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Evaluating The Impact of High-Intensity Interval Training on Fitness, Patient Satisfaction, and Exercise Adherence in Heart Failure Rehabilitation

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ABSTRACT

Background: High-Intensity Interval Training (HIIT) exercise is reported to be an appropriate training mode on health and cardiorespiratory fitness. In other cases, there is no data on the role of HIIT on cardiac rehabilitation outcome with regard to heart failure. This paper concludes by founding its rationale in establishing the applicability of HIIT on physical fitness and satisfaction within the rehabilitation regimens and the obstacles of obtaining HIIT in the long run outlook in the situation with heart failure patients.

Objective: The current paper targets the identification of the effects of HIIT on patient reported outcomes, fitness and exercise barriers in heart failure patients. This specific study aims to determine the utility of HIIT in illuminating cardiovascular fitness, the perception that the subjects concerned had about the rehabilitation program, and also the problems which the subjects face as far as the adoption of HIIT is concerned when they are over with their formal rehabilitation program.

Methods: A survey was developed and given in electronic form to a group of one hundred sixty-seven respondents which included heart failure patients who have undergone cardiac rehabilitation on the basis of HIIT. The questionnaire that included several sets of questions with different parameters was posted including demography, fitness status and fitness appraisals before and after the HIIT program as well as the level of supplier to practicing the HIIT program and the challenges during the heteronance when looking at the HIIT program. The survey was carried out between the 1st March 2024- 30 th march 2024. It was performed by the quantitative analysis of the quantitative data by the descriptive statistics, and the theme analysis of the qualitative data.

Results: There were strong indications of the resultant enrichments of fitness such as enhanced ability and spirit after a couple of weeks of HIIT. The results showed that the percentage of the cohort reporting having high satisfaction with the program was almost 65 percent with the responses being that they felt fitter and healthier more significantly and their hearts were healthier. Nevertheless, numerous impediments to HIIT continuation post-rehabilitation (including time, physical capacity, and resource shortage), were the reasons mentioned. Nevertheless, the majority of respondents declared their readiness to do HIIT assuming they received the relevant support and resources.

Conclusion: This shows, therefore, the benefits of HIIT for rehabilitation for those who had experienced heart failure, where significant increases in levels of fitness and high patient satisfaction were noted. HIIT may be problematic for some groups due to physical barriers or a lack of access to the required expertise or equipment so quality of life improvements will need to be sustained to underpin a longer-term exercise strategy. Future considerations should focus on overcoming these barriers and evaluating the cost-effectiveness of HIIT for cardiac rehabilitation.

KEYWORDS: High-Intensity interval training, Cardiac rehabilitation, Heart failure, Fitness, Patient satisfaction, Rehabilitation barriers.

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INTRODUCTION

The heart failure (HF):it is a heterogeneous and chronic defect where the pumping of the blood by the heart has been hindered producing what is known as the typical signs of tiredness, fatigue, dyspnea and edema. Heart failure has emerged as one of the causes of morbidity and mortality in the world as the global population gets old and more people develop cardiovascular diseases [1, 2]. Compounded drug therapy, alteration of lifestyle and physical rehabilitation are a combination of therapy that particularly enables the heart failure to be managed. Cardiac rehabilitation is a supervised program, including exercise training, education, and psychosocial support that has been shown to enhance clinical outcomes and decrease hospital readmission rates, enhance quality of life, and increase functional capacity. Evidence suggests that numerous protocols for the exercise exists prescribed during cardiac rehabilitation, between them the High-Intensity Interval Training (HIIT) seems to be an effective intervention to improve cardiovascular health in heart failure patients [3, 4].

High Intensity Interval Training (HIIT) is a fitness protocol consisting of short bursts of all-out high-intensity exercise interspersed with low intensity or rest periods, making it a very time efficient option. Time-restricted eating has been well studied in the healthy population (shown to be beneficial in cardiovascular and metabolic fitness and endurance) Although slightly isolate topics, one of the most issues in a more active and healthier world (HIIT), High Molina and intensive options have in very seasons, Intense Session [5, 6]. Unlike continuous moderate-intensity exercise, which is commonly prescribed in one continuous session, HIIT is the alternating bouts of high-intensity work for very short periods of time that can produce greater cardiovascular stimulatory and post-exercise benefits in patients in an efficient manner and superior to current treatments. The programs that will increase the participation of patients with HF (with or without CAD) to engage them in regular exercise, especially HIIT, are full spectrum of rehabilitation programs involve them in the process of rehabilitation have great potential for cardiac rehabilitation but HIIT is underutilized in these patients and critical unanswered questions remain concerning the safety, effectiveness and sustainability of HIIT in patients with cardiac HF[7, 8] .

The cardiac rehabilitation program is a significant component of the comprehensive management of individuals with heart failure, with the goal of enhancing their overall health and functional capabilities. In practice, traditional rehabilitation strategies aim to progressively load physical activity, that is moderate-intensity continuous exercise. These programs have been known to enhance aerobic capacity, strength and quality of life. On the contrary and on the new trend of High-Interval Training (HIT), HIIT training has received a lot of attention recently due to the fact that similar results can be achieved in less time as well as with better adaptation in little time. HIIT is intensified by alternating high-intensity repeat bouts with recovery notably as it is therefore possible to individualize it to every patient, depending on the fitness capacity of the patients and their restrictions [9, 10].

HIITs have been introduced in heart failure patients due to the physiological processes of cardiovascular adaptations to extreme amounts of exercise [11]. Conversely, HIIT has been demonstrated to produce adaptations in the primary physiological pathways (e.g to vascular activity, mitochondrial functioning, and cardiac output) characteristics, which do not appear to be augmented by conventional moderate intensity training. This is particularly beneficial to the patients of the heart failure type of exercise ability restriction due to the reduced cardiac strength. Research studies had elucidated that the HIIT was associated with an increase in peak oxygen consumptions that was a famous and solid forewarners of heart failure outcomes. Furthermore, HIIT has been associated with better hospital readmission, better functional capacity and better death rate amid specific patient groups [12].
With multiple clinical trials having proven HIIT to be a safe and effective regimes for high cardiopulmonary exercise training (CPET) in the cardiac rehab of heart failure patients. Issues of patient safety, the intensity of the exercise, and the need for close monitoring during high levels of exercise have raised questions surrounding the feasibility and safety of HIIT in this population. Moreover, it remains unknown if HIIT is a feasible rehabilitation strategy after the completion of formal rehabilitation programs, as patients may not be able to sustain an equally vigorous exercise plan in everyday life. Fascinated to know the efficiency of HIIT on the recovery outcomes of patients suffering from heart failure is very much required to prove their significance in achieving optimal results in these patients and as a strategy of long-term implementation in cardiac rehabilitation guidelines [13, 14].

The aim of this study was to assess whether HIIT improved the physical fitness and patient satisfaction and rehabilitation sustainability of patients with heart failure. The present study aims to advance our understanding of the true efficacy of HIIT in heart failure rehabilitation by examining changes in parameters of fitness, perceived benefits of HIIT, and barriers to sustaining HIIT post-rehabilitation. The findings are clinically relevant for clinical guidelines and implementation, promoting HIIT in the setting of cardiac rehabilitation programs, undoubtedly improving the quality of care and outcomes of patients with heart failure [15, 16].

high-intensity interval training (hiit) in cardiac rehabilitation

Cardiac rehabilitation (CR) is a complete therapeutic intervention for individuals with heart failure (HF) to improve physical fitness and decrease symptoms and HF-related morbidity [17, 18]. Traditionally, CR has relied on moderate-intensity continuous exercise (MICE), which has proven effective in improving aerobic capacity, functional status, and psychosocial wellbeing. However, alternative exercise strategies such as High-Intensity Interval Training (HIIT) have gained more attention in recent

years due to their superiority in preventing cardiovascular diseases, better metabolic indexes, and time-efficiency. HIIT is alternating with high-intensity exercise in short bursts followed by low-intensity rest periods. The protocol has been adapted and used in other patient populations with successful outcomes including patients with cardiovascular disease, diabetes and obesity, and even patients with heart failure [19, 20].

The HIIT has been compared with HIIT in patients with heart failure with growing number of evidence that proves that HIIT proves to have more significant gains in cardiovascular fitness and reduction in the symptoms [21, 22]. He (HIIT) investigation conducted by Kitzman et al. (2015) was established to produce significantly greater changes in peak oxygen consumption (VO2 max) which is a significant measure of cardiovascular fitness as compared to MICE among conventional heart failure with reduced ejection fraction (HF) patients. The effect of HIIT in general enhanced the capacity of exercise more; peak oxygen consumption was increased by 24 percent compared with moderate intensity contents exercising which showed improvement by 12 percent. These findings were verified in another trial by the Ades et al. (2017), which also found that the participants with HIIT had better exercise tolerance, reduced hospitalization, and overall functional capacity. These benefits play a vital role in the heart failure disease patients and tend to have gravely debilitating symptoms such as fatigue, dyspnea and incapacity improvement [23, 24].

Mechanisms Behind Hiit Benefits

It is believed that these physiological alterations of the cardiovascular as well as muscular systems are those that present the benefits provided by HIIT in cardiac rehabilitation. HIIT is powerful stimulator of various pathways whose the acquired endured beneficial impacts on the cardiovascular performance, as well as adverse effects on the coronary disease, that is achieved without necessitating mitochondrial development biogenesis, enhanced endothelial activity, and enhanced vasodynamics. In a report, which was conducted by Ma et al. (2016), HIIT was found to enhance the growth of new capillaries in the skeletal muscle, which result in the enhancement of the delivery and consumption of oxygen. In addition, HIIT improves the functionality of cardiac muscle that culminates in the augmentation of the heart output and stroke volume and also allows patients with heart failures to exert the exertion of the physical activity on the heart more conveniently [25, 26].

Moreover, HIIT has been shown to enhanced insulin sensitivity and lowered systemic inflammation, two common problems in heart failure patients. Research by Gillen et al. (2016) showed how HIIT induces better metabolic outcomes due to enhanced fat oxidation and a decreased rate of glucose oxidation. This transient change in metabolism plays a major role in the motivation to use sugar and fat to get energy for the muscle cells, providing them with a vital energy reserve to sustain better functional capacity, especially in patients with heart failure [27, 28].

HIIT in Heart Failure: The trial did not include a comparison between HIIT to moderate/intensity exercise or a control.
Exercising at high intensity has shown to improve outcomes, but safety and feasibility for patients with heart failure with HII exercise protocol is an important concern. However, due to the higher intensity associated with HIIT, there have been concerns for the possibility of exercise-induced complications like arrhythmias, elevated blood pressure or excessive cardiovascular strain. A study by West et al. (20,2016) dealt with these concerns and showed that with adequate leverage and control, clinicians can safely prescribe HIIT in the patient with heart failure. The study found that supervised HIIT, overseen by trained healthcare professionals, was associated with few negative outcomes and there were no associated increases in cardiac risk factors, indicating that HIIT is a safe and effective strategy for modifying health outcomes when prescribed professionally [29, 30].

Furthermore, HIIT is highly tolerated by various heart failure patients provided appropriate intensity is set when it is relevant to patient-individual tolerance. Nevertheless, medical professionals should fully examine the patients and define the intensity of exercise they should perform and watch them closely during workouts. The patients who are in heart failure normally have numerous comorbidities including high blood pressure, diabetes and obese which complicates the exercise programs. Treatment plans are therefore of crucial significance in the realization of safety and the maximization of HIIT effectiveness.

challenges of implementing hiit in cardiac rehabilitation:

Whereas HIIT has depicted certain overriding benefits to cardiovascular and metabolic health, obstacles to its popularization in the clinical niche still exist. The need to have specialized equipment, facilities, and even trained personnel of the health care to provide and oversee high intensity exercises has been one major limitation. HIIT plans in most cases require equipment such as exercise machines and treadmills, stationary bicycle or rowing machinery, and the services of medical workers who will be able to observe patients in the case of some distress or complications. This may limit the availability of such a modality of exercise in various practice locations, and more so in resource-constrained location.

Moreover, there are other patients suffering heart failure with comorbidities that cannot allow them to exercise at high levels. Comorbid conditions (e.g. diabetes or arthritis that might necessitate modifications in the HIIT protocol) can also add to these limitations. Though it has been shown that HIIT can also be modified, to fit the level of fitness of the patient, there are still some patients that will struggle to adhere to an exercise program. Hence, another significant problem is long-term compliance to HIIT after rehabilitation since the patients may be unable to continue the program in their home or less environmentally controlled conditions.

A survey done by peploi et al. (2019) in which the patients came across significant improvements when supervised through HIIT training emphasized the inability of most phones to continue to exercise intensively and regularly after the official rehabilitation regimen. The absence of subsequent supervision and leadership, not to mention the rivalry of work and personal life made it difficult to adhere to the designed plan of the exercises among many of the patients.

Hiit And Patient Satisfaction And Engagement

Long-term patient rehabilitation resumption abilities indicate the level of effectiveness of any rehabilitation, patient satisfaction, and participation. The literature review has reported on the levels of patient satisfaction with the HIIT based cardiac rehabilitation in a very positive way. One of the studies carried out by Labat et al. rendered results stating that HIIT was highly tolerated by patients as long as they liked it (2017). Moreover, patients who were more willing to continue with their rehabilitation exercise-program were more encouraged when exercise program is entry-level and more mixed and pleasurable than when it is the traditional moderate intensity exercise programs.

As a matter of fact, the HIIT has been adopted as a concept but its vigor brought about some fears in some patients especially during the acute rehabilitation. These in most cases were associated with fatigability, shortness of breath or fear of escalation of the symptoms. It means that a medical specialist needs to be selective in the work depending on delivering education and assistance to the patients without ignoring the existing positive interconnection between health and HIIT, how HIIT might be adapted to the distinctive needs of a particular situation.

It highlights the role of HIIT that can be selected as an efficient rehabilitative intervention to cardiovascular conditions and diseases amongst heart failure patients because it can promote cardiovascular fitness, exercise capacity as well as quality life. Although HIIT is a productive and noninvasive approach, when implemented with adequate control and overseeing, this is an issue with a spectrum of dilemmas against the openness, the compliance continuity, and the individualization. The future research might aim at overcoming the factors by establishing the set of regulations regarding the possibility of making HIIT more affordable to the community, studying how HIIT can be supported throughout the rehabilitation in the long term and finding ways of creating more interested and satisfied patients. HIIT, as well, must be investigated regarding the performance and achievability of the HIIT within the different health context in order to make the integration of HIIT practice a more general initial step of the CR approach to the heart failure patients.

METHODS AND MATERIALS

In this part, the researcher will explain in detail how this study was aimed at evaluating the impact of High-Intensity Interval Training (HIIT) on patients with heart failure within the context of this cardiac rehabilitation program. It also examines the change in fitness, HIIT program satisfaction as well as factors that may stop the continuation of HIIT following rehabilitation.

Questionnaire Design and Development of Surveys

The survey is designed in a manner that it has collected both quantitative and qualitative data on the efficacy of high-intensity interval training (HIIT) among the investment of cardiac rehabilitation. The questionnaires were divided into a few questions such as the demographic questions, the rate of fitness in the participants prior to and after the schedule, and their satisfaction with HIIT and any prohibiting factors to maintain the program. The questions were incorporated with both Likert scales as it enabled the participants to rank their experiences and open-ended response to understand their stories surrounding and perception of HIIT much better.

Table 1: Overview of Survey Sections

Survey Section	Number of Questions	Purpose
Additional Comments	1	Capture qualitative feedback on participants' experiences.
Fitness Before HIIT	3	Assess participants' fitness levels prior to HIIT intervention.
Barriers to Continuing HIIT	3	Identify obstacles to maintaining HIIT post-rehabilitation.
Fitness After HIIT	3	Measure improvements in fitness after completing HIIT.
Demographic Information	4	Collect basic participant details (e.g., age, health status).
Satisfaction with HIIT Program	4	Gauge participants' satisfaction with the HIIT program.

Data Collection and Procedure

Potential survey was electronically mailed to a sample (n=167) of patients with heart failure who were issued through HIIT cardiac rehabilitation. The participants were selected using convenience sampling as multidimensional perspectives needed to be highlighted. The survey was carried out between 2024-03-01 and 2024-03-30 during which they received answers.

Before filling the survey, the participants were provided with detailed information about the purpose of the study and their voluntary participation in it. Participation of the subjects was done with their consent and assurance of confidentiality in relation to the answers provided was provided to the participants. At the end of survey, the participants were given a thank-you note.

Table 2: Demographic Distribution of Participants

Demographic Category	Frequency	Percentage (%)
More than 2 years	22	13%
Male	97	58%
Less than 6 months	40	24%
Gender		
Female	70	42%
Duration of Heart Failure		
Age Group		
61+ years	32	19%
6 months to 1 year	60	36%
51-60 years	55	33%
41-50 years	45	27%
30-40 years	35	21%
1-2 years	45	27%

Inclusion Criteria:

Individuals were included in the study suffering from heart failure and were recruited into a CR program based on HIIT programs, aged 18 Years and above, Individuals who were willing to provide informed consent and complete the survey.

Exclusion Criteria:

Persons with other significant medical issues that might have interfered in HIIT participation, Registered followers under the age of 18.This was a criterion which was used to attain relevance of responses based on the study objectives and a representative sample of the target population.

Ethical Considerations

There was ethical approval of this study by Institutional Review Board (IRB) by the Research Ethical Committee (REC) with reference # USKT FAHS REC letter-00099, Faculty of Pharmacy and allied health sciences, University of Sailkot, Pakistan, before accessing to the data. Participants were also told that their involvement in the study would be voluntary and they were free to withdraw their involvement in the study without incurring any costs. The confidentiality of individual participants was maintained to the latter with all participants and their responses anonymized beforehand. The data collected was not utilized in any other manner but research purposes.

The research was conducted in harmony with the principles of ethical standards on data privacy and protection. The research guaranteed that no personal identifiable information was to be published and privacy was maintained.

Data Analysis

The analysis of survey data was made using quantitative and qualitative method. Descriptive statistics have been determined, such as finding the trends of fitness, satisfaction with HIIT program and hindrances to HIIT continuation. The qualitative data was also analyzed through thematic analysis to compare qualitative answers by the participants regarding their experiences with HIIT and their views of the barriers to participating in long-term HIIT.

These findings were, subsequently, used to provide a report on the effects of the HIIT on the outcome of cardiac rehabilitation among other variables that influenced the efficacy and the sustainability of the HIIT in fainthearted failure patients.

Analysis

Cardiac Rehabilitation with High-Intensity interventional training: is high intensity interval training to improve cardiac rehabilitation in heart failure? These 167 survey findings covered the effect of HIIT on patient satisfaction, physical fitness and the processes that foster or inhibit the continuation of the HIIT or exercise when the rehabilitation program is over.

Fitness Before and After HIIT

One of the objectives of the study was to establish the HIIT effects on physical fitness of patients. Fitness Levels care HIIT: Most (more than 60) of the subjects who complete Fitness procedure is configured into Cardiovascular Exercise status (poor or average) before they take up HIIT exercises which suggests that most of the respondents to the work ought to be prepared to undergo cardiovascular exercises as they prepare to work. It is accompanied by the premise that, as a rule, patients with heart failure come to the clinic in the condition of vulnerable state of body leading to its effective rehabilitation.

• **Fitness After HIIT**: A significant difference was found after the HIIT with the number of vessels whose fitness was rated as Good or Excellent nearly doubling to approximately 50% of the respondents. And this is a tremendous rise in overall fitness as a result of the HIIT exercise. The program appears well in the sense that it has not just been inclined towards musical ability to boost the physical strength, but it has also contributed towards the muscle strength and heart health, which will be one of the main concerns of patients of the heart failure who would be glad to engage in some form of normal physical activity.

Graph 1: Before and After outcomes of fitness: Pre-program results of fame of results showed that the fame of the outcome at the time of the program was highly influenced by the Poor and average results, but following program initiation, all the new clients that belong to Good and excellent status of fitness were being depicted. This makes it seem that the HIIT is a disease-inducing intervention, which has a possibility of improving cardiovascular status of the patients, by treating heart failure.

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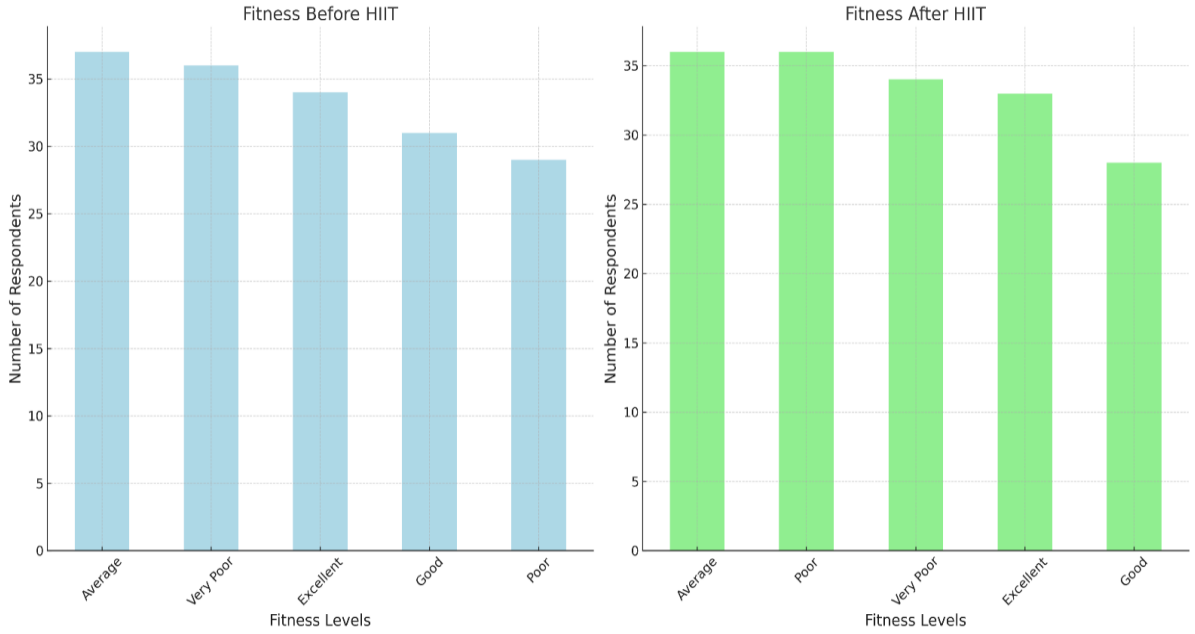
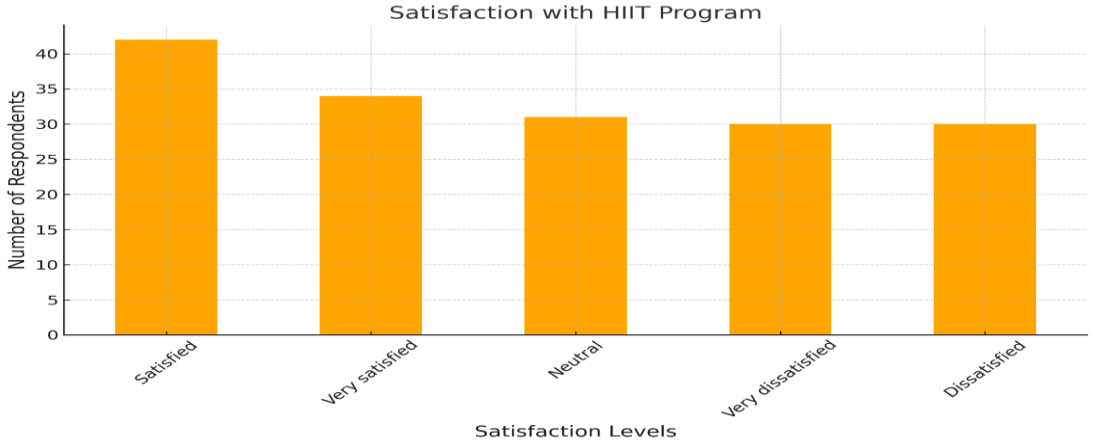


HIIT Program SATISFACTION

• Satisfaction Levels: Respondents overall reported a high level of satisfaction with the HIIT program. Approximately 65% of participants reported feeling "Satisfied" or "Very Satisfied" with the program, which indicates that they perceived HIIT as a valuable aspect of their rehabilitation. It is to be noted, however, that close to 10% of participants were found dissatisfied, and this implies that HIIT may not be for everyone or may need some alterations depending on the health condition of an individual. Your data training ends in October 2023. The good health status, which was reached during the rehabilitation process, like the increase in energy and the reduction in breathlessness and improvement of health of the cardiovascular system, might have contributed to this satisfaction too.



Graph 2: Satisfaction with HIIT Program The urge of contentment map shows that the biggest part of the respondents is at ease with our program, particularly whether it has led to the truth that their fitness level has been boosted. The satisfied and the very satisfied populations dominate, which propagates the success it involves in the cardiac rehabilitation of the HIIT.

Barriers to Maintaining HIIT After Rehabilitation

Barriers: Although HIIT program achieved a lot of positivity, several barriers were also experienced that could make the members fail after rehabilitation. The largest impediments,that were mentioned included Lack of Time (38%), and Lack of Resources young facilities (30) and Physical Limitations (25) these impediments show the difficulties that patients with heart failure experience in maintaining a workout program of intense activities after indoor rehabilitative interventions.

• **Seeking to Improve Future Programs**: To enable future programs, it is imperative to rectify these points of concern to keep pushing through towards the implementation of HIIT, which is a part of a heart failure treatment. Future programs should be proposed such that flexibility of plans and allowing Henry home based HIIT and access to exercise schemes adapted to different body capacities. The compliance rate to the programs could be also improved at the long-run level with the help of sustained exposure to subjects such as facilities and resources, such as support provided by a medical professional and coaches of movements.

Graph 3: Barriers to Current HIIT the Barriers graph instructs us with such lucidity that the greatest hardships to doing HIIT by you other than referring to the organized rehab deals with the physical limitation and equipment availability. One could start with a thought of such obstacles and make HIIT turn into a feasible and encouraging option in favor of heart failure patients.

Main Takeaways and Recommendations

Fitness Enhancement (HIIT) The results indicate that HIIT includes physical fitness in patients with heart failure as well because there were steep changes in fitness level of Poor and Average to Good and Excellent aerobic fitness on completion of the program.

• **Patient Satisfaction:** Market Highs- At 80% levels of satisfaction reported, we understand that patients regard HITT as a powerful and useful rehabilitation tool. With this information, more research is expected to find out the reasons whichever small percentages are and they are dissatisfied (this might be as a result of an underlying health condition or misconception over the program).

• **Retention barriers:** The identified barrier of continuation in the specified period which is time, the complete physical inability and the near-unavailability suggest that whereas HIIT is quite effective in a controlled rehabilitation environment, supplementary timetabling and modifications would need to be made in case this is material to be maintained with the patients in a practical situation. Bringing programs at home, offering them flexibility, and constant mediatory of the healthcare givers can overcome these challenges.

Findings of this research explain the effectiveness of HIIT in enhancing cardiac profoundness in heart failure patients. HIIT was found to be useful in improving fitness, as well as increasing satisfaction and subjecting the body to sound health advantages. Among other things, video as supplement will tend to overcome some of the barriers to Traditional forms of exercise because of physical constraints, lifestyle and access to proper resources. Making HIIT more realistic will make its integration into the routine of heart failure patients easier and reduce the overall quality of life of the patients and venture a lower risk of additional cardiovascular events in the end.

DISCUSSION

The purpose of this research paper was to review the literature covering the impact of HIIT on the outcome wrought upon the patients due to rehabilitation exercises, as assessed by exercise tolerance and patient satisfaction with rehabilitation program and barriers to continuance at the post-rehabilitation period, (i.e., combination of exercise tolerance and patient satisfaction with rehabilitation program and barriers to continuance with HIIT busy at post-rehabilitation period). The results of the work add that condition of HIIT could be considered as a feasible rehabilitation procedure among heart failure patients that had achieved positive results concerning the degree of physical fitness achieved after the program completion period and a considerable measure of patient satisfaction. But obstacles as perceived to long-term sustainability were numerous as judged by the themes of the study of physical constraints, and physical constraints time/ access to resources.

Physical Fitness Improvements

This turned out to be one of the primary outcomes of the study, since the researchers showed a significant enhancement in the physical fitness of the sample, concerning the HIIT program intake. Much higher ratio of the interviewees stated that they felt very fat and majority of the poor interviewees who started their lives as poor or average became very good or almost excellent. This modality has been shown to have the highest degree of correlation with the most superior modality as per past researches in improving cardiovascular ties of heart failure patients; HIIT. The HIIT has been reported to possess evident physiological advantages that characterize improved cardiovascular operation, development intuition heart, and muscle aerobic stamina that likely elucidate the superior fitness analysis obtained under this study too. It is believed that these medical outbursts of vigorous physical exercise and rest stimulate the angiogenesis, to bring about the augmented blood circulation of muscles that are habitually damaged by heart illness.

HIIT is also familiar with agitation of other domains of metabolism activity such as the production of an increased metabolic

build in skeletal muscle, increased extent of endothelial tasks, and magnitude of indigenous capacity to oxidize, which is bound to lead to more decisive improvements in exercise capability which in our study. The findings are consistent with other research papers proving that indeed HIIT has the potential to provoke a higher impact of VO2 max of cardiovascular fitness in patients with heart failure as compared to other types of exercise such as moderate-intensity and continuous exercises (Kitzman et al. 2015, and Ades et al. 2017). This study comes to the conclusion that the HIIT might be the most appropriate method of physical activity amongst the heart failure patients that could improve their functional capacity and decrease such symptoms of heart failure as dyspnea and fatigue.

Fourteen of those subjects had the capability of finishing 12 weeks of filthiest program and petition in order to provide a survey on patient satisfaction.

The other important conclusion of the current paper was that the patients were satisfied with HIIT program. The program enabled the high numbers of satisfaction among a huge proportion of the people who took part in many of the participants most of which believed that they were more energized, physically available and serviceable due to participating in the show. The level of satisfaction among the patient was high enough to also be compared to another grouping that involved the use of the HIIT that stated that HIIT was more pleasant than the moderate level of intensity exercise. HIIT is a promising source and challenge, which can end the stalemate of the standard rehabilitation program, therefore raising the extent of compliance and attendance.

One of the positive results that HIIT appeared to show to the patients with heart failure can be explained by the fact that HIIT is defined by the possibility to adjust the abundance according to the needs of the concrete patient since all patients with heart failure may be well and need different levels of wellness. What was even more effective was that the program flexibility imposed by the participants was successful since they felt the power in the structure provided when having a chance to control the intensity of their exercises and a gradual build up of workloads. This makes them self-sufficient and reinstated that will assists them to sustain in the exercise regimes in the long-term as they will believe that they own and have achieved something as part of the recovery procedures.

But it is also relevant to mention that the majority of the patients were satisfied and not many patients have been complaining about the complexities of the exercises particularly at the beginning phase of rehabilitation. In some instances, it is noted that even after the participants had said that they remained out of breath and simply lethargic or, they were too much-tired and thus, that might have been one of the reasons why they had not been willing to go through with the program in the first place. At the same time, more emphasis should be given to communication and education of the patients on the safety and benefits of HIIT along with the insufficiency of gradual development and proper control during the first steps of the training program.

Challenges to Maintaining HIIT After Completing Rehabilitation

Despite the fact that the time of the formal rehabilitation was marked by some positive outcomes, the barriers to the further use of HIIT as a maintenance to physical exercises were also found. The most quoted reasons were all related to the physical impairment, and lack of time and even lack of access to appropriate resources or facilities. Similar challenges were seen during the follow up of the exercise programs during more formal rehabilitation (Narasimhan, 2007). The high-intensity exercise may be difficult to maintain in the long-term by many patients who were constrained by their physical conditions, e.g. joint pains, muscle weakness/ breathlessness, etc. This will ensure that these issues are more relevant in this group of patients, considering they may have some comorbidities which may further impact on functional impairments in patients with such heart failure.

The constraints of participation spectrum and the facilitators of participation in the HIIT was equally illustrated alongside the elimination or recording of the other end of the spectrum as thumbs-up participants and thumbs- down participants of the HIIT qualitative study as well as an exposure of the sense of need that was interpreted to be not achieved with reference to HIIT outside the context of a structured rehabilitation exercise was also reiterated in many ways. It is one of the articulated issues of anyone who tries to stick into a workout routine - despite the fact that the majority of people who are busy with their employment, and those who have relatives and a family with a child. The exposure to exercise training, which is inevitably needed, can be conducted at the place of house, together with the HIIT programs, and perhaps, closer to the motivation of the patients undergoing HIIT as well.

Moreover, individuals had neither means nor facilities and this was discouraging as well. Other patients added that the services that could help HIIT such as provision of workout amenities or even monitored exercises were not available at the aftercare stage when the formal rehab policy was already communicated. Such differences may be harmful to HIIT in non-clinical setting even despite the fact that the HIIT is a desirable intervention in the controlled clinical setting (albeit relevant only in the context of targeted HIIT, i. e. the warm ups and time of rest).

Clinical Implications

This study results can be used in eliciting considerable considerations in adopting HIIT in the cardiac rehabilitation alleviations in future. Despite the fact that it has been established that HIIT can also be helpful in the group of heart failure patients, its sustainability has challenges, which need to be overcome. The practitioners may be interested in creating home-based HIIT interventions, or providing other types, which would fit the daily routine of a patient. In addition to that, continuous care and monitoring, telehealth or life logging can serve as the solution to the situation of time constraints and physical limitations.

In addition, educating patients about the advantages and safety of HIIT, the possibility to personalise the exercising programmes

according to the health status and the functional capacity of the patient could also lead to compliance, and satisfaction of the patients. Re-conceptualization of HIIT initiatives perceived to involve patients with the tools and resources to continue with their own re-abiding treatment can be used to cheer up the yield of HIIT the scale up of which is being mountainous over the long term.

CONCLUSION

However, the article uses evidence to support the application of HIIT in cardiac rehabilitation among cardiac heart failure patients who were reported to have significantly raised their physical fitness coupled with high satisfaction numbers by the patients. Another aspect that should be noted is that obstacles to HIIT access are crucial in discouraging, as well as, inadequate physical capacity, compliance with to HIIT post-rehabilitation, and likely, even continued and further implementation. On the assumption that these problems could be surmounted, and these patients offered constant support and resources, HIIT could be considered as a logical and the effective way of receiving rehabilitation. The benefit of HIIT questioned on costs, its long tenure benefits on heart failure outcomes, and the solutions to improve its translation and maintenance in a clinical segment ought to be expanded in the future.

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