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## SYSTEMATIC REVIEW OF MEANS AND METHODS OF PRACTICAL INFLUENCE ON TAEKWON-DO TRAINING

### REVISÃO SISTEMÁTICA DOS MEIOS E MÉTODOS DE INFLUÊNCIA PRÁTICA NO TREINAMENTO DO TAEKWON-DO

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#### ABSTRACT

The investigation of means and methods of practical influence can assist in training and allow for improved sport performance. Therefore, the objective of this study was to review in the literature methods and means with practical influence on Taekwon-Do specifically. A systematic review was conducted with English/Portuguese descriptors, namely martial arts/*artes marciais*, exercise/*exercícios*, physical fitness/*aptidão física* and athletic performance/*desempenho esportivo*, on Portal Capes, Sport Discus, Lilacs, Medline and PubMed databases. After application of inclusion and exclusion criteria, 12 studies were selected. In the studies analyzed, 21 types of training means and 19 types of training methodologies were identified. Among the results, there is an evident use of special means, mainly exercises with kicks and the interval method, with high intensity, to prepare athletes to the physiological demands of combat and to develop their aerobic and anaerobic systems.

**Keywords:** Martial arts. Exercise. Sport performance. Review. Sports.

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#### RESUMO

A investigação de meios e métodos de influência prática podem auxiliar o treinamento e possibilitar melhora do desempenho esportivo. Portanto, o objetivo deste trabalho foi revisar na literatura os métodos e meios de influência prática específicos para a modalidade Taekwon-Do. Foi realizada uma revisão sistemática com os descritores em inglês/português: martial arts/*artes marciais*, exercise/*exercícios*, physical fitness/*aptidão física* e athletic performance/*desempenho esportivo* nas bases de dados Portal Capes, Sport Discus, Lilacs, Medline e PubMed. Foram consideradas publicações em português, espanhol e inglês. Após a aplicação de critérios de inclusão e exclusão, foram selecionados 12 estudos. Nos estudos avaliados, foram identificados 21 tipos de meios de treinamento e 19 tipos de metodologias de treinamento. Entre os resultados, evidencia-se a utilização de meios especiais, principalmente o trabalho com chutes e o método intervalado, com elevada intensidade, para preparar os atletas às demandas fisiológicas do combate e desenvolver os sistemas aeróbio e anaeróbio.

**Palavras-chave:** Artes marciais. Exercício. Desempenho esportivo. Revisão. Esportes.

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#### Introduction

The term Taekwon-Do means “the way of the foot and fist” and is a martial art of Korean origin developed from the combination of several body systems of attack and defense. It was devised in South Korea by general officer Choi Hong Hi between 1945 and 1955, after World War II and during the Korean War<sup>1,2</sup>. The modality is classified as a striking combat sport and characterized by blows with fists and feet in alternating effort and with high-intensity physical demand during fights<sup>3</sup>.

Martial arts are combat activities influenced by cultural and ethical aspects. They are practices that can act in the physical, spiritual and social spheres. Combat sport modalities are forms of martial arts turned into sport, whose main goal is partial simulation of “true” one-on-

one fights. They must be governed by regulatory entities or institutions, and comprise championships with rules and classifications<sup>3</sup>.

Sport performance in combat sports are related to the development and combination of determining aspects (technical and physiological) of the modality<sup>4</sup>. Studies<sup>5,6</sup> have been proposed to identify the profile of Taekwon-Do athletes and practitioners and the characteristics linked to sport success. These investigations agree that sport performance is the result of high physical, technical and psychological condition.

In this sense, systematically-elaborated training and preparation methodologies are necessary, according to the specificity of the modality and with the purpose of achieving high performance levels<sup>4</sup>. The athlete needs to perform basic tasks related to assimilation and development of technique, tactics, and motor, functional and psychological abilities<sup>7</sup>. The literature on the modality suggests that to achieve the ideal levels of sport preparation and the execution of basic preparation tasks it is necessary to resort to training methods and means<sup>7,8</sup>.

Training methods are broader, as they refer to the way of using and handling the means (exercises) in the preparation process. They are divided into Practical Influence Methods (PIM), Verbal Influence Methods (VIM) and Demonstrative Influence Methods (DIM)<sup>7,8</sup>. Due to the specificity of an athlete's preparation, during the training process PIMs are predominant, while VIMs and DIMs are complementary. PIMs are further subdivided into Programmed Methods (PM), Competitive Methods (CM) and Play Methods (PIM)<sup>7,8</sup>.

PMs are directly related to the concrete objectives of an athlete's preparation and divided into two classifications: teaching of motor action techniques (TT) and motor capacity training (MCT). TT comprises the integral category (integral study of motor action) and the synthetic-analytical category (division of motor action in phases). MCTs concern load handling (volume and intensity) and are subclassified into continuous loading method, interval loading method and mixed loading method<sup>7,9</sup>. CMs are methods that model competition and express its characteristics. Action focuses on the overcoming of previous results or defeat of an opponent in order to solve a given training task. Its goal is to promote complex influence on different aspects of preparation<sup>7</sup>. PIMs have as main peculiarity the resolution of certain training tasks. Unlike the competitive method, the play method is not linked to the official competition of the modality, but to a playful situation with no strict rules<sup>4,7,8</sup>.

Training means correspond to physical exercises and influence directly or indirectly on the development of sport readiness. Exercises are classified into general preparatory, special preparatory and competitive<sup>7,8</sup>. General Preparatory Exercises (GPE) aim at the athlete's multilateral development, and may or may not present similarities with the technical movements of the modality. On the other hand, Special Preparatory Exercises (SPE) have parameters that resemble the movements of the modality, and the Competitive Exercise (CE) is a comprehensive motor activity geared towards the solution of the motor task that is constituent part of the competition's object<sup>4,7,8</sup>.

Proper physical preparation for the modality determines what methods and means to be used, as they are directly linked to the intended goal<sup>7,8</sup>. However, the training of combat modalities, mainly when it comes to motor skills, has developed empirically, based only on the experience of coaches or also on contemporary, but non-specific, methods turned solely to strength resistance and muscle hypertrophy, which can lead to performance impairment<sup>10</sup>. In this sense, a review of means and methods of practical influence can provide guidelines to assist training in this modality. In view of this issue, the following question arises: what are the means and methods of practical influence analyzed in the literature for Taekwon-Do

training? Thus, the objective of this study was to carry out a systematic review of the literature on means and methods of practical influence in the Taekwon-Do modality.

## Methods

Systematic review was chosen as the methodology of this research because the latter is a careful investigation with application of explicit and systematic methods of search, critical appraisal and synthesis of selected information, synthesizing evidence related to a specific theme<sup>11-13</sup>. Steps consisted of systematic search in the literature, critical analysis for inclusion and exclusion of studies, and collection of outcome variables (data extraction), as described below.

### *Search Strategy and Eligibility*

Studies were searched for on Portal Capes, Sport Discus, Lilacs, Medline and PubMed databases, and publications in Portuguese, Spanish and English were considered. Studies published between 2000 and July 2015 were considered. The option for this period is due to the fact that only in 2000 the modality officially entered the Olympic Games, with consequent increase of its representativeness in international competitions. In addition, the most current aspects of training, that is, the last 15 years, were included in the review.

The PICO strategy was used to help construct the guiding question of the research and the study selection. The PICO strategy represents the acronym for Population, Intervention, Comparison (not in the present study) and Outcomes<sup>14</sup>. Then, population (Taekwon-Do athletes and practitioners), intervention (means and methods of practical influence) and outcome (improvement of performance-related skills) were defined. No comparison between studies was performed, since no standard or more recurrent intervention was defined. Additionally, due to the aim of contemplating the surveying of training methods and means, the several interventions and designs made comparison unfeasible.

There was consultation to DeCS (Health Sciences Descriptors), MESH (Medical Subject Heading), Thesaurus, and common search terms between the three vocabularies in Portuguese, Spanish and English were defined. The descriptors were combined according to PICO items. For the item Population, the descriptors martial arts/*artes marciais* were used. In this item, in addition to the descriptor *artes marciais/artes marciales/martial arts*, the synonym *taekwondo* (entry term) was used in order to refine the search. For the item Intervention, the descriptors *exercícios/ejercicio/exercise* and *aptidão física/ aptitud física/physical fitness* were used, whereas for the item Outcome the descriptor *desempenho esportivo/rendimiento atlético/athletic performance* was used.

Advanced search on the databases was chosen and the Boolean operators “AND”, “OR”, and “AND NOT” were employed to combine the descriptors. The Boolean operator “AND NOT” was used for the entry terms “judo”, “karate”, “muay thai”, “jiu jitsu” and “tai chi” to filter Taekwon-Do studies only. As limits of the searches, the descriptors should appear in the title or in the abstract. Repeated studies were disregarded. Eligible studies were those with descriptors in the title and abstract and whose theme suited the purpose of the review. In this sense, titles and abstracts were read and, in case of doubts, the full article was read as well.

### *Inclusion and Exclusion Criteria*

In the second stage, the previously defined exclusion criteria were applied: review articles; comparative studies with other fight modalities; martial arts or combat sport

modalities; studies addressing pathological aspects or rehabilitation, and those involving physical, biomechanical tests and anthropometric or psychological profile, because the latter did not contemplate a training routine.

In the third stage, the inclusion criteria were applied to the selection of studies that would compose the review. The included studies were those involving Taekwon-Do athletes or practitioners; application and analysis of training means and methods; application for training prescription; goal of increasing level of preparation and sport performance.

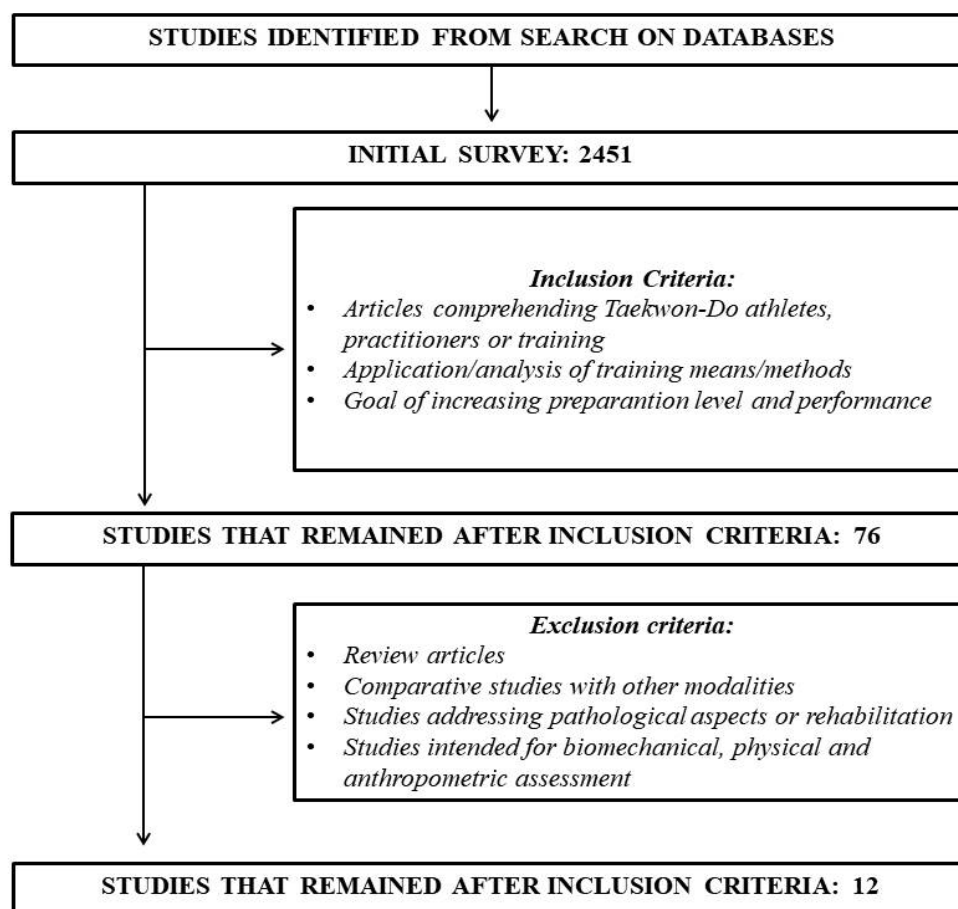
#### Data Extraction

After the completion of the previous steps, a reviewer extracted the following data: authorship; year of publication; sample characteristics; time of experience in the modality. The training aspects observed were training contents, intervention proposals on training method or mean, and outcome of interventions.

#### Results

The initial survey returned 2,451 studies. After application of the exclusion criteria, only 76 articles with potential for review remained. Afterwards, the inclusion criteria were applied and, out of the 76 studies, only 12 were selected (Figure 1).

**Figure 1.** Stages of the methodology used for search and selection of studies included in the systematic review



Source: Authors

Table 1 presents details and information on the 12 studies<sup>15-26</sup> included in the review. The assessment comprehended: year of publication; number of subjects, number of subjects by sex; age; height; total body mass (BM); training experience time (Exp); weekly training frequency (WTF); duration of training sessions (DS) and technical level of the sample.

Of the 12 studies included in the review, eight (67%)<sup>15-22</sup> were conducted in the last five years. The total sum of the population investigated in the studies is 192 participants. The mean number of participants per study was  $16 \pm 9.15$ , with 72.90% of males and 31.61% of females. Only two studies<sup>16,18</sup> had mixed sample (male and female) and only one was carried out with a female sample<sup>17</sup>. The sample's mean age was  $20.65 \pm 5.65$  years, mean height was  $172.14 \pm 7.80$  cm and mean BM was  $66.34 \pm 8.28$  kg. One study<sup>23</sup> did not report the sample's mean age, and five studies<sup>17,19,23</sup> did not report height and total body mass values.

**Table 1.** Characterization of the number, sex, body composition, training frequency and level of the described individuals

| Study   | Year | N  | ♂  | ♀  | Age (years) | Height (cm) | BM (kg) | Exp (months) | WTF (days) | DS (min) | Sample level |
|---|------|----|----|----|-------------|-------------|---------|--------------|------------|----------|--------------|
| <i>Santos, Valenzuela and Franchini</i> <sup>15</sup> | 2015 | 11 | 11 | -  | 20.3        | 177         | 71.8    | 115.2        | 5          | 120      | Advanced     |
| <i>Seo et al</i> <sup>16</sup>                        | 2015 | 34 | 22 | 12 | 19.15       | 172.3       | 64.8    | 110.4        | NR         | NR       | Advanced     |
| <i>Lim et al</i> <sup>17</sup>                        | 2015 | 24 | -  | 24 | 27.2        | NR          | NR      | 0            | 0          | 0        | No exp       |
| <i>Pashkov</i> <sup>18</sup>                          | 2015 | 30 | NR | NR | 13          | NR          | NR      | NR           | NR         | NR       | Beginner     |
| <i>Woo, Chow and Koh</i> <sup>19</sup>                | 2014 | 13 | -  | 13 | 30.7        | NR          | NR      | 0            | 0          | 0        | No exp       |
| <i>Leichtweis et al</i> <sup>20</sup>                 | 2012 | 8  | 8  | -  | 21.6        | 173.3       | 75.2    | 121.2        | NR         | NR       | Advanced     |
| <i>Haddad et al</i> <sup>21</sup>                     | 2011 | 18 | 18 | -  | 14          | 168         | 55.2    | 72           | 4          | NR       | Advanced     |
| <i>Sant'Ana, Liberali and Navarro</i> <sup>22</sup>   | 2011 | 7  | 7  | -  | 24.9        | 174.6       | 70      | NR           | NR         | NR       | Advanced     |
| <i>Jakubiak and Saunders</i> <sup>23</sup>            | 2008 | 12 | 12 | -  | NR          | NR          | NR      | NR           | NR         | NR       | Advanced     |
| <i>Bridge et al</i> <sup>24</sup>                     | 2007 | 8  | 8  | -  | 22.5        | 177         | 70.5    | 64.8         | 4          | 120      | Advanced     |
| <i>Bouhleb et al</i> <sup>25</sup>                    | 2006 | 8  | 8  | -  | 20          | 179.9       | 70.8    | 84           | 5          | 90       | Advanced     |
| <i>Melhim</i> <sup>26</sup>                           | 2001 | 19 | 19 | -  | 13.8        | 155         | 52.4    | 10.4         | 3          | 60       | Intermed     |

Note: NR: Not reported in the study; ♂: male; ♀: female

Source: Authors

About the experience of the investigated population with practicing the modality, the participants had been training for  $82.57 \pm 38.66$  months, with a frequency of  $4.2 \pm 0.84$  training days per week and mean duration of  $97.5 \pm 28.72$  minutes per training session. Three studies<sup>18,22,23</sup> did not report Exp; five studies<sup>16,18,20,22,23</sup> did not report the participants' WTF, and only four studies<sup>15,24-26</sup> reported the durations of the training sessions the participants performed. There is a predominance of studies (66.66%) conducted with participants of advanced technical level in the modality. Black belts or participants with at least five years practicing Taekwon-Do (average time for black belt graduation) were considered advanced. Two studies (16.67%)<sup>17,19</sup> were carried out with participants with no prior experience in the modality; one study (8.33%)<sup>18</sup> involved beginners; one study (8.33%)<sup>26</sup> was conducted with intermediate-level students, and eight studies (66.67%)<sup>15,16,20-25</sup> counted with advanced-level practitioners.

Table 2 displays details of the studies' design: number of participants per group (N); duration of intervention (DI); intervention weekly frequency (Frequency); total number of sessions (TS), duration of each session (DS) and intervention performed.

**Table 2.** Study designs

| Study  | Groups | N  | DI (weeks) | Frequency (weekly) | TS (days) | DS (min) | Intervention               |
|--|--------|----|------------|--------------------|-----------|----------|----------------------------|
| Santos, Valenzuela and Franchini <sup>15</sup> | Exp.*  | 11 | -          | -                  | 5         | -        | WRT, Plyometry and CxT     |
| Seo et al <sup>16</sup>                        | Exp.   | 34 | 8          | NR                 | -         | 120      | Running, Plyometry and CRT |
| Lim et al <sup>17</sup>                        | Exp.*  | 12 | -          | -                  | 2         | -        | TM                         |
|  | Cont.* | 12 | -          | -                  | 2         | -        | -                          |
| Pashkov <sup>18</sup>                          | Exp.   | 15 | NR         | NR                 | NR        | NR       | CT                         |
|  | Cont.  | 15 | -          | -                  | -         | -        | -                          |
| Woo, Chow and Koh <sup>19</sup>                | Exp.   | 7  | 8          | NR                 | 20        | 30       | TM                         |
|  | Exp.   | 6  | 8          | NR                 | 20        | 30       | TM                         |
| Leichtweis et al <sup>20</sup>                 | Exp.*  | 8  | -          | -                  | 4         | -        | IRT, Plyometry and CxT     |
| Haddad et al <sup>21</sup>                     | Exp.*  | 9  | -          | -                  | 4         | 32       | MSTE                       |
|  | Exp.*  | 9  | -          | -                  | -         | -        | Running                    |
| Sant'Ana, Liberali and Navarro <sup>22</sup>   | Exp.   | 4  | 8          | 3                  | 24        | 24       | MSTE                       |
|  | Cont.  | 3  | -          | -                  | -         | -        | -                          |
| Jakubiak and Saunders <sup>23</sup>            | Exp.   | 6  | 4          | 3                  | 24        | NR       | ERT                        |
|  | Cont.  | 6  | -          | -                  | -         | -        | -                          |
| Bridge et al <sup>24</sup>                     | Exp.   | 8  | 1          | 5                  | 10        | 120      | MSTE                       |
|  |        |    |            |                    |           |          | ERT                        |
| Bouhleb et al <sup>25</sup>                    | Exp.*  | 8  | -          | -                  | 4         | 30       | MSTE                       |
|  | Cont.  | 6  | -          | -                  | -         | -        | -                          |
| Melhim <sup>26</sup>                           | Exp.   | 19 | 8          | 3                  | 24        | 50       | MSTE                       |

**Note:** \*: cross-sectional studies; NR: Not reported in the study; MSTE: Modality-Specific Technical Exercises; WRT: Weight Resistance Training; CRT: Circuit Resistance Training; CxT: Complex Training; IRT: Isometric Resistance Training; ERT: Elastic Resistance Training; TM: Teaching Methodology; CT: Coordination Training.

**Fonte:** Authors

Concerning the research methods used, six studies (50%)<sup>15,16,20,24-26</sup> had only one intervention group; four studies (33.33%)<sup>17,18,22,23</sup> had control groups, and two studies (16.67%)<sup>19,21</sup> had two experimental groups. The mean number of participants per group was 11.75±8.11. Five studies (41.67%)<sup>15,17,20,21,25</sup> were cross-sectional, and seven (58.33%)<sup>16,18,19,22-24,26</sup> were longitudinal, with mean duration of 6.17±2.99 weeks, weekly frequency of 3.5±1 days, mean of 12.10±9.67 sessions, and mean duration of 58±43.11 minutes per session.

In the 12 studies, 11 different interventions were identified. In some studies, these interventions were assessed separately<sup>17,18,22,23,25,26</sup>, while in others<sup>15,16,19,20,21,24</sup> they were compared with two or more types of training. The studies that performed interventions with specific technical exercises of the modality<sup>21,22,24-26</sup> and interventions with strength and power training<sup>15,16,20,23,24</sup> accounted for 41.67% each; running<sup>16,21</sup> and teaching and learning of modality-specific gestures<sup>17,19</sup> were assessed in 16.67% of the studies, and, finally, coordination training<sup>18</sup> corresponded to 7.69%.

Table 3 presents the details of studies that include information on the contents and aspects observed in the studies and their results. As seen in Table 2, some researches conducted training assessing content in isolation or combining two or more contents.

**Table 3.** Contents covered and main results

|   | Approached Content  | Results   |
|---|---|---|
| <i>Santos, Valenzuela and Franchini</i> <sup>15</sup> | Muscle power and kicking speed  | Complex exercise with rest interval of 10 min promoted ↑ in kicking frequency speed   |
| <i>Seo et al</i> <sup>16</sup>                        | Body comp., flexibility, strength, agility, power, anaerobic and aerobic metabolism | ↓ of body mass, fat % and angular speed of knee flexion at 180°/s; ↑ in peak power and anaerobic capacity, bone mineral density, angular speed of knee extension and flexion at 60°/s and extension at 180°/s |
| <i>Lim et al</i> <sup>17</sup>                        | Learning of Skills in Series  | Intervention with self-controlled feedback promoted ↑ in learning scores  |
| <i>Pashkov</i> <sup>18</sup>                          | Motor coordination  | ↑ in the execution of jumps, decision making and balance  |
| <i>Woo, Chow and Koh</i> <sup>19</sup>                | Learning of Skills in Series  | ↑ in learning scores for the group that received instructions on movement outcome   |
| <i>Leichtweis et al</i> <sup>20</sup>                 | Muscle power and kicking speed  | Complex exercise promoted ↑ in speed in the frequency of 4 kicks. Plyometric training promoted ↑ in the execution speed of a single kick  |
| <i>Haddad et al</i> <sup>21</sup>                     | Aerobic resistance  | ≈ HR and PE responses between interval and specific interval running training methods   |
| <i>Sant'Ana, Liberali and Navarro</i> <sup>22</sup>   | Aerobic resistance  | ↑ in frequency and total number of kicks  |
| <i>Jakubiak and Saunders</i> <sup>23</sup>            | Kicking speed   | ↑ in kicking speed of the experimental group  |
| <i>Bridge et al</i> <sup>24</sup>                     | Cardiovascular conditioning   | HR responses as to Sparring, Tulls and Core Movements > Kicking Specific Techniques > Technical Combinations, Step Sparring and Kicking with Resistance Band  |
| <i>Bouhleb et al</i> <sup>25</sup>                    | Anaerobic power, anaerobic capacity and VO <sub>2max</sub>                          | There was correlation between HR values and La concentration found during the competition and the values obtained during 10s and 3min of specific exercises   |
| <i>Melhim</i> <sup>26</sup>                           | Aerobic power, anaerobic capacity and power   | ↑ in power and anaerobic capacity. There was no ↓ in restHR and ↑ in aerobic power.   |

**Note** = ↑: Increase; ↓: Decrease; ≠: Difference; ≈: Similar; >: Greater than. PE: perceived effort; HR: heart rate; restHR: resting heart rate; La: Lactate

**Source:** Authors

There was predominance of studies addressing contents related to metabolic and functional aspects<sup>15,16,18,20-26</sup>, totaling 83.33% of the investigations. Studies addressing learning<sup>17,19</sup> totaled 16.67%. Researches involving metabolic aspects<sup>16,21,22,24-26</sup> accounted for

50%, and those covering functional aspects<sup>15,16,18,20,23</sup> corresponded to 41.67%. Only one study<sup>16</sup> analyzed both metabolic and functional aspects.

Analyzing the studies' results, 25% showed increases in aerobic and anaerobic metabolism<sup>16,22,26</sup>. The investigations that found similarities in intensity and cardiorespiratory adaptations between general exercises (running) and specific exercises of the modality<sup>21,24,25</sup> corresponded to 25%. Increases in speed and power<sup>15,20,22</sup> were reported by 33.33% of the studies. Better responses and learning scores related to feedback methodologies<sup>17</sup> and instruction<sup>19</sup> were pointed out in 16.67% of the researches. Studies that investigated improvement in coordination skills<sup>18</sup> represented 7.69%.

Table 4 presents the training methods. Seventeen different types of training methods were observed in the studies and classified as Teaching Methods (TM), Motor Skill Training Method (MSTM), Competitive Methods (CM) and Play Methods (PIM).

**Table 4.** Classification of training methods used in the studies

| Study  | TT       |                                    | MCT                                 |                      |                        | CM       | PIM          |
|--|----------|------------------------------------|-------------------------------------|----------------------|------------------------|----------|--------------|
|  | Integral | Synthetic-analytical               | Interval                            | Continuous           | Mixed                  |          |              |
| Santos, Valenzuela Franchini <sup>15</sup>   |          |                                    | MSTW, Plyometry and CxT             |                      |                        |          |              |
| Seo et al <sup>16</sup>                      |          |                                    | Plyometry and CST                   | Permanent continuous | Progressive continuous |          |              |
| Lim et al <sup>17</sup>                      |          | Self-controlled feedback           |                                     |                      |                        |          |              |
| Pashkov <sup>18</sup>                        |          |                                    | Coordination training               |                      |                        |          |              |
| Woo, Chow and Koh <sup>19</sup>              |          | Inner and outer focus instructions |                                     |                      |                        |          |              |
| Leichtweis et al <sup>20</sup>               |          |                                    | IST, Plyometry and CxT              |                      |                        |          |              |
| Haddad et al <sup>21</sup>                   |          |                                    | Running and interval kicking rounds |                      |                        |          |              |
| Sant'Ana, Liberali and Navarro <sup>22</sup> |          |                                    | Interval kicking rounds             |                      |                        |          |              |
| Jakubiak and Saunders <sup>23</sup>          |          |                                    | ERE                                 |                      |                        |          |              |
| Bridge et al <sup>24</sup>                   |          |                                    | ERE                                 |                      | Technical              | Sparring | <i>Tulls</i> |
| Bouhlef et al <sup>25</sup>                  |          |                                    | Interval kicking rounds             |                      |                        |          |              |
| Melhim <sup>26</sup>                         |          |                                    | Technical Training                  |                      |                        |          |              |

**Note** =TT: Technique Teaching Method; MSTM: Motor Skill Training Method; CM: Competitive method; PIM: Play Method; MSTW: Maximum Strength Training with Weights; CxT: Complex Training; IST: Isometric Strength Training; CST: Circuit Strength Training; ERE: Elastic Resistance Exercise.

**Source:** Authors



A large part of the studies (91.67%) assessed motor skill training methods<sup>15,16,18,20-26</sup>. The studies classified in TM corresponded to 16.67% and were listed in the Synthetic-Analytic category. These studies approached self-controlled feedback<sup>17</sup> and instruction focused on the outcome of the movement<sup>19</sup> in the learning of skills of the modality. No study addressing teaching of skills with the integral method was found.

From the set of studies that assessed MSTMs, 83.33%<sup>15,16,18,20-26</sup> accounted for the interval method, followed by the mixed method (16.67%)<sup>16,24</sup> and by the continuous method (8.33%)<sup>16</sup>. The CM was assessed in 16.67% of the researches included in this review and had fight as object of study. Cardiorespiratory responses<sup>24,25</sup> and metabolic responses<sup>25</sup> related to sport combat were assessed. Among the reviewed studies, no approach to the Play Method was identified.

Table 5 presents the training means. In the studies surveyed, 18 different types of training means were identified and classified as GPE, SPE and CE.

**Table 5.** Classification of training means used in the studies.

| Study  | GPE  | SPE  | CE                                   |
|--|--|--|--------------------------------------|
| Santos, Valenzuela and Franchini <sup>15</sup> | Exercise with Weight<br>Jumps<br>Complex Exercise  |  |                                      |
| Seo et al <sup>16</sup>                        | Intensive Running<br>Extensive Running<br>Stair-Climbing Running<br>Exercise with Weight |  |                                      |
| Lim et al <sup>17</sup>                        |  |  | Tulls                                |
| Pashkov <sup>18</sup>                          | Coordination Training  |  |                                      |
| Woo, Chow and Koh <sup>19</sup>                |  | Technical Combinations   |                                      |
| Leichtweis et al <sup>20</sup>                 | Isometric Exercise<br>Jumps<br>Complex Exercise  |  |                                      |
| Haddad et al <sup>21</sup>                     | Interval Running   | Kicking rounds   |                                      |
| Sant'Ana, Liberali and Navarro <sup>22</sup>   |  | Kicking rounds   |                                      |
| Jakubiak and Saunders <sup>23</sup>            |  | Kicking with resistance band   |                                      |
| Bridge et al <sup>24</sup>                     |  | Core Movements<br>Technical combinations<br>Combined fights<br>Kicking with resistance band<br>Kicking-specific exercise | Tulls<br>Sparring<br>Sparring Drills |
| Bouhleb et al <sup>25</sup>                    |  | Kicking rounds   | Sparring                             |
| Melhim <sup>26</sup>                           |  |  | Tulls                                |

**Note=** GPE: General Preparation Exercise; SPE: Special Preparation Exercise; CE: Competitive Exercise

**Source:** Authors

Five studies<sup>15,16,18,20,21</sup> (41,67%) subjected the sample to GPEs. Within this universe, strength exercises were the most studied<sup>15,16,20</sup>, accounting for 58.3%, followed by running<sup>16,21</sup> (33,3%) and coordination exercises<sup>18</sup> (8.3%).

SPEs were analyzed in six studies<sup>19,21-25</sup> (50%). In this category of training means, kicking exercises were the most assessed, corresponding to 60%<sup>21-26</sup> of all special preparation exercises, followed by technical combinations<sup>19</sup> (20%), combined fights<sup>24</sup> (10%) and core movements<sup>24</sup> (10%).

CEs were studied in three researches<sup>17,24,26</sup>, representing 25% of the sample. Among the competitive means, Tulls<sup>17,24,26</sup> were the most employed exercises, corresponding to 60% of the total of this universe, followed by sparring<sup>24,25</sup> (40%). Only two studies<sup>21,25</sup> compared two training means.

## Discussion

The purpose of sport preparation is to enable maximum levels of physical, technical, tactical and psychological skills. To achieve the necessary level of motor and functional skills, development of adequate psychological skills, and assimilation and improvement of technique and tactics are tasks that the athlete must fulfill during the training process. Exercise as a means of training is the basis of preparation and the main element of solution of these tasks. Training mean is necessarily linked to method, which is the organized process of utilization of means<sup>7,27</sup>.

In this sense, the objective of this article was to carry out a literature review on means and methods of practical influence for Taekwon-Do; the number of studies increased as of 2011, which corroborates with Franchini and Del Vecchio<sup>28</sup>. The authors of said study point out the growing popularity of and publications and studies on fights, martial arts and combat sports. The popularity of these modalities has increased, causing greater exposure in the media and, in the case of Taekwon-Do, allowing for greater entry of practitioners to training centers. In a survey carried out by the Ministry of Sports<sup>29</sup> between 2011 and 2013 and published in 2014, the number of athletes of this modality in Brazil grew 232%. With the higher demand of athletes and practitioners, there is consequently a greater amount of studies and publications on the modality. However, of the twelve studies, only three had the participation of female athletes. Male predominance in the investigated population of the studies may reflect the fact that gyms and *dojangs* are still environments dominated by male culture. Female participation faces a number of difficulties related to lack of support and discrimination<sup>30</sup>. Additionally, martial arts and combat sports are linked to the concepts of vigor, toughness and aggressiveness, considered antagonistic to femininity standards<sup>30,31</sup>.

A large part of the included studies addressed the training of aerobic, anaerobic and muscle power contents. The modality's physiological and functional profile was object of study in several investigations. It is a consensus that athletes need high levels of aerobic and anaerobic power, anaerobic capacity, muscle power and flexibility.

Heller and Peric<sup>33</sup> suggest that performance in the modality is significantly connected to the anaerobic metabolism, since the latter is determinant due to the intense and intermittent efforts during the fight. The aerobic metabolism is necessary to support metabolic demands and to ensure adequate recovery between fights<sup>22</sup>, because during competition combats can happen on the same day. Finally, for being a striking modality involving blows with fists and feet, muscle power is essential for the execution of fast and efficient actions<sup>34</sup>.

Among the GPEs identified for the modality, strength exercises were the most recurrent. Ratamess<sup>35</sup> suggests in his study that in combat sports strength training should

include basic exercises, power exercises, and complementary exercises for muscle strengthening.

The studies that analyzed the manifestation of muscle power used plyometric exercises and complex exercise. For power modalities, it is interesting that, during warm-up, strength exercises are included to boost manifestations of quick strength<sup>36</sup>. This mechanism is known as post-activation potentiation (PAP) and is an expansion of the production of explosive strength resulting from previous execution of strength exercises<sup>36,37</sup>.

Running was used as a means of training aerobic and anaerobic capacities in the included studies<sup>16,21</sup>, which corroborates with the literature, since running is traditionally an exercise widely used for aerobic and anaerobic development<sup>10,21</sup>. For Taekwon-Do specifically, running corresponds to GPE, not specific to the modality<sup>21,22</sup>.

The present review found no study that dealt with the theme of flexibility exercises for the modality. Flexibility in Taekwon-Do is fundamental, since kicks aimed at the opponent's head can be decisive and mean higher scores<sup>5,6,32,33</sup>. On the other hand, an inadequate range of motion may compromise the performance of the technique<sup>6,32</sup>. These data allow affirming that there is in the scientific literature a greater need for in-depth investigations on the correlation between flexibility and its development for this group of athletes.

The study by Pashkov<sup>18</sup> used balance coordination exercises, displacements and technique variations. The development of coordination skills serves as the basis for the execution of specific techniques in later stages<sup>38</sup>.

The SPEs<sup>21,22,24-26</sup> identified in the review related to power, aerobic and anaerobic contents. Kicking exercises (specific motor gesture) were more used as a way of promoting increases in aerobic and anaerobic metabolism<sup>21,22,24-26</sup> using resistive material (elastic band) as part of the overload for power and speed training in special movements<sup>23,24</sup>.

Bridge, Jones<sup>24</sup> and Melhim<sup>26</sup> verified that specific exercises such as core movements, punching and kicking drills are effective activities to promote cardio-respiratory overload<sup>24</sup> and to develop anaerobic capacity and power<sup>26</sup>. These findings suggest that these exercises are capable of producing the same intensity and responses as traditional GPEs, like running, but with greater specificity, which may somehow improve transfer to real competitive conditions.

Because specialization is a rather important principle of improvement in any type of activity, SPEs represent the main means of conditioning and improvement of results<sup>8</sup>. Thus, the greater the degree of correspondence between training exercises and exercises performed during competition, the greater the transfer and the more effective the training process<sup>27</sup>.

CEs were identified in the studies by Bridge and Jones<sup>24</sup>; Bouhleb and Jouini<sup>25</sup> and Melhim<sup>26</sup>. These studies used Tulls (patterns), Sparring Drills (tactics) and Sparring (fight) as ways of promoting anaerobic and cardiovascular adaptations. Tulls are sequences of attack and defense against one or more imaginary opponents, applying a diversified repertoire of techniques<sup>1,2,39</sup>. Sparring consists of confrontation between two practitioners, following the rules of competition, but with psychological aspects and lower intensities than in a real competition, which avoids injuries. Sparring is an effective and specific means of training that fully reproduces competitive combat<sup>1,2</sup>. Sparring drills are technical and tactical exercises that partially simulate a fight<sup>1,2,24</sup>.

CEs intend to represent fully the object of competition, but are performed under training conditions and aim to fulfill tasks of the latter. These models consist of indicators such as effort/recovery ratio, types of displacements performed and efficiency of actions, biomechanics of technical skills, as well as variables related to the way of acting, such as tactics and strategies<sup>8,27</sup>.

The methods identified in the review were classified as Programmed Methods (PM), Play Methods (PIM) and Competitive Methods (CM). PMs were subdivided into Teaching Methods (TMs) and Motor Skill Training Methods (MSTMs). Analyzing TMs, the studies<sup>17,19</sup> that approached this theme used the Synthetic-Analytic method. Rufino and Darido<sup>40</sup> point to a significant increase in studies that have addressed learning through analytical methods.

However, Kozub and Kozub<sup>41</sup> show that during the process of learning fights, martial arts and combat sports, it is necessary to teach the tactical aspects of these modalities. The authors state that in many cases students only learn to perform technical gestures separately, presenting gaps in their knowledge of tactical aspects.

Regarding MSTMs, Interval Methods were widely approached and used mainly for specific stimuli of the aerobic/anaerobic metabolism<sup>21,22,24-26</sup> and strength training<sup>15,16,20,23,24</sup>.

Bouhlel and Jouini<sup>25</sup> suggest that intervals of specific exercise rounds lasting ten seconds and three minutes reproduce physiological demands during combat. During the fights, athletes perform several intense attacks of short duration (1-5 seconds) interposed with active recovery intervals, revealing an effort-pause ratio between 1:2 and 1:8<sup>32</sup>. Thus, the inclusion of high-intensity interval methods has been suggested to prepare athletes face the physiological demands of competition<sup>42</sup>. The effort and recovery ratio adopted in the studies included in the review was 1:1<sup>22</sup> and 1:2, and the duration of the series was between three and seven minutes<sup>21,25,26</sup>.

Mixed methods were employed in two studies<sup>16,24</sup> and also aimed to promote specific stimuli of the aerobic/anaerobic metabolism. The mixed method is characterized by starting with interval loads and ending with continuous loads. In this way, there is an initial request of alactacid/lactic anaerobic metabolism and then aerobic demands, incurring load accumulation during the session<sup>8</sup>. The continuous method was used in only one study<sup>16</sup> with the objective of stimulating the aerobic metabolism. In this sense, depending on the training period, the continuous method becomes non-specific for the modality<sup>8</sup>.

About the CMs identified in the review, Braz and Spigolon<sup>27</sup> highlight that, despite the difficulty of load control, the competitive method is efficient for athletic improvement, but one must be careful with the low physical conditioning and initial level of technique learning, as these factors limit its use.

## Conclusions

Publications on the modality have been intensified in the last five years, with male samples being predominant in the analyzed studies. The twelve studies reviewed presented important information about means and methods analyzed in the literature, as well as contributions for coaches and athletes, in view of training prescription. Among the methods of practical influence surveyed in the review, the teaching method used in the studies analyzed in this review was the Synthetic-Analytic one. However, it is important to contextualize technique teaching with the tactical aspects of the modality. The findings also suggest the use of high-intensity interval methods to prepare athletes for the physiological demands of combat. The effort and recovery ratio (load) adopted in the studies included in the review was 1:1 and 1:2.

The general preparation exercises most reported in the studies were strength exercises related to manifestation of muscle power. There was use of special exercises, specific kicking drills in particular, for the development of the aerobic and anaerobic systems, instead of traditional general preparation exercises.

However, there is a lack of studies related to the development of flexibility and to technical, tactical and psychological aspects of the modality. Studies with different designs that address these aspects are suggested.

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