Investigating the effects of biological maturity and relative age on physical fitness and sport-specific skills of young futsal players

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Abstract

The purpose of this study was to investigate the effects of biological maturity and relative age on physical fitness and sport-specific skills in young futsal players. The study included 58 male athletes in the age group of 12 years who participated in futsal games in school sports. The age of the study group was 12.57 ± 0.26 years, the average height was 158.74 ± 8.48 cm, and the body weight was 50.15 ± 9.25 kg. After determining the relative age, maturity status, height, and body weight of the study group according to their birth months, they were asked to participate in a hand strength test, a vertical jump test, a sit-stand test, a 30-metre sprint test, a 505 mobility test, a push-up test, and a sit-up test. A significant difference was found in the values of height, body weight, right and left hand grip strength, vertical jump test, sit-stand flexibility test, 30 m sprint test, 505 agility test, push-up test, and sit-up test in young male futsal players who were born in the first months of the year and matured early compared to athletes who were born in the last months of the year and matured late. As a result of our study, it was found that futsal players born in the first months of the year or matured early were taller and heavier than futsal players born in the last months of the year or matured late. It was also found that these athletes have better performance scores than their peers born in the last months of the year or matured later.

Keywords: Anthropometry, biological maturation, futsal, relative age

Genç futsal oyuncularında biyolojik olgunluk ve bağıl yaşın fiziksel uygunluk ve spora özgü beceriler üzerindeki etkilerinin incelenmesi

Öz

Bu çalışmanın amacı, genç futsal oyuncularında biyolojik olgunluk ve bağıl yaşın fiziksel uygunluk ve spora özgü beceriler üzerindeki etkilerinin incelenmesidir. Çalışmaya okul sporları futsal maçlarına katılan 12 yaş grubunda 58 erkek sporcu katılmıştır. Araştırma grubunun yaşları 12,57±0,26 yıl, boy ortalaması 158,74 ± 8,48 cm ve vücut ağırlıkları 50,15 ± 9,25 kg'dır. Araştırma grubunun doğum aylarına göre bağıl yaşları, olgunluk durumları, boy uzunlukları, vücut ağırlıkları belirlendikten sonra el kavrama kuvveti testi, dikey sıçrama testi, otur-eriş testi, 30 m sprint testi, 505 çeviklik testi, şınav testi ve mekik testlerine katılmaları istenmiştir. Genç erkek futsal oyuncularından yılın ilk aylarında doğan ve erken olgunlaşan sporcuların, yılın son aylarında doğan ve geç olgunlaşan sporculara göre boy uzunluğu, vücut ağırlığı, sağ ve sol el kavrama kuvvetleri, dikey sıçrama testi, otur-eriş esneklik testi, 30 m sprint testi, 505 çeviklik testi, şınav testi ve mekik testi değerlerinde anlamlı düzeyde farklılık tespit edilmiştir. Çalışmamız sonucunda yılın ilk aylarında doğan veya erken olgunlaşan futsal oyuncularının, yılın son aylarında doğan veya geç olgunlaşan futsal oyuncularına göre daha uzun ve ağır oldukları görülmektedir. Ayrıca bu sporcuların yılın son aylarında doğan veya geç olgunlaşan yaşıtlarından daha iyi performans değerlerine sahip oldukları sonucu ortaya çıkmaktadır.

***Anahtar Kelimeler:** Antropometri, biyolojik olgunlaşma, bağıl yaş, futsal*

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INTRODUCTION

Growth is a universal process in children and adolescents. This process, from infancy to adulthood, consists of three phases. These are growth, maturation, and development. Although these terms are generally accepted as synonymous, there are some differences between them (Kara, 2021). Growth refers to measurable changes in size, body composition, and various body systems, while maturation refers to progress toward a mature state (Manna, 2014).

Biological maturation is defined as the progression to a biologically mature state. It is a biological process that affects all body tissues, organs, and systems and is influenced by various genetic and environmental factors (Ceylan, 2022; Söğüt et al., 2022).

Individual differences in growth and maturation are very important in identifying and developing talented young athletes. Especially in team sports, anthropometric characteristics and basic motor characteristics of children are considered in the talent selection stages for the industry (de Almeida-Neto et al., 2022). It is known that the maturity level of both sedentary and athletes differs significantly within the same relative age group (Şengür et al., 2021).

Individual differences in anthropometric characteristics, strength, power, motor performance, and motor skills are observed in athletes with different levels of maturity (Eliöz et al., 2016; Thurlow et al., 2021; Sarıakçalı et al., 2022). In contrast, athletes of the same relative age who mature early may perform better than athletes with late or normal maturity. During the developmental process in adolescence, there is an increase in parameters such as running speed, agility, and strength development, as well as an increase in height and body weight (Saç & Çolak, 2019). Another aspect that should be considered in biological maturation is the birth months of athletes of the same age. In the same year, it is noteworthy that children born in the first months of the year can be almost one year older than those born in the last months of the year (Mülazımoğlu et al., 2013). This is called the relative age effect. The relative age effect is when athletes of the same age are grouped together and there is a difference of almost one year between the individuals in the group, so that athletes who are older in months perform much better than others (Yavuz, 2019). Sports competitions are organized by age categories. Accordingly, the month and day of birth of athletes are not used to calculate their age. Instead, only the year of birth is used to determine the age of competition. Because of this situation, the biological maturity level of athletes may vary with the relative age effect. Among children in the same age group, those with high technical abilities but still underdeveloped body

measurements may have difficulty achieving the desired performance. This situation leads children to tend to stop playing sports and withdraw (Albaladejo-Saura et al., 2021).

The differences in the birth months of athletes in the same age category or even the same age may affect their physical characteristics, or biological maturation and relative age effect may affect their performance. This situation can also be observed in futsal athletes. This situation has also been highlighted in studies on this topic in the literature. Ferreira et al. (2020), in a study of Brazilian female futsal players, found that athletes born in the first months of the year were taller than athletes born in the last months. Oliveira Castro et al. (2022) found that the majority of elite female futsal players in the U15, U17, U20, and senior categories were born in the first months of the year. Figueiredo et al. (2021) conducted a national study of Portuguese soccer and futsal players and found that elite athletes were born in the 1st or 2nd month of the year. Morales et al. (2017) examined the effect of birth months on the performance of athletes participating in the Brazilian National Futsal League and concluded that male futsal players were generally born in the first six months of the year. The athletes indicated that being grouped based on their biological maturity was more equitable and they also felt more physically comfortable and performed their motor skills more easily on the soccer field (Moran et al., 2021).

The aim of our study was to investigate the effects of biological maturity and relative age on physical fitness and sport-specific skills in young futsal players.

METHOD

Research group (population-sample)

The study included 58 male athletes aged 12 years who participated in futsal games in school sports. The age of the study group was 12.57 ± 0.26 years, mean height was 158.74 ± 8.48 cm, and body weight was 50.15 ± 9.25 kg.

Ethical approval

This study was conducted at Kırıkkale University, Faculty of Sport Sciences, according to the principles established in the Declaration of Helsinki. The Kırıkkale University Ethics Committee for Noninterventional Research gave its approval (date: 26/08/2020, number: 2020.08.01). The purpose of the study was explained in advance to all athletes and their parents. In addition, the parents of all subjects signed a written informed consent form before participating in the study.

Data collection tools

Anthropometric measurements: Participants' height was measured using a SECA brand portable stadiometer, 2013 model, with bare feet. Body weight was measured using a digital scale while wearing shorts and a T-shirt.

Handgrip strength measurements: Participants' handgrip strength was measured using a Takei brand handgrip dynamometer. During the measurements, the dynamometer was adjusted to the participants' hand size. Then, the participants were asked to press the dynamometer with the highest force they could exert without any support while standing on their side and holding their arms at an angle of 10-15° to the body (İri & Öztekin, 2021). The same procedure was repeated three times for each hand and the highest values were recorded.

Vertical jump test: The Fusion Sport Brand Smart Jump Model jump mat was used to determine the vertical jump heights of the participants. During the measurements, participants stood on the mat with their hands on their hips, and after a quick squat to full squat, they were asked to jump as far as possible (Kızılet et al., 2010; Pamuk et al., 2023). The test was repeated twice and the highest score was recorded.

Sit-back test: The hip flexibility of the participants was measured using the sit-reach test. A sit-reach table was used for the test. Participants were asked to sit with the soles of their feet on the bottom edge of the table, then lean forward without bending their knees and push the ruler as far as possible on the table (Musa, 2020). The test was repeated twice and the highest score was noted.

30 m sprint test: Participants attempted to run a distance of 30 m at maximum speed. At the beginning and end of the test, the times achieved by the participants were recorded using light barriers (Ceylan et al., 2016; Başkaya & Akkoyunlu, 2023).

505 Agility test: Participants' agility abilities were measured with the 505 Agility Test using the Fusion Sport Brand Smart Speed Model photocell. Participants completed the test by running a distance of 5 meters back and forth after a 10-meter run (Bektaş et al., 2022).

Push-up test: Participants were asked to raise their bodies upward while pressing straight down on the floor with their hands. During the test, the arms were kept slightly flexed, fully extended but without locking the elbow. The body was in a straight line from head to heel. A push-up was counted when the chest was pushed back up while slightly approaching the floor. Participants were asked to do as many push-ups as possible while holding a stopwatch for one minute (Taşkın et al., 2015).

Shuttle test: Participants begin the test lying on the floor with the back of their shoulders on the floor and their knees at 90° to the floor. At this point, the soles of the feet were in full contact with the floor. During the test, the researchers held the participants' ankles and recorded the contact of the participants' elbows with their knees during each sit-up as 1 successful sit-up. The test duration was 30 s and the successful sit-ups were recorded throughout the duration (İpek-Dongaz et al., 2020).

Calculation of the relative age

To calculate the relative age of athletes, a year is first divided into 4 quarters: 1st-3rd months Q1, 4th-6th months Q3, and 10th-12th months Q4. Then, the athlete was classified into the quarter in which his birth month was.

Calculation of biological maturity

The estimated adult body length (PAS) was used as an indicator of maturity (Khamis and Roche, 1994). Body height was determined and treated as an estimated percentage of adult height (%PAS). The calculation of the PAS protocol was based on age (deciles), body mass, body size, and average size of the parents. Parental body size was collected using an informed consent form. For children of the same relative age, individuals with a higher estimated adult height are considered to be at a more advanced stage of physical maturation compared to smaller individuals (Khamis & Roche, 1994). The Khamis-Roche method has been used in many studies to estimate biological maturation status (Malina et al., 2004; Malina et al., 2005a). In this study, grouping among children was performed. Using the sample median Z-score of the determined % PAS value, the latest maturation status ($p < 50\%$) and the earliest maturation status ($p > 50\%$) were indicated. According to this method, the maturation status of the study group was classified as early, on time and late.

Data analysis

Kolmogorov-Smirnov and Shapiro-Wilk normality tests were applied to the obtained data. These tests showed that the data did not have a normal distribution. For this reason, the Kruskal-Wallis H test was used to test the significance of the difference between the mean values of the groups, and the post hoc analysis test was used to determine which groups caused the difference between the groups. In addition, descriptive statistical analyzes were applied to the data. All statistical analyzes were performed using the SPSS 23 statistical program.

FINDINGS

Table 1. Descriptive statistical values of the research group

Variables	N	Min.	Max.	X̄	S.d.
Age (Year)	58	12.02	12.99	12.57	0.26
Height Length (cm)	58	135.00	173.00	158.74	8.47
Body Weight (kg)	58	29.10	67.10	50.15	9.25
Right Hand Grip Strength (kg)	58	13.20	32.60	22.24	4.94
Left Hand Grip Strength (kg)	58	11.30	30.30	20.29	4.09
Vertical Jump (cm)	58	15.80	39.60	25.67	6.75
Sit Reach Test (cm)	58	16.10	32.20	24.67	3.75
30 m Sprint Test (sec)	58	4.97	6.96	5.79	0.48
505 Agility Test (sec)	58	3.24	5.93	4.09	0.60
Push-up Test (pcs)	58	6.00	31.00	14.64	5.22
Shuttle Test (pcs)	58	15.00	38.00	28.53	4.69

*=p<0.05

The descriptive statistical values of age, height, body weight, right and left hand grip strength, vertical jump test, sit-stand flexibility test, 30-metre sprint test, 505 agility test, push-up test, and sit-up test of the research group are shown in Table 1.

Table 2. Descriptive values of age and anthropometric characteristics classified according to relative age and biological maturity groups

Variables		N	Min.	Max.	X̄	S.d.
Age (Year)	Q1	8	12.83	12.99	12.89	0.04
	Q2	18	12.52	12.73	12.63	0.06
	Q3	16	12.24	12.53	12.40	0.08
	Q4	16	12.02	12.26	12.16	0.08
	Total	58	12.02	12.99	12.57	0.26
	Early	12	12.02	12.48	12.23	0.13
	On-time	23	12.24	12.71	12.49	0.13
	Late	23	12.55	12.99	12.82	0.13
	Total	58	12.02	12.99	12.57	0.26
Height Length (cm)	Q1	8	167.00	173.00	169.88	2.23
	Q2	18	161.00	167.00	163.78	2.24
	Q3	16	156.00	160.00	158.81	1.28
	Q4	16	135.00	156.00	147.44	5.54
	Total	58	135.00	173.00	158.74	8.48
	Early	12	166.00	173.00	168.83	2.37
	On-time	23	159.00	165.00	161.70	2.08
	Late	23	135.00	158.00	150.52	6.62
	Total	58	135.00	173.00	158.74	8.48
Body Weight (kg)	Q1	8	47.30	64.50	58.54	5.97
	Q2	18	42.70	67.10	53.71	7.41
	Q3	16	39.20	63.10	50.96	7.81
	Q4	16	29.10	53.40	41.13	6.75
	Total	58	29.10	67.10	50.15	9.26
	Early	12	44.80	64.50	57.23	6.68
	On-time	23	40.90	67.10	52.77	7.82
	Late	23	29.10	58.20	43.83	7.88
	Total	58	29.10	67.10	50.15	9.26

*=p<0.05

The age, height, and body weight values of the study group, grouped by relative age and biological maturity, are shown in Table 2. Accordingly, the age, height, and body weight values of the study group grouped by relative age groups are Q1>Q2>Q3>Q4, while the order of these values by maturity groups is Early>On-time>Late.

Table 3. Descriptive values of performance test results classified according to relative age and biological maturity groups

Variables		N	Min.	Max.	X̄	S.d.
Right Hand Grip Force (kg)	Q1	8	20.10	26.80	24.83	2.09
	Q2	18	17.20	32.60	24.84	4.14
	Q3	16	13.80	29.40	22.21	5.10
	Q4	16	13.20	24.10	18.06	3.86
	Total	58	13.20	32.60	22.24	4.94
	Early	12	20.10	30.10	25.74	2.62
	On-time	23	13.80	32.60	22.72	4.86
	Late	23	13.20	29.40	19.94	4.87
	Total	58	13.20	32.60	22.24	4.94
Left Hand Grip Strength (kg)	Q1	8	17.70	30.30	23.40	3.86
	Q2	18	17.20	24.60	21.22	2.17
	Q3	16	15.20	30.20	21.01	4.03
	Q4	16	11.30	24.60	16.98	4.06
	Total	58	11.30	30.30	20.29	4.09
	Early	12	17.70	30.30	22.60	3.66
	On-time	23	15.20	30.20	21.13	3.41
	Late	23	11.30	25.50	18.24	4.12
	Total	58	11.30	30.30	20.29	4.09
Vertical Jump Test (cm)	Q1	8	21.60	32.60	28.24	4.06
	Q2	18	21.10	39.60	32.19	6.33
	Q3	16	17.60	31.30	21.33	3.17
	Q4	16	15.80	31.30	21.42	4.03
	Total	58	15.80	39.60	25.68	6.75
	Early	12	21.60	38.60	30.35	5.01
	On-time	23	17.60	39.60	27.65	7.59
	Late	23	15.80	31.30	21.27	3.42
	Total	58	15.80	39.60	25.68	6.75
Sit Reach Test (cm)	Q1	8	25.10	32.20	28.30	2.18
	Q2	18	21.30	30.30	26.77	2.33
	Q3	16	18.50	29.10	23.14	2.88
	Q4	16	16.10	32.10	22.02	3.80
	Total	58	16.10	32.20	24.67	3.75
	Early	12	25.10	32.20	28.39	2.12
	On-time	23	18.50	30.20	25.01	2.95
	Late	23	16.10	32.10	22.38	3.52
	Total	58	16.10	32.20	24.67	3.75
30 m Sprint Test (sec)	Q1	8	5.12	5.73	5.38	0.22
	Q2	18	5.02	6.53	5.66	0.38
	Q3	16	4.97	6.93	5.77	0.49
	Q4	16	5.24	6.96	6.16	0.46
	Total	58	4.97	6.96	5.79	0.49
	Early	12	5.12	5.73	5.43	0.21
	On-time	23	4.97	6.53	5.70	0.39
	Late	23	5.12	6.96	6.06	0.52
	Total	58	4.97	6.96	5.79	0.49

*=p<0.05

Table 3. (Continuation) Descriptive values of performance test results classified according to relative age and biological maturity groups

Variables		N	Min.	Max.	X̄	S.d.
505 Agility Test (sec)	Q1	8	3.33	3.89	3.65	0.20
	Q2	18	3.41	4.18	3.76	0.20
	Q3	16	3.24	5.38	4.09	0.49
	Q4	16	4.03	5.93	4.67	0.71
	Total	58	3.24	5.93	4.09	0.60
	Early	12	3.33	3.89	3.69	0.19
	On-time	23	3.24	4.19	3.82	0.26
	Late	23	3.68	5.93	4.56	0.69
	Total	58	3.24	5.93	4.09	0.60
Push-up Test (pcs)	Q1	8	20.00	31.00	24.13	3.64
	Q2	18	14.00	21.00	16.78	1.96
	Q3	16	12.00	14.00	13.00	0.82
	Q4	16	6.00	12.00	9.13	1.93
	Total	58	6.00	31.00	14.64	5.22
	Early	12	18.00	31.00	22.58	3.75
	On-time	23	13.00	19.00	15.00	1.65
	Late	23	6.00	14.00	10.13	2.26
	Total	58	6.00	31.00	14.64	5.22
Shuttle Test (pcs)	Q1	8	34.00	38.00	35.50	1.31
	Q2	18	29.00	34.00	31.22	1.73
	Q3	16	26.00	29.00	27.88	0.96
	Q4	16	15.00	25.00	22.69	2.65
	Total	58	15.00	38.00	28.53	4.69
	Early	12	33.00	38.00	34.83	1.47
	On-time	23	28.00	33.00	29.78	1.48
	Late	23	15.00	28.00	24.00	3.00
	Total	58	15.00	38.00	28.53	4.69

*=$p<0.05$

The results of the research group performance tests are shown in Table 3. According to the relative age groups of the research group, the ranking of the scores for left hand grip strength, seated extension test, 30-m test, 505-mobility test, push-up test, and seated extension test is Q1>Q2>Q3>Q4. However, the ranking of the right hand grip strength values is Q2>Q1>Q3>Q4. The ranking of the vertical jump test values is Q2>Q1>Q1>Q4>Q3. The ranking of all performance test scores obtained according to the biological maturity groups of the research group, except for the 30m sprint test and the 505 agility test, is Early>On-time>Late. The ranking of the scores of the 30m sprint test and the 505-mobility test is Early<On-time<Late.

Table 4. Comparison results between groups according to relative age groups

Dependent Variable	Relative Age Groups				Kruskal-Wallis		Post-Hoc Comparisons
	Q1 (N=8)	Q2 (N=18)	Q3 (N=16)	Q4 (N=16)	Value	p	
Anthropometry							
Height Length (cm)	169.87	163.78	158.81	147.44	52.802	**0.001***	Q1>Q2>Q3>Q4
Body Weight (kg)	58.54	53.71	50.96	41.13	24.785	**0.001***	Q1&Q2&Q3>Q4
Performance Tests							
Right Hand Grip Strength	24.82	24.84	22.21	18.06	18.788	**0.001***	Q1&Q2&Q3>Q4
Left Hand Grip Strength	23.40	21.22	21.00	16.98	15.351	**0.002***	Q1&Q2=Q3>Q4
Vertical Jump Test	28.24	32.19	21.32	21.42	31.117	**0.001***	Q1&Q2>Q4>Q3
Sit Reach Test	28.30	26.77	23.14	22.02	25.691	**0.001***	Q1&Q2>Q3>Q4
30 m Sprint Test	5.38	5.66	5.77	6.16	16.797	**0.001***	Q1&Q2&Q3<Q4
505 Agility Test	3.65	3.76	4.09	4.67	32.421	**0.001***	Q1&Q2&Q3<Q4
Push-up Test	24.12	16.78	13.00	9.13	52.008	**0.001***	Q1>Q2>Q3>Q4
Shuttle Test	35.50	31.22	27.88	22.69	52.046	**0.001***	Q1>Q2>Q3>Q4

*=p<0.05

The results of the Kruskal Wallis H test and post hoc analysis for comparison between groups according to the relative ages of the study group are shown in Table 4. According to this, the results of Kruskal Wallis H-test are statistically significant (p<0.05) for all tested variables. According to the results of post hoc analysis for comparison between groups, the ranking of values of body height, push-up test and pendulum test is Q1&Q2&Q3>Q4, while the ranking of values of body weight, grip strength of right hand, 30 m sprint test, 505 agility test is Q1&Q2&Q3>Q4. The ranking order of the values of left hand grip strength, vertical jump test and sitting stretch test is Q1&Q2>Q4 > Q3.

Table 5. Comparison results between groups according to maturity groups

Dependent Variable	Maturity Groups			Value	p	Post-Hoc Comparisons
	Early (N=12)	On-time (N= 23)	Late (N=23)			
Anthropometry						
Height Length (cm)	168.83	161.69	150.52	49.61	**0.001***	Early > On-time > Late
Body Weight (kg)	57.23	52.78	43.82	20.02	**0.001***	Early & On-time > Late
Performance Tests						
Right Hand Grip Strength	25.74	22.71	19.94	11.77	**0.001***	Early & On-time > Late
Left Hand Grip Strength	22.60	21.13	18.24	9.50	**0.001***	Early & On-time > Late
Vertical Jump Test	30.35	27.65	21.27	17.60	**0.001***	Early & On-time > Late
Sit Reach Test	28.39	25.00	22.38	22.29	**0.001***	Early > On-time > Late
30 m Sprint Test	5.42	5.70	6.06	15.23	**0.001***	Early & On-time < Late
505 Agility Test	3.68	3.82	4.56	28.36	**0.001***	Early & On-time < Late
Push-up Test	22.58	15.00	10.13	47.86	**0.001***	Early > On-time > Late
Shuttle Test	34.83	29.78	24.00	49.15	**0.001***	Early > On-time > Late

*=p<0.05

The results of the Kruskal Wallis H test and post hoc analysis for intergroup comparison according to the maturity groups of the research group are shown in Table 5. According to this, the results of Kruskal Wallis H-test were statistically significant (p<0.05) for all tested variables. According to the results of post hoc analysis for the comparison between the groups, the order of comparison between the groups for the values of body height, sitting stretch test, push-up test and sit-up test was Early > Timely > Late, while the order of comparison between the groups for the values of body weight, rightand left hand grip strength and vertical jump test was Early & Timely > Late. The order of comparison between the groups for the values of the 30 Sprint Test and the 505 Agility Test is Early & Timely < Late.

DISCUSSION AND CONCLUSION

The aim of the study was to examine the effects of biological maturity and relative age on physical fitness and sport-specific skills in young futsal players. Biogrouping, which is based on growth and biological maturation characteristics instead of relative age, is a method that aims to create an equal training and competition environment to provide young athletes with the most favorable development opportunities (Cumming et al., 2017).

A significant difference was found between the values of height, body weight, right and left hand grip strength, vertical jump test, sit-stand flexibility test, 30-metre sprint test, 505 agility test, push-up test, and shuttle test in young male futsal players born in the early months

of the year and matured early compared to athletes born in the latter months of the year and matured late. The result of our study shows that futsal players born in the first months of the year and matured early are taller and heavier than futsal players born in the last months of the year and matured late. It is also found that these athletes have better performance scores than their peers born in the last months of the year and matured later.

The concept of biological maturation, which explains that athletes in the same age group have certain advantages and disadvantages depending on the month of birth, has been studied not only in football but also in other sports (Nakata & Sakamoto, 2011). In these studies, it is found that the distribution of birth dates of young elite athletes in teams of the same age group by month is high in the first months of the year and decreases in the last months of the year. These results show the presence of a biological maturation effect in the selection of athletes and the formation of teams (Ford et al., 2011). In the upper categories, it is known that athletes born in the first months of the year have a low chance of being selected or participating in the team, which is also supported by the research, while in the lower categories, a high level of physical developmental superiority or a maturation difference factor is found. One of the most important reasons for this situation is the desire to achieve early success on youth teams. This is because young athletes go through different stages of physical and physiological development during adolescence, depending on their age, and therefore may be superior to their peers. This superiority can become an opportunity to be selected and favoured. When a team is formed of athletes with early maturation and physical superiority in the same age group, the chances of success for that team increase (Moore et al., 2020).

When examining similar studies in the literature, it appears that early maturing athletes perform better compared to peers who have reached the same relative age but later or normal biological maturity. The age variable is commonly used in determining motor skills in children and athletes (Batez et al., 2021). In their study, Abbott et al. (2019) compared the physical and technical performance of soccer players who were divided into maturity groups within the age group 11-15 years and participated in soccer competitions. As a result of the study, they found that the performance of the early maturing athletes was better than the other groups. Bradley et al. (2019) indicated that they felt more comfortable playing ball with children of the same height and weight in a tournament grouped by maturity level, and that they felt more comfortable practicing basic skills and improved in their performance. Cumming et al. (2017) found that classifying 11-14-year-old soccer players by maturity group as a result of performance measures and assessments increased their competitive experience. Figueiredo et al. (2021), in

their study of 5306 female and 126285 male soccer players and 2437 female and 23988 male soccer players in the U7, U9, U11, U13, U15, and U19 age groups registered with the Portuguese Soccer Federation, found that relative age positively influenced athletic performance and that athletes born in the early months of the year were more successful. Morales et al. (2017), in their study of 376 male and 227 female athletes participating in the Brazilian Men's and Women's National Futsal League, found that the majority of athletes were born in the first months of the year and were favored based on relative age. Mülazımoğlu et al. (2013) conducted a study of 780 male soccer players and found that the majority of athletes who were preferred in the lower age groups, with the exception of professional teams (A), were born in the first months of the year. Oliveira Castro et al. (2022), in their study of a total of 387 elite male futsal players, including 97 athletes in the U15 age category, 88 athletes in the U17 age category, 116 athletes in the U20 age category, and 86 athletes in the senior age category, found that the majority of athletes were born in the early months of the year and were preferred based on relative age. Lidor et al (2021) conducted a study on 1397 athletes from gymnastics, judo, swimming, tennis, track and field, soccer, handball, volleyball, and water polo (390 females, 1007 males) to investigate the effect of relative age in Israeli athletes aged 14-18 years and emphasized that although there was no effect of relative age on female athletes, male athletes born in the first months of the year had stronger abilities than their peers. Similar results are evident in studies of basketball. In a study conducted by Saç and Çolak (2019) to investigate the age-related anthropometric, physiological, and biological maturation characteristics of young basketball players aged 12-14 years, it was emphasized that physical and physiological parameters related to relative age and biological maturation level during puberty are important for success in basketball.

On the other hand, it is also known that the maturity level of athletes affects performance. Jones et al. (2000) studied the relationship between maturation and physical fitness in 161 girls and 152 boys aged 10-16 years and reported that maturation affects physical fitness, especially in boys, although it affects both sexes. (2016) compared the differences in size, function, and sport-specific technical abilities of 60 young soccer players in the U14 and U17 age categories in relation to differences in biological maturation status and emphasized that maturation affects body weight, height, flexibility, and upper extremity muscle strength. Giuriato et al. (2021) studied the effects of maturation on motor performance in adolescents in 771 subjects aged 14-19 years and emphasized that maturation has effects on body size and body shape and this contributes to motor performance. Malina et al. (2005b) studied the effects of maturation on

body size and sport-specific skills of athletes on 69 soccer players aged 13.2-15.1 years and reported that maturation has an effect on body size.

The results of our study suggest that maturity level, as well as relative age, is an important factor to consider in talent selection and training programs in this age range. In addition, we believe that by creating more league categories, talented athletes who are disadvantaged due to being born in the latter months of the year will not be disengaged from the sport by preventing large performance gaps between their competitors.

Recommendations

Dividing young athletes into training and competition groups based on biological maturation has the potential to prevent potential injuries in advance, create a fair competitive environment, and promote performance development by providing effective training conditions. The application of biological maturation as well as chronological age to talent selection and training groups, including in soccer and other team sports, should ensure that athletes with the same level of performance train together. This approach can also help reduce feelings of inadequacy by making athletes feel more comfortable and able to reach their true level of performance. Apart from the fact that this situation reveals differences in athletes' anthropometric and performance levels due to differences in relative age and biological maturity, taking maturity levels into account can make a valuable contribution to talent selection and the organization of training programs.

GENİŞLETİLMİŞ ÖZET

GİRİŞ

Büyüme ve olgunlaşmadaki bireysel farklılıklar, yetenekli genç sporcuların belirlenmesi ve gelişmesi için çok önemlidir. Aynı bağıl yaş grubu içerisinde hem sedanterlerde hem de sporcularda, olgunluk durumlarının önemli ölçüde farklılık gösterdiği bilinmektedir (Şengür ve ark., 2021).

Aynı kronolojik yaşta olup erken olgunlaşan sporcular, geç veya normal olgunlaşma düzeylerine sahip sporculardan daha iyi bir performans ortaya koyabilmektedir. Adolesan gelişim sürecinde, boy uzunluğu ve vücut ağırlığının artmasının yanı sıra koşu hızı, çeviklik ve kuvvet gelişimi gibi parametrelerde de artış söz konusudur (Saç & Çolak, 2019). Biyolojik olgunlaşma ile birlikte dikkat edilmesi gereken diğer bir konuda aynı yaşta olan sporcuların doğum aylarıdır. Aynı yıl içerisinde, yılın ilk ayları doğan çocukların yılın son ayları doğanlardan hemen hemen bir yıl daha büyük olabilme durumu dikkat çekicidir (Mülazımoğlu ve ark., 2013). Buna bağıl yaş etkisi denilmektedir. Göreli yaş etkisi, aynı yaştaki sporcuların gruplandırılması nedeniyle grup içindeki bireyler arasında neredeyse bir yıl kadar fark olması ve böylelikle ay olarak yaşı daha büyük olan sporcuların diğerlerine göre çok daha

iyi performans göstermesi durumudur (Yavuz, 2019). Spor dallarında yarışmalar yaş kategorilerine göre yapılmaktadır. Buna göre sporcuların doğum ay ve günleri ile yaşları hesaplanmamaktadır. Bunun yerine yalnızca doğum yılları ile yarışma yaşı belirlenmektedir. Bu durum sebebiyle sporcuların biyolojik olgunlaşma düzeyleri de, bağıl yaş etkisi ile birlikte değişkenlik gösterebilmektedir.

Futsal, futbolun uluslararası yönetim organı FIFA (Federation deFootball Association) tarafından resmi olarak onaylanmış, futbolun salonda oynanan türüdür (Göral, 2014). Futsal, düz çizgi olarak adlandırılan, sık ve kararlı, yüksek yoğunluklu ve kısa süreli oyun eylemlerinin en yüksek yüzdesine sahip, aralıklı bir spordur (Alvares ve ark., 2020). Futsal ülkemizde Türkiye Futbol Federasyonu Bünyesinde oynandığı gibi (Türkiye Futbol Federasyonu, 2023) Gençlik ve Spor Bakanlığı Okul Sporları Faaliyetleri içerisinde de faaliyetler gerçekleştirilmektedir. Okul Sporları Faaliyetleri içerisinde Küçükler (10-11 yaş), Yıldızlar (12-13 yaş), Gençler-B(14-15 yaş) ve Gençler-A (14-17 yaş) yaş kategorilerinde müsabakalar düzenlenmektedir (Gençlik ve Spor Bakanlığı, 2023). Aynı yaş kategorinde hatta aynı yaşta olan sporcuların doğum ayları farklılıkları fiziksel özelliklerini ya da biyolojik olgunlaşma ve bağıl yaş etkisi performans durumlarını etkileyebilir. Bu durum futsal sporcularında da görülmektedir. Çalışmamızın amacı genç futsal oyuncularında biyolojik olgunluk ve bağıl yaşın fiziksel uygunluk ve spora özgü beceriler üzerindeki etkilerinin incelenmesidir.

YÖNTEM

Çalışmaya okul sporları futsal maçlarına katılan 12 yaş grubunda 58 erkek sporcu katılmıştır. Araştırma grubunun yaşları 12,57±0,26 yıl, boy ortalaması 158,74 ± 8,48 cm ve vücut ağırlıkları 50,15 ± 9,25 kg'dır. Araştırma grubunun boy uzunluğu ölçümleri SECA marka 2013 model taşınabilir stadiometre ile çıplak ayakla, vücut ağırlıkları ise dijital tartı ile üzerlerinde şort ve tişört varken ölçülmüştür. El kavrama kuvveti ölçümleri ise Takei Marka el- kavrama dinamometresi ile ölçülmüştür. Dikey sıçrama testi için Fusion Sport Marka Smart Jump Model sıçrama matı kullanılmış, otur-eriş testi için otur-eriş sehpası kullanılmıştır. 30 m sprint testi ve 505 çeviklik testinde Fusion Sport Marka Smart Speed Model fotosel kullanılmıştır. Şınav ve mekik testlerindeyse kronometre kullanılarak test gerçekleştirilmiştir. Araştırma grubunun bağıl yaşları için bir yıl dört çeyreğe bölünmüştür. Biyolojik olgunluğun hesaplanması için tahmini yetişkin vücut boyu (PAS) olgunluk göstergesi olarak kullanılmıştır (Khamis & Roche, 1994). Elde edilen veriler normal dağılım göstermediği için Kruskal Wallis H testi yapılmış, grup içi karşılaştırmalar için Post-Hoc analizi yapılmıştır. Ayrıca betimsel istatistiklerde yapılmıştır. Tüm istatistiksel analizler SPSS 23 istatistik programı ile gerçekleştirilmiştir.

BULGULAR

Araştırma grubunun yaş, boy uzunluğu, vücut ağırlığı, sağ ve sol el kavrama kuvvetleri, dikey sıçrama testi, otur-eriş esneklik testi, 30 m sprint testi, 505 çeviklik testi, şınav testi ve mekik testi değerlerinin bağıl yaş gruplarına göre sınıflandırılmış tanımlayıcı istatistiktik değerleri Q1>Q2>Q3>Q4 şeklinde sıralanmaktadır. Bağıl yaş gruplarına göre ve olgunluk durumuna göre yapılan Kruskal Wallis H testi sonuçları istatiksel olarak anlamlıdır (p<0,05).

TARTIŞMA VE SONUÇ

Genç erkek futsal oyuncularından yılın ilk aylarında doğan ve erken olgunlaşan sporcuların, yılın son aylarında doğan ve geç olgunlaşan sporculara göre boy uzunluğu, vücut ağırlığı, sağ ve sol el kavrama kuvvetleri, dikey sıçrama testi, otur-eriş esneklik testi, 30 m sprint testi, 505 çeviklik testi, şınav testi ve mekik testi değerlerinde anlamlı düzeyde farklılık tespit edilmiştir. Çalışmamız sonucunda yılın ilk aylarında doğan ve erken olgunlaşan futsal oyuncularının, yılın son aylarında doğan ve geç olgunlaşan futsal oyuncularına göre daha uzun ve ağır oldukları görülmektedir. Ayrıca bu sporcuların yılın son aylarında doğan ve geç olgunlaşan yaşıtlarından daha iyi performans değerlerine sahip oldukları sonucu ortaya çıkmaktadır.

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Fikir ve Kavramsal Örgü *Idea or Notion*	Araştırma hipotezini veya fikrini oluşturmak *Form the research hypothesis or idea*	Abdüsselam TURGUT Hakan YAPICI
Tasarım *Design*	Yöntem ve araştırma desenini tasarlamak *To design the method and research design.*	Abdüsselam TURGUT Hakan YAPICI
Literatür Tarama *Literature Review*	Çalışma için gerekli literatürü taramak *Review the literature required for the study*	Abdüsselam TURGUT Hakan YAPICI
Veri Toplama ve İşleme *Data Collecting and Processing*	Verileri toplamak, düzenlemek ve raporlaştırmak *Collecting, organizing and reporting data*	Abdüsselam TURGUT Hakan YAPICI
Tartışma ve Yorum *Discussion and Commentary*	Elde edilen bulguların değerlendirilmesi *Evaluation of the obtained finding*	Abdüsselam TURGUT Hakan YAPICI

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Etik Kurul Beyanı/ *Statement of Ethics Committee*

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