

The effect of kung fu training on response time in 7-9 aged children

Yasemin Bayraktar , Abdullah Arguz 

Faculty of Sports Sciences, Selçuk University, Konya, Türkiye.

Abstract

Received:

October 30, 2024

Accepted:

December 25, 2024

Online Published:

December 30, 2024

Keywords:

Children, kung fu, response time.

The aim of this study was to examine the simple and choice response times of kung fu athletes and non-athletic children aged 7-9. The study included a total of 66 kung fu athletes (54 female and 12 male) and 63 non-athletic children (51 female and 12 male), who voluntarily participated. The Light Trainer measurement device was used to determine the participants' simple and choice response times. The participants were divided into two groups: kung fu athletes and non-athletes. Kung fu athletes and non-athletic children participated in measurements on different days under two research conditions (simple and choice response times), selected randomly. Independent samples t-test and Mann-Whitney U test were applied for data analysis. According to the results of the study, the simple and choice response times of kung fu athletes were significantly shorter than those of non-athletes ($p < 0.05$). Male kung fu athletes also exhibited shorter simple and choice response times compared to male non-athletes ($p < 0.05$). While there was no significant difference in the simple response times between female kung fu athletes and non-athletic girls ($p > 0.05$), the choice response times of female kung fu athletes were significantly shorter ($p < 0.05$). In conclusion, it was determined that children who received kung fu training had faster simple and choice response times compared to non-athletic children. This suggested that kung fu training positively influenced children's response times.

Introduction

Response time (reaction time) has played a crucial role in sports disciplines and daily activities (Metin et al., 2016; Sant'Ana et al., 2016). It was defined as the time interval between the onset of a stimulus and the response to that stimulus (Jensen, 2006; Kuang, 2017). Physiologically, response time was recognized as a complex process, and its mechanisms had been the subject of extensive investigation by researchers (Kuang, 2017). Dependent on the speed of the sensorimotor loop, response time occurred as the stimulus was perceived, information was transmitted to the brain via afferent nerves, the response was generated by the central nervous system, and then the corresponding action was executed (Adleman et al., 2016; Greenhouse et al., 2017).

Response time was categorized into two main types: simple response time and choice response time (Kamuk, 2006). Simple response time referred to the time elapsed between the perception of a single stimulus and the correct response (Büyükyazı & Tatar, 2004). Choice response time is the time taken to initiate a

response to more complex stimuli. In these types of response, since the correct response must be selected from multiple options, the response time is longer compared to simple response. Additionally, an increase in the number of stimuli can lead to a longer response time (Boisgontier, 2014). In sports, response time was recognized as a significant factor, especially in disciplines like kung fu (martial arts), which required rapid movement, coordination of hands and feet, or the ability to simultaneously defend and attack. The ability to respond effectively to quick and forceful attacks was directly related to response time. For this reason, visual response time was considered one of the critical performance parameters in combat sports (Polat et al., 2018; Bozkuş, 2013; Donovan et al., 2006).

In combat sports, athletes needed high response times to excel in both attack and defense. It was reported that expert karate athletes could deliver punches in as little as 242 ms and 298 ms (Vences Brito et al., 2011; Martinez de Quel & Bennett, 2014). In kung fu, experts had been found to reach hand speeds of 5.79 m/s (Neto et al., 2012). Studies comparing athletes and sedentary individuals indicated that athletes generally exhibited

✉ A. Arguz, e-mail: aarguz46@gmail.com

superior response times (Maudrich et al., 2021; Ün & Erbahçeci, 2001; Sherwood & Selder, 1979). However, this research differed from previous studies by focusing on children and female athletes, which added originality to the investigation.

The aim of this study was to examine the simple response time (RT) and choice response time (CRT) of 7-9-year-old kung fu athletes and sedentary children. This study sought to determine whether regular training in kung fu enhanced motor skills and improved response time, providing a significant advantage in response times compared to sedentary children.

Method

Participants

A total of 129 participants, including 54 female kung fu athletes, 51 female non-athletes (not actively involved in a sports discipline) 12 male kung fu athletes, and 12 male non-athletes (not actively involved in a sports discipline), aged between 7-9, were included in the measurements. A total of 66 kung fu athletes (age: $8.16 \pm .07$ years; height: $1.29 \pm .07$ cm; body weight: 26.37 ± 4.26 kg; sports experience $3.39 \pm .89$ years) participants and 63 non-athletes participants were included in the study. Before the study, the participants and their parents were informed about the study and the voluntary consent form signed consent forms were obtained. The participants were unaware of the groups to which they had been assigned. The study was conducted in accordance with the Declaration of Helsinki. It was approved by the Selcuk University Faculty of Sports Sciences Non-Interventional Clinical Research Ethics Committee on 05.11.2024 with the decision numbered 122.

Procedure and Measures

Quiet Environment Hand-Eye Response Time

In the study, the Light Trainer measurement device was used to determine the participants response times. The protocol conducted by Göğebakan et al. (2024) was adapted and organized to determine the participants response times. Prior to the start of the study, both kung fu athletes and non-athlete participants were provided with detailed information about the device and the procedure.

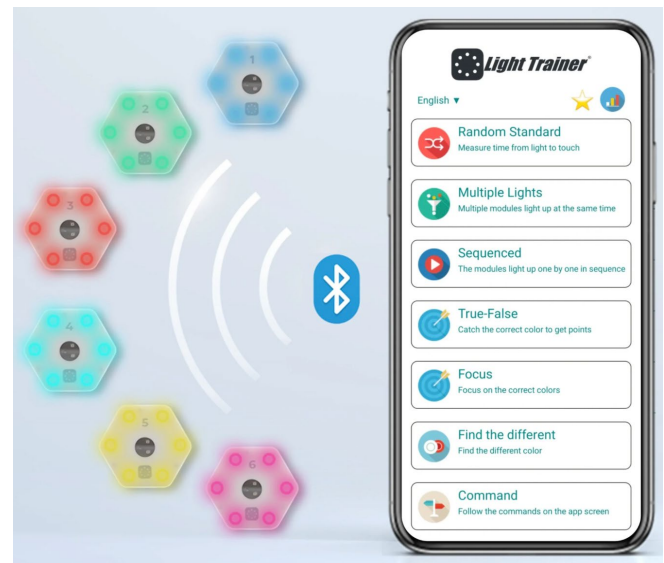


Figure 1. Light trainer pro system (Göğebakan et al., 2024).

The participants were randomly assigned to the simple and choice tests. In the study, the "Random Standard" (simple response time) and "Focus" (choice response time) protocols within the Light Trainer system were applied. In the simple response time test, participants were instructed to extinguish the randomly flashing green light. In the choice response time test, participants were instructed to extinguish the green light displayed among a series of red lights. A six-sensor light disk was positioned in three different regions relative to the participant's hand. These distances were: zero distance, shoulder distance, and random distance. For the zero distance, a light disk was mounted on a flat platform, and participants were asked to place both hands immediately next to the disk. For the shoulder distance, participants were instructed to place the tested hand one shoulder width away from the light disk. Participants stood facing a flat platform at arm's length for the starting position, and were instructed to raise their arms to chest level, with their palms lightly touching the platform. Given that limb length can affect response time (Çelik & İnce, 2024), participants were positioned at a distance equal to their arm's length from the platform, standing directly in front of the disks. They were instructed to place their hands on the disks without making contact and to extinguish the illuminated sensor lights in a randomized sequence over a 30-second period.

Data Analysis

For data analysis, appropriate statistical tests were used to make comparisons between groups. The Shapiro-Wilk test was conducted to assess the normality of the

data distribution. Independent samples t-test was applied for comparisons between groups when the data showed a normal distribution. For data that did not follow a normal distribution, comparisons between groups were made using the non-parametric Mann-Whitney U test. A significance level of $p < 0.05$ was considered for all statistical analyses. The data were analyzed using SPSS 22.0 (Statistical Package for the Social Sciences).

Results

The mean, standard deviation, minimum and maximum values of height (cm), body weight (kg), age (years) and sports experience (years) of kung fu athletes and non-athlete participants were given in Table 1.

The comparison of response times between female athletes and non-athletes is presented in Table 1. No statistically significant difference was found in the

comparison of simple response times between athletes and non-athletes ($p > 0.05$). However, a statistically significant difference was found in the comparison of choice response times between the two groups ($p < 0.05$). It was determined that athletes had lower choice response times than non-athletes.

The comparison of response times between male kung fu athletes and non-athletes is presented in Table 2. A statistically significant difference was found in the comparison of simple response times between male kung fu athletes and non-athletes ($p < 0.05$). It was determined that athletes had lower simple response times. Similarly, a statistically significant difference was found in the comparison of choice response times between kung fu athletes and non-athletes ($p < 0.05$). This difference showed that kung fu athletes had lower choice response times than non-athletes.

Table 1
Descriptive characteristics of the participants.

Groups	Gender	Variables	Mean	SD	Minimum	Maximum
Kung fu athletes	Male (n=12)	Age (years)	8.14	.69	7.00	9.00
		Height (cm)	1.29	.08	1.12	1.41
		Body Weight (kg)	24.67	3.01	20.00	29.00
		Sports Experience (years)	3.42	.90	2.00	5.00
	Female (n=53)	Age (years)	8.16	.75	7.00	9.00
		Height (cm)	1.29	.07	1.16	1.46
		Body Weight (kg)	26.47	4.33	20.00	40.00
		Sports Experience (years)	3.38	.90	2.00	5.00
Non-athletes	Male (n=12)	Age (years)	7.00	.00	7.00	7.00
		Height (cm)	1.25	.05	1.16	1.34
		Body Weight (kg)	27.33	6.41	20.00	35.00
	Female (n=51)	Age (years)	7.96	.64	7.00	9.00
		Height (cm)	1.30	.08	1.16	1.54
		Body Weight (kg)	27.41	6.87	19.00	47.00

Table 2
Comparison of response times between female kung fu athletes and non-athletes.

Variables	Groups	n	Mean ± SD	Mean Rank	Sum of Ranks	U	p
Simple Response Time	Female kung fu athlete	54	.709 ± .098	47.69	2575.50	1090.50	0.66
	Female non-athlete	51	.753 ± .116	58.62	2989.50		
Choice Response Time	Female kung fu athlete	54	.952 ± .126	59.19	3018.50	1061.500	.043*
	Female non-athlete	51	1.042 ± .201	11.42	2546.50		

* Female kung fu athlete statistically lower ($p < 0.05$).

Table 3

Comparison of response times between male kung fu athletes and non-athletes.

Variables	Groups	n	Mean \pm SD	t	p
Simple Response Time	Male kung fu athlete	12	.709 \pm .098	1090.50	.030*
	Male non-athlete	12	.753 \pm .116		
Choice Response Time	Male kung fu athlete	12	.952 \pm .126	3.500	.000*
	Male non-athlete	12	1.042 \pm .200		

* Male kung fu athlete statistically lower ($p < 0.05$).**Table 4**

Comparison of kung fu athletes and non-athletes, regardless of gender.

Variables	Groups	n	Mean \pm SD	Mean Rank	Sum of Ranks	U	p
Simple response time	Kung fu athlete	66	.713 \pm .099	56.57	3733.50	1522.500	.009*
	Non-athlete	63	.767 \pm .117	73.83	4651.50		
Choice Response Time	Kung fu athlete	66	.961 \pm .128	53.89	3557.00	1346.000	.001*
	Non-athlete	63	1.105 \pm .239	76.63	4828.00		

* Kung fu athlete statistically lower ($p < 0.05$).

The comparison of simple and choice response times between kung fu athletes and non-athletes, regardless of gender, is presented in Table 3. A statistically significant difference was found in the comparison of simple response times between kung fu athletes and non-athletes ($p < 0.05$). It was determined that kung fu athletes had lower simple response times than non-athletes. Similarly, in the comparison of choice response times, it was statistically determined that kung fu athletes had lower choice response times than non-athletes ($p < 0.05$).

Discussion

The aim of this research was to examine the effects of simple and choice response times in 7-9-year-old kung fu athletes and children who did not engage in sports. According to the research findings, it was determined that kung fu athletes (regardless of gender) had shorter response times than non-athletes. In terms of simple and choice response times, it was found that male kung fu athletes had shorter response times compared to non-athletes. However, no significant difference was found in the simple response times of female kung fu athletes compared to non-athletic girls. On the other hand, female kung fu athletes had shorter choice response times than non-athletic girls.

It was observed that response time had a significant impact on various areas such as academic achievement, sports performance, and daily life tasks (Reigal et al., 2019). Athletes relied on their quick decision-making

abilities and fast reflexes to achieve success. Therefore, there were studies in the literature on athletes' response time (McMorris et al., 2000; Davranche et al., 2006; Arguz et al., 2023).

For athletes to perform at their best, their response times, along with other athletic qualities, needed to be at the highest level (Göral et al., 2012). This research investigated how the response times of 7-9-year-old kung fu athletes differed when compared to non-athletic children. The study found that kung fu athletes had shorter simple and choice response times than non-athletic children, indicating that kung fu training positively contributed to response times. In a study by Reigal et al. (2019), they examined the simple and choice response times of children aged 10-12 years. They divided the children into three groups: those who did not engage in any physical activity, those who engaged in 1-3 hours of physical activity per week, and those who did more than 3 hours of physical activity per week. They reported that children who participated in more than 3 hours of physical activity per week had shorter simple and choice response times than the other groups. This finding supported the results of our research. Children, who engaged in sports training, showed shorter response times, demonstrating the positive effects of sports on children. In a study by Bickmann et al. (2021), it was reported that there was no difference in simple and choice response times between professional and amateur athletes. This suggested that even non-expert athletes may have response times comparable to expert athletes.

Therefore, even at the beginner level, sports training had a positive effect on response times. Kuan et al. (2018) compared the visual response times of athletes and non-athletes aged 13-16 years and reported that athletes had shorter visual response times than non-athletes. Both the literature review and the results of our own research revealed that both adult and child athletes had shorter response times compared to non-athletic individuals.

Another finding of the study was that male kung fu athletes performed better, with shorter simple and choice response times compared to non-athletic boys. In female kung fu athletes, no significant difference was found in simple response times, but their choice response times were shorter than those of non-athletic girls. In a study by Ayoubi et al. (2024), the response times of 12-16-year-old male athletes and non-athletes were examined, and it was reported that athletes had shorter response times than non-athletes. This finding was consistent with the results of our research on male kung fu athletes and non-athletes. However, Peterson (2010) reported results contrary to our findings, stating that there was no difference in visual response times between male athletes and non-athletes. This study was conducted on individuals aged 18-30 years. In the same study, Peterson (2010) also found no difference in the visual response times of 18-30-year-old women who were athletes compared to those who were not. This finding supported the lack of difference in simple response times between female kung fu athletes and non-athletic girls in our study. Kaminska et al. (2016) examined the simple and choice response times of participants who took part in physical education classes and those who did not, and reported that there was no difference in response times between the participants.

The findings of our study suggested that kung fu training positively contributed to response times in children during their developmental period. Different findings in the literature were thought to be influenced by factors such as the age of participants, sports experiences, and the devices used to measure response times. For example, the age of the participants and their sports experience may have had a significant impact on response time, as cognitive and motor skills may improve with age and increased sports experience. Additionally, the tools and methods used to measure response time may have caused variations in the results of such studies. Therefore, the results of our study may have differed from other research due to differences in measurement devices and participant groups.

However, the results of our study clearly showed that kung fu training had a positive effect on response times in both boys and girls. This suggested that a specific sport like kung fu could contribute to the cognitive and physical development of children and accelerate their decision-making processes. Kung fu training helped improve children's reflexes, attention, and decision-making abilities, which significantly influenced the shortening of their response times. This finding provided important evidence that early involvement in sports could positively affect not only the physical health of children but also their mental abilities. This research demonstrated that children engaging in sports, particularly disciplined sports like kung fu, could benefit from improved response times during their developmental years.

Conclusion

In conclusion, it was observed that the simple and choice response times of kung fu athletes were shorter than those of non-athletes. Moreover, male kung fu athletes had shorter simple and choice response times compared to non-athletes, while female kung fu athletes had shorter choice response times than non-athletic girls. It could be said that kung fu training not only enhanced physical development but also contributed to mental development. Future research could investigate the effects of different sports branches (team sports, individual sports, endurance sports) on response times.

Authors' Contribution

Study Design: YB, AA; Data Collection: YB, AA; Statistical Analysis: YB, AA; Manuscript Preparation: YB, AA.

Ethical Approval

The study was approved by the Selcuk University Faculty of Sports Sciences Non-Interventional Clinical Research Ethics Committee on 05.11.2024 with the decision numbered 122.

Funding

The authors declare that the study received no funding

Conflicts of Interest

The authors declare no conflict of interest.

References

- Adleman, N. E., Chen, G., Reynolds, R. C., Frackman, A., Razdan, V., Weissman, D. H., & Leibenluft, E. (2016). Age-related differences in the neural correlates of trial-to-trial variations of reaction time. *Dev Cogn Neurosci*, 19, 248-257.
- Arguz, A., Bayraktar, Y., Aslan, A. K., Kocaoğlu, Y., & Erkmén, N. (2023). The effect of warming on visual response time in dominant and non-dominant lower and

- upper extremities. *Turkish Journal of Sport and Exercise*, 25(3), 348-356.
- Ayoubi, S., Behgam, N., Sadeghi-Bahmani, D., Heidari, H., Maghbooli, Z., Eskandarieh, S. (2024). Response inhibition, attention and processing speed in male athlete and non-athlete adolescents. *Caspian Journal of Neurological Sciences*, 10(4), 290-295.
- Boisgontier, M. P., Wittenberg, G. F., Fujiyama, H., Levin, O., Swinnen, S. P. (2014). Complexity of central processing in simple and choice multilimb reaction-time tasks. *PLoS one*, 9(2), e90457.
- Bozkuş, T. (2013). An evaluation of the relationship between physical activity, healthy lifestyle behaviors, anaerobic performance, muscle strength, and sprint performance in folk dancers. *International Journal of Academic Research*, 5, 151-157.
- Büyükyazı, G., & Tatar, A. (2004). Comparison of mental reaction time levels of men who have regular exercise with sedentary individuals. *Gazi Journal of Physical Education and Sport Sciences*, 9(4), 41-50.
- Celik M.E., & Ince A. (2024), The examination of relationships between upper extremity joint lengths, reaction time and shoulder strength parameters in youth canoe athletes. *Turkish Journal of Kinesiology*, 10(4), 241-248.
- Davranche, K., Audiffren, M., & Denjean, A. (2006). A distributional analysis of the effect of physical exercise on a choice reaction time task. *J Sports Sci*, 24(3), 323-329.
- Donovan, O. O., Cheung, J., Catley, M., McGregor, A. H., & Strutton, P. H. (2006). An investigation of leg and trunk strength and reaction times of hard-style martial arts practitioners. *J Sports Sci Med*. 1(5), 5-12.
- Göğebakan, R., Baştürk, D., Arguz, A., Bayraktar, Y., Erkmen, N., & Say, S. (2024). The effect of sports specific warm-up on lower and upper extremity visual response time in female athletes. *Physical Education of Students*, 28(5), 296-302.
- Göral, K., Saygın, Ö., & Babayığıt İrez, G. (2012). Examining of reaction time of professional soccer players according to their playing positions. *Selçuk University Journal of Physical Education and Sport Science*, 14 (1), 5-11.
- Greenhouse, I., King, M., Noah, S., Maddock, R. J., & Ivry, R. B. (2017). Individual differences in resting corticospinal excitability are correlated with reaction time and GABA content in motor cortex. *J Neurosci*, 37(10), 2686-2696.
- Jensen, A. (2006). *Clocking the mind: Mental chronometry and individual differences*. Amsterdam: Elsevier.
- Kamuk, Y. U. (2006). *A study on the method of measuring simple reaction, choice reaction and discriminative reaction times of the Turkish air force academy cadets*, Master's thesis, Marmara University, Türkiye.
- Kuan, Y. M., Zuhairi, N. A., Manan, F. A., Knight, V. F., & Omar, R. (2018). Visual reaction time and visual anticipation time between athletes and non-athletes. *Malaysian Journal of Public Health Medicine*, 1, 135-141.
- Kuang, S. (2017). Is reaction time an index of white matter connectivity during training? *Cogn Neurosci*, 8, 126-128.
- Litwic-Kaminska, K., Michalak, M., & Sobieralska-Michalak, K. (2016). Attention and psychomotor reactions among students from sport and non-sport classes. *Polish Journal of Sports Medicine*, 32(2), 123-131.
- Martinez de Quel, O., & Bennett, S. J. (2014). Kinematics of self-initiated and reactive karate punches. *Res Q Exercise Sport*, 85(1), 117-123.
- Maudrich, T., Kenville, R., Schempp, C., Noack, E., & Ragert, P. (2021). Comparison of whole-body sensorimotor skill learning between strength athletes, endurance athletes, and healthy sedentary adults. *Heliyon*, 7(8), e07723.
- McMorris, T., Sproule, J., Draper, S., & Child, R. (2000). Performance of a psychomotor skill following rest, exercise at the plasma epinephrine threshold, and maximal intensity exercise. *Percept Mot Skills*, 91(2), 553-562.
- Metin, B., Wiersema, J. R., Verguts, T., Gasthuys, R., van Der Meere, J. J., Roeyers, H., & Sonuga-Barke, E. (2016). Event rate and reaction time performance in ADHD: testing predictions from the state regulation deficit hypothesis using an ex-gaussian model. *Child Neuropsychology*, 22(1), 99-109.
- Neto, O. P., Silva, J. H., Marzullo, A. C., Bolander, R. P., & Bir, C. A. (2012). The effect of hand dominance on martial arts strikes. *Hum Mov Sci*, 31(4), 824-833.
- Paterson, G. (2010). *Visual-motor response times in athletes and non-athletes*. Master's thesis, Stellenbosch: University of Stellenbosch.
- Polat, S. Ç., Akman, O., & Orhan, Ö. (2018). A comparison of the reaction times of elite male taekwondo and kickboxing athletes. *The Online Journal of Recreation and Sports*, 7(2), 32-39.
- Reigal, E. R., Barrero, S., Martin, I., Morales-Sanchez, V., Juarez-Ruiz de Mier, R., & Hernandez-Mendo, A. (2019). Relationships between response time, choice attention, physical activity, and physical fitness in children. *Front Psychol*, 10, 2278.
- Sant'Ana, J., Franchini, E., da Silva, V., & Diefenthaler, F. (2016). Effect of fatigue on reaction time, response time, performance time, and kick impact in taekwondo roundhouse kick. *Sports Biomech*, 16(2), 201-209.
- Sherwood, D. E., & Selder, D. J. (1979). Cardiorespiratory health, reaction time, and aging. *Med Sci Sports*, 11, 186-189.
- Ün, N., & Erbahçeci, F. (2001). The evaluation of reaction time in mentally retarded children. *Pediatr Rehabil*, 4(1), 17-20.
- Vences Brito, A. M., Rodrigues Ferreira, M. A., Cortes, N., Fernández, O., & Pezarat-Correia, P. (2011). Kinematic and electromyographic analyses of a karate punch. *J Electromyogr Kinesiol*, 21(6), 1023-1029.