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Effect of Aerobic Exercises and Resisted Exercises on Quality of Life in Cancer Patients - An Experimental Study

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ABSTRACT

Background: Patients' quality of life (QoL) is negatively impacted by cancer and its treatment modalities, such as chemotherapy, radiation, and surgery, which result in physical, emotional, and social constraints. Exercise therapy is regarded as a successful non-pharmacological technique for enhancing functional ability and lessening symptoms associated with cancer treatment.
Aim: To assess the effect of aerobic and resisted exercises on quality of life in cancer patients.
Methodology: Cancer patients visiting different cancer outpatient departments participated in a quasi-experimental study. Convenience sampling was used to choose 44 individuals over the age of 18 who had received a cancer diagnosis at least six months earlier. The European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30) was used for baseline evaluation. Participants engaged in a 4-week exercise regimen that included resistive exercises (two sets of 8–12 repetitions) and aerobic activities (15–20 minutes of walking or brisk walking). Three weeks of unsupervised and one week of supervised exercise were part of the intervention. The same questionnaire was used for post-intervention evaluation. A paired t-test was used to examine the data, and $p < 0.05$ was deemed statistically significant.
Results: Significant improvements were observed in overall functional performance, physical, emotional, and social functioning following the intervention ($p < 0.001$). Symptom scores reduced significantly, while global QOL scores improved from 46.2 ± 16.27 to 61.0 ± 9.67.
Conclusion: Cancer patients' quality of life was greatly enhanced by aerobic and resistive exercise, and their symptoms were lessened. These results imply that programs for cancer rehabilitation should include exercise therapy.

Keywords: Cancer, Quality of Life, Aerobic Exercise, Resisted Exercise, Cancer Rehabilitation, Physiotherapy, EORTC QLQ-C30.

INTRODUCTION

Cancer is the ensuing driving reason for death internationally, and is responsible for an expected 9.6 million death in 2018. Comprehensively, around 1 out of 6 death is expected to cancer [1]. Within the forecasted changes in population demographics in the next twenty years, even if current global cancer rates remain unchanged, the estimated incidence of new cancer will rise to 21.4 million by 2030. Cancer is contagious one of major non communicable disease and very

quickly spreading main health issue in the community across the world. Around the world, cancer is becoming one of the most common causes for morbidity and mortality[1,2]. The cancer diagnosis carries significant changes to the method of living with physical and emotional changes because of inconvenience, pain, disfigurement, reliance and loss of confidence [3,4]. According to the International Agency for Research on Cancer, in the year 2020, 18.1 million cases of cancer were diagnosed worldwide, and this number will increase in the following two decades, reaching 27 million[5] .

According to WHO Quality of life (QoL) defined as "an individual's perception of their life status in the context of the culture and value systems in which they live and in affiliation to their goals, expectations, standards and concerns[6]. In another word, QOL assessment offers complete evaluation of an illness's interference with an individual's adaptive functioning and can consider the individual's values, viewpoints, satisfaction, living situations, achievements, functionality, cultural background, and spirituality. Now a days, quality of life surveys has gained importance in the medical world, particularly in oncological research.[7] Impairments due to cancer and its treatment, they can affect multiple body systems also impose limits on physical functioning and participation in activities of daily living and life roles of many patients, consequently limiting their quality of life.[8] The effect of various treatments on health related quality of life assessing by the clinician. A repeated QOL assessment among cancer patients is useful, this has already proved by many studies. A recent study states that 63.2% of non-biomedical and 30.1% of the medical interference had an impact on QOL. QOL assessment is also instrumental and helpful to revise the treatment plans[9]. Quality of life has been used widely as an outcome variable in health care studies to reflect patients' perceptions of well-being as opposed to crude indicators of morbidity and mortality.[10,11] The clinical and scientific interest in the quality of life (QoL) of patients with cancer is increasing since the 1990.[12] QOL review the person's emotional, social, and physical aspects that influence well-being in Daily life. It is important to maintain QOL along with improvements in survival. There is some evidence of cancer patients' symptom burden and decreasing QOL during oncological treatments.[13] QoL may be evaluated as a primary endpoint of treatment both in clinical practice and in clinical trials to define meaningful response.[14] Due to serious side effect profiles of treatment models such as radiotherapy [RT] and chemotherapy [CT], consequential treatment induced side effects come up and the QoL deteriorates.[16]

As we know "Physiotherapy is defined as systematic method of assessing musculoskeletal, neurological, cardio respiratory disorder and psychosomatic illness with the help of manual therapies and mechanical agencies."[16] On the other hand physical exercise is an effective therapeutic intervention if prescribed properly in managing pain, side effects and improving Quality of Life (QoL) and specific physical exercise has almost no side effect, though risk of adverse effects should be taken care of. According to certain studies a vicious cycle is created which might be used to explain the connection of physical inactivity and the worsening of symptoms and side effects.[17] Participants agreed that education for initial level to practice already enables physiotherapists to play a vital role in the detection and management of many cancer-related impairments (ex. pain and reduced range of motion or physical fitness) that may preclude patients from engaging in activities of everyday functioning and participating in life roles. By the help of teaching coping strategies, maximizing compensation capacity, and improving ergonomics of (alternative) movement strategies most physiotherapists can manage these impairments and help patients to adapt functional loss or chronic symptom burden. While the evidence base underpinning the effectiveness of physiotherapy interventions for individuals with cancer is growing, cost

effectiveness data are currently limited to a few studies.[18,19,20]

In palliative oncology and therapeutic strategies like ambulation training with or without aids, imagery practice, decongestive physiotherapy, activity modification, strengthening programs, proprioceptive neuromuscular facilitation, endurance training, joint mobilizations, aquatic therapy, work simplification techniques and energy conservation physical therapist definitely hold key role and are more than useful in alleviation of cancer pain.[21,22] According to studies The European Organization for Research and Treatment of Cancer (EORTC) QLQ-C30 is a cross culturally accepted and widely used instrument for assessing the health related quality of life (HRQoL) of cancer patients.[23]

The purpose of the study was to study the effect of aerobic and resisted exercises on quality of life in cancer patient also its effect on various physical, emotional, social role in cancer patients those who were taking cancer treatment.

LITERATURE REVIEW

1) Shamini Kosgallana, Prasanna Jayasekara.et al., conducted a study named "Oral health related quality of life of oral cancer patients treated with radiotherapy alone or with chemotherapy in a tertiary referral centre in Sri Lanka" in year 2023 This study assessed the OHRQOL and its changes from baseline to the last week of radiotherapy and three months post radiotherapy among oral cancer patients who received this treatment alone or with chemotherapy. This prospective longitudinal study was conducted among 90 oral cancer patients waiting for radiotherapy alone or with chemotherapy. The modified Sinhala version of the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire Oral Health Module (EORTC QLQ-OH15) was used to gather data related to OHRQOL before radiotherapy. Socio-demographic and clinical data were also recorded. The same cohort of patients were followed up and assessed their OHRQOL during the last week of radiotherapy and three months post radiotherapy. Concluded that the OHRQOL of oral cancer patients who received radiotherapy alone or with chemotherapy had deteriorated from the baseline level to the last week of radiotherapy but then improved at three months post radiotherapy. The OHRQOL however did not return to the baseline level three months post radiotherapy. OHRQOL during the last week of radiotherapy was influenced by the OHRQOL at baseline, civil status and sites of metastasis.
2) Anil Kumar Agarwal, Abhishek Yadav .et al., conducted a study named "Assess and Evaluation the Quality of Life (QOL) Among Cancer Patients Undergoing Treatment by Using EORTC QLQ-30 Scale" in February 2022 .The study aimed to analyze the impact of clinical characteristics and social determinants of health on the QOL of a cohort of persons diagnosed and/or treated for cancer .They performed a cross-sectional study in a cohort of 155 with various stages of cancer at different stages of their disease. Data were obtained using questionnaires QLQ-C30 from the European Organization for Research and Treatment of Cancer (EORTC). Resulted that Out of 155 subjects, large proportion were diagnosed with Oral cancer 67(43.2%) and Breast cancer 23(14.8%). The mean of global health status/QOL was 52.34 (SD= 23.34). Quality of life was significantly associated with some functional scales as role functioning ($P \leq 0.001$), social function, ($P=0.00$), and symptom scales as pain ($P=0.00$), loss of appetite ($P=0.004$) and financial impact ($P=0.02$) as well as associations were noted in relation to sociodemographic characteristics. The highest functional status was cognitive functioning (54.58±27.68). This study concluded that

The cancer diagnosis has become more prevalent and carries significant changes to the method of living with physical and emotional changes in term of quality of life (QOL) because of inconvenience, torment, disfigurement, reliance and loss of confidence.

3) Dirk Weyhe, Dennis Obonyo.et al., conducted a study named **"**Effects of intensive physiotherapy on Quality of Life (QOL) after pancreatic cancer resection" in year 2022. The aim of this exploratory study is the assessment of QOL in the intervention group, using various QOL questionnaires in their validated German translations and gather data on its feasibility in the context of chemotherapy with a follow-up of 12 months. They perform a randomized control trial using Intervention of intensified physiotherapy program consisted of endurance and muscle force exercises using cycle ergo-meter. In the control group physiotherapy was limited to the duration of the hospital stay and was scheduled for 20 min on 5 days per week. The clinical visits took place 2 days preoperative, 1 week, 3 months, 6 months and 12 months postoperative. Both groups attended the follow-up program. QOL was evaluated using the Short Physical Performance Battery (SPPB), Short Form-8 Health Survey (SF-8) and the European Organization for Research and Treatment of Cancer (EORTC) QLQ-C30 and pancreatic cancer specific module QLQPAN26 questionnaires. The course of QoL was evaluated using a repeated measures ANOVA and a per protocol design. This first randomized controlled study with a 12-month follow-up shows that supervised physiotherapy or prescribed home-based exercise after pancreatic cancer resection is safe and feasible and should be proposed and started as soon as possible to improve certain aspects of QOL.
4) Anna Pyszora, Jacek Budzyński.et al., conducted a study named **"**Physiotherapy programme reduces fatigue in patients with advanced cancer receiving palliative care" in year 2017. The study aimed to evaluate the effect of a physiotherapy programme on CRF and other symptoms in patients diagnosed with advanced cancer. The study was designed as a randomized controlled trial. Sixty patients diagnosed with advanced cancer receiving palliative care were randomized into two groups: the treatment group (n = 30) and the control group (n = 30). The therapy took place three times a week for 2 weeks. The 30-min physiotherapy session included active exercises, myofascial release and proprioceptive neuromuscular facilitation (PNF) techniques. The control group did not exercise. The outcomes included Brief Fatigue Inventory (BFI), Edmonton Symptom Assessment Scale (ESAS) and satisfaction scores. This study concluded that physiotherapy programme, which included active exercises, myofascial release and PNF techniques, had beneficial effects on CRF and other symptoms in patients with advanced cancer who received palliative care. The results of the study suggest that physiotherapy is a safe and effective method of CRF management.
5) Janakiraman Balamurugan and Ravichandran Hariharasudhan.et al., conducted a study named "Physical Therapy Interventions are Beyond Adjunct Care in Improving Quality of Life and Alleviating Pain Related to Cancer and its Treatment**"** in December 2015. This nonsystematic narrative review outlines the existing evidences of association between physical exercise, physical therapy intervention strategies, pain control and quality of life, evidence-based exercise guidelines for cancer survivors and patients. Concluded that Cancer pain is very much manageable but still poorly managed. Many studies have proved that different types physical exercise and physical therapy

intervention like aerobic exercises, strengthening or progressive resisted exercises, massage, relaxation technique, proprioceptive neuromuscular facilitation, postural exercise and breathing exercise are effective in treating cancer related complications when used in precise dosages, different combinations and clinician should also remember safety issues. Thus, exercise itself is not a single entity but should be combined effectively based on stage of cancer, region, type of cancer, type of drug and several other factors to be effective.

6) Chuhan Huang[1], Yingjie Cai[1], Yufei Guo[1], Jingjing Jia[2], Tieying Shi[1] et al., conducted a study on "Effect of a family-involvement combined aerobic and resistance exercise protocol on cancer-related fatigue in patients with breast cancer during postoperative chemotherapy: study protocol for a quasi-randomised controlled trial" in May 2022. Proposes to assess the preliminary effects of a family-involvement exercise protocol on alleviating CRF in patients with BC through a quasi-randomised controlled trial (Q-RCT). Concluded that the convenience of the family involvement exercise for the management of CRF may provide patients, healthcare professionals and policy makers with further guidance for CRF management in the long-term.
7) F. Dimeo*, S. Schwartz, N. Wesel, A. Voigt & E. Thiel.et.al., conducted a study named "Effects of an endurance and resistance exercise program on persistent cancer-related fatigue after treatment" in 2008. Objective of the study was to evaluate the functional capacity and quality of life of children and adolescents during cancer treatment and post-treatment. The results of the present study show that exercise is a promising and effective therapeutic approach to persistent cancer-related fatigue. However, it does not affect all components of the fatigue syndrome, which are the cause of substantial impairment in cancer patients

MATERIALS & METHODS

METHODOLOGY

STUDY DESIGN: Quasi experimental study
STUDY POPULATION: Cancer patients
STUDY SAMPLING: Convenience sampling
SAMPLE SIZE: 44 (According to 4pq/l2)
4*0.9*(1-0.9)/ (0.9)2 = 0.36/0.0081

STUDY DURATION: 4 months

Inclusion Criteria:

1. Patients who were willing to participant.
2. Cancer patient above age 18 years diagnosed 6 months prior.

Exclusion Criteria:

1. Patient with mental impairment.
2. Patient not willing to participate in the study.
3. Patient with musculoskeletal impairment (recent fracture and trauma).

Procedure

Samples were recruited based on inclusion and exclusion criteria by convenient sampling. After explaining aim & objectives of the study written consent was obtained from all the participants. Demographic data and baseline data on EORTC QOL C-30 questionnaire was taken by interview method. With proper warm up and cool down 15-20 min of aerobic exercise was given followed by 5 min rest then 2 set of each exercise with set of 8-12 repetitions of resisted exercise for 4 weeks. In this 1 week supervised and 3 weeks unsupervised aerobic and resisted exercise protocol was given. Within those unsupervised 3 weeks checklist for the exercises was given to keep record of the exercises done by the patients. Post Exercise protocol, again patients were interviewed on EORTC QOL C-30 questionnaire. Data was collected, results were analyzed and results were discussed and conclusion was drawn.

Exercise Protocol

➢ *Study Duration*

- Total duration: **4 weeks**
- Frequency: **3–5 sessions per week**
- Supervision:
  - **Week 1:** Supervised exercise sessions
  - **Weeks 2–4:** Home-based/unsupervised exercise program with weekly follow-up

➢ Exercise Structure

Each exercise session will include:

Component	Duration
Warm-up	5–10 minutes
Aerobic exercises	15–20 minutes
Rest interval	5 minutes
Resistance exercises	15–20 minutes
Cool-down	5–10 minutes
Total Session Duration	45–60 minutes

➢ Warm up Protocol (5-10 min)

Low-intensity activities to prepare the body for exercise:

- Slow walking
- Marching in place
- Shoulder rolls
- Neck movements
- Gentle stretching of upper and lower limbs
- Deep breathing exercises

Intensity:

- Light intensity
- Borg Rating of Perceived Exertion (RPE): 9–11

➢ Aerobic exercise protocol

Mode of Exercise

Participants may perform any of the following based on tolerance and availability:

- Brisk walking
- Low-impact aerobic movements

Intensity

- Moderate intensity
- 50–70% of maximum heart rate

Maximum Heart Rate Formula

HRmax=220−ageHR_{max}=220-ageHRmax=220−age

Target intensity:

- RPE: 11–13 (somewhat hard)

Progression

- Week 1: 15 minutes
- Week 2–4: Progress to 20 minutes as tolerated

➢ Rest period (5min)

- Duration: 5 minutes
- Participants encouraged to:
  - Sit comfortably
  - Perform deep breathing
  - Drink water if needed

➢ *Resisted exercise protocol*

Frequency

- 2–3 days/week

Intensity

- Low to moderate resistance
- Resistance bands or light dumbbells (0.5–2 kg)

Dosage

- 2 sets of each exercise
- 8–12 repetitions
- 1–2 minutes rest between sets

Upper Limb Exercises

1. Bicep curls
2. Shoulder flexion
3. Shoulder abduction
4. Wall push-ups

Lower Limb Exercises

1. Sit-to-stand
2. Mini squats
3. Heel raises
4. Seated knee extension

Core/Functional Exercises

1. Pelvic tilts
2. Bridging exercises

Progression

Resistance increased gradually according to patient tolerance and fatigue level.

➢ **Cool-Down Protocol (5–10 Minutes)**

- Slow walking
- Gentle stretching
- Relaxed breathing exercises
- Upper and lower limb stretches Intensity gradually reduced to resting level.

Statistical Analysis

Collected data were entered in excel software and analyzed using R software version 4.0.2.

Continuous variables were presented as mean and standard deviation. Categorical variables were presented as count and per cent. Comparing mean of pre and post were done using paired t-test. $p < 0.05$ were considered as statistically significant.

RESULT

All contacted patients agreed with participation and were recruited for the study. During the study there were no adverse events. All patients completed 1 week protocol and out of 50 patients 6 patients drop out from the study after 1 week. They did not come for follow up after 4 weeks.

The exercise intervention led to a statistically significant improvement in functional performance [pre: Mean 70.5(SD 11.88), post: Mean 81.4 (SD 7.69), P<0.001]. After the 4-week exercise protocol there is significant improvement in symptoms; the mean symptom score decreased after the exercise protocol [pre: Mean 28.2(SD 11.08), post: Mean 21.3(SD 12.35), P<0.001].

Global QOL score was increased [pre: Mean 46.2(SD 16.27) , post: Mean 61.0(SD 9.67), P <0.001]; The individual component of functional component which are physical, social and emotional score also significantly improved; Physical [pre: Mean 75.1(SD 15.43), post: Mean 85.8(SD 11.75), p<0.001] ; Social [pre: Mean 54.7(SD 17.74), post: Mean 62.1(SD 11.48), p<0.001] ; Emotional [pre: Mean 65.2(SD 17.92), post: Mean 77.7(SD 13.42), p<0.001].

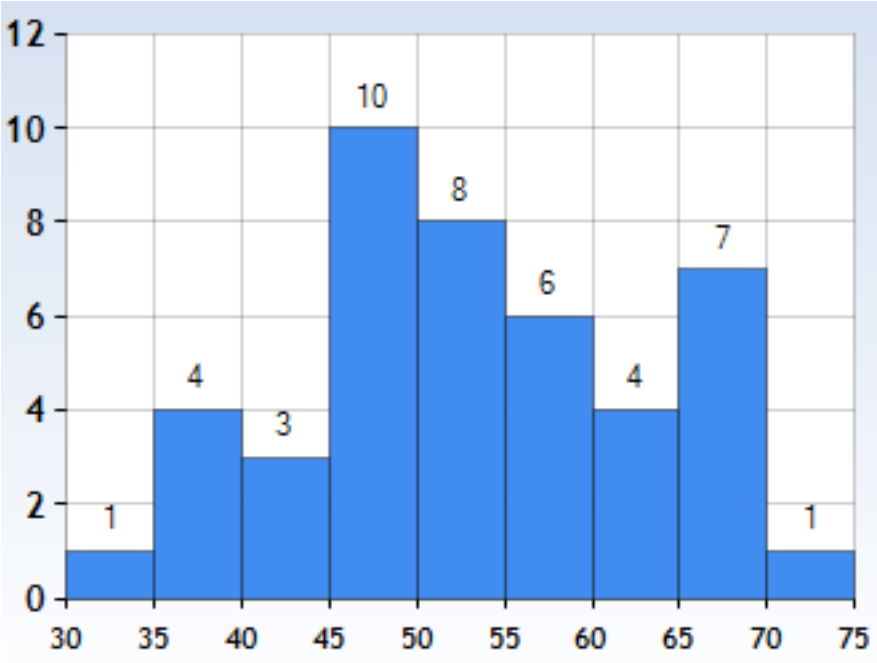

Figure 1: Histogram – Age in years

Table 1 –Age in years

Mean	53.0
Standard Deviation	10.34
Minimum	30
Maximum	71

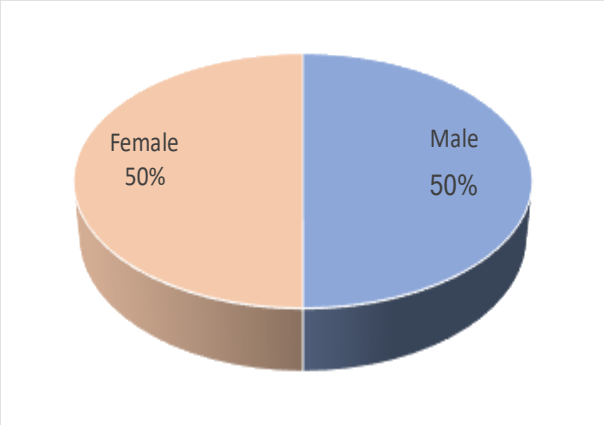

Figure 2: Pie diagram – Sex

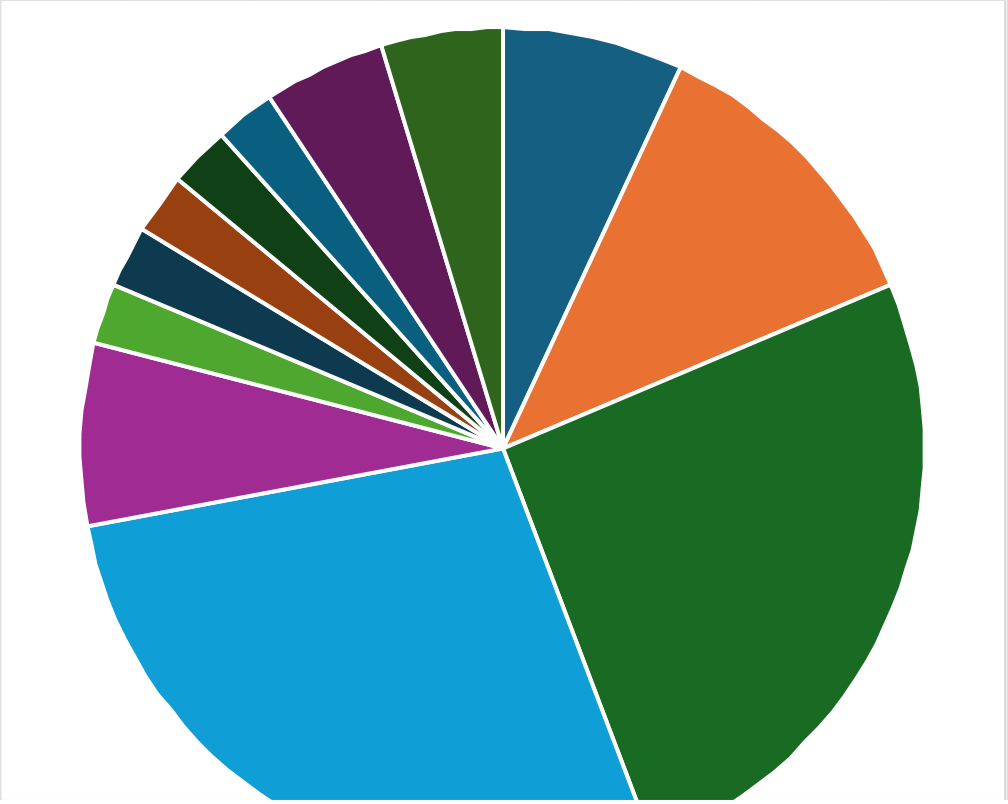

Figure 3: Cancer distribution

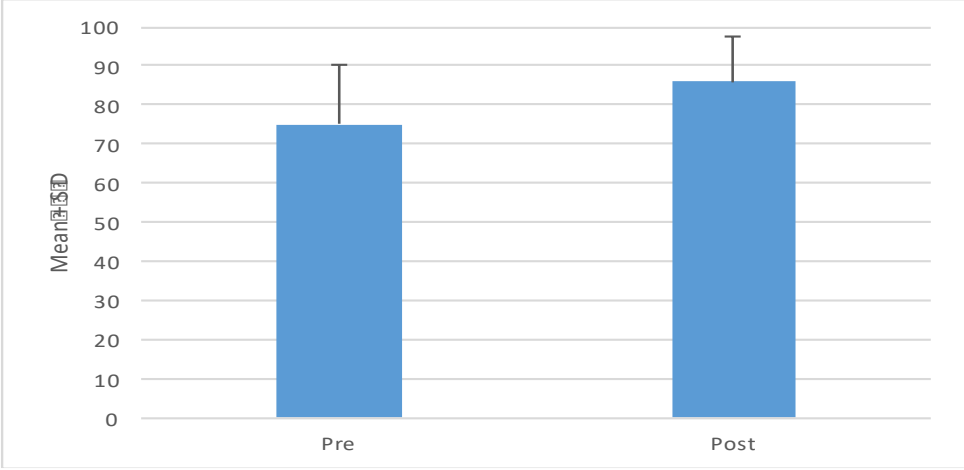

Figure 4: Physical (EORTC QOL C-30)

Table 2- pre post scores of physical compo

	Pre	Post	p value
Mean	75.1	85.8	< 0.001
S D	15.43	11.75	

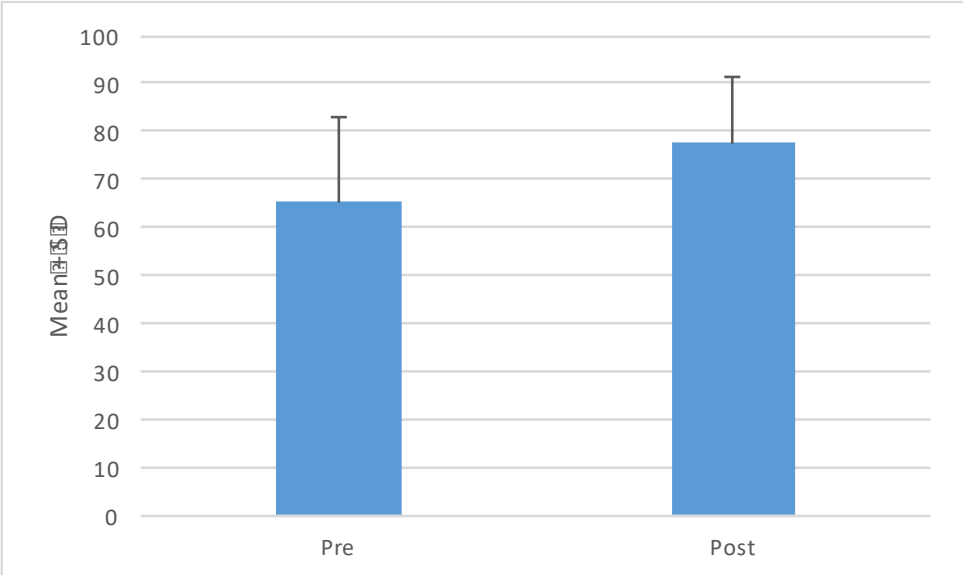

Figure 5: Emotional (EORTC QOL C-30)

Table 3 – pre post scores of emotional component

	Pre	Post	p value
Mean	65.2	77.7	< 0.001
S D	17.92	13.42	

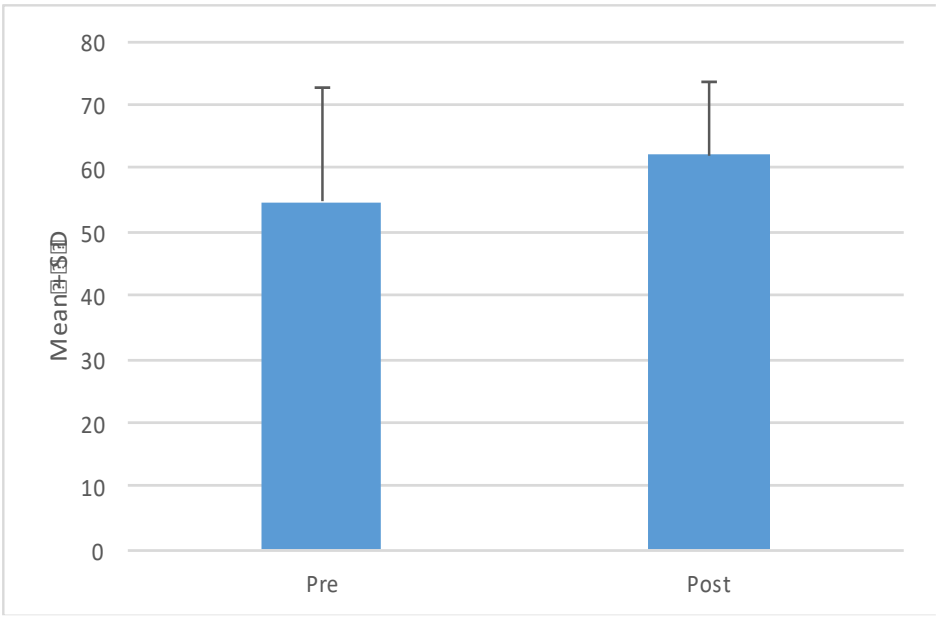

Figure 6: Social (EORTC QOL C-30)

Table 4 – pre post scores of social component

	Pre	Post	p value
Mean	54.7	62.1	< 0.001
S D	17.74	11.48	

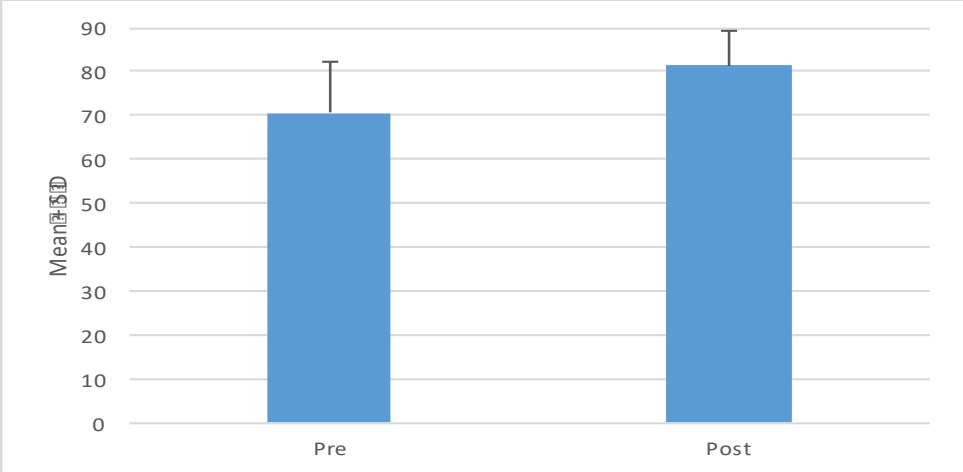

Figure 7: Overall functional score (EORTC QOL C-30)

Table 5- pre post comparison of overall functional scores

	Pre	Post	p value
Mean	70.5	81.4	< 0.001
S D	11.88	7.69	

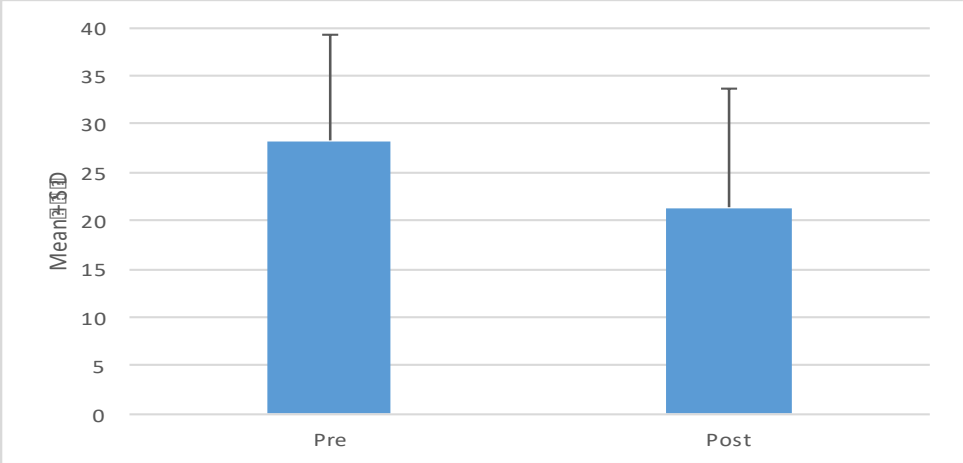

Figure 8: EORTC QOL Symptoms Score

Table 6- pre post comparison of symptoms score

	Pre	Post	p value
Mean	28.2	21.3	< 0.001
S D	11.08	12.35	

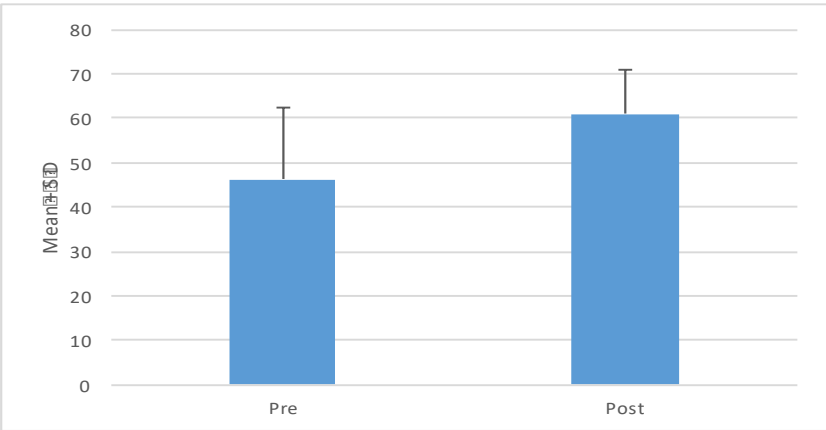

Figure 9: EORTC QOL Global Score

Table 7 – pre post comparison of global scores

	Pre	Post	p value
Mean	46.2	61.0	< 0.001
S D	16.27	9.67	

DISCUSSION

Cancer and its treatment like chemotherapy, radiotherapy and surgeries related to cancer affects the quality of life of the patients. Recent studies revealed that cancer patients experience many symptoms which affect their QoL. This study included 44 cancer patients with cancer of glottis, oesophagus, breast, buccal mucosa, tongue, oropharynx, ovary, supraglottis, rectum, hypopharynx, colon and squamous cell. Out of 44, 50% patients were male and 50% were female.

In this study, a 4-week (1 week supervised and 3 weeks unsupervised) exercise program containing Aerobic and resisted exercises; Aerobic exercises included brisk walking and walking; Resisted exercises including hip abduction, seated knee raising, raise before standing, standing lateral raise using water bottle and body weight as a resistance led to substantial increase of functional score and global score also decrease in symptom score. Duration for aerobic exercise was twice per week for15-20 min and resisted exercises twice a week with two sets consist of 8-12 repetition. 50 patients were participated in my study, out of which 6 patients discontinued after 1 week. Average age group included was + 53years.

Addressing the unmet needs of these patients and ensuring higher satisfaction rate are recommended to maintain adequate HRQoL[1]. One of the RCT with follow up of 12 months in pancreatic cancer stated that there was a significant effect on the physical and psychological aspect of qol of supervised exercise in pancreatic cancer patients and survivors. Also revealed that prescribed intensified physiotherapy or exercise is safe, feasible and has a high adherence in pancreatic cancer patients, even in the post-hospitalization phase[24]. In this study revealed that there is significant effect of aerobic and resisted exercises on social aspect along with physical and psychological aspect as mention above.

A study by F. Dimeo*, S. Schwartz concluded that exercise is a promising and effective therapeutic approach to persistent cancer-related fatigue. However, it does not affect all components of the fatigue syndrome, which are the cause of substantial impairment in cancer patients[26]. In the symptom section fatigue was one of the components which get significantly improved as symptom score is reduce so the QoL improved.

A 12-week RCT study conducted in 2021 on 356 patients with BC, which showed that combined aerobic and resistance exercise improved patients' fatigue symptoms, muscle strength and quality of life. However, because some patients could not persist in completing the exercise, the advantages of the tested exercise over traditional exercise programme were not obvious[27]. Not only breast cancer patients but also patients with various cancer like buccal mucosa, ovary, tongue, oesophagus, etc. Showed that combined aerobic and resisted exercise improved patients overall QoL.

Result of present study revealed that there is significant improvement in various components of EORTC QOL C-30 questionnaire. There are sub component in functional role which are physical, emotional and social role. Physical role is improved by 10.7% (fig.3); Emotional role is improved by 12.5 (fig 4); Social score is improved by 7.4 % (fig 5). Overall functional role score is improved by 10.9%. Then various symptoms like fatigue, pain, etc. are reduced after 4 weeks of treatment protocol is by 6.9% (fig 7). Global score of EORTC QOL C-30 questionnaire is also improved by 14.8% as compare to baseline score.

CONCLUSION

Results of this study concluded that, aerobic & resisted exercises significantly affect different components of quality of life positively including, functional role,

physical, emotional & social role in the cancer patients. Also, findings concluded that aerobic & resisted exercises help to reduce overall symptoms. However, the clinical implication of the study is to include Aerobic and resisted exercises in the protocol of cancer rehabilitation.

Also, the limitations of the study were Small sample size, Restrictions for the choice of aerobic exercises, Lack of a control group for comparison, short intervention duration of only 4 weeks, Majority of exercises during 3 weeks were unsupervised, which may affect adherence and accuracy. However, the future scope of studies suggests that Randomized controlled trials should be performed with a proper control group, longer duration exercise interventions and follow-up assessments are recommended. And Different exercise protocols can be compared to identify the most effective rehabilitation approach.

Declaration by Authors

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Conflict of Interest: No conflicts of interest declared.

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