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SUMMARY

Aim: The aim is to scientifically substantiate the feasibility of using the health improving forces of nature to slow down the natural aging of people of different ages.

Materials and Methods: The research involved 5 groups of respondents: the 1st group – students who were involved in sports (28 boys, 34 girls), the 2nd group – students who were not engaged in sports (29 boys, 22 girls), the 3rd group – female adults (45–65-year-old; n = 16), who were not engaged in health improvement training, the 4th group – female adults (45–65-year-old; n = 13), who used biologically active additives, the 5th group – 45–65-year-old women (n = 27) and men (n = 18) who were engaged in health improvement training according to the system by P. K. Ivanov.

Results: It was found that the physiological age of the 1st group was higher than the stated age; of the 2nd group corresponded to the stated age; of the 3rd group was exceeded the stated age by 6.9 years; of the 4th group was exceeded by 5.8 years; of the 5th group was lower than the stated age by 4.8 years for men and by 10.1 years for women.

Conclusions: It is proved that tempering according to the system by P. K. Ivanov, which does not require any material costs, has a pronounced health effect on the body of people of different ages (especially mature and elderly).

Key words: physiological age, tempering, health improvement system, people of different ages

Słowa kluczowe: wiek fizjologiczny, hartowanie, system poprawy zdrowia, osoby w różnym wieku

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INTRODUCTION

The formation of people's health priorities, motives for a healthy lifestyle since childhood, during school and student years is an urgent problem today in terms of the future of the state. According to sociological data, in particular oblasts of Ukraine, being in a difficult economic, social and environmental situation, only up to 2–4 % of children can be considered completely healthy: they have no disabilities in physical development. Over the past 10 years, the incidence rate among the population of Ukraine has increased by 2.5 times. The respective number of people who consider

themselves unhealthy has grown during this period from 30 to 90%. Even athletes who are characterized by a high level of physical development and fitness, also suffer from various cold-related diseases [1–3].

Modern medicine offers a large arsenal of pharmacological agents to prolong active human longevity. It is no coincidence that the concept of “anti-aging” or “healthy aging” is one of the priorities of the United Nations project entitled: “Research programs on aging in the XXI century”. However, the use of these drugs for revitalization or anti-aging is limited due to the frequent development of allergic reactions and

various complications that occur during their use [4, 5]. Moreover, nowadays humanity has to fight for life with the coronavirus (COVID-19), using a large arsenal of psychophysical rehabilitation agents in the fight against the viral pandemic [6-8]. Whether we like it or not, we need to “learn” how to live with the coronavirus for some period of our lives. Blind faith in medicine, in its main remedy i.e. pills, with which a person can easily become healthy, is the psychological basis of neglect of real natural remedies for health improvement. The scientists [9] emphasize the need to replace the traditional health care strategy, which involves the prevention and treatment of diseases, and to develop a fundamentally new strategy that is to stimulate the viability and body defences.

The natural health improvement of a human being is one of such stimulants. There are many systems of health improvement and tempering; the system by P.K. Ivanov is one of the most famous. This system is simple and accessible to everyone. It is based on love and trust in nature and people, wishes for health, help to those who need it, as well as swimming in open water or dousing with cold water, conscious refusal to eat and drink for a certain period of time, mental self-regulation, observance of moral norms, etc. [10, 11].

It is everyone's responsibility to maintain and enhance one's own health. But it is more often than not for a person with the wrong lifestyle, pernicious habits, sedentary lifestyle, overeating, etc. to have many different diseases before 30 years. The physiological age of such people is much higher than their stated one. Therefore, the subject of our research is to study the physiological age of people as an indicator of their health, quality and life expectancy.

AIM

The aim is to scientifically substantiate the feasibility of using the health improving forces of nature to slow down the natural aging of people of different ages.

MATERIALS AND METHODS

Our survey embraced 5 groups of people of different ages and occupations:

- the 1st group was represented by 18-19-year-old students who were involved in various sports (track-and-field athletics, swimming, boxing, wrestling) while studying at the Brovary Higher School of Physical Culture (28 boys, 34 girls);
- the 2nd group included students of the Faculty of Social Technologies of the University “Ukraine” (29 boys, 22 girls) who were not engaged in sports;
- the 3rd group consisted of adults (45-65-year-old women; n=16), who were not engaged in health improvement tempering;
- the 4th group comprised adults (45-65-year-old women; n=13), who were not engaged in health improvement tempering, but were supporters of nutrition with the use of food biologically active additives (BAA) produced by “Tianshi” corporation;
- the 5th group was represented by members of the Brovary city club of natural human health according to the system

by P.K. Ivanov entitled “Aquarius”: 45-65-year-old women (n=27) and men (n=18).

The representatives of the 1st, 2nd, 3rd and 4th groups were investigated once, the 5th group members were examined repeatedly for 30 years (from 1995 to 2020): the 1st survey took place in 1995, the 2nd – in 2005, the 3rd – in 2015 and the 4th – in 2020. The subjects of this group were divided into three subgroups depending on the length of their experience: the 1st subgroup included individuals with 5 years of experience, the 2nd – 15 years and the 3rd – 25 years or more.

It is important to note that P.K. Ivanov's health improvement system (system of healing of the person by forces of nature) is a complex influence on the human body of natural factors such as air, water and the earth for the purpose of activation of protective forces for struggle against diseases. This system is simple and accessible to everyone, there are almost no contraindications. The proponents of the health improvement system by P.K. Ivanov (group 5) led an active and healthy lifestyle (HLS). All of them follow the 12 rules of this system, move around the city only on foot or by bicycle, come upstairs exclusively on foot. All of them have homesteads or country-houses where they are engaged in “occupational therapy”. They do not take medication, because they stopped suffering from cold-related diseases and flu after they began practicing natural tempering. All members of this club have been vaccinated against COVID-19. The participants are not vaccinated against seasonal flu as there is no need for it.

The physiological age of the research participants was determined by the method of V.M. Serheiev [12]. This technique involved testing participants on 15 tests: body-weight indicator (c.u.); heart rate after coming upstairs to the 4th floor (beats/min.); heart rate after 2 minutes of rest (beats/min.); ability to come upstairs (number of floors); heart rate after 20 squats for 30s (beats/min.); heart rate 1 minute after 20 squats (beats/min.); systolic blood pressure (mm Hg); diastolic blood pressure (mm Hg); strong hand dynamometry (kg); Genchi test (breath-holding after exhalation) (s); push-ups from the floor (hardpoint) (times); flexibility test (angled position) (cm); Bondarevskyi test for balance (standing position, for example, on the left foot, with your right heel put on the knee of the left foot, hands on the belt, eyes closed) (s); tapping test in the first square for 10 s (times); tapping test in the fourth square (%). The test results were correlated with tabular data according to the age of the participant [Table I]. The difference between the tabular value and the obtained one was determined (with the corresponding sign: “-” if the participant's indicator exceeds the tabular one, or “+” if the participant's indicator is less than the tabular one). After that, the sum of all differences for each test (taking into account the sign) was determined and divided by the number of tests (15). The value obtained made the physiological age of the participant [Table 1].

The health status of the research participants was monitored systematically by medical staff (twice a year). In addition, self-control was exercised.

The research methods: analysis and generalization of literature sources, study of medical records of participants,

Table 1. Normative indicators for determining the physiological age of persons of different ages according to the method by V.M. Sergeiev [12].

	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Body-weight indicator	105	104	103	102	101	100	98	96	94	93	92	91	90	88
Heart rate after coming upstairs to the 4 th floor	104	106	108	110	112	116	120	122	124	126	128	130	132	134
Heart rate after 2 minutes of rest	93	94	95	96	98	100	102	104	106	108	110	112	114	116
Ability to come upstairs	35	32	30	28	26	24	22	18	14	12	8	6	4	3
Heart rate after 20 squats for 30 s	106	108	110	112	114	116	118	120	122	124	126	128	130	132
Heart rate 1 min after squats	72	74	76	78	80	82	84	86	88	96	102	108	112	114
Systolic blood pressure	100	105	108	110	115	120	125	130	135	140	145	150	155	160
Diastolic blood pressure	60	65	68	70	73	75	78	80	83	85	88	90	93	95
Dynamometry	45	56	54	52	51	50	49	48	47	46	44	43	42	38
Genchi test	45	42	40	38	35	32	30	28	25	23	21	19	18	15
Push-ups from the hardpoint	32	30	28	25	22	20	18	16	14	12	10	8	6	–
Flexibility test	-12	-11	-8	-7	-5	-3	0	+2	+6	+8	+10	+12	+14	+15
Balance test	42	40	33	30	28	25	20	17	15	10	8	7	5	3
Tapping test in the 1 st square	74	72	70	67	65	63	61	59	57	55	53	51	49	47
Tapping test in the 4 th square	3,5	4	4,5	5	5,5	6	7	8	9	10	12	13	14	15

observation, testing, pedagogical experiment, statistical analysis. The authenticity of difference between the indicators of studied groups by means of Student's t-test was determined. The significance for all statistical tests was set at $p < 0.05$.

The research was carried out according to the requirements of the Code of Ethics of Boris Grinchenko Kyiv University (protocol No.11 of 27 November 2019). Informed consent was received from all individuals who took part in this research and who could refuse participation at any time.

RESULTS

According to the research results of student youth [Table 2], it was found that the physiological age of male athletes with an average stated age of 18.9 years was 1.5 years younger and made 17.4 years. The female athletes' difference between the stated and physiological age made 0.4 years (the stated age was 18.5 years and physiological – 18.1 years). The physiological age of the students who were not engaged in sports (boys and girls) outstrips their stated age: for boys by 12.3 years; for girls by 8.7 years. This indicates premature physiological aging of student youth.

The comparative analysis of the stated and physiological age of students-athletes and students who were not engaged in sports shows a significant ($p < 0.001$) aging of the body of students who were not engaged in sports, regardless of their gender peculiarities, while statistically insignificant ($p > 0.05$) differences were registered in students-athletes (boys and girls) between the physiological and stated age, i.e. there was no "age wear" of the organism.

Table III reveals the results of longitudinal studies of the impact of tempering activities according to the system by P.K. Ivanov on the body of adults. It was found that the average values of the physiological age of HLS supporters, regardless of the length of their experience (5, 15, 25 and more years), differed from the stated age in the direction of its reduction. Namely: for women with 5 years of experience the difference was 8.9 years (48.2-39.3), for 15 years of experience – 16.3 years (58.8-42.5), for 25- and 30 years of experience – 8.4 years (60.0-51.6) and 6.8 years (65.0-58.2), respectively. On average, their physiological age was 10.1 ($8.9+16.3+8.4+6.8/4$) years lower than their stated age. The similar trend was observed among men: the physiological age was lower than the stated age by 5.4 years (45.6-40.2) with 5 years of experience in tempering and 4.1 years (56.3-52.2), respectively, with 15 years of experience. In all these cases, the physiological age lagged behind the stated age by an average of 4.8 years ($5.4+4.1/2$), i.e. there was no natural "wear" of the organism [Table 3].

The comparative analysis of the indicators of the stated and physiological age of 45-65-year-old women who were not supporters of the health improvement system by P.K. Ivanov and their female peers who were not engaged in health training, and those women who were supporters of health nutrition using biologically active additives, indicates the accelerated aging of the body particularly of the representatives of the 3rd and 4th groups [Table 4].

The latter was reflected in a probable ($p < 0.05$) increase in their physiological age relative to the stated one. Thus, the physiological age of women of the 3rd group on the average

Table 2. Indicators of the stated and physiological age of the student-athletes (group 1) and the students who were not engaged in sports (group 2), Mean±SD, years

Gender	n	Stated age	Physiological age	Difference
Students who were engaged in sports				
Boys	28	18.90±1.47	17.40±1.35	1.5
t; p		0.75; >0.05		
Girls	34	18.50±1.34	18.10±1.28	0.4
t; p		0.22; >0.05		
Students who were not engaged in sports				
Boys	29	19.10±1.60	31.40±1.34	12.3
t; p		5.89; <0.001		
Girls	22	19.60±1.55	28.30±1.30	8.7
t; p		4.30; <0.001		

Note: Mean – arithmetical average; SD – standard deviation; p – the significance of the difference between the indicators of studied groups due to the Student's t-test, t – t-test value

Table 3. Indicators of the stated and physiological age of 45-65-year-old men and women, who were engaged in tempering according to the system by P.K. Ivanov (group 5), at different stages of the survey (1995, 2005, 2015, 2020), Mean±SD, years

Studied indicators	Research stages	EG	CG	p2
Well-being, points	Beginning	4.3±0.19	4.4±0.20	p>0.05
	End	6.4±0.17	5.9±0.18	p<0.05
	p1	p<0.001	p<0.001	
Activity, points	Beginning	4.7±0.21	4.8±0.23	p>0.05
	End	5.6±0.22	5.7±0.23	p>0.05
	p1	p<0.01	p<0.05	
Mood, points	Beginning	4.8±0.18	5.1±0.19	p>0.05
	End	7.2±0.19	6.4±0.20	p<0.05
	p1	p<0.001	p<0.001	

Mean – arithmetical average, SD – standard deviation, p1 – the significance of the difference between the studied indicators within groups at the beginning and the end of research, p2 – the significance of the difference between EG and CG

Table 4. Indicators of the stated and physiological age of 45-65-year-old women who were not engaged in health improvement tempering (group 3) and those who were not engaged in health improvement tempering, but used food biologically active additives (group 4), Mean±SD, years

Gender	n	Stated age	Physiological age	Difference
Persons who were not engaged in health improvement tempering (group 3)				
Women	16	42.90±2.26	49.80±1.62	6.9
t; p		2.48; <0.05		
Persons who were proponents of food biologically active additives (group 4)				
Women	13	39.00±1.86	44.80±1.77	5.8
t; p		2.26; <0.05		

Note: Mean – arithmetical average; SD – standard deviation; p – the significance of the difference between the indicators of studied groups due to the Student's t-test, t – t-test value

was higher by 6.9 years (49.8-42.9), and the 4th group – by 5.8 years (44.8-39.0) than their stated age.

DISCUSSION

The use of tempering procedures in combination with health improving physical training sessions, as one of the components of a healthy lifestyle, is a powerful factor in

improving health, increasing the body's reserve capacity, as well as reducing the physiological age of people of different ages, genders and occupations that a priori increases their life expectancy [13]. Tempering according to the health system by P.K. Ivanov is not only tempering of the body on the physical level, it is also hardening of the spirit, training of

the will, achieving harmony in development through love of nature and people around you [12, 14]. The use of this system, which does not require any material costs, can be one of the alternative programs for the formation of a healthy lifestyle of young people, which aims to educate a healthy harmoniously developed and spiritually enhanced personality.

Before analysing the materials of our research, we would like to focus on one fact, which, in our opinion, is debatable. Thus, from the studies [15], we find that the differences between the stated and physiological age, which allow us to assess the intensity of aging of the individual, are most pronounced in long-living persons, while they are insignificant in young people. Therefore, according to the authors [15], "it makes sense to determine the physiological age only in 30-year-old or even 35-year-old persons." We partially agree with the covered fact. After all, there are a number of works that indicate significant differences between the stated and physiological age even at a young age. Thus, we clear out from the researches [16] that the difference between the stated and physiological age of students can be 4-5 years or more.

According to the materials of our research, the physiological age of 18-19-year-old students-athletes was 1.5 years lower than their stated age, while their peers-athletes' physiological age in the same sports, respectively, was higher than their stated age by 0.4 years, that is, we can assume that it, in general, corresponded to the calendar one. Therefore, we can assume that such athletes do not have "age-related wear" of the body. Different situation was observed in their peers (boys and girls) who were not engaged in sports. Thus, according to the results of the research, they revealed significant differences between their physiological and stated age in the direction of increasing the latter. All this indicates the aging of their still young body.

The slowdown in physiological aging among the surveyed adults (groups 3, 4 and 5) was observed in the followers (men and women) of natural tempering according to the system by P.K. Ivanov. Thus, men's physiological age was lower than their chronological age by an average of 4.8 years, respectively, women's by 10.1 years. The adults of the same age category, who were not engaged in health tempering, revealed age "wear" of the body. Their physiological age was 6.9 years higher than their stated one. Accelerated (on average by 5.8 years) age-related aging of the body was also observed in adults who were supporters of HLS in the nomination of "health nutrition" with the use of biologically active additives. To the above it should be added that those individuals who adhered to the principles of HLS, had a naturally greater energy potential for health, and therefore did not get sick, maintained efficiency, vigour for many years.

Thus, the following effects of tempering procedures were revealed according to the results of the research, as well as in our previous studies: 1. Systematic dousing with cold water according to the system by P.K. Ivanov significantly increased the body's defences of people of different ages and, as a result, they did not suffer from acute respiratory and viral infections; 2. Such persons also completely refused to take flu pills; 3. They got rid of pernicious habits (smoking, alcohol); 4. The

use of cold water therapeutic procedures had a positive effect on the vegetal tonicity of the body, which contributed to the harmonization of their psycho-emotional state; 5. The result of many years of tempering of people of different ages, genders and occupations according to the system by P.K. Ivanov is a restructuring of their consciousness in relation to themselves, their partners (for example, the elimination of possible aggressive behaviour towards rivals in sports), other people, and so on. The results of our many years of research complement and expand the findings of many scientists [17-19].

CONCLUSIONS

1. The physiological age of students who were not engaged in sports is higher than their stated age (in boys by 12.3 years, in girls by 8.7 years), which indicates the "age wear" of their body. The physiological age of students who were engaged in sports is generally consistent with the stated one. The physiological age of 45-65-year-old men, who were systematically engaged in the health system by P.K. Ivanov, is lower on average by 4.8 years than the stated one, of women – by 10.1 years. Persons of the same age who were not engaged in health tempering have age "wear" of the body. Their physiological age is 6.9 years higher than their stated age. Accelerated (on average by 5.8 years) age-related aging of the body was also observed in women who used of biologically active additives, but were not engaged in tempering procedures according to the mentioned system.
2. P.K. Ivanov's system of natural tempering of the person does not demand any material expenses, has the expressed improving effect on the body of people of different ages, gender and professional employment, and therefore, in our opinion, it can be referred to the existing methods of a healthy way of life and anti-aging.

Prospects for further research: to investigate the impact of P.K. Ivanov's system on the span of life and health indicators of people of different ages.

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