RESEARCH ARTICLE

Physiological impact of Tabata exercise on cardiometabolic and cardiorespiratory parameters in transgender people of Multan

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Abstract

Objective: To investigate factors directly related to cardiometabolic and cardiorespiratory fitness in transgender people.

Method: The cross-sectional, experimental study was conducted at the Government Girls Comprehensive Higher Secondary School, Multan, Pakistan, from January to February 2023, after approval from the ethics review committee of the Muhammad Institute of Medical and Allied Sciences, Multan, and comprised transgender people aged 17-28 years. Data was collected using the physical activity readiness questionnaire. All the participants were subjected to Tabata sessions for 4 weeks. Standard cardiometabolic and cardiorespiratory fitness values were noted at baseline and post-intervention. Data was analysed using SPSS 23.

Results: Of the 44 participants, 26(59%) were trans-men, 18(40.9%) were trans-women, 16(36.3%) were aged 17-19 years, and 10(22.7%) had other transgender individuals in their families. Cardiorespiratory and cardiometabolic parameters showed significant improvement post-intervention compared to baseline values ($p<0.05$).

Conclusion: Tabata exercises were found to be useful in maintaining cardiorespiratory and cardiometabolic parameters as well in increasing the participants' motor performance.

Key Words: Cardiorespiratory fitness, Transgender persons, Social isolation, High-intensity interval training.

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Introduction

Transgender is a broad phrase that describes people whose sexual attributes and desires are in colflict. For example, if the transgender person is a male, he wishes to live as a female; and if the transgender person is a female, she wishes to live as a male. An individual whose apparent show or performance is gender-atypical cannot be categorised as a transgender person.[1] Transgender means a person who is neither male nor female, and "people with the third gender are known as transgenders."[1]

The increasing rate of cardiometabolic disorders, especially in transgender people, has become a health concern across the world. A balanced cardiometabolic system is necessary for a high quality of life (QOL). A large-scale study conducted on transgender people from 22 countries reported an incidence of reduced cardiometabolic stamina, ranging from 3% to 59% in different parts of the world.[2]

The cardiovascular system supplies oxygenated blood to the whole body. Any variation in any heart chamber will create a severe problem. A cardiac patient may have different disorders, such as myocardial infarction (MI), hypertension (HTN), flutter, tachycardia, fibrillation, angina and coronary artery blockage. These aetiologies are directly associated with cardiometabolic disorders.[3] Cardiometabolic disorders and endurance are inextricably linked. Obesity is caused primarily by an accumulation of low-density lipoproteins (LDLs) in the body, which leads to cardiovascular disorders (CVDs). Obesity and overweight were found to be considerably greater in transgender people.[3] The prevalence of cardiometabolic disorders rises in direct proportion to the rise in body mass index (BMI), which has an inverse relationship with QOL. Transgender people with a BMI below the normal range are more likely to get osteoporosis and have a weak immune system.[3] Cardiometabolic fitness, defined as the body's capacity to engage in dynamic, major muscle exercise for an extended time frame at a moderate to high intensity, is an essential component of physical fitness, and normal cardiometabolic fitness (CMF) and body weight are essential for good QOL.[4]

In 2012, there were 175 million individuals who died as a

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result of cardiometabolic disorders, accounting for 30% of all global deaths, with cardiac heart disease and stroke being the major causes. The risk factors associated with CVDs are diabetes mellitus (DM), HTN, smoking, unhealthy diet, alcohol consumption, and decreased CMF.[5] The capacity of circulatory and respiratory systems to effectively provide oxygen to the functioning muscles to endure physical therapy is called CMF, which is measured using various exercise models, such as high knees, jumping jacks, and spot jumps.[6,7]

The impact of high-intensity interval training (HIIT) on an aerobic energy-releasing system of the human body was studied, revealing that after HIIT, the improvement of the body's maximal oxygen consumption (VO_2 max) was closely associated with the oxygen demand (%VO_2 max) of HIIT, and demonstrating that training intensity was an important factor in improving the body's maximum oxygen power post-HIIT.[8]

The current study was planned to investigate factors directly related to CMF and cardiorespiratory fitness (CRF) in transgender people.

Subjects and Methods

The cross-sectional, experimental study was conducted at the Government Girls Comprehensive Higher Secondary School, Gulgasht Colony, Multan, Pakistan, from January to February 2023, after approval from the ethics review committee of the Muhammad Institute of Medical and Allied Sciences, Multan.

The sample size was calculated with level of confidence 95% and error margin 5% using a formula described in literature.[9] The sample was raised using non-probability convenience sampling technique. Those included after permission from the Punjab School Education Department, were transpersons aged 17-28 years after written consent from them, or form their parents and guru in case they were aged <18 years.

Those with any type of mental or physical impairment, a history of a chronic condition associated with cardiovascular risk ailments, any kind of serious surgery, DM, hepatitis, breathing difficulties, asthma, congestive heart failure, or MI were excluded.

Data was collected using the Physical Activity Readiness Questioner (PAR-Q)[10] and World Health Organisation Quality of Life-Brief version (WHOQOL-BREF).[11]

Cardiac parameters, blood pressure (BP), heart rate (HR), respiration rate (RR), oxygen saturation (SpO_2), temperature, and VO_2 max were recorded. A mercury manometer (Certeza mercury B.P apparatus, Germany), a pulse oximeter (Lifecare:Fingertip pulse oximeters, China), a thermometer (Hamilton Company, USA), and a stethoscope (Certeza, Garmany were used to record parameters like B.P, pulse rate, oxygen saturation and body temperature). Metabolic parameters, ketone bodies through urine analysis, blood glucose, blood cholesterol, and uric acid were recorded (Best-Check 3-in-1 device, China). The standard formula was used to calculate body mass index (BMI). The WHO recommendations for the South Asian population were followed.[12] The percentage of body fat (BF%) was calculated using an analytic scale (BG55, Beurer, Germany)[13], with obese - BF% 32.1% or more) and overweight BF% 27.1-32%.

All the subjects were exposed to Tabata sessions for 4 weeks (5 days/week and each session lasted for about 12 minutes). Participants' physical efficiency index (PEI)[14] was assessed by applying the Harvard Step Test[15], in which the participants were asked to step up and down using a high stool (16.25 inches). The test used a 120bpm metronome at 30 cycles per minute, and the formula for

$$\text{PEI} = \frac{100 \text{ x test duration in seconds}}{2 \text{ x sum of heart beats in the recovery periods}}$$

calculating PEI [14] was:

Exercise-induced stress tests were also done under the guidance of a physician and a physiotherapist. The hand muscular strength (HST) measurement, the 30-second sit-up test (SIT) for abdominal muscular strength, and the sit-and-reach test (SRT) for flexibility were used to assess the musculoskeletal component characteristics.[16] Eurofit guidelines were used for these tests.[17] The motor component was identified using the 4x10m shuttle run test to measure agility and the vertical jump test (VJT) in line with literature.[18]

The participants did Tabata exercise for 12 minutes, and activities involving exercise-induced stress, such as high knees, jumping jacks, and spot jumps, were used for measuring CMF (Figure 1). Participants did 7-8 bouts of 20-second exercise with 10 seconds of rest between the bouts while maintaining time with a pre-recorded beep (Figure 2).[18] The exercise was called off when the participant could not keep pace. The number of bouts for each exercise was recorded. BP, RR, VO_2 max, HR and temperature were measured before and after the sessions. The instructor encouraged the subjects to put forth their best effort during the exercise. BP, HR, RR, VO_2 max and temperature were noted,[19] and VO_2 max was calculated using the formula:[19]

Figure-1: Measuring of parameters and participants performing Tabata exercise.

VO_2 max = HR max × SV max × (a-VO_2 difference) max (2)

After exercise, the participants' body temperature was expected to rise by up to 1°C before returning to normal once equilibrium was reached.[20] All the parameters were measured at baseline on day 1 and post-intervention after 4 weeks.

Data was analysed using SPSS 23. Shapiro-Wilk test was used to assess data normality. Normally distributed data was subjected to parametric paired t-test to compare the baseline and post-intervention mean values. Quantitative data was expressed using mean ± standard deviation (SD), whereas categorical variables were expressed using frequencies and percentages. Pearson correlation was done between demographic data and physical fitness. $P<0.05$ was considered statistically significant.

Results

Of the 44 participants, 26(59%) were trans-men, 18(40.9%) were trans-

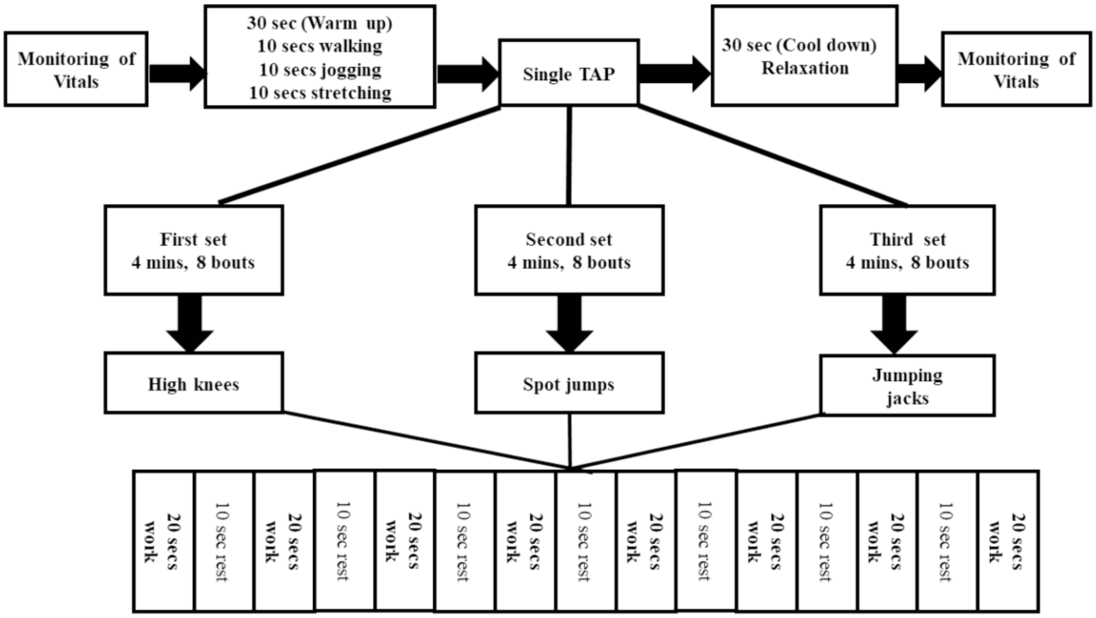

Figure-2: Intervention scheme.
TAP: Tabata Training programme.

Table-1: Demographic data

Variables	n (%)
On the basis of gender	
Trans women	18(40)
Trans men	26(59.9)
On the basis of socioeconomic background	
Rural	12(27.2)
Urban	32(72.7)
Age (years)	
17-19	16(36.3)
20-22	14(31.8)
23-25	12(27.2)
26-28	2(4.5)
Anyone else in family member (transgender)	
Yes	10(22.7)
No	34(77.2)
On the basis of BMI	
Underweight	2(4.5)
Normal	24(54.5)
Overweight	14(31.8)
Obese	4(9.0)
Quality of life	
Very poor	14(31.8)
Poor	10(22.7)
Neither poor nor good	10(22.7)
Good	7(15.9)
Very good	3(6.8)

BMI: Body mass index.

women, 16(36.3%) were aged 17-19 years, and 10(22.7%) had other transgender individuals in their families (Table 1).

Table-2: Comparison of baseline and post–intervention values

Parameters	Values	Mean±S.D	Sig.
Uric acid	Pre-value	482.31 ±175.34	<0.001
	Post-value	234.61 ±54.35	
Glucose	Pre-value	5.39±0.82	<0.001
	Post-value	2.97±0.70	
Ketones	Pre-value	0.57 ± 0.53	<0.001
	Post-value	0.26 ± 0.12	
Cholesterol	Pre-value	5.20±0.73	<0.001
	Post-value	2.85±0.77	
Systolic B.P	Pre-value	126.34±7.29	0.05
	Post-value	127.27±5.44	
Diastolic B.P	Pre-value	80.56±3.51	0.00
	Post-value	85.79±5.80	
HR	Pre-value	76.54±5.90	0.010
	Post-value	73.59±2.03	
Oxygen saturation	Pre-value	88.25±3.01	<0.001
	Post-value	95.63±0.96	
RR	Pre-value	19.95±3.62	0.05
	Post-value	20.93±0.97	
BMI	Pre-value	21.24±2.64	<0.001
	Post-value	18.89±1.95	
Temperature	Pre-value	35.89±0.60	<0.001
	Post-value	37.34±0.17	
Body fat	Pre-value	30.27±5.24	<0.001
	Post-value	26.02±5.36	
Body weight	Pre-value	65.24±13.67	<0.05
	Post-value	63.81±11.81	
Fat (%)	Pre-value	15.67± 7.03	<0.05
	Post-value	13.90±6.14	
PEI [points]	Pre-value	42.96±4.23	<0.05
	Post-value	46.57±4.27	
Ag [s]	Pre-value	10.08±0.55	<0.001
	Post-value	16.25±1.78	
VJ (cm)	Pre-value	57.35±9.43	<0.05
	Post-value	60.35±8.37	

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S.D: Standard deviation, HR: Heart rate, BMI: Body mass index, PEI: Physical efficiency index, Ag: Agility, RR: Respiration rate, BP: Blood pressure..

Cardiorespiratory and cardiometabolic parameters showed significant improvement post-intervention compared to baseline values (Table 2). Correlation of CRF, QOL and CMF paramters was also noted (Table 3).

Table-3: Correlation of cardiorespiratory fitness (CRF), quality of life (QOL) and cardiometabolic fitness (CMF) paramters.

	Age	QOL	RR	Oxygen Saturation	Cholesterol
QOL	-0.7343	1			
RR	0.583655	-0.60551	1		
Oxygen Saturation	0.20476	0.10644	0.657794	1	
Cholesterol	-0.58365	0.605511	-1	-0.65779	1

RR: Respiration rate.

Discussion

The current study assessed that after doing Tabata exercises, there was a marked reduction in CRF parameters, including oxygen SpO_2, HR, RR, BP, and CMF parameters, including uric acid, cholesterol level, BMI and BF%. There was also a decrease in the levels of glucose and ketones. Improvements were also noted in physical fitness indices, agility and motor performances of transgender people. As such, the current study supported the value of Tabata exercises in physical activity intended to lower BF% and to increase physical capability.

Due to the Tabata exercises, there was stimulation of the vagal tone. These high-intensity exercises caused the secretion of epinephrine, which caused adrenaline receptors to stimulate.[21] Epinephrine has been shown to stimulate lipolysis and is mainly accountable for fat release from fat stores. Markedly more beta-adrenergic receptors are stimulated, favouring lipolysis.[22] During exercise, the blood flow increases, eliminating local ischaemia and meeting the oxygen demand of skeletal muscles, and, as a result, CRF increases.[23] There is also an increase in the body's temperature up to 1°C to maintain homeostasis.[24]

Popowczak et al.[25] conducted a study in which Tabata exercises were supplemented with physical education in young students, but the study had male and female subjects. Zapata-Lamana et al.26 also looked into the effects of exercises using the Tabata protocol, and tested the dose-response with duration and frequency.

To our knowledge, the current study is the first from Pakistan to examine how Tabata exercises affect transgender people. Transgender people have for long suffered society's negligence, with even their own families making them feel ashamed, and limited research has been done to highlight their physical health and wellness. Many transgender people live on the periphery of society and have to put up with stigma, isolation, discrimination, violence and poor health. They have trouble getting the proper medical care, whether broader or tailored to their gender-specific needs.

The current study has limitations as it had a small sample size, and was done at a single centre.

Conclusion

Tabata sessions improved CRF and CMF parameters, increased motor performance, and improved physical function among transgender subjects.

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Disclaimer: The text is based on an academic thesis.

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AB: Investigation.
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