reduced the rate of sensorimotor reaction with and without motivator among the teachers within their professional activity.

Keywords: Aquafitness, state anxiety, neuroticism, 1-minute estimation, stress resistance, sensorimotor reaction

https://doi.org/10.15405/epsbs.2021.05.50
Corresponding Author: Valentina Ivanovna Dolgova
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

1. Introduction

The symptoms of mental strain, chronic fatigue, and poor health indicate the features residing in prolonged stress and mental overload, which lead or may lead to a complete disintegration of various mental spheres, and above all, emotional (Belousova et al., 2019; Dolgova et al., 2017; Kolesnichenko et al., 2018; Yin et al., 2019; Schoeps et al., 2019). When these symptoms begin they are almost invisibly, but the more they escalate, they more irreversible the consequences for the teachers, ending up with complete down-skilling, reduced motivation, interest in work and any professional activity.

The psychophysiological mechanisms of the onset and development of mental strain are determined by the individual neurodynamic models of brain, personality psychophysiological categories and the level of non-specific adaptive elements of human brain tissue. The above is especially true for middle-aged female teachers, whose pedagogical activity is rich in numerous stress factors throughout the school year. In this regard, it is relevant to monitor the psychophysiological status of teachers during the academic year and to find various ways of preventing mental strain via physical culture at large (Bolach & Pystupa, 2014; Kotlo et al., 2016; Petrovych, 2013; Romanowska-Tolloczko & Smolinski, 2007) and aquafitness in particular (Alteneder & Hornbeck, 2003; Foley, 2017; Lazar et al., 2013; Nasehi et al., 2014). A rational for a training program based on different forms of water aerobics can serve as an effective means for solving health problems for middle-aged female teachers, boost optimal vitality and trigger the mechanisms of anti-stress protection of the body.

2. Problem Statement

Despite a growing interest from specialists towards the necessity to modify mental strain experienced by middle-aged teachers, so far no rationale has been provided to take up this challenge via aquafitness.

3. Research Questions

Research questions are related to the contribution of aquafitness to emotional state and psychophysiological status of middle-aged teachers throughout the academic year.

4. Purpose of the Study

To study the effect of physical activity (aquafitness) on the emotional state and psychophysiological status of middle-aged teachers in their professional activity.

5. Research Methods

Psychophysiological characteristics of middle-aged schoolteachers (50–55 years old) engaged in middle school (grades 5–9) were evaluated throughout the academic year – at the beginning of the year (background level), and following 3 and 9 months of teaching. Three months after the beginning of the

https://doi.org/10.15405/epsbs.2021.05.50
Corresponding Author: Valentina Ivanovna Dolgova
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

school year, the first quarter ended (a third of the educational process), and after 9 months – the end of the school year.

The study involved 26 women, divided into two groups of 13 people each. The female teachers of the control group (CG) were involved in a traditional pedagogical process that did not include any additional physical exercises. The female teachers of the experimental group (EG) attended physical culture and health-improving classes specifically designed subject to their body type. The classes were coupled with swimming in a pool, whose water medium is thought as a natural simulator with many functions (twice a week for 45 minutes), and aerobic exercise (once a week) lasting 60 minutes. A persistent healthy effect of performing aerobic exercise in water is attributed to an improved activity of human functional systems (cardiovascular, endocrine, respiratory, etc.), the phenomenon of gravitational unloading of the musculoskeletal system.

The somatometric indices of women in both groups were within the age norm. The body mass index of the teachers of both groups was 28.9 ± 0.4. Following a medical check-up, all teachers were eligible to teach at school, and had a work experience of at least 25 years. In addition, the teachers of the study sample did not suffer from hypertension, coronary artery disease, atherosclerosis, persistent heart rhythm disturbances, diseases of the endocrine and respiratory systems.

Stress resistance or state anxiety of the teachers was evaluated using the test of Ch. Spielberg, Yu. Khanin; individual personality traits were typified using the Eysenck personality questionnaire (form A) (Zabrodin & Pakhalyan, 2015).

A “1-minute” test was carried out in two options: 1) each subject counted for 1-minute time under the control of a stopwatch, trying to stay within one environmental minute; 2) using a stopwatch, a 1-minute span was estimated by the subjects counting from 1 to 60. The first option assumes estimations of a metric second, and the second – self-assessed metric 1-second duration. Each measurement was repeated three times, following the average value to be found.

Human neurodynamic indices are relatively stable and make it possible to characterize the state of nervous processes. One of the verified characteristics is stress resistance, which is a kind of complex visual-motor response. This indicator was analyzed using the UPDK-MK software package (software version 5.3.1221) developed by Neurocom CJSC. The values in the range of 275–371 ms indicate the greatest stress resistance, 371-590 ms – lower results. Statistical processing of the results was performed using Excel 2000 and STATISTICA 8.0 following a Student’s *t*-test for dependent and independent samples. The mean value (X) and the error of the mean (m) were calculated, the differences were considered significant at $p < 0.05$ (Sidorenko, 2003).

6. Findings

At the beginning of the study, the teachers of both groups were asked to answer 14 questions in a questionnaire to assess the type of professional activity, the actual lifestyle, patterns of physical activity, motives and interests in physical exercises. It turned out that most of the respondents spent their working time at their desks and were subject to continuous mental strain; 20 % of female teachers preferred to spend their working time standing, while the rest had a combined type of work activity like walking

https://doi.org/10.15405/epsbs.2021.05.50
Corresponding Author: Valentina Ivanovna Dolgova
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

around school, sitting at a desk, a computer, etc. Over 80 % of female teachers were not engaged in any physical activity, including fitness, aerobics, swimming, etc.

The Eysenck personality questionnaire was used to identify 16 extroverts and 10 introverts (on the "sincerity" scale, all the women got at least four points, indicating that they gave honest answers to the questions proposed). On the "extraversion", "introversion" and "neuroticism" scales, no significant differences were found between the 2 groups of women. The state anxiety indicators of female teachers throughout the academic year are presented in Table 1.

Table 1. State anxiety indicators of female teachers throughout the academic year

Groups/Anxiety levels (points)	High	Medium	Low
Background level (start of academic year)			
CG	66.1±2.1	44.2±1.6	35.3±1.6
EG	67.1±2.6	44.8±0.7	35.9±1.8
3 months later			
CG	65.6±2.3	43.9±1.7	34.2±0.7
EG	60.1±1.8*	40.9±1.6*	31.3 ±0.8*
9 months later			
CG	68.3±1.3	45.1±0.8	37.6±0.7
EG	-	36.4±0.9*	25.1±0.5**

Note: reliability of the differences in the EG indicators of female teachers vs the EG indicators, calculated using the Student's *t*-distribution: *–p <0.05; **–p <0.01.

At the beginning of the academic year, the number of teachers with a high level of state anxiety in the CG was 6, medium – 4, and low – 3. In the EG there were 7 teachers with a high level of state anxiety, medium and low – 3. Thus, at the beginning of the academic year, there were no significant differences between the levels of state anxiety among the female teachers.

Three months after the beginning of the school year, in both groups there was a persistent tendency towards a decrease in the average scores characterizing the levels of state anxiety. This indicates the activation of body's compensatory and adaptive mechanisms aimed at resisting mental strain. As compared with the background level of the EG teachers with high and medium levels of state anxiety, the average indicators decreased by 10.4 % ($p<0.05$) and 8.7 % ($p<0.05$), respectively.

Nine months after the beginning of the academic year, there were no teachers in the EG with a high level of state anxiety. As compared with the background level of the EG teachers with medium and low levels of state anxiety, the average indicators decreased by 18.8 % ($p<0.05$) and 30.1 % ($p<0.01$), respectively.

Three and particularly nine months after the beginning of the academic year, average points equivalent to the levels of state anxiety of the EG teachers reduced significantly, which proves a positive effect of fitness and swimming on the women's psycho-emotional state.

The changes in the levels of neuroticism and state anxiety among female teachers of the groups tendentiously coincided during the academic year. These indicators significantly decreased among the EG teachers by the end of the academic year in comparison with the background values.

Based on the results of the "1-minute estimation" test, there was time underestimation in women-extroverts whose circadian rhythm was high. 1-minute fluctuations in female teachers were assessed throughout the academic year. The findings are presented in Table 2.

https://doi.org/10.15405/epsbs.2021.05.50
Corresponding Author: Valentina Ivanovna Dolgova
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

Table 2. "1-minute estimation" indicators among teachers throughout the academic year

Groups/1-minute indicators	1-minute counting (number of digits)	Counting time up to 60 (s)
	Background level	
CG	73.4 ±1.6	55.4 ±0.9
EG	74.2±0.9	56.1±0.8
	3 months later	
CG	72.2±2.1	56.6±0.7
EG	73.8±1.8	57.2±0.9
	9 months later	
CG	80.3±2.7	49.2±0.8
EG	61.4±1.8*	60.2±1.3*

Note: reliability of the differences in the EG indicators of female teachers vs the EG indicators, calculated using the Student's *t*-distribution: *–p <0.05; **–p <0.01.

Based on the results of the "1-minute estimation" test three months after the beginning of the school year, the number of digits estimated by counting for 60 s did not significantly change as compared to the background level.

Nine months after the beginning of the academic year, the"1-minute estimation" indices changed as compared to the background level as follows: the number of digits estimated by counting for 60 s by the CG teachers increased by 9.4 % (p <0.05); by the EG women it decreased by 17.3 % (p <0.05). The counting time up to 60 s estimated by the CG women decreased by 11.2 % (p <0.05); by the EG women – increased by 7.3 % (p <0.05) compared to the beginning of the school year.

It turned out that extrovert teachers reduced their physical activity and mental performance faster than introverts during testing. The highly anxious women were characterized by a greater number of counts per minute and a lower value of a subjective minute. The results of the analysis of stress resistance are summarized in Table 3 and Table 4.

The average "1-minute estimation" values for women of both groups vary in different periods of the educational process. The greatest overestimation of time occurred by the end of the academic year both among women-extroverts and introverts in the CG, "1-minute estimation" values among teachers from the EG during this period approached the environmental minute values. The fact that "1-minute" estimation approximates the environmental values in women from the EG at the end of the academic year speaks for particular effectiveness of time management and successful implementation of the tasks set. It is a common fact that, the perception of time spans and, accordingly, their assessment depends on the functional state of the human body, especially in the psychoemotional sphere (Bougault & Boulet, 2013; Meredith-Jones et al., 2011; Petrescu et al., 2014; Shishkina & Beygul, 2014). Consequently, the proposed fitness programs contributed to the improvement of psychoemotional state of the teachers from the EG during the entire academic year, which increased stress resistance, positively influenced the functioning of cardiovascular, endocrine, respiratory and other systems.

https://doi.org/10.15405/epsbs.2021.05.50
Corresponding Author: Valentina Ivanovna Dolgova
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

Table 3. Comparative analysis of stress resistance in both groups of teachers at the beginning of the academic year (background level) (n = 13)

Stress resistance	Index, unit	T3		T4	
		M±m	CV	M±m	CV
CG	M, ms	501.95 ±51.43	11.3	402.74 ±56.44	15.78
EG	M, ms	498.41 ±15.99	4.3	382.58 ±21.6	6.4

Table 4. Comparative analysis of stress resistance in both groups of teachers at the end of the academic year (n = 13)

Stress resistance	Index, unit	T3		T4	
		M±m	CV	M±m	CV
CG	M, ms	570.95 ±51.43	11.3	479.74±56.44	15.78
EG	M, ms	419.41 ±15.99	4.3	343.58 ±21.67	6.4

The entire sample of women is characterized by stress resistance indices below the average, which can be considered as a population characteristic or as a marker of mental strain. Stress resistance indices suggest that there is a fairly large range of control values. The coefficient of variation in all samples is less than 30 %, which indicates the relative homogeneity of the populations.

The indices T3 and T4 represent the speed values of sensorimotor reactions when actions are performed with and without motivation. The index T3 in the control and experimental groups throughout the academic year do not have significant differences (CG: t=0.95, p=0.352; EG: t=0.0, p=1.000). In a similar way, the speed values of the sensorimotor reaction with motivation change (CG: t=0.96, p=0.335; EG: t=1.27, p=0.215). These data indicate some genetic determination of the speed of sensorimotor reactions, but the lack of reliability in the speed values of sensorimotor reactions with motivation indicates the stress of regulatory mechanisms in the population of teachers.

The reduced reaction time in both groups in the T4 index confirms the impact of the motivational component in increasing the effectiveness of teachers' activities, the mechanism of which is associated with the processes of sensorimotor integration in the cerebral cortex.

The difference between T3 and T4 indices in the control and experimental groups at the end of the academic year has statistically significant differences (t=2.81, p=0.009; t=2.25, p=0.0034), which proves the effectiveness of the proposed stress prevention program and confirms improvements the mechanisms of sensorimotor regulation among teachers from the EG.

7. Conclusion

The study enables the following conclusion:

The program of aquafitness classes during the academic year contributed to a decrease in mental strain in middle-aged female teachers, which was expressed in a decrease in arousal processes and is a sign of the stress resistance phase.

During aquafitness classes, there is a gradual stabilization in the mental state of middle-aged teachers, which is confirmed by a decrease in the level of state anxiety, an adequate subjective assessment of time spans, indicating an improvement in the process of registration and reproduction of information.

Aquafitness classes decrease the rate of sensorimotor reaction with and without motivation. Being stress resistance indices, they characterize the state of sensorimotor integration in the cerebral cortex.

Acknowledgments

The paper is written in the framework of the Scientific and Methodological Foundations of Psychology and Management Technology of Innovative Educational Processes in the Changing World scientific project of the comprehensive plan of research, project and organizational activities of the research centre of Russian Academy of Education in the South Ural State Humanitarian Pedagogical University for 2018-2020 (Grant from the Mordovia State Pedagogical Institute named after M.E. Evsevyev)

References

Alteneder, R. R., & Hornbeck, C. (2003). Advocating for Aqua Therapy: Here's What Women Need to Know About Exercising in Water. *AWHONN Lifelines, 7(*5), 445–449. https://doi.org/10.1177/1091592303259519

Belousova, N. A., Dolgova, V. I., & Maltcev, V. P. (2019). Neurodynamic Features of Elderly Teachers as Indicators of Professional Performance. *Advan. in Health Sci. Res., 16*, 65–68.

Bolach, B., & Pystupa, T. (2014). Health Oriented Training for Women in Selected Fitness Clubs. *Pedag., Psychol. and Med. and Biolog. Probl. of Phys. Train. and Sports*, *1*, 85–89.

Bougault, V., & Boulet, L-P. (2013). Airways Disorders and the Swimming Pool. *Immunol. and Allergy Clin. of North Amer., 33*(3), 395–408. https://doi.org/10.1016/j.iac.2013.02.008

Dolgova, V. I., Belousova, N. A., Mamylina, N. V., Vorozheykina, A. V., & Bogachev, A. N. (2017). Impact of physical activity of correctional orientation in the form of combined fitness and swimming on the psychophysiological state of 40–45-year-old women. *J. of Phys. Ed. and Sport, 17*(2), 905–909.

Foley, R. (2017). Swimming as an accretive practice in healthy blue space. (2017). *Emotion, Space and Society, 22*, 43–51. https://doi.org/10.1016/j.emospa.2016.12.001

Kolesnichenko, A. A., Petrova, Yu. O., & Polkovnikova, A. V. (2018). Emotional burnout syndrome in teachers and its prevention. *Digital Society in Personality Development. Int. Sci. and Pract. Conf.,* 138–141.

Kotlo, E. N., Kotlo, S. A., & Yachmeneva, A. S. (2016). *Strength Building Fitness in Stimulating*. https://doi.org/10.15405/epsbs.2019.12.23

Lazar, J. M., Khanna, N., Chesler, R., & Salciccioli, L. (2013). Swimming and the heart. *Int. J. of Cardiol., 168(120)*, 19–26. https://doi.org/10.1016/j.ijcard.2013.03.063

Meredith-Jones, K., Waters, D., Legge, M., & Jones, L. (2011). Upright water-based exercise to improve cardiovascular and metabolic health: A qualitative review. *Complementary Therapies in Medicine, 19*(2), 93–103. https://doi.org/10.1016/j.ctim.2011.02.002

Nasehi, M., Nasehi, M., Rahmani-Nia, F., Mirzaei, B., Torabi-Nami, M., & Zarrindast, M.-R. (2014). Swimming improves the emotional memory deficit by scopolamine via mu opioid receptors. *Physiol. & Behavior, 128,* 237–246. https://doi.org/10.1016/j.physbeh.2014.02.011

Petrescu, S., Piţigoi, G., & Paunescu, M. (2014). The Effects of Practicing Swimming on the Psychological Tone in Adulthood. *Proc. – Soc. and Behavioral Sci., 15923*, 74–77. https://doi.org/10.1016/j.sbspro.2014.12.331

Petrovych, V. (2013). Fitness as Means of Weight Reduction Among Women. *Phys. Train., Sport and Cult. of Health in the Modern Society, 1*(21), 212–215.

Romanowska-Tolloczko, A., & Smolinski, A. (2007). Factors Determining Self-esteem of Women Practicing Sport in Fitness Clubs. *Pedag., Psychol. and Med. and Biolog. Probl. of Phys. Train. and Sports, 9*, 138–140.

Schoeps, K., Tamarit, A., Barrera, U., & Barron, R. G. (2019). Effects of emotional skills training to prevent burnout syndrome in schoolteachers. *Ansiedad y Estres, 25*(1), 7–13. https://doi.org/10.1016/j.anyes.2019.01.002

Shishkina, E., & Beygul, I. (2014). Impact of Air Fitness on Functional Indicators of Women. *Phys. Train., Sport and Culture of Health in the Modern Society, 2*, 53–56.

Sidorenko, E. V. (2003). *Methods of mathematical processing in psychology.* Speech.

Yin, H., Huang, S., & Chen, G. (2019). The relationships between teachers' emotional labor and their burnout and satisfaction: A meta-analytic review. *Ed. Res. Rev., 28*(100283), 40. https://doi.org/10.1016/j.edurev.2019.100283

Zabrodin, Y. M., & Pakhalyan, V. E. (2015). *Psychognosis. Reference book*. Tertiary Education.