



## CONTENT ANALYSIS OF SOME DOCTORAL THESIS STUDIES CARRIED OUT IN TURKEY ON THE BRANCH OF TAEKWONDO IN THE FIELD OF SPORTS SCIENCES

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### **Abstract:**

Taekwondo is an old martial art with a Korean origin that is performed with hands and feet, where several combined techniques are used together, and nerve-muscle use levels are high (Mark, 1984; Kim et al., 2011). The history of taekwondo may be traced back to centuries ago. Initially, this branch used to be taught for the person to defend themselves. Afterwards, throughout the centuries, it has been spread around the world as an artistic form. In addition to having an artistic form, the branch of taekwondo also requires high competitive strength. Taekwondo is a competitive sport that requires the displacement of the body parts of the opponent. As words, 'tae' means foot strike, 'kwon' means hand strike, and 'do' means philosophy (Kazemi et al., 2006). Taekwondo competitions are divided into two categories as sparring and poomsae. Sparring is performed against an opponent, while poomsae (imaginary sparring) is a branch where a single person performs. Taekwondo that is known as a demonstration sport showed itself for the first time in the 1988 Seoul and 1992 Barcelona Olympics. Its inclusion in official competitions occurred in the 2000 Sydney Olympic Games (Kazemi et al., 2004; Gupta, 2011). Taekwondo as an Olympic sport is a branch performed by 75-120 million individuals in more than 140 countries (Razi, 2016). Innovations made in equipment in time, changes in rules, safety measures, organization of competitions, and its prominent media- and education-related aspects have increasingly raised the interest in this branch and helped it gain its popularity today. With the increase in the popularity of the branch and the prominence it has gained in the Olympics, World Taekwondo has recently made some changes in the rules. Some changes may be listed as changes in the scoring system (increase in the point score of techniques applied on the head region), smaller game dimensions, enactment of the 10-sec rule and changes in penalty points (Moenig, 2015). Competitions are held in the form of 3 rounds of 1.5 minutes each for the Juniors and Teens categories and 3 rounds of 2 minutes each for the Youths and Adults categories,

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with 1 minute of rest between the rounds (Birrer, 1996; Toskovic et al. 2004; Heller ve ark., 1998). Competitions consist of various techniques applied on the head and torso regions. These techniques may be applied in the form of attack, counterattack and combined techniques. Athletes are scored based on the region on which they apply the techniques and the degree of difficulty. For athletes to receive points, they need to have multiple physical qualities. For competitive performance, taekwondo requires various factors including physical (Heller ve ark., 1998; Gao, 2001; Melhim, 2001; Ball et al.,2011; Estevan et al., 2011), psychological (de Prado, 2012), technical (Bridge et al., 2011; Cular et al., 2011) and tactical (Falcó et al., 2009; González et al., 2011) factors. This is why taekwondo training has been structured in a way to target these specific performance mediators (Heller et al., 1998; Gao, 2001). From this perspective, the purpose of taekwondo training is to prepare athletes in terms of both their physical activities and meeting of the physiological demands of competition (Marković et al., 2005; Pieter, 1991; Casoline et al., 2012). As strikes are important in taekwondo, athletes need to have explosive leg strength, aerobic resilience, balance and flexibility (Heller et al., 1998; Marković et al., 2005). Taekwondo athletes must have the capacity to rapidly produce muscle strength through kicks, because 80% of taekwondo skills are related to kicking (Shirley, 1992). Although these characteristics are not the only determinants of performance, they are among helpful pieces of information for trainers. There are studies in the literature on the physical and physiological characteristics of athletes. Nevertheless, it is important to increase the number of these studies and select the suitable training method for this group of athletes.

**Keywords:** Taekwondo, doctoral thesis, field of sports sciences

## 1. Objective

The purpose of this study is to investigate some doctoral dissertation studies carried out on the branch of Taekwondo in the field of Sports Sciences in Turkey and published on the dissertation platform of the Council of Higher Education (YÖK). The year the studies were conducted, the group used in these studies, how the data were collected in these studies, the contents of the studies and the results obtained from the studies were examined.

### 1.1 Significance of the Study

It is believed that this study is significant in terms of revealing scientific studies conducted on practitioners of taekwondo and shedding light on future studies. Another important point of the study is that taekwondo is an Olympic branch and has the second highest number of licensed athletes in Turkey after football.

## 2. Method

In the study, the text-based document analysis method among qualitative research methods was utilized (Sert et al., 2020). The study examined some doctoral dissertation studies conducted on the branch of Taekwondo in the field of Sports Sciences in Turkey published on YÖK's dissertation platform. These dissertations were accessed via this dissertation platform. There were 29 doctoral dissertations in total about the topic. 25 of these dissertations could be accessed, while 4 could not be accessed.

The content analysis table of some doctoral dissertation studies on the branch of Taekwondo in the field of Sports Sciences carried out in Turkey is presented below.

**Table 1:** Distribution by years, dissertation names and statuses of national doctoral dissertations on Taekwondo

Work	Number of theses	Dissertation Names	Research method
Ramazanoğlu (2002)	2	- The thoughts of personnels of private taekwondo sport establishments about their institutions personnel management and a proposal for a new management model to spreat taekwondo	Quantitative
Şahin (2002)		- The Research of taekwondo sportment's having taekwondo education attitude to compresion of taekwondo sport as comparative related to the some varieties	Quantitative
Çınar (2005)	2	-The effect of magnesium supplementation on the physical performance, hematologic parameters and lactic acid of the sportman	Quantitative
Neşe Şahin (2005)		- Analysis of menarche ages, menstrual cycle features and reproductive hormons of athletes in different branches	Quantitative
Çakmakçı (2007)	1	- Effects of national team camping period of teakwondo sportswomen on some haematological and biochemical parameters	Quantitative
Çatıkkaş (2008)	1	- Time course analysis of muscular power variations following static stretching in athletes of differing flexibility levels	Quantitative
Arslan (2009)	2	- The effect of a eight-week proprioception training programme on dynamic postural control in taekwon do athletes	Quantitative
Boyalı (2009)		- Lipid peroxidation of vitamin E application in acute taekwondo exercise,its effects on antioksidant enzymes and lactate levels	Quantitative
Bezci (2010)	1	- The study of relationship between coping style with stress and problem solving skills of taekwondo coaches	Quantitative
Çelenk (2011)	2	- Relationship between 2d:4d ratio and some biochemical and endocronological parameters effect performance in elite female athletes from different branches	Quantitative
Özder (2011)		- Kinantropometrik analysis of male athletes of different industries (Football, wrestling, weightlifting, teakwando)	Quantitative

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Sarialioğlu (2012) Sucan (2012)	2	- A morphometric comparative study on static footprints of national and amateur taekwondo players - The effect of the quality of life on psychological performance in individual and team athletes	Quantitative Quantitative
Gürkan (2013)	1	- The comparison of static balance values of hearing-impaired elite male athletes	Quantitative
Canbaz (2016) Alp (2016) Taşkın (2016) Mavi Var (2016)	4	- Taekwondo coach in Turkey leadership, creativity and investigation of burnout - Acute effects of static and dynamic stretching exercises on lower extremity strength performances in taekwondo athletes - Effect of anaerobic power on quickness and agility - The effects of water contrast therapy and electrotherapy on delayed onset muscle soreness of the individual and team sport players	Quantitative Quantitative Quantitative Quantitative
Tazegül (2017) Dilek (2017)	2	- The investigate to relationship between and narcissism levels and body perception of elite male athlete - The study of athlete perception of the behaviours of coaches: Comparison of Turkish and Bosnian Herzegovinian samples	Quantitative Quantitative
Evli (2018) Yiğit (2018) Yavuz Eroğlu (2018)	3	- Moral maturity and social integration levels of different sport branches in university teams - Investigation of the relationship between servant leadership and sports satisfaction levels in sportsman - Investigating the effects of emphathetic and moral sufficiency on decision making styles of referees	Quantitative Quantitative Quantitative
Güder (2019) Gönen (2019) Yıldız (2019) Aktaş (2019) Acar (2019)	5	- A survey on the influence of the number and severity of strikes applied during competitions on skeletal muscle damage for taekwondo athletes - The effect of the coach-athlete relationship on athletes' level of state anxiety, anger and subjective well-being: Taekwondo and American football example - Sportsmanship orientation in athletes: Goal commitment and the role of morality in sport - Examination of lower-upper limb of power and force parameters of elite athletes - Determination of anthropometric and motoric characteristics of athletes in Sivas province between the ages of 10-25	Quantitative Quantitative Quantitative Quantitative Quantitative
Çakır (2020)	1	- Comparison of training loads and motoric properties of elite and non-elite taekwondo players	Quantitative
Ölmez (2021) Sevinç Yılmaz(2021)	2	- Effect of training with video and visual support materials on technical development in sports (taekwondo) - Normative Study Of Some Biomotor Abilities Of 10-14 Age Group Taekwondo Athletes	Quantitative Qualitative Quantitative

### 3. Discussion and Conclusion

This study examined some doctoral dissertation studies conducted on the branch of Taekwondo in the field of Sports Sciences in Turkey published on YÖK's dissertation platform. 29 doctoral dissertations were found on the platform. Four of these

dissertations could not be accessed as they were not open for access, while 25 could be accessed. The years, numbers, names and research methods of the accessed dissertations are presented in Table 1. This section provides information about the accessed dissertations.

The study by Çakmakçı (2007) investigated whether or not the camp period (on national team level) had an effect on some biochemical and hematological parameters in 15 high-level elite female taekwondo athletes with a mean age of 22.26 years. The participants of the study were given a four-week training program to apply. Two training sessions were practiced per day in the first three weeks, while one training session was practiced per day in the fourth week. Blood samples were collected from the participants at the beginning and at the end of the study for the parameters of RBC, WBC, PLT, HG, HCT, MCV, MCH, MCHC, Cholesterol, Triglycerides, Glucose, Urea, AST and ALT. At the end of the study, while there was a statistically significant increase in the levels of HGB, HCT, PLT, MCV, MCH, MCHC, AST, ALT and Glucose, there was a reduction in the total cholesterol levels ( $P<0.05$ ). No statistically significant difference was observed in the WBC, RBC, PLT and Urea levels ( $P>0.05$ ). According to the researcher, the training program applied in the camp period led to some changes in some biochemical and hematological parameters, but these changes stayed within the reference values specified by SESAM.

Çatıkkaş (2008) investigated whether or not static stretching caused muscular strength changes based on the elasticities of 36 elite taekwondo and 20 football athletes at the ages of 18-30. The participants performed maximal-level static stretching exercises. Right after this, the “Counter Movement” jumping test was applied on the athletes. On the other day, the athletes were instructed to jump down from a 70-cm-high platform, and the “Depth Jumping Test” was applied. According to the findings of the study, there was no statistically significant difference in the Counter Movement and Depth Jumping test results ( $p>0.05$ ). According to Çatıkkaş, while the static stretching exercises did not create a significant difference in the jumping test results, it did not negatively affect power production in the athletes with poor elasticity.

Arslan (2009) examined whether or not an eight-week proprioception program had an effect on dynamic postural control and knee joint proprioception in active taekwondo athletes. In the study, 13 male and 13 female athletes constituted the experiment group, while 8 male and 8 female athletes constituted the control group. The mean age of the female experiment group was 20.92, and the mean age of the female control group was 20.75 years. The mean age of the male experiment group was 20.23, and the mean age of the male control group was 19.87 years. Throughout the study, a proprioception training program was applied with the participants for three days a week. Measurements were made on the participants at the beginning and at the end of the study. As a result of the study, significant differences were observed in the knee joint (dominant and non-dominant) proprioception and double-leg (dominant and non-dominant) postural control values of the male and female experiment group participants ( $p<0.05$ ). No significant change in the knee joint proprioception and double-leg postural

control results was reported among the male and female control group participants ( $p>0.05$ ). According to the researcher, applying proprioception training programs is useful in developing the position sense perception performances of athletes.

Twenty-four individuals participated voluntarily in the study conducted in 2009 by Boyalı on healthy male taekwondo athletes. The participants were divided into two groups. The first group (vitamin E group) was given vitamin E for four weeks and performed acute Taekwondo exercises one day a week. The second group (control group) performed acute Taekwondo exercises one day a week till fatigue for four weeks. Blood samples were collected from the athletes at the beginning and at the end of the study for tests on GSH (Glutathione), GSH-px (Glutathione-peroxidase), CAT (Catalase), SOD (Superoxide Dismutase), No (Nitric Oxide), MDA (Malondialdehyde) and plasma lactate values. As a result of the study, it was reported that the vitamin E application during acute taekwondo training prevented free radical formation and suppressed lactate levels. According to Boyalı, if it can be adjusted at an appropriate dose, vitamin E application affects the performance of athletes positively (Boyalı, 2009).

Bezci (2010) studied the relationship between the skills of coping with stress and problem-solving skills of taekwondo trainers. The study included a total of 448 trainers who had participated in development seminars and had a mean age of 36.76. According to the data of the study, there was no statistically significant relationship between the two variables. There was only a significant difference in the problem-solving skill levels based on the order of the participants among all children of their family and their sex.

Çelenk (2011) conducted a study on the relationship between vitamin, hormone and mineral values affecting performance and the 2D:4D ratio on 77 female athletes from seven different Olympic sports branches (boxing, weightlifting, Taekwondo, football, volleyball, handball, athletics) and 26 non-athlete women. The x-ray images of both hands of the participants were taken to determine the 2D:4D ratios of both the control and experiment groups. The 30-m sprint and Wingate tests were applied on both groups. Blood samples were collected to determine vitamin, mineral and hormone levels. As a result of the study, it was observed that the 2D:4D ratio of the experiment group consisting of athletes from different sports branches was significantly lower than that in the control group ( $p<0.05$ ). The results of the Wingate and 30-m sprint tests in the experiment group were also significantly higher ( $p<0.05$ ). A positive relationship was determined between some hormone values, low 2D:4D ratios and performance values. According to the conclusion of the researcher, it was seen that the 2D:4D ratio played an assistive role at the stage of determining athlete performance.

Özder (2011) aimed to reveal the characteristics of the somatotype and kinanthropometric values of 130 national team athletes of different sports branches (Taekwondo, weightlifting, wrestling, football). In the study, using the IBP (International Biological Programme) techniques, some anthropometric measurements (height, weight, calf circumference, biceps circumference in flexion, biceps circumference in a free position, knee diameter, and to determine somatotypes, skin fold thicknesses) were collected from the athletes. According to the results of the study, the values of the athletes

varied based on their branches. Each branch displayed unique somatotype characteristics. It was also reported that the subcutaneous fat percentages of the athletes of weightlifting were higher than those in other branches. When they compared athletes in the international literature and athletes in Turkey, they could state that these athletes had a similar character in the kinanthropometric sense. According to the researcher, in studies to be conducted, the kinanthropometric criteria of athletes should be kept in mind in talent selection, training programs and at stages of arranging the diets of athletes.

Sarialioğlu (2012) conducted a study with 35 national taekwondo athletes (10 female-25 male) and 65 amateur taekwondo practitioners (40 female-25 male) at the ages of 19-27 to determine the morphometric values of static footprints, reveal differences and determine their relationships if any. In the study, drawing ink was applied on the soles of the feet of each individual, and the prints of both of their feet were collected on a white paper surface on flat ground. On the collected footprints, 12 parameters were measured including the length measurements of the tip points of all toes, tip of the heel, arch width, metatarsal width, heel width, the Staheli Index, &-1 and &-2 angles, and the Chippaux-Smirak index. As a result of the 0-5 metric measurements that were made, statistically significant differences were determined between the arch width, metatarsal width and heel width values of the male and female athletes ( $p<0.05$ ). There was no significant difference between the male and female athletes in terms of the Chippaux-Smirak Index (CSI) and Staheli Index (SI) parameters ( $p>0.05$ ). When the male amateur and national athletes were compared, it was found that both feet' arch widths, the Chippaux-Smirak Index (CSI), the Staheli Index (SI) and the &-1 and &-2 angles were distinctive ( $p<0.05$ ). The researcher concluded that, in the branch of Taekwondo, foot morphology is a significant factor in athlete success.

Sucan (2012) conducted a study to determine the effects of quality of life and psychological performance levels on individuals taking part in individual and team sports. The study included athletes from the individual branches ( $n=357$ ) of taekwondo, athletics, skiing and swimming. The included team branches ( $n=389$ ) consisted of basketball, football, handball and volleyball. The sample of their study consisted of 746 individuals who were licensed athletes for at least 5 years and at the ages of 18-25. The study used WHOQOL-BREF-TR (for quality of life) and a psychological performance scale. As a result of the study, it was recommended to assess all data as a whole. According to the researcher, factors that affect the performances of athletes negatively should be determined, and programs to turn these factors towards the positive should be organized.

In the study conducted by Gürkan (2013) to compare the static balance statuses of national-level athletes who were preparing for the Olympics and had hearing impairment, the participants included 32 voluntary male individuals aged 17-37. The sample consisted of the taekwondo ( $n=11$ ), basketball ( $n=11$ ) and sedentary ( $n=10$ ) groups. Elasticity, agility and balance tests were applied on the athletes. The results of the study showed that the elasticity and agility values of the national-level athletes were significantly higher than the sedentary individuals. In the double-leg static balance

measurement, there was no statistically significant difference between the groups. On the other hand, the national-level athletes were better than the sedentary group in the left-leg static balance results. According to the researcher, long-term regular exercise among hearing-impaired individuals contributes to improvement of balance control.

Canbaz (2016) carried out their study to determine the leadership, burnout and creativity levels of trainers registered under the Turkish Taekwondo Federation. The sample was determined as 1044 active trainers who were registered under the Federation and had visas in 2015. The researcher applied a creativity scale, the Maslach Burnout Inventory and a leadership scale in the sample. In the results of the study, it was seen that the education levels were higher among the trainers who also had higher leadership levels. In the comparison between the sexes, the female trainers were reported to be more creative. It was found that, as the age group of the participants got older, their satisfaction levels decreased, and their burnout levels increased. The researcher argued that the reason for the high burnout levels and low life satisfaction levels of the high-ranking trainers was insufficient material and immaterial support.

Alp (2016) examined whether or not dynamic and static stretching exercises had an acute effect on lower extremity strength performance in 14 male taekwondo athletes at the ages of 18-22. They performed isokinetic tests on the athletes for 6 days with a resting interval of 48 hours. As a result of the study, no significant difference was observed between the pretest and posttest values of the athletes in their 60 and 180°/sec angular velocity knee and foot isokinetic strength comparisons ( $p>0.05$ ). There was also no significant difference in the angular velocity based on the applied stretching protocols ( $p>0.05$ ). The researcher recommended stretching protocols to be applied specifically for branches.

The study conducted in 2016 by Taşkın included 14 female national-level taekwondo athletes with a mean age of 21.29 and 16 male national-level taekwondo athletes with a mean age of 21.81. The study investigated whether or not anaerobic strength had an effect on quickness and agility. The researcher used the Wingate test to measure the anaerobic strength of the athletes, quickness test to measure their quickness and T test to measure their agility. According to the results of the study, the body height values in the men and the women did not affect anaerobic strength. The body weight values in the men and the women affected anaerobic strength. In parallel with these results, a significant positive effect was observed in agility and quickness performance (Taşkın, 2016).

The study by Mavi Var (2016) included 45 volunteering athletes at the ages of 18-28. The athletes consisted of those taking part in individual (taekwondo, boxing, wrestling) and team (handball, volleyball, football) sports and with an active, ongoing sports career. In these athletes, the study investigated whether or not contrast bath therapy and electrotherapy had an effect on the problem of delayed-onset muscle soreness. The athletes were randomly divided into three groups (contrast bath therapy group, electrotherapy group and control group). To induce delayed-onset muscle soreness in the athletes, they were worked with 80% of the previously determined



maximal isokinetic strength values for the right and left legs until reaching the maximal pain level. Before and after the study, blood samples were collected five times from the athletes. To determine the muscle soreness levels, VAS (visual analog scale) was applied at five different times. As a result of the study, it was reported that the contrast bath therapy and electrotherapy practices provided more significant results than passive resting in terms of removing muscle soreness.

The study in 2017 by Tazegül included 424 volunteering male athletes who were involved in sports on an elite level and had top three rankings in nation-wide competitions in Turkey in the youths and adults categories. The branches constituting the sample of the study were athletics (n=34), boxing (n=52), wrestling (n=45), weightlifting (n=37), handball (n=36), rowing (n=35), taekwondo (n=41), swimming (n=36), water polo (n=31), volleyball (n=35) and bodybuilding (n=42). In the study where whether or not there was a relationship between the narcissism levels and body perceptions of the athletes was investigated, the Narcissistic Personality Inventory and Body Perception Questionnaire were applied on the participants. Among the branches, the narcissism scores of the athletes in the bodybuilding branch turned out to be higher than those of the other branches. The body satisfaction scores of the athletes in the branch of wrestling were higher than the others. When the athletes were compared within and between their branches, a significant relationship was found between their body perceptions and narcissism values. It was observed that the body perception levels of the national-level athletes were lower in comparison to those who were not national-level athletes (Tazegül, 2017).

Dilek (2017) planned their study to determine the behaviors of the trainers of individuals who were athletes of different branches towards these individuals. The study included 1394 athletes who took part in the branches of football, athletics, swimming, taekwondo, basketball and karate and had ongoing active competitions. Among the athletes, 743 were competing in these branches in Turkey (515 women and 228 men), while 651 were competing in Bosnia-Herzegovina (225 women and 426 men). In the study, to determine differences between both the athletes from Turkey and Bosnia-Herzegovina and among different sports branches, the Turkish and Bosnian adaptations of the "Coaching Behavior Scale for Sports" were utilized. It was observed that the athletes from Bosnia-Herzegovina were more positive in terms of assessing trainer behaviors than the Turkish athletes. In both groups, the views of the female athletes towards trainer behaviors were significantly more negative. In both samples, characteristics like the level of the trainer, their experience, national competition status and high educational level provided a positive influence on the athletes. As another result of the study, it was determined that trainers from Bosnia-Herzegovina had higher levels of professional competency and positive behaviors than those from Turkey.

Evli (2018) investigated the social integration and moral maturity levels of athletes of universities in different branches. The population of the study included athletes competing in a university-level championship in the academic year of 2015-2016. The sample consisted of 548 athletes who participated in competitions in 9 branches

(volleyball, basketball, taekwondo, football, handball, wrestling, gymnastics, athletics, folk dances) who were randomly selected. Moral maturity and social integration in sports scales were applied on the athletes. As a result of the study, considering the difference between the sexes, the moral maturity and social integration levels of the male athletes were significantly higher. Regarding the sports ages of the athletes, it was determined that, as the age of starting sports among the athletes got younger, there was an increase in their moral maturity levels. There was no significant difference between their moral maturity levels when a comparison was made between individual and team sports. Again, in relation to the comparison in terms of team sports and individual sports, the social integration level of the branch of folk dancing was higher in comparison to those of handball and football. Among the individual sports, the branch of taekwondo had the highest social integration and moral maturity levels in the statistical sense. According to the researchers, taking part in any sports branch contributes positively on levels of moral maturity and social integration.

The study conducted in 2018 by Yiğit examined the relationship between the satisfaction levels of national-level and non-national-level athletes and the servant leadership model of trainers. The study included athletes of the individual sports branches of taekwondo, judo and wrestling. Among the participants, 190 were national-level athletes, while 67 were non-national-level athletes. In total, 141 male and 116 female athletes (n=257) participated in the study. In the study, the Athlete Satisfaction Questionnaire and Servant Leadership Scale were applied. According to the results, when the trainer servant leadership characteristics of the national-level athletes were examined, it was determined that there was a statistically significant difference based on the variables of individual and team satisfaction, athlete satisfaction, trainer satisfaction and years of working with the trainer. When an assessment was made in terms of athlete satisfaction and the servant leadership levels of trainers, the results of the national-level athletes were significantly more positive than the non-national-level athletes (Yiğit, 2018).

Yavuz Eroğlu (2018) investigated the effects of the empathy and moral maturity levels of individuals working as referees in 9 different branches on their decision-making styles. The sample of the study consisted of 586 referees from the branches of basketball, handball, volleyball, judo, karate, taekwondo and wrestling. Moral maturity and empathic tendency scales and the Melbourne Decision-Making Questionnaire were applied among the participants. As a result of the study, it was reported that there was a weak relationship between decision-making and moral maturity and empathic tendency ( $R^2=0.174$ ). The self-esteem in decision-making scores of the referees in team sports were higher than the referees in individual sports. It was stated that the empathic tendency and moral maturity levels of the referees in the included branches reduced the panic decision-making process in the positive sense. In the decision-making process, their levels of moral maturity and empathic tendency increased the self-esteem levels of the referees.

The study carried out in 2019 by Güder aimed to determine whether or not the numbers and magnitudes of the techniques applied by taekwondo athletes during a

competition affected muscle damage. Eighteen male athletes who actively participated in national and international competitions and had a mean age of 18.82 voluntarily participated in the study. To determine the muscle damage in the athletes, they were included in five competitions within one day. It was aimed to determine whether or not there was a relationship between the strike numbers and strike magnitude of the athletes and their muscle damage. To be able to determine muscle damage, blood samples (myoglobin, CK, LDH, AST, ALT) were collected from the athletes before the competition, right after the competition, and 24 and 48 hours later. As a result of the study, a positive significant relationship was found between the number of strikes performed by the athlete and strike magnitude ( $p < 0.05$ ). There was no significant relationship based on the number and magnitude of strikes performed against the athlete ( $p > 0.05$ ). No significant difference was reported in the blood samples collected from the athletes based on numbers and magnitudes of strikes. It was reported that the blood samples collected 48 hours after the competitions could not drop down to base values (Güder, 2019).

Gönen (2019) studied the effects of the trainer-athlete relationship on anger, anxiety and subjective wellbeing levels in athletes in the branches of Taekwondo and American football. The study included a total of 420 voluntary athletes who participated in competitions in the scope of university sports in the academic year of 2017-2018 including 243 from the taekwondo branch (136 men, 107 women) and 177 (men) from the American football branch. The athletes were given a form including demographic information, the "Athlete Form of the Coach-Athlete Relationship Questionnaire", the "Spielberger State Anxiety Inventory", the "Aggression and Calmness Sub-Dimensions of the Anger-Related Behaviors Dimension of the Multidimensional Anger Scale" and the "Oxford Happiness Questionnaire". As a result, a positive and moderate relationship was determined between the trainer-athlete relationship levels and the subjective wellbeing scores. There was a negative and moderate relationship between the state anxiety and aggression scores and the trainer-athlete relationship levels. When the state anxiety and anger levels were compared between the branches as individual and team sports, no significant difference was reported. However, the subjective wellbeing scores of the athletes of the Taekwondo branch were higher. The researcher observed that, as the trainer-athlete relationship scores of the athletes increased, their state anxiety and anger scores decreased, and their subjective wellbeing scores increased.

The study by Yıldız (2019) aimed to examine the effects of the goal commitment of active athletes competing in different categories on their moral disengagement behaviors, and in parallel with this, their sportspersonship orientations. The sample of the study consisted of a total of 628 athletes including 241 female and 387 male athletes from individual and team branches (football, basketball, volleyball, handball, futsal, athletics, taekwondo, kickboxing, boxing, archery, tennis, hockey, Muay Thai, wushu, table tennis, arm wrestling, wrestling, orienteering, badminton, judo). In the study, the Multidimensional Sportspersonship Orientation Scale, the Moral Disengagement in Sport Scale and the Goal Commitment Scale were applied. Based on the results of the

study, the athletes with high levels of sportspersonship orientation were found to be those committed to their goals. Furthermore, the moral disengagement behavior levels in sports were lower among the athletes with high goal commitment and sportspersonship orientation levels.

Aktaş (2019) researched the lower and upper extremity power and strength values of elite athletes in different branches. In the study, 32 active male athletes with a mean age of 21.16 years voluntarily participated. Football and taekwondo where the lower extremities are used most and boxing and handball where the upper extremities are used more were included in the study. The Wingate arm-leg power test and isokinetic strength measurements were applied on the athletes. Measurements were also taken to determine the athletes' blood pressure, heart rate and blood lactate levels. As a result of the study, the Wingate and isokinetic strength values were compared, and it was found that the lower extremities were significantly stronger than the upper extremities. The isokinetic arm strength and Wingate levels in the boxing and handball branches were significantly higher in comparison to the taekwondo and football branches, while there was no statistical significance in the lower extremity values ( $p < 0.05$ ). According to the researcher, this difference was observed as the extremity that was actively used most by the branch became dominant based on the branch. When the resting heart rate and blood lactate levels were examined, it was determined that the Wingate power and isokinetic strength measurements did not differ significantly based on the branches.

Acar (2019) planned their study to determine the anthropometric and motoric characteristics of 402 athletes continuing their active sports careers in the province of Sivas at the ages of 10-25. The included branches were freestyle wrestling (86 males), handball (16 males-22 females), athletics (15 males-11 females), volleyball (8 males-10 females), taekwondo (23 males-20 females), football (161 males) and basketball (20 males-10 females). The athletes' demographic information, information on dietary habits, anthropometric measurements, skin fold thicknesses (somatotypes) and motor performance measurements were collected. As a result of the study, as the age increased, a significant difference between the muscle-fat percentages was reported between the sex and age categories. The skin fold thicknesses and fat percentages of the female participants were higher than those of the males. While the muscle and fat densities were high in the branches of volleyball, wrestling and basketball, they were the lowest in athletics. While the athletes and footballers were prominent in the speed tests, the wrestlers were prominent in the strength-stamina tests. It was reported that the performance values of those who started sports at an early age in the branches of wrestling, taekwondo, athletics and basketball were better. Considering the somatotype structures, it was observed that the wrestlers were endomorphic mesomorphs, the athletes of taekwondo, volleyball and football were mesomorphic ectomorphs, the handballers were ectomorphic mesomorphs, and the basketballers were endomorphic ectomorphs. The branch where protein intake was the lowest was basketball, whereas the branch with the lowest energy and carbohydrate intake was taekwondo. When the performance characteristics of the taekwondo athletes based on the sex and age categories

were examined, there was a significant difference in the teen-youth male athletes in terms of their elasticity tests, standing long jump, right-left arm strength, ball throw and flexed-arm hand test values ( $p<0.05$ ).

Çakır (2020) performed their study to find an answer to the question of where the difference comes from by making comparisons between elite and non-elite taekwondo athletes based on their internal training loads and motoric characteristics. The study was carried out with 16 (8 elite and 8 non-elite) male athletes who were competing in the weight classes of 63-68-74 kg and actively taking part in taekwondo in the season of 2019-2020 in the province of Istanbul. In the study, anthropometric measurements, quickness test, sprint test and isokinetic tests were applied on the athletes. The internal training loads of the athletes were monitored for 1 month with a phone application named the Fatigue Index Calculation Module. According to the results of the study, the results of the body fat percentages, sprint test and agility tests were significantly in favor of the elite taekwondo athletes ( $p<0.05$ ). Moreover, the fatigue indices and angular velocities were found to be significantly higher in the elite taekwondo athletes ( $p<0.05$ ). The knee-hip flexion and extension peak torque values were significantly in favor of the elite athletes. According to the researcher, good motoric characteristics and a high training load are important elements of being an elite athlete.

In 2021, Ölmez said that visually supported training will be used in motoric, technical, tactical, etc. The mixed method was used to examine the effects of characteristics on Taekwondo training. In the study, 28 people constitute the experimental group and 29 the control group. While the training program was applied to the experimental group using video visuals and materials for 12 weeks, the control group was given classical Taekwondo training. As a result of the study, it has been determined that Taekwondo trainings with visual support increase the success performance and accelerate the development.

Sevinç Yılmaz analyzed some anthropometric and biomotor abilities of 10-14 age group taekwondo players in 2021 and established norms. 650 (female-male) athletes participated in the study voluntarily. This study contributes to the literature in terms of presenting the current status of the athletes, making comparisons, and following their development over the years. It is thought that the created norms will be effective in following the performance of the athletes and preventing the time-material losses of trainers and sports scientists.

Consequently, it is considered that the studies examined here have been useful for the worlds of taekwondo and science. It is known that increasing the number of studies on taekwondo, which has the second highest number of licensed athletes on the national level in Turkey and is an Olympic branch, will contribute to the literature. It was observed that preparing training programs for athlete selection and performance improvement by utilizing such studies in the literature will be beneficial for trainers, athletes and sports scientists. It is noteworthy that no study has been conducted on the poomsae branch of taekwondo. As national and international competitions are held in the poomsae branch,

and as the participation rates are high, it is believed that conducting studies also in this field will be useful.

### **Conflict of Interest Statement**

The author declares no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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