

## Effect of Breathing Exercise on Respiratory Efficiency and Pain Intensity among Children Receiving Chemotherapy

Marwa Abd Elkreem, Hejazi

Lecturer of. Pediatric Nursing, Cairo University, Egypt

Email: [miramzakarya@yahoo.com](mailto:miramzakarya@yahoo.com)

Afkar Ragab Mohammed\*

Assist. Prof. Pediatric Nursing, Cairo University, Egypt

E-mail: [afkar\\_ragab@hotmail.com](mailto:afkar_ragab@hotmail.com)

Nesreen Sayed Mohammed,

Lecturer of. Pediatric Nursing/, Cairo University, Egypt

E-mail: [ntrb\\_752005@yahoo.com](mailto:ntrb_752005@yahoo.com)

### Abstract

Breathing exercises can be used to strengthen respiratory muscles, but they can also be used to create energy. It also combats stress as it stimulates the release of epinephrine. Multidisciplinary management may be needed, with a team including social workers, physiotherapists, play therapists, and music therapists. Cancer pain should always be measured using validated pain assessment tools. The aim of the current study is to determine the effect of breathing Exercise on respiratory efficiency and pain intensity among children under chemotherapy. A convenient sample of 70 children older than 3 years old, with cancer and treated by chemotherapy; were included in the study. A quasi-experimental research design was used to conduct the study. The study was conducted in the National Cancer Institute (N.C. I) in the pediatric wards. Data was collected using a structured interview schedule it was developed by the researchers the first one was for children's sociodemographic data and cancer history, the second was to assess the respiratory efficiency and the third was the pediatric facial pain scale. The study's results revealed that more than half of the studied children were male, less than two thirds of the studied children had Acute Lymphoblastic Leukemia (ALL), The majority of the studied children had pain as an associated problem from cancer and its treatment. All the children had easy fatigability, loss of weight, and feeding problems. There were significance differences between pre and post breathing exercises in relation to vital signs, O<sub>2</sub> saturation and pain intensity. Multiple efforts from pediatric oncology team are needed to prepare children with cancer prior conducting cancer treatment as well their mothers or care givers. Further researches are needed on a larger sample for generalization of the reached results.

**Keywords:** Breathing Exercise- chemotherapy - respiratory efficiency – pain

### 1. Introduction:

Cancer in children can occur anywhere in the body, including the blood and lymph node system, brain and central nervous system (CNS), and kidneys. Most of the time, there is no known cause for childhood cancers. Childhood cancers may behave very differently from adult cancers. Leukemia (accounts for about 34% of childhood cancer cases) Brain and CNS tumors (27%), including tumors of the spinal cord. Children with advanced cancer experience distressing physical symptoms from the disease process and from ongoing treatment (**Childhood Cancer, 2012**). In addition the treatment of cancer in children can include chemotherapy, radiation and surgery. The type of treatment needed depends on the type and severity of cancer and the child's age.

Chemotherapy is medication which is used as a tool to eliminate cancer cells in the body. Kids with cancer can be given the chemotherapy medications **intravenously** or **orally** (by mouth). Some forms of chemotherapy can be given **intrathecally**, or into the spinal fluid. The drugs enter the bloodstream and work to kill cancer in all parts of the body. The duration of chemotherapy treatment and type and number of different drugs used depends on the type of cancer and the child's response to the drugs. Every child's treatment differs, so a child may receive daily, weekly, or monthly chemotherapy treatments. The doctor may also recommend cycles of treatment, which allow the body to rest and recover between periods of chemo (*Chordas & Nelson, 2011, Graham, 2010 & Hoekelman*).

Methotrexate and mercaptopurine are most widely used in the treatment of leukemias, non-Hodgkin Lymphoma (NHL), the histiocytoses, and osteosarcoma. Myelosuppression, mucositis, nausea, vomiting, and alopecia are the most common side effects of chemotherapy. Syndrome of high fever, malaise, myalgias, joint or bone pain, rash, conjunctivitis, and chest pain has been reported. Chemotherapy handling and administration is not without risks and a thorough understanding by the pediatric oncology nurse is pertinent for safety of the patient, caregiver, and oncology nurse (*Graham & Hoekelman, 2010*).

During the treatment for acute leukemia (AL) a patient may experience a wide variety of complications that mainly have three possible origins, namely the disease itself (leukemic infiltration), peripheral blood cell

depression (because of hemorrhagic or infectious processes) and toxicity induced by processes) and toxicity induced by chemotherapy. Late pulmonary toxicity from bleomycin includes pulmonary fibrosis, restrictive-obstructive lung disease, and delayed interstitial pneumonia. The risk of pulmonary fibrosis more commonly occurs with cumulative doses greater than 400–500 units (*Vagace. & Gervasini, 2011*)

There are many benefits of deep breathing exercise which are 1. Deep breathing exercise makes the child calm. 2. Deep Breathing exercise helps to detoxify the body. 3. Deep Breathing exercise relieves pain. 4. Deep Breathing exercise makes the child happy. 5. Deep Breathing exercise helps to improve the child's posture. 6. Deep Breathing exercise stimulates the lymphatic system. 7. Deep Breathing exercise increases the cardiovascular capacity. 8. Deep Breathing exercise gives energy. 9. Deep Breathing exercise improves the digestion. 10. Deep breathing exercise strengthens the major organs of the body, such as lungs and the heart. 11. Deep Breathing exercise helps to regulate weight. 12. Deep breathing exercise helps to sleep better. 13. Deep breathing exercise lowers blood pressure (*Berdar & Carrekl, 2012*). *Scott (2011)* indicated that breathing exercises can't solve the world's problems, and other stress relief strategies need to be used in certain situations. Breathing exercises are excellent for reversing your stress response and reducing stress.

*University of Maryland Medical Center (2013)* added that deep breathing exercise has a positive spiritual effect. Breathing exercise and muscle relaxation are now commended treatment for many stress related disorders. Diaphragmatic breathing exercise, abdominal breathing exercise, belly breathing or deep breathing exercise is breathing that is done by contracting the diaphragm, a muscle located horizontally between the chest cavity and stomach cavity (*Okeal et al, 2009*). Air enters the lungs and the belly expands during this type of breathing. Deep breathing exercise is marked by expansion of the abdomen rather than the chest when breathing. It is considered by some to be a healthier way to breathe, and is considered by some a useful form of complementary and alternative treatment (*Peter, 2011*). Deep breathing exercise involves slow and deep inhalation through the nose, usually to a count of 10, followed by slow and complete exhalation for a similar count. The process may be repeated 5 to 10 times, several times a day (*Maron, 2013*).

Pain is one of the most common symptoms in children with cancer. Pain in children with cancer is usually well controlled using the World Health Organization's guidelines. Cancer pain should be approached with an understanding of the individual child and family and with an open mind about interpatient variability in analgesic response. Multidisciplinary management may be needed, with a team including social workers, physiotherapists, play therapists, and music therapists. Cancer pain should always be measured using validated pain assessment tools (*International Association for the Study of Pain, 2009*). Children with advanced cancer experience distressing physical symptoms from the disease process and from ongoing treatment. Pain associated with cancer has been one of the most salient and common symptoms documented by researchers (*Van Cleve, et al, 2012*).

*Cancer-Related Pain Management (2012)* mentioned that pain experience includes an individual's perception of pain, evaluation of the meaning of pain, and response to pain. The perception of pain refers to whether an individual notices a change in the way he or she usually feels or behaves. A child evaluates their symptoms by making judgments about the severity, cause, treatability, and effect of such symptoms on their lives. Responses to pain include physiological, psychological, sociocultural, and behavioral components. In addition the child's response to pain is determined by their age, cognitive abilities, cultural background, and previous experience and exposure to pain. Understanding the interaction of these components of the pain experience is essential if the pain is to be effectively managed. Treatment procedures are the most common sources of pain in children. Clinical professionals usually use distraction techniques to reduce pain. However, there is no agreement between them that which distraction technique is better for reducing pain (*Bagheriyan et al, 2011*)

Children perceive pain differently from adults. There are numerous factors involved in the pathogenesis of pain in children with cancer. They will experience pain associated with the disease, pain caused by procedures used to establish a diagnosis and evaluate the disease, and pain related to treatment intervention. Furthermore, the expression of pain varies according to their age and developmental characteristics. In order to effectively manage the pain experienced by children with cancer, it is critical to understand the developmental aspects related to their response to pain (*Pediatric Society of New Zealand, 2013*)

Nonpharmacologic or behavioral approaches to acute pediatric pain are rooted in the gate-control theory. The theory suggests that descending nerve impulses from the brain, such as thoughts, beliefs, emotions, and attention, can influence the ascending pain signal from the tissue damage. For example, anxiety might heighten pain experience, whereas attention focused on a pleasant activity might decrease pain. Thus, behavioral interventions typically involve teaching coping, inducing relaxation, or providing distraction. Behavioral skills can be helpful in treating and coping with pain (*Halgadottir H. (2012)*). Specific techniques include relaxation, meditation, guided imagery, distraction, and redirected thinking, as well as changing thoughts and beliefs about pain and what it means. Other effective approaches include support groups, massage, music, and counseling focused on pain management and behavioral modification (*Cohen, 2008*)

*Takken et al (2010)* indicated that the principal causes of reduced physical fitness and muscle strength in ALL

survivors are likely to be neuropathy and myopathy; both are short-term effects of the chemotherapeutic treatment. The sedentary lifestyle is considered to be another contributing factor. It was found during treatment as well as after treatment that children who survived ALL have a lower daily energy expenditure compared with healthy subjects. The principal causes of reduced physical fitness and muscle strength in ALL survivors not only implicate consequences for daily life activities of survivors, but also for their health in adulthood. Children treated for cancer often have a reduced body height and bone mineral density, and are more obese than their healthy peers in addition physical exercise has been suggested to further improve the health outcome for patients who survived cancer. Exercising during chemotherapy had a positive effect on cancer patients (*Roth, 2010*).

Nurses today have many roles. A nurse has many responsibilities in the rehabilitation of a child who has needed oncology hospital treatment. The nurse's role are emphasized on caring for the child and his families, working with the doctor, co-ordination, protecting the child from chemotherapy's side effects, teaching the child, and the family about chemotherapy protocol (*Marlow, 2010 and Ball & Bindler, 2011*). Holistic nurses provide care which is meant to deal with children's physical, psychological, social, mental and spiritual health. Oncology health nurses provide all care for children who are receiving chemotherapy before, during and after the sessions. Hospice and palliative care nurses provide care and help to ease the pain of, terminally ill children (*Darbyshire, 2013*).

Nurses providing cancer chemotherapy care has to establish, monitor, maintain supportive and therapeutic relationships while providing cancer chemotherapy care to persons living with cancer. An oncology nurse has to consider the emotional, cultural, and spiritual context of person's initial and ongoing care such as fears and misconceptions, need for language assistance, ability to cope and other concerns specific to the person (*Canadian Association of Nurses in Oncology, 2011*). Nurses caring for children with cancer are required to have knowledge of basic pediatric oncology. The pediatric oncology nurse must develop an understanding of the components of the immune system, the process of hematopoiesis, and the intimate interaction of biologic agents with each other and with other elements of the immune system" (*Andam, & Silva, 2010*)

"An independent double check" is a process in which a second practitioner conducts verification, the most critical aspect is to maximize the independence of the double check to ensure drug safety (*Cohen, 2010*).

The role of an oncology nurses may include but is not limited to assessment, therapeutic communication, coordination of care, education and information, access to resources, psychosocial support, and referral to specialized services and professionals to manage identified problems (*Canadian Association Nurse, 2011*).

Nurses are needed to be familiar with special pediatric considerations such as growth and development, problems and needs of children at any developmental stages. According to *Simon. (2010)* pain in children with cancer can be caused by a number of factors. The cancer mass itself can produce pain by tissue distention or infiltration. Inflammation due to infection, necrosis, or obstruction can also cause pain. Cancer treatment consisting of chemotherapy, radiation therapy, and surgery can cause pain. Nurses must accurately assess the child's pain and intervene appropriately; pain control is of paramount importance (*Ryan, et al, 2013*).

## 2. Significance of the Study

Children diagnosed with cancer experience many complex physical, functional, psychosocial and behavioral problems during the course of their illness. Treatment usually involves multiple hospitalizations, and interference with the child's normal development, activities and social interactions over a long time. Pain in children with cancer is now recognized as a significant debilitating symptom that affects quality of life. Although advances in pain management have been made, there is still a need for improvement. Lack of knowledge on state of the art pharmacological and non- pharmacological practices. Pain in children with cancer can be caused by a number of factors the cancer mass itself can produce pain by tissue distention or infiltration. Inflammation due to infection, necrosis. Chemotherapeutic agents can also be a cause of pain during treatment. Nothing about serious illness like cancer is easy, but one of the hardest things for parents may be watching their child struggle with pain, stress, and anxiety. So the aim of the current study is to determine the effect of breathing exercise on respiratory efficiency and pain intensity among children receiving chemotherapy.

## 3. Aim of the Study:

The main aim of the current study is to determine the effect of breathing exercise on respiratory efficiency and pain intensity among children receiving chemotherapy.

## 4. Research Hypotheses

1. The results of respiratory efficiency scores after the application of breathing exercise is better than the results of the same respiratory efficiency scores before the application of breathing exercise
2. The scores of pain assessment after the application of breathing exercise is less than the score of pain assessment before the application of breathing exercise

## 5. Material and Methods

### 5-1. Research Design:

A Quasi-experimental research design was utilized to conduct this study.

### 5-2. Sitting:

The study was conducted in the National Cancer Institute (NCI) in the Pediatric wards.

### 5-3. Sample:

A convenient sample of 70 children aged 3 years old, and more, and had pediatric oncology diseases and treated with chemotherapy.

#### Inclusion Criteria

- Children had pediatric oncology diseases
- The disease in the first stage.
- Children/ parents accept to participate in the study.

### 5-4. Tools:

Data were collected using three questionnaire sheet designed by the researchers. One of them is for children, the second is for respiratory efficiency and the third is for the pain assessment. The child questionnaire sheet:

- I. The child questionnaire sheet composed of three parts (30 questions).
  - A. The first part had 16 questions about the socio-demographic data about the child,
  - B. The second part had 10 questions about the child's illness and hospitalization.
- II. Respiratory efficiency sheet:

It included three parts (50 questions). It covered the following:

- a) Vital signs.
- b) Characteristics of skin.
- c) Characteristics of respiration.
- d) Presence of cough.
- e) Oxygen saturation.
- f) Capillary refill.

- III. Pain facial assessment scale

### 5-5. Tool validity and Reliability

Three specialists in pediatric oncology and pediatric oncology nursing revised the data collection tools to obtain face and content validity, all comments were considered before conducting the study.

Reliability was applied by testing seven children with cancer and their mothers reliability coefficients' alpha between questions was 0.69.

### 5-6. Ethical Considerations:

All participants were informed about the aim of study and verbal agreement (consents) was taken before data collection. The subjects were informed that the data will be anonymous and confidential. The researchers also informed the children and mothers about their rights to withdraw from the study at any time without giving any reason and without any effect on their children care.

### 5-7. Statistical design:

A compatible personal computer (PC) was used to store and analyze data. The Statistical Package for Social Studies (SPSS), version 11.0 was used. Data were coded and summarized using means and standard deviation for quantitative variables and percentage distribution for qualitative variables. Comparison of means was performed using paired-sample t-test. F. test statistic used to compare the variances of the same simple's measures. Correlation among variables was done using Pearson correlation coefficient (Pearson's  $r$ , test) to measure of the strength and direction of the linear relationship between the study variables' means and standard deviations.

### 5-8. Pilot Study

A pilot study was carried out on 10% children with cancer in the NCI to test clarity and applicability of the tool. Appropriate modifications were done prior to data collection for the actual study.

### 5-9. Data Collection Procedures

The researchers explain the aim of the study to the nurse administrators of the pediatric oncology department. The mothers were informed about the aim of the study and the children and their mothers were informed that the participation is not obligatory. Data collected through face to face interview to be able to include illiterate participants, insure higher response rate and to clarify misunderstood questions. Each interview took about 20-40 minutes for children and their mothers. The study was conducted during the period of Sept. 2013 to Jan. 2014. The sample size was computed to be 70 children. Most of the mothers of the studied children were cooperative with the researchers.

## 6- Results

In studying the effect of breathing exercise on respiratory efficiency and pain intensity among children receiving



chemotherapy it was found that more than half (53%) of the studied children were male, and 47% were female while less than two thirds aged from 3 to 6 years old with mean  $\pm$ SD  $6.1 \pm 1.4$  ( Figure, 1).

Regarding children sociodemographic characters ties the study results revealed that more than two thirds (72.9%) of children came from rural areas, while the rest of them came from urban areas. Nearly two thirds of the children (65.7%) had 1-2 siblings and thirty (30%) had 3-4 siblings. More than half (54.3%) of the children' ranked as the second child, more than one third (38.6%) ranked as the first child, and a minority of (7.1%) was ranked as the third one.

More than two thirds (68.6%) of the studied children were enrolled either in nursery or in elementary school, while more than thirty (31.4%) were not enrolled in schools because of health related conditions as reported by 90.9% of the children or their mothers (Table, 1). The same table illustrated that 100% of the school teachers were informed with the child's disease to observe children during school attendance (72.9%). Regarding sociodemographic characteristics of parents of the studied children the study results revealed that 50% of the fathers had basic education followed by 25% just read and write and 15.7%, had secondary school education. More than half of the fathers (52.9%) had manual work, while, 42.8% of them were employed.

Regarding to the studied children' mothers it was found that more than two thirds (72.9%) were illiterate, followed by basic, secondary school education and higher education (12.9 %, 10%, 2.8%) respectively. more than three quarters of the mothers (78.9%) were house wives, while the rest of them were working.

In relation to the family monthly outcome it was found that more than half (58.5%) of the children' families had insufficient income while 41.5% reported that they have sufficient income.

Figure (2) illustrated that less than two thirds (64%) of the studied children had Acute Lymphoblastic Leukemia (ALL), followed by lymphoma, bone tumors and brain tumors (14%, 13%, and 9%, respectively)

It was clear from Figure (3) that the vast majority (90%) of the studied children had pain as the associated problem from cancer and its treatment, vomiting was reported by 67% of the children. All the children had easy fatigability, loss of weight, and feeding problems.

The study's results clarify that more than half of the studied children (55%) had no previous hospitalization and the most common cause of hospitalization while 61% was hospitalized twice. Regarding the causes of hospitalization; more than one third of the children (38.7%) were hospitalized for investigations, followed by chemotherapy administration, deterioration and perform surgery (32%, 16.2 % and 9.6%, respectively). The same table shows that more than half of the studied children (58.6%) were hospitalized for 1 to three weeks, while 41.4% were hospitalized for more than three weeks.

The majority of the children (80.4%) had no previous chemotherapy. Regarding children' knowledge about chemotherapy more than three quarters of them (78.9%) had information about this treatment More than half of the children (58.6%) got information from their parents, and 41.4% got information from the physician.

When studying the preparation for hospitalization it was found that all children had no psychological preparation for hospitalization, as well as for physical exercises, breathing exercises, physiotherapy and complete physical assessment. On the other hand all children' parents had informed consent and checking the vital signs. The vast majority of children (91.4%) had prepared for laboratory investigations.

Table (2) shows that all children and their mothers had no preparatory knowledge about chemotherapy as regards to times of sessions, side effects, post chemotherapy regimen and follow up care.

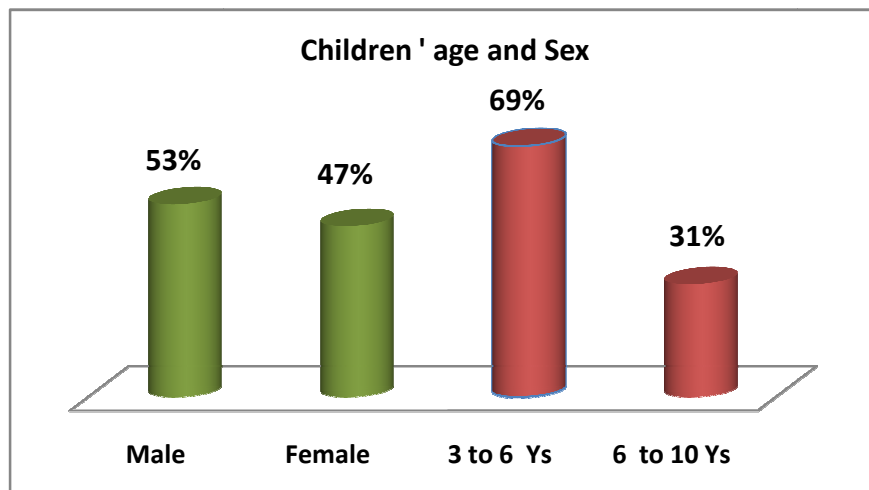
Table (3) revealed that there were significance differences between pre and post breathing exercises in the first and second measurements, so the means scores are positively changed ( $P \leq 0.05$ ) in both O<sub>2</sub> saturation, respiratory rate, heart rate and temperature. The same table illustrates that there were significance differences between pre and post breathing exercises in the first and second measurements in relation to depth of respiration breathing sounds ( $P < 0.05$ ), another significance differences were found between pre and post breathing exercises in relation to presence of cough, and type of cough, and the amount of sputum ( $P < 0.05$ ).

Table (4) illustrates the presence and characteristics of pain as pre and post breathing exercises, highly significance differences were detected regarding the presence of pain, time and severity of pain ( $P$  value =, 0.001). Table (5) clarify that there were highly statistical differences between the two measurements in both vital signs and O<sub>2</sub> saturation ( $P$  value = 0.000). Table (6) shows that there were positive correlation, in the first measurement of pain On the same line, there were negative correlation, in the second measurement regards vital signs and oxygen saturation. On the other hand, the study results revealed that, there were no statistically significant relationships among gender and age of children and their oxygen saturation and vital signs

**Socio-demographic Characteristics of Children and their Families**

**Figure (1) Percentage Distribution of Children's Sex and Age (N=70)**

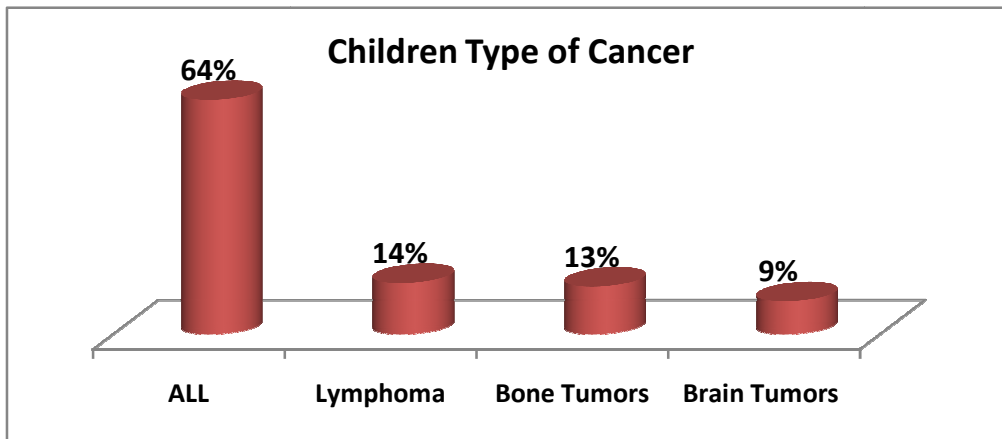
The mean age is 6.1 + 1.4



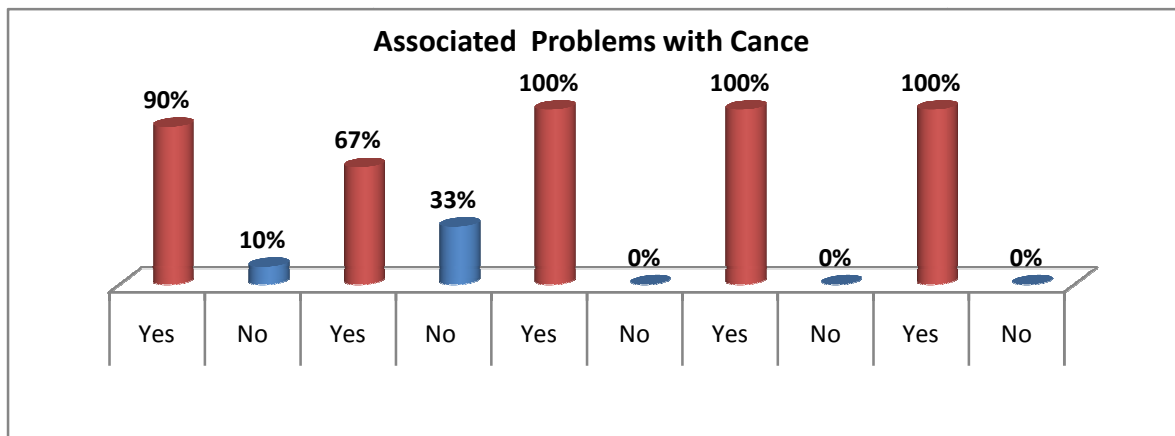
**Table (1) Percentage Distribution of School Enrollment, School Grade, and Cause of Absenteeism: (N=70)**

Item	(n=70)	
	No.	%
Nursery or School enrollment:		
Yes	48	68.6
No	22	31.4
Cause of absenteeism (n=22):		
Health related causes	20	90.9
Economic related causes	2	9.1
The teacher in the school or nursery informed about the child's disease (n=48):		
Yes	48	100.0
No	0	0.0
Why the teacher in school or nursery informed about the child's disease (n=48):		
To help the child to take the prescribed medications.	3	6.25
To notify the mother about any complication.	9	18.75
To observe the child continuously.	35	72.9
To decrease the child's effort in the school.	1	2.1

**Figure (2) Percentage Distribution of Diagnosis and Diagnoses: (N=70)**



**Figure (3) Percentage Distribution of the Associated Problems with Cancer : (N=70)**



**Table (2) Percentage Distribution of Knowledge about Preparation for chemotherapy session: (N=70)**

Required knowledge	No	%
• about time of chemotherapy session		
Yes	0	0.00
No	70	100
• about type of chemotherapy session		
Yes	0	0.00
No	70	100
• about side effect of chemotherapy session		
Yes	0	0.00
No	70	100
• about feeding after chemotherapy session		
Yes	0	0.00
No	70	100
• about effort after chemotherapy session		
Yes	0	0.00
No	70	100
• about follow up after chemotherapy session		
Yes	0	0.00
No	70	100

**Table (3) Mean scores of Respiratory Efficiency in Pre and Post Breathing Exercise (N=70)**

Items	1 <sup>st</sup> measurement				2 <sup>nd</sup> measurement			
	Pre	Post	t-test	P-V.	Pre	Post	t-test	P-V.
O2 Saturation	91.7±3.3	92.2±3.4	2.5	0.01*	92.7±3.6	93.8±3.9	2.11	0.02*
Capillary refill time	4.5 ±0.84	4.0 ±0.7	2.3	0.02*	3.9±0.6	3.9±0.5	0.14	0.07
Respiratory Rate	35.66± 2.74	35.3±2.5	2.22	0.02*	34.2±2.6	33.4±2.6	1.25	0.03*
Pulse rate	103.6±8.4	101.8±7.1	2.8	0.03*	99.6±5.8	97.7±5.6	0.019	0.01*
Temperature	37.8±0.24	37.8±0.20	2.9	0.02*	37.7±0.18	37.6±0.18	1.7	0.04*
Systolic blood pressure	78.36±6.3	78.35±6.3	2.3	0.08	80.4±6.5	82.4±6.6	2.07	0.5
Diasystolic blood pressure	58.4±3.9	58.4±3.9	2.1	0.09	58.4±3.8	58.9±3.7	1.09	0.4

**Table (3): Cont. Respiratory Efficiency in Pre and Post Breathing Exercise (N=70)**

Items	1 <sup>st</sup> measurement				2 <sup>nd</sup> measurement			
	Pre		Post		Pre		Post	
	No	%	No	%	No	%	No	%
Depth of respiration:								
Deep	5	7.1	15	21.4	25	35.7	43	61.4
Shallow	65	92.9	55	78.6	45	64.3	27	38.6
X2 = 1.09					P value = 0.04*			
Rhythm of respiration:								
Regular	5	7.1	14	20.0	24	34.3	42	60.0
Irregular	65	92.9	56	80.0	46	65.7	28	40.0
X2 = 0.11					P value = 0.06			
Breath sound:								
Clear	5	7.1	12	17.1	20	28.6	24	34.3
Wheezing	65	92.9	58	82.9	50	71.4	46	65.7
X2 = 0.42					P value = 0.03*			
Items	1 <sup>st</sup> Day				2 <sup>nd</sup> Day			
	Pre		Post		Pre		Post	
	No	%	No	%	No	%	No	%
Presence of cough:								
Present	67	95.7	67	95.7	58	82.9	58	82.9
Absent	3	4.3	3	4.3	12	17.1	12	17.1
X2 = 0.8					P value = 0.03*			
Type of cough:								
Dry	5	7.5	7	10.5	10	17.3	11	19.0
Productive	62	92.5	60	89.5	48	82.7	47	91.0
X2 = 1.04					P value = 0.02*			
Color of sputum :								
White	9	14.5	10	16.7	12	25.0	15	31.9
Yellow	41	66.1	37	61.7	25	52.1	21	44.7
Green	12	19.4	13	21.6	11	22.9	11	23.4
X2 = 0.29					P value = 0.08			
Amount of sputum								
Little	5	8.0	8	13.3	11	22.9	13	27.7
Moderate	55	88.7	50	83.3	35	72.9	32	68.1
Large	2	3.3	2	3.4	2	4.2	2	4.2
X2 = 0.7					P value = 0.04*			



**Table (4) Pain Scores as Pre and Post Breathing Exercises (N=70)**

Items	1 <sup>st</sup> measurement				2 <sup>nd</sup> measurement				
	Pre		Post		Pre		Post		
	No	%	No	%	No	%	No	%	
Presence of pain:									
Present	70	100.0	70	100.0	61	87.1	58	82.9	
Absent	0	0.0	0	0.0	9	12.9	12	17.1	
X <sup>2</sup> = 0.48					P value = 0.001*				
Time of pain:									
At specific Position	14	20.0	20	28.6	17	23.0	15	25.9	
Continuous	5	7.1	0	0.0	0	0.0	0	0.0	
X <sup>2</sup> = 1.3					P value = 0.01*				
Site of pain:									
Joints	70	100.0	70	100.0	61	100.0	58	100.0	
Bones	51	72.9	50	71.4	44	77.0	43	74.1	
Head	18	25.7	10	14.3	13	21.1	0	0.0	
X <sup>2</sup> = 0.3					P value = 0.1				
Severity of pain:									
Mild	0	0.0	0	0.0	8	13.1	32	55.1	
Moderate	52	74.3	60	85.7	40	65.8	26	44.9	
Sever	18	25.7	10	14.3	13	21.1	0	0.0	
X <sup>2</sup> = 0.07					P value = <0.001*				

**Table (5) Means for two measurements for vital signs and Oxygen Saturation**

Items	Mean for two measurements for vital signs	F	P Value
Respiratory rate	34.6 + 2.8	10.6	0.000**
Pulse	100.6 + 7.3	9.4	0.000**
Temperature	37.7 + 0.2	7.08	0.000**
Systolic B.P.	79.8 + 6.6	6.2	0.000**
Diastolic B.P.	58.6 + 3.8	0.3	0.00**
O <sub>2</sub> saturation	92.6 + 3.3	5.6	0.001**

**Table (6) Correlation Matrix of Vital Signs, Oxygen Saturation and Score of pain and Child's Sex and Age:**

Items	Score of pain		Child's age	Child's sex
	1 <sup>st</sup> measurement	2 <sup>nd</sup> measurement		
Respiratory Rate	r=0.82 P value=	r=-0.3 P value=0.94	r=0.202 P value=0.07	r=-0.046 P value=0.70
Pulse rate	r= 0.93 P value=	r=-0.17 P value=0.14	r=- 0.012 P value=0.90	r= 0.065 P value=0.59
Temperature	r= 0.35 P value=	r=-0.08 P value=0.47	r= 0.004 P value=0.97	r=-0.030 P value=0.80
Systolic blood pressure	r= 0.62 P value=	r=-0.09 P value=0.48	r=0.058 P value=0.63	r=- .103 P value=0.39
Diasystolic blood pressure	r=0.57 P value=	r=-0.08 P value=0.48	r=-0.209 P value=0.82	r=0.188 P value=0.11
O <sub>2</sub> saturation	r= 0.321 P value=	r=0.06 P value=0.47	r= -0.214 P value=0.07	r= 0.070 P value=0.56

## 8- Discussion:

In studying the effect of breathing exercise on respiratory efficiency and pain intensity among children receiving chemotherapy it was found that more than half of the studied children were male, this results is not matched with Sitaresmi et al, (2008) in studying of health-related quality of life assessment in Indonesian childhood acute lymphoblastic leukemia where he found that 51% of the children were female. According to (Matziou et al,2009) who investigated health-related quality of life in children with newly diagnosed cancer they reported that nearly 62% of children were males. Another study done by (Johns, et al., 2009) reported that fifty-seven percent of the children were male. In the same line Van Cleve et al (2012) found that sixty percent of the studied children were males. This is consistent with findings of several international cancer registries. More over according to cancer registries in Asia and Africa, by contrast, the risk in boys appears substantially greater than in girls. This is unlikely to reflect biological differences in susceptibility by sex (Steliarova- Foucher et al, 2006). The current study revealed that less than two thirds aged from 3 to 6 years old with mean  $+SD$   $6.1 + 1.4$ , this result was nearly matched to Sitaresmi et al (2008) who found that 88% of the studied children were from 2-7 years old. The researchers own opinion and clinical observation revealed that cancer pattern is chanced to reach even newborns and infants but for methodological reasons newborns and infants were excluded. In the same context Johns, et al. (2009) indicated that fifty-seven percent of the children were male; the mean age at diagnosis was  $6.7 \pm 5.2$  years.

Regarding children sociodemographic characteristics the study results revealed that more than two thirds of children came from rural areas, while the rest of them came from urban areas. This results was parallel with Mohsen et al (2010) who recommended that the effect of geographical differences on childhood cancer incidence rates and high mortality rate to be investigated in future studies. This result might reflect the cancer risk factor exposures in the rural areas where the pesticides and water pollution. In fact there was some newly open cancer institutes in some regional areas in Egypt; that present the services but many physician still refer cases to the NCI in Cairo or to 57357 pediatric hospital, this results also reflect the trusting of treatment and investigations availability in Cairo rather than in other regional hospitals.

Nearly two thirds of the studied children had 1-2 siblings and thirty had 3-4 siblings. According to American Society of Clinical Oncology (2012) A child with cancer changes the family dynamics, and these changes are often especially difficult for the healthy siblings. Some parents find that they don't have much energy left to spend with their other children after looking after a sick child. Many parents find it difficult to think about the experience from the viewpoint of the healthy siblings. With a little effort, though, parents can help maintain a family life that feels more normal and takes into account everybody's needs. The researchers' point of view that it is challenging issue for the pediatric oncology nurse to care for children as bio-psychosocial being. The study's results pointed out that more than half of the children ranked as the second child, more than one third ranked as the first child, however the child's rank children with cancer and all family members will be negatively affected.

Regarding nursery and school enrolment more than two thirds of the studied children were enrolled either in nursery or in elementary school, while more than thirty were not enrolled in schools because of health related conditions as reported by most of the children or their mothers of the children or their mothers. This results is consistent with Yilmaz et al ( 2013) who studied School-Related Problems in Children Treated for Cancer , and found that 30.3% of children experienced various physical difficulties stemming from cancer therapy that affected their school life. The number of late enrollments, the number of children repeating a grade, and the rates of school absenteeism were also found to be higher in the survivors with cancer. In addition the current study founded that all school enrolled children were informed their teachers with child's illness for the reason to observe children during school attendance, Yilmaz et al ( 2013) collected data about the school enrollment of children with cancer from both parents and teachers and already teachers were acquainted with children's conditions. Many studies were support school teachers' involvement with the child's chronic illness for the reason of school follow up. Get professional help. Cancer Council (2011) recommended that with the parent's permission, staff from the hospital can visit the school to discuss the student's diagnosis and treatment with staff and classmates.

Regarding sociodemographic characteristics of parents of the studied children the study results revealed that half of the fathers had basic education followed by just read and write then secondary school education. More than half of the fathers had manual work, while, the rest of them were employed. Regarding mothers it was found that more than two thirds were illiterate, followed by basic, secondary school education and higher education. more than three quarters of the mothers were house wives. In a relevant study done by Mohamed et al (2013) found that, nearly two thirds of them were house wives. In the same field Eiser et al (2006), Eiser, (2007) and Turner et al (2008) indicated that parents socio-demographic data such as education and work are considered the child's psychosocial aspects that are contributing to the child's coping process and improving QOL, seeking medical help, and caring of their child with cancer.

Clearly, the current study evident that, less than two thirds of the studied children had Acute Lymphoblastic

Leukemia (ALL), followed by lymphoma, bone tumors and brain tumors This is in the same line with the study done in Greek by Matziou, et al (2009) who found that, diagnosis was categorized as (a) leukemia–lymphoma (59.7%) and (b) solid tumors (40.3%). Also this is agreement with (Markus, et al., 2006) who found that, in Switzerland the majority of children suffered from leukemia or malignant lymphoma. However, about 30 percent of the children were diagnosed with a malignant brain tumor or another malignant solid tumor. This is in the same line with Ahmed et al. (2012) and Elattar, et al., (2009) who reported that, in Egypt the most diagnosis of children with cancer was leukemia, (33.2%) new cases. Lymphoma was the next most common (18.1%), followed by brain tumors accounting for 7.1%, of all childhood cancer. According to (Little, 2005) who stated that hematological malignancies, tumors of the central nervous system account for the majority of all cancers. In addition Cancer Facts & Figures (2012) reported that leukemia represents (34% of all childhood cancers), then brain and other nervous system (27%), followed by neuroblastoma (7%), and Wilms' tumor (5%).

The current study detected that, the vast majority of the studied children had pain as an associated problem with cancer and its treatment, vomiting was reported by two thirds of the children. All the children had easy fatigability, loss of weight, and feeding problems. These results were matched with Bahy (2007) who documented that, half of preschool children under study were diagnosed late after signs and symptoms of leukemia appeared by more than four weeks, they lost weight from 6-8 kg before receiving therapy. These findings were supported by study done in London by (Berg, et al., 2009) who investigated the effects of childhood cancer on participation and QOL. Ninety-two percent of children (9 to 18 years of age) reported living with late effects of lower extremity pain and numbness, memory and attention deficits, and fatigue, depression, or both. In the same field Pediatric Society of New Zealand (2013) indicated that cancer pain is also often present and an unavoidable part of being unwell. Pain adds worry to an already miserable situation and has no useful purpose. Despite this, children do not always admit they are sore; especially when they are in a different environment like a hospital.

The current study indicated that the majority of the children had no previous chemotherapy. Regarding children' knowledge about chemotherapy more than three quarters of them had information about this treatment. More than half of the children got information from their parents, and more than one third got information from the physician. On the same context Ahmed et al (2012) documented that more than one thirds of mothers acquired their information from child's doctor. Meanwhile less than one third of them obtained their information from nurses. In same line with the result of the present study (Gorete, et al., 2007) reported that all the mothers obtained their information and explanations about childhood cancer from various sources including books, doctors, nurses, other mothers have already experienced the same case, family members, healthcare team, friends and from families in the same situation. In the same context with the result of the present study (Christiansen, et al., 2008) reported that mother's interviewees felt well informed by the hospital team and found it easy to access information that they needed.

The study results revealed that, all children had no psychological preparation for hospitalization, as well as for physical exercises, breathing exercises, physiotherapy and complete physical assessment. In the same issue James et al (2013) indicated that pediatric nurse has an important role in explaining to the child and his mothers the routine of the hospital, as a preparation for hospitalization. In addition Pediatric Society of New Zealand (2013) concluded that when families are encouraged to maintain their caring role as much as possible, children's anxieties are lessened and the pain they experience is reduced. Families can expect to be as involved in their child's care as they wish to be. On the other hand all children' parents had informed consent and checking the vital signs. The vast majority of children had prepared for laboratory investigations. The researchers' interpretations in these aspects, that although this is true for nurses protection and applying routines, and documentations it was more comprehensive to care for the child as psychosocially to provide comprehensive preparation for that group of children.

The present study illustrated that all children and their mothers had no preparatory knowledge about chemotherapy as regards to times of sessions, side effects, post chemotherapy regimen and follow up care. On the same context Ahmed et al (2012) documented that total mother's knowledge about childhood cancer and chemotherapy pre program were 3% had satisfactory knowledge compared to mother's knowledge immediate post and after three months were 90.1% and 88.8% respectively. In the same subject James et al (2013) indicated that oncology nurse should reinforce teaching concerning diagnosis, treatment plan, medication protocol and side effects. These findings were agreed with study done in Italy by (Turner, et al., 2008) who studied that mothers of children with advanced cancer commonly had lack of training and information about the impact of the disease and treatment on their children, in response to this problem, an educational manual had been designed primarily for mothers, after the program mothers were understand the physical and emotional impact of advanced cancer and strategies to help them to cope with chemotherapy. Another study done in Spain by (Rodrigues, et al., 2010) found that there was lack of mothers information about childhood cancer thus the study was to identify the mother's needs during the hospitalization with their child and supported by educational intervention to understand the disease and the care required by the mother at hospital. Furthermore, the finding was supported

by (Juma, et al., 2010 ) who found that the majority of the mothers had no knowledge of cancer and chemotherapy in children pre program, while after educational program the mothers representing 94% identify all knowledge about childhood cancer and chemotherapy.

The current study results pointed out that there were significance differences between pre and post breathing exercises in the first and second measurements, so the means scores are positively changed ( $P \leq 0.05$ ) in both O<sub>2</sub> saturation, respiratory rate, heart rate and temperature. In addition there were significance differences between pre and post breathing exercises in the first and second measurements in relation to depth of respiration breathing sounds ( $P < 0.05$ ), another significance differences were found between pre and post breathing exercises in relation to presence of cough, and type of cough, and the amount of sputum ( $P < 0.05$ ).

The above results were supported by Okeal et al,( 2009) who reported that breathing exercise and muscle relaxation are now commended treatment for many stress related disorders. According to Peter (2011) deep breathing exercise is marked by expansion of the abdomen rather than the chest when breathing. It is considered by some to be a healthier way to breathe, and is considered by some a useful form of complementary and alternative treatment

Apparently, the current study' results revealed that, the presence and characteristics of pain as pre and post breathing exercises, highly significance differences were detected in both presence of pain , time and severity of pain ( $P = 0.001$ ). This result matched with a study conducted by Menache et al, (2010) found that, physical exercises and changing position have profound positive effect on severity of pain, respiratory pattern, and oxygen saturation.

The current study results demonstrated that, there were positive correlation between the score of pain in first measurement, respiratory pattern, and oxygen saturation. This result was supported by Perry and Potter, (2012) who reported that pain and anxiety or fear increase stimulates the sympathetic nerves system to increase heart rate and cardiac output and vascular resistance causing blood pressure to rise On the other hand, there were negative correlation between the score of pain in the second measurement, and respiratory pattern, and oxygen saturation. These results interpret the effectiveness of breathing exercises in the second measurement so the researchers teach children to performed deep breathing exercise so the score of pain decrease after more breathing exercise This result matched with a study conducted by Maron, (2013) who indicated that deep breathing is one of the best ways to lower stress in the body, so when the person breathe deeply it sends a message to the brain to calm down and relax. The brain then sends this message to the body. Those things that happen when the person stressed, such as increased heart rate, fast breathing, and high blood pressure, all decrease as you breathe deeply to relax.

## 9. Conclusion

The current study results concluded that more than half of the studied children were male, while their age was less than two thirds aged from 3 to 6 years old with mean  $\pm$ SD  $6.1 \pm 1.4$ . More than sixty percent of the children had (ALL), followed by lymphoma, bone tumors and brain tumors. The vast majority of the children had pain as an associated problem from cancer and its treatment; children were suffered from easy fatigability, loss of weight, and feeding problems. There are significance differences between pre and post breathing exercises in the first and second measurements, so the means scores are positively changed ( $P \leq 0.05$ ) in both O<sub>2</sub> saturation, respiratory rate, heart rate and temperature. Positive effects have been demonstrated as a results of breathing exercises, this means that the study hypotheses were attained.

## 10. Recommendations

Based on the findings of the current study, it was recommended that:

- Breathing exercises are the best ways to lower stress in the body.
- Researchers should cluster all articles findings about breathing exercise and its relation to improve patients' oxygen saturation and vital signs as an evidence-based practice.
- Pediatric oncology nurses have to be well acquainted with all pain assessment tools, non-pharmacological pain management and breathing exercises for children with cancer.
- Multiple efforts from pediatric oncology team are needed to prepare children with cancer prior conducting cancer treatment as well their mothers or care givers.
- For further researches the study should be replicated to conduct on a larger sample including different diagnosis and in other pediatric hospitals is needed for generalization of the reached results on the population.

## 11. Acknowledgement

The authors wish to acknowledge and express their deepest thanks for all children and their mothers for cooperation.

## 12. References

1. Ahmed, H. M. , Elhamshary, A.H., El Sayed ,E.M. & Mahmoud, F. S.(2012) : The effect of educational intervention on maternal management of children with cancer and their quality of life Faculty Of Nursing Benha University Unpublished Doctoral Theses
2. American Society of Clinical Oncology (2012): Siblings and Cancer. 2005-2014 American Society of Clinical Oncology. Cancer.Net.
3. Andam, R .and Silva, M., (2010): A Journey to Pediatric Chemotherapy Competence Department of Hematology/Oncology, 111 Michigan Avenue NW, Washington. msilva@cnmc.org
4. Bagheriyan, S Borhani, F Abbaszadeh, A and Ranjbar H (2011): The effects of regular breathing exercise and making bubbles on the pain of catheter insertion in school age children; Iran J Nurs Midwifery Res, 16(2): 174–180.
5. Bahy, A. , Dabash, S. & Rashad, H. (2007) : Assessment of Nutritional Status Of Children With Acute Lymphoblastic Leukemia Who Are Receiving Chemotherapy Faculty Of Nursing CAIRO University Unpublished Master Theses
6. Ball, J., & Bindler, R. (2011). Pediatric nursing: Caring for children. (pp.701-720). Norwalk: Appleton & Lange.
7. Berdat, P., & Carrekl, T. (2012). Fun exercise program for kids, Critical Care Nurses, October,19. [www.findarticles.com](http://www.findarticles.com).
8. Berg, C., Neufeld, P., Harvey, J., Downes, A., & Robert J., (2009): Late effects of childhood cancer, Participation, and Quality of life of adolescents, OTJR: Occupation, Participation and Health, Vol. 29, No. 3, Pp: 46-98.
9. Busby, C. Hamdan , M. and Ariabi, E. (2010): Cancer, Infant Mortality and Birth Sex-Ratio in Fallujah, Iraq 2005–2009; International Journal of Environmental Research and Public Health. 7, 2828-2837;
10. Canadian Nurses Association (2011). *Leadership: Succession Planning for Nursing Leadership*. from [www.cna-aiic.ca](http://www.cna-aiic.ca).
11. Canadian Association of Nurses in Oncology (2011): STANDARDS AND COMPETENCIES FOR CANCER CHEMOTHERAPY NURSING PRACTICE
12. Cancer Council (2011): Cancer Council Helping [www.cancercouncil.com.au](http://www.cancercouncil.com.au)
13. Cancer Facts & Figures (2012) American Cancer Society, Inc. No. 500812
14. Childhood Cancer (2012): 2005-2014 American Society of Clinical Oncology (ASCO). Cancer.Net
15. Chordas, C. and Graham, K. (2010): Chemotherapy. In Tomlinson, D. and Kline, N. E. Pediatric Oncology Nursing; Advanced Clinical Handbook. 2<sup>nd</sup>. Ed. Chapter 9, P 203; In Springer-Verlag Berlin Heidelberg 2005, 2010
16. Christiansen, N., Kevin, M., G., and Duggan, A ., (2008): Oral Chemotherapy in Pediatric Oncology in the UK: problems, Perceptions and Information Needs of Parents, Pharmacy World & Science , Vol. 30, Number 5, Pp:550-555.
17. Cohen, L. L; (2008): Behavioral Approaches to Anxiety and Pain Management for Pediatric Venous Access, PEDIATRICS Volume 122,
18. Cohen, M.R. (2010). Medication errors. Nursing, 40 (1), 14.
19. Darbyshire, P. (2013). Parents, nurses, and pediatric nursing: A critical review. Journal of Advanced Nursing, 18: 1670- 1680.
20. Eiser, C (2007): Beyond Survival: Quality of life and Follow-up After Childhood Cancer. J Pediatr Psychol, 32:1140-50.
21. Eiser, C Holland, J. and Johansen, C. (2006): Psychosocial aspects of childhood cancer. Childhood Cancer Rising to the challenge, ([www.uicc.org](http://www.uicc.org)) p-p 31- 36.
22. Elattar, I.A., Ali-Eldin, N.H., Moneer, M.M., Elbasmy, A.A., Belal, D, Aref, N., Kamel, M., Negm, D., Samy,A., and Mohammed, R., (2009): Cancer Statistics for Children Age Less than 20 year, National Cancer Institute, Cairo.
23. Gorete, M. L., Vasconcelos, C., and Pontes, M., (2007): Childhood Cancer: Maternal Perceptions and Strategies for Coping with Diagnosis, Journal Pediatric, (Rio J.) vol.83 no.6, Pp: 52-54.
24. Halgadottir H. (2012). Pain Management Practices in Children after Surgery: International Pediatric Nursing , October, AORN Journal. [www.googel.com](http://www.googel.com)
25. Hoekelman, R., Friedman, S., & Nelson, N. (2011). Primary pediatric care. (3rd ed., pp.220-225).Tokyo: Mosby.
26. International Association for the Study of Pain (2009): Global Year Against Cancer Pain.Leukemia – The Scientist's Perspective and Challenge [www.intechopen.com](http://www.intechopen.com)
27. James, S. R., Nelson, K. A. & Ashwill, J. W.(2013): Nursing Care of Children: principles and practice, 4th ed. London: Elsevier, ( p.p.231, 605 ).
28. John, A. H., Naomi, E.C., McCarthy, M., Donath, S,M., Anderson, V.A., and Wolfe, J., (2009): Quality of Care



- at the End of Life in Children with Cancer, *Journal of Pediatrics and Child Health*, Vol. 45, no.3, Pp: 656–659.
29. Johns, A. L., Oland, A. A., Katz, E. R., Askins, M. A., Butler, R.W., and Dolgin, M. J., (2009): Qualitative Analysis of the Role of Culture in Coping Themes of Latina and European-American Mothers of Children with Cancer, *Journal Pediatric Oncology Nursing*, Vol. 26, no.(3), Pp: 167–175.
  30. Juma, M., Otiti, S., and Mwanda, W., (2010): Childhood Cancer; Mothers Awareness and Understanding of Causative Factors in Chakol Division of Teso District in Western Province of Kenya, *Kenyatta National Hospital, Nairobi, Medical Training College*, Vol. 21, no.(6), Pp: 151–162.
  31. Little J., (2005): *Epidemiology of Childhood Cancer*, IARC Scientific Publications, Vol. 149, Lyon, France: IARC.
  32. Lown, E.A., Ness K. K., and Oeffinger, K.C., (2009): Health Behaviors, Medical Care, and Interventions to Promote Healthy Living in the Childhood Cancer Survivor Study Cohort
  33. Markus, A. L., Vollrath, M., Felix, K. N., Hanspeter, E. G., and Felix, H. S., (2006): Health-Related Quality of Life in Children with Newly Diagnosed Cancer, *Health Quality Life Outcomes*, Vol. 20, No.3, Pp: 55-45.
  34. Marlow, R. (2009). *Textbook of pediatric nursing*. (5th ed. P. 630). Philadelphia: W.B. Saunders Company.
  35. Maron, B. (2013): Breathing exercise. *Children's Health News*, June, 49, 12.[www.yahoo.com](http://www.yahoo.com).
  36. Matziou, V., Perdikaris, P., Feloni, D., Moschovi, M., Tsoumakas, K., and Merkouris, A.,(2009): Cancer in Childhood: Children's and Parents' Aspects for Quality of Life, *European Journal of Oncology Nursing*, Vol. 13, Issue 5, Pp:132,209-216.
  37. Menache, C.; Wessel, D.; Jonas, R. and Newburger, J. (2010). Current incidence of acute pulmonary complications after cardiac operation in children. *AORN Journal*. February, 28: 15-21.
  38. Mohsen, M. S., Abbasali, P. Saeid, D.( 2010): Childhood Cancer in Iran , Volume 32 - Issue 5 - pp 376-382 Lippincott Williams & Wilkins, Inc.
  39. Nathan, P. C., . Ford, J. S., Henderson, T. M., . Hudson, M., Emmons, K.M.,Casillas, J. N.,
  40. Ogah, A.; Surat, A.; Okoruwa, G.; Ezeonwumelu, J. and Okolo, S. (2012). Oxyhemoglobin Saturation in Sickle Cell Anemic Children (Steady State) Using Pulse Oxymetry in Jos University Teaching Hospital, Jos, Nigeria. *Asian Journal of Medical Sciences* 4(5): 161-165
  41. Okeal, M., El-Badry, S., & Youssef, A. (2009). *Principles and practice of basic exercise* (4th ed.,pp.10-20) Cairo.
  42. Pediatric Society of New Zealand (2013): Pain and childhood cancer [www.healthline.govt.nz](http://www.healthline.govt.nz)
  43. Perry, A. and Potter, P. (2012). *Study Guide for Fundamentals of Nursing*. ( 8<sup>th</sup> ed.,) London: Mosby.
  44. Peter, M. (2011). Exercise and children. *AORN Journal*, [www.findarticles.com](http://www.findarticles.com).
  45. Rheingans, J. I. (2008). Pediatric oncology nurses' management of patients' symptoms. *Journal of Pediatric Oncology Nursing*, 25, 303-311.
  46. *Rodrigues, L., Margareth, A., Luciana, P., and Alves, M., (2010): Uncertainties in the Childhood Cancer: Understanding the Mother's Needs. Escola. Anna Nery, vol.14, n.2, Pp: 301-308. ISSN*
  47. *Roth, E (2010): Exercises for Chemo Patients, "British Medical Journal"*
  48. Ryan, S., Gregg, J., & Patel, L. (2013). *Core pediatrics*. (pp. 147-160). Boston: Mosby.
  49. *Schwappach, D. and Hochreutener, M(2010): Oncology Nurses' Perceptions About Involving Patients in the Prevention of Chemotherapy Administration Errors; Journal of Oncology Nursing Forum, 371 (2) Online Exclusive Article.*
  50. Scott, E (2011) : Breathing Exercises for Stress Relief., Breathing Exercises are Popular for a Reason *Stress Management* 24,
  51. Simon,C.(2010): Pain in Children with Cancer Pain in Children with Cancer in *Pediatric Oncology Nursing; Advanced Clinical Handbook*; 2<sup>nd</sup>. Ed. P 529
  52. Sitaresmi, M., Mostert, S., Gundy, M. Sutaryo, and Veerman, A. (2008): Health-related quality of life assessment in Indonesian childhood acute lymphoblastic leukemia. *Health and Quality of Life Outcomes*, 6:96.
  53. Steliarova-Foucher, E., Hery, C. and Pisani, P (2006): The burden of childhood cancer. *Childhood Cancer Rising to the challenge*, ([www.uicc.org](http://www.uicc.org)) p-p 9-15.
  54. Takken, T; van der P., . Zwerink1, M., Hulzebos1, E., Bierings, M., Paul J. Helder1, M. and Van der Net, J. (2010): Development, feasibility and efficacy of a community based exercise training program in pediatric cancer survivors, *Psycho-Oncology* 18: 440–448
  55. Tomlinson, D. and Kline, N. E. (2010): *Pediatric Oncology Nursing; Advanced Clinical Handbook*; 2<sup>nd</sup>. Ed.
  56. Turner, J., Clavarino, A., Yates, P., Hargraves, M., Connors, V., and Hausmann, S., (2008): Enhancing the Supportive Care of Parents with Advanced Childhood Cancer: Development of A self-directed Educational Manual, *European Journal of Cancer*, Volume 44, Issue 12, Pp:1625-1631.
  57. University of Maryland Medical Center (2013) Relaxation techniques <http://umm.edu/health/medical/altmed/treatment/relaxation-techniques>



58. Vagace. M. J. and Gervasini G. (2011) Chemotherapy Toxicity in Patients with Acute Leukemia
59. Van Cleve,L., Cynthia. F . Muñoz . Riggs, M. Bava, L., and Savedra, M. (2012): Pain Experience in Children With Advanced Cancer
60. Yilmaz MC, Sari HY, Cetingul N, Kantar M, Erermis S, Aksoylar S ( 2013): Determination of School-Related Problems in Children Treated for Cancer. J Sch Nurs.