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Research Paper

Effect of a 12-week Myanmar fitness dance program on cardio-metabolic responses of physically inactive adults

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ABSTRACT
Background and Objective*: Myanmar fitness dance (MFD) program is a physical fitness dance training given by Department of Sports and Physical Education to raise the health of people as a part of "exercise is medicine" (Myanmar) activity since 2017. Although cardio-metabolic benefits of dance have been observed through aerobic dance, Zumba, those of MFD have not yet been studied.*
Methods: *A quasi-experimental study was conducted to find out the effect of a 12-week MFD program on cardio-metabolic responses of physically inactive adults from the Department of Medical Research (DMR). Anthropometric, blood pressure (BP), and heart rate (HR) measurements were done by using standard procedures. The subjects were selected in accordance with inclusion criteria such as the age between 25 and 59 years, body mass index (BMI) ≥18.5 kg/m2, physical activity < 600 met-mins/week, and haemoglobin concentration ≥ 11 g%. Fasting plasma glucose, total cholesterol (TC), triglyceride (TG), high-density lipoprotein (HDL) were measured with a spectrophotometer and low-density lipoprotein (LDL) was calculated by Friedewald formula. Serum insulin was measured by the ELISA method and HOMA-IR was calculated. Cardiopulmonary fitness was expressed as maximal oxygen consumption (VO_{2max}), calculated from measured physical work capacity (PWC_{170}). A moderate-intensity MFD training (50 min/day, 3 days/week) including warming up and stretching was given for 12 weeks by a sports officer. A total of 114 subjects (5 males and 109 females) participated completely for 12-week. After the 12-week intervention, all measurements described above were repeated within one week.*
Results: *After the 12-week, the cardio-metabolic parameters such as body weight, BMI, body fat percent, waist circumference, systolic BP (SBP), diastolic BP (DBP), HR, TC, TG, and LDL were reduced, while fat free mass (FFM) and VO_2max were increased. Their percent changes (95% CI) were -0.66 (-1.18 to -0.13), -0.64(-1.17 to -0.08), -6.06 (-7.54 to -4.74), -4.1(0.47 to -5.05), -2.24(-4.02 to -0.54),-2.91(-5.04 to -.0.79), -7.09 (-9.58 to -4.52), -16.65 (-19.84 to -13.35), -14.22 (-18.71 to -9.4), -6.29 (-22.05 to 13.84), 12.76 (11.47 to 14.04) and 32.77 (24.33 to 43.03), respectively. HOMA-IR and HDL were not changed significantly.*
Conclusion*: This study highlighted that the moderate-intensity MFD practicing without dietary control for 12-week improves most of the cardio-metabolic responses.*
KEY WORD: *Myanmar fitness dance, cardio-metabolic response, physically inactive adults*

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I. BACKGROUND AND OBJECTIVE

In Myanmar, a total of 15.7% (12.5% for males and 18.8% for females) had low physical activity.[1] Physically inactive lifestyle coupled with energy-rich food consumption is associated with increased cardio-metabolic risk.[2]

A meta-analysis reported that central obesity, high BP, hypertriglyceridemia, elevated LDL cholesterol, low HDL cholesterol together with hyperglycemia, hyperinsulinemia and insulin resistance are associated with 2-fold increase in cardiovascular outcomes and 1.5 fold increase in all-cause mortality.[3]

Among many different exercise modalities, aerobic dance is one of the most commonly practiced adult fitness activity.[4] As dancing can be tailored to fit a target population's age and culture, Zumba is becoming a global dance fitness activity to reduce lifestyle disease epidemic. It has been shown to be beneficial in lowering body fat mass, and weight reductions as well as improvements in fasting triglycerides in middle-aged obese women.[5] Previous study has found the improvement of cardiopulmonary fitness (CPF) with Myanmar cultural dance in female college students of University of Culture in Myanmar in the year 2005.[6]

Myanmar, a low-income Southeast Asia country with an estimated population of 53.9 million, is currently facing an increasing burden of non-communicable diseases.[7] Thus, a scientifically sound exercise program is needed in the hope that the general population can be persuaded to partake in more physical activity to ameliorate the risks of life-style related diseases.

MFD program is a physical fitness dance training given by Department of Sports and Physical Education to raise the health of people as a part of "exercise is medicine" (Myanmar) activity since 2017. MFD is a form of aerobic exercise which focused on whole-body rhythmic movements which fuses fitness improvement and entertainment.

Although cardio-metabolic benefits of dance have been observed through aerobic dance, Zumba, those of MFD have not yet been studied. Thus, the present study aimed to find out the effect of a 12-week MFD program on cardio-metabolic responses of physically inactive adults.

II. METHODS

A quasi-experimental study was conducted at DMR, during August to October, in 2019.

Ethical approval

The present study was approved by the Institutional Review Board, DMR (Ethics/DMR/2019/072) and conducted according to the ethical guideline. All participants were informed and explained about the purpose and test procedures and gave their written consent to participate in the study. Furthermore, they were aware of possibility to stop their participation at any time for any reason.

Recruitment of participants and study procedures

DMR staffs were invited by means of standardized invitation letter. One hundred and forty adults responded to the invitation. Aim and detail procedures of the study were explained followed by a video show. Before the study, a written informed consent was taken. Physical activity was assessed by using global physical activity questionnaire (Myanmar version). Hemoglobin concentration was assessed by taking finger-prick blood using Hemocue (Hb 201^+ analyzer, Sweden). Body weight (BW) was measured to the nearest 0.1 kg in light clothes without any footwear with calibrated weighing scale (Stathmos Lindell. AB, Sweden). Standing height was measured to the nearest 0.1 cm using stadiometer. BMI was calculated by dividing BW by height squared (kg/m^2). A total of 123 subjects, aged between 25 and 59 years, BMI $\geq$18.5 kg/m^2, physical activity < 600 met-min/week, and hemoglobin concentration $\geq$ 11 g%, were selected. Those subjects with known history of cardiopulmonary disease, and those currently taking lipid lowering agents were excluded.

Waist circumference (WC) was measured at the mid-level between lowest rib and anterior superior iliac spine with non-stretchable tape from the side. Triceps skinfold thickness was measured on the posterior surface (over the triceps muscle) and biceps skinfold thickness was measured on the anterior surface of the left upper arm (over the biceps muscle) at the upper arm midpoint mark to the nearest 0.1 mm with a pair of calipers (GIMA, Italy) by well-trained technicians.[8] BFP was calculated as described in Kwok *et al.* (2001).[9]

Blood pressure and cardiopulmonary fitness measurement

Subjects were advised to avoid strenuous activity and caffeine for 24 hours prior to CPF testing. Resting BP was assessed with a digital BP monitor (ALPK2, Japan) for pre-and post-test SBP and DBP levels in the laboratory after resting for at least 10-min at the sitting position.

CPF was assessed by calculation of VO_{2max} from measured PWC_{170} by using cycle ergometer (Monark, Sweden) under supervision of a medical doctor.[10, 11] HR was monitored with a polar pacer. The test was started after taking baseline HR and it was recorded at each minute and the same load was continued for 3 minutes. There were 3 consecutive workloads and each lasted for 3 minutes. Then, PWC was calculated at HR 170 beats/min.

Fasting blood samples and biochemical analysis

Venous blood samples were collected between 8:00 and 9:00 am after 12 hour overnight fast at baseline and within 7 days after intervention for biochemical analysis. Fasting plasma glucose (FPG) was quantified within 2 hour of blood collection by glucose oxidase, phenol, 4-aminophenazone (GOD-PAP) method using a spectrophotometer and TC and TG were quantified by enzymatic colorimetric methods, HDL was quantified after precipitation of the apolipoprotein B containing lipoproteins with phosphotungstic acid (CyanSmart, USA) and LDL was calculated by Friedewald formula (LDL=TC-HDL(TG/5).[12] Fasting serum insulin (FSI) was quantified by ELISA method using the microplate reader (Human Reader, Germany). The homeostatic model assessment of insulin resistance (HOMA-IR) was calculated as follows: HOMA-IR= [fasting serum insulin (μIU/mL) x fasting plasma glucose (mg/dL)]/405.[13] After the intervention, all the measurements described above were repeated within one week.

Myanmar fitness dance program

The MFD was trained 50 min/day, 3 days/week for 12 weeks by a sports officer. Before each dance session, warming up was done for about 5 min and cooling down and stretching was done after each session. To be moderate intensity activity, MFD was carried out 10 min/bout, 5 bouts/day with minimal rest between them to maintain their heart rate at the 50-70% of their predicted maximal heart rate.

Statistical analysis

Data analysis was completed with the Statistical Package for Social Science software (SPSS, version 20). The categorical variables were expressed as number (percentage) and numerical variables as mean ± SD. Independent sample T test was used to compare the variables between different BMI groups. Students paired 't' test was used to compare the variables before and after intervention. One sample 't' test was used to expressed percent change values as mean (95% confidence interval). The p value < 0.05 was considered as statistically significant.

III. RESULTS

Overall, 123 physically inactive adults were recruited. Of these, 9 adults were dropped out due to illness or personal reasons and 114 (93%) completed the 12-week MFD program.

Table 1. Basic characteristic of physically inactive adults (n = 114)

Variable	number (%) or mean (SD)
Completed age in years, mean (SD)	40.54 (7.54)
< 40 years, number (%)	52 (45.6%)
≥ 40 years, number (%)	62 (54.4%)
Sex, number (%)	
Female	109 (95.6%)
Male	5 (4.4%)
Known history of diseases, number (%)	
Hypertension	8 (7.01%)
Diabetes mellitus	4 (3.5%)
Classified according to BMI, number (%)	
Normal weight (BMI between 18.5 and < 25 kg/m^2)	44 (38.6%)
Overweight (BMI between ≥ 25 and < 30 kg/m^2)	49 (43%)
Obese (BMI ≥ 30 kg/m^2)	21 (18.4%)

Table-2. Cardio-metabolic variables according to BMI

Cardio-metabolic variables	Normal weight (n = 44) (Mean±SD)	Overweight (n = 49) (Mean±SD)	Obese (n = 21) (Mean±SD)
BW (kg)	53.1±5.5	66.12±5.8***	^{c}77.72±8.0$^{\$\$\$}$
BMI (kg/m^2)	22.16±1.6	27.4±1.28***	^{c}31.41±1.25$^{\$\$\$}$
BFP (%)	28.77±4.1	36.11±4.34***	^{c}42.54±3.39$^{\$\$\$}$
FFM (kg)	37.7±3.35	42.23±4.64***	44.67±5.63$^{\$\$\$}$
WC (cm)	72.02±5.5	84.02±5.86***	^{c}93.15±7.44$^{\$\$\$}$
SBP (mmHg)	114.56±11.84	127.63±13.57***	128.68±14.09$^{\$\$\$}$
DBP (mmHg)	72.22±7.03	82.44±7.6***	83.78±10.54$^{\$\$\$}$
HR (beats/min)	85.77±12.89	86.65±11.27	92.84±12.5$^{\$}$
VO_{2max} (mL/kg/min)	27.94±11.34	25.56±5.21	^{b}21.41±4.72$^{\$}$
FPG (mg/dL)	85.22±14.51	87.82±12.67	^{a}98.96±21.68$^{\$\$}$
FSI (μIU/mL)	10.8±4.57	16.38±6.35***	^{a}21.08±10.65$^{\$\$\$}$
HOMA-IR	2.27±1.07	3.58±1.65***	^{b}5.32±3.3$^{\$\$\$}$
TC (mg/dL)	148.31±33.9	152.64±26.54	^{a}168.89±24.92$^{\$}$
TG (mg/dL)	107.13±30.68	137.89±80.25*	152.16±55.72$^{\$\$\$}$
HDL (mg/dL)	44.31±15.40	42.39±17.83	45.79±19.43
Indirect LDL (mg/dL)	82.57±33.17	82.66±29.8	92.66±37.14

Independent samples T test
*(p<0.05), ***(p<0.001) indicate significant difference between normal weight and overweight
$^{\$}$(p<0.05),$^{\$\$}$(p<0.01),$^{\$\$\$}$(p<0.001) indicate significant difference between normal weight and obese
^{a}(p<0.05), ^{b}(p<0.01), ^{c}(p<0.001) indicate significant difference between overweight and obese

Table-3. Cardio-metabolic risk according to BMI

Cardio-metabolic risk markers[14, 15]	Normal weight (n=44) n (%)	Overweight (n=49) n (%)	Obese (n=21) n (%)	Total (n=114) n (%)
Central obesity (WC ≥ 90 cm for males, ≥ 80 cm for females)	2 (4.5%)	36 (73.5%)	19 (90.5%)	57 (50%)
High BP (SBP ≥130 or DBP ≥ 85 mmHg, or treatment of previously diagnosed hypertension)	5 (11.4%)	23 (46.9%)	9 (42.9%)	37 (32.5%)
Hyperglycemia (FPG ≥ 115 mg/dL)	1 (2.3%)	0	3 (14.3%)	4 (3.5%)
Hyperinsulinemia (FSI > 25 µIU/mL)	0	4 (8.2%)	4 (19%)	8 (7%)
Increased HOMA-IR (≥ 1.56 for men, ≥ 1.64 for women)	29 (65.9%)	48 (97.9%)	18 (85.7%)	95 (83.3%)
High TC levels (≥ 150 mg/dL)	22 (50%)	26 (53.1%)	16 (76.2%)	64 (56.1%)
High TG levels (≥ 150 mg/dL)	5 (11.4%)	15 (30.6%)	9 (42.8%)	29 (25.4%)
High LDL levels (≥ 100 mg/dL)	16 (36.4%)	12 (24.5%)	8 (38.1%)	36 (31.6%)
Reduced HDL (< 40 mg/dL for men, < 50 mg/dL for women)	28 (63.6%)	35 (71.4%)	11 (52.4%)	75 (65.8%)

The effect of the 12-week MFD intervention on anthropometric, body composition and cardio-metabolic variables are presented in Table-4. After the 12-week intervention, body weight (p<0.01), BMI (p<0.01), BFP (p<0.001), and WC (p<0.001) decreased significantly, while FFM (p<0.001) increased significantly. VO_{2max} (p<0.001) improved significantly. BP (both SBP and DBP) (p<0.01) and HR (p<0.001) decreased significantly. TC, TG and LDL decreased significantly (p<0.001). On the other hand, FPG, FSI, HOMA-IR and HDL marked a non-significant change.

Table-4. Changes in anthropometric, body composition and cardio-metabolic variables of the physically inactive adults (n = 114) before and after a 12-week MFD program

	Before Mean±SD	After Mean±SD	Percent change Mean (95% CI)
BW (kg)	63.18±10.84	62.72±10.59**	-0.66(-1.18 to -0.13)
BMI (kg/m^2)	26.11±3.73	25.93 ± 3.6**	-0.64(-1.17 to -0.08)
BFP (%)	34.48±6.52	32.32±6.18***	-6.06(-7.54 to -4.74)
FFM (kg)	40.87±5.11	46.02±5.86***	12.76(11.47 to 14.04)
WC (cm)	81.14±9.99	77.65±8.95***	-4.1(0.47 to -5.05)
SBP (mmHg)	122.63±14.36	119.29±13.47**	-2.24(-4.02 to -0.54)
DBP (mmHg)	78.66±9.38	75.92±10.08**	-2.91(-5.04 to -.0.79)
HR (beats/min)	87.44±12.22	80.1±9.92***	-7.09(-9.58 to -4.52)
VO_{2max} (ml/kg/min)	25.79±8.43	32.84±13.74***	32.77(24.33 to 43.03)
FPG (mg/dL)	88.46±15.78	89.33±15.3	2.17(-1.4 to 5.39)
FSI (µIU/mL)	14.98±7.62	15.12±8.38	7.82(0.09 to 16.08)
HOMA-IR	3.36±2.13	3.4±2.16	12.65(2.91 to 22.74)
TC (mg/dL)	153.7±30.03	126.05±29.08***	-16.65(-19.84 to -13.35)
TG (mg/dL)	128.23±62.99	104.13±48.51***	-14.22(-18.71 to -9.4)
HDL (mg/dL)	43.72±17.09	43.14±16.62	14.55(2.06 to 27.61)
Indirect LDL (mg/dL)	84.32±32.38	62.08±31.24***	-6.29(-22.05 to 13.84)

Paired ‘t’ test and one sample ‘t’ test
**indicates significant difference (p < 0.01)
***indicates significant difference (p < 0.001)

IV. DISCUSSION

The findings of the present study (Table-2 and Table-3) support the evidence that the cardio-metabolic risk was higher in the overweight and obese than the normal weight adults.

After the 12-week intervention, despite both BW (0.66%) and BMI (0.64%) were significantly reduced from baseline values, the mean BW reduction was only about 1 kg. Significant reductions in WC (4.1 %) and BFP (6.06 %), while a significant increase in FFM (12.76%) were also found (Table-4). These findings are in agreement with the well-designed studies of previous researchers in which aerobic dance leads to loss of a significant amount of BMI (3.1 kg). In that study, weight-loss program, that comprised low impact aerobic dance prescription (60 min/day, 2-3 day/week) and food restriction, lasted for 3 months, caused a significant decreased in BFP (6.1%) and a non-significant change in FFM (1.6 kg).[16] It has been well recognized that FFM is typically decreased after dietary restriction. [17] The discrepancy in these findings might be due to the fact that the present study was not a weight loss program and diet was not restricted. In the present study, as the majority of the adults (70/114, 61.4%) were overweight and obese, who were physically inactive and unfamiliar with exercise, the MFD training was initiated with low intensity and frequent rest to prevent the musculoskeletal injuries due to heavy BW. Thus, the progressively increased intensity of the MFD intervention in the present study is not sufficient to cause large BW reduction. The MFD program conducted for 12 weeks results in small loss in body mass, moderate loss in BFP and moderate increases in FFM.

After MFD intervention, there was a significant decrease in SBP (2.24%), DBP (2.91%), TC (16.65%), TG (14.22%) and LDL (6.29%) of the subjects, while HDL was not changed significantly (Table-4). Fall in TC, TG and LDL was more marked than fall in BW (0.66%) and BFP (6.06 %). Thus, the present study indicated that the short-term (12-week) MFD training reduces BP, TC, TG and LDL without concomitant changes in BFP, BW as well as HDL. These findings agreed with that of a study done in USA.[17] It also found that the 12-week Zumba dance intervention caused significant reduction in SBP (13.63 mmHg, p=0.02), DBP (6.19 mmHg, p = 0.03), and TG levels (16.92 mg/dL, p = 0.02), despite minimal weight loss (0.96 kg, p = 0.87).

In the present study, there was no significant change in FPG, FSI and HOMA-IR after the 12-week intervention (Table-4). Similarly, a study on non-diabetes overweight and obese women (n = 23) found no significant changes in fasting glucose and insulin sensitivity after 16-week Zumba dance intervention (3 times/week, 60 min/session). However, no significant changes in BP and blood lipids was found in that study.[18] A study in USA also found that after 12-week Zumba dance intervention, minimal weight loss (0.96 kg, p = 0.87) with fasting glucose increase slightly (by 1.62 mg/dL), but not significantly.[17] Increase insulin sensitivity has been shown with the consumption of the low glycemic Mediterranean diet in a lifestyle intervention study in USA. They found that BMI (3%), BFP (7.95%) and HOMA-IR (34%) were reduced significantly in 15 overweight women (age 24 ± 1 year, mean BMI 27.6 ± 0.8 kg/m^2) after lifestyle intervention [high-intensity intermittent exercise (20 minutes/day, three times a week), fish oil capsule (1100 mg/day), and low glycemic Mediterranean diet].[19] In the present study, since there was no appropriate control of dietary intake, only a bit change in BW, BMI, and BFP loss of the subjects exhibited. It might be a reason why there was no significant improvement of insulin sensitivity after the 12-week MFD intervention.

As expected, the 12-week MFD program induced a significant increase in VO_{2max} (32.77%) in the present study. The effect of MFD on CPF is impressive, given that the most component of MFD is aerobic exercise, and possible mechanism may involve enhanced cardiac contractility which underlie the significant increase in maximal oxygen uptake.[20] Similarly, a study reported that maximal oxygen uptake increased significantly (18%) following 12 weeks of aerobic dance in obese middle-aged Japanese women.[16]

In summary, it can be concluded that MFD is a useful exercise modality to raise the cardio-metabolic health in physically inactive adults. However, a short term (12 weeks) MFD practicing without dietary and other lifestyle modifications would not have positive impact on HDL, FPG, FSI and insulin sensitivity.

Conflict of interest

The authors declare that there has no conflict of interests.

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