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UDK 796.853.24

Stepanyuk S.
Candidate of Physical Training and Sport Sciences, Associate Professor
Associate Professor, Department of Theory and Methods of Physical Education Kherson State University
Serputko O.
Candidate of the Second (Master's) Level of Higher Education
Kherson State University, Aikido instructor Eurasia Aikido Organization Head of AIWA DOJO
Lukyanchenko M.
doctor of pedagogical sciences, Professor
Professor, Department of Theory and Methods of Physical Education
Drohobych State Pedagogical University of Ivan Franko
Turchyk I.
Doctor of pedagogical sciences, Professor
Professor, Department of Theory and Methods of Physical Education
Drohobych State Pedagogical University of Ivan Franko

THE CONCEPT OF CENTER IN AIKIDO STUDY

The article analyzes the concept of "center" in the context of aikido and other oriental martial arts. It is determined that the category of center in aikido completely coincides with the definition of the general center of gravity in general physiology. That once again proves the practical effectiveness of techniques used in aikido, as well as the important positive impact of aikido practice on harmonizing the interaction of right and left-brain hemispheres, balance of psycho-emotional state and improvement of general health and well-being.

The state of physical culture and sports activities of Aikido athletes is revealed, which is seen as a syncretism of external (physical, social) and internal (emotional, mental, volitional, independent) multifaceted work, which, although not a competitive and stimulating system, but aimed at long term of study and comprehension, without age requirements.

It was found that a deeper understanding by aikido practitioners of the basic and key concepts of the presented martial art contributes to a better understanding of the biophysical basis of techniques, ukemi and tai sabaki movements, which increases the level of preparation for the certification. In addition, it was found that understanding and using the work of the center has a significant positive impact in the study of other martial arts, including judo, iaido, jodo, hand-to-hand combat, and even in teaching acrobatics elements.

The authors of this article, based on their own experience of Aikido practice and its teaching, as well as other disciplines in the field of physical culture and sports, provide a generalized and diverse vision of the concept of "center" to better master key concepts, awareness effective and wide application of theoretical knowledge gained in training.

We consider the results of the presented study to be especially significant for people of the second adulthood and older age who practice aikido [7]. It is possible because the use of the center can significantly reduce the load and joints of both upper and lower body, which not only allows practicing aikido even in old age, but also makes practice possible even in the presence of injuries or disabilities [8].

The results of the presented research are relevant both for martial arts schools and for any kind of sports and physical culture activities that involve interaction with a partner.

Key words: *aikido, center, general center of gravity, general center of mass, center of physical equivalence, concept of center, sheikatanden, hara.*

Степанюк С., Серпутько О., Лук'янченко М., Турчик І.. Поняття «центру» у вивченні айкідо. *В статті проаналізовано поняття «центру» як в контексті айкідо, так і інших східних одноборств. Визначено, що категорія центру в айкідо повністю співпадає з визначенням загального центру тяжіння у загальній фізіології, що зайвий раз доводить практичну ефективність технік, використовуваних в айкідо, а також важливий позитивний вплив практики айкідо на гармонізацію взаємодії правої та лівої півкуль головного мозку, орієнтації у просторі, збалансованості психо-емоційного стану та покращення загального стану здоров'я та самопочуття.*

Розкрито стан фізкультурно-спортивної діяльності спортсменів з айкідо, що вбачається як синкретизм зовнішньої (фізичної, соціальної) та внутрішньої (емоційної, психічної, вольової, самостійної) багатогранної роботи, яка, хоча й не має під собою змагально-стимулюючої системи, проте спрямована на багаторічний термін вивчення та осмислення, без вікового цензу.

Виявлено, що більш глибоке розуміння практикуючими айкідо базових та ключових понять представленого бойового мистецтва сприяє кращому усвідомленню біофізичних основ виконання технік, укемі та переміщень тай сабакі, що підвищує рівень підготовки до атестацій. Крім того, встановлено, що розуміння та використання роботи центру має значний позитивний вплив у вивченні інших одноборств та бойових мистецтв, зокрема, дзюдо, іайдо, джодо, рукопашний бій, та навіть при навчанні акробатичним елементам.

Автори даної статті, базуючись на власному досвіді практики айкідо та його викладання, а також інших дисциплін галузі фізичної культури та спорту, надають узагальнене та різнобічне бачення трактування поняття «центру» з метою кращого засвоєння практикуючими айкідоками ключових понять, усвідомлення практичної складової цих понять та більш ефективного та широкого застосування отриманих теоретичних знань на тренуваннях.

Особливо значимими вважаємо результати представленого дослідження для осіб другого періоду зрілого віку та більш старших вікових періодів, що займаються айкідо, адже використання центру дозволяє значно зменшити навантаження та суглоби як верхньої, так і нижньої частини тіла, що не просто дозволяє практикувати айкідо навіть в похилому віці, а також робить можливим практику навіть за наявності травм чи інвалідності.

Результати представленого дослідження є актуальними як для шкіл східних одноборств, так і для будь-яких видів спортивно-фізкультурної діяльності, що передбачає взаємодію з партнером.

Ключові слова: *айкідо, центр, загальний центр тяжіння, загальний центр мас, центр фізичної рівнодії, поняття центру, шейкатанден, хара.*

Formulation of the problem. The vast majority of martial arts are based on the study and awareness of ki energy, which is the natural force of every living creature. That is why all people possess this power, just as all people can practice martial arts, regardless of age or gender, but only a few reach the level when they can develop their energy ki [5].

The place where ki energy is located and circulates is called in eastern martial arts hara, or sheikatanden, and its location is a point just below the abdomen (the exact location is individual, depending on gender, weight, physical state and experience of practicing disciplines Budo) [10].

Interestingly, this point completely coincides with the center of physical equilibrium, which in physiology and biophysics is also called the "common center of mass", or "common center of gravity", which is the point of application of all gravitational forces of the human body. Thus, regardless of what our ideas about how techniques and movements in aikido work bases on, the knowledge of general physiology, or the traditional Eastern ideological interpretation of the harmony of soul and body, it remains indisputable that the concept of "center" in aikido is related to the center of gravity of the body. It means that it is a certain point at which the weight of the body is concentrated and balanced between the upper and lower, as well as its right and left parts. After all, it is impossible to release one's ki energy, and even more so, to use the strength and energy of your partner without maintaining the balance of your own body.

The traditional practice of aikido involves focusing on the center of the body of hara, or sheikatanden, not only as the center of gravity, but also the will, the place of concentration of mind, experience, which we use in all our movements and actions. The founder of aikido, Morihei Ueshiba, argued that training in aikido should be always and everywhere. The ability to instantly relax and fully focus on the center is a key point in self-control, avoiding emotional outbursts even in the most stressful situation. Interesting in this regard is the experience of meditation of Eastern practitioners, according to which the habit of focusing on the center allows you to perform any mental or physical work without knowing fatigue, self-renewing their own resources and gradually forming even their own character. The ultimate goal of this practice is the complete harmonization and coordination of mind and body, movements and thoughts of one's own with the movements and thoughts of the partner, oneself

and society, etc. That is, both the means and the goal is centralization as a way of perceiving oneself and the world and as a part of being [9].

Thus, the **purpose of research** was to describe and formulate the concept of "center" as a fundamental category in the study of aikido.

Materials and methods of research. There is a significant lack of scientific works and research in the field of aikido sports science among the Ukrainian scientists. At the same time, this problem is one of the most discussable among the practitioners since the time of formation of the Art of Peace until nowadays. In recent years, the area of the research in the field of aikido and Budo disciplines has become a space of interest for such Ukrainian authors of scientific researches as O.G. Shalar (2020, 2021), E.A. Strikalenko (2019, 2020, 2021), S.I. Stepanyuk, O.K. Serputko (2022) [7]. Also seems informative in this context of research the study of physiological and biophysical patterns in the context of different sports by S.K. Golyaka (2021) [3].

Our research is an attempt to summarize, analyze and study all the data and experience about the concept of the center in aikido through the prism of our own instructor's work with children and adults and inner feeling and understanding. To give certain, common, at the same time scientific and practical meaning of the concept for its further effective usage in aikido studies is our aim.

Working on the solving the mentioned task, we used such methods of research as analysis of literature sources, as well as theoretical analysis and generalization of scientific data, taking into account the experience of our own observations during the training process.

Presentation of the main material of the study. The general center of gravity of a person or the general center of mass of the body is the point of application of all gravitational forces of its constituent parts (i.e. body parts). When we say "the center of gravity of the human body" and mean a living person, we do not mean a geometric point, but only the sphere in which it is located. Each part of the human body at a certain mass and its specific location has its own center of gravity [3].

The location of the general center of gravity of the human body depends on many factors: age, sex, muscle development, spine shape, physique, etc. The location of the center of gravity of the body also changes with different postures and movements of human parts, with changes in blood circulation, respiration, digestion and others. At the same time inside the body, there is a redistribution of its mass, which affects the position of the general center of gravity [4].

Newborns' center of gravity is located at the level of 5-6 thoracic vertebrae. Men's center of gravity is at the level of the third lumbar – the fifth sacral vertebrae, and in women at the level of the fifth lumbar to the first coccygeal. In old age, the position of the center of gravity of the body depends, among other things, on the characteristics of posture.

In the anatomical analysis of movements, it is important to know the trajectory (movement) of the center of gravity. Without this, it is impossible to determine the speed, acceleration or effort experienced by the body or its individual parts when performing the movement [3].

In modern biomechanics, the concept of geometry of body masses is introduced. Body weight is a physical measure of energy, so the laws of its formation in ontogenesis actually determine the laws of development and formation of energy potential of the body of children and adolescents. The results of research indicate that in the course of ontogenetic development in humans changes not only the mass and age, but also the geometry of body mass. In this regard, there is reason to believe that each geometry of human body mass during development corresponds to certain patterns of neurohumoral, endocrine and other support [2].

The location of a person's center of gravity is in many cases a crucial factor in balance. To determine the equilibrium, it is important to determine the projection of the center of gravity on the support area. To do this, one should find the line of gravity an imaginary vertical line drawn from the center of gravity of the body to the area of support [1].

The area of support is determined by the area of the supporting surfaces of the body and the amount of space between them. Human resilience depends on it. The area of support is always taken into account in the anatomical analysis of exercise [3].

The center of gravity of the human body in the anatomic position is located in the hip area. Over it will be applied the result of the gravity force executed on the center of gravity of the limbs; in such position, these forces pass through the spinning axis of the joints and will not have rotational effects on them.

That resultant will act: on the support (at rest) as a weight and will be annulled by its very reaction force. The weight of the bodies cannot be changed, but it is possible to vary the moments of the gravity forces during the execution of the techniques [10].

According to the aforementioned, we can point out the benefits of the practice of Aikido; by adopting the Sankakutai posture the practitioner will exercise his body by executing an isometric work (without relative displacement) in order to annul the rotational effect of the gravity force on the limbs during the position.

When making external action on a body (or limb) it will make a similar action over the attacker, and it will be always aim at the opposite way of the acceleration experienced by the body (or limb) and applied over the point of contact.

During his action, the aikido practitioner overcomes the forces of resistance through the muscular strength and makes an effort to overcome all the resistance and communicate acceleration to their organs in motion and to his opponent's, to whom the motion volume, the moment and the kinetic energy is transmitted. By making those moves the opponent's motion way, the value of the force applied is considerably reduced and therefore forces of reaction [6].

A fluent and continuous movement guarantees an execution with an approximately constant speed, which implies very small values of acceleration. The forces of muscular traction are the only internal sources of the man's energy. The man can take advantage from the rest of the forces and direct the moves only with these forces.

The variation of the force arm of the muscle traction concerning the rotation axis produces variations in the rotational effect of this force. This arm varies along with the variation of the joint angle. For example, with an elbow making a 90-degree angle, its flexors lose 10 times the strength.

As long as the aikido practitioner improves his moves, he makes a better use of his muscle strength reflected in the execution of the technique and saves more energy. For that reason, it is affirmed that the systematic practice of Aikido contributes to the reinforcement of a correct posture, plus favoring a satisfactory development of the motor skills and using one's center as well [9].

The simplest movement of a limb in a joint is that around an axis and in a determined direction. The value of this movement will depend on the moment of the force applied on itself. The motor activity will always include groups of joint movements. The space elements of the motion system are a group of simultaneous joint moves that when being replaced by others develop as consecutives series.

The time elements of the motion system are the phases of the moves. The phase is a part of the motion system isolated in time. During its execution, the character of the motion system has no essential variations. The moment when an essential variation begins, a phase ends and the next starts [3].

Internal interactions favor the integrity of the system. The movements of the system are coordinated in space and time. Even when in the Omote variant of Aikido in different phases of movement become evident, the transition from one to the other should take place continuously, avoiding the typical accelerations of the sudden changes of speed, which proves the saving of forces achieved in the application of the techniques.

When the human body thoroughly preserves the posture, the valid laws for the balance of the rigid body can be applied on it. The balance is kept given the situation of the different parts of the body thanks to the muscle, dynamic and static efforts, which makes a favorable influence in the development of the vestibular apparatus [8].

To preserve the position of the body, the individual must be in balance. The position of the body is determined by its posture by its orientation and situation in space, as well as for its correspondence with support. For that reason, to preserve the position of the body, the sportsman should fix the posture and avoid that applied forces vary the posture. In addition, one cannot allow a displacement of the body from a given place to any direction or a turn from one's support, since in a motion state an acceleration of this movement makes the body lose balance.

That explanation shows the advantages of the defense postures adopted by the Aikido practitioner; open postures with a great area of support, and a very low gravity center that guarantees stability.

This posture is also useful from the therapeutical point of view given the isometric work executed by the muscle systems aimed at keeping the posture, as it has previously noted. With the motor mastery, the aikidoka makes an utmost use of the muscle strength being able to keep one's position for long period.

The angle of stability serves as a dynamic index of the body's stability. The line of action of the gravity force and the straight line that joins the gravity center with the corresponding limit of the supporting area make it up. When stability is determined in the human body, it is necessary to take into account the limits of the supporting area, the security of the preservation of the posture and even the limit position of the body and the real line of the turn.

In the struggle to preserve, the position it is used the weakening of the action of the interference forces and the strengthening of the action of the balance forces.

During the recovery movements, the aikido practitioner makes use of the external forces without which the gravity center of the body cannot return to the preservation area of the position. Such forces may be caused by accelerated moves of the limbs. For that reason, a right-handed practitioner accompanies his displacements stressed by his upper limbs.

Results of the research. "Work of the center" is the goal of all aikido practitioners, and many aspects and statements of both O'Sensei himself and many researchers have been devoted to this aspect, trying to describe in words an almost mystical concept, without mastering which, despite the complexity aikido techniques become impossible.

Thus, important components of the definition of "center" and "work of the center" in Aikido are the following theses:

1. The center is always expressed through the athlete's stance. Conventionally speaking, the center of a person is always directed to the direction of the abdomen or navel, because the hara by definition is two centimeters below the navel. The foot of the front leg should be directed towards the center, as well as the knee of the front leg. The palms of the hands should always be in front of the center, both at rest and when performing techniques, including weapons. The elbows should be lowered and directed towards the center. The gaze is always directed towards the center. This position is called "strong" and its preservation in the performance of various techniques and throws means the effective operation of the center.

2. The importance of abdominal muscle tension for the center. Although physical strength is not considered to be determinative for aikido, muscle function is important. Moreover, the explosive power, flexibility, and precision of actions that involve deep work on the muscular system of the whole body, including the abdominal muscles is important, because its work ensures the work of the center.

3. Use of body weight. Without the use of whole-body inertia and movement, only individual muscles will work, i.e. the force of the push or pressure will be equal to the strength of the arm muscles. When using the inertial potential of the whole body, the force of action on the partner will be equal to the mass of the whole body. In order to ensure the use of the weight of the whole body, the movement should start from the lower part of the body: legs, pelvis and center. It is needed to make the movement of the whole body and to maintain the posture.

4. Coordinated work of all parts of the body. The total strength of the pressure is directly dependent on the timing (how tense all the muscles at the same time), and the quality of general and special physical training (how each of the links is strong and enduring). After all, the coefficient of strength will depend not on the strongest muscle, but on the weakest, because it will

make it impossible to work with the center, or make it inefficient, which, again, will affect the imbalance of posture and proper technique.

Conclusions/ discussion. Thus, the category of "center" occupies an important place in the study and teaching of the principles and techniques of aikido, and is a basic concept, the understanding of which ensures the effectiveness of technical improvement required for successful certification. The concept of "center" is inextricably linked with such concepts used in aikido and other types of martial arts as "work of the thighs", "movement of the whole body", "work of the center" and others.

The "center", or haratanden is used in aikido, from the point of view of physiology and biomechanics coincides with the general center of gravity of the human body and provides a balanced movement of the athlete, in addition, allows throwing and performing techniques of great power without significant muscular strength. Possession of the center involves a low position of the body due to the knees, back, coordination of arms and legs. The whole body is in a state close to relaxed, but the attention is focused on the center, which allows one to be collected and respond instantly to the attack. In addition, it is important to remember that the goal of aikido is much higher than just learning techniques, moving the whole body, or spectacular throws with minimal energy expenditure, it is internal coherence and balance, including psycho-emotional, is the main condition not only for success in learning the concept of "center", but also the teaching of aikido in general.

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Бондаренко В. В.
доктор педагогічних наук, професор, завідувач кафедри спеціальної фізичної підготовки Національної академії внутрішніх справ
Арсененко О. А.,
старший викладач кафедри спеціальної фізичної підготовки, Національної академії внутрішніх справ
Корнійчук Ю.М.
старший викладач кафедри спеціальної фізичної підготовки, Національної академії внутрішніх справ
Білик В.В.
старший викладач кафедри спеціальної фізичної підготовки, Національної академії внутрішніх справ
Тихий О. В.
старший викладач кафедри спеціальної фізичної підготовки, Національної академії внутрішніх справ

ВИЗНАЧЕННЯ РІВНЯ ФІЗИЧНОЇ ПІДГОТОВЛЕНОСТІ ПРАЦІВНИКІВ ПРАВООХОРОННИХ ОРГАНІВ В КРАЇНАХ ЄВРОПИ : КОМПАРАТИВНИЙ АНАЛІЗ

Здійснено аналіз нормативних документів і наукових праць, які висвітлюють особливості визначення рівня фізичної підготовленості працівників правоохоронних органів зарубіжних країн, вимог щодо рівня фізичної підготовленості кандидатів до вступу на службу в поліцію та практичних працівників. Констатовано відсутність єдиної думки щодо критеріїв оцінювання рівня фізичної підготовленості. Встановлено, що здебільшого перевірці піддають найбільш значущі фізичні якості, однак критерії оцінювання різняться. З'ясовано, що окрім виконання загальновідомих контрольних вправ, серед яких бігові і гімнастичні вправи, перевагу надають вправам практичної спрямованості. Під час добору кандидатів на службу в поліцію країн Західної Європи тестують рівень розвитку витривалості, координаційних якостей, швидкості, спритності та швидкісно-силових здібностей; у країнах Східної Європи – рівень розвиненості швидкості, спритності, силових якостей, витривалості. Перспективи подальших наукових досліджень полягають у вивченні питання оцінювання рівня фізичної підготовленості працівників