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Effect of Trimetazidine on Functional Capacity in Patient with Ischaemic Cardiomyopathy (TOFCAPI)

Mohsin Ahmed[1*], Golam Morshed[2], Mahmood Hasan Khan[3], Md. Arifur Rahman[2], Muhammed Aminur Razzaque[1], Shariful Islam[1], Sayeedur Rahman Khan[1], Chowdhury Md. Kudrat-E-Khuda[1], Salahuddin Anis Shiblee[4], Md. Habibur Rahman[4]

[1]Department of Cardiology, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh
[2]Department of Cardiology, Government Employee's Hospital, Dhaka, Bangladesh
[3]Department of Cardiology, Delta Hospital Ltd., Dhaka, Bangladesh
[4]IPDI Foundation, Dhaka, Bangladesh

Email: *profmohsinahmed@gmail.com, drmdgolammorshed@gmail.com, drarif79@yahoo.com, drmhk78@gmail.com, aminurrazib74@gmail.com, ratan_cts@yahoo.com, dr.rumibd@gmail.com, kudratsays@gmail.com, shibleemusic@gmail.com, habib.ipdi21@gmail.com

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Abstract

Objective: This study aimed to evaluate the efficacy of trimetazidine on exercise capacity via a six-minute walk test in patients with ischaemic cardiomyopathy and also evaluate the effect of trimetazidine on left ventricular function via echocardiography in the same population. **Methods:** This prospective observational study, conducted at the National Institute of Cardiovascular Diseases in Dhaka, Bangladesh, enrolled 200 patients with ischaemic cardiomyopathy and a depressed left ventricular ejection fraction (LVEF < 35%). We investigated the effects of modified-release trimetazidine on exercise capacity and left ventricular function in ischaemic cardiomyopathy patients with an LVEF less than 35%. The cohort, was divided into Group 1, which received modified-release trimetazidine alongside standard anti-ischaemic therapy and Group 2, which received standard therapy. Patients were subjected to a year-long study with follow-ups at the 1st and 6th months. Using SPSS software, statistical analysis was used to assess treatment-related effects and baseline comparability. **Results:** In this study (n = 200) of ischaemic cardiomyopathy patients, the mean age was 58 years, with 76% of the patients being male. All study subjects received GDMT (Guideline-Directed Medical Therapy) for angina and heart failure. Those who received the modified released form of trimetazidine developed lesions during the 1st and 2nd

follow-ups, during which the LVEF, LVIDd, and six-minute walk distance significantly improved ($p < 0.05$). There was a progressive improvement in functional status, which was statistically highly significant at the second follow-up. **Conclusion:** The findings of the present study demonstrated that the addition of modified-release trimetazidine to GDMT can improve exercise capacity and left ventricular function in patients with ischaemic cardiomyopathy.

Keywords

Bangladesh, Heart Failure, Exercise Capacity, Trimetazidine, Ischaemic Cardiomyopathy

1. Introduction

Exercise capacity is a more powerful predictor of mortality than other established risk factors for CVD [1] [2]. Exercise capacity is expressed in terms of metabolic equivalents (METs), which are common clinical measures of exercise tolerance. It has been found that each 1-MET increase in exercise capacity confers a 12% improvement in survival [1].

Myocardial energy metabolism may normalise in the early stages of heart failure, but as failure progresses, mitochondrial oxidative metabolism is reduced and glycolysis is increased with the downregulation of glucose and fatty acid oxidation [3]. Although there have been considerable advances in therapeutics, heart failure remains a leading cause of mortality and morbidity in developed countries and is becoming increasingly common in developing countries [4] [5]. Reducing free fatty acid (FFA) oxidation and, increasing glucose oxidation improve cardiac contraction and slow the progression of left ventricular (LV) failure [4]. Failure of the myocardium in heart failure appears to be caused to some degree by alterations in substrate metabolism [6]. Trimetazidine acts as a partial inhibitor of fatty acid oxidation and, in turn, stimulates glucose oxidation [5] [6] [7]. Improvements in LV systolic function with trimetazidine in heart failure patients, especially those with diabetes, have been reported in several studies [8]-[13].

The efficacy of trimetazidine has been well studied in numerous large-scale international clinical studies as well as RCTs. However, few small-scale studies have been performed on the Bangladeshi population. Therefore, it is of particular interest to study its efficacy on a large scale among the Bangladeshi population.

The aim of the present study was to evaluate the efficacy of trimetazidine on exercise capacity by a six-minute walk test in patients with ischaemic cardiomyopathy and to evaluate the effect of trimetazidine on left ventricular function by echocardiography in the same population.

2. Materials and Methods

2.1. Study Design

This study used a prospective observational method and was carried out at Dhaka's National Institute of Cardiovascular Diseases. The primary goals of the study were to assess the impact of modified-release trimetazidine on the capacity of patients suffering from ischaemic cardiomyopathy to exercise. The secondary objective was to evaluate the effect of trimetazidine on left ventricular function in patients with ischaemic cardiomyopathy.

2.2. Participant

Participants in this single-center study were diagnosed with ischaemic cardiomyopathy, which was defined by an echocardiogram-confirmed left ventricular ejection fraction (LVEF) of less than 35%. All patients were uenrolled after six months and treatment was administered for one year overall. Participants had to meet three criteria to be eligible: they had to have ischaemic cardiomyopathy, an LVEF of less than 35%, or at least one case of heart failure hospitalisation in the year before admission. Those with unstable angina, abrupt cardiac failure, chronic pulmonary or systemic illnesses, or renal insufficiency were excluded due to specific criteria.

Based on the findings of an echocardiogram, modifications in the electrocardiogram (ECG), symptoms, and results of coronary angiography (CAD), stable ischaemic cardiomyopathy was diagnosed. Over the course of the six months, a thorough screening process was used to enroll patients and those who met the eligibility requirements.

A single drug in the morning and one in the evening were the recommended dosages of modified-release trimetazidine, which was administered as part of the treatment. Throughout the course of the trial, this standardised strategy attempted to guarantee constant compliance with the treatment plan.

3. Procedures

The study procedures included a systematic approach to evaluate the effect of trimetazidine on patients' capacity to exercise and left ventricular function in cases of ischaemic cardiomyopathy. The participants were divided into two groups for comparative purposes. Group 2 received standard treatment combined with a control treatment, while Group 1 received regular therapy with modified-release trimetazidine. Throughout the trial, modified-release trimetazidine and substitute medication were given according to the recommended dosage.

3.1. Recruitment and Screening

Prospective participants were carefully screened over a six-month period using predetermined inclusion and exclusion criteria. After that, those who qualified were contacted to obtain their informed consent, guaranteeing that they fully

understood the study.

3.2. Baseline Assessments

Baseline assessments focused on confirming a left ventricular ejection fraction (LVEF) of less than 35%. Along with additional techniques, echocardiography was used in these evaluations. A comprehensive approach, taking into account the patient's symptoms, coronary angiography (CAD) results, electrocardiogram (ECG) findings, and echocardiography confirmation, led to the diagnosis of stable ischaemic cardiomyopathy.

3.3. Treatment Administration

Participants were given modified-release trimetazidine (Trimetazidinel®) according to standard recommendations. To ensure standarised and consistent treatment across the duration of the trial, the suggested maintenance included taking one medication in the morning and one in the evening.

3.4. Follow-Up Visits

Over the course of the six-month treatment plan, a number of routine follow-up appointments were planned. During these sessions, the patients' capacity to exercise was monitored, their left ventricular function was evaluated, and they were closely observed for any possible complications. The goal of this comprehensive approach was to record the constant modifications and reactions to trimetazidine.

3.5. Data Collection

For each participant, a comprehensive range of clinical and biochemical data was gathered, including BMI, blood pressure, demographic information, cardiovascular risk information, patient complaints, and biochemical criteria. The dataset included a variety of features, including the six-minute walk distance, NT-pro BNP levels, NYHA functional class, and echocardiographic measures such as LVEF, LVIDd, PASP, TAPSE, and MR grading. This all-inclusive methodology guarantees a comprehensive assessment of the effect of trimetazidine on ischaemic cardiomyopathy.

During the visit, standardised information collection methods were used to record data on safety parameters, exercise capacity, and left ventricular function. The utilisation of standardised forms and computerised records enabled thorough and uniform documentation, therefore improving the authenticity of the study data.

3.6. Outcome

The outcomes of the study were evaluated using two key objectives. Initially, the effect of trimetazidine on the ability of ischaemic cardiomyopathy patients to exercise was evaluated. Secondly, the effect of trimetazidine on the function of

the left ventricle in these patients was assessed.

This study included measurements such as six-minute walk distance and other important clinical indications for the primary goal of exercise capacity. The secondary objective was to evaluate left ventricular function via echocardiographic measurements such as the degree of mitral regurgitation (MR), pulmonary artery systolic pressure (PASP), tricuspid annular plane systolic excursion (TAPSE), left ventricular ejection fraction (LVEF), and left ventricular internal diameter in diastole (LVIDd).

Our study provides information on these results to better understand how well trimetazidine works to improve left ventricular function and exercise capacity in patients suffering from ischaemic cardiomyopathy. A detailed comprehension of the drug's effects on the population under study was made possible by the thorough evaluation of both primary and secondary objectives.

3.7. Statistical Analysis

The statistical analysis for this study was performed using SPSS software for Windows, version 25.0. Categorical variables were displayed as percentages, and continuous data were displayed as the mean ± SD. The student's t-test for independent group and Pearson's chi-square test for categorical variables were used to confirm baseline comparability between Group 1 (receiving modified-release trimetazidine) and Group 2 (receiving standard anti-ischaemic medication only). After the treatment, changes in the parameters were evaluated using repetitive measures analysis of variance (ANOVA), which enabled the analysis of within- and between-subject differences in the first and sixth months. A two-tailed p-value of 0.05 or less was considered to indicate statistical significance and provides an important basis for assessing how effectively trimetazidine works to improve the capacity for exercise and left ventricular function in ischaemic cardiomyopathy patients.

4. Results

The baseline characteristics (Table 1) of the study cohort, including differences between Group 1 (standard therapy with modified-release trimetazidine) and Group 2 (standard therapy alone), were not significantly different. Similarly, other variables such as BMI, vital signs, sex distribution, cardiovascular risk factor, and patient complaints showed no significant changes between the groups (all $p > 0.05$), the mean age of the participants was 58 ± 10.22 years, and there was a nonsignificant trend ($p = 0.052$) due to the small difference in years between Group 1 (56 ± 9.29 years) and Group 2 (60.2 ± 10.9 years).

The table shows the baseline characteristics of the study population. No significant difference was detected ($p > 0.05$).

Figure 1 shows the prevalence of angina severity by visually representing the distribution of Canadian Cardiovascular Society (CCS) anginal classes throughout the total study group. Significant changes were identified when examining

Table 1. Baseline characteristics of the study population.

	Overall (n = 200)	Group 1 (n = 106)	Group 2 (n = 94)	p-Value
Age	58 ± 10.22	56 ± 9.29	60.2 ± 10.9	0.052^{ns}
BMI (kg/m^2)	26.44 ± 4.74	26.71 ± 4.49	26.14 ± 5.04	0.552^{ns}
Pulse (min)	78.31 ± 6.91	78.26 ± 7.32	78.3 ± 6.5	0.947^{ns}
Systolic BP (mmHg)	120.7 ± 10.61	119.69 ± 14.28	121.85 ± 3.05	0.314^{ns}
Diastolic BP (mmHg)	81.53 ± 2.22	81.66 ± 2.51	81.38 ± 1.87	0.537^{ns}
Respiratory Rate (breaths/min)	19.58 ± 0.59	19.49 ± 0.61	19.7 ± 0.6	0.107^{ns}
Gender				
Male	152 (76%)	82 (77.4%)	70 (74.5%)	0.736^{ns}
Female	48 (24%)	24 (22.6%)	24 (25.5%)	
Cardiovascular Risk factors				
Hypertension	72 (36%)	40 (37.7%)	32 (34.1)	0.701^{ns}
Diabetes	86 (43%)	54 (50.9%)	32 (30.2%)	0.088^{ns}
Dyslipidemia	24 (12%)	16 (15.1%)	08 (8.5%)	0.312^{ns}
Smoking	32 (16%)	23 (21.7%)	09 (9.6%)	0.358^{ns}
Family History of IHD	25 (12.5%)	14 (13.2%)	11 (11.7%)	0.286^{ns}
Patient Complaints				
Palpitation	113 (56%)	96 (90.7%)	17 (18.1%)	0.286^{ns}
Syncope	07 (3.5%)	07 (6.6%)	00 (00%)	0.421^{ns}
Body Swelling	15 (7%)	13 (12.3%)	02 (2.1%)	0.286^{ns}
Shortness of Breath	174 (87%)	92 (86.8%)	82 (87.2%)	0.098^{ns}
H/O Cardiac Arrest	12 (6%)	09 (8.5%)	03 (3.2%)	0.241^{ns}
Biochemical Parameters				
RBS (mmol/l)	8.87 ± 4.53	9.36 ± 5.76	11.5 ± 30.7	0.615^{ns}
Hb (gm/dl)	11.84 ± 1.9	9.18 ± 11.22	8.7 ± 13.9	0.849^{ns}
Serum Ferritin (µg/l)	310.45 ± 436.7	311.23 ± 245.8	309.4 ± 425.5	0.291^{ns}
Serum creatinine (mg/dl)	1.34 ± 0.7	1.45 ± 0.9	2.3 ± 2.7	0.419^{ns}
TSH (mU/L)	3.25 ± 10.15	3.39 ± 7.23	1.2 ± 1.2	0.312^{ns}
Na^+ (mEq/L)	135.24 ± 99.8	145.7 ± 130.71	123.4 ± 43.47	0.267^{ns}
K^+ (mEq/L)	6.8 ± 13.07	5.3 ± 7.2	8.5 ± 17.4	0.218^{ns}
Cl^- (mEq/L)	87.9 ± 33.1	89.6 ± 32.5	86.2 ± 34.1	0.615^{ns}
NYHA Functional Class				
I	02 (1.0%)	00	02 (2.1%)	0.755^{ns}
II	06 (3%)	02 (1.9%)	04 (4.3%)	
III	54 (28%)	32 (30.1%)	22 (23.4%)	
IV	128 (69%)	98 (92.4%)	30 (31.8%)	

Continued

NT-pro BNP (pg/ml)	5351.08 ± 6034.5	4536.5 ± 6198.5	6269.6 ± 5771.74	0.153[ns]
Six minutes' walk distance (Feet)	135.6 ± 146.6	127.81 ± 131.44	144.36 ± 163.01	0.576[ns]
Echo				
LVEF (%)	30.25 ± 4.2	30.05 ± 4.1	30.5 ± 4.3	0.786[ns]
LVIDd (mm)	59.23 ± 10.07	59.3 ± 8.9	59.2 ± 11.3	0.687[ns]
PASP (mmHg)	29.00 ± 12.73	30.1 ± 3.7	29.5 ± 4.5	0.932[ns]
TAPSE (mm)	10.18 ± 2.88	11.3 ± 3.8	10.8 ± 3.2	0.291[ns]
MR (mild/moderate/severe)	3.00 ± 1.26	3.2 ± 1.6	2.9 ± 0.8	0.349[ns]

Ns: Not significant.

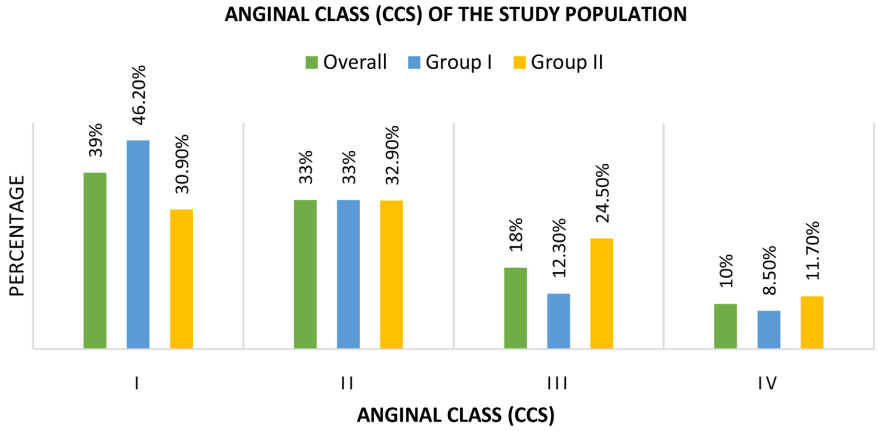

Figure 1. Anginal class (CCS) of the study population (n = 200).

certain treatment groups: In CCS I, II, III, and IV, Group 1 (standard therapy with modified-release trimetazidine) had percentages of 46.2%, 33%, 12.3%, and 8.5%, respectively. The distribution of patients in Group 2 (standard therapy only) was as follows: 30.9% for CCS I, 32.9% for CCS II, 24.9% for CCS III, and 11.7% for CCS IV.

Table 2 shows the background medications received by the study population. As shown in the above table, the majority of the participants were treated with aspirin (93%), diuretics (73.5%), and clopidogrel (48.5%). Then digoxin (43%), ß-blockers (24%), and ACE inhibitors (19.5%) were used. Fewer participants in the study population also received anticoagulants (8.5%). These numbers are also reflected in the groupwise distribution.

Table 3 shows significant improvements in the follow-up assessment. With improved exercise capacity, the six-minute walk distance improved significantly from 127.81 ± 131.44 feet during enrollment to 303.01 ± 125.6 feet at the second

Table 2. Background medication used by the study population (n = 200).

Drugs	Group: I (n = 106)	Group: II (n = 94)	Overall (n = 200)
Aspirin	102 (96.2%)	84 (89.4%)	186 (93%)
Clopidogrel	37 (34.9%)	60 (63.8%)	97 (48.5%)
Nitrate	52 (49.1%)	23 (24.5%)	75 (37.5%)
Beta Blocker	23 (21.7%)	26 (27.7%)	49 (24%)
ACE inhibitor	19 (17.9%)	20 (21.3%)	39 (19.5%)
Diuretics	85 (80.1%)	89 (94.7%)	174 (73.5%)
Digoxin	38 (35.9%)	48 (51.1%)	86 (43%)
Anticoagulants	12 (11.3%)	05 (5.3%)	17 (8.5%)

Table 3. Follow-up status of the study population (n = 200).

Group 1	During enrollment	1st follow up	2nd follow up	p-value
Six minutes' walk distance	127.81 ± 131.44	244.6 ± 142.7	303.01 ± 125.6	**<0.05[s]**
LVEF	30.25 ± 4.2	38.2 ± 5.7	51.0 ± 6.7	**<0.05[s]**
LVEDD	59.30 ± 8.92	53.09 ± 6.6	46.2 ± 4.95	**<0.05[s]**
NT-pro BNP	4536.5 ± 6198.5	4671.3 ± 4875.3	3461.08 ± 4313.9	**<0.05[s]**
		Group 2		
Six minutes' walk distance	144.36 ± 163.01	180.3 ± 135.7	212.97 ± 148.6	**<0.05[s]**
LVEF	30.50 ± 10.26	34.7 ± 7.3	40.8 ± 7.03	**<0.05[s]**
LVEDD	59.16 ± 11.33	58.7 ± 6.2	54.2 ± 6.2	**<0.05[s]**
NT-pro BNP	6269.6 ± 5771.74	5619.5 ± 5671.2	5337.1 ± 5371.6	**0.544[ns]**

Functional Class	I	II	III	IV	p-Value
1st follow-up					
Group 1	06 (5.7%)	30 (28.3%)	40 (37.7%)	30 (28.3%)	0.302[ns]
Group 2	00 (0%)	22 (23.4%)	38 (40.4%)	34 (36.2%)	
Functional class					
2nd follow-up					
Group 1	20 (18.9%)	54 (50.9%)	22 (20.8%)	10 (9.4%)	**0.001[s]**
Group 2	00 (0%)	08 (8.5%)	55 (58.5%)	31 (33%)	

Pair t-test and chi-square test was done to see the significance. **S:** Significant. **Ns:** Not significant.

follow-up ($p < 0.05$). Furthermore, a significant increase in the left ventricular ejection fraction (LVEF) was observed, increasing from 30.25% ± 4.2% to 51.0% ± 6.7% ($p < 0.05$), indicating improved heart efficiency. Moreover, there was a significant decrease in the left ventricular end-diastolic diameter (LVEDD) from 59.30 ± 8.92 mm to 46.2 ± 4.95 mm ($p < 0.05$), indicating positive structural changes. In Group 1, NT-pro BNP levels decreased significantly with time ($p < 0.05$). In Group 2, there were no statistically significant improvements ($p = 0.544$). With increased exercise capacity, the six-minute walk distance dramatically improved, from 144.36 ± 163.01 feet to 212.97 ± 148.6 feet ($p < 0.05$). Positive improvements in heart function and structure were further highlighted by the decrease in LVEDD from 59.16 ± 11.33 mm to 54.2 ± 6.2 mm ($p < 0.05$) and the increase in LVEF from 30.50 ± 10.26 to 40.8 ± 7.03 ($p < 0.05$). The levels of NT-pro BNP did not significantly decrease ($p = 0.56$).

Group 1 showed significant progress in the functional class assessment at the first follow-up, with 18.9% in Class I, 50.9% in Class II, 20.8% in Class III, and 9.4% in Class IV ($p = 0.001$). Among those classified 0% in Class I, 23.4% in Class II, 40.4% in Class III, and 36.2% in Class IV ($p = 0.302$), Group 2 showed smaller changes. At the second follow-up, the positive effects continued, with Group 2 demonstrating significant positive changes in functional classes and Group 1 maintaining improvement ($p = 0.001$).

As shown in Figure 2, Group 1 showed significant improvements in the Canadian Cardiovascular Society (CCS) anginal class analysis, with decreases in Class I patients (64.5% to 52.0%) and Class III patients (20.0% to 0.0%). Notably, a significant correlation ($p = 0.042$) was found between the therapy groups and anginal class modifications according to the Pearson chi-square test. These results indicate the intervention's possible effectiveness and its positive impact on the anginal condition.

5. Discussion

The findings of the present study demonstrated that the addition of modified-release trimetazidine to the GDMT can improve exercise capacity and left

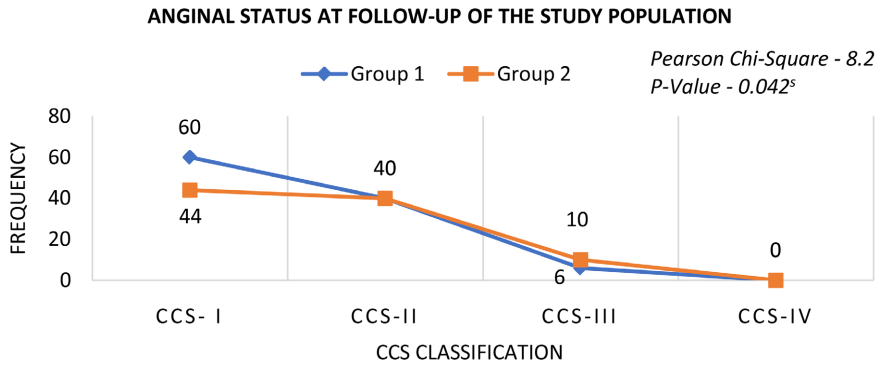

Figure 2. Anginal status of the study population during final follow-up (n = 200). s: Significant.

ventricular function in patients with ischaemic cardiomyopathy. In this study, patients with ischaemic cardiomyopathy were given a dose of 35 mg of modified-release trimetazidine twice a day to evaluate its effectiveness [1]. The advantage of this trimetazidine formulation is better patient compliance with therapy because of the lower frequency of drug administration compared to that of the conventional form. Trimetazidine increases cardiac contractility in individuals with ischaemic cardiomyopathy, which can be explained by the regulation of mitochondrial activity and increase in glycolytic adenosine triphosphate (ATP) generation [3] [4]. It is generally accepted that the myocardium needs a substantial amount of energy movement, with ATP functioning as the main source of energy. Beta-oxidation of free fatty acids and glucose breakdown are the two simultaneous mechanisms for energy delivery. The latter comprises glycolysis and lactate oxidation, which results in the degradation of pyruvate dehydrogenase to acetyl coenzyme A. The increase in myocardial contractility with trimetazidine treatment in patients with ischaemic cardiomyopathy can be explained by the regulation of mitochondrial function and by the increase in glycolytic adenosine triphosphate (ATP) synthesis [3] [4]. Under aerobic conditions, the myocardium generates energy predominantly by oxidizing free fatty acids (70% - 80%), with a smaller amount obtained from glycolysis (20% - 30%) [5]. The oxidation of glucose ensures the activity of ion pumps, Na^+/K^+ ATPase, and Ca^{2+} ATPase, which preserve the myocyte membrane potential and rapid transport of Ca^{2+} between subcellular compartments [5] [6]. The glycolytic and pyruvate pathways require less oxygen per mole of ATP produced than does free fatty acid oxidation [7]. The glucose-fatty acid cycle, described by Randle and colleagues in 1964, preserves the balance between available energy substrates [8]. Utilisation of glucose is controlled by the availability of insulin and also by competition with the free fatty acid pathway metabolites. Increased metabolism by the free fatty acid mechanism inhibits the glycolytic pathway, which may be unfavorable in situations of decreased oxygen delivery to the heart or under conditions such as stress, heart failure, and diabetes [9]. Trimetazidine selectively inhibits the long-chain 3-ketoacyl coenzyme. A thiolase is a key enzyme involved in the beta-oxidation of fatty acids. While reducing fatty acid oxidation, this compound stimulates glucose uptake and induces phosphorylation [3] [4]. In the present study, we assessed the impact of trimetazidine, when used with traditional antianginal medications on the functional ability of patients with ischaemic cardiomyopathy. Trimetazidine improved total functional capacity, as measured by the six-minute walk test. Our study showed that patients' functional capacity improved with time.

Greater improvement was observed after 6 months. The statistical analysis revealed highly significant values ($p = 0.032$ and 0.001, respectively). Compared to the meta-analysis results of Zhao *et al.*, which revealed a significant improvement in the six-minute walk test score following treatment with trimetazidine in IHD patients [2] [10], our results were comparable. According to Brottier and colleagues' pioneering study [11], the LVEF (determined by radionuclide angio-

graphy) increased by more than 9% compared with those in the placebo group in patients with ischaemic cardiomyopathy treated with trimetazidine for six months. In another study, Belardinelli and Purcaro (12) aimed to determine the effect of trimetazidine on LVEF by echocardiography in 38 patients with ischaemic cardiomyopathy. The resting LVEF in the trimetazidine-treated group increased from 33.1% ± 4.5% to 39.5% ± 5.9% ($p = 0.001$). On the other hand, our study showed that over the course of time, the left ventricular systolic function (analysed by echocardiography) also improved significantly, indicated by the decrease in the left ventricular end-diastolic diameter with time (53 mm and 48 mm) ($p = 0.001$). Another parameter used to assess systolic function was the LVEF (also measured by echocardiography). Additionally, the LVEF increased significantly in the trimetazidine-treated group of patients (Group 1). More improvement was observed in the second or last follow-up than in the first one after 6 months (38% and 51%, respectively). The statistical analysis showed highly significant values ($p = 0.008$ and 0.000, respectively). We also detected an improvement in the functional capacity of our patients by analysing their NYHA class, which showed a definite and statistically significant improvement in functional class in the trimetazidine-treated group ($p = 0.001$). In a meta-analysis performed by Gao *et al.*, seven of the included studies reported data compared to conventional therapy [13]. Both the NYHA and CCS classifications showed significant improvement. Additionally, in the subgroup analysis, the patients in Group 1 (the trimetazidine-treated group) also experienced significant improvements in terms of the LVEDD, LVEF, and the six-minute walk test.

In addition to improving the LVEF, trimetazidine can also improve arrhythmia by reducing heart rate variability [14] [15]. In our study, the analysis of demographic data such as age, sex, BMI, pulse, and systolic and diastolic blood pressure did not yield any statistically significant differences among the groups. Previously, all the other studies using trimetazidine rather than the standard anti-ischaemic drugs could not yield any statistical significance for their study population. We also did not find any differences from a demographic point of view. This is likely due to the similar baseline characteristics of the enrolled study population. From a risk factor analysis and laboratory parameters point of view, our study yields similar statistically insignificant results, which are comparable to those all-other studies and meta-analyses regarding trimetazidine. The obtained data support the therapeutic importance of metabolic treatment with the modified-release form of trimetazidine in patients with LV dysfunction and ischaemic cardiomyopathy. An improvement in LV function data indicate that the addition of trimetazidine to conventional therapy may lead to functional improvement in patients with ischaemic cardiomyopathy. The beneficial effect of treatment with trimetazidine was also shown by an improvement in exercise tolerance in these patients.

6. Limitations

The study team also confers some limitations on their study. They are:

- This was a single-center study. To make the findings more representative of the population, the study team would like to perform a multicenter study of this patient cohort with the molecule.
- The duration of the study was also small. If this could be done for a long time, the study could also yield a strong outcome.
- Moreover, the study population was small. Therefore, to ensure comprehensive results, a large study population is needed.
- Moreover, there has been no head-to-head analysis of the other conventional drugs used in ischaemic for treating cardiomyopathy to prove the superiority of these molecules over the other drugs.
- Complications like arrhythmia in this special group of patients were not included in this study to determine their effect.

7. Conclusion

Our study determined that the addition of modified-release trimetazidine to GDMT can improve exercise capacity and left ventricular function in patients with ischaemic cardiomyopathy. At follow-up, both groups showed significant improvements in cardiac indices and exercise capacity. Particularly in functional class assessments, Group 1, which was administered trimetazidine, showed significant improvements. These results are encouraging and should be further studied for validation and greater significance in the treatment of CVD.

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Conflicts of Interest

The authors of this study declare that they have no further financial interests, links, or affiliations with any individuals, organisations, or entities that could have compromised the impartiality and integrity of the research. The study follows ethical guidelines, and the authors confirm to the truth and transparency of the data they have provided.

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