THE EFFICACY OF AEROBIC EXERCISE AND RELAXATION TECHNIQUE IN FATIGUE AMONG CHILDREN WITH ACUTE LYMPHOBLASTIC LEUKEMIA- A COMPARATIVE STUDY

Dissertation submitted to

The Tamil Nadu Dr. M.G.R. Medical University

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In partial fulfillment of the requirements for the degree of

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COLLEGE OF PHYSIOTHERAPY
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CERTIFICATE

This is to certify that the dissertation work entitled **"The Efficacy of Aerobic Exercise and Relaxation Technique in Fatigue Among Children with Acute Lymphoblastic Leukemia- A Comparative Study"** was carried out by the candidate bearing the **Register No.271540062 (October 2017)** in College of Physiotherapy, SRIPMS, Coimbatore, affiliated to the Tamil Nadu Dr. M.G.R Medical University, Chennai towards partial fulfillment of the **Master of Physiotherapy (Pediatrics).**

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

Place:

Date:

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ABBREVIATIONS

ALL	-	Acute Lymphoblastic Leukemia
CRF	-	Cancer Related Fatigue
CFS	-	Child Fatigue Scale
PMR	-	Progressive Muscle Relaxation
PFS	-	Parent Fatigue Scale
QOL	-	Quality Of Life

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1. INTRODUCTION

Childhood cancer is one of the leading cause of death by disease among which Acute Lymphoblastic Leukemia (ALL) accounts for 30% of all the malignancies[1]. ALL is the most common form of pediatric leukemia which is also known as Acute Lymphocytic or Acute Lymphoid Leukemia[2]. Incidence is approximately 3-4 cases per 100,000 children below 15 years with peak incidence below 2-5 years of age [3]. In most of the countries, the incidence rate in children was approximately four times than that of the adults [4]. Studies have shown a 98% cure rate in ALL[5]. But even with these survival rates in pediatric population, only half of the ALL patients survived 5 years [6].

Exact etiology of ALL is still unknown but common etiological factors include ionizing radiations ,congenital anomalies, chemical agents like Benzene and Immunodeficiency syndromes[7]. Many studies have reported the risk factors like Down syndrome, Erbstien Barr Virus (EBV) infections, parental history of fetal loss, miscarriage, perinatal exposure to pesticides and still birth to be reasons for developing leukemia [8, 9, 10].

The pathogenesis of ALL is assumed to be the neoplasm arising from the clonal proliferation of immature cells of hemopoetic system which are characterized by the aberrant or arrested differentiation [7].

The associated complications of ALL include musculoskeletal, Central Nervous System (CNS) and other systemic complications. Recent study have shown that 2% of the boys diagnosed with ALL shows testicular enlargement [5]. Neural complications like pain, paresthesia and reduced deep tendon reflexes have been reported in various studies [11]. Musculoskeletal complications like impaired gross motor and fine motor performances, increased fatigue, compromised ROM, strength and endurance have also been identified[11,12].

Unfortunately, fatigue has become the most debilitating symptom in patients with cancer [13]. It was reported to be an intensive disability among cancer patients [14] as it induces inactivity which on prolonged rest lead to muscle wasting and loss of endurance [12]. Fatigue affects quality of life to about 60% in cancer patients. But limited focus was given to those groups recognized with fatigue complaining unique experiences [15].

The medical management of ALL includes antineoplastic agents administered for induction, consolidation and maintenance therapy [16]. For newly diagnosed form of ALL, Asparagine and Anthracycline are administered [5]. Optimal use of antileukemic agents together with prognostic factors resulted in steady improvement of treatment outcome [17]. Findings have shown that even after excluding cranial irradiation approximately 6% of children with ALL may relapse after completion of treatment and those who remain in remission at 4 years is considered cured [38].Since most of the deaths were assumed to be infection related, corticosteroids, prophylactic antibiotics and antifungals are administered for preventing infections in children receiving chemotherapy [16, 18].

Many studies have been undergone and is still on work regarding the hazardous side effects of drugs on ALL. Studies have reported the lower doses of Asparagine for longer periods were responsible for high incidence of thrombosis [19]. Dexamethasone effect on treating pediatric ALL was found effective but caused serious metabolic and neurophysiological side effects [20]. Various studies focused on greater risk of developing Osteonecrosis and myocardial impairment in children receiving Corticosteroids and

Doxorubicin treatment [21, 22].Dosage of methotrexate was found to cause neurocognitive impairment [23]. Associated mobility functions and weakness were exhibited by children undergoing treatment at standard risk [24]. The age of impact was studied to be one of the most important prognostic factor for outcome [25]. Thus an early diagnosis, infection control and parental education is needed to improve the conditions of children and many studies have pointed the importance of a feasible intra hospital or home based rehabilitation program for cancer children(26).

The rehabilitation services for musculoskeletal, neurological and cardiovascular late effects among ALL children proved to improve the physical function [27]. But for an effective physical therapy intervention age, type of exercises, location of implementation and parent motivations are necessary [28]. Many studies clarified the extend of physical therapy to be implemented should be within the normal safe boundaries [24]. There are studies providing strong evidences of implementing exercises which brought noticeable effect even during chemotherapy[29,30].These exercises showed appreciable improvement in level of fatigue and endurance improving Quality of Life (QOL)[2, 31].

Evaluation of presence of fatigue should be clearly made prior to treatment through regular screening and assessment [32].Numerous studies have been carried out to identify a valid scale to measure fatigue level in children and was put forward as reliable enough[32,33,34]. Many reports proved the effectiveness of aerobic exercise in children with ALL and even during the chemotherapy [14, 30, 31]. These training focused to improve strength, functional mobility, reduce fatigue, and improve cardiovascular fitness, improve muscle strength and physical function [35, 36]. Relaxation techniques implemented on children brought greater results than aerobic exercise in certain studies thereby reducing fatigue level and cancer related symptoms [37].

NEED FOR THE STUDY

There are various physiotherapy treatments available for management of ALL related fatigue thereby improving endurance and QOL .In spite of all these managements, the improvement in the level of fatigue was not satisfactory. Fatigue measures for children and adolescents are important because they allow degree of fatigue to be described and high risk groups to be identified [39].

There are studies reporting the relationship between aerobic exercise, relaxation technique and fatigue which showed greater results. Some studies also showed that exercise was not as effective as expected to bring down the fatigue level. On the other hand strong evidences supporting the exercise interventions on relieving fatigue level have been stated without much adverse effects .This shows that the effect of relaxation technique and aerobic training have to be studied further for clinical evidence.

AIM OF THE STUDY

This study was aimed to find out the effect of aerobic training and relaxation technique on fatigue in children with ALL.

2. OBJECTIVES

- To find out the effectiveness of CSF in aerobic training among children with ALL.
- To find out the effectiveness of PSF in aerobic training among children with ALL.
- To find out the effectiveness of CSF in relaxation technique among children with ALL.
- To find out the effectiveness of PSF in relaxation technique among children with ALL.
- To compare the outcomes of CSF between the aerobic training and relaxation technique among children with ALL.
- To compare the outcomes of PSF between the aerobic training and relaxation technique among children with ALL.

HYPOTHESIS

Null Hypothesis

1. There was no significant difference in CFS outcome in aerobic training among children with ALL.
2. There was no significant difference in PFS outcome in aerobic training among children with ALL.

3. There was no significant difference in CFS outcome in relaxation technique among children with ALL.
4. There was no significant difference in PFS outcome in relaxation technique among children with ALL.
5. There was no significant difference in outcome of CFS between the aerobic training and relaxation technique among children with ALL.
6. There was no significant difference in outcome of PFS between the aerobic training and relaxation technique among children with ALL.

Alternate Hypothesis

1. There was a significant difference in CFS outcome in aerobic training among children with ALL.
2. There was a significant difference in PFS outcome in aerobic training among children with ALL.
3. There was a significant difference in CFS outcome in relaxation technique among children with ALL.
4. There was significant difference in PFS outcome in relaxation technique among children with ALL.

5. There was a significant difference in outcome of CFS between aerobic training and relaxation technique group.
6. There was a significant difference in outcome of PFS between aerobic training and relaxation technique group.

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3. REVIEW OF LITERATURE

Dhoriyani Narendra B, *et al* [7] concluded that relaxation exercises proved to be more effective in treating fatigue among ALL children than aerobic exercise as it relieves stress and was easy to perform among groups of children that lasted for 3 weeks.

Fernando. C. Dimeo, *et al* [37] concluded the effects of aerobic training which could improve the physical performance but was no better than progressive relaxation technique in treating fatigue.

Ali Hassan pour Dekhordi and AmisJalali[46]in their study pointed out the importance of PMR that had greater effect in relieving fatigue and improving the quality of life.

Tseng Tien Haung and Kirsten K Ness [36] summarized the impact of exercise on health and physical function among children during and after cancer treatment. They reported reduced levels of fatigue and improved physical activity in children who completed aerobic exercise program.

Dimeo, *et al* [41] concluded the effects of aerobic exercise program which can be prescribed in defined intensity, duration, frequency as a therapy in managing fatigue among cancer patients.

Shadi Farzin Gohar MD, *et al* [26] demonstrated the feasibility of physical therapy program in hospital and home based plan during initial four phases of medical treatment and focused on the importance of further studies on the same for better results.

Anna Spathis, et *al* [15] concluded fatigue as a major disabling factor among cancer patients in their study and suggested to focus on the effectiveness of interventions to promote activity and manage symptoms

Deborah Tomlisonet al [39] in their study analyzed the psychometric properties of the scales measuring fatigue and found the parent, child fatigue scale to be effective.

Dimeo F, *et al* [12] also concluded that aerobic training can be safely carried after high dose chemotherapy thereby preventing loss of physical performance.

Marja Schoenmakers et al [24] conducted the pilot study to find the effects of exercises on muscle strength before and after treatment of ALL and concluded that certain muscle groups showed improvement in activity.

Marilyn .J. Hockenberry, *et al* [33] in his study to develop and test the instruments for measuring fatigue thereby studying the instrument development and content validation was the first to provide PFS,CFS,SFS as valid and reliable instruments to measure fatigue in children.

Hinds P S, *et al* [39] determined the effects of exposure to dexamethasone on sleep and fatigue in pediatric patients with ALL showing the validity of FSC (Fatigue Scale Children) and FSP (Fatigue Scale Parent).

Donald. P. Lawrene, *et al* [48] has concluded that the assessment properties of the scale was only promising and pointed to focus on the development of much precise assessment tools.

Alison Crichton, *et a* [47] has appreciated the robust measurement properties notably content validity showed by FSC and FSP scoring systems, providing moderate evidence for structural validity of child and parent forms. The evidence assessed was exclusively limited for children with hematology /oncology diagnosis.

Victoria G Marghese *et al* [11] focused on early initiation of treatment with greater emphasis on endurance activities which improves the quality of life.

San Juan *et al* [35] stated the effects of an intra-hospital exercise program which braught significant increase in measure of aerobic fitness,strength anf functional mobility.

Ladha *et al* [40] showed that a 30 minute of moderate intensity exercise in ALL children receiving medical treatment provides a similar neutrophil response that of healthy age group.

4. METHODOLOGY

Study design

A comparative study

Study setting

Pediatric inpatient oncology ward, Sri Ramakrishna Institute of Oncology and Research, Coimbatore.

Sampling technique

A convenience sampling.

Sample size

A total of 30 acute lymphoblastic leukemia patients was selected on the basis of inclusion criteria and conveniently allocated into two groups of 15 each. Both the groups were designed for experimentation.

Study duration

The study was conducted over a period of 10 months.

Treatment duration

The treatment duration was 4 weeks.

Inclusion criteria

- Children undergoing chemotherapy
- Aged between 5-12
- Both gender
- Children with preserved cardiac function
- Children able to accept and follow verbal instructions
- Children complaining of fatigue

Exclusion criteria

- Children with unstable cardiac function
- Children with platelet count less than 3000/uL
- Children with recent surgeries(less than 3 months)
- Children with congenital musculoskeletal anomalies
- Children with visual and hearing deficits
- Children with systemic complications.

Method of collection of data

The selected ALL patients were conveniently assigned into two equal groups: Group A/aerobic exercise group and Group B/Relaxation technique group. Both the groups were explained about the study and a written consent (*Annexure I)* was signed and obtained from the parents of children involved in the study.

All the participants were assessed by the pediatric assessment (*Annexure II*) for the general health status which consist of age, gender, height, weight, duration of chemotherapy, vitals and general physical examination.

All the participants were evaluated by the Child Fatigue Scale, (*Annexure III*) which was explained by the trainer to the children and were asked to rate their level of fatigue before and after the completion of the treatment regimen. The parents of all the participants were given with the Parent Fatigue Scale questionnaire, (*Annexure IV*) and was asked to answer it based on the tiredness level of their child before and after the treatment and the total score was taken for analysis.

The group A and B received Aerobic exercise (*Annexure-V*) and Relaxation technique (*Annexure-VI*) respectively for a period of 4weeks. All the vital parameters were measured during each session to confirm that subjects were stable and the treatment sessions were carried out under the presence of the parent.

Outcome Measures

The assessment tools used to assess the level of fatigue were:

1.Child Fatigue Scale

2. Parent Fatigue Scale

TREATMENT TECHNIQUES

Aerobic training group (*Annexure V)*

The children in this group received the low intensity aerobic training which consisted of general warm ups, static cycling, walking on treadmill incorporated with aerobic play activities and finally cool down.

The activities were demonstrated to the children by the therapist. The treatment focused on improving their strength and endurance there by reducing fatigue. The treatment was conveniently arranged for the children which lasts for about 30 minutes a day for 3 alternate days a week for 4 weeks.

The treatment circuit consists of:

- Initial warm up (5 minutes)
- Static cycling (5minutes)
- Low resistance treadmill walking (5minutes)
- Play activities (5minutes)
- Cool down (5 minutes)

Proper rest periods were allotted between each sessions and was carried under the presence of the parent.

Relaxation technique group (*Annexure VI*)

The children in this group received Jacobson's relaxation technique which lasts for about 30 minutes a day for 3 alternate days a week for 4 weeks.

Jacobson's relaxation technique was demonstrated to the children in a quiet peaceful ambience .Then the children were asked to perform the same for about 30 mints.

Training includes:

- Gentle breathing (5minutes)
- Visual imaging (5minutes)
- Tightening and loosening each body parts and joints (5minutes)
- Release state(5 minutes)
- Gentle breathing(5 minutes)
- Whole body stretching(5 minutes)

Proper rest periods were allotted between each sessions and was carried under the presence of the parent.

Materials

- Exercise mat
- Static cycle
- Treadmill
- Consent form
- Scoring chart
- Vitals monitoring instruments
- Stationary materials

5. DATA ANALYSIS& RESULTS

Data collected from participants of the same group (intra group) were analyzed using paired' test and the difference between the two groups (inter group) were analyzed using independent 't' test.

Paired't' test:

't' = $\frac{\bar{d}\sqrt{n}}{SD}$

SD = $\sqrt{\frac{\sum(d-\bar{d})^2}{n-1}}$

Where,

$\bar{d}$ =calculated mean difference between pre and post-test values.

d =difference between pre and post-test values.

n =sample size

SD= standard deviation

Independent 't' test:

't' = $\frac{\overline{X_1}-\overline{X_2}}{SD\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$

SD = $\sqrt{\frac{(n_1-1)SD_1^{\ 2}+(n_2-1)SD_2^{\ 2}}{(n_1+n_2)-2}}$

Where,

$\overline{X_1}$ = mean of group A

$\overline{X_2}$ = mean of group B

n_1 = number of subjects in group A

n_2 = number of subjects in group B

SD_1 = standard deviation of group A

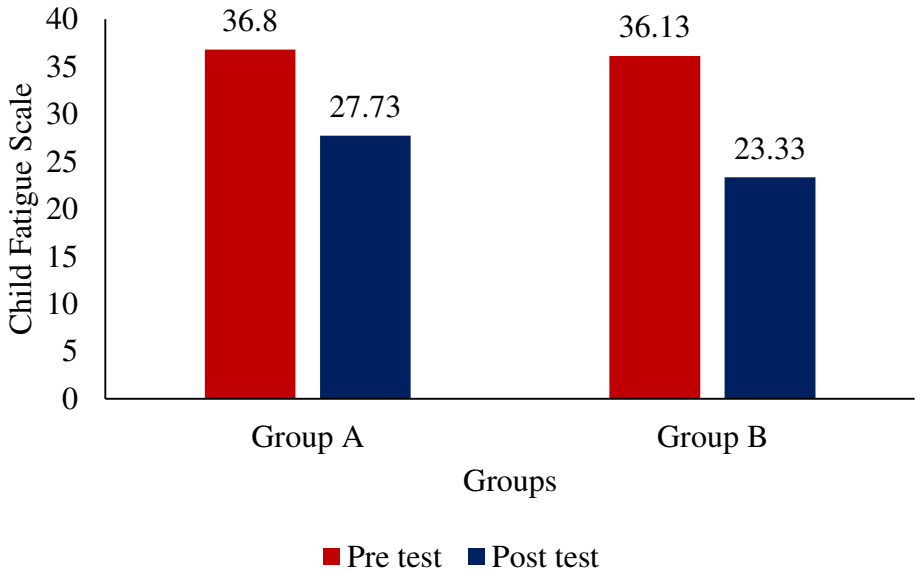
SD_2 = standard deviation of group B

DATA INTERPRETATION

Table I: Child Fatigue Scale (CFS) scoring for Group A and Group B

Groups		N	Mean	Mean difference	SD	The calculated 't'value
Group A	Pre Post	15 15	36.8 27.73	9.07	5.035	6.9686
Group B	Pre Post	15 15	36.13 23.33	12.8	4.83	10.26

Graph I: Child Fatigue Scale (CFS) scoring for Group A and Group B



RESULTS:

GROUP A:

The mean and standard deviation of the group A is 9.07 and 5.035. The calculated ‘t’ value is 6.9686 which is greater than the table value (1.76) at the level of $p< 0.05$. The result showed that there is significant difference between the pre and post-test of CFS score among participants of group A.

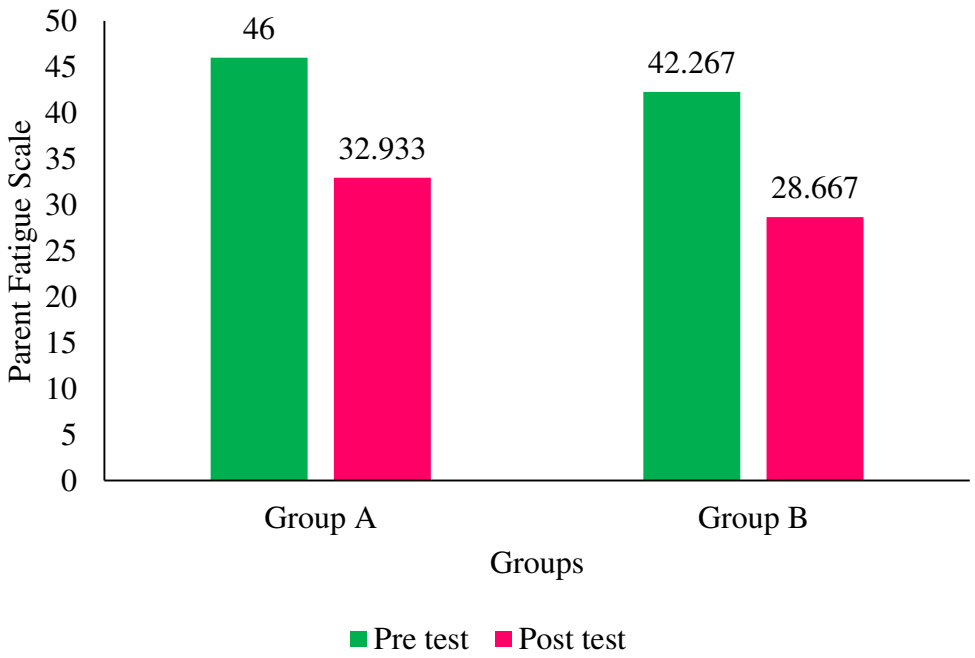
GROUP B:

The mean and standard deviation of group B is 12.8 and 4.83.The calculated ‘t’ value is 10.26 which is greater than the table value (1.76) at the level of $p<0.05$. The result showed that there is significant difference between the pre and post-test of CFS score among participants of group B.

Table II: Parent Fatigue Scale (PFS) scoring for Group A and Group B

Groups		N	Mean	Mean difference	SD	The calculated 't'value
Group A	Pre Post	15 15	46 32.933	13.06	5.202	9.73
Group B	Pre Post	15 15	42.267 28.667	13.6	6.378	10.69

Graph II: Parent Fatigue Scale (PFS) scoring for Group A and Group B



RESULTS:

GROUP A:

The mean and standard deviation of group A is 13.06 and 5.202.The calculated ‘t’ value is 9.73 which is greater than the table value(1.76) at the level of $p < 0.05$. The result shows that there is a significant difference between the pre and post-test of PFS score among the participants of group A.

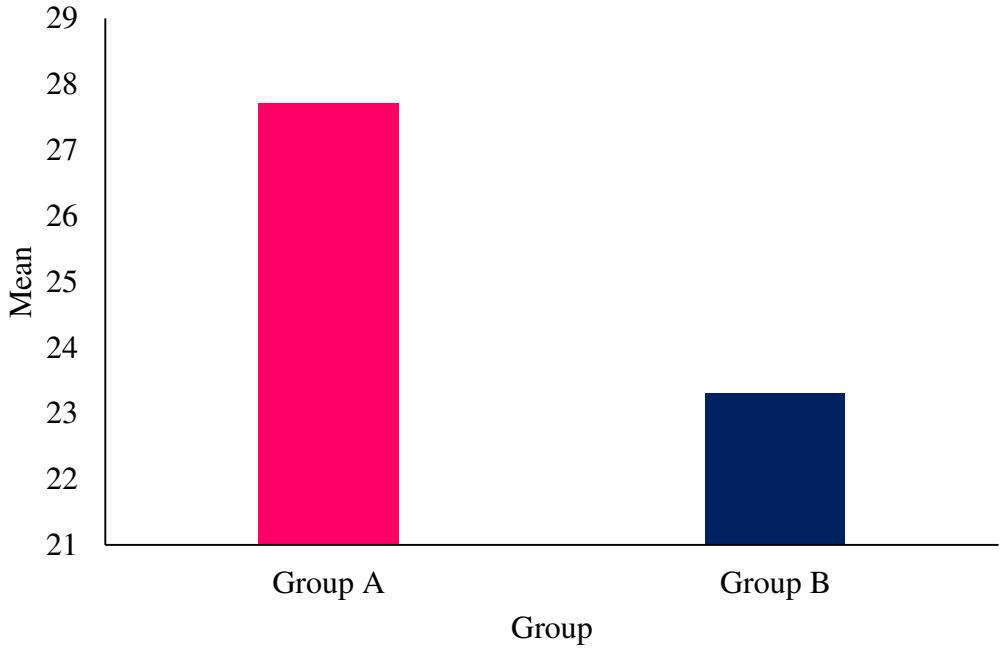
GROUP B:

The mean and standard deviation of group B is 13.6 and 6.738.The calculated ‘t’ value is 10.69 which is greater than the table value(1.76) at the level of $p<0.05$. The result shows that there is a significant difference between the pre and post-test of PFS score among the participants of group B

Table III: Child Fatigue Scale scoring in Aerobic vs. Relaxation group

Parameters	Group	Mean	SD	Calculated 't'value	Table 't' value
Fatigue level	Group A Group B	27.7 23.3	4.2770	2.848	2.048

Graph III: Child Fatigue Scale scoring in Aerobic group vs. Relaxation group



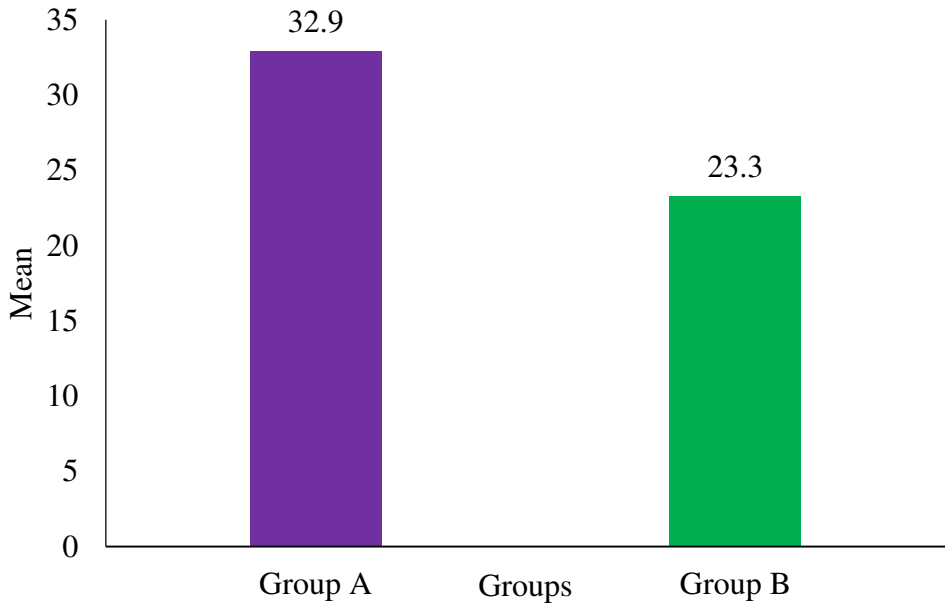
RESULTS:

The mean values of aerobic training group (27.7) is greater than the relaxation training group (23.3). The calculated 't' value is 2.848 which is greater than the table value (2.048). The study showed that there is significant difference in child fatigue scale level of aerobic training group and relaxation training group at the level of $p<0.05$. This shows that aerobic training is effective than the relaxation training in improvement of fatigue among ALL children.

Table IV: Parent Fatigue Scale scoring in Aerobic group vs. Relaxation group

Parameters	Group	Mean	SD	Calculated 't'value	Table 't' value
Fatigue level	Group A Group B	32.9 28.6	4.9940	2.3579	2.048

Graph IV: Parent Fatigue Scale scoring in Aerobic group vs. Relaxation group



RESULTS:

The mean value of the aerobic training group (32.9) is greater than the relaxation group (28.6). The calculated‘t’ value is 2.3579 which is greater than the table value (2.048). The study showed that there is significant difference in parent fatigue scale level of aerobic training group and relaxation training group at the level of $p<0.05$. This shows that aerobic training is effective than relaxation technique in improvement of fatigue in ALL children

6. DISCUSSION

The study was aimed to investigate the effects of Aerobic exercise and Relaxation technique on the children with Acute Lymphoblastic Leukemia (ALL). The ALL children have fatigue as one of the major problem which alters their mood and limits their functional activity. These children requires assistance for doing activities as they always seem tired, even with limited independent walking .When compared to normal child, they appear drained and gets exhausted easily. There are studies supporting the relationship between aerobic exercise and relaxation technique on fatigue level among children with ALL.

For the study purpose, 30 ALL children complaining fatigue were selected on the basis of inclusion criteria and divided into two equal groups. Both groups A and B were assigned for experimentation. Based on age parameter, 21 children were in the age group of 5-9 and 9 under the age group of 10-12. Based on the gender, 18 were boys and remaining 12 girls.

At the baseline of the study, all the participants were evaluated by the Child Fatigue Scale for measuring their level of fatigue. The parent fatigue scale questionnaire was filled by the parent and was

collected to measure the level of fatigue of their children. The collected data was taken as the pre interventional scores for analysis. Group A was treated with aerobic exercises. Group B was treated with Jacobson's relaxation technique. The treatment duration was over a period of 4 weeks. After this treatment period, all the participants were reevaluated by the same assessment tools and the collected data were taken as the post interventional scores for analysis.

The collected data was statistically analyzed in order to compare the variables, which was done within the groups by paired 't' test and to compare the variables between the groups which was done by the independent 't' test. The difference were considered at the significant level of $p<0.05$.

The statistical analysis of variables within the group result showed significant difference. The **CSF** scoring result showed in Table 1 and Graph 1 accepted the alternative hypothesis 1 and 3 thus showing a significant difference in CFS outcome in aerobic and relaxation training groups among ALL children. The **PFS** scoring result showed in Table II and Graph II accepted the alternative hypothesis 2 and 4 thus showing a significant difference in PFS outcome in aerobic and relaxation training among ALL children.

The statistical analysis of the variables between aerobic exercise group and relaxation group result showed significant difference. **CSF** scoring result showed in table III and graph III accepted the alternative hypothesis 5 and confirmed the significant difference in outcome of CFS in aerobic and relaxation training group.

The PFS scoring result showed in table IV and Graph IV accepted the alternate hypothesis 6 and confirmed the significant difference in outcome of PFS in aerobic and relaxation training group.

The results confirmed the effects of Aerobic training which was effective than the relaxation technique in improving the cancer related fatigue. The result supported the previous studies which stated that aerobic training can improve fatigue in children. The study determined that there was significant increase in endurance level, which was also stated in the other studies. The improvement in fatigue level has a significant improvement in functional activities of daily living. All these factors contributed to the improvement in overall fitness, cardiovascular fitness, and increased endurance.

RECOMMENDATIONS

- Subjects with a large sample size can be studied.
- The effects on various age groups can be studied.
- Fatigue recovery of ALL children on various severity levels can be studied.
- Long term effects of aerobic training and relaxation training can be studied
- Tamil translated version of the parent and child fatigue questionnaire can be used to yield a better outcome as the original questionnaire is available in the English version.

7. CONCLUSION

The study confirmed the effects of both Aerobic exercise and Relaxation technique which could reduce the level of fatigue among children with ALL. The aerobic training yield better results compared to relaxation training in reducing fatigue level among ALL children.

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ANNEXURE-I

CONSENT FORM

I…….... (parent) hereby agree to provide my fullest consent and co-operation to allow my child to be taken as a subject for the research work of (**Reg no.271540062)** entitled **"*The efficacy of aerobic exercises and relaxation technique in fatigue among children with acute lymphoblastic leukemia-A comparative study*".** I have decided to volunteer my child for the study on my own will and was not compelled by individual or group of people and my consent is not for any monetary benefits.

The possible outcomes and effects of the study as well as the procedure that will be executed on my child is fully explained to me by an investigator in the language best known to me and I am aware that my child being subjected to this study and I'll have to give more time for assessments and treatments.

The questions and queries I have posed have been answered to my satisfaction and I am aware that my child's identity will be kept confidential. I am also aware that I can discontinue or withdraw from this study on my child at anytime without adversely affecting my child's health.

The matter in this consent form was read by me /read to me by an investigator and is true and understanding to the fullest of my knowledge.

Sign of the parent **Sign of the investigator**

Place:

Date :

ANNEXURE -II

ASSESSMENT FORM

Name: GROUP: ID NO:

Age: Date of assessment:

Gender:

Height:

Weight:

Informant:

Medical history:

Chief complaints:

Present medical illness:

Onset:

Duration of hospital stay:

Birth history:

Developmental history:

Immunization history:

Drug history:

Higher mental functions:

Cognitive development:

Socially adaptive:

Speech:

Vision:

Hearing:

Vitals:

Temperature:

Pulse rate:

SPO2:

BP:

RR:

General appearance:

Facial:

Posture:

Behavior:

Sleep activity:

Appetite:

Interactiveness:

General health status:

Breathing:

Muscle tone:

Circulation:

Nutritional status:

Hydration:

Mental state:

Level of fatigue**:**

Hematological:

Platelet count**:**

WBC count:

Units of blood transfused:

Neurological:

Level of consciousness:

Gait:

Recent changes:

Changes in appearance:

Changes in treatment:

ANNEXURE –III

CHILD FATIGUE SCALE

Sl No	How have you been feeling during the past one week?	Yes/no	Not at all	A little	Sometimes	Quite a lot	A lot
1.	I have been tired.						
2	My body has felt different.						
3	I have been tired in the morning.						
4	I need a nap most of the time						
5	I have not been able to play.						
6	I have been playing around.						
7	I have been feeling sad.						
8	I have been mad.						
9	I stop doing things and take rest.						
10	I have not been able to do activities.						
11	I have not been able to run.						
12	I found hard to keep my eyes open.						
13	I have slept more at night						
14	I have trouble thinking.						
	Score: 1-not at all 2-a little 3-some times 4-quite a lot 5-a lot						

TOTAL SCORE:

INTERPRETATION

The *Childhood Fatigue Scale (CFS)* is a 14-item, two-part instrument. The items ask the child for a "yes" or "no" (frequency) response regarding their experience of any fatigue-related symptoms during the past week. If the statement is true for the child, he or she is asked to rate how much the problem bothers the child on a five-point Likert scale ranging from "Notat all" to "A lot." (Intensity). If the child has not experienced the particular problem, and has answered with a "no" response forthe question, the score is zero for that question. Frequency scores range from 0 to 14, and intensity scores, also considered total fatiguescores, ranges from 0 to 70. Higher scores correspond to greater amounts of experienced fatigue.

ANNEXURE –IV

PARENT FATIGUE SCALE

Sl.No	How your child have been feeling during the past week?	Not at all	Almost never	Sometimes	Not always	Always
1.	My child has been tired in the morning.					
2.	My child has hard time getting out of bed.					
3.	My child has been too tired to eat.					
4.	My child has not slept throughout night.					
5.	My child has been tired in the afternoon.					
6	My child always needed a nap.					
7.	My child seems to have no energy.					
8.	My child feels tired after night's sleep.					
9.	My child has play changes during the day.					
10.	My child always wanted to lie down.					
11.	My child needs rest while walking.					
12.	My child has become quieter.					
13.	My child has become less interactive.					
14.	My child has become more irritable.					
15.	My child shows mood swings.					
16.	My child has become in co-operative.					
17.	My child has dark circles under his/her eyes.					
Score: 1-not at all 2-almost never 3-sometimes 4-not always 5-always						

TOTAL SCORE:

INTERPRETATION

The *Parent Fatigue Scale* (*PFS*) consists of 17 items regarding parents' perceptions of the amount of fatigue experienced by their children in the past week. The items are rated on a five point Likert scale ranging from 1-"Not at all "to 5-"Always" . Scores on the parent scale range from 17–85 with higher score corresponding to greater amounts of perceived fatigue.

ANNEXURE –V

TREATMENT PROTOCOL FOR AEROBIC EXERCISE GROUP

Aerobic training may be defined as the ability to deliver oxygen to the exercising muscles and utilize it to generate energy during exercise. Aerobic fitness depends on pulmonary, cardiovascular and hematological components of oxygen delivery and oxidative mechanism of exercising muscle.[44]

GUIDELINES:

- Exercises should be performed at least after 2hrs after consumption of food.
- Should not have exercised vigorously prior to the treatment session.
- Should be made familiar with treadmill and static cycling.
- Procedures should be well explained to the children.
- The vitals should be checked prior to exercise sessions.
- The safety and well-being of the children are of great importance as they are immune- compromised.

Treatment sessions:

1. Initial warm up Duration: 5 minutes

Low intensity warm ups are advisable**.**

These includes: speed walking and arm swinging

Initial starting position: Standing, with arms on sides.

Instructions: Ask the children to start walking with their maximum speed with arm swinging on sides from their starting position.

Trainer: Stands and observes the children; counts on stop watch.After 5 mints general warm-up, provide rest for about 2 minutes.

2. Static cycling Duration: 5 minutes

Initial starting position: Sitting upright, heels on the pedal, knees fully extended, arms on grab bars.

Instructions: Ask the child to pedal up the cycle slowly and gradually increase the speed.

Trainer: Stand nearby the child and set the timer. After 5 minutes of cycling, provide rest for about 2 minutes.

3. Low resistance treadmill walking Duration: 5 minutes

Initial starting position: Stand upright, hands on grab bars, feet flat on the platform.

Instructions: Ask the child to start walking slowly with heads upright.

Resistance should be appropriate to the size and age of the children**.**

Trainer:Stand near the child, monitor the activity and set the timer. Monitor Heart Rate (HR), maximum of about 195.After treadmill walking for 5 mints, provide proper rest period for about 2minutes.

4. Play activities duration: 5 minutes

Children are made to indulge in group activities to bring relief and to make them overcome the sense of training**.**Activities like jogging, passing ball, chasing, simple aerobic dance steps are performed in groups (any of these).

Initial starting position: Standing on pairs (groups of 2)

Instructions: Ask the children to start jogging slowly standing face to face.

Trainer: Stand near the groups and observe the activities .Set the timer.

5. Cool down **Duration: 5 minutes**

Cool down sessions should be made more interactive and relaxing. Activities of gentle breathing and stretching are incorporated. Children are asked to slow down jogging into mild static walking to lower their breathing rate and gradually come to pause .Children are made to take 2/3 sets of breathing.

Initial starting position: standing with arms on side.

Instructions: Gently breathe in and bring both the hands outward and over the head .Gently breathe out and bring back the hands to the sides of the body. Make 3-5 repetitions.

Trainer: stand near the children and observe their activities.

Benefits of aerobic exercises:

- Improves general fitness.
- Tones muscle groups.
- Increases bone strength.
- Increases cardiovascular fitness.
- Increases oxygen carrying capacity.
- Reduce stress and depression.

These techniques can be easily performed by the children and are easy to administer.When incorporated with play activities and in groups, children gets more interested in performing it.

ANNEXURE-VI

TREATMENT PROTOCOL FOR RELAXATION TRAINING JACBSONS PROGRESSIVE RELAXATION

This technique initially found by Edmund Jacobson (1938) and later modified by Wolpe (1958) and later Bernstein and Borkoveks (1973) was named as 'progressive relaxation training' (PRT).[43]

PRT is defined as learning to relax specific muscle groups while paying attention to the feelings associated with both the tensed and relaxed states. The aims are:

- To achieve a state of deep relaxation in increasingly short periods.
- To control excess stress in stress inducing conditions.

Jacobson's progressive relaxation technique involves contracting and relaxing the body parts to feel calmer. Before starting the sessions, a general format of this technique should be well explained to the children. Initially it might be difficult to relax the parts but with proper training and time, they can master these technique and can practice throughout life.

PROCEDURE:

- A silent and calm environment is necessary to perform training.
- The hospital setting with limited crowd area is selected for the same.
- The children are made familiar with the method, explained and demonstrated well before the actual starting of the sessions.
- The children are made to lie down freely in the mat and are advised to wear loose clothes. This takes around 5 mints.

First session: **duration: 5 minutes**

1. Gentle breathing

- Children are advised to close their eyes.
- Ask the children to observe the natural rhythm of breathing.
- Ask them to take a full breath of air in -hold –and let go. Repeat 3-5 times.
- Inhale through the nose, raise your tummy and slowly exhale through the mouth.

Second session: **Duration: 5 minutes**

2. Visual imaging

- Ask the children to visualize their body parts
- Starting from toes, knees, thighs, buttocks, stomach, chest, shoulder, neck, hands, face and head.
- Ask them to visualize objects like birds, trees, school, home, waterfalls and so on.
- Ask them to listen the sounds like twitching of birds or tapping of foot.

Third session **Duration: 5 minutes**

3. Tightening and loosening of body parts

- Guide the children with proper instructions for each body part:
- Gently pull up the toes towards body-tighten-hold up-loosen.
- Press heels on the floor-tighten-holdup-loosen.
- Pull knees together –hold briefly-loosen.
- Squeeze the buttocks together-hold –loosen.
- Gently pull in the tummy muscles –tighten –holdup-loosen
- Gently pull the shoulders up tight towards the ears-hold-loosen.
- Gently press the elbows and upper arms to the side of the body-hold –loosen.
- Hands gently clench, tighten-hold-loosen.

- Push the head forward slightly –hold up-let the head go back to normal position.
- Grit the teeth together-hold-loosen jaw.
- Purse the lips –hold up tightly-loosen.
- Press the tongue to the roof of the mouth –hold-loosen
- Tighten the eyes-hold-loosen.
- Forehead frown a little-hold-loosen.

Forth session **Duration: 5 minutes**

4. Release state

- This session is more free and enjoying.
- Ask the children to feel the difference from the previous session
- Ask them to spend a few moments enjoying the feeling of release, releasing a little more with each exhale.

Fifth session **Duration: 5minutes**

5. Gentle breathing

- Ask the children to become aware of the present breathing pattern, contact between the body and floor/bed.
- Ask the children to gently open the eyes.
- Ask them whether they feel any sort of bodily changes after the session.

Sixth session **duration: 5 minutes**

6. Stretching

- Ask the children to gently bring the palms together, extend and bring back of their head.
- Ask them to pull their hands upward and push their legs downward and feel the whole body stretching. Hold for a few seconds and release.
- Ask the children to get up and have their activities.