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Do Lipid Profiles, Body Composition, and Physical Fitness Improve after a FIFA 11+ Training Programme from Obese Women?

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Abstract

Studies dealing with the effectiveness of the Fédération Internationale de Football Association (FIFA) 11+ prevention programme to improve lipid profiles, body composition and physical fitness outcomes in obese women aged 30–40 years are limited. The present study aims to indicate the effects of the application of the FIFA 11+ warm-up programme on lipid profiles, body composition, and physical fitness in obese women. The randomized controlled trial design was used in this study. Participants were 54 obese women, divided into a FIFA 11+ n=27; age: 35.29±2.90 and a control group n=27; age: 35.29±2.71 and trained for six weeks. Before and after the training period, blood was taken, and body composition test, VO2max performance, muscular strength test, and balance tests were assessed. Significant differences were found in the HDL-cholesterol, LDL-cholesterol, triglycerides, BMI, body fat, waist circumference, VO2Max, arm curl, wall-sit test and Y balance test in favour of FIFA 11+ over the control group. However, there were no significant effects on cholesterol. The main findings of this study suggest that just six weeks of implementation of the FIFA 11+ improves lipid profiles, body composition, and physical fitness in obese women.

Keywords: *FIFA 11+, lipids profiles, body composition, cardiorespiratory, muscular strength, balance, obese women*

Introduction

Obesityin women is a serious public health concern worldwide (World Health Organization, 2017). In Indonesia, 14.8%ofwomen aged 30-40 years had obesity in 2012 (Kesehatan et al., 2019). In 2013–2018, these figures had risen to 21.8% (Kesehatan et al., 2019), highlighting the need for effective prevention strategies tostem and reverse the growth of obesityin women in Indonesia. Specifically, with evidence of the greater burden of obesity in the most disadvantaged in developed countries, obesity-treatment strategies targeting healthy disadvantaged communities are required. In addition, more women suffer from obesity or extreme obesity compared to men (Ogden, Carroll, Kit, & Flegal, 2014).

Literature regarding lipid profiles is also relevant to obese women. Total cholesterol, triglycerides, and LDL cholesterol are higher in obese women (Rizk & Yousef, 2012). LDL cholesterol and total cholesterol have a contribution to cardiorespiratory disease and its clinical consequences such as coronary heart disease (Jiang et al., 2013). The risk of cardiovascular disease is also affected by HDL-C (Shah & Mathur, 2010). Low levels of cardiorespiratory fitness (VO_{2max}) and a high percentage of body fat (% BF) are risk factors for many chronic diseases,including diabetes, hypertension, dyslipidaemia, and cardiovascular diseasethat increase risk of morbidity and mortality. Another consequence of low levels of physical activity is poor muscular strength,which is an independent risk fac-

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tor for diabetes and cardiovascular disease as well as a general cause of mortality.

Exercise has a greater and direct effect on these risk factors for obesity diseases (Landry & Driscoll, 2012). Despite the well-documented benefits of exercise training, many obese individuals do not participate in physical activity with lack of time as the largest barrier (Greenway & Pekarovics, 2012). Only 1.5-3.0% of obese women meet the current recommendations of 150 min/week of exercise (Tudor-Locke, Brashear, Johnson, & Katzmarzyk, 2010), so research is needed to identify practical and effective exercise modalities in this population.

The "11+" programme of the Fédération Internationale de Football Association (FIFA) is a widespread measure aimed at injury prevention. Whilethe injury prevention programme is created for football,it also received attention from other sports (Reis, Rebelo, Krustrup, & Brito, 2013). As FIFA 11+ may share similarities with aerobic exercise as moderate to higher intensity (>30-40% VO_2max) and 250-300 minutes/week (20 minutes/day) may also be similar (Fogelholm, 2010).

Thus, this study aimed to analyse theeffects of the FIFA 11+ on lipid profiles, body composition, cardiorespiratory fitness, muscle strength, and balance of obese women. Based on current literature, we hypothesize that performing the FIFA 11 + for six weeks may induce improvements in lipid profiles, body composition, cardiorespiratory fitness, muscle strength, and balance in obese women.

Methods

Participants

The participantswere obese women aged 30-40 years old from Yogyakarta, Indonesia,recruited through an advertisement placed around the area. Sixty-seven answered our request. Subsequently, study details were described by the researcher. A period of six weeks was given to obtain full consent. Following this period, thirteen participants wereendorsed forparticipation in the study. The main reason for declining participation was transportation difficulties for attending the laboratory assessments. Fifty-four samples were selected and randomly allocated by a blinded assistant into two groups: control (twenty-seven) and FIFA 11+ (twenty-seven). The participants were evaluated according to the eligibility criteria to determine if they met the requirements to participate in the study. The inclusion criteria for this study were: 1) to obese women between 30-40 years old; 2) BMI[3]25-29.9 (Obesity I (World Health Organization, 2000)); 3) physically inactive less than 3 months (exercise≤45 min/session and ≤ 2 times/week); 4) HDL cholesterol < 114.29 mg/dL, triglycerides ≥ 150.56 mg/dL. The exclusion criteria were: obese women whose health conditions including diabetes, hypertension,injuries such as fractures, sprains, surgery or conditions requiring immobilization,or obese women following a doctor-prescribed diet. Written informed consent was provided by the participants, and all procedures were handled according to the Declaration of Helsinki. The study obtained approval from the ethics committee of Khon Kaen University (Decision number: HE622224).

Study design

The randomized controlled trial design was used in this study. The fully eligible participants that participated in the study were randomized and assigned using the web service www.randomizer.org, without any affiliation or acknowledgement of the participants in the control and experimental groups. All participants were tested at three points in time: baseline, after the thirdfull week of intervention, and after a six-week period. At point, the participants were submitted to the following testing procedures: lipid profiles (HDL cholesterol, LDL cholesterol, total cholesterol and triglycerides), body composition (BMI, body fat, waist circumference) and physical fitness (cardiorespiratory fitness, muscular strength, balance) of the participants.

Settings and locations where the data were collected

The research was conducted in Yogyakarta, Indonesiaat the Faculty Sport Sciences Laboratory of the Yogyakarta State University. The study commenced in January 2020 with the baseline measurements and ended in March 2020.

Interventions

The FIFA 11+ training programme consists of three parts: beginning with running exercises (part I); followed by six exercises to develop strength, balance, muscle control, and core stability (part II); and ending with advanced running exercises (part III) (Daneshjoo, Mokhtar, Rahnama, & Yusof, 2013). Table 1 shows the details of each part.

The assistant of the intervention group was selected to administer the FIFA 11+ during the warm-up with the intensity controlled that each subject's HR was monitored, with formal training guaranteed by the researcher. The assistant was selected as the key element to administer the programme to reassure a better rate of participant's compliancetowards it. Paper and video support wereprearranged for the participants in the intervention group. The researcher provided a thorough explanation of each exercise to the participantsusingthedatadownloadedfromawebsite(http://www.footballmedicinecentre.com/11-warm-up-program/)and emphasized theimportance of maintaining appropriate posture and body control, such as leg alignment, kneepositioning over the toes, and smooth landings during exercise. To help participants familiarize themselves with the exercises, the downloaded data wereprinted and distributed. All participants started in level 1 and moved to level 2 in three weeks, as predicted in the FIFA 11+ manual, meaning that all participants had three weeks of FIFA 11+ in level 3.

FIFA 11+ was executed three timesa week, as this is the minimum recommended frequency to collect proclaimed effects of the programme, over a sixweek period. The average of 20 minutes to complete the FIFA 11+ and short breaks of 1-2 minutes were allowed. Every participant wore an HR monitor (Polar Electro, Finland) during the training. An alarm on the HR monitor was set at ± 5 beats of the target HR to judge the exercise intensity. The researcher set up the field for the FIFA 11+ training programme in advance. Six cones were placed in 5-6 m intervals, and another row of cones was placed next to the first row. Next to the cones, there was an area prepared so all participants could perform the movements without interfering with one another. Parts I and III were performed in the cone area, and Part II was performed in the separate area next to the cones.

During the intervention, adoctor and aphysiotherapist visited the group. The control participants maintained their individual habits of physical activity and did not engage in any prescribed exercise training during the interventions. The researcher visited the group regularly to ascertain the correct execution of the programme. The presence of the participants and the frequency of sessions were recorded on predefined data collection forms.

Table 1. Components of FIFA 11+ training program

Exercise	Protocol
Part I: Running exercise (8 minutes)	
Running straight ahead	2 Repetitions
Running hip out	2 Repetitions
Running hip in	2 Repetitions
Running circling partner	2 Repetitions
Running shoulder contact	2 Repetitions
Running quick forwards and backwards	2 Repetitions
Part II: Strength, plyometric, balance (10 minutes)	
The bench	
Level 1: static	3 x 20-30 sec
Level 2: alternate legs	3 x 20-30 sec
Level 3: one leg lift and hold	3 x 20-30 sec
Sideways bench	
Level 1: static	3 × 20-30 sec (each side)
Level 2: raise and lower hip	3 × 20-30 sec (each side)
Level 3: with leg lift	3 × 20-30 sec (each side)
Hamstrings	
Level 1: Beginner	3-5 Repetitions
Level 2: Intermediate	7-10 Repetitions
Level 3: Advanced	12-15 Repetitions
Single-leg stance	
Level 1: hold the Ball	2 x 30 sec
Level 2: throwing ball with partner	2 x 30 sec
Level 3: test your partner	2 x 30 sec
Squats	
Level 1: with toe raise	2 x 30 sec
Level 2: walking lunges	2 x 30 sec
Level 3: one leg squats	2 x 30 sec (each leg)
Jumping	
Level 1: vertical jumps	2 x 30 sec
Level 2: lateral jumps	2 x 30 sec
Level 3: box jumps	2 x 30 sec
Part III: Running exercises (2 minutes)	
Running across the pitch	2 Repetitions
Running bounding	2 Repetitions
Running plant and cut	2 Repetitions

Outcome measures

The participants' baseline characteristics, such as age and dominant leg, were recorded with a pre-designed questionnaire. Participants only used minimal clothing (underwear), and jewellery wasremoved.Participants were advised not to move and not talk during body composition measurements (body weight (kg), fat per cent (%)) using Karada Scan Body Composition HBF 375 (Omron Healthcare, Kyoto, Japan). The Body Mass Index (BMI) is calculated by the formula weight (kg) divided by height (m) that is expressed in squares (kg/m2). A measuring placed on a measuring tape at the part of the iliac crest to measure waist circumference is measured in centimetres (cm) and the height of the players with the digital stationary stadiometer (DS-103, DongSahn Jenix, Seoul, Korea).

For each testing protocol, all participants received verbal directives and visual demonstrations from the examiner. All tests were performed at the beginning of the week, after a 48-hour rest period following the last intervention in the end.

Lipid Profiles

Trained nurses took blood from the antecubital vein, and the sample was transported to the Yogyakarta State University laboratory to be analysed by trained laboratory technicians. Once sufficient blood had been collected (minimum 5

ml around three times included pre-, post1- and post2-test). Participants were prohibited from eating, drinking alcohol, smoking, exercising, and bathing for 30 minutes before taking measurements and fasting overnight 12 hours. They removed tight clothes from the arms then sat onachair with feet flat on the floor. Theirhands were on the table so that the cuff was at the same level as the heart. Total cholesterol, triglyceride, LDL-cholesterol and HDL-cholesterol analyses were performed with a Hitachi 704 analyser, which is serviced by Roche Diagnostics (formerly Boehringer-Mannheim Diagnostics).

Cardiorespiratory fitness (VO_{2max})

The YMCA cycle ergometer submaximal test to measure cardiorespiratory fitness (measurement of VO_{2max}) (Golding & Sinning, 1989). Submaximal exercise test to estimate VO_{2max} using the ergometer cycle. Age HRmax was predicted for two consecutive workloads and increased to close to 85% of HRmax by using three protocols or 3-minute consecutive workloads designed to increase HR between 110 bpm; 50 rpm was set as the initial pedalling speed, and 150 kpm•min-1 (25W) was set as the initial workload. At 15 seconds at the last minute, it is used to measure HR to determine the next workload. For example, if HR was around 80-89 bpm or 90-100 bpm, then in the second stage, there was an increase in workload to 600 or 450 kpm•min-1. The formula from Golding (Golding & Sinning, 1989) is used to estimate maximum oxygen consumption (ml•kg-1•-min-1).

Muscular strength

The arm curl test part of Senior Fitness Test (Rikli & Jones, 2001)measured the number of times that the full extension and curl was performed for 30 s with a two kg dumbbell while sitting in a chair (the muscle strength of the upper limb). The wall sit test was used to measure the time taken to maintain posture by leaning against the wall as if sitting on a desk with legs open to shoulder width leg (the muscular strength of the lower extremities).

Balance

The Y-balance test, developed to standardize the modified star excursion balance test, is a simple, reliable test to measure dynamic balance and has demonstrated very good levels of reliability (ICC ranging from 0.80 to 0.9) (Shaffer et al., 2013). First, the Y-balance test was demonstrated, followed by four practice trials before the activeassessment trials took place (Robinson & Gribble, 2008). The testing was performed with the participant standing with the heel of the weight-bearing foot in the centre of the grid, maintaining the base of support. The participant was instructed to slide the box, reaching as far as possible and to return the initial upright position without losing balance in the three testing directions. The assessor recorded the distance that the participant reached after each of the three activeassessment trials. As the heel was aligned with the middle of the grid, the foot length was subtracted in the anterior reach distance, avoiding re-alignment of the foot during the testing procedure. The trial was discarded if the participant rested the foot or gained balance by touching the floor, if he failed to return the reaching foot to the starting position,orif the weight-bearing foot was lifted or moved. The reach distance was normalized to the participant's leg length (anterior superior iliac spine to inferior medial malleolus), providing a measure of performance (Robinson & Gribble, 2008). The composite reach distance was obtained by calculating the total of the greatest reach distance from each direction, giving the overall performance of the test. The best trial of each direction was considered for analysis.

Data analysis

Statistical analysis usedSPSS version 20.0 (IBM SPSS Statistics for Windows, IBM Corp, Armonk, New York, USA). Data were expressed as the mean±standard deviations (SD). The normality of the data was evaluated using the Kolmogorov Smirnov test. If the normal distribution is found to be parametric, the statistics are used analysis. Independent t-tests are used to determine differences between baseline values. The statistical significance level was set a $p \leq 0.05$ for all analyses.

Results

In the present study, no severe injuries were observed that would influence participation in the study. A total of 54 participants participated in the study, being allocated to the FIFA 11+ (n=27) and the control group (n=27). At baseline the FIFA 11+ group presented a higher body mass index (28.03±0.75), a higher level of cholesterol (154.00±25.43), a higher number of triglycerides (153.81±33.28),a higher number of LDL-C (94.11±9.85), a higher R postero-lateral (11.18±1.33), a higher L postero-lateral (10.84±1.23) and a higher L Composite (25.24±1.52) (Table 2).

Table 2. Baseline characteristics of the participants stratified by group (mean ± SD)

Characteristics	FIFA 11group	Control group
Age (years)	35.29 ± 2.90	35.29 ± 2.71
Weight (kg)	72.41± 3.21	72.22 ± 3.36
Height (m)	1.60 ± 0.03	1.60 ± 0.03
BMI (25.9-29.0)	28.03 ± 0.75	27.96 ± 1.06
Body Fat (%)	35.61± 1.11	35.52 ± 1.62
Waist circumference (cm)	90.11 ± 1.18	89.37 ± 1.75
Systolic	140.18 ± 5.94	137.07 ± 7.62
Diastolic	95.55 ± 3.85	93.92 ± 4.67
Cholesterol (mg/dl)	154.00 ± 25.43	158.00 ± 23.92
Triglycerides (mg/dl)	153.81 ± 33.28	154.55 ± 32.77
HDL-C (mg/dl)	48.48 ± 10.45	52.48 ± 10.18

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Characteristics	FIFA 11group	Control group
LDL-C (mg/dl)	94.11 ± 9.85	95.62 ± 8.67
VO2Max	28.69 ± 1.20	28.99 ± 1.20
Arm Curl Test	9.18 ± 1.21	9.48 ± 0.97
Wall Sit Test	25.70 ± 3.38	26.62 ± 2.22
R anterior	9.05 ± 0.41	9.15 ± 0.41
R postero-lateral	11.18 ± 1.33	11.48 ± 1.33
R postero-medial	7.70 ± 0.63	8.01± 0.63
R Composite	27.94 ± 1.71	28.24 ± 1.71
L anterior	7.88 ± 0.52	7.98 ± 0.52
L postero-lateral	10.84 ± 1.23	11.14 ± 1.23
L postero-medial	6.51± 0.72	6.81 ± 0.72
L Composite	25.24 ± 1.52	25.54 ± 1.52

The pre-test 1 and post-intervention results of each group are reported for descriptive purposes in Table 3 (FIFA 11+ and control groups).

After sixweeks, the FIFA 11+ training programme in the cholesterol, triglyceridesand LDL-cholesterol was notably decreased, and HDL-cholesterol was notably increased. In the body composition, there were significant effects for BMI, body fat, and waist circumference.Furthermore, the effect of FIFA 11+ improves performance in physical fitness in the VO_{2max}, arm curl, wall sit test, and Y balance test.

Table 3. Pre-test and Post-test changes in lipid profiles, body composition, and physical fitness

	FIFA 11+ Group			Control Group		
	Pre-test	Post-test	p	Pre-test	Post-test	p
BMI	28.03 ± 0.75	24.79 ± 0.20	0.000	27.96 ± 1.06	27.72 ± 1.06	.630
Body Fat	33.61 ± 1.11	31.10 ± 0.90	0.000	35.52 ± 1.62	35.18 ± 1.62	.683
Waist Circumference	90.11 ± 1.18	81.40 ± 2.06	0.000	89.37 ± 1.75	88.22 ± 2.15	.062
Cholesterol	154.00 ± 25.43	134.25 ± 23.32	0.000	158.00 ± 23.92	151.00 ± 21.64	.510
Triglycerides	153.81 ± 33.81	135.37 ± 32.08	0.000	154.55 ± 32.77	150.81 ± 37.70	.915
HDL-C	48.48 ± 10.45	59.33 ± 11.17	0.000	52.48 ± 10.18	54.33 ± 11.58	.771
LDL-C	94.11 ± 9.85	79.74 ± 13.89	0.000	95.62 ± 8.67	92.44 ± 16.78	.680
VO2max	28.69 ± 1.20	33.38 ± 0.65	0.000	28.99 ± 1.20	28.79 ± 1.21	.830
Arm Curl	9.18 ± 1.21	19.07 ± 1.29	0.000	9.48 ± 0.97	9.18 ± 1.14	.582
Wall Sit	25.70 ± 3.38	36.67 ± 1.81	0.000	26.62 ± 2.22	26.48 ± 2.94	.975
R anterior	9.05 ± 0.41	11.42 ± 1.11	0.000	9.15 ± 0.41	8.95 ± 0.42	.220
R postero-lateral	11.18 ± 1.33	12.45 ± 1.07	0.000	11.48 ± 1.33	11.18 ± 1.34	.704
R postero-medial	7.70 ± 0.63	10.09 ± 0.95	0.000	8.00 ± 0.63	7.70 ± 0.64	.220
Composite R	27.94 ± 1.71	33.96 ± 2.60	0.000	28.24 ± 1.71	27.94 ± 1.72	.809
L anterior	7.88 ± 0.52	10.15 ± 0.80	0.000	7.98 ± 0.52	7.68 ± 0.53	.106
L postero-lateral	10.84 ± 1.23	12.85 ± 1.07	0.000	11.14 ± 1.23	10.84 ± 1.24	.664
L postero-medial	6.51 ± 0.72	8.66 ± 0.83	0.000	6.81 ± 0.72	6.51 ± 0.73	.303
Composite L	25.24 ± 1.52	31.67 ± 2.12	0.000	25.54 ± 1.52	25.24 ± 1.53	.764

Discussion

Despite the great success of the FIFA 11+ Injury Prevention Programme, it was difficult, in practical terms, to persuade obese women to apply this programme regularly solely to prevent injuries andimprove health, so the aim was to prove that it also has a positive and direct impact on obese women's lipids profiles, body composition, and physical fitness. The findings of the current study indicate that the training stimuli provided by the implementation of FIFA 11+ three times per week for sixweeks appear to be sufficient to elicit significant improvements in some (HDL-cholesterol, LDL-cholesterol, triglycerides, BMI, body fat, waist circumference, VO_{2max}, arm curl, wall sit test and Y balance test).

In this study, obese women aged 30-40 years with FIFA 11+ were more effective with regard to lipid profiles (HDL cholesterol, LDL cholesterol, and triglycerides) than controls with the same respondent criteria. Meanwhile, there are FIFA 11+ effects on lipid profiles (total cholesterol) which show that

FIFA 11+ effects were more effective than the control group in obese women aged 30-40 years.

In this study, FIFA 11+ regardinglipid profiles (HDL cholesterol, LDL cholesterol, and triglycerides) were judged to be more effective than the control group in obese women aged 30-40 years. This is because HDL directly inhibitsatherosclerosis by removing cholesterol from cells and inhibiting LDL oxidation (Crichton & Alkerwi, 2015) while low-density lipoprotein cholesterol (LDL-C) has a significant decrease in the maximum heart rate effect (only 75%).

In this study, obese women aged 30–40 years with FIFA 11+ in body composition (VO_{2max}, Arm Curl, Wall Sit, R anterior, P-lateral L, CompositeR, L anterior, L-Postero-lateral, and Composite L) more effective than the control group in obese women aged 30-40 years. Meanwhile, when viewed from the composition of the body (R postero-medial and L postero-medial), FIFA 11+ is no more effective. Physical fitness associated with the effects of sports training cannot be concluded and contested where no exercise protocol consistently results in measurements of body composition and positive changes in different populations. FIFA 11+, which takes 12-16 weeks to produce a significant change in abdominal obesity, but for body mass there is only a slight decrease.

In addition, those people withBMI on a scale of 25-29.9 kg/m^2 undergoing 6 to 16 weeks of training intervention training will have a minimal effect on body composition (Nicklas et al., 2015). Reducing fat mass needs to be done because energy expenditure is very important and it is generally said that FIFA 11+ programme is isocaloric and there are no dietary interventions combined with training programmes (Heydari, Freund, & Boutcher, 2012).

Some study limitations should be acknowledged, one of whichmay be associated with the fact that the participants were not blinded to control/intervention, which may lead to special motivational efforts or create expectations generated by the admission to theintervention group. We also knew the FIFA 11+ training is well-known to be associated with injury prevention. However, we only observed changes inlipid profilesor performance caused by FIFA 11+ training and did not investigate how much these changes contributed to injury prevention among obese women. Another limitation isthe short study period, which may be a limiting factor in this study. In the next study, it will be necessary to examine the effects of FIFA 11+ in obese women by lengthening the study period. Finally, this study based on research exclusively on an Indonesian population, and further research is needed to extend it to other ethnic groups.

The main findings of this study suggest that just 6 weeks of implementation of the FIFA 11+ warm-up programme improves lipids profiles, body composition and physical fitness in obese women. Therefore, the FIFA 11 + programme can be considered appropriate for this age, as it seems to be adequate for inducing significant performance enhancements in obese women. Moreover, given the improvements in lipid profiles, body composition, and physical fitness, our study would advocate the introduction of these essential movement competency skills in obese women aged 30-40 years. Ultimately, thedue to evidence-based health benefits of the FIFA 11+ warm-up programme, this study'starget population could be expanded to obese youth and children in a school environment, with the aimof improving public health.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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