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Improvement of lower limbs specific endurance-speed combined motor ability in elite athletes of Qwan Ki Do martial art

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Abstract

The present study wishes to highlight the effects of some physical training means within the preparatory phase on specific endurance-speed combined motor ability in lower limbs, in Qwan Ki Do martial art. We started from the hypothesis that using an efficient planning and adequate means it is possible to improve the combined motor ability in lower limbs, with positive effects on athletes' efficiency.

The experiment was performed over 5 weeks. In the study were included 11 male (group 1) and 8 female (group 2) elite athletes from the Romanian Qwan Ki Do national team. The team was in the preparatory phase for participating in European Championships. The means used for the experiment included long runs with constant tempo, Fartlek runs, intermittent long, medium, and short runs and also general and specific force–endurance and endurance–speed circuits.

The results reveal a general significant progress in tests in both groups, suggesting that an adequate programme could conduct to the improvement of specific endurance-speed combination in lower limbs, which may represent an important support in athletes' physical training.

***Key words**: martial arts, physical training, planning, physical tests, specific training*

Rezumat

Studiul de faţă îşi propune să pună în evidenţă efectele unor mijloace ale antrenamentului fizic din perioada pregătitoare asupra aptitudinii motrice combinate rezistenţă-viteză specifică la nivelul membrelor inferioare, în arta marţială Qwan Ki Do. S-a pornit de la ipoteza că, prin utilizarea unei planificări judicioase şi a unor sisteme de acţionare adecvate, se poate îmbunătăţi această calitate combinată, cu efecte pozitive în eficienţa practicanţilor.

Experimentul a fost desfăşurat pe durata a circa 5 săptămâni. În cadrul cercetării au fost incluşi 11 sportivi de elită de sex masculin (grupa 1) şi 8 de sex feminin (grupa 2), componenţi ai lotului naţional al României, aflat în perioada pregătitoare, în vederea participării la Campionatul European. Mijloacele utilizate in experiment au inclus alergări de durată în tempo uniform, alergări Fartlek, alergări intermitente de durată lungă, medie şi scurtă, precum şi circuite de forţă-rezistenţă şi rezistenţă-viteză generală şi specifică.

Rezultatele pun în evidenţă un progres, în general, semnificativ la teste la ambele grupe, ceea ce sugerează că un program adecvat conduce la îmbunătăţirea cuplului rezistenţă-viteză specifică la membrele inferioare, care poate constitui un suport important în pregătirea fizică a sportivilor.

***Cuvinte cheie**: arte marţiale, antrenament fizic, planificare, teste fizice, pregătire specifică*

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Introduction

Qwan Ki Do is a traditional martial art that comprises two categories of events, with~~in~~ different durations: between 45 and 65 seconds (for the technical trials) and 2 minutes (for the fights). It is obvious that the alactacid/anaerobic energy source is intensely solicited, taking into account the executions of maximal-speed, maximal-force and high-precision technical procedures. At the same time, the inclusion of lactic training within practices is justified by the prolongation of maximal and sub-maximal effort during competitions [1]. In this specific type of effort, the role of aerobic energy system seems to concern a better recovery of the anaerobic energy reserves in the rest periods between trials/fights or intra-effort [2].

Martial arts literature is rather poor on this topic. A *Kung Fu* research [3] used a protocol that also comprised kicking at maximal speed, and the conclusion – based on VO_2 max analysis – is that the expert Kung Fu practitioners (through their cardiovascular response) manifest a greater economy in the specific effort, compared to the novice ones.

During fights, the combined motor skill of resistance–specific speed is often solicited, mostly at the level of lower limbs (manifested in full-speed moving and kicking), in long-term effort conditions (usually in the second half of the time allotted by regulation for competition events). In this situation, it is apparent that the lactic anaerobic energy system is also solicited. Therefore, certain studies have focused on determining the level of lactacidemia as an objective indicator of how much this system is actually involved in martial arts competition effort.

A study on Wushu [4] reported mean values of lactacidemia – after the specific effort made during specific technical tests (taking about 1 minute each) – ranging between 4.5 and 5.2 mmol/l, depending on the event. In Taekwondo [5], competition fights recorded values of 7.0±1.3 mmol/l for lactacidemia. In karate [6], values recorded at the end of fights ranged between 4.5 and 6.5 mmol/l. In the Pencak Silat martial art [7], high lactacidemia values were reported (12.5+2.1 in male athletes and 13.1+4.0 in female athletes), at the end of the last round within the competition fight, which comprised three two-minute rounds, with one-minute breaks in between.

In Qwan Ki Do [8], lactacidemia values at the end of fights show the obvious involvement of a lactic anaerobic energy source for supporting the effort (mean values ranging between 6.1 and 10.3 mmol/l).

In this context, this study aims to highlight the effects of certain physical training means within the preparatory period upon the combined motor ability of resistance–specific speed at the level of lower limbs, in the Qwan Ki Do Martial Art.

Whereas laboratory tests are more objective, they do require expensive equipment and more time, reason for which we chose to use specific field tests, easy to apply and interpret.

Hence, our hypothesis was the following: the use of judicious planning and proper action systems can improve this combined motor ability, with positive effects upon the efficiency of athletes.

Material and methods

The experiment was conducted for around five weeks. The research series comprised 11 male elite athletes (group 1) and 8 female elite athletes (group 2), members of the Romanian national Qwan Ki Do team (who were preparing for the European Championship). The subjects' age ranges between 20 and 33 in male athletes, respectively between 20 and 29 in female athletes; they have over 10 years of competition practice and experience.

Tests used within the research (denominations taken from Qwan Ki Do)

1. Truc Cuoc with the front leg (direct kick) – 60 sec.: from a stance of choice (*Dinh Tan Tien, Am Duong Tan* or *Tieu Tan*), with front leg of choice; kicks are executed only using the front leg (contact with the floor between executions) for 60 seconds, at full speed. The number of executions is recorded.

2. Truc Cuoc with the rear leg – 60 sec.: from a stance of choice (*Dinh Tan Tien* or *Am Duong Tan*); kicks are executed only using the rear leg (coming back to initial position between executions) for 60 seconds, at full speed. The number of executions is recorded.

3. Hoanh Cuoc with the front leg (circular kick) – 60 sec.: from a stance of choice (*Dinh Tan Tien, Am Duong Tan* sau *Tieu Tan*), with front leg of choice; kicks are executed only with the front leg (contact with the floor between executions) for 60 second, at full speed. The number of executions is recorded.

4. Hoanh Cuoc with the rear leg – 60 sec.: from a stance of choice (*Dinh Tan Tien* sau *Am Duong Tan*), kicks are executed only using the rear leg (coming back to initial position between executions) for 60 seconds, at full speed. The number of executions is recorded.

Table I. Intermittent long, medium, and short runs used into the experiment

Action	Effort		Recovery	
	Intensity (tempo)	Duration	Duration	Type
Intermittent long runs 7 x 3 min. (with 3 min pause between repetitions)	High, 3/4	3 minutes	3 minutes	**Active** : walking or techniques executed with minimal effort.
Intermittent medium runs 10 x 1 min. (with 2 min. and 30 sec. pause between repetitions)	Submaximal between 3/4 and 4/4	1 minute	2 minutes and 30 seconds	**Active** : walking or techniques executed with minimal effort.
Intermittent short runs 14 x 15 sec. (with 1 min. and 30 sec. pause between repetitions)	Maximal, 4/4	15 seconds	1 minute and 30 seconds	**Active** : walking or techniques executed with minimal effort.

Contents of training for endurance–speed couple throughout the experiment

The experiment was conducted for around five weeks, during the training period for attending the 2013 European Championship in Zurich, Switzerland. The period was divided into two phases, each comprising two and a half weeks.

First phase

The first phase included long runs with constant tempo (1/4, 2/4 or 3/4), as well as Fartlek training on diverse surfaces. Runs were alternated to obtain a more complex adjustment of the body. In this period, we also used general force–endurance and endurance–speed circuits.

Second phase

In the second phase, we used intermittent long, medium, and short runs (see Table I). Runs were also alternated for a more complex adjustment of athletes' body. During the same phase, we also used specific force–endurance and endurance–speed circuits.

Concerning the scheduling of the dissociated physical training sessions, we chose runs for the mornings and circuits for the afternoons, except for Sundays (days off for recovery).

Furthermore, integrated physical training focused on the development of lactic and aerobic energy systems, as well as on practicing specific techniques, in speed conditions.

Results and discussions

After applying the initial and the final tests in the two groups, we processed the results statistically (using *SPSS 17.0 for Windows – Paired Sample Test* and *Independent Sample Test*), as illustrated in the tables below (Tables II and III).

Table II. Results of male elite athletes (group 1) of Qwan Ki Do (arithmetic mean ± mean standard error) at initial and final tests

Tests	Initial result	Final result
1. Truc Cuoc with front leg – 60 sec.	81.54 (2.33)	87.81 (1.52) *
2. Truc Cuoc with rear leg – 60 sec.	68.54 (2.67)	73.72 (2.93)
3. Hoanh Cuoc with front leg – 60 sec.	63.27 (1.75)	85.45 (1.44) *
4. Hoanh Cuoc with rear leg – 60 sec.	65.72 (2.24)	70.63 (1.87)

Legend: * significant difference ($p < 0.05$) from the initial test.

Table III. Results of female elite athletes (group 2) of Qwan Ki Do (arithmetic mean ± mean standard error) at initial and final tests

Tests	Initial result	Final result
1. Truc Cuoc with front leg – 60 sec.	79.25 (6.33)	88.5 (5.7)
2. Truc Cuoc with rear leg – 60 sec.	70.37 (5.31)	76.75 (4.93)
3. Hoanh Cuoc with front leg – 60 sec.	72.37 (1.74) #	84.87 (3.17) *
4. Hoanh Cuoc with rear leg – 60 sec.	60.5 (2.25)	71.12 (3.24) *

Legend: * significant difference ($p < 0.05$) from the initial test; # significant difference in group 2 compared to the same result in group 1.

We found a significant improvement of results from the initial to the final test, in both groups.

It is worth underlining the significant progress of group 1 for tests 1 and 3, considering that the initial result indicated a certain deficit. The same aspect is also apparent for group 2 in tests 3 and 4. Hence, findings suggest that, whereas subjects progressed in all tests, the training program had greater influence on the endurance–speed combined motor ability, manifested in kicks.

On the other hand, we have not found, generally speaking, significant differences between males and females at initial and final tests within the research, (except for the initial result of test 3 in the male groups, which we mentioned above).

The results seem to confirm some data from the literature and to justify development of endurance–speed combined motor ability in lower limbs, based especially on lactic energy system [5, 7, 8].

Conclusions

The endurance–speed combined motor ability at the level of lower limbs in elite Qwan Ki Do athletes has recorded important improvements, but we believe that values can still go higher, considering the potential of athletes.

However, findings illustrate a significant progress in both groups, which suggests that the physical training program used leads to an improvement of resistance–specific speed couple at the level of lower limbs, which may represent an important support in the physical training of athletes.

Values obtained (mostly in final tests) can be used as reference point for future determinations concerning professional and elite athletes of Qwan Ki Do and of other martial arts with similar effort regime during competitions.

Limits of the research

Because these are specific field tests (measuring the number of kicks in 60 seconds) designed at the beginning of this research, we have not found any identical terms of comparison in the scientific literature in Qwan Ki Do.

Likewise, we believe that we have not reached maximum results due mostly to the reduced allotted time (5 weeks) for influencing this combined motor ability.

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