

# Psychosomatic symptoms in preschool children and how to treat them

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**Summary. Background.** Recent years saw an increase in children with emotional problems, which negatively affects not only their mental but also physical health. The current study aims to determine the structure of psychosomatic symptoms in preschool children and develop an effective treatment method for preschool teachers to deploy. **Methods.** A total of 259 children aged 4 to 5 years from Moscow preschools were divided into two groups: children (n=92) exposed to a standard education program and children (n=167) enrolled in the proposed education program for psychosomatic enhancement. The experiment lasted 6 months. **Results.** Using the proposed education program led to substantial improvements in the following KiddyKINDL subscales from baseline: Physical Well-being (1.19-fold increase,  $p<0.05$ ), Emotional Well-being (1.24-fold increase,  $p<0.05$ ), Self-esteem (1.21-fold increase,  $p<0.05$ ), Family (1.17-fold increase,  $p<0.05$ ), and Kiddy Parents (1.2-fold increase,  $p<0.05$ ). The control group demonstrated slight but not significant improvements ( $p>0.05$ ). **Conclusions.** Therefore, the preschool teachers can use the proposed education program to enhance the psychosomatic health of preschool-aged children.

**Key words.** Emotional sphere, emotional well-being, physical well-being, psychosomatic health.

*Sintomi psicosomatici nei bambini in età prescolare e come trattarli.*

**Riassunto. Scopo.** Gli ultimi anni hanno visto un aumento dei bambini con problemi emotivi. Ci sono molti processi socioeconomici, politici e di altro tipo in corso nel mondo in questo momento, che cambiano il modo in cui viviamo e ciò che ci circonda. Questi cambiamenti possono influenzare negativamente la salute dei bambini, sia dal punto di vista somatico che mentale. Il presente studio mira a determinare la struttura dei sintomi psicosomatici nei bambini in età prescolare e a sviluppare un metodo di trattamento efficace da utilizzare per gli insegnanti prescolari. **Metodi.** Un totale di 259 bambini di età compresa tra 4 e 5 anni delle scuole materne di Mosca sono stati divisi in due gruppi: bambini (n=92) esposti a un programma educativo standard e bambini (n=167) iscritti al programma educativo proposto per il miglioramento psicosomatico. L'esperimento è durato 6 mesi. **Risultati.** L'utilizzo del programma educativo proposto ha portato a miglioramenti sostanziali nelle seguenti sottoscale KiddyKINDL rispetto al basale: Benessere fisico (aumento di 1,19 volte,  $p<0,05$ ), Benessere emotivo (aumento di 1,24 volte,  $p<0,05$ ), Autostima (aumento di 1,21 volte,  $p<0,05$ ), Famiglia (aumento di 1,17 volte,  $p<0,05$ ) e Genitore-figlio (aumento di 1,2 volte,  $p<0,05$ ). Il gruppo di controllo ha mostrato miglioramenti lievi ma non significativi ( $p>0,05$ ). **Conclusioni.** Alla luce di questi risultati, gli insegnanti della scuola materna possono utilizzare il programma educativo proposto per migliorare la salute psicosomatica dei bambini in età prescolare.

**Parole chiave.** Benessere emotivo, benessere fisico, salute psicosomatica, sfera emotiva.

## Introduction

The top priority of humanity should be the health of children, as child well-being is among the most important indicators of a country's socio-economic development<sup>1-3</sup>. Despite the rapid development of medicine, the state of health among children is alarming, and statistics are discouraging. The mortality rate in children aged 1 to 4 years in the United States is 24.3 deaths per 100.000 residents; children aged 5 to 14 years die at the rate of 13.6 per 100.000 residents<sup>4</sup>.

In Europe, child mortality for 2017 amounted to 256, with more than 50% of death cases among children under 1 year<sup>5</sup>. In 2015, 43.8 million Russians experienced some kind of illness registered for the first time; in 2016, primary morbidity grew by 1.5 million cases due to an increase in the first-time registered children under 14 years of age<sup>6</sup>.

Given the facts above, there exists an obvious need to preserve the health of children. It includes physical health, mental health, and social well-being<sup>3,7,8</sup>. It is vital to promote child health early in life, especially

during the preschool period<sup>9</sup>. The preschool years are a short, very important period in a child's development<sup>10</sup>, characterized by the formation of a child's self-concept. Across this time period, children make leaps in their cognitive, emotional, moral, and communicative development. Therefore, the preschool period is the most favourable time to instill good skills and habits in the child<sup>10,11</sup>. Full-fledged mental and physical development, however, requires the presence of appropriate conditions and support from parents and teachers<sup>12,13</sup>.

When it comes to health, preschool children must get a balanced diet<sup>14</sup>, a sufficient amount of sleep<sup>15</sup>, and enough physical activity<sup>16-18</sup>. While it is more or less clear what somatic health is all about, the mental and emotional well-being of preschoolers poses certain challenges to parents and teacher<sup>19</sup>. If a focus is on psycho-emotional development, then the spotlight is put on emotions, which drive a child's performance<sup>11</sup>. To ensure normal psycho-emotional development, parents and teachers thus have to teach the children to recognize, understand and control their emotions and feelings<sup>20-22</sup>.

A lot of attention has been devoted to the issues of psychosomatic health in preschool-aged children<sup>23-26</sup>. However, there are many socioeconomic, political, and other processes going on in the world right now, which change how we live and what is surrounding us. These changes may negatively affect the health of children, both somatic and mental sides. Hence, it is vital to come up with new ways to keep children healthy. This study aims to investigate the structure of psychosomatic symptoms in preschool-aged children and develop an effective treatment method for preschool teachers to deploy.

## Materials and methods

### PARTICIPANTS

The study involved 259 children, including 148 (57.1%) girls and 111 (42.9%) boys, aged 4 to 5 years, who attended preschools in Moscow. The inclusion criteria were those aged 4 to 5 years old, without mental and physical disabilities, and an informed consent form signed by parents or guardians. Children with chronic somatic pathology, congenital defects, mental illness, physical and/or mental retardation, and from families with low socioeconomic status were not included in the study. All children were divided into 2 groups: a control group and an experimental group. The control group, comprising 92 children (55 girls and 37 boys), was exposed to a standard education program. The experimental group, comprising 167 children (93 girls and 74 boys), was enrolled in the proposed education program. The groups were homogeneous in age, gender, physical and mental

development, and socioeconomic status of the parents.

### EXPERIMENT

The experimental education program for preschoolers aims to improve their psychosomatic health and instill a healthy lifestyle. It consists of health and fitness activities, play-therapy sessions, and sensory room interventions. Children participated in regular sessions with a psychologist, held on a one-on-one basis or in a group setting several times a month with the involvement of parents or guardians. Child psychologist taught children how to understand their emotions and physical experiences, as well as interact with peers and adults, in a playful unobtrusive manner. Children also received psychological support in these sessions. Sensory rooms, created in the studied preschools for the current research, were used to strengthen the children's psychosomatic health, whereas walking along a specially designed *health route* (greenspaces and open spaces for outdoor sensory walks) enhanced their physical well-being through exposure to play and nature. The experiment lasted 6 months.

### INSTRUMENTS

Both groups underwent clinical-anamnestic and clinical-psychopathological examinations before and after the experiment. The research also used questionnaires to gather information about children's psychosomatic health from parents and guardians.

Data on psycho-emotional and somatic well-being of children were collected using the Kiddy-KINDL questionnaire<sup>27</sup> (parent version) for measuring Health-Related Quality of Life (HRQoL) in children aged 3 to 6 years. The parent version of the Kiddy-KINDL consists of 7 subscales: Physical Well-being (4 items), Emotional Well-being (4 items), Self-esteem (4 items), Family (4 items), Friends (4 items), Everyday Functioning (4 items), and Kiddy Parents (22 items). There are another 7 items related to the child's health (Disease Module) that parents could answer, among which 6 items are meant to supplement the filter question (i.e., *Is your child staying in hospital just now or does it have a long-term illness?*). Parents are not obligated to answer these questions if the first item receives a negative response. The original seven subscales were rated on a 5-point Likert scale (0= never, 1= rarely, 2= sometimes, 3= often, 4= always). The additional yes/no styled items scored 0 for no and 1 for yes. All items on each subscale were summed up to a total score and converted into a 0 to 100 scale, with higher scores indicating better Quality of life (QoL)<sup>27</sup>.

The Strengths and Difficulties Questionnaire (SDQ)<sup>28</sup> was used to assess the emotional and somatic well-being of preschoolers. This instrument consists of 25 items arranged along a three-point response scale (0= not true, 1= somewhat true, and 2= certainly true) and is structured in 5 dimensions: Emotional Symptoms, Conduct Problems, Hyperactivity/Inattention, Peer Problems, and Prosocial Behavior. For each of the 5 subscales, a score ranges from 0 to 10 if all 5 items were completed. Scores can be considered normal (<6.0 points), borderline (6 points), or abnormal (>6.0 points). For this study, parents and guardians were given a shorter version of the SDQ questionnaire, comprising of 5 items: 1) 'often complains of headaches, stomach-aches or sickness'; 2) 'has many worries, often seems worried'; 3) 'often unhappy, down-hearted or tearful'; 4) 'nervous or clingy in new situations, easily loses confidence'; and 5) 'has many fears, easily scared'<sup>28</sup>.

During the play therapy sessions, children participated in standard games aimed to estimate their levels of emotional and cognitive development. The emotional testing for preschoolers consisted of a Max Lucher Colour Test<sup>29</sup>, a Visual-Associative Mood Self-Assessment Task (VAMSAT) by M.P. Fetiskin<sup>30</sup>, and a Faceless Doll Test<sup>31</sup>. VAMSAT<sup>30</sup> estimates how a child understands his/her emotional state. The child is shown nine faces, each depicting a specific emotional state, and instructed to choose one which best describes his/her current mood. In the Faceless Doll Test<sup>31</sup>, the child is given a female doll or a male doll without a face and multiple assembly pieces (i.e., eyes, eyebrows, noses, and mouths) that reflect different emotions. The child is allowed to create any facial expression of his/her desire. The resulting face is interpreted according to the reference table. The cognitive screening tools aimed to evaluate perception (missing parts, 'what do you see' game, odd one out), attention (find and cross out, write down the symbols, also known as the Pieron-Ruzer test), memory (remember dots), and verbal logical reasoning (constructing sentences, understanding stories) functions<sup>31,32</sup>.

## DATA ANALYSIS

Statistical data processing was done using Student's t-test and Fisher's F-test. The qualitative data and symptom frequencies were compared using Fisher's exact test. The samples were tested for normality using the Hana-Shapiro-Wilk test. Differences were considered statistically significant at  $p < 0.05$ . The study results were presented as Mean (M)  $\pm$  standard deviation (SD).

Analyses were made with Statistica Pro software (Stat Soft inc., USA), version for Windows 10, and Microsoft Excel 2013 (Microsoft, USA).

## ETHICAL ISSUES

The research protocol, the informed consent form, and the experimental education program were approved by the Bioethics Committee of the [BLIND-ED] University. Children were enrolled in the study after their parents or guardians signed an informed consent.

## Results

In general, parents reported their children felt weak and lacked energy (81.9%,  $n=238$ ), felt tired and worn out (84.2%,  $n=217$ ), slept poorly (55.2%,  $n=143$ ), had headaches (83.4%,  $n=216$ ), stomach-aches (71.4%,  $n=185$ ), poor appetite (69.5%,  $n=180$ ), nausea (58.7%,  $n=152$ ) and dizziness (55.6%,  $n=144$ ). The most frequently reported psycho-emotional symptoms were not being in a good mood (86.1%,  $n=223$ ), emotional lability (84.6%,  $n=219$ ), feeling unsure (83.8%,  $n=217$ ) and scared (72.6%,  $n=188$ ), and low self-esteem (44.4%,  $n=115$ ). The comparison groups did not differ statistically in the frequency of written complaints at the beginning of the experiment and were homogeneous.

The mean *KiddyKINDL* scores (table 1) for Self-esteem, Friends, Everyday Functioning and Kiddy Parents subscales were lower compared to other subdomains. There were no statistically significant differences between the experimental and control groups at baseline ( $p < 0.05$ ). The overall *KiddyKINDL* scores were below the normal range in both groups ( $67.60 \pm 4.03$  in the control group vs  $67.20 \pm 3.87$  in the experimental group).

After 6 months of the experiment, children in the control group showed slight improvements in all subscales, not statistically significant ( $p > 0.05$ ). The experimental group, on the other hand, demonstrated substantial improvements for Physical Well-being (1.19-fold increase,  $p < 0.05$ ), Emotional Well-being (1.24-fold increase,  $p < 0.05$ ), Self-esteem (1.21-fold increase,  $p < 0.05$ ), Family (1.17-fold increase,  $p < 0.05$ ), and Kiddy Parents (1.2-fold increase,  $p < 0.05$ ). The experimental group also showed a 1.2-fold improvement in the overall *KiddyKINDL* score; this was a statistically significant difference from baseline and compared to the control group ( $p < 0.05$ ). A slight but not significant increase was seen in Friends (1.19-fold increase,  $p < 0.05$ ) and Everyday Functioning (1.18-fold increase,  $p > 0.05$ ) subscales compared to the control values.

At the beginning of the study, 19.6% of the control group children and 18.6% of the experimental group children were reported to stay in a hospital or have a long-term illness. By the end of the study time period, the proportion of such children decreased to 18.5% and 14.4%, respectively. After 6 months, a decrease

in the Disease subscale score from baseline was only seen in the experimental group; the total of the Disease subscale dropped by 1.24 times ( $p < 0.05$ ).

For the *SDQ*, parents reported scores (table 2) that indicate a higher frequency of fears and pain complaints among children in both groups when compared to confidence loss and feelings of anxiety and unhappiness.

After 6 months of the experiment, children in the experimental group less often seemed worried and unhappy (1.47-fold decrease,  $p < 0.05$ ), clingy (1.35-fold decrease,  $p < 0.05$ ), or afraid (1.55-fold decrease,  $p < 0.05$ ) in new situations. Parents also reported a drop in complaints of headaches, stomachaches or sickness (1.44-fold reduction,  $p < 0.05$ ). These were statistically significant differences compared to the control values ( $p < 0.05$ ). Children in the control group also demonstrated slight but not significant improvements ( $p > 0.05$ ).

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## Discussion

This study was to examine the psychosomatic health of preschool-aged children. The results show that preschoolers often experience these somatic symptoms: generalized weakness, insomnia, dizziness, nausea, abdominal discomfort, and headaches. Among psycho-emotional symptoms, parents often reported not being in a good mood, mood lability, insecurity, being easily scared, and low self-esteem. Note that children with psycho-emotional difficulties were more likely to have somatic disorders. The reason behind this association is that negative emotions, stress, and fears create a favourable background for the onset or progression of somatic disorders and illness, resulting in the depletion of the body's resources. Somatic disorders or diseases also cause deterioration of the child's psycho-emotional state so that he/she becomes indifferent to toys, moody, and more sensitive<sup>16,18,32-36</sup>.

According to the results of the parent reports of the *KiddyKINDL*, children had problems with psycho-emotional well-being. The *KiddyKINDL* total score was low ( $67.60 \pm 4.03$  in the control group and  $67.20 \pm 3.87$  points in the experimental group); the lowest scores were obtained for self-esteem, friends, everyday functioning, and kiddy parents (table 1). Due to insufficiently developed skills in communication, preschool-aged children do not know how to handle conflict situations and disagreements with their peers. It is why preschoolers are vulnerable to favourable external influences. The consequences may be communication difficulties, social withdrawal, unwillingness to attend kindergarten, and more. In addition to that, children at this age begin to show interest in various gadgets and spend more time

watching animated films, which may inhibit the development of communication skills and accelerate social withdrawal from peers and parents. The results of the *KiddyKINDL* questionnaire coincide with the results of the *SDQ* questionnaire (table 2), which indicate that preschoolers had many fears, were anxious, lacked confidence in new situations, and experienced somatic symptoms, such as headaches, stomach pain, and nausea.

The present findings are consistent with similar studies. In particular, Vanaelst et al.<sup>23</sup> examined 4066 European children aged 4 to 11 years and found a decline in their emotional ( $p < 0.001$ ) and somatic ( $p < 0.001$ ) well-being. No sex-based differences were revealed ( $p = 0.282$ ). The researchers also emphasized the influence of family and environment on the psycho-emotional state of children<sup>23</sup>. Whalen et al.<sup>25</sup> examined the relationship between psycho-emotional well-being and physical health in preschool children. Schottelkorb et al.<sup>24</sup> explored associations between somatic symptoms and behavioural problems in preschoolers. The authors also show how play therapy can help to reduce the existing behavioural difficulties<sup>30</sup>.

The main goal of this study was to develop an effective education program for preschoolers that would improve their psychosomatic well-being. The proposed program proved to be more effective than the standard one, as evidenced by substantial improvements in the *KiddyKINDL* and *SDQ* subscales versus the control group ( $p < 0.05$ ). A 6-month follow-up revealed good results, but the proposed program will likely have even greater effects in the long run. When constructing the education framework, special attention was paid to the development of communication skills and alleviation of problems with peer interaction, self-identification, and self-perception in children. The proposed program also aimed to teach preschoolers how to understand their inner experiences, emotions, and their body. Because the classes took place in small groups, each child received enough attention. Joint activities with parent involvement helped parents to understand the feelings of their children better. The kids were able to share their experiences with their parents. In general, the proposed education program was designed to enhance the child's psycho-emotional well-being, which plays a fundamental role in regulating the cognitive processes and affects the child's self-esteem and moral development.

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## Conclusions

Using the proposed education program led to improvements in the following *KiddyKINDL* subscales: Physical Well-being (1.19-fold increase,  $p < 0.05$ ), Emotional Well-being (1.24-fold increase,  $p < 0.05$ ),

Self-esteem (1.21-fold increase,  $p < 0.05$ ), Family (1.17-fold increase,  $p < 0.05$ ), and Kiddy Parents (1.2-fold increase,  $p < 0.05$ ). The overall QoL improved 1.2-fold from baseline. The frequency of pain complaints among preschool children decreased 1.44-fold ( $p < 0.05$ ). The results of the *SDQ* questionnaire also showed that children became less often anxious (1.47-fold decrease,  $p < 0.05$ ), clingy (1.35-fold decrease,  $p < 0.05$ ), or afraid (1.55-fold decrease,  $p < 0.05$ ) in new situations.

Thus, it is recommended to use the developed program for classes with 4-5-year-old preschoolers, since it helps to improve the mental and somatic state of children, as well as facilitates the rapid establishment of relationships between children and their peers, parents and educators.

### Prospects for further research

Future research will focus on developing a psychosomatic rehabilitation program for children who are often hospitalized with nervous system diseases.

### References

- Sagner M, McNeil A, Arena R. The next chapter: the future of health care and lifestyle interventions. In: *Lifestyle medicine*. Cambridge: Academic Press 2017, 437-46.
- Lilly CM, Motzkus C, Rincon T, et al. ICU telemedicine program financial outcomes. *Chest* 2017; 151: 286-97.
- Khoury MJ. Precision medicine vs preventive medicine. *JAMA* 2019; 321: 406.
- Garfield RL. Spending on children's health care in the United States: accomplishments and challenges in financing health services for children. *JAMA Pediatr* 2017; 171: 110-11.
- Duke T, Yano E, Hutchinson A, et al. Large-scale data reporting of paediatric morbidity and mortality in developing countries: it can be done. *Arch Dis Child* 2016; 101: 392-7.
- Ulumbekova GE, Kalashnikova AV, Moklyachenko AV. Health indicators for children and adolescents in Russia. *Vesnik vy'sshej shkoly` organizaczii i upravleniya zdra-vookhraneniem* 2016; 3: 18-33. (in Russian)
- Greenland P, Hassan S. Precision preventive medicine—ready for prime time? *JAMA Intern Med* 2019; 179: 605-6.
- World Health Organization. Constitution. 2021. Available from: <https://www.who.int/about/governance/constitution>
- Alexander KE, Brijnath B, Biezen R, Hampton K, Mazza D. Preventive healthcare for young children: a systematic review of interventions in primary care. *Prev Med* 2017; 99: 236-50.
- Martins EC, Osório A, Veríssimo M, Martins C. Emotion understanding in preschool children: the role of executive functions. *Int J Behav Dev* 2016; 40: 1-10.
- Smith JP, Glass DJ, Fireman G. The understanding and experience of mixed emotions in 3-5-year-old children. *J Genet Psychol* 2015; 176: 65-81.
- Ocasio K, Van Alst D, Koivunen J, Huang CC, Allegra C. Promoting preschool mental health: results of a 3 year primary prevention strategy. *J Child Fam Stud* 2015; 24: 1800-8.
- Shoshani A, Slone M. Positive education for young children: effects of a positive psychology intervention for preschool children on subjective well-being and learning behaviors. *Front Psychol* 2017; 8: 1866.
- Drennen CR, Coleman SM, de Cuba SE, et al. Food insecurity, health, and development in children under age four years. *Pediatrics* 2019; 144: e20190824.
- Matricciani L, Paquet C, Galland B, Short M, Olds T. Children's sleep and health: a meta-review. *Sleep Med Rev* 2019; 46: 136-50.
- Teixeira Costa HJ, Abelairas-Gomez C, Arufe-Giráldez V, Pazos-Couto JM, Barcala-Furelos R. Influence of a physical education plan on psychomotor development profiles of preschool children. *J Hum Sport Exerc* 2015; 10: 126-40.
- Venetsanou F, Kambas A, Giannakidou D. Organized physical activity and health in preschool age: a review. *Cent Eur J Public Health* 2015; 23: 200-7.
- Rodriguez-Ayllon M, Cadenas-Sánchez C, Estévez-López F, et al. Role of physical activity and sedentary behavior in the mental health of preschoolers, children and adolescents: a systematic review and meta-analysis. *Sports Med* 2019; 49: 1383-410.
- Bierman KL, Motamedi M. Social and emotional learning programs for preschool children. In: Durlak J, Domitrovich C, Weissberg RP, Gullotta T (eds). *Handbook of social and emotional learning: research and practice*. New York: Guilford Press 2015, 135-51.
- Birgisdóttir F, Gestsdóttir S, Thorsdóttir F. The role of behavioral self-regulation in learning to read: a 2-year longitudinal study of Icelandic preschool children. *Early Educ Dev* 2015; 26: 807-28.
- Silkenbeumer JR, Schiller EM, Kärtner J. Co-and self-regulation of emotions in the preschool setting. *Early Child Res Q* 2018; 44: 72-81.
- Hoemann K, Xu F, Barrett LF. Emotion words, emotion concepts, and emotional development in children: a constructionist hypothesis. *Dev Psychol* 2019; 55: 1830-49.
- Vanaelst B, De Vriendt T, Ahrens W, et al. Prevalence of psychosomatic and emotional symptoms in European school-aged children and its relationship with childhood adversities: results from the IDEFICS study. *Eur Child Adolesc Psychiatry* 2012; 21: 253-65.
- Schottelkorb AA, Swan KL, Jahn L, Haas S, Hacker J. Effectiveness of play therapy on problematic behaviors of preschool children with somatization. *J Child Adolesc Counsel* 2015; 1: 3-16.
- Whalen DJ, Belden AC, Tillman R, Barch DM, Luby JL. Early adversity, psychopathology, and latent class profiles of global physical health from preschool through early adolescence. *Psychosom Med* 2016; 78: 1008-18.
- Movchun V, Lushkov R, Pronkin N. Prediction of individual learning style in e-learning systems: opportunities and limitations in dental education. *Education and Information Technologies* 2021; 26: 2523-37.
- Ravens-Sieberer U. The KINDL questionnaire for assessment of health-related quality of life in children and adolescents-revised version. In: Schumacher J, Klaiberg A, Brähler E (eds). *Diagnostic methods for evaluation of quality of life and well-being*. Göttingen: Hogrefe Verlag, 2003.
- Goodman R. Psychometric properties of the Strengths and Difficulties Questionnaire. *J Am Acad Child Adolesc Psychiatry* 2001; 40: 1337-45.
- The Lüscher Color Test. <https://bit.ly/3qAtfwD> [accessed 25 March 2022].
- Illin EP. Emotions and feelings: tutorial. 2nd ed. Sankt-Peterburg: Piter, 2011.
- Timchenko AV, Pokhilko DS. Analysis of modern methods of diagnostics of children's emotions. *Bulletin of Kh-NPU named after H.S. Skovorody. Psychology* 2017; 55: 259-68.

32. Nguen MA. Diagnostics of the level of development of emotional intelligence of a senior preschooler. *Child in Kindergarten* 2008; 1: 83-5.
33. Pashanova OV, Ermakov DA, Philippova AV, Tikhonova YA, Pronkin NN. Analysis methods for medications improving Cerebral circulation. *Res J Pharm Technol* 2021; 14: 115-21.
34. Maussumbekova S, Beketaeva A. Application of immersed boundary method in modelling of thrombosis in the blood flow. In: Danaev N, Shokin Y, Darkhan AZ (eds). *Mathematical modeling of technological processes. CITech* 2015. Communications in Computer and Information Science. Cham: Springer, 2015.
35. Baimbetov AK, Bizhanov KA, Abzaliev KB, Bairamov BA, Yakupova I. Prediction of arrhythmia recurrence after atrial fibrillation ablation in patients with normal anatomy of the left atrium. *Int J Clin Pract* 2021; 75: e14083.
36. Baimbetov AK, Abzaliev KB, Jukenova AM, Bizhanov KA, Bairamov BA, Ualiyeva AY. The efficacy and safety of cryo-balloon catheter ablation in patients with paroxysmal atrial fibrillation. *Ir J Med Sci* 2022; 191: 187-93.