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## Introduction

The elaboration of the tae-kwon-do matches endurance training, foresees a precise study of fighting, by the evaluation of the action and recovery times and therefore of the physical stress the athletes face.

It results that the endurance ability has a particular importance for the efficiency of the matches' actions, because the musculature has to be able to adequately react for all the length of the fight, at the nervous processes that permit to realize efficient actions.

G. Lehmann is one of the few scientists who offer some reference parameters for the match endurance training in TKD, for this we wanted give our contribution on that subject, with the experimentation of a specific endurance circuit in TKD.



## TEST LACTATE

	basal		after 3 min		after 6 min	
athlete	circuit	fight	circuit	fight	circuit	fight
mean	1,7	1,8	12,4	11,1	11,8	10,4
st.dev.	0,41	0,33	1,97	1,83	1,68	1,79

	basal	after 3min.	after 6min.
correlation ( r )	0,83	0,90	0,88
diff. % circ-fight	-5%	12%	14%
anova ( p )	0,59 (n.s.)	0,14 (n.s.)	0,08 (n.s.)

## Methods

The experimentation was conducted on a group of 10 athletes (age 23±5; h 176±5; years of practice 9±3; weight 72±14) practising TKD of different agonistic level (from regional to international).

The circuit we created is like a TKD match, with 3 rounds of 2 minutes and 1 minute of recovery. During each round a blue athlete and a red one, perform: 20 seconds of attack, 10 seconds of counterattack, 20 seconds of counterattack, 10 seconds di attack.

The experimental protocol scheduled 2 training sessions. In the first one the athletes had to execute a simulation of the match, with regular fights; in the second, they had to execute the circuit. We controlled the HR (with heart rate counter POLAR F4) in different situations: basal, at the end of each fighting round or circuit, 3 minutes after the end of the fight/circuit, 6 minutes after the end of the fight/circuit.

We detected also the lactate production (with LACTATE PRO) in three moments: basal, 3 minutes after the end of the fight/circuit, 6 minutes after the end fight/circuit.

To evaluate the test reliability, the athletes repeated the trials of the circuit and of the fight twice at a short time distance, and we calculated the correlation between test and retest.

To study the validity of the circuit, as a training of the specific endurance in TKD, we compared the circuit and the fight considering the La and the HR measured (correlation, % difference; Anova).

## TEST HEART RATE

	basal		1°round		2°round		3°round		after 3min.		after 6min.	
athlete	circuit	fight	circuit	fight	circuit	fight	circuit	fight	circuit	fight	circuit	fight
mean	95	98	180	175	185	181	187	185	132	127	116	115
st.dev.	8,83	9,68	7,31	7,90	8,46	6,93	7,06	4,22	13,01	14,26	10,90	11,87

	basal	1°round	2°round	3°round	after 3 min	after 6 min
correlation ( r )	0,86	0,79	0,80	0,81	0,85	0,84
diff. % circ-fight	-3%	3%	2%	1%	5%	0%
anova ( p )	0,44 (n.s.)	0,16 (n.s.)	0,31 (n.s.)	0,33 (n.s.)	0,35 (n.s.)	0,96 (n.s.)

## Results

The values of the test-retest correlation are all very high either for the HR or for the La, with r always higher than 0.81 (p<0.01). The results of the validity study showed a high correlation between the HR and the La values inherent the fights and the circuit, which has already had a similar trend. Regarding to the cardiac frequency there is a percentage difference minimal and absolutely meaningless between the results of the different phases (diff. between 3 and 5%). The production of lactate instead, during the fight is on average lower to the circuit of 12-14%, maybe because in the fight the pauses and the recovery phases "tactic" are more frequent. But also regarding the lactate the differences, even if higher, are also meaningless (p = n.s.) statistically. In effect, the statistic non significant difference of the results of La and HR, respectively obtained during the circuit and the fight, is the common data of the research, therefore there is no significant difference between the circuit and the fight in relation to the production of lactate and to the trend of the cardiac frequency. (Cfr. tabs)

## Conclusions

The experimentation conducted permits us to state the validity of the circuit as a specific exercise of simulation of the physical stress in a tae-kwon-do matches. The absence of a significant difference between the circuit and the fight in relation of the lactate production and of the cardiac frequency trend, permits us to state that the circuit we adopted puts to work the athletes in a similar way of the sportive fight of TKD. In this sense the circuit can be considered as an effective mean of training and specific evaluation the trainers have at their disposal.



## References

Lehmann G. (1996), Leistungsport, 4, 6-11