World Applied Sciences Journal 12 (10): 1826-1831, 2011
ISSN 1818-4952

The Relationship Between Reaction Time and Decision-Making in Elite Kickboxing Athletes

[1]M. Çağrı Çetin, [2]Özden Taşğın and [3]Fatma Arslan

[1]Department of Physical Education and Sport,
Mustafa Kemal University, Hatay,Turkey
[2]Faculty of Science and Arts, Nevsehir University, Nevsehir,Turkey
[3]Department of Physical Education and Sport,
Karamanoglu Mehmetbey University, Karaman, Turkey

Abstract: The purpose of this study was to examine the psychological and psychomotor variables such as reaction time, decision-making situation and relations between the variables of kick boxing athletes in different branches. A total of 32 male, 22 female elite kick boxing athletes participated in this study voluntarily. They were divided into two groups, according to branch, (full contact male (n=18), female (n=12) and light contact male (n=14), female (n=10)). Reaction time was measured by using New-tested 2000 device and to determine the styles of decision-making was asked to fill "Melbourne Decision Making Scale". There was a meaningful correlation between reaction time and "careful" from styles of decision-making in full contact male and reaction time and "panic" from styles of decision-making in full contact female. According to the results, Full contact male-female athletes were significantly faster and more careful than light contact male-female athletes. As a result, kick boxing may be effective about decision time in the development of reaction times and it can improve the appropriate response to stimulus and careful decision-making capabilities of athletes.

Key words: Sport · Athletes · Perceptual Ability · Perception Time

INTRODUCTION

In order to get a successful performance in sports, it is both necessary to make motor behavior efficiently and have a high level of perceptual abilities. Athletes are severely affected by place, time constraints, regulations and the competitor in competitive high-level sports [1]. These restrictions can facilitate decision making, improve an athlete's rapid ability, perceive relevant information exactly and allow more time for preparation and organization of motor behavior [2, 3].

A few researchers mentioned that reaction time was a sensitive evaluation of the reaction with simple reaction time and the whole speed of the perceptual and motor systems [4]. Because, it is required that athletes need to have a quick decision in a daily training. The speed of the perceptual and motor systems can develop long-term practice in sports and the processing speed of the perceptual and motor systems of athletes may be predicted with a simple reaction time. In previous studies are mentioned that there is no relationship between simple reaction time and offensive ability in baseball [5] or other sports [6,7]. Athletes especially have many decisions to make with open skills such as competition [4]. They stated that some reaction time abilities were advanced by sports practice, especially sports-specific decision-making abilities [8-10].

Coordination motor abilities are very important in combat sports so that they can play a major role in precision and control of sport movements under constantly changing conditions. the ability to change from one movement performance to another upon combat situation (motor adjustment), speed and precision of movements expected and unexpected signals with the whole body or its parts (speed of reaction), the precision of evaluating body position change such as time and space orientation and combine the ability of the single movements into complex ones (movement combining)

Corresponding Author: Fatma Arslan, Department of Physical Education and Sport,
Karamanoglu Mehmetbey University, Yunus Emre Campus, 70100, Karaman, Turkey.
Tel: +90-338-226-2087, Fax: +90-338-226-2124, E-mail: farslan@kmu.edu.tr.

[11]. According to Thomas [12], sport performance comprises from two components: a physical component and a cognitive component and it is a sophisticated field, so while The physical component is showing various skills observed such as kicking or throwing, the cognitive component consists of knowledge and decision-making processes.

Decision-making is one of the most critical cognitive components in sport performance. Superior athletic performance requires both the successful implementation of physical skills and highly exact decision-making [13]. Therefore, the purpose of this study was to examine the relationships between decision-making such as psychological and reaction time from psychomotor variables to the kick boxing national team athletes.

MATERIALS AND METHODS

Subjects: In this study, totally 22 female and 32 male national kickboxing athletes participated as volunteers at the camping period. Subjects were divided into two groups, according to their branches as full contact (n=30) and light contact (n=24) athletes who got degrees from international competition.

Reaction Time (RT): Visual and auditory reaction times were measured by using the New-test 2000 that can measure with 1 / 1000 precision with a simple sound and lighting choice. Visual Right (VR) and Visual Left (VL)-Audial Right (AR) and Audial Left (AL) reaction times (RT) were measured,against the Light and sound warnings. At the beginning of the test, it was given the general information about the application form and the opportunity to test about the device once in the subjects. Before the test, the subject was sat in front of the device and asked to press the button when it came with light and sound stimulation. Data were evaluated after the compression time recorded. Measurement was repeated 10 times. Each test was given ten stimulus and average of the eight trials was recorded as reaction time after the highest and the lowest value removed. Measurements were calculated as the average of 8 responses from 10 measured values, excluding the two lowest and two highest values.

Decision Making: In this research, "Melbourne Decision Making Scale" [14] was used as a means of data collecting and adapted into Turkish by Deniz [15]. Melbourne Decision Making Scale consists of two parts. The first part of the parts aims to determine the decision-making self-esteem and consists of 6 items and a single sub-factor. The second one aims to identify the decision-making styles and four sub-factors. Item analysis was made by the calculation of internal consistency of the scale. Co-efficient of internal consistency of decision-making self-esteem is in Melbourne Decision Making Scale: Cronbach Alpha = .72; for "careful" decision-making style sub-dimensions: Cronbach Alpha = .80; for "avoidant" decision-making Cronbach Alpha = .78; for "suspensive" decision-making Cronbach Alpha = .65; for "panic" decision-making Cronbach Alpha = .71 [15].

Self-Esteem in Decision Making (SR): The scale aimed to determine the self-confidence. Careful decision-making (CF) states of his/her choice that before he/she decides to search the necessary information and after evaluating alternatives carefully. Avoidant decision-making (AVD), an individual's avoid to decision-making, he/she has a tendency to leave decisions to the others and thus, he/she gets rid of working situation from decision-making by revolving to responsibility of someone else. Suspensive decision-making (S), it is a kind of postponing the decision continuously, delaying and dropping without a valid reason. Panic decision-making (P), when the individual meets in a decision situation, he/she feels himself under time pressure to show impetuous behavior and he/she feels that she/he must make efforts to achieve quick solutions.

Statistical Analysis: The SPSS statistical program (version 15.0) was used for data analysis. Standard statistical methods were used for the calculation of means and SD. Relationships of the variables were tested with Pearson's correlation analysis as statistical method. For all tests significance at $p < 0.05$ was considered significant.

RESULTS

Athletes' Demographic Characteristics Were Presented by Branches and Sex in Table 1: Kickboxing athletes' Reaction time and decision making means±SD values by branches and sex were shown in table 2. It was found that in female full contact athletes' means VR and VL reaction time than in light contact athletes were lower, but higher means AR and AL reaction time were recorded in this group than in light contact female athletes'. In male full contact athletes' lower of means both VR-VL and AR-AL reaction time were detected than in light contact male athletes'. While the average of self-esteem, careful, avoidant and suspensive were high in full contact female

Table 1: Data summary for kickboxing athletes by branches and sex

			Female			Male	
Branches	Variables	N	Mean	SD	N	Mean	SD
Full Contact	Age	12	22,16	4,63	18	23,28	4,25
	Height	12	174,67	7,02	18	178,55	10,65
	Weight	12	68,91	12,93	18	78,39	19,84
	Sport Age	12	8,46	4,36	18	11,44	5,61
Light Contact	Age	10	20,50	3,81	14	22,07	5,25
	Height	10	169,30	5,06	14	175,50	6,99
	Weight	10	60,67	13,92	14	67,94	12,32
	Sport Age	10	6,50	2,68	14	8,21	5,04

Table 2: Reaction time and decision- making mean and standard deviation values by branches and sex in kickboxing athletes

			Female			Male		
Branches	Variables		N	Mean	SD	N	Mean	SD
		Visual right	12	191,08	46,63	18	188,22	1,562,259
	Reaction Time	Visual left	12	199,17	28,002	18	181,72	2,038,109
		Audial right	12	184,25	31,20	18	167,56	2,096,277
		Audial left	12	189,42	33,51	18	168,17	3,288,527
		Self- esteem	12	10,67	1,30	18	9,72	170,830
Full	Decision	Careful	12	10,75	1,60	18	9,61	171,974
	Making	Avoidant	12	4,25	3,33	18	4,00	208,637
Contact		Suspensive	12	3,25	2,05	18	3,67	249,706
		Panic	12	2,92	1,73	18	3,61	206,195
		Visual right	10	217,20	33,03	14	199,71	18,09
	Reaction Time	Visual left	10	205,10	58,10	14	190,71	20,55
		Audial right	10	179,30	24,34	14	174,21	22,69
		Audial left	10	186,200	28,65	14	171,93	13,269
Light		Self-esteem	10	9,90	1,85	14	10,21	1,42
Contact	Decision Making	Careful	10	10,10	2,51	14	9,86	2,63
		Avoidant	10	4,20	2,57	14	3,14	1,83
		Suspensive	10	2,20	2,09	14	2,142	1,29
		Panic	10	3,50	2,64	14	2,14	1,41

Table 3: Pearson correlations of reaction time and Decision Making make by sex in full contact kick boxing athletes

Full contact	Sex		VR with P	VL with AR	AL with CF	S with P
	Female	r	-0,648(*)	0,597(*)	-0,719(**)	0,852(**)
		p	0,023	0,040	0,008	0,000
			VL with CF	AR with CF	AVD with P	S with P
	Male	r	-0,470(*)	-0,682(**)	0,588(*)	0,716(**)
		p	0,049	0,002	0,010	0,001

*P<0,05

Table 4: Pearson correlations of reaction time and Decision Making make by sex in light contact kick boxing athletes

Light contact	Sex		VR with VL	AR with AL	AVD with P	S with P
	Female	r	0,929(**)	0,719(*)	0,688(*)	0,925(**)
		p	0,000	0,019	0,028	0,000
			VR with AL	SE with CF	AVD with S	S with P
	Male	r	0,655(*)	0,564(*)	0,543(*)	0,623(*)
		p	0,011	0,036	0,045	0,017

*P<0,05

Note: This article was presented as oral presentation in International Scientific Conference Physical Activity for Everyone (10 – 11 December 2010) in Belgrade/Serbia and published as abstract in conference abstract book.

athletes', the average of only panic was high in light contact female athletes'. Higher means at avoidant, suspensive and panic were recorded in full contact male athletes' than in light contact male (Table 2). There was a significant relationship between RTVR and panic, RTVL and RTAR, RTAL and carefully decision-making, suspensive and panic decision-making in female full contact athletes; reaction time VL and carefully decision-making, RTAR and carefully decision-making, avoidant and panic decision-making, suspensive and panic decision-making in male full contact athletes ($p<0.05$) (Table 3).

A significant relationship was found between RTVR-VL, RTAR-AL, avoidant and panic decision-making, suspensive and panic decision-making in female light contact athletes; VR and AL, self-esteem and carefully decision-making, avoidant and suspensive decision-making, suspensive and panic decision-making in male light contact athletes ($p<0.05$) (Table 4).

DISCUSSION

Specific athletic groups were often different from the general population, because of their pre-selection or training effects. Therefore, the present study examined whether there was a relationship between reaction time and decision-making in kick boxing national team athletes.

Reaction time could be divided into three sections; The first section was perception time: the time for the application and perception of the stimulus and giving the necessary reaction to it, The second section was decision time which described the time for giving an appropriate response to the stimulus and the third section was motor time: it was the time for compliance to get an order received [16,17]. In this study, both the auditory and visual reaction times were better in full contact athletes' than light contact athletes'. But, Male athletes had higher perception time than female athletes and they had better decision time for giving an appropriate response to the stimulus than female athletes. Besides, *et al.* [18], indicated that high performance athletes was a very good reaction time. The studies demonstrated that male athletes had faster reaction time [19,20].

A few researchers mentioned that many factors affected from perceptual skills to knowledge base, decision making and motor skills of sportive performance [21,1]. Decision making is only one elements of the information processing that indicating differences between experienced and inexperienced athletes. The information processing involves perception, thinking, knowledge base and the implementation of motor skill [22-24]. In our study, it was found that full and light contact kick boxers were higher in self-esteem for decision-making and careful decision-making style. Besides, it was shown that all of the athletes were lower of means of avoidant, suspensive and panic decision-making. This situation indicated that athletes did not leave decisions to others and tend to delegate responsibility to someone else who had received low point from avoidant, suspensive and panic decision-making styles. It was thought that female athletes had a capable of careful decision-making and precipitant decision-making and tended to visual situations during competition or training in this study.

Tenenbaum [25] described various types of decision making and their corresponding cognitive components and proposed a conceptual scheme of accessing decision-making in open-skill sports. A significant relationship was found to be reaction time VR with panic, reaction time VL with reaction time AL and reaction time AL with careful in full contact female ($p<0.05$); VL and reaction time AR with careful, avoidant with suspensive, avoidant with panic and panic with suspensive from sub dimensions of decision making in full contact male($p<0.05$). Reaction time was defined into four stages as the start of eye movements, eye movement time, decision time and muscle contraction time by Singer *et al.* [26]. In this study, it was thought that male athlete's tended to careful decision-making and had taken the confident decisions and they had highly decision time that was given the appropriate response to stimulus.

While correlation was found between reaction time VR with VL, reaction time AR with AL, avoidant with panic and suspensive with panic the suspensive from sub dimensions of decision making in light contact female ($p<0.05$); a significant relationship was detected reaction time VR with AL, self-esteem with careful, avoidant with suspensive and suspensive with panic from sub dimensions of decision making in light contact male. Tenenbaum and Lidor [27] emphasized the major role of visual attention in affecting anticipation and the interactive collaboration between working memory and knowledge structure from an applied perspective, elaborated on the efficacy of different cognitive strategies (e.g. attention control, pre-performance routines, simulation training) in practically enhancing judgment and decision-making quality in sport.

Kioumourtzoglou *et al.* [28] found that there was not a significant difference between decision-making times and exactly decision-making skills in studying physical education amateur basketball players with the Greek national water polo team.

Mc Pherson [24] tested decision-making during the competition and he detected significant differences between novice table tennis players with elite and champion table tennis players in the decision-making levels. Besides he said that elite table tennis layers had higher of decision-making skills than novice table tennis players [24]. In this study, it was detected that full contact athletes were higher both reaction times and careful decision-making skills for the age of sport high athlete's than the light contact athletes whose sport age was less.

CONCLUSION

In conclusion, the successful all of the kick boxer were found to be capable of careful decision-making, maintaining quicker reaction time, making appropriate or effective decisions in highly contested moments at every stage of the competition or training championship while gaining challenging experience of practical participation. In addition, it can be said that a long-term studies kick boxing to be effective in the development of reaction times about decision time that was given the appropriate response to stimulus and careful decision-making capabilities of athletes. Besides, it can be said that they have a high perception with regard to their decision-making in training or competition.

ACKNOWLEDGMENTS

The authors would like to thank all of the kick boxing athletes who participated in this study. Besides we wanted to say that satisfaction for support of the head of the Turkish Kickboxing Federation.

REFERENCES

1. Williams, A.M. and K. Davids, 1998.Visual Search Strategy, Selective Attention and Expertise in Soccer. Research Quarterly for Exercise and Sport, 69(2): 111-128.
2. Houlston, D.R. and R. Lowes, 1993. Anticipatory Cue-Utilization Processes Amongst Expert and Nonexpert Wicketkeepers in Cricket. International J. Sport Psychol., 24: 59-73.
3. Ripoll, H., 1991. The Understanding-Acting Process in Sport: The Relationship between the Semantic and the Sensorimotor Visual Function. International J. Sport Psychol., 22: 221-243.
4. Schmidt, R.A. and T.D. Lee, 1999. Motor Control and Learning. Human Kinetics, Champaign.
5. Nielsen, D. and C. Mcgown, 1985. Information processing as a predictor of offensive ability in baseball. Percept. Mot. Skills, 60: 775-781.
6. Abernethy, B. and R.J. Neal, 1999. Visual Characteristics of Clay Target Shooters. J. Sci. Med. Sport, 2: 1-19.
7. Mero, A., L. Jaakkola and P.V. Komi, 1989. Neuromuscular, Metabolic and Hormonal Profiles of Young Tennis Players and Untrained Boys, J. Sport. Sci., 7: 95-100.
8. Liddle, P.F., K.A. Kiehl and A.M. Smith, 2001. Event-related fMRI study of response inhibition, Hum. Brain Mapp, 12: 100- 109.
9. Miller, J.O. and K. Low, 2001. Motor Processes in Simple, Go/No-go and Choice Reaction Time Tasks: A Psychophysiological Analysis. J. Exp. Psychol. Hum. Percept. Perform, 27: 266- 289.
10. Naito, E. and M. Matsumura, 1996. Movement-Related Potentials Associated with Motor Inhibition Under Different Preparatory States During Performance of Two Visual Stop Signal Paradigms in Humans. Neuropsychologia, 34: 565-573.
11. Sadowski, J., 2005. Dominant Coordination Motor Abilities in Combat Sports, J. Human Kinetics, 13: 61-72.
12. Thomas K.T., 1994. The development of sport expertise: From Leeds to MVP legend, 46: 199-210.
13. Chamberlain, C.J. and A.J. Coelho, 1993. The Perceptual Side of Action: Decision-Making in Sport. In J. L. Starkes & F. Allard (Eds.), Cognitive Issues in Motor Expertise, Amsterdam: Elsevier.
14. Mann, L., M. Radford, P.Burnett, S. Ford, M. Bond, K. Leung, H. Nakamura, G. Vaughan and K.S. Yang, 1998. Cross-Cultural Differences in Self-Reported Decision-Making Style and Confidence. International J. Psychol., 33: 325-335.
15. Deniz, M.E., 2004. Investigation of the Relation Between Decision Making Self-Esteem, Decision Making Style And Problem Solving Skills of University Students. Eurasian J. Educational Res., 15: 23-35.
16. Teichner W.H., 1954. Recent studies of simple reaction time. Psychol. Bull., 51: 128.
17. Tripo R.S., 1965. How fast can you react? Sci. Dig., 57: 50.
18. Fox, E.L., R.W. Bowers and L.M. Foss, 1988. Physiological Foundations of Physical Education and Sport. (Ed. Cerit M 1999) Bağırgan Publishing House Ankara.

19. Jevas, S. and J.H. Yan, 2001. The Effect of Aging on Cognitive Function. A Preliminary Quantitative Review. Researche Quarterly for Exercise and Sport, 72: A-49.
20. Deary, I.J., G. Der and G. Ford, 2001. Reaction Times and Intelligence Differences. A Population-Based Cohort Study Intelligence, 29(5): 389.
21. McMorris, T. and A. Beazeley, 1997. Performance of Experienced and Inexperienced Soccer Players on Soccer Specific Tests of Recall, Visual Search and Decision Making. J. Human Movement Studies, 33: 1-13.
22. Benguigui, N. and H. Ripoll, 1998. Effects of tennis practice on the coincidence timing accuracy of adults and children. Research Quarterly for Exercise and Sport, 69(3): 227-223.
23. Radlo, S., C. Janelle, D. Barba and S. Frehlich, 2001. Perceptual decision making for baseball pitch recognition: using P300 latency and amplitude to index attentional processing. Research Quarterly for Exercise and Sport, 72(1): 22-31.
24. Mc Pherson, S.L., 1999. Expert-Novice Differences in Performance Skills And Problem Representations Of Youth And Adults During Tennis Competition. Research Quarterly for Exercise and Sport, 70(3): 233-251.
25. Tenenbaum, G., 2003. Expert athletes: An Integrated Approach to Decision Making. In Starkes JL&Ericsson KA (Eds.), Expert Performance in Sports, Champaign, IL: Human Kinetics.
26. Singer, R.N., M. Murphey and L.K. Tennant, 1993. Handbook of Research on Sport Psychology. New York, USA: Macmillan Publishing.
27. Tenenbaum, G. and R. Lidor, 2005. Research on decision-making and the use of cognitive strategies in sport settings. In Hackfort D, Duda JL& Lidor R (Eds.), Handbook of research in applied sport psychology: International perspectives, Morgantown, WV: Fitness Information Technol.,
28. Kioumourtzoglou, E., T. Kourtessis, M. Michalopoulou and V. Derri, 1998. Differences in Several Perceptual Abilities Between Experts and Novices in Basketball, Volleyball and Water-Polo. Perceptual and Motor Skills, 86(1): 899-912.