

## EFFECT OF WALKING ON SIX MINUTE WALK DISTANCES, IN SICKLE CELL ANEMIA PATIENTS

### EFFECTUL MERSULUI ASUPRA MODIFICĂRII DISTANȚEI DE MERS PARCURSE ÎN 6 MINUTE, LA PACIENȚII CU SICLEMIE

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**Key words:** walking exercise, sickle cell anemia, six minute walk distance

**Cuvinte cheie:** exerciții de mers, siclemie, distanță parcursă în șase minute

#### Abstract

**Background.** In most countries sickle cell anemia is a major public health concern & hence important challenge even in developing countries. SCA is inheritant, lifelong disease & hence requires effective intervention. Walking has been used as exercise protocol as walking is a part of everyday life and it is easy to administer. Therefore a study was undertaken to know the initial status of sickle cell patients and later on by implementing walking as exercise protocol the changes encountered in 6 min walk distances in pre & post walking intervention in Sickle cell anemia patients was carried out.

**Aim.** To know the distance covered in the 6MWT before and after 3 week exercise intervention in SCA patients.

**Materials and Methods.** Experimental pre test post test design was carried out at Sickle cell anemia and Physiotherapy outpatient department in 40 individuals with SCA and initial parameters (weight, hemoglobin) were documented followed by performance of 6 MWT after which patients were administered with 3 weeks of exercise intervention in form of walking & compared for 6 Minute Walk test parameters pretest to post test.

**Results.** indicate that there is a marked change in distance covered in pre to post test after 6MWT performance after 3 weeks of exercise intervention.

**Conclusions.** The increased levels of distances covered in post test indicates that although SCA patients have exercise intolerance this can be overcome by administering simple 3 weeks of walking intervention & this improves the fitness levels of SCA patients.

#### Rezumat

**Introducere.** În majoritatea țărilor, siclemia este o problemă majoră a sănătății publice, ridicând probleme majore chiar și țărilor dezvoltate. Siclemia este ereditară, cronică, necesitând deci intervenții efective. Mersul este folosit în protocoalele de recuperare, deoarece mersul face parte din viața cotidiană și este foarte ușor de administrat. Acest studiu s-a efectuat pentru a afla statusul inițial al pacienților cu siclemie și mai apoi, după implementarea unui program de mers, pentru a afla modificările apărute în distanța parcursă în 6 minute, ce către acești pacienți.

**Scop:** Studiul urmărește stabilirea distanței parcursă în 6 minute, înainte și după efectuarea a 3 săptămâni de intervenție kinetică, de către pacienții cu siclemie.

**Material și metodă:** Studiul experimental test-retest s-a realizat în Departamentul de recuperare al pacienților cu siclemie, pe 40 de subiecți cu siclemie, urmărind ca parametri inițiali greutatea și hemoglobina. S-au înregistrat rezultatele test-retest la testul de 6 m mers. După evaluarea inițială subiecții au urmat 3 săptămâni de intervenție kinetică sub forma unor exerciții de mers.

**Rezultatele** indică faptul că există o schimbare marcantă între valorile test-retest a distanței parcursă în 6 metri la subiecții cu siclemie, care au urmat 3 săptămâni de exerciții de mers.

**Concluzii:** Creșterea distanței parcursă la posttest de către pacienții cu siclemie, demonstrează că intoleranța la efort poate fi depășită prin administrarea unui program de 3 săptămâni de exerciții de mers, ceea ce permite creșterea nivelului de fitness al acestor pacienți.

#### Introduction

In most countries where sickle cell anemia is a major public health concern, its management has remained inadequate, and the diagnosis is usually made when a patient presents with a severe complication. [1] The most important challenge is to improve the prospects for the patients with sickle-cell anemia in developing countries. The main aspects of comprehensive

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care for patients are early intervention and improve the quality of lives of people living with sickle-cell anemia in developing countries.[1]

Sickle cell anemia is inherited, lifelong disease and hence requires effective intervention. Sickle cell anemia has no widely available cure. Proper care and treatment helps many people who have the disease in having improved quality of life and reasonable health for long periods of time. Due to improved treatments and care, people with Sickle cell anemia are now living into their forties or fifties, or even longer. If one has Sickle cell anemia, it's important to adopt or maintain a healthy lifestyle, take steps to prevent and control complications, learn ways to cope with pain [2]

Children with Sickle cell anemia have impaired responses to exercise when compared with healthy black children.[3,4,5,6] Controversy exists as to the mechanism/s, responsible for this cardiac dysfunction[7]. The changes in HR, BP, Respiration, and perceived level of dyspnoea provide data that permit quantitative estimation of cardiovascular functioning and conditioning.[8, 9] Therefore, all these parameters have been included for the study. Few studies have been done on exercise tolerance in normal and also in SCA children on treadmill, in western countries and occasional ones in India. [10,11]

Sickle cell disease has an effect on cardiovascular system and in turn can hamper pulmonary system. Six minute walk test is a sub-maximal test, which puts less stress on the cardiovascular system than a maximal test. Using a sub-maximal test allows children and adults suffering from sickle cell disease to participate, whereas a maximal test might be too taxing.[12] keeping this in mind, six minute walk test was used as an assessment tool, rather than treadmill or cycle ergo meters.

Walking has been used as exercise protocol as walking is a part of everyday life and it is easy to administer and requires minimal understanding for patients to carry out the test. [12]

Liem RI, et al, in 2009, in their study commented that cardiopulmonary disease is associated with decreased functional capacity among adults with Sickle cell disease and they used six minute walk test as a cardiopulmonary exercise testing.[13] In view of this, six minute walk test was incorporated. The American College of Sports Medicine recommends that for aerobic improvement a minimum of 3 aerobic sessions per week has to be implemented and the same number of sessions was incorporated for this study.

The need for the present study is to know the effects of walking intervention in patients with SCA. In view of this the current study was undertaken to know the cardiopulmonary responses on performance of exercise testing in the form of Six Minute walk test and also implement exercise program and again perform the Six Minute walk test and check whether there is any improvement in their exercise capacities so that sickle cell patients can hope to be benefited.

### **Aim**

To know the distance covered in the 6MWT before and after 3 week exercise intervention in SCA patients.

### **Hypothesis**

There is increase in the fitness level in terms of distance covered in 6MWT in Sickle cell anemic patients after 3 weeks of exercise intervention in the form of walking.

### **Material and Methods**

Experimental pre test post test design was carried out in Sickle cell anemia regional center outpatient department and Physiotherapy outpatient department.

### **Subjects**

The subjects who volunteered to participate for the study were the patients suffering from SCA any trait. Only those subjects who fulfilled the inclusion criteria and who gave the written

consent were included .Total 40 individuals obtained by convenient sampling would undergo for a test protocol for a given period of time.

**Inclusion criteria:** Patients with SCA ( any trait),Both male and female, Age group 12-25 years of age, Patients with the ability to walk, Patients should have the ability to complete the 6 Minute walk test, Physically independent patients, Patients not using walking aids for locomotion.

**Exclusion criteria:** Patients with cardiac, vascular, respiratory impairments, musculoskeletal & neurological impairments interfering with ambulation, Pregnancy, Leg ulcers, patients on blood transfusion (3 weeks prior from the commencement of research and also during the study period) were excluded from the study

**Exercise intervention:** Mode of exercise: walking, Intensity: walking at one's own comfortable walking pace, Frequency: 3 sessions per week on Monday, Wednesday, and Friday. The subjects were asked to walk at the same time of the day that is in the morning. Duration: The exercise session lasted for 10 minutes.

**Pre & post exercise sessions:** Before the commencement of the exercises all the subjects were given a 5-minute warm-up which included active movements of all the joints, non-strenuous arm, leg and trunk movements. Following exercises were included:

Arm Exercises: (bilateral): Flexion of shoulder, Abduction of shoulder, Arm swings

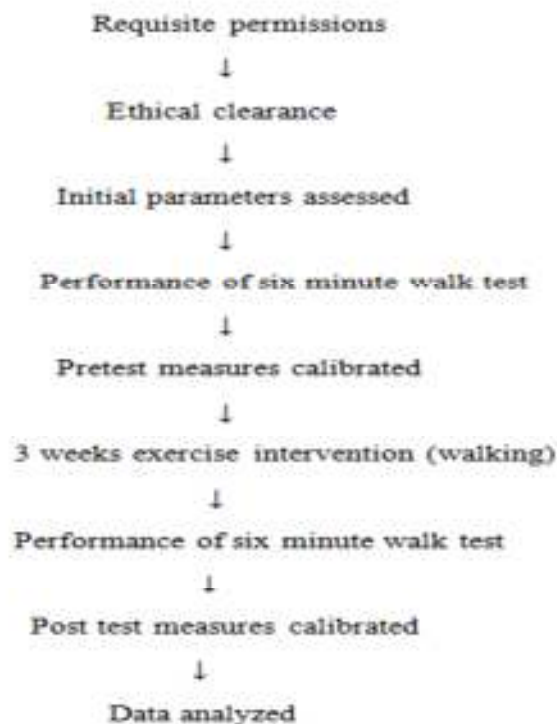
Leg Exercises: One leg flexion and extension, one leg abduction and adduction, Knee curls, Ankle- planter flexion and dorsiflexion.

Trunk Exercises: Flexion and extension, Side flexion: right and left

Then the subjects were asked to perform a 10 minutes of walking at the patients self selected speed in the presence of researcher so that dyspnoea is not provoked. Even if dyspnoea was provoked oxygen cylinder was in close vicinity to prevent any untoward effect. This was later followed by a cool-down period, which lasted for 5 minutes and comprised of exercises for arms, legs and the trunk as in warm up phase.

Main outcome measures: The main outcome measure for the pre and post test exercise capacity was measured by six minute walk distances achieved from Six Minute walk test.[14]

General procedure: The following procedure was followed after obtaining the written informed consent from the participants

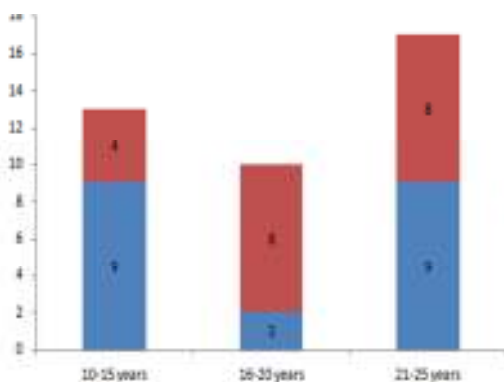


**Data analysis**

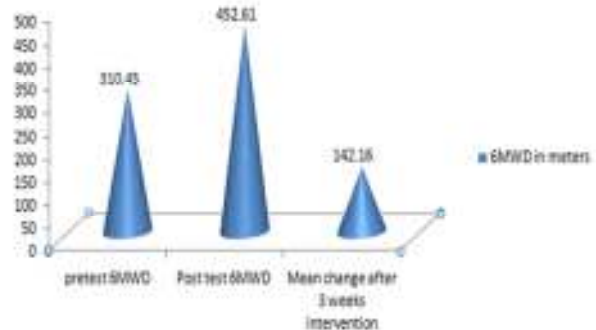
Continuous variables were presented as mean ± SD & were compared between pre and post test in SCA by t- test. P-value <0.05 was considered as statistical significance. Data analyzed with statistical software STATA version 10.0.

**Results**

The results obtained from the 40 subjects of sickle cell anemia reveal that the mean age of the subjects was 18.62 ± 4.60 and consisted of both males & females as shown in fig 1. The hemoglobin levels was 8.40 ± 0.76 percent and the weight was 40.62 ± 7.10 kg's. It is to note that the distance covered in 6MWT before and after implementation of 3 weeks exercise intervention in patients with SCA has shown an increase (graph 2),and statistically significant with p < 0.05 (p= 0.0000) thereby supporting the hypothesis. All the other cardiovascular & respiratory parameters of 6MWT except dyspnoea were not significant in pre & post test measures (table 1 & 2)



**Fig 1: Age & sex distribution**



**Fig 2: 6 MWD pre & post test**

**Table 1: pre test: Before exercise intervention**

Parameter	Baseline	After 6 MWT	t-value	p-value	After 6 MWT	After 2 min Rest	t-value	p-value	After 2 M Rest	Baseline	t-value	p-value
SBP	110.75 ±12.81	112.4 ± 0.74	0.6240	0.5345,NS	112.4 ± 0.74	109.4 ±10.58	1.2378	0.2122,NS	109.4 ±10.58	110.75 ± 12.81	0.5117	0.6089,NS
DBP	74.37 ± 7.46	74.85 ±6.07	0.3121	0.7558,NS	74.85 ±6.07	73.62 ±5.93	0.9123	0.3544,NS	73.62 ±5.93	74.37 ± 7.46	0.4914	0.6203,NS
HR	101.95 ±13.61	101.22 ±12.89	0.2446	0.8056,NS	101.22 ±12.89	100.87 ±12.12	0.1251	0.9008,NS	100.87 ±12.12	101.95 ±13.61	0.3730	0.710,NS
RR	24.4 ± 5.67	23.2 ±4.54	0.6935	0.4888,NS	23.2 ±4.54	23.9 ±4.04	1.3503	0.1808,NS	23.9 ±4.04	24.4 ± 5.67	0.4534	0.6515,NS
Dyspnoea	0.05 ±0.15	0.35 ±0.34	3.4121	0.0010,HS	0.35 ±0.34	0.07 ± 0.18	3.0843	0.0028,HS	0.07 ± 0.18	0.05 ±0.15	0.6695	0.5051,HS
SpO <sub>2</sub>	98.02 ±0.16	97.67 ±1.70	1.2961	0.1987,NS	97.67 ±1.70	97.95 ± 0.22	1.0144	0.3136,NS	97.95 ± 0.22	98.02 ±0.16	1.7470	0.0846,NS

**Table2: post test: After exercise intervention**

Parameter	Baseline	After 6 MWT	t-value	p-value	After 6 MWT	After 2 min Rest	t-value	p-value	After 2 min Rest	Baseline	t-value	p-value
SBP	112.82 ± 12.24	109.4 ±10.58	0.5117	0.6089,NS	109.4 ±10.58	111.7 ±10.72	0.3232	0.7474,NS	111.7 ±10.72	112.82 ± 12.24	0.4370	0.6633,NS
DBP	75.77 ± 7.32	75.62 ±5.93	0.4914	0.6203,NS	75.62 ±5.93	75.55 ±5.34	0.0567	0.9550,NS	75.55 ±5.34	75.77 ± 7.32	0.1569	0.8737,NS
HR	100.73 ± 9.87	100.87 ±12.12	0.3730	0.710,NS	100.87 ±12.12	100.57 ±12.12	1.6456	0.1039,NS	100.57 ±12.12	100.73 ± 9.87	0.0825	0.9345,NS
RR	23.07 ± 4.09	23.9 ±4.04	0.4534	0.6515,NS	23.9 ±4.04	23.35 ±3.42	1.9484	0.0532,NS	23.35 ±3.42	23.07 ± 4.09	0.3217	0.7435,NS
Dyspnoea	0 ± 0	0.07 ± 0.18	0.6695	0.5051,NS	0.07 ± 0.18	0.025 ± 0.11	3.0440	0.0032,HS	0.025 ± 0.11	0 ± 0	1.4327	0.1559,NS
SpO <sub>2</sub>	98.02 ±0.16	97.95 ± 0.22	1.7470	0.0846,NS	97.95 ± 0.22	97.95 ± 0.22	1.7470	0.0846,NS	97.95 ± 0.22	98.02 ±0.16	1.7470	0.0846,NS

**Discussion**

The reason for this increase in SCA group may be attributed to the fact that, exercise training for a period of 3 weeks does help in improving the distance covered as the functioning of dysfunctional RBC's is improved to certain extent due to compensatory mechanisms exhibited

by the body when steadily exercised. So, the changes in pre to post test in relation to distance covered in SCA patients suggests that SCA patients when exercised in a steady manner over a period of time, than in that case the utilization of oxygen is markedly increased without creating any untoward effects on the systems and hence exercise capacity is also increased and the same is noted in this study by improved levels of distance covered on performance of 6MWT. Post-test results have indicated that there is a tremendous increase in distance covered in SCA group when compared to pretest, emphasizing the fact that exercise training improves in overcoming the exercise limitation in SCA patients. Thereby, stressing the fact that exercise limitation in the SCA could be overcome by proper exercise training. Such patients have to be cautiously exercised in order to prevent any untoward effects.

3 weeks of exercise intervention has improved cardiovascular & respiratory parameters. Moreover, all the pre test results of SCA group have an abnormal response to exercise which is in line with the statement stated by American college of Sports Medicine in relation to SCA.[15] But the post test have again emphasized that walking intervention has improved their endurance (cardiovascular and pulmonary). Keeping in view with the role of anemia in producing exercise intolerance as discussed by Callahan and co-workers in which they quoted that patients with SCA who undergo exchanged transfusion showed improved work performance but such a study cannot be correlated in this current scenario, since the patients on blood transfusion were not considered for the study and is beyond the scope of current study. Moreover the effects on the tidal volume and the physiological dead space cannot be discussed as it is not in the preview of the present study. But, till then increased respiratory rate always tend to have smaller tidal volumes, but the quantification of how small the tidal volumes are has not been considered as it is not in the protocol of the study.

The strength of this study was that it was able to establish the fact that properly implemented exercises over a period of time (3 weeks) is adequate enough in improving the exercise capacity in SCA patients in relation to distance covered. The weakness of the current study is that all patients were not monitored on all the days of the exercise program. Moreover, the impact of blood transfusions and medications was not evaluated.

**Conclusions:** This study suggests that there is a marked increase in the six minute walk distances after 3 weeks of exercise intervention in form of walking when compared to pre test values. The improvements gained in post test indicate that walking exercise can help overcome the exercise intolerance which is encountered in SCA patients and thereby, help them overcome the cardiovascular and pulmonary dysfunctions which SCA patients suffer from.

Multiple factors have been found to have an impact in these patients, few to list are reduced hemoglobin, sickle shaped RBC's, easy fatigability of patients, reduced saturation levels, increased respiratory rate (compensatory mechanisms), reduced tidal volumes, increased cardiac output, decreased heart rate while exercising, and endothelial dysfunction.

But, all factors have not been studied as it is difficult to study multiple factors simultaneously at the same time. SCA is a multi-factorial disease and all these factors have to be considered for helping to improve their status and quality of life. Therefore, it is concluded, that the 3 weeks of exercise intervention in form of walking can improve the fitness level in form of distance covered after six minute walk test in SCA patients.

**Recommendations:** It is recommended that further work in this regards with different samples and same variant of sickle cell should be considered along with multiple factors of the disease.

**Conflict of interests.** There are no conflicts of interests

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