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# VOLUNTARY SPASMODIC CONTRACTIONS AND NEUROPLASTICITY IN HUMAN MOVEMENT

# CONTRAÇÕES ESPASMÓDICAS VOLUNTÁRIAS E NEUROPLASTICIDADE NO MOVIMENTO HUMANO

# CONTRACCIONES ESPASMODICAS VOLUNTARIAS Y NEUROPLASTICIDAD EN EL MOVIMIENTO HUMANO

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## ABSTRACT

In this work the intention is to investigate a new method of neural training and its intensity in physical exercise for different audiences and their physiological conditions as a way of explaining the application of the fiber hit method, using the bibliographic methodology as proof that this method can intensify conditioning capabilities, rehabilitate physical motor capacity, treat comorbidities, and prevent injuries. In this work the intention is to investigate a new method of neural training and its intensity in physical exercise for different audiences and their physiological conditions as a way of explaining the application of the fiber hit method, using the bibliographical methodology, this method aims to intensify conditioning capabilities, rehabilitate physical motor capacity, treat comorbidities, and prevent injuries. The introduction will present the history from primitive times to the present day and how the voluntary spasmodic method emerged. In the development, it will address the intensity, volume of training and its chemical reactions through physical exercise as a form of neurophysiological treatment applied to motor learning of movement. In the conclusion, the importance will be reported within the general and specific objectives to broaden the vision of health professionals in relation to muscle spasms and their relevance. The topic was described as voluntary spasmodic contractions and the neuroplasticity of human movement, as it aims to address a type of brain training that will contribute to hypertrophy, prevention, rehabilitation of injuries and increased intensity of physical exercise. Strength training, for example, requires an action potential firing to activate type I, type IIA and type IIB fibers that can be potentiated through spasmodic contractions that stimulate a contraction on top of the dynamic or isometric contraction. In conclusion, it aims to contribute to science in cultural areas and aspects of bodybuilding.

**Keywords:** Voluntary Spasms. Electrical Impulses. Neural Training. Strength Training.

## RESUMO

Neste trabalho a intenção é investigar novo método de treinamento neural e sua intensidade no exercício físico para diversos públicos e as suas condições fisiológicas como forma de explicar a aplicação do método fiber hit, utilizando a metodologia bibliográfica como comprovação que este método tem como intensificar capacidades condicionantes, reabilitar capacidade físico motoras, tratar comorbidades e prevenir lesões. Na introdução foi apresentado a história desde a época primitiva até os dias atuais e como surgiu o método

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espasmódico voluntário. No desenvolvimento foi abordado a intensidade, volume de treinamento e suas reações químicas mediante ao exercício físico como forma de tratamento neurofisiológico aplicado à aprendizagem motora do movimento. Na conclusão por sua vez, relatou-se a importância dentro do objetivo geral e específicos, com intuito de ampliar a visão dos profissionais da saúde em relação aos espasmos musculares e suas relevâncias. O tema foi descrito como contrações espasmódicas voluntárias e a neuroplasticidade do movimento humano, pois tem como objetivo abordar um tipo de treino cerebral que irá contribuir para a hipertrofia, prevenção, reabilitação de lesões e aumento de intensidade do exercício físico. O treinamento de força, por exemplo, requer um disparo de potencial de ação para ativar as fibras tipo I, tipo IIa e tipo IIb que podem ser potencializados através das contrações espasmódicas que estimula uma contração por cima da contração dinâmica ou isométrica. Na conclusão visa contribuir para a ciência em âmbitos culturais e aspectos da musculação como um todo.

**Palavras-chave:** Espasmos Voluntários. Impulsos Elétricos. Treinamento Neural. Treinamento de Força.

**RESUMEN**

Este trabajo tiene como objetivo investigar un nuevo método de entrenamiento neuronal y su intensidad en el ejercicio físico para diversos públicos y sus condiciones fisiológicas como una forma de explicar la aplicación del método de impacto de fibra, utilizando metodología bibliográfica para demostrar que este método puede intensificar las capacidades de acondicionamiento, rehabilitar habilidades motoras físicas, tratar comorbilidades y prevenir lesiones. La introducción presenta la historia desde los tiempos primitivos hasta la actualidad y cómo surgió el método espasmódico voluntario. El desarrollo aborda la intensidad, el volumen de entrenamiento y sus reacciones químicas a través del ejercicio físico como una forma de tratamiento neurofisiológico aplicado al aprendizaje del movimiento motor. La conclusión, a su vez, informa la importancia dentro de los objetivos generales y específicos, con el objetivo de ampliar la comprensión de los profesionales de la salud sobre los espasmos musculares y su relevancia. El tema se describió como contracciones espasmódicas voluntarias y la neuroplasticidad del movimiento humano, ya que busca abordar un tipo de entrenamiento cerebral que contribuirá a la hipertrofia, la prevención, la rehabilitación de lesiones y el aumento de la intensidad del ejercicio. El entrenamiento de fuerza, por ejemplo, requiere un potencial de acción para activar las fibras de tipo I, IIa y IIb, que pueden potenciarse mediante contracciones espasmódicas que estimulan una contracción que va más allá de las contracciones dinámicas o isométricas. La conclusión pretende contribuir a la ciencia en contextos culturales y aspectos del culturismo en general.

**Palabras clave:** Espasmos Voluntarios. Impulsos Eléctricos. Entrenamiento Neuronal. Entrenamiento de Fuerza.

## 1 INTRODUCTION

The Fiber Hit neuromuscular training method, which emerged from the urban dance Body Popping. This method is based on voluntary spasmodic contractions, directly stimulating the nervous system to strengthen communication between brain and muscles. As the muscles depend on this system, the repetition of electrical stimuli and the volume of training help to refine neural signals, taking advantage of neuroplasticity, that is, the brain's ability to create new connections and develop more precise movements.

Fiber Hit can be applied in several areas, such as high sports performance, rehabilitation of injuries and neurological disorders, physical conditioning and treatment of comorbidities. The text also traces a historical overview of dance: from primitive rituals linked to harvests and changes of season, through the ancient dances of Egypt and India, to Greece, where the practice gained focus on aesthetics and strengthening the body, expressed in the concept of Kalokagathia ("what is beautiful is good"). In the Middle Ages, however, dancing was considered profane and forbidden by the Church. This cultural path shows how dance evolved to enable contemporary methods such as Fiber Hit.

During the Middle Ages, the practice of dancing was largely forbidden by the Church, being preserved only by the peasants. In the Renaissance, dance resumed its space, with the erudite modality convincing the Church that its practice could serve science and study. Ballet came to be valued as the basis of other dances, although urban styles such as Body Popping have irregular and distinct movements. In the period of Romanticism, ballet takes on a narrative character, transmitting fictional stories, while Isadora Duncan develops a more natural and free approach, marking the transition to modern dance and later to contemporary dance, which integrates concepts, expressiveness and body aesthetics.

From 1929, with the economic crisis in the United States, urban dancers began to perform in the streets, consolidating Street Dance. During this period, the practice was marked by dance battles, diversity of styles and the need for competitive performance. The name "Street Dance" refers to the public exposure of these performances, and not to the creation of the modality in the streets. External influences, such as the term robot. Introduced in 1920, it inspired mechanical movements used in dance.

In the 1970s, Afrika Bambaataa consolidated hip hop culture, composed of four elements: Breaking Dance, graffiti, DJs and basketball. In Break Dance, dancers needed to master different styles and movements, seeking mobility and versatility in their performances. In 1980, Boogaloo Sam created the group Electric Boogaloos and developed the Body Pop

dance, which arose from the fusion of the Boogaloo styles, learned in Oakland, and Strutting, practiced in San Francisco. Body Popping is characterized by robotic movements and spasmodic muscle contractions, bringing new energy and expressiveness to urban dance.

With the consolidation of Funk Style, Body Popping became part of this culture along with Locking, created by Don Campbell, although the latter is not addressed in this study. Although Boogaloo Sam defined the fundamentals of Body Popping and its muscle contractions, there was no development of resistance exercises or scientific discussion about contractions, aspects that will be explored in the present work. Historical evolution shows how urban dance has been structured, differentiating styles and consolidating practices that influence both artistic expression and neuromuscular training.

The development of the voluntary spasmodic method originated in the study of the urban dance Body Popping, considering the experience of one of the researchers with 20 years of practice in the modality. It was observed that only historical approaches were not enough to understand the qualities of dance. It is necessary to explore aspects such as physiology, biomechanics, anatomy, genetics, motor learning, cytology and biochemistry. The emphasis on physiology showed that the theme extended to areas little explored by science, making the research relevant not only for physical education, but also as a cultural manifestation.

The study aims to reach different groups: bodybuilders, high-performance athletes, individuals with comorbidities, and people in injury prevention or rehabilitation, analyzing the applicability of the method in the development of physical and neuromotor skills. Fiber Hit, based on voluntary spasmodic contractions, contributes to the specific training of dancers, special populations and bodybuilders, stimulating neuroplasticity and improving coordination and conditioning skills.

The method can be integrated with other resistance training protocols, such as bi-set and tri-set. It also has therapeutic potential in neurodegenerative diseases, such as Parkinson's, Stiff Person Syndrome and Restless Legs Syndrome, by facilitating the transmission and coordination of muscle action potentials.

This work is justified by investigating a theme little explored in physical education, contributing to scientific advancement and to the development of motor and coordination skills in healthy individuals and special populations. This article is structured in five sections: the Introduction, which addresses the history of dance from the primitive to the contemporary periods, which culminated in the emergence of Body Popping and the Fiber Hit method;

Relevance, highlighting the application of the method in specific training for dancers of this modality popping, resistance conditioning and prevention of comorbidities; the Theoretical Framework, based on physiology, explaining the effects of Fiber Hit on high performance, physical and neurological rehabilitation, and its neuromotor implications; the Methodology, describing the development of the research; the Discussion of Results; and the Conclusion.

The study emphasizes muscle physiology, explaining that contraction involves the sliding of contractile proteins (actin and myosin) and the movement of non-contractile proteins (nebulin, titin), producing force and movement. Unlike involuntary spasmodic contractions, historically seen only as a post-exercise effect, the Fiber Hit method uses voluntary spasmodic contractions as a training tool, enhancing physical exercise and promoting neuroplasticity in human movement. The specific objectives include evaluating the application of Fiber Hit in high performance, in comorbidities, in motor and neurological physical rehabilitation, in injury prevention, and to understand the effectiveness of voluntary spasmodic neuromotor applicability in physical exercise.

## 2 DEVELOPMENT

### 2.1 THE FOCUS OF VOLUNTARY SPASMODIC CONTRACTIONS IN BRAZIL AND IN THE WORLD

There is a distinction between voluntary and involuntary spasmodic contractions, highlighting the scarcity of studies on the subject both in Brazil and internationally. Within the World Health Organization (WHO), involuntary spasmodic contractions are not clearly addressed, and topics such as chronic diseases, pandemics, antimicrobial resistance, and vaccination are prioritized.

In Brazil, the Ministry of Health recognizes involuntary spasmodic contractions, especially in dystonias, characterized by sustained or intermittent muscle contractions that generate abnormal movements, postures, or cramps. However, voluntary spasmodic contractions remain poorly studied, not finding direct references in health agencies. This scientific vacuum highlights the need for specific research, especially for high-performance application, motor learning, rehabilitation, injury prevention, and treatment of comorbidities, allowing the development of innovative neural methods.

## 2.2 TRAINING INTENSITY BASED ON PHYSIOLOGICAL FUNCTIONALITIES

The human body in conditions of physiological stress starts to seek homeostasis to improve its functionality. In a discussion on physiology, the effectiveness of the application of the neuromuscular method will be verified through bibliographic references that prove the applicability of the new fiber hit concept (SCOTT and EDWARD, 2017).

Voluntary spasmodic contractions (VCE) added to concentric and eccentric contractions require high oxygen uptake, increased hydrogen ions, and lactic acid. This is because at the beginning of muscle activity, the body enters an oxygen deficit reaching its stable state, proceeding to oxygen debt (PERES, 2019).

CEVs force the human body to send an action potential on top of an existing muscle contraction, either isometric or dynamic, through the affected target muscle. This causes the oxygen deficit and debt to be greater and increase the feeling of training intensity (SCOTT AND EDWARD, 2017).

Through this intensity mentioned above, the body decreases the intrinsic rhythm of the sinoatrial node (S-A) through an increase in acetylcholine, less sensitivity to catecholamines (Epinephrine, noradrenaline), an effect caused by cardiac hypertrophy. In this way, bradycardia occurs after training, which is intensified with the requirement of this new training method, by increasing muscle activity and hormone production (catecholamines), increasing oxygen uptake in the tissues. (PERES, 2019).

In cardiorespiratory adaptations at rest, cardiac volume, heart rate, ejection volume, blood volume and hemoglobin concentration, and skeletal muscle capillary density increase. These physiological changes can be intensified with the fiber hit method, since successive contractions occur in addition to dynamic contraction, requiring much greater physiological stress in the body, causing resistance to the hormone adrenaline (SCCOTT and EDWARD, 2017).

In muscle biomechanics it finds proteins which slide between each other to cause muscle contraction. This contraction occurs through calcium that binds to troponin releasing the tropomyosin filaments, releasing ATP in muscle contraction and relaxation, along with these proteins we have titin that is linked to myosin which is responsible for the elastic force of the muscle activated when successive contractions occur, the body enters a kind of energy saving to increase the effectiveness of muscle work (PAULO,  RUY AND MÁRIO, 2019).

Successive voluntary contractions, being applied very quickly, directly affect titin, which improves muscle power at various points of contractility caused by contraction peaks that will

intensify fatigue levels. Suppose that in the execution of the barbell curl exercises in an isometry of 90º and 60º of amplitude: at these angles the biceps will gain additional strength, since the isometry improves the activity of the nebulin, which is responsible for stability and muscle strength to the desired degree (ALEX, 2013).

Just as these effects of nebulin in relation to stability occur, so does titin at different angles. However, the target muscle will not enter into an energy economy due to the fact that it is under the influence of resistance training that will enhance muscle fatigue by the amount of neural information sent to the muscle that leads to fatigue the golgi tendon organ (OTG) (EMERSON, 2019).

During the exercise, two considerations must be worked on: volume and intensity. These, in turn, define the level of physical conditioning that must be worked on with each individual, and it is no different with spasmodic contractions. The frequencies of contractions can be increased both in volume and intensity (BERGSON, 2017).

In high performance, it is possible to demand a high intensity of muscle contraction added to the volume of high repetitions. The amount of action potential that is sent to the affected muscle contributes to a great deal of neural stress. The ways of working on action potentials are: proprioception (rhythmic initiation, repeated contractions, contracting, relaxing, and rhythmic stabilization), (RÔMULO, PATRÍCIA, CHRISTIANO, AND ADRIANO, 2017).

Proprioception uses exercises to maintain stability and improve neuromotor actions. With fiber hit, the body starts to send neural information without necessarily having to be in balance, since we can send muscle spasms to any region of the body (ALEX, 2013).

With this method it is possible to perform some variations of resistance training, for example, while performing the barbell curl exercise it is possible to send contraction stimuli to the quadriceps, forcing the body to send action potentials and improve its coordination function (SCOTT and EDWARD, 2017).

Successive contractions constrict some blood vessels, depending on the amount that these vessels are contracted through the friction of the endotheliums, can stimulate the production of nitric oxide increasing the production of follistatin which inhibits myostatin (a protein that when inhibited occurs protein synthesis contributing to the gain of muscle mass (ALEX, 2013).

With the increase in muscle contractions, there is an increase in body temperature for the body to balance the temperature, activates the sweat glands, releasing sweat for heat transfer to the external environment. Due to this body dehydration, the kidney releases renin,

which will be taken to the liver, where the angiotensiogen is located, this chemical reaction releases angiotensin I (SCOTT AND EDWARD, 2017).

This substance is a not very powerful vasodilator, due to body dehydration there is a drop in blood pressure, although the production of angiotensin I will still not be enough to raise blood pressure, so this product is sent to the lung that will undergo a chemical reaction by the angiotensin-converting enzyme (ACE), (SCOTT AND EDWARD, 2017).

After this reaction, angiotensin I is converted into angiotensin II which is a powerful vasoconstrictor, and ultimately regulating blood pressure. Angiotensin II enhances blood pressure balance through the release of the hormone aldosterone. This hormone accumulates a large amount of sodium in the blood, causing the liquids in the middle, less concentrated, to accumulate to the more concentrated, decreasing the production of urine to balance the amount of soluble in the arteries, increasing the blood flow that will be redirected to the heart, thus resulting in a potentiated balance of blood pressure (SCOTT AND EDWARD, 2017).

As the spasmodic contractions method works with successive contractions, the heat production in the muscles is intensified and will leave these physiological effects as soon as possible (SCOTT AND EDWARD, 2017).

The act of contracting with voluntary spasmodic contractions opens up a new range of scientific information to be studied and elucidated (MENDES, 2021).

## 2.3 FIBER HIT METHOD APPLIED IN WEIGHT LOSS, REHABILITATION IN HYPERTENSION AND CARDIOVASCULAR PROBLEMS

The Fiber Hit method, based on voluntary spasmodic contractions, demonstrates potential for application in special populations, acting in the prevention and treatment of comorbidities. Metabolic syndrome, associated with conditions such as heart disease, hypertension, diabetes and insulin resistance, can benefit from the method, which promotes metabolic stress and neuromuscular adaptations similar to weight training.

In diabetes, Fiber Hit favors glucose uptake through the activation of GLUT-4 without the need for insulin, as muscle contraction stimulates the AMPK protein, triggering chemical reactions that reduce blood glucose levels. In metabolic syndrome, contractions increase the release of adrenaline, promoting lipolysis of adipose tissue and transport of fatty acids to the muscle, enhancing weight loss and insulin sensitivity.

In hypertension and cardiovascular diseases, the method helps regulate vascular homeostasis. Increased blood flow and shear stress stimulate the production of nitric oxide (NO) and prostacyclin, which enlarge vessel diameter and reduce angiotensin II, elevating bradykinin. This process improves endothelial function, exerts an anticoagulant effect, and prevents thrombi formation through the activation of protein C and degradation of factors Va and VIIIa, inhibiting thrombin and excessive coagulation.

The physiological mechanisms that favor blood pressure control through physical exercise and voluntary spasmodic contractions. Shear stress induces the release of nitric oxide (NO) and prostacyclin, inhibiting platelet aggregation and activating fibrinolysis, with the participation of thrombomodulin and plasminogen tissue activator (t-PA). Continuous stimulation of epinephrine at alpha receptors promotes vasoconstriction, while activation of beta receptors increases adrenergic sensitivity, increasing bradykinin release and favoring vasodilation. These processes, associated with dynamic muscle contraction, intensify endothelial shear stress and improve vascular function, helping in the treatment of hypertension, atherosclerosis, and arteriosclerosis. Apply the method in neurological and physical rehabilitation and injury prevention.

## 2.4 APPLY THE METHOD IN NEUROLOGICAL AND PHYSICAL REHABILITATION AND INJURY PREVENTION

Before explaining the physiology of tendons and muscles, it is important to highlight the limitations of the Fiber Hit method in rehabilitation and prevention. First of all, it is not possible to apply spasmodic contractions to stabilizing muscles. These muscles need to maintain regularity, as they protect the joints and prevent injuries; therefore, the body blocks voluntary spasms. "The role of the local (segmental) stabilizing muscles is to provide protection and support to the joints through the control of excessive physiological and translational movement" (COMEFORD & MOTTRAM, 2001b).

In addition, at the beginning of rehabilitation it is necessary to adopt conservative training. Then, the physiotherapist can add other strategies that reestablish the individual's functional capacities, such as electrotherapy, which sends signals to the target muscles and induces the brain to activate the injured region (JAMES, 2021).

## 2.5 MOTOR PHYSICAL REHABILITATION

The Fiber Hit method does not replace electrotherapy, as muscle strain or stretch requires care in the initial treatment, since no patient would be able to perform a voluntary spasmodic contraction in grade I, II or III lesions. using low intensity to enhance the tension capacity of the tendon OTG and improve the contractile function of the muscle spindle (JAMES, 2021).

Thus, by sending a large amount of electrical signals to the entire body, the Fiber Hit technique, when performed on only one leg or walking in a straight line, increases the difficulty of balance, requiring greater motor activity from the stabilizing muscles. This effect, resulting from the random sending of stimuli to different agonist muscles, reinforces the balance pattern with intense activation of the muscles that stabilize movement (COMEFORD & MOTTRAM, 2001b).

## 2.6 NEUROLOGICAL REHABILITATION FOR POST-CANNABIS USERS

Cannabis is known to have a psychoactive effect caused by Δ9 – THC (tetrahydrocannabinol). This substance alters the mesolimbic system in a dysfunction of the reward system with the reduction of dopamine naturally produced by the nucleus accumbens, which can even lead to depression. Some side effects of cannabis use will be listed, which are: drowsiness, lethargy, impaired motor coordination (balance and strength), alteration of time and space, psychomotor retardation, reduced ability to perform complex motor activities, impairment of short-term memory (motor cortex), impairment in concentration (BORILLE, 2016).

In this way, the method of voluntary spasmodic contractions can contribute to the pyruvate and lactate production pathway caused by the high intensity of training of successive contractions, allowing greater activity of astrocytes which are cells that create a barrier against toxic agents found in the blood known as the blood-brain barrier, these cells relate to blood capillaries and neural cells. This lactate production allows the stimulation of the hormone irisin that activates BDNF proteins that are directly related to cognition, perception, production of neural buds, dendrites, refinement of action potentials and speed of this electrical signal and better capacity for neural activity (RUMAJOGEE, 2017).

## 2.7 APPLICABILITY OF FIBER HIT IN PREVENTION OF JOINT INJURIES

Regarding the synovial joints, the synovial fluid and the bursa and its influence on the benefit of cartilage will be discussed. Synovial fluid is thixotropic, its viscosity can be altered by speed, duration, shear rate, temperature and PH. The application of the fiber hit method can be summarized in contracting the muscles with the static body without presenting joint movements, but allowing muscle movement by voluntary spasms, this will lead to a warming of the muscles and resulting in this, a release of synovial fluid caused by the speed of contractions and muscle activity at work (DUFOUR, 2016; PILLU, 2016).

Synovial fluid has mechanical properties and its particles resemble a carpet of molecules that are made up of movable bearings capable of sliding to avoid the joint shear rate while protecting against abrasion. Bursae work as shock absorbers, just like cartilage it is not possible to hypertrophy the bursa, but they work as shock absorbers around the joint and minimize the impact between bones, tendons and muscles. These, in turn, are filled with synovial fluid and their viscosity rate can improve with good hydration, strengthening and joint warming (DUFOUR, 2016; PILLU, 2016).

There are different types of cartilages: hyaline, fibrocartilage and elastic cartilage, the hyaline characteristic will be discussed. It is not possible to hypertrophy the cartilage, but it is possible to improve its resistance by hydration and imbibition, since the cartilaginous material is porous and allows a reabsorption of synovial fluid and eliminate waste through the pores caused by joint compression and decompression. Therefore, although it is not necessary to have joint movement to warm the body and release synovial fluid, it is interesting that there is body movement to achieve the imbibition of the fluid in the entire area of the cartilage, allowing its redistribution throughout its extension. Thus, it is perceived that the fiber hit method as a form of warm-up should preferably present random movements without additional load on the body with voluntary spasmodic contractions to accelerate muscle warm-up, release and distribution of synovial fluid in the joints (DUFOUR, 2016; PILLU, 2016).

## 2.8 RESTRICTIONS AND CLINICAL APPLICATIONS

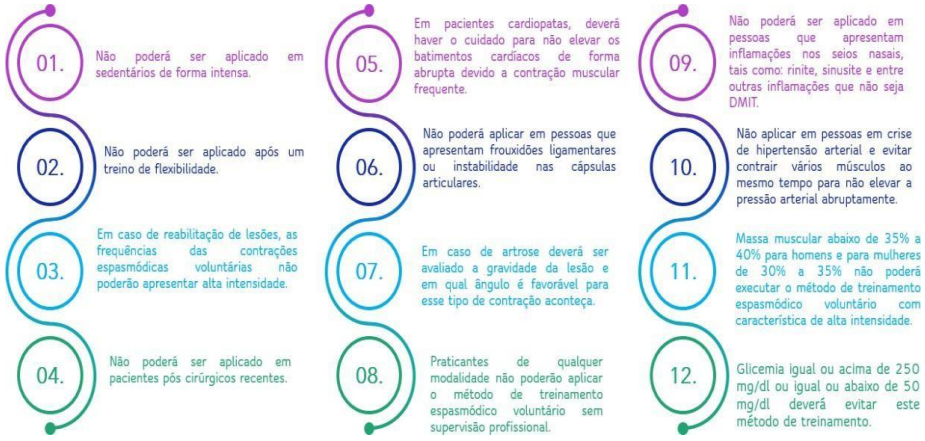
The safety of the application of the fiber hit method will be addressed, to avoid injuries and intensify body physiology, the knowledge of this application and clinical restriction is important because it contributes to the efficiency of the method. In this way, it is possible to develop conditioning and coordination skills with total safety, although the lesion is

multifactorial, and it may be difficult to detect the lesion in isolation (NATÁLIA, 2015). The clinical characteristic exists in two main natures: those that aim to recognize, diagnose and predict the evolution of diseases and interventions that aim to treat or prevent them (MOACYR et al., 2004).

The athlete can be injured by any medical problem that occurs, if the limitation is not perceived through clinical examinations. The relationship between sport and athlete is totally linked to sports injuries, since it increases capacity as a primary result in relation to health. The health of the athlete in the background does not mean that it is less important, only attention and emphasis is given priority to the level of the practitioner. To reach the high level of the athlete, it is necessary to bring him to his maximum capacity, which may compromise his physical integrity or not (AUGUSTO et al., 2008). To illustrate, Figure 01 shows some important clinical constraints.

**Figure 1**

*Clinical restrictions*

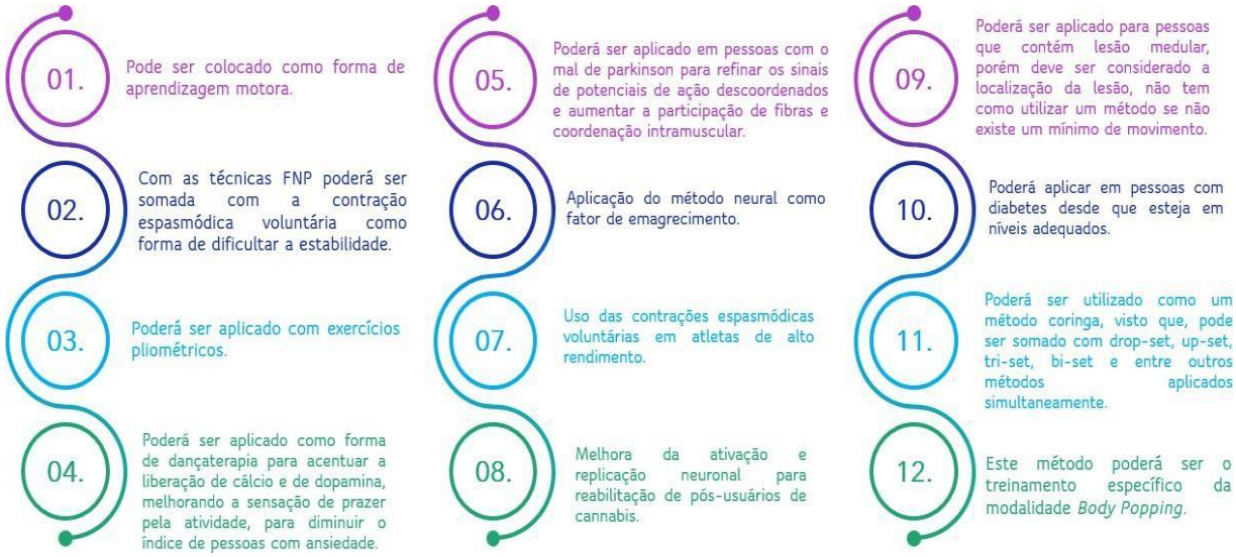



Source: Survey data (2023).

Nevertheless, Figure 01 is clear in describing the restrictions in order to expose the need to understand the subject. And then Figure 02 already describes the clinical applications in order to realize the importance of specific studies on the subject.

**Figure 2**

*Clinical applications*




Source: adapted by the collaborators (2023).

## 2.9 ANATOMY APPLIED TO THE FIBER HIT METHOD

It is crucial to understand human anatomy because it is the science that studies macro and microscopically the constitution and development of organized beings. The word anatomy means to cut into parts. Studying the main muscles to understand where the method is applied is extremely important, since not all muscles are likely to have voluntary spasmodic contraction (DANGELO; FATTINI, 2007).

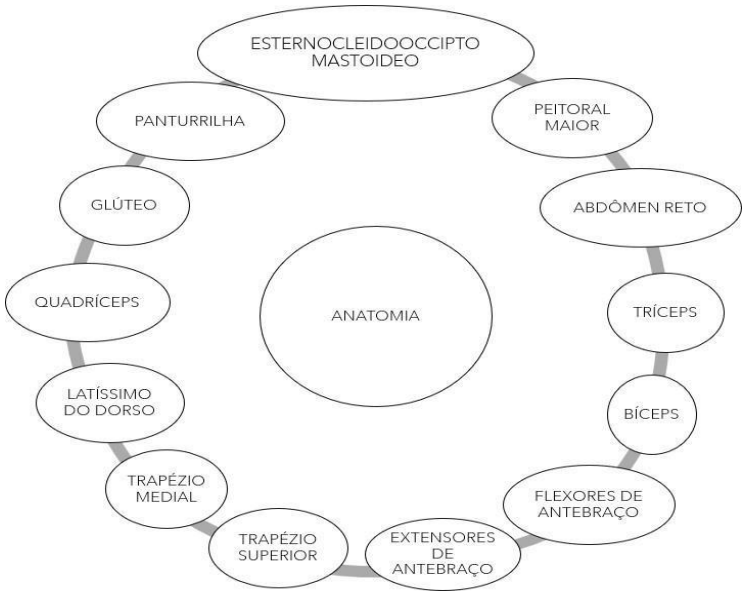
It was reported here in this subject that the method has its limitation and that it is not possible to contract all muscles, since the stabilizing muscles have the function of avoiding unwanted movements and excessive translational. As every rule also exists, it is possible to contract some stabilizing muscles, among them are: Sternocleidoocciptomastoid, forearm flexors, straight abdomen and calf (a little more difficult to be contracted spasmodically, with load it becomes more difficult) (COMEFORD AND MOTTRAM, 2001b).

## 2.10 THE MAIN MUSCLES THAT CAN BE CONTRACTED BY THE FIBER HIT METHOD

It is necessary for the physical education professional to have knowledge about the locomotor system and about the functioning of the body in general during body movements (CARDINOT et al., 2014).

**Figure 3**

*Anatomy applied to the fiber hit*




Source: Adapted by contributors (2023)

## 2.11 NEUROSCIENCE AND NEUROPHYSIOLOGY OF THE FIBER HIT METHOD IN HUMAN MOVEMENT

The Fiber Hit method acts directly on neuroplasticity, influenced by three factors: genetics, environment, and task. Genetics determines individual neural adaptations; The environment and the execution of new tasks promote experiences that stimulate the formation of new neural branches and dendrites. Irregular and repetitive movements refine the electrical signals in the axons, improving fine motor coordination.

The method also impacts the conditioning physical capacities: strength, flexibility, speed and endurance. By refining coordination and enhancing strength, Fiber Hit increases endurance and speed, while improving the malleability of tendons and ligaments, especially when combined with proprioceptive training. The electrical stimulation of muscle fibers varies according to the type: I fibers respond to light loads, while IIA and IIX fibers allow greater force production. The repetition and sum of muscle stimuli increase the recruitment of fibers, enhancing neuromuscular and coordination performance.

Increased stimuli and heavier loads depolarize higher threshold fibers (type IIX), allowing for greater muscle strength. The rotation of motor units allows fatigued fibers to be temporarily replaced by rested ones, preventing fatigue in submaximal contractions; maximum contractions generate tetany, showing that the Fiber Hit method does not act at maximum loads.

Fiber recruitment follows an order: type I → IIA → IIX, with low-intensity training until fatigue increasing the recruitment of type IIA fibers. The frequency and firing speed of motor neurons determine the sum and increase in the recruitment of muscle fibers, characteristics enhanced by Fiber Hit due to voluntary spasmodic contractions.

Synchronization of motor units increases muscle recruitment by stimulating motor neurons simultaneously. Intramuscular coordination enhances the activation of fibers within the muscle, while intermuscular coordination refers to the cooperation between muscles for movement. Co-contraction regulates joint stability and force production, decreasing when greater agonist recruitment is required.

The concept of Time Course indicates that strength gains can be noticed in 10 days, while hypertrophy occurs later. Muscle strength is the ability to overcome resistance; maximum force is the maximum that the muscle can generate in one contraction; and explosive force results from the combination of strength and speed of movement.

Force resistance, defined as the ability to maintain force production for prolonged periods, and the influence of the speed of movement on the types of force worked. Training with blood flow restriction (20% to 50% of 1RM), such as KATSU TRAINING, generates metabolic stress, increasing pyruvate and lactate production, which activate the hormone irisin and the BDNF protein, promoting neurogenesis and neural plasticity.

The method stimulates type IIA fibers due to decreased oxygen and increased glycolytic activity, increasing the recruitment of type II composite fibers and sustaining strength levels. Metabolic stress also influences hormones, myokines, reactive oxygen species, and muscle swelling, contributing to hypertrophy and physiological adaptation.

Training principles are highlighted: adaptation, accommodation, trainability, specificity and range of motion. These principles indicate that the gains depend on the magnitude of the stimuli, the progressive increase in overload, the proximity of the training to the functional reality of the objective and the range of motion used. Voluntary spasmodic contraction, as in the Fiber Hit method, can be applied at any amplitude, ensuring efficiency, power, and specificity of training.

For power development, it is recommended to train with intensities equal to or greater than 60%, while for speed it is used from 30% to 60%, favoring low loads and fast contraction. It is not necessary to achieve failure at 60% load to achieve effective results. It is important to maximize the speed of movement, even at higher loads, to optimize muscle power

(strength x speed). The Fiber Hit method can be applied with higher intensities to increase neural stress and enhance training.

## 3 METHODOLOGY

With regard to methodological procedures, the study intends to be developed from a bibliographic research, since Gil (2010) defends its importance in the production of scientific research, emphasizing that: "bibliographic research is carried out through the rereadings of theoretical references already examined, and published in some medium, whether in the traditional form in physical books, or through magazines and electronic books, e-books, or web site pages" (GIL, 2010, p. 74).

In turn, the approach of the bibliographic review will take place under the bias of qualitative research regarding the theme in question. As for the objectives of the research, it was consummated as descriptive, at first, and, later, documentary, since at first Goldenberg (2005) teaches that this type of research is regularly used with the purpose of investigating a variety of information on a specific theme and/or subject, in order to describe its nuances and its most relevant points.

For the second, the author argues that this typology is carried out through the search for official, historical documents about the place and/or the subject that is intended to be researched (GOLDENBERG, 2005). The data will be cataloged and the results presented via graphs and tables or in another way if necessary.

## 4 RESULTS

The study on voluntary spasmodic contractions and their relationship with the neuroplasticity of human movement presents significant challenges, given the innovative nature of the topic and the scarcity of scientific studies addressing its applicability in physical exercise. The main objective was to investigate the efficiency of muscle contractility and the physiological requirements that support the execution of these contractions. The Fiber Hit method, inspired by the Body Pop dance, is the central focus of the study, being analyzed for its relevance to different audiences, including high-performance athletes, individuals with comorbidities and practitioners of physical exercises.

The literature search revealed that there are no scientific records on voluntary spasmodic contractions, while the available literature is restricted to involuntary contractions related to diseases. Organizations such as the WHO and the Ministry of Health do not

address this phenomenon in depth, highlighting the differential of the study and the potential to expand the fields of application of the Fiber Hit method. The study demonstrated that the controlled execution of these contractions can act as an intensifier of physical training, promoting neuromuscular stimuli that improve strength, coordination and endurance, in addition to favoring neuroplasticity through the creation of new dendritic branches and refinement of electrical signals between axons and muscles.

The results indicate that the Fiber Hit method can be applied in different contexts, from the specificity of training Body Popping dancers to injury prevention and physical and neurological rehabilitation. It was observed that the technique requires professional supervision, especially for special populations, due to the risk of muscle overload, joint injuries, and cardiovascular stress. The study emphasizes that, although the application of the technique in large populations has not yet been tested experimentally, its practice in dance and physical exercises by the researcher demonstrated safety and efficacy, indicating that the brain can regulate the intensity of the stimulus appropriately.

The Fiber Hit method is relevant both for resistance training and for the development of motor and neuromotor skills in healthy individuals with comorbidities. In addition, the study shows that the Body Pop dance, despite its artistic origin, constitutes a practical form of voluntary spasmodic contractions, and can be adapted for structured physical training. The method enhances the specificity of training, improves strength, power, coordination and endurance, in addition to favoring the prevention of musculoskeletal injuries and the improvement of physical conditions in special populations.

Another relevant point identified is the risk associated with the practice without adequate supervision. The modality, when applied incorrectly, can overload muscles and joints, affecting the health of unprepared individuals. The study reinforces that scientific knowledge and professional guidance are essential for the safe application of the method, especially when used by dancers or bodybuilders who seek to intensify their body skills.

In conclusion, the results highlight that the Fiber Hit method, based on voluntary spasmodic contractions, constitutes a new field of study with significant potential for application in physical training and rehabilitation, offering contributions to neuroplasticity, motor performance and injury prevention. The bibliographic research fulfilled its role of theoretically grounding the method, paving the way for future experimental studies that can validate its efficacy in different contexts and populations.

## 5 CONCLUSION

In this theme, a subject little reported by science was addressed, which is neural training that can influence the individual's learning, intensify conditioning capacities, rehabilitate physical motor skills, treat comorbidities and prevent injuries. It is concluded that the existence of this science is essential, as it will contribute to cultural scientific advances (body popping dance) and advances in bodybuilding as a whole.

All the objectives proposed by this content were fulfilled, in historical terms, the importance of fiber hit in high performance, the efficiency of the neural method in comorbidities, in physical motor and neurological rehabilitation, prevention and its neuromotor activity both in learning and in improving coordination and conditioning skills.

This science was very challenging for the team that addressed this topic, as it is a method not yet scientifically reported. Proving this neural method in search of references that can prove its existence was not an easy task. It required the knowledge of one of the researchers who has been dancing the sport for 18 years with the inclusion of physical education for this approach.

The understanding and deepening of this topic allowed us to better understand the physiology of exercise, the importance of neuroscience and neurophysiology. These sciences have improved skills in research, selection, organization and communication of information.

It is concluded that this subject has not been fully clarified and that greater approaches should be made on this subject in order to improve and discover new possibilities of spasmodic muscle contraction in human movement.

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