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Comparison on Effects of Various Exercise Methods in Football on Children's Some Physical, Physiological and Technical Capacity

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ABSTRACT The aim of this study is to research whether interval running or 4X4 narrow field practices is a more effective training method for developing aerobic capacity, anaerobic power, strength, speed, flexibility and technical capacity of children during preparation season. Children have been randomly divided into three groups as "Narrow Field Practice Group (NFP)" (n=8), "Interval Running Group (IR)" (n=8) and "Control Group (CG)" (n=8). Aerobic capacity, speed, leg strength, vertical jump, flexibility, anaerobic power, body mass index and football technical scores of children were measured then for the duration of six weeks. NFP and IR groups participated in 4x4 minutes and 3 days a week narrow field practices and interval running practices. CG participated in low intensity training and final measurements were taken. SPSS was used in analyzing the data acquired. Values acquired as a result of preliminary, final tests were statistically compared with help of ANNOVA test. As a result of the study, significant increase was observed in VO_2max, passing and dribbling values of NFP and IR groups, sprint, juggling on feet and knee, passing and dribbling values of NFP group.

INTRODUCTION

Football is a highly coordinated sport discipline in which aerobic and anaerobic efforts are used continually; and speed, strength, agility, flexibility, mobility, balance, muscular and cardio-respiratory endurance, coordination are factors that have effects on performance simultaneously (Akgün 1994). Players must be competent enough in all skills pertaining to football instead of being highly competent in one skill. Therefore, training methods that help in increasing productivity in all skills which are required to play football are quite important. Nowadays (Aslan 2012), from this perspective, while organizing training for football, physiological needs required by the sport needs, must be well analyzed. Determination of physiological needs are required determining motion analysis methods on football and in which often, violence is also included and scope of the athletes doing basic movements as running, jumping, turning, kicking, dribbling during the competitions (Sever 2016). Trainers usually employ running drills without a ball in order to increase players' endurance. On the other hand; narrow field practice is one of the most often used exercises by trainers for football training (Köklü 2008). Narrow field practices includes the moves that take place during a game such as passing the ball with reduced number of players, controlling the ball under pressure, quick decision making and kicking/shooting the ball (Köklü 2011). Also, training exercises pertaining to football that increase aerobic endurance such as changing directions while running, turning and dribbling are also utilized along with narrow field practices (Stone and Kilding 2009). It is believed that these exercises have effect on children's technical capacity along with their physical and physiological parameters.

So, the aim of this study within this context is to determine which of those different training methods is developing more of children's physical, physiological and technical capacity during the preparatory period that is, only in a limited time.

METHODOLOGY

Participants

24 boys who are at primary school age voluntarily participated in this study with permission from their parents as a family voluntary study principle. Children were divided randomly into three groups as "Narrow Field Practices

Group (NFP)", "Interval Running Group (IR)", and "Control Group (CG)". In NFP group, average age is 12.25+1.03 year. average height is 153.58+7.35 cm, average weight is 41.83+5.16 kg. In IR group, average age is 11.88+1.12 year, average height is 150.03+8.75 cm, average weight is 42.11+10.41 kg. In CG group, average age is 12.38+0.916 year, average height is 155.45+8.11 cm, average weight is 51.11+11.34 kg.

Measures

Height and Weight: Weights of participants were measured by a 0.1 kg sensitivity electronic scale and the heights of participants were measured by 0.01 cm sensitivity electronic height measuring device.

Body Mass Index: Measurements of participants were taken between 8:00 – 10:00 am in the morning before taking any liquid or food and after bathroom use. During the measurement light clothes were preferred and measurements were taken without shoes or socks but bare foot.

Heart Rate (HR): HR measurements were recorded by professional HR measurement device such as Polar GEONAUTE 110 (Made in France) that was developed to measure heartbeats and is able to record every single heartbeat.

10m – 30m Sprint Test: Test was taken at indoor tracks where start and end lines were previously determined as 10 and 30 meters. 0.01 sensitivity photocell detectors (New test Power timer) were installed at the start and finish lines and better result of 2 tryouts with rest period was taken as a result of the test.

Leg Strength: Measurement was performed with use of Takei brand (Made in Japan) leg dynamometer after five minutes of warming up after participants placed their feet on dynamometer table as their knees bent, arms tight, back straight and body slightly leaning forward and pulled dynamometer bar up as much as they can while they gripped it with both hands. Better result was recorded as a test result after two tryouts.

Flexibility Measurements: Sit and reach test was performed in order to measure flexibility. Players sat on the ground and placed their foot bottoms without socks evenly. Participants' body leaned forward, knees locked and hands in front; they tried to reach and push the ruler forward. 1-2 seconds waiting time was performed at the farthest reach point. Test was repeated twice and the better performance was recorded as a test result.

Shuttle Run Test: Prosport Tmr Esc 1500, Conconi & Shuttle Run Tests Timer (Tumer Engineering, Ankara) and Prosport shuttle gage were used for this test. Aerobic strength values of participants were determined from VO_2max norms chart according to the number of shuttles they ran.

Technical Measurements: Participants were asked to perform feet-knees juggling and head juggling and number of bouncing until they dropped the ball on the ground was recorded. Again, one passing and driving the ball, dribbling, passing and shooting/kicking tests were performed twice. Better results of each repetition were recorded as their test results.

Protocol: This study was performed in a region of 830 meters altitude (Temperature for the month of October 160 C – 46 % humidity, for the month of November 50 C – 32 % humidity) and it lasted 8 weeks. All participants without exception were asked to train low intensity aerobic based exercises for 55 minutes a day, 3 days a week for 2 weeks with average HR of 120-160. These exercises were performed in order for participants to have anatomic conformity and to prevent any possible injury. After two weeks of exercises, participants rested one day. After groups were formed, three days a week for the following six weeks IR group performed running for 4x4 minutes (with 3 minutes active resting periods in between) with the range of 90-95 percent of HRmax; NFP group played narrow field game in two teams of 4 participants in a field dimensions 24m x 36 m for 4x4 minutes (with 3 minutes active resting periods in between) with the range of 90-95 percent of HRmax. In the meantime, control group performed low intensity tactic exercises with the range of 55-65 percent of HR max. All three groups trained together in the remaining exercises such as warming up and cooling down periods. Trainings lasted 55 minutes; 15 minutes for warming up, 25 minutes for main exercise (16 minutes running + 9 minutes resting) and 15 minutes for cooling down. For the duration of 6 weeks of training period, no other technical, endurance, strength, speed or flexibility exercises were performed but only Interval Runnings and Narrow Field Practices were performed by two experimental groups. No other training was performed for the remaining days of any given week during the experiment period.

RESULTS

As a result of comparison on preliminary tests of physical attributes of groups via ANOVA, it was observed that, statistically there was no significant difference between groups in terms of age, height, weight, HRmax, HRrest, body mass index, body fat in percentage, body fat in kg and body mass without fat ($p>0.05$) (Table 1).

As a result of comparison on preliminary tests of physiological capabilities of groups via ANOVA. it was observed that, statistically there was no significant difference between groups in terms of vertical jump, leg strength, 10 meters sprint, 30 meters sprint, anaerobic power, flexibility, shuttle run and VO_2max ($p>0.05$) (Table 2).

As a result of comparison on preliminary tests of technical capabilities of groups via ANOVA (Table 3), it was observed that, statistically there was no significant difference between groups ($p>0.05$).

As a result of comparison on final tests of physical attributes of groups via ANOVA (Table 4), it was observed that, statistically there was no significant difference between groups in terms of height, weight, HRrest, body fat in percentage and body mass without fat ($p>0.05$). It was observed that statistically there was significant difference in terms of HRmax, body mass index and body fat in kg ($p<0.05$).

As a result of comparison on final tests of physiological capabilities of groups via ANOVA (Table 5), it was observed that, statistically there was no significant difference between groups in terms of vertical jump, leg strength, 30 meters sprint, anaerobic power and flexibility ($p>0.05$); however it was observed that statistically there was 0.01 level difference in terms of shuttle run and VO_2max ($p<0.01$), and statistically 0.05 level difference in terms of 10 meters sprint ($p<0.05$). When checked the test results in terms of VO_2max, it was observed that there was a significant difference between Narrow Field Practice Group and Control group; and Interval Running Group and Control Group ($p<0.01$).

As a result of comparison on final tests of technical capabilities of groups via ANOVA (Ta-

Table 1: Preliminary-test average values of groups' physical attributes and results of comparison (ANOVA)

Variables	*Interval running group(n=8)x ± ss*	*Narrow field group(n=8)x ± ss*	*Control group practices (n=8)x ± ss*	*F*	*p*
Age (year)	12.25± 1.03	11.88± 1.12	12.38± 0.916	0.511	0.607
Height (cm)	153.58± 7.35	150.03± 8.75	155.45± 8.11	0.923	0.413
Weight (kg)	41.83± 5.16	42.11±10.41	51.11±11.34	2.534	0.103
HRmax (beat)	195.50± 2.26	195.00± 2.26	194.75± 4.89	0.102	0.903
HRrest (beat)	86.62± 6.16	84.50± 5.68	89.00± 4.40	1.356	0.279
Body mass index (kg/m^2)	18.31± 1.66	18.61± 2.74	21.02± 3.36	2.456	0.110
Body fat (%)	17.83± 3.19	18.20± 3.89	22.28± 6.40	2.205	0.135
Body fat (kg)	7.38± 1.11	7.70± 2.64	11.71± 5.11	4.056	0.032
Body mass without fat (kg)	34.46± 5.05	34.41± 8.43	39.40± 7.66	1.268	0.302

$^{*}p<0.05$. $^{**}p<0.01$

Table 2: Preliminary-test average values of groups' physiological capabilities and results of comparison (ANOVA)

Variables	*Interval running group(n=8)x ± ss*	*Narrow field group(n=8)x ± ss*	*Control group practices (n=8)x ± ss*	*F*	*p*
Vertical jump (cm)	24.48± 5.07	25.96± 7.01	27.67± 6.07	0.546	0.587
Leg strength (kg)	74.06± 8.45	72.06± 5.21	72.00±14.50	0.107	0.899
10 m sprint (sec)	2.20± 0.19	2.18± 0.10	2.25± 0.30	0.249	0.782
30 m sprint (sec)	5.58± 0.42	5.51± 0.39	5.63± 0.42	0.169	0.845
Anaerobic power (kgm/sec)	46.19±10.33	47.99±18.73	59.93±17.03	1.789	0.192
Flexibility (cm)	18.37± 6.07	16.05± 6.24	13.28± 4.38	1.635	0.219
Shuttle run (number)	37.63± 6.50	37.25± 6.34	32.75± 4.97	1.647	0.217
VO_2max ($ml.kg^{-1}.min^{-1}$)	31.75± 2.43	31.51± 2.39	30.17± 1.52	1.235	0.311

$^{*}p<0.05$. $^{**}p<0.01$

Table 3: Preliminary-test average values of groups' technical capabilities and results of comparison (ANOVA)

Variables	*Interval running group(n=8)x ± ss*	*Narrow field group(n=8)x ± ss*	*Control group practices (n=8)x ± ss*	*F*	*p*
Technical points	0.21± 2.31	-0.07± 0.99	1.49± 3.26	1.230	0.313
Feet-Knee juggling (number)	31.38±11.00	36.50±10.25	30.63± 6.82	0.899	0.422
Head juggling (number)	8.25± 2.31	6.38± 1.06	6.63± 1.40	2.939	0.075
Dribbling with one pass (sec)	34.41± 4.53	33.40± 2.70	37.16± 2.01	2.835	0.081
Dribbling (sec)	16.12± 2.73	16.36± 2.74	16.66± 1.87	0.096	0.909
Passing the ball (points)	5.13± 1.12	4.13± 1.35	4.50± 1.41	1.199	0.321
Shoot/kick (points)	8.63± 1.84	7.50± 2.56	7.00± 1.30	1.421	0.264

$^{*}p<0.05$. $^{**}p<0.01$

Table 4: Final-test average values of groups' physical attributes and results of comparison (ANOVA)

Variables	*Interval running group(n=8)x ± ss*	*Narrow field group(n=8)x ± ss*	*Control group practices (n=8)x ± ss*	*F*	*p*
Height (cm)	154.05±7.49	150.56± 8.98	155.76± 8.12	0.831	0.449
Weight (kg)	43.81±4.87	43.40± 9.66	52.76±11.46	2.702	0.090
HRmax (beat)	200.88±3.79	199.00± 3.07	195.13± 4.91	4.303	0.027*
HRrest (beat)	86.25±4.46	81.87± 5.79	86.12± 6.69	2.451	0.111
Body mass index (kg/m^2)	18.43±0.86	18.88± 2.34	21.92± 3.63	4.428	0.025*
Body fat (%)	18.71±3.05	18.42± 3.83	23.72± 7.31	2.750	0.087
Body fat (kg)	8.12±1.13	7.96± 2.18	12.76± 5.66	4.672	0.021*
Body fat without fat (kg)	35.70±5.05	35.46± 8.33	40.00± 7.71	1.030	0.374

$^{*}p<0.05$. $^{**}p<0.01$

Table 5: Final-test average values of groups' physiological capabilities and results of comparison (ANOVA)

Variables	*Interval running group(n=8)x ± ss*	*Narrow field group(n=8)x ± ss*	*Control group practices (n=8)x ± ss*	*F*	*p*
Vertical jump (cm)	26.26± 5.51	27.90± 2.34	27.28± 5.95	0.150	0.862
Leg strength (kg)	76.56± 8.82	75.68± 6.16	72.31±14.32	0.376	0.691
10 m sprint (sec)	2.08± 0.16	2.06± 0.09	2.27± 0.21	4.107	0.031*
30 m sprint (sec)	5.34± 0.47	5.27± 0.34	5.65± 0.42	1.834	0.184
Anaerobic power (kgm/sec)	50.15± 10.33	53.93± 17.87	60.89± 15.69	1.059	0.365
Flexibility (cm)	19.31± 6.22	16.91± 6.13	13.71± 4.43	1.971	0.164
Shuttle run (number)	45.88± 7.41	46.13± 5.33	33.00± 4.47	13.080	0.000**
VO_2max (ml.kg^{-1}.min^{-1})	34.76± 2.60	34.86± 1.97	30.33± 1.57	12.208	0.000**

$^{*}p<0.05$. $^{**}p<0.01$

Table 6: Final-test average values of groups' technical capabilities and results of comparison (ANOVA)

Variables	*Interval running group(n=8)x ± ss*	*Narrow field group(n=8)x ± ss*	*Control group practices (n=8)x ± ss*	*F*	*p*
Technical points	0.43± 1.96	0.06± 1.85	0.83±2.64	0.692	0.512
Feet-Knee juggling (number)	32.63± 14.65	77.50± 22.67	38.75±9.28	17.436	0.000**
Head juggling (number)	9.00± 1.92	10.38± 1.50	8.13±2.74	2.281	0.127
Dribbling with one pass (sec)	32.39± 3.67	28.82± 2.60	37.13±2.22	16.514	0.000**
Dribbling (sec)	15.04± 2.19	12.86± 1.84	16.79±2.53	6.370	0.007**
Passing the ball (points)	5.13± 1.24	7.38± 0.91	5.88±1.12	8.605	0.002**
Shoot/kick (points)	9.13± 2.16	9.13± 2.16	8.25±1.75	0.480	0.625

ble 6), it was observed that, statistically there was no significant difference between groups in terms of technical points, head juggling and shooting/kicking ($p>0.05$) whereas there was statistically significant difference in terms of feet-knee juggling, dribbling with one passing, dribbling and passing ($p<0.01$).

DISCUSSION

Average age was 12.17±1.00 years, average height was 153.02±8.06 cm, and average weight was 45.02±9.98 kg among 24 students who participated in the study. Müniroglu and his colleagues reported that average height 143.28±11.85 cm and average weight was 37.17±10.29 kg of those young male football players with average age 11.60±1.66 year who participated in their study (Müniroglu et al. 2015). In the study conducted by Vanttinnen and others in Finland it was reported that average height was 1.54±0.10 meters and average weight was 41.6±7.6 kg of 12 years old male football players who participated in their study (Vattinen et al. 2007). Average age, body weight and height reported on these studies are similar to results reached in other studies. Average HRrest values of these students participated in the study was observed 86.70±5.55 beats and average HRmax values was observed 195.08±3.24 beats. Dagdelen reported in his study conducted in 2013 with boys age 12 to 14 that resting heart beats average of experiment group was 80.30±6.70 beats and resting heart beats average of control group was 77.06±4.20 (Dagdelen 2013). Alemdaroglu and his friends reported that in their study they conducted in 2012, average HRmax values was 197.8±4.1 beats of those professional male football players with average age of 15.8±0.4 whereas average HRmax values was 194.1±5.2 beats of those amateur football players with average age of 15.4±03 (Alemdaroglu et al. 2009). It is observed that average HRmax and HRrest values of participants in that study are similar to other study results that were examined. Average body mass index of athletes in preliminary measurement was observed as 19.31±2.84. During the study Çolak and Kaya conducted in 2006 in the province of Erzincan among children age 12-14, average body mass index was 18.11±3.21 kg/m2 among male participants of Erzincan City whereas it was 17.34±2.51 kg/m2 in outer boroughs of Erzincan (Çolak and Kaya 2006). Behdari and his friends reported that in their study they conducted in 2016 among male participants age 9-12, average body mass index was determined 16.46±1.41 kg/m^2 in the first group, 16.83±2.14 kg/m^2 in the second group and 17.34±2.33 kg/m^2 in the third group (Behdari et al. 2016). Average body mass indexes observed in other studies are similar to the average body mass index in this study. Average vertical jump of participating students was recorded as 26.04±5.98 cm. Average vertical jump values in the study Pienaar and Viljoen conducted in 2010 in South Africa among children age from 10 to 15 were 23.3±5.8 cm among 10 years old participants, 23.2±7.7 cm among 11 year old participants, 23.8±5.2 cm among 12 years old participants, 26.1±5.5 among 13 years old participants and 29.4±8.5 cm among 14 years old participants (Pienaar and Viljoen 2010). It can be discussed that average of vertical jump values in this study is similar to other studies examined. Leg Strength of participants was recorded as 72.70±9.74 kg. Savaº and Sevim recorded average leg strength of 14-16 years old basketball players as 88.7 kg in their study conducted in 1992 (Savas and Sevim 1992). Average leg strength of participants in this study is lower than the findings in study conducted by Savaº and colleagues and the reason behind this difference may be the experiment group was consisting of basketball players. Average of 10 meters sprint values of students was recorded 2.21±0.21 seconds and average of 30 meters sprint values of same students was recorded 5.57±0.39 seconds. Gonzalo and others reported that average of 10 meters sprint was 2.48 seconds in their study they conducted among male football players age from 9 to 12 (Gonzalo et al. 2012). It is understood that 10 meters and 30 meters sprint test results of this study is similar to the ones examined for comparison. Anaerobic power average of the athletes was recorded 51.37±16.32 kgm/sec. Saygin in his study in 2010 among 12 years old male participants, recorded average anaerobic power as 53.61±11.67 kgm/sec (Saygin 2010). Average flexibility value of football players was found 15.90±5.78 cm. In Diker and Müniroglu's study conducted in 2016 among soccer players with average 11.53±0.50 years of age it was reported that test average on flexibility experiment group was 16.4±4.6 cm and it was 17.6±4.7 cm in soccer players with average 13.06±0.25 years of age. Average flexibility val-

ues of footballers in our study is similar to others study results (Diker and Müniroglu 2016).

Average flexibility value of football players was found 15.90±5.78 cm. VO_2max values average of participants was recorded 31.14±2.18 ml.kg-1.min-1. In [a]enel's study conducted in 1998 among students with average 12.66 years of age it was reported that test average on VO_2max experiment group was 36.89±5.78 ml.kg-1.min-1 and it was 18.06±2.00 ml.kg-1.min-1in control group ([a]enel 1998). Average feet-knee juggling was 36.13±14.49 times, average head juggling was 8.00±3.17 times, average dribbling time with one pass was 35.20±3.72 seconds, average dribbling time was 16.38±2.38 seconds, average point for passing the ball was 4.58±1.31 points, average point for shooting/kicking was 7.71±2.01 points and total technical point was 0.4221 among participating students. In literature, there is not enough study regarding technical tests performed on children. Köklü recorded total technical points 0.0038 while average feet-knee juggling was 135.97 times, average head juggling was 17.63 times, average time for dribbling with one pass was 7.32 seconds, average time for dribbling was 12.36 seconds, average point for passing the ball was 5.94 points and average point for shooting/kicking was 10.69 points among participating football players in his study conducted with elite youth football players in 2011 (Köklü 2011). Some of the technical parameters show similarity with other studies whereas some of them are different. Reason for these differences may be because of league levels those athletes played football as well as differences of variables such as age, height, weight and body mass index.

CONCLUSION

In conclusion, it is observed that there are both similarities and differences between the researcher's study and the other studies. The researcher's think that different results in these studies may be because of whether participants were athletes or not, population, social and environmental differences. When final test results of groups' physical attributes were examined there were no differences between experiment groups and control group. Therefore this prevented the researcher's from understanding the reason for changes in experiment groups that whether it was due to exercises or it was due to participants' age group in which children are in the phase where they grow fast. When the final test results of groups' physiological capabilities were examined, there are significant differences between experiment groups and control group in terms of aerobic endurance. According to this finding we can say that interval running and narrow field practices have similar effects on children in football playing. Also, there is a noticeable difference between narrow field practice group and control group in terms of 10 meters sprint. When compared the narrow field practice group in terms of their leg strength among themselves, it is observed that participants' leg strength improved; therefore, the researcher's think that increase in lower extremity strength has a positive effect on increasing speed. Although the information in literature suggests that narrow field practices are more likely to develop players' technical capabilities than running, the researcher's study does not confirm it. Narrow field practices did not have significant effect on players' technical capabilities despite the fact that groups have similar attributes in terms of "total technical points" according to final tests performed in this study. The researcher's think that the reason for not having significant improvements on players' technical capabilities in their study is because of high speed and intensity during athletes' practices. However, when technical test results were examined in terms of each parameter; it is clear that narrow field practice group improved more significantly in more parameters than other groups.

RECOMMENDATONS

Determining the effects of different training methods on the performance of children players is quite important for the sports community, and increasing the number of future scientific studies on children players will have a significant impact on sports science.

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