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Effect of small-sided recreational soccer on metabolic controls, lipid profile and physical characteristics in untrained males

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General Note
Article is recommended to print as color digital version in recycled paper.

ABSTRACT

We compared effects of small-sided recreational soccer on metabolic controls, lipid profile and physical characteristics in untrained males. Thirty-five participants with mean age 19.08 years were randomized into three different groups namely; six a side group (n = 12), four a side group (n=8) and control group (n = 15). Participants in six a side and four a side group played supervised recreational football on artificial outdoor pitches for sixteen weeks. Duration of each session was 30 minutes with two halves of 15-15 minutes. Testing for lipid profile and metabolic controls was done at designated laboratory as per standard protocols. Polar heart

rate monitors were used to measure intensity of football sessions. To compare effects, one-way anova was used. We observed significant differences among three groups in HbA1C ($F_{2, 29}$ = 12.82, p = .000), fasting sugar ($F_{2, 29}$ = 10.81, p = .000), total cholesterol ($F_{2, 29}$ = 7.51, p = 0.002), triglycerides ($F_{2, 29}$ = 10.11, p = .000), low-density lipoprotein ($F_{2, 29}$ = 9.39, p = .001) and very low-density lipoprotein ($F_{2, 29}$ = 6.27, p = .005). We also observed significant differences among three groups in systolic blood pressure ($F_{2, 29}$ = 13.77, p = .000), diastolic blood pressure ($F2_{, 29}$ = 8.97, p = 0.001) and resting heart rate ($F_{2, 29}$ = 13.81, p = .000). However, no significant change was reported in high-density lipoprotein among three groups ($F_{2, 29}$ = .291, p = .750). Findings of the present study suggests that recreational football training with six and four sided teams appears to be effective in bringing change in physiological and physical parameters in untrained males. Fasting blood glucose and HbA1c reduced significantly in both six a side group and four a side group after 16 weeks of recreational football.

Keyword: Small Sided Football, Lipid Profile, HBA1c

1. INTRODUCTION

Health profile of person along with mortality from cardio vascular disease has a relationship with activity of person (Hu et al., 2005). This is a well-known fact documented, that physical activity affect positively many diseases related to lifestyle and other cardiovascular risk factors (Pedersen & Saltin, 2006). One of the major health problems of this century is physical inactivity (Blair, 2009).

The health and fitness from conventional exercises like performing exercises on cycle or doing jogging or running are well established (Goodpaster et al., 2003; Menshikova et al., 2005; Ross & Janssen, 2001; Tjonna et al., 2008). The main problem with such types of exercise regime is the adherence, which is usually quite low (Robison & Rogers, 1994). This poor adherence to such endurance activities is generally because of inability of these exercises to generate intrinsic motivation among participants (Silvaet al., 2008; Teixeira et al., 2006).

Any exercise programme must be enjoyable so that it could be successfully incorporated into person's lifestyle (Ryan & Deci, 2000). In addition, there is evidence, which suggest that non-structured exercise regimes are more liked by adults than doing exercise alone in a structured way (Burke et al., 2005). Participation in recreational sports compare to traditional endurance training is more enjoyable, if it takes place in a social environment. However, at present, it is not clear if recreational sport or activity is actually effective in improvement of health & fitness (Brittany et al., 2013).

Small-sided games of soccer provide a marked physiological response for all ages including youngsters, elderly and untrained individuals. Football practice or training of 12 to 14 weeks has proved to be enough for inducing muscular adaptation and other performance related parameters, which are maintainable, and some of them can be even further elevated if continued to train even though at reduced level of frequency (Krustrup et al., 2010).

Sports participation has been widely accepted as important for public health (Khan et al., 2012). Football is immensely popular team sport in the world. There are around 270 million or more active club players in world (FIFA, 2006). Football participation also renders peer-based psychosocial support (Ottesen et al., 2010), and it is likely that it will contribute to long-term adherence to training. Therefore, aim of present study was to compare the effects of 16 weeks six a side and four a side recreational football on physical characteristics, metabolic controls and lipid profile in untrained males.

2. MATERIALS AND METHODS

Participants

We randomized 35 untrained males into three different groups namely; six a side football group (SFG), n = 16; four a side football group (FFG), n = 8 and the third one as control group (CG), n = 15. After 16 weeks of intervention, there was no withdrawal of participants from the SFG and FFG groups whereas in control group three participants withdrew from the study and did not report for measurements after 16 weeks of intervention. SFG and FFG groups played recreational soccer for sixteen weeks. Control group participants are advised to follow their normal routine. The study was approved by the Research Committee of King Fahd University of Petroleum and Minerals vide project number IN131063.

Study Design

Participants in SFG group played 6 a side supervised recreational football on artificial outdoor pitches, while participants in FFG group played 4 a side recreational football. The football pitches were 30 m wide and 40 m in length. In order to keep up the

intensity high, fulltime goalkeeper was not allowed. We choose evening time to organize our sessions of recreational football. Participants played football for 30 minutes in each session with two halves of 15-15 minutes. Before starting session, participants had to perform warming up exercise for 10 minutes. After the end of supervised football session, participants carried out cooling down exercise for 10 minutes, which included stretching exercises, and slow jogging and walking. The intensity of football sessions was measured by monitoring the heart rate of all participants in both experimental groups.

Testing Protocols

Body fat percent was recorded using Omron body composition Scale. Hear rate while playing football was checked and recorded with help of Polar Heart Rate Monitor. Blood sample were taken for measuring fasting glucose, HbA_1c, total cholesterol, low density lipoprotein, very low density lipoprotein, high density lipoprotein, and triglycerides), according to standard procedures. Blood pressure and heart rate at rest was checked and recorded after resting in supine position for at least 20 minutes using Omron Blood-Pressure Monitor.

Statistical Tests

We have checked normality of data using Shapiro Wilks Test. In addition, between group differences in delta values (post minus pre values) was tested by one-way ANOVA. Wherever significant differences were found, bonnefori post hoc test was employed to find differences between two groups. The data was presented as mean & standard deviation.

3. RESULTS

General characteristics are shown in table 1. Mean age of participants was 19.08 years. No adverse complications occurred during the exercise programme. The study outcomes are shown in (table 2).

Table 1 General Characteristics

Variables	SFG	FFG	CG
Age*(years)*	19.50 ± 0.522	19.50 ± 0.53	18.25 ± 0.45
Height *(m)*	167.37 ± 3.71	174.00 ± 2.00	171.91 ± 5.29
Weight*(kg)*	72.02 ± 8.36	79.00 ± 8.62	69.87 ± 9.50
BMI *(kg/m^2)*	25.40 ± 2.29347	26.08 ± 3.54	23.87 ± 3.32
Average Hear Rate *(b/m) (Measured during play)*	165.18 ± 9.69	169.44 ± 8.95	
Maximum Heart Rate *(b/m)*	190.54 ± 8.61	192.81 ± 5.59	
Playing Time *(min) (Minutes per session)*	26.92 ± 3.94	29.20 ± 6.02	

Data shown as Means ± SD

Table 2 Physical Characteristics, Metabolic Controls and Lipid Profile (Difference between Post and Pre Scores, One Way Anova)

Variables	SFG	FFG	CG	P Value
Body Mass (Kg)	0.17±1.56	1.83±1.34$	-1.4±1.42$#	.000*
Body Fat (%)	0.70±1.44	0.72±0.50	-1.31±1.30$#	.000*
Systolic BP (mg/dl)	9.16±7.09	4.25 ±3.24	-1.00±1.53$	.000*
Diastolic BP (mg/dl)	3.08±2.60	1.25 ±2.05	-0.91±3.62$	.001*
Heart Rate (mg/dl)	8.91±6.52	7.75±3.45	0.91±3.62$#	.000*

HbA1C	-0.15±0.11	0.11±0.12$	-0.10±0.11#	.000*
FS (mg/dl)	15.83±4.34	19.00 ±1.85	11.2±4.07$#	.000*
TC (mg/dl)	15.16±5.42	31.12 ±7.12$	14±15.08#	.002*
TG (mg/dl)	-1.41±20.86	8.37±8.94	-28.8±23.04$#	.000*
HDL (/cmm)	-0.36±5.11	1± 4.24 $	-0.1±2.40#	.750
LDL (%)	-1.41±20.86	43.87±26.67$	18.48±12.42#	.001*
VLDL (%)	0.63±4.98	-1.62±3.47	-2.34±5.20 $	.005*

Data shown as Means ± SD, *significant difference P < 0.05
$significant difference from SFG, #significant difference from FFG

Physical Characteristics

One way ANOVA revealed significant differences in body mass among SFG, FFG and CG after 16 weeks of recreation football ($F_{2, 29}$ = 11.89, p = .000). Bonferroni post hoc test revealed significantly lesser mean in SFG (71.85±8.53) than FFG (77.16±7.28), (p = .057) and CG (77.30±8.74), (.039). FFG also had significantly lesser mean (77.16±7.28) compared to CG (77.30±8.74), (p=.000). Significant differences also seen in body fat percent among SFG, FFG and CG ($F_{2, 29}$ = 10.32, p = .000). Bonferroni post hoc test revealed significantly lesser mean (25.27±5.02) in SFG than CG (22.19± 5.52), (p = 0.001). FFG also had lesser mean (22.41±6.64) than CG (22.19± 5.52), (p = 0.003).

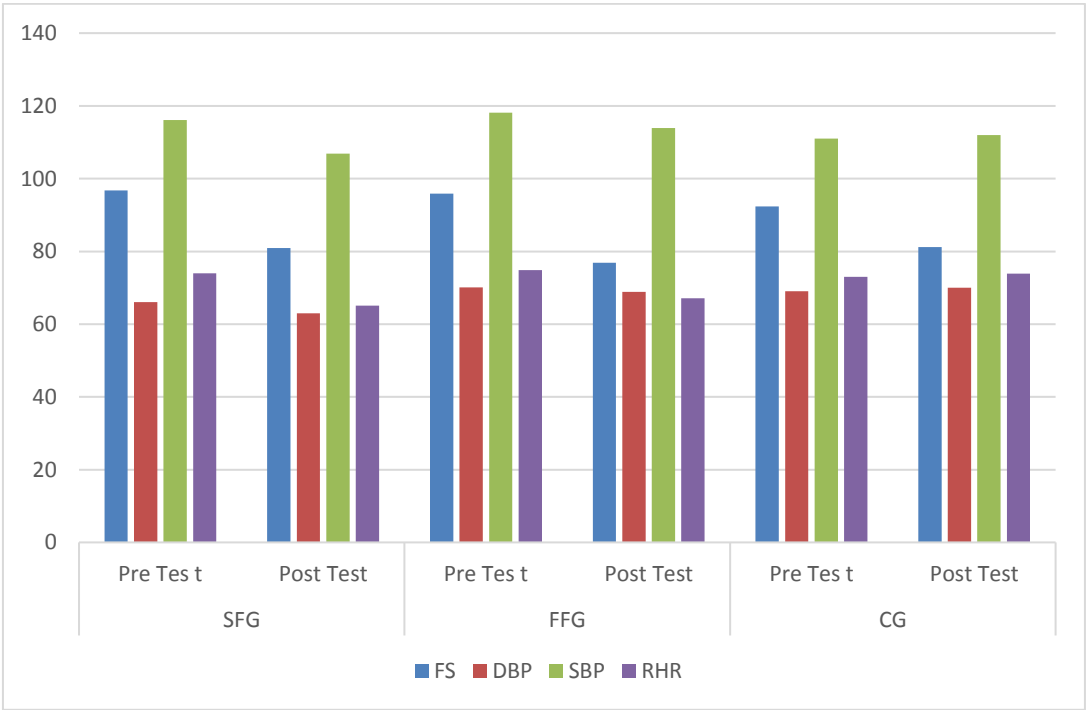

Figure 1 Mean Values of FS, DBP, SBP and RHR at Baseline and after 16 week of Intervention in SFG, FFG and CG Groups

Significant difference was seen in systolic blood pressure among SFG, FFG and CG ($F_{2, 29}$ = 13.77, p = .000). Bonferroni post hoc test revealed significantly lesser mean (106.91±7.91) in SFG than CG (112.00± 4.30, (p= .000). Significant change was also observed in diastolic blood pressure. There was statistically significant difference among SFG, FFG and CG group ($F_{2, 29}$ = 8.97, p = 0.001).

Bonferroni post hoc test revealed significantly lesser mean (63.00±3.07) in SFG than CG (70.00± 3.51, p= .001). We have also observed significant differences in resting heart rate among SFG, FFG and CG ($F_{2, 29}$ = 13.81, p = .000). Bonferroni post hoc test revealed significantly lesser mean (65.08± 6.47) in SFG than CG (73.91± 7.66), (p = .000). FFG also had significantly lesser mean (67.12± 8.02) compared to CG (73.91± 7.66), (p = .002) (Table 2, Fig. 1).

Metabolic Controls

One-way ANOVA revealed significant differences in HbA1C among SFG, FFG and CG ($F_{2, 29}$ = 12.82, p = .000). Bonferroni post hoc test revealed significantly lesser mean (5.20±0.15) in FFG than SFG (5.39±0.13, p= .000). FFG also had significantly lesser mean (5.20±0.15) than CG (5.28± 0.18, p= .001). ANOVA also revealed significant differences in fasting sugar among SFG, FFG and CG ($F_{2, 29}$ = 10.81, p = .000). Bonferroni post hoc test revealed significantly lesser mean (80.91±4.35) in SFG than CG (81.20±4.71, p= .016). FFG also had significantly lesser mean (76.87±4.88) than CG (81.20±4.71, p= .000) (Table 2, Fig 2).

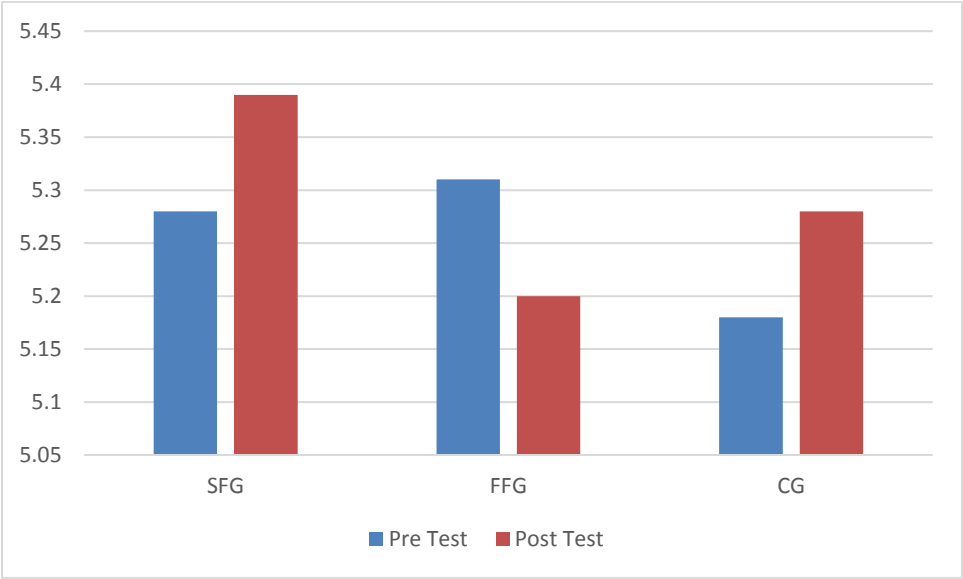

Figure 2 Mean Values of HBA1c at Baseline and after 16 week of Intervention in SFG, FFG and CG Groups

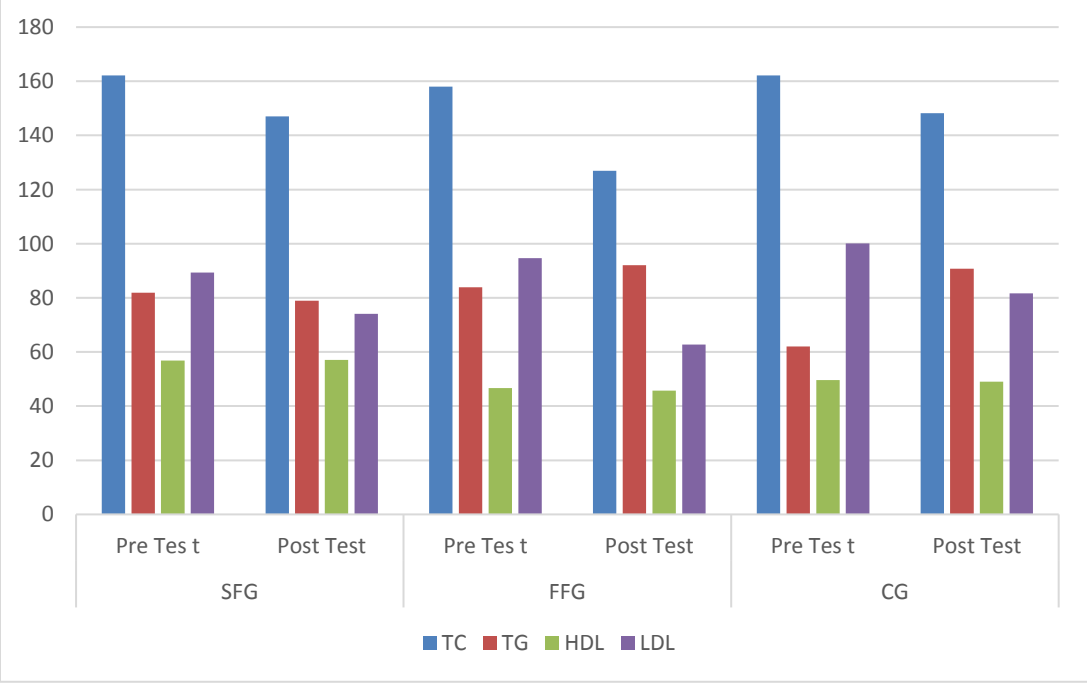

Figure 3 Mean Values of TC, TG, HDL and LDL at Baseline and after 16 week of Intervention in SFG, FFG and CG Groups

Lipid Profile

Significant change was observed in total cholesterol (TC) values after 16 weeks of football among three groups. There was statistically significant difference among SFG, FFG and CG group ($F_{2, 29}$ = 7.51, p = 0.002). Bonferroni post hoc test revealed significantly lesser mean (126.87±7.80) in FFG than SFG (147.00±24.67, p= .007) and CG (148.16±24.18, p= .004). One-way ANOVA revealed significant differences in triglycerides (TG) among SFG, FFG and CG group ($F_{2, 29}$ = 10.11, p = .000). Bonferroni post hoc test revealed significantly lesser mean (78.91± 9.43) in SFG than CG (90.80±26.94), (p = .006). FFG also had significantly lesser mean (83.87 ±3.79) compared to CG (90.80±26.94), (p = .001).

There no significant change reported in high-density lipoprotein (HDL) among SFG, FFG and CG group ($F_{2, 29}$ = .291, p = .750). One-way ANOVA revealed significant differences in low-density lipoprotein (LDL) among SFG, FFG and CG group ($F_{2, 29}$ = 9.39, p = .001). Bonferroni post hoc test revealed significantly lesser mean (62.68±10.97) in FFG than SFG (74.1±26.47), (p = 0.001) and CG (81.60±19.70), (p = 0.003). We have also observed significant differences in very low-density lipoprotein (VLDL) among SFG, FFG and CG group ($F_{2, 29}$ = 6.27, p = .005). Bonferroni post hoc test revealed significantly lesser mean (15.68±2.16) in SFG as compared to CG (18.00±5.42), (p = 0.005) (Table 2, Fig. 3).

4. DISCUSSION

Physical Characteristics

We have also followed participants for 6 months post intervention. We will be discussing follow up during discussion of our findings. Body mass and body fat percent was significantly reduced in SFG and FFG groups compare to control group following 16 weeks of recreational football. These results were in line with another study on football where body fat percent was reduced significantly after 12 week of football (Randers et al., 2009). Both BM and BFP also reduced significantly with in SFG and FFG group during 16 weeks of intervention. But this effect could not be carried over for next 6 months as BM and BFP was increased during 6 month of follow up period compared to baseline. This shows that participants did not follow the intervention beyond 16 weeks of study period. There was significant change in blood pressure among three groups following 16 week of intervention. SBP & DBP was reduced significantly during the intervention period of 16 weeks with in SFG and FFG group. Participants in both SFG and FFG reached to a level of systolic blood pressure (106.91 & 113.87 mmHg) and diastolic pressure (63 & 68.87 mmHg) respectively after 16 weeks of football training. This was an indication of good cardiac health. Also in the meta-analysis of 61 studies, it was found that risk of cardiac death was decreased linearly to decreased blood pressure with (systolic 115mmHg & diastolic 75mmHg) (Cornelissen et al., 2005). But after 6 month of follow up period both diastolic and systolic blood pressure reverted back to baseline levels in both SF and FFG groups. This shows that benefits of 16 weeks of training in football were not carried forward for next 6 months. However, benefits of 16 week of football training was maintained in resting heart rate as it reduced significantly even after 6 month follow up period in both SFG and FFG Group. Further significant change was seen in resting heart rate between intervention and control groups from pre to post test. Resting heart rate also changed significantly with in SFG and FFG groups.

Metabolic Controls

HbA1C and fasting blood glucose changed significantly among three groups. Post hoc test revealed significant difference in HbA1C between SFG and FFG groups. FFG group reported lower HbA1C compared to SFG and CG group after 16 weeks of training. After 6 months of follow up period, HbA1C increased in both SFG and FFG group, which shows no effect of intervention on participants during follow up period. On the other hand, fasting sugar in both SFG and FFG groups reduced significantly after 6 month of follow up period. Both results are bit contrary to each other. There was a steady and gradual decrease in fasting sugar from baseline to 6 months in both SFG and FFG groups.

Lipid Profile

There was significant change in total cholesterol, triglycerides, low-density lipoprotein and very low-density lipoprotein among three groups. TC and LDL reduced significantly in both SFG and FFG groups. However, TG and VLDL increased in FFG group after 16 weeks. No significant change was seen in high-density lipoprotein among three groups. We have seen reduction in TC and LDL from baseline to 16 weeks with in both SFG and FFG group; however TC was increased back to pre-training level during 6 month follow up in both groups. LDL is the only component, which has shown reduction even after 6 months of training during follow up period in FFG group. LDL is a strong predictor of coronary artery disease, reduction in LDL during 6 month training is one of the positive outcomes of the study. However, LDL in SFG group increased back to baseline levels after 6 month of follow up. Our results on LDL in FFG group were supported by another study on football where LDL was reduced after 12 weeks of training (Menshikova.et al.,

2005). HDL is also one of the positive outcomes as it increased in both SFG and FFG groups even during 6 month follow up. This shows that effect of 16 week of football training were carried forward for next 6 months. As also suggested in literature that HDL generally respond to aerobic type training which increases according to the dose along with increase in energy expenditure (Kokkinos & Fernhall, 1999; Durstine et al., 2001; Durstine et al., 2001a; Durstine et al., 2001b).

After completion of 16 weeks of intervention, follow up period of 6 months did not produce encouraging results. Most of the components returned to baseline levels or more during this follow up period. This shows that participants were not motivated enough to carry on with recreation football after the intervention was over. These negative changes during follow up period could be because of combination of many other factors including diet. Moreover, intervention was finished just before the summer vacation of university. It means that participants spend majority of their follow up period in vacation, and they might not have access to continue recreational football back home.

5. CONCLUSION

Findings of the present study suggests that recreational football training with six and four sided teams appears to be effective in bringing change in physiological and physical parameters in untrained males. Fasting blood glucose and HbA1c reduced significantly in both SFG and FFG group post 16 weeks of recreational football. Blood pressure and resting heart rate also reduced significantly post 16 weeks in both SFG and FFG groups. Significant reduction was seen TC and LDL in both SFG and FFG groups. Recreational football could be promoted as an intense physical activity for untrained males with inactive background. Present study showed that 16 week of recreational small-sided football sessions would have positive outcome on the health profile of inactive males. Furthermore, our study indicated that regular participation in recreational small-sided football could have a similar training effect compare to traditional aerobic exercises. Keeping in view limitations, number of players in a team (Small sided games) is more important factor than the size of football pitch to elicit favorable response in various cardiovascular factors.

Authors Contribution

Rakesh Tomar - Principal Investigator
Varghese C Antony - Co-Investigator

Conflict of Interest

Authors hereby declare that they have no conflict of interest.

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