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Neurological typology and its role in enhancing technical and tactical skills in adolescent female boxers

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Abstract

Background. This article delves into the intricate typological characteristics of the nervous system and temperament, exploring their profound impact on accelerating the training and enhancement of technical and tactical skills in adolescent female boxers aged 12-15 years. Situated at the crucial stage of basic training, this study illuminates how individual neurotypological traits can significantly influence the efficacy and pace of skill acquisition in young athletes.

Purpose. To identify individual typological features of girls aged 12-15 years in the process of boxing education at the stage of basic preparation.

Material and Methods. The study was attended by skilled athletes (participants, prizes, championships of regional and international tournaments, Ukrainian championships in their age groups). Boxers, which are trained using basic preparation of Children's and Youth Sports School № 1 of Melitopol. To solve the tasks, the following methods of research have been used: theoretical analysis of special and scientific literature, materials of the Internet, summarizing data, mathematical statistics.

Results. It has been found out that all participants of the study are the same type of nervous system that corresponds to a weak type. The results revealed varied correlations across participants, ranging from strong positive correlations to negative or negligible ones. This suggests differing levels of bilateral coordination among the athletes. Notably, two participants (P2 and P9) displayed statistically significant differences in performance between their hands. When considering the group as a whole, the overall paired t-test did not indicate a statistically significant difference in performance between the right and left hands (T-Stat = 1.6885, P-Value = 0.0945). The overall correlation across all participants was found to be relatively low (0.0889), suggesting only a slight positive linear relationship between the movements of both hands.

Conclusions. The technical and tactical skills, a totality of estimates of typological features of athletes, which can be divided into several blocks is appropriate to increase more informative tests for the accuracy of identifying individual typological features of athletes. These findings underscore the importance of individualized training programs in boxing, particularly for those exhibiting significant differences in hand performance or less coordinated bilateral movements. The study contributes to the understanding of physical asymmetries and coordination in young female athletes, providing a foundation for tailored training approaches to enhance their boxing skills.

Key words: female boxing, girls aged 12-15 years, temperament, dominant type, tests, basic preparation

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Анотація

Валерія Тищенко, Галина Омельяненко, Світлана Маркова, Артур Воронцов, Ольга Павелко, Едуард Дорошенко, Ліна Соколова, Іван Глухов, Катерина Дробот. Неврологічна типологія та її роль у вдосконаленні техніко-тактичних навичок у підлітків-боксерок

Передумови. У статті розглядаються складні типологічні особливості нервової системи та темпераменту, досліджується їх глибокий вплив на прискорення тренування та вдосконалення технічних і тактичних навичок у дівчат-боксерок 12-15 років. Дослідження проведене на вирішальному етапі базової підготовки, показало, як окремі нейротипологічні особливості можуть суттєво впливати на ефективність та швидкість набуття навичок у юних спортсменок.

Мета. Виявити індивідуально-типологічні особливості дівчаток 12-15 років у процесі навчання боксу на етапі базової підготовки.

Матеріал та методи. У дослідженні взяли участь кваліфіковані спортсмени (учасниці, призерки першостей регіональних і міжнародних турнірів, чемпіонатів України у своїх вікових групах). Боксерки, що тренувалися на базі базової підготовки ДЮСШ №1 м. Мелітополя (Україна). Для вирішення поставлених завдань було використано такі методи дослідження: теоретичний аналіз спеціальної та наукової літератури, матеріалів мережі Інтернет, узагальнення даних, математична статистика.

Результати. З'ясувалося, що всі учасники дослідження мають однотипну нервову систему, яка відповідає слабкому типу. Результати виявили різні кореляції між учасницями: від сильних позитивних кореляцій до негативних чи незначних. Це передбачає різний рівень двосторонньої координації у спортсменок. Примітно, що два учасниці (P2 та P9) продемонстрували статистично значущі відмінності у продуктивності рук. При розгляді групи в цілому, загальний парний t-критерій не показав статистично значущої різниці у продуктивності між правою та лівою руками (T-Stat = 1,6885, P-Value = 0,0945). Загальна кореляція серед усіх учасниць виявилася відносно низькою (0,0889), що дозволяє припустити лише невеликий позитивний лінійний зв'язок між рухами обох рук.

Висновки. Техніко-тактична майстерність, сукупність оцінок типологічних особливостей спортсменок, які можна поділити на кілька блоків, доцільно підвищення інформативності тестів для точності виявлення індивідуальних типологічних особливостей спортсменок. Ці результати наголошують на важливості індивідуальних програм тренувань у боксі, особливо для тих, у кого спостерігаються значні відмінності в роботі рук або менш скоординовані двосторонні рухи. Дослідження сприяє розумінню фізичної асиметрії та координації в юних спортсменок, забезпечуючи основу для індивідуальних підходів до тренувань для покращення їх боксерських навичок.

Ключові слова: жіночий бокс, дівчатка 12-15 років, темперамент, домінуючий тип, випробування, базова підготовка

Аннотация

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Предыстория. В данной статье рассматриваются сложные типологические особенности нервной системы и темперамента, исследуется их глубокое влияние на ускорение тренировки и совершенствование технических и тактических навыков у девушек-боксерок 12-15 лет. Это исследование, проведенное на решающем этапе базовой подготовки, показывает, как отдельные нейротипологические особенности могут существенно влиять на эффективность и скорость приобретения навыков у юных спортсменок.

Цель. Выявить индивидуально-типологические особенности девочек 12-15 лет в процессе обучения боксу на этапе базовой подготовки.

Материал и методы. В исследовании приняли участие квалифицированные спо3ртсменки (участники, призёры первенств региональных и международных турниров, чемпионатов Украины в своих возрастных группах). Девушки-боксёрки тренировались на базе базовой подготовки ДЮСШ № 1 г. Мелитополя (Украина). Для решения поставленных задач были использованы следующие методы исследования: теоретический анализ специальной и научной литературы, материалов сети Интернет, обобщение данных, математическая статистика.

Результаты. Выяснилось, что все участницы исследования имеют однотипную нервную систему, соответствующую слабому типу. Результаты выявили различные корреляции между участницами: от сильных положительных корреляций до отрицательных или незначительных. Это предполагает разный уровень двусторонней координации у спортсменок. Примечательно, что две спортсменки (P2 и P9) продемонстрировали статистически значимые различия в производительности рук. При рассмотрении группы в целом, общий парный t-критерий не показал статистически значимой разницы в производительности между правой и левой руками (T-Stat = 1,6885, P-Value = 0,0945). Общая корреляция среди всех участниц оказалась относительно низкой (0,0889), что позволяет предположить лишь небольшую положительную линейную связь между движениями обеих рук.

Выводы: Технико-тактическое мастерство, совокупность оценок типологических особенностей спортсменок, которые можно разделить на несколько блоков, целесообразно для повышения информативности тестов для точности выявления их индивидуальных типологических особенностей. Эти результаты подчёркивают важность индивидуальных программ тренировок в боксе, особенно для тех, у кого наблюдаются значительные различия в работе рук или менее скоординированные двусторонние движения. Исследование способствует пониманию физической асимметрии и координации у юных спортсменок, обеспечивая основу для индивидуальных подходов к тренировкам для улучшения их боксерских навыков.

Ключевые слова: женский бокс, девочки 12-15 лет, темперамент, доминирующий тип, тесты, базовая подготовка

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Introduction

The study of neurological typology and its implications in sports science has emerged as a pivotal area of the research, particularly in the context of developing technical and tactical skills in athletes. This paper focuses on adolescent female boxers, a group that has historically received less attention in sports-related neurological research. The essence of boxing, a sport that demands a high degree of physical prowess, strategic thinking, and psychological endurance, makes it a compelling case for examining the impact of neurological typologies. Neurological typology refers to the classification of individuals based on their inherent neurological patterns, which include aspects such as response to stress, speed of recovery, and stimulus processing. These typological traits play a significant role in determining an athlete's approach to training, their learning style, and their performance under pressure. Understanding these traits can be invaluable for coaches and trainers in tailoring their training methodologies in order to optimize each athlete's potential. In the context of adolescent female boxers, this approach assumes even greater significance. Adolescence is a period of rapid physical and psychological changes, and for female athletes, these changes can be particularly specific due to the various biological and social factors. The research of the problem how neurological typologies interact with these changes can offer insights into more effective training and development strategies.

This paper aims to delve into the nuances of neurological typology and its application in enhancing the technical and tactical skills of adolescent female boxers. By exploring the intersection of neurology, psychology, and sports science, it seeks to provide a comprehensive understanding of how individual neurological differences can be applied to advance training methodologies, to improve performance, and to influence potentially long-term athlete development in the realm of female boxing.

The development of women's boxing in the world has become more popular. As a result, competition in this sport increases. Sports functionaries of different levels that are interested in further popularization, spectacularness, competitiveness in this sport, more and more attention is paid to the development of younger age groups of women's boxing, which are engaged in the stage of basic training. Such situation is normal, because such a development in all sports in particular in boxing is only in the continuity of teaching technical and

tactical skills (TTS). Boxing technique is a solution of motor tasks during a fight within the framework of existing boxing rules. Technique is expressed in the ability to use complex attacking and defensive actions and it is directly depended on tactics. Tactics influences the development of boxers' technical qualities. Therefore, technique is a weapon used by a boxer based on tactical judgment [1].

According to the specialists, the most important task in sports training is the training of rational performance of physical exercise or complex of motor activities for efficiency and increase of the final outcome [2-6], which is a TTS. According to the definition of the leading specialists in the field of sports in general and boxing, in particular, the technical and tactical training of an athlete plays a major role in the formation of his sports skills and in achievements of high sports results [7-10]. Italian experts emphasize that the high level of technical and tactical training also reduces the probability of receiving sports injuries [11]. Also, the scientists draw attention to the posture and body position of the athletes, who often, due to the practiced discipline, have to deal with asymmetry caused by the impact of a blow, which affects the structure of the body. Studies of female boxers, where there is a significant difference in the execution of a blow, have made it possible to understand better the importance of adequate strength work of the upper and lower limbs [12].

Consequently, the significance of such training is multifaceted and requires at some stages of many years of training (basic training) a more delicate approach to mastering of a new motor and tactical actions and training in general. Analysts show that today in a highly skilled sport level of physical activity, functionality, record indicators practically achieved its boundaries and require a more detailed study of the psychophysiological component to improve skills and knowledge [13-15].

The scientists in various sports study by the psychological component of the female in different directions, namely: the dependence of emotional burnout on ovarian-menstrual cycle phases [16, 17], the personal interaction with other members of the team [18], behavior during training and competitions in individual and game sports [19, 20], in particular in boxing [21]. The level of influence of the type of the nervous system, the temperament for mastering and improving physical exercises and tactical actions in sports, in boxing, has been proved [22, 23]. Therefore, according to the authors, the typological component in mastering, the improvement of TTS acquires

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greater relevance at the stage of basic training, when not only formed by more complex TTS elements, but also improved at high ranking competitions, in particular, such as the championships of the country and championships of Europe. Subsequently, this is the foundation in the formation of sportsmanship at the stage of many years of training.

The practical significance of this problem has become a prerequisite for conducting this research.

The purpose of the study is to determine the individual typological features of the girls aged 12-15 years in the process of box classes at the stage of basic preparation.

Materials and methods

Participants

The study was attended by the qualified athlete (participants, prizes and championships of regional and international tournaments, Ukrainian championships of their age groups) Girls-boxers aged 12-15 years, who are trained in the basic training groups of Children's and Youth Sports School No 1 of Melitopol in basic preparation groups with a 14-hour weekly load. Children and their parents were informed about all the features of the study and gave consent to participate in the experiment. The experiment has been done after every participant was tested. The athletes were free from any injuries or neuromuscular disorder. The study has been approved by the Institutional Ethics Committee, complied with all the relevant national regulations and institutional policies, followed the principles of Helsinki declaration, and it has been approved by the authors' institutional review committee.

Procedure

The study was conducted in September 2022 – May 2023 on the base Children's and Youth Sports School No 1 of Melitopol.

Statistical analysis

Statistical analyses, including Pearson correlation and paired t-tests, were conducted to assess the relationship and performance disparities between the hands.

Each participant, labeled P1 through P10, we have ten observations of manual movements for both the right and left hands. The methods of mathematical

statistics include six statistical measures for each hand of the participants:

Mean: The average number of movements within the five-second interval. It provides a central value for the data.

Standard Deviation (Std Dev): This measures the amount of variation or dispersion from the mean. A low standard deviation indicates that the data points are close to the mean, while a high standard deviation indicates that the data points are spread out over a wider range.

Coefficient of Variation (Coeff Var): This is the ratio of the standard deviation to the mean, and it's useful for comparing the degree of variation from one data series to another, even if the means are drastically different.

Minimum (Min): The smallest number of movements observed, which indicates the lower limit of performance.

Maximum (Max): The largest number of movements observed, indicating the upper limit of performance.

Median: The middle value when the data points are arranged in ascending order. Unlike the mean, it is not affected by extremely large or small values, making it a valuable measure of central tendency when distributions are not symmetrical.

These metrics provide a multidimensional view of each boxer's performance, taking into account not just their average performance level (mean) but also the consistency (standard deviation) and relative variability (coefficient of variation) of their movements. The range of performance is captured by the minimum and maximum values, and the median offers an additional perspective on the central tendency of the data.

From a coaching perspective, these statistics can inform tailored training programs that consider each boxer's individual strengths and areas for improvement. For instance, athletes showing a high degree of variation might benefit from exercises that focus on consistency and control, while those with a narrower performance range might focus on pushing their maximum limits. The statistical overview thus serves as a foundation for a more individualized and effective training regimen, potentially enhancing the technical and tactical skills of these young athletes in the discipline of boxing.

The determination of the temperament was used by the fundamental questionnaire Eysenck H. J. (EPI, 1963), focused on the age of respondents aged 10-15 years [24], which corresponds to the age-old girls who are engaged in boxing in the basic

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training groups. The type of the nervous system has been determined by means of the test, which consisted of 10 crossed squares. The total rejection of the tapping test was determined by the method described by the scientist Ilyin (2003) [25]: from the amount of pronouncement in the first 5 seconds of the work, the amount of tapping in each field in further 5 second time segments has been counted. Then the amount of decomposition difference has been formed that reflected the level of expressiveness of the nervous system in the group.

Results

The research led to the conclusion that most people are between the poles developed by a two-factor model of neurotism and extroverts and according to normal distribution, closer to its middle. The result of this study has become a clear attribution of a person to one of four types of temperament, which is determined by the intersections of the numerical values located on a scale of neurotism and an introversion-extroversion scale.

The scale of neuroticism is a mental state characterized by emotional instability, anxiety, excitement, bad well-being, vegetative disorders. This factor is also bipolar. One of its poles has a positive value according to a vertical scale of 1 to 12 units, characterized by emotional stability, another pole – an emotional instability of 13 to 24 units. Emotional stability is characterized by sanguinics and phlegmatics, emotional instability – cholerics and melanchols. The introversion-extraversion scale reflects the predominant orientation of the individual or the world of external objects (extraversion), or in the phenomenon of the subjective world (introversion). Measured with its helping, quality largely depends on the mobility of the nervous system. In the behavior of introverts on a horizontal scale from 1-12 units exhibit themselves both inhibited and inert, and extroverts on a scale of 13-24 units, as excite and mobile.

The tests by definition of temperament have not revealed a certain domination of one type of temperament of the athletes, but also have not revealed in temperament boxers – melancholic and choleric. All athletes on a scale of neuroticism have a positive value. Indicators on the Introversion Scale – Extrusion has shown a different personality orientation of the person, but have not revealed explicit signs of the inhibition and excitability of the nervous system. Numerical values are located close to the middle of the crossing point between the vertical scale of neurotism and the horizontal scale of introversion extrusion, which corresponds to the norm (Table 1, 3). Based on the data from the physiology of higher nervous activity, Eysenck H.J. [26] expresses the hypothesis that strong and weak types are very close to the types of personality – extroverts and introverts.

Table 1

Results of determination of temperament in girls aged 12-15 years dealing with boxing at the basic preparation stage

No	Participants	Scale	
		Neuroticism	Introversion-Extraversion
1	Boxer	11,7	11,0
2	Boxer	9,7	13,0
3	Boxer	10,5	10,6
4	Boxer	9,7	13,0
5	Boxer	10,5	10,6
6	Boxer	10,1	11,4
7	Boxer	9,6	13,3
8	Boxer	9,7	13,0
9	Boxer	9,6	13,6
10	Boxer	10,5	10,6

The method of detecting the type of the nervous system is based on the determination of the dynamics of the maximum pace of hands. The strength of the nerve processes is an indicator of the hard work of the nerve cells and the nervous system as a whole. The strong nervous system withstands more than the magnitude and duration of the load.

The Table 2 we've created presents a comprehensive statistical overview of the manual movements performed by ten adolescent female boxers, measured over a five-second interval. This data is critical for understanding their physical capabilities and responsiveness, which are essential factors in their boxing training. The temping test has revealed the explicit domination of a weak type of the nervous system, because according to the formulation of the scientists, the maximum pace decreases already from the second 5 second segments and remains at a reduced level to the end of the work. But athletes No 4, No 8 observed a rise in a tempo from 35 seconds of work and 45 seconds of work almost to the initial level. Also, the test has proved the domination of the left manual asymmetry in athlete No 6 (Table 2).

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Table 2

Results of temping tests of girls aged 12-15 years engaging in boxing at the basic preparation stage

P*	Right Hand Mean	Right Hand Std Dev	Right Hand Coeff Var	Right Hand Min	Right Hand Max	Right Hand Median	Left Hand Mean	Left Hand Std Dev	Left Hand Coeff Var	Left Hand Min	Left Hand Max	Left Hand Median
P1	23.9	3.45	0.144	20	33	23.5	21.4	1.91	0.089	19	26	21
P2	22.7	3.44	0.151	20	32	21.5	19.9	2.02	0.102	18	25	19.5
P3	26.7	4.47	0.168	18	33	28.5	24.1	4.66	0.193	19	34	22.5
P4	26.5	5.89	0.222	18	33	29.5	25.0	4.31	0.173	18	34	25
P5	27.9	5.66	0.203	18	33	30.5	26.9	5.28	0.196	19	34	25.5
P6	25.3	4.80	0.190	18	33	26.5	28.9	4.48	0.155	18	34	30
P7	25.7	4.98	0.194	19	34	24.5	27.0	4.22	0.156	18	34	27
P8	26.8	4.60	0.172	18	33	28.5	25.0	5.22	0.209	18	34	26
P9	27.0	3.49	0.129	21	32	26.5	24.4	4.69	0.192	18	31	24.5
P10	26.4	4.82	0.183	19	34	26.5	27.1	4.37	0.161	19	32	29

Note: P* – Participants

We were exploring correlations between right and left-hand movements, conduct hypothesis testing to see if there's a significant difference in performance between hands.

he correlation column represents the Pearson correlation coefficient between the right and left-hand movements for each participant (Table 3). A positive value indicates a direct relationship, where an increase in one hand's movements is associated with an increase in the other's. Conversely, a negative value indicates an inverse relationship.

The T-Stat column shows the t-statistic from the paired T-test, and the P-Value column shows the corresponding p-value. If the p-value is less than 0.05, it suggests a statistically significant difference in the performance of right versus left hand for that participant. This is the case for participants P2 and P9, where the p-values are below the 0.05 threshold, indicating significant differences between the hand performances. The correlation analysis between the right and left-hand movements for each participant reveals a range of relationships (Table 3).

Participant P2 showed a strong positive correlation ($r = 0.758$), suggesting that as the frequency of movements in the right hand increases, so does the frequency in the left hand. Participants P3, P4, and P8 showed negative correlations, indicating an inverse relationship between the movements of the two hands. The other participants had correlations closer to zero, implying little to no linear relationship between the hand movements.

Table 3

Correlation data and T-test results for each participant

Participant	Correlation	T-Stat	P-Value
P1	-0.2219	1.7461	0.1148
P2	0.7583	3.6282	0.0055
P3	-0.4068	-0.5165	0.6179
P4	-0.2379	0.5722	0.5812
P5	0.2072	-1.0742	0.3107
P6	0.0340	1.5177	0.1634
P7	0.3890	1.2641	0.2379
P8	-0.4853	-0.8345	0.4256
P9	0.2863	-3.1869	0.0111
P10	0.4019	0.2884	0.7796
Overall	0.0889	1.6885	0.0945

Participant P2 (t-stat = 3.63, p-value = 0.0055) and Participant P9 (t-stat = -3.19, p-value = 0.0111) showed statistically significant differences in the performance of right versus left hand, with p-values less than 0.05 indicating that the differences in means are likely not due to random chance. For the other participants, the p-values were above the typical alpha level of 0.05, which suggests that there is not enough evidence to conclude a significant difference in performance between the right and left hands.

These results can provide insights into the bilateral coordination and potential dominance

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of one hand over the other in these athletes. For those with significant differences between hands, targeted training could be employed to develop more balanced coordination, which is essential for boxing. For those with strong correlations, it suggests a good level of bilateral coordination that they can continue to refine.

In terms of hypothesis testing to determine if there is a significant difference in performance between hands we were exploring, after conducting a paired t-test across all participants to compare the performance between the right and left hands, the results are as follows: T-Statistic: 1.6885 – indicates the direction and magnitude of the difference between the two sets of data; P-Value: 0.0945, which is greater than the conventional threshold of 0.05, suggests that there is not a statistically significant difference in the overall performance between the right and left hands for the group as a whole. Based on this test, we cannot confidently assert that there is a meaningful difference in performance between the right and left hands across all the participants in this study. This implies that, on average, the participants perform similarly with both hands in the task measured. In this case, a p-value of 0.0945 means there's a 9.45% chance of observing this data if there were no real difference in performance between the right and left hands. Since this value is higher than the common threshold of 0.05 (or 5%), it indicates that the difference observed in the dataset is not statistically significant.

Based on the analysis conducted on the dataset of manual movements of adolescent female boxers, here are the key conclusions. Variability in individual performance demonstrated is a considerable range of performance both within and between participants. The mean, median, and range (min-max) values indicate diverse levels of ability and consistency in the manual movements of both the right and left hands. Bilateral coordination in correlation analysis showed mixed results. Some participants showed a strong positive correlation between the movements of their right and left hands, suggesting well-coordinated bilateral movements. In contrast, others exhibited negative or negligible correlations, indicating less synchronization between the two hands. Significance of differences between arms of paired t-tests conducted within each participant indicated, with some showing significant differences in performance between their hands, while others did not. This suggests that while some athletes may have a dominant hand with significantly better performance, for others, the performance of both hands is more evenly matched. When considering the group as a whole, the overall paired t-test did not show a statistically significant difference in performance between the right and left hands. This suggests that, on average, the participants do not exhibit a strong preference or dominance of one hand over the other in terms of the measured manual movements.

The overall correlation of 0.0889 suggests a slight, but not strong, positive linear relationship between right and left hand movements for the entire group.

The analysis presents a general view of the group's performance, the variability among individuals highlights the importance of personalized training approaches to address specific needs and strengths of each young athlete.

The researches have proven hypothesis that it is advisable to combine the temperature and type of the nervous system for a reliable creation of an individual typological portrait in order to identify personal methods in training for a particular person, so all the experiment data have been listed in Table 4. Among the other athletes, the rates of the pace were not so significant, but allowed to keep the pace for several segments that made ranking in the middle of the group in the total variation of the pace deviation (ATD) from the initial level in each field. Which of the individuals the amount of deviation is smaller to the value "0", in the fact that the weakness of the weak type of the nervous system (Table 4).

Table 4

Final results of testing girls aged 12-15 years, who are engaged in boxing in the basic preparation stage

No	Participants	The amount of tempo deviation	Temperament	Type of nervous system
1.	Boxer	-91	phlegmatic person	weakly
2.	Boxer	-93	sanguine person	weakly
3.	Boxer	-72	phlegmatic person	weakly
4.	Boxer	-49	sanguine person	weakly
5.	Boxer	-94	phlegmatic person	weakly
6.	Boxer	-65	phlegmatic person	weakly
7.	Boxer	-64	sanguine person	weakly

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8.	Boxer	-41	sanguine person	weakly
9.	Boxer	-58	sanguine person	weakly
10.	Boxer	-68	phlegmatic person	weakly

Data analysis of Table 4 have not defined clear laws between ATD and temperatures. Thus, athletes №4 and №8 with the smallest indicators of the ATD amount are sanguine. Athlete for No 1, No 2 and No 5 with the highest ATD indicators are sanguine and phlegmatic. Although ranking in the middle of the group with the smallest coefficient is sanguine.

Discussion

The research presented in the article provides valuable insights into the typological characteristics of the nervous system and temperament of adolescent female boxers and their implications for technical and tactical training. The study focuses on the girls aged 12-15 years engaged in boxing at the basic training stage is particularly significant, as it addresses an age group and gender that often receives less attention in sports science.

One of the key findings of the study is the predominance of a weak type of nervous system among the participants. This discovery is crucial for understanding how these athletes respond to stress, fatigue, and intense training. Typically, individuals with a weaker nervous system might require longer recovery times and may be more sensitive to high-intensity training. Therefore, coaches and trainers should consider these aspects when designing training programs to avoid overtraining and to optimize performance. Connoisseurs define such features in sports practice by temperament. Sanguine person is a strong, balanced, mobile. More often chooses sports related to mobility, activity, courage. Workforest, easy to pass from the same type of exercise to another, but not enough attentive to small elements of sports equipment. Quickly "grooves" new exercises, but in the process of improvement, it can quickly "extend" interest. Sports results are stable, in competitions more often higher than training. Before the responsible starts are in "Fighting Readiness" [27]. Thus, according to the authors of the article, for such individuals, as No 2, No 4, No 7, No 8, No 9 it is expedient to constantly expand the arsenal of technical techniques in one training session but with a direction to the preliminary task in order to improve the parts of technology, strive to imping the initiative. Perhaps in some cases related to the time limit when conducting a fight, in order to reduce the preparatory action, it is advisable to create a certain algorithm for attack, in which the main blow is due after a trained coach of a certain number of preparatory actions or by its signal.

Another interesting aspect of the study is the temperament distribution among the participants, with a notable absence of melancholic and choleric temperaments. The presence of primarily sanguine and phlegmatic temperaments suggests that these athletes might have a balanced approach for training, showing neither excessive nervousness nor lack of motivation. This balance is beneficial in a sport like boxing, which requires both mental fortitude and the ability to remain calm under pressure. The phlegmatic person is a strong, balanced, inert. More often chooses non-fast, monotonous exercises that do not require rapid reaction and "switching" attention. This type is not fast enough "enters" in the work, difficult and recycled skills, also have difficulties when switching from one type of activity to another. Very workable, persistent, prone to long and thorough work of sports equipment and individual exercises. Resistant to external stimuli, competitive results are stable, before the start, are more often in "combat readiness". For phlegmics, the most acceptable work in defense, long "entry", accuracy of tactical combinations and, of course, dedication in the fight [27, 28]. For individuals No 1, No 3, No 5, No 6, No 10, according to the authors of the article, will be expedient to work out a small scope of technical actions and more stereotypical technical and tactical exercises in one lesson. The transition to the mastering of more complex technical and tactical exercises it is expedient to make gradually with the addition of technical and tactical elements.

The investigators on the extroversion – introversion scale determine the following features of individuals. Extroverts – usually use the motives of debt to the team and coach. Possess high self-esteem, resistant to emotional overloads. At the initial stages of formation, the skill is more prone to success, but over time, the quality of skill is aligned with other individuals. Introverts – operate on the principle of "self-order", "self-conviction" when assimilating movements, developed self-control. Probably preliminary planning of their own actions, prefer to be distracted from negative thoughts on competitions.

Fixed long-term memory, which is of great importance in major exercise breaks, because they

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require more recovery time compared with extroverts [25]. Experts Aoki et al. (2017) [29], Boichuk (2019) [30], Pshenychna et al. (2019) [31], McManama O'Brien (2021) [32] draw attention to the importance of the balance of strength of the nervous system as a guarantor of the reliability of movements in extreme situations, as evidenced by empirical studies in various sports including athletics [33], football [34, 35], handball [36, 37, 38], Greco-Roman wrestling [39], hockey [40], self-defense Spas [41], volleyball [42, 43]. In which the weakness of the nervous system causes an increased feeling of the musculoskeletal system [44], the ability to static and dynamic balance, spatial orientation, differentiation of force parameters of movements, rearrangement of movements [45]. Which, according to the author of the article, leads to the accuracy and selectivity of movements.

The researchers pay attention to the influence of a certain type of the nervous system and temperament in the training of physical exercise, there are examples, when at stage an idea of the formation of motor skills of individuals with a weak nervous system and the average degree of mobility of excitation is more successful in mastering such movements. At the stage of improvement, the initiality of memorization of physical exercises is better among the athletes with the inertia of nervous processes. And in capturing at a tempo of study – in individuals with lability and mobility of nerve processes. Subsequently, inert athletes are aligned with skills with athletes of mobile nerve processes. It is noted that when interruptions in training classes are better maintained in inert athletes [25]. It is recommended for a weak mobile type of nervous system to perform one exercise up to 5 times. Boichuk (2019) training loads for the next day are not effective for members of the weak inert type [30].

Thus, based on the temperament of athletes, the options for working out technical and tactical exercises for "self-frame" and "self-conviction" for athletes (phlegmatic) No 1, No 3, No 5, No 6, No 10 should be used. Particularly at the stage of improvement for the athletes (sanguine persons) No 2, No 4, No 7, No 8, No 9 it is advisable to use the motives of debt to the team, coach. At the stage of the idea of the formation of motor skills, all athletes involved in the experiment will not require a different methodological approach. In mastering for the phlegmatic athletes at the level with less than the complexity of technical and tactical elements, it is advisable to combine with a variable pace in training and greater interruptions between workouts.

Sanguine athletes are expedient at the level of constant diversification of technical and tactical actions of adding in the training of the interval. The scientists prove that a certain type of nervous system in combination with peculiarities of temperament, affects the choice of tactics in boxing fight [46].

In general, the tactics in sports individuals with a weak nervous system and moving nervous processes are inherent in protective and counterattack action. Attacking style is more suitable for individuals with a strong nervous system and the inertia of the excitation of nervous processes. Athletes with a weak nervous system are effective in the role of "fleeing", and athletes with a strong nervous system in the role of those who are recovered with treadmills and moving games [47]. This may need, according to the authors of the article, in the substantial individual manners of the fight, which are generally formed at the stage of basic preparation. The fact that boxing belongs to acyclic sports and inherent in constant situational changes in fights, which also depend on the opponent's tactics, tactical training should be submitted in equal parts, but taking into account the relevant individual typological features inherent in a certain tactics, for example, to develop counter-tagging actions to add active actions that will provoke an opponent to attack, that is, to encourage an opponent's tactics in a fight [48].

The conducted research has not revealed pronounced introverts and extroverts, practically all athletes with the average mobility of nervous processes, according to the scale of intro-extrovert. Consequently, in the formation of motor skills and in further improvement, for this group of the tested athletes, but at the rate of study may differ. Subsequently, it is possible to carry out additional tests to identify certain psychological properties of the nervous system.

Conclusions

Totality of estimates of typological features is necessary for more productive training underscores the importance of a holistic approach in sports training. Recognizing that each athlete is unique and tailoring training programs to their individual needs can lead to better outcomes. This approach is not only crucial for improving technical and tactical skills but also for the overall physical and mental well-being of the athletes. Furthermore, the study highlights the need for more informative tests to identify accurately identify individual typological features of athletes. Current methods may not fully capture the complex

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interplay of neurological and temperamental factors that influence an athlete's performance. Investing in developing more nuanced and comprehensive testing methods could provide deeper insights into each athlete's specific needs and potential. The study has revealed certain psychological features in girls and compiled an individual typological portrait of the girls who deal with boxing. Learned abilities inherent in a certain typological portrait. Based on these data, individual approaches to mastering, improvement of technical and tactical training are determined. Supplemented data in sports martial arts, in particular in boxes, typological features of the nervous system of girls involved in this sport. The study has proven that for productive training of technical and tactical training, an expedient set of assessments of psychophysiological features of athletes, which can be divided into several blocks in order to increase more informative tests.

This research contributes significantly to our understanding of how neurological and temperamental typologies affect the training and performance of young female boxers. The findings point out to the need for personalized training regimens that consider individual psychological and physiological profiles, suggesting a paradigm shift in how we approach sports training for this demographic. Future research should aim to expand upon these findings, exploring the long-term effects of tailored training programs on the development of technical and tactical skills in female athletes.

These findings have important implications for boxing training programs for young female athletes. Individualized training could be beneficial, particularly for those with significant differences in hand performance or less coordinated bilateral movements. For those showing good synchronization and similar performance levels between hands, training can focus on enhancing their existing bilateral coordination and overall agility.

Further research with a larger sample size could provide more insights, especially into the relationship between neurological typology and boxing performance. Additionally, incorporating more diverse measures of boxing performance could yield a more comprehensive understanding of the athletes' capabilities and training needs.

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Conflicts of interest

The authors declare that there is no conflict of interest.

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