American Journal of Nursing Research, 2020, Vol. 8, No. 3, 331-343
Available online at http://pubs.sciepub.com/ajnr/8/3/3
Published by Science and Education Publishing
DOI:10.12691/ajnr-8-3-3

The Effect of Applying a Progressive Muscle Relaxation Technique on Nausea and Vomiting Induced by Chemotherapy among Leukemic Children

Rana Saleh Refaat Mohamed Amer[1,*], Mohamed Mersal Hamad[2], Rabab El-Sayed Hassan El-Sayed[3]

[1]B.Sc. Nursing, Mansoura University, Egypt
[2]Professor of teaching exercises methods, Department of Curriculum and Instruction, Faculty of Physical Education, Mansoura University, Egypt
[3]Professor of Pediatric Nursing, Faculty of Nursing, Mansoura University, Egypt
*Corresponding author: arony53@yahoo.com

Received February 07, 2020; Revised March 11, 2020; Accepted March 24, 2020

Abstract **Background:** Although the using of several anti-emetic medications, chemotherapy-induced nausea and vomiting have still considered the most prevalent problems for patients receiving chemotherapy agents. Applying a progressive muscle relaxation technique as complementary and alternative medicine may reduce chemotherapy-induced nausea and vomiting. **Aim:** Assess the effect of applying a progressive muscle relaxation technique on nausea and vomiting induced by chemotherapy among leukemic children. **Design:** A clinical trial. **Setting:** Oncology Center affiliated to Mansoura University, Mansoura City. **Subjects:** a convenience sample of 66 children who attended the previously mentioned setting were equally and randomly divided into control and study groups. **Tools of data collection:** A questionnaire sheet, Rhodes Index of Nausea and Vomiting Form 2 and Behavioral relaxation self-rating scale. **Results:** Children in the study group were less experienced acute and delayed attacks of nausea and vomiting in relation to the frequency and distress, as well as showing a significant increase in the relaxation feeling compared to children in the control group who received only routine care. **Conclusion:** The study findings proved the positive effect of applying a progressive muscle relaxation technique in reducing nausea and vomiting induced by chemotherapy among leukemic children of the study group. **Recommendation:** Providing in-service training and regular educational programs or courses about progressive muscle relaxation technique as complementary and alternative medicine to internalize the natural methods for improving health and relieving nausea and vomiting associated with chemotherapy.

Keywords: *chemotherapy, leukemic children, nausea, progressive muscle relaxation technique, vomiting*

Cite This Article: Rana Saleh Refaat Mohamed Amer, Rabab El-Sayed Hassan El-Sayed, and Mohamed Mersal Hamad, "The Effect of Applying a Progressive Muscle Relaxation Technique on Nausea and Vomiting Induced by Chemotherapy among Leukemic Children." *American Journal of Nursing Research*, vol. 8, no. 3 (2020): 331-343. doi: 10.12691/ajnr-8-3-3.

1. Introduction

Leukemia is a type of blood cancer mainly white blood cells, in which there are uncontrolled increase of these cells. Eventually, normal blood cells decline and the cancer cells prevent the manufacture of normal red blood cells, platelets and white cells resulting in developing life-threatening symptoms. Additionally, the cancer cells can distribute to the bloodstream, lymph nodes, the brain, spinal cord and other parts of the body. Furthermore, there are four main types of leukemia, which include; acute lymphocytic leukemia (ALL), acute myeloid leukemia (AML), chronic lymphocytic leukemia (CLL) and chronic myeloid leukemia (CML) [1].

Despite of advances in treatment and the survival rate for childhood cancers has increased to approximately 80%, cancer remains the second leading cause of death following accidents among children aged from 5 to 14 years [2]. In addition, the most prevalent and commonest types of cancer diagnosed in children ages from zero to 14 years are a leukemia 29% of childhood cancer, brain cancer and other central nervous system 26%, neuroblastoma 6%, wilms tumor 5%, non-hodgkin lymphoma 5%, hodgkin lymphoma 3%, rhabdomyosarcoma 3%, retinoblastoma 2%, osteosarcoma 2% and ewing sarcoma 1% [3]. Leukemia is the most common malignant childhood cancer among children aged 1 to 14 years, which accounted for 41% of malignancies in children under the age of 15 and about 3,000 children and adolescents under the age of 19 years old [4]. Acute lymphocytic leukemia is the most common childhood malignancy accounting for 25% of all childhood cancers [5]. Worldwide, the incidence of ALL is about 3 per 100,000 population and about 3 out of 4 cases occur in children under age of 6

years old as it constitutes 80% of childhood leukemia with a higher incidence among male gender that divided into 85% of cases have B-cell ALL and 15% have T-cell ALL [6]. A study in Alexandria founded that, leukemia represented 2.5% of the total hospital admissions per year, which include mainly acute lymphocytic and partly myeloid leukemia. The incidence of lymphatic and haemopoietic cancer also increased 11 times more than that reported 30 years ago in children [7]. Meanwhile, in El-Mansoura University Oncology Center, the number of children admitted with leukemia is 8041 cases from July 2016 to July 2017 [8]. Symptoms of leukemia are fatigue, dyspnea or anemia that can lead to angina, severe sepsis resulting from reduction of white blood cells or bruising and epistaxis resulting from thrombocytopenia [9]. On the other hand, the treatment of leukemia depended on the type and stage of the cancer, which can involve one or more of the treatment therapy such as chemotherapy, radiation therapy, biological or immune therapy and stem cell transplantation [10]. Chemotherapy is the firsthand choice of any cancer treatment, especially leukemia [11]. In despite of improving the survival rate of patients who have many types of cancer undergoing chemotherapy treatment, there are gastrointestinal side effects, which significantly affect the clinical outcome and the quality of life of oncology patients. These side effects are constipation, vomiting, diarrhea, bloating, nausea and ulceration that can result in reducing chemotherapy dose and discontinuation of treatment for many patients. Additionally, the incidence of these side effects is about 100% in patients receiving aggressive dose of chemotherapy and 40% in patients receiving standard maintenance dose chemotherapy [12]. Nausea and vomiting are the most prevalent of unwanted adverse effects from chemotherapy treatment. The incidence of chemotherapy-induced nausea and vomiting (CINV) is more than 50%, even after the anti-emetic prophylaxis, so new complementary alternative modalities of other non-pharmacological techniques can be used in addition to pharmacological treatments since it had completely failed to manage this side effect. It is found that children and adults respond well to various types of mind/body interventions such as a progressive muscle relaxation technique, which can control effectively anticipatory nausea and vomiting in oncology patients who treated with chemotherapy agents [13]. Over the past twenty years, the most important roles of the children's oncology nurse are the safe and correct administration of chemotherapy and providing support for children and their families in order to enable them to manage the physical and psychological consequences of prescribed treatments. However, the nurse should have knowledge, competence and technical skills to fulfill effectively this role, as this qualification could come from their clinical experience and education [14]. In addition, nurses should enhance the sense of security and provide emotional support for children because of the new situation of having leukemia and starting chemotherapy treatment [15]. Moreover, nurses may act as care providers and consultants during chemotherapy sessions and play significant role in the management of the immediate and the long-term needs of children with leukemia and their families so nursing interventions are directly related to the understand various therapies for leukemia, preventing or managing side effects, and observing for late effects of treatments [16]. There are some strategies to prevent or manage complications of the leukemia and its treatment such as providing patient and family education, actively assessing, monitoring and teaching the children and their families about these new technologies for treatment of chemotherapy side effect such as progressive muscle relaxation technique [17]. Progressive muscle relaxation technique (PMRT) is a technique of alternately tensing and relaxing muscle groups throughout the body to become aware of tension and contrast between muscle tension and relaxation. This resulting in producing a deep state of relaxation from tensing and relaxing various muscle groups throughout the body and the physiological mechanisms that are triggered by inducing the relaxation response are reduction of respiratory rate, oxygen consumption, heart rate and muscle tension [18]. PMRT is one of complementary and alternative medicine that was invented by dr. Edmund Jacobson, which has a recognized positive effect on CINV, pain, fatigue and mental health [19].

1.1. Significant of the Study

From the researcher's clinical experience, it is observed that nausea and vomiting are the most common and unpleasant side effects of chemotherapy that may prevent a child's compliance with treatment. Anti–emetics not only can't control nausea and vomiting completely, but also have numerous side effects. It is recommended to find out other methods for a better control. Therefore, this study was conducted to shed the light on the importance of introducing a progressive muscle relaxation technique combined with the routine care of using anti–emetic medication(s) to reduce nausea and vomiting induced by chemotherapy among leukemic children.

1.2. Aim of the Study

Assess the effect of applying a progressive muscle relaxation technique on nausea and vomiting induced by chemotherapy among leukemic children.

1.3. Research Hypothesis

Applying a progressive muscle relaxation technique will reduce the frequency, duration and distress of nausea as well as frequency, amount and distress of vomiting induced by chemotherapy among leukemic children of the study group.

2. Subjects

2.1. Study Design

This study carried out through a clinical trial.

2.2. Setting

This study was carried out at the pediatric department of Oncology Center affiliated to Mansoura University (OCMU) in El-Mansoura City.

2.3. Subjects

A convenient sample of oncology pediatric patients who attend the previously mentioned setting during the study period by using block randomization with opaque sealed envelope method were recruited to achieve the aim of the study n= (66).

2.4. Tools of Data Collection

Tool I: A questionnaire sheet

a) Characteristics of children including; Age in years, gender, level of education, residence and child ranking.

b) Clinical data of the studied children: Present medical history including; diagnosis, age at diagnosis, administration date of first chemotherapy dose, protocol of chemotherapy administration, current anti-emetic medication and others types of medication.

Tool II: Rhodes Index of Nausea and Vomiting Form 2 (pre/post intervention):

It was adopted from Rhodes and Mc denial, (1999) [20], which formed of 8 items 5 point Likert-type self-report pencil and paper instrument in order to measure the child's perceived nausea, vomiting and retching experience, occurrence and distress before and after the relaxation session in relation to chemotherapy dose. **Scoring system of Rhodes Index of Nausea and Vomiting Form 2:** The total scores of all the three subscales has a range from 0 – 32 that sub classified into much better when zero score is obtained and better, same, worse or much worse when 1 – 8, 9 – 16, 17 – 24, 25 – 32 scores are obtained respectively.

Tool III: Behavioral relaxation self-rating scale (pre/post intervention) This tool was adopted by poppen, 1988 [21], which consisted of seven numbered descriptive phases signifying different degrees of relaxation and tension in order to assess the relaxation of any patient before and after each relaxation session.

Scoring system of Behavioral relaxation self-rating scale: It was composed of 7 items and scored from 1 – 7; with 7 is the highest score in which the children represented as feeling more deeply and completely relaxed than they ever had, while 1 is the lowest score in which the children represented as feeling extremely tense and upset throughout the body.

3. Method

3.1. Preparation Phase

This phase included a review of the past and recent related literature and studies about the effect of applying a progressive muscle relaxation technique on nausea and vomiting induced by chemotherapy among leukemic children using available periodicals and books in addition to internet search, to get acquainted with the various aspect of the study problem, obtain and develop relevant tools; including the steps of progressive muscle relaxation technique to implement the study intervention on pediatric oncology patients

The internal consistency of the tools was tested for their reliability using Cronbach alpha coefficient test by a statistician to assess reliability of the tools; the tool (II) was reliable as r= 0.938, and tool (III) was reliable as r= 0.878.

3.2. Ethical Consideration

The researcher followed ethical research principles as following:

- An oral consent was obtained from one of the child's parents after illustrating the aim & nature of the study.
- Anonymity and singularity of the data collected by the researcher in the present study were confirmed.
-The researcher emphasized that participation is voluntary and each participant had the right to withdraw from the study at any time without any responsibility.

3.3. Pilot Study

A pilot study was done on 10% of the total subject's size (7 children) according to the criteria of selection before starting the data collection to test the tool clarity, effectiveness, applicability to estimate the time needed to apply the study and to detect the required modification. The study subjects of the pilot study were included in the study sample because there was no modification in the study tool.

3.4. Operational Phase/Fieldwork

- Data collection extended from the first of July 2017 to the end of December 2017 (6 months) after an approval had been obtained from the director of Oncology Center - Mansoura University (OCMU).
- The researcher was available in the first three days of leukemic child's hospital admission in the previously mentioned setting in which each child with his/her caregiver were met individually.
- The researcher started by introducing herself to the children and their caregiver and giving them a brief idea about the purpose and nature of the study.
-Throughout the periods of data collection, the researcher assigned each child randomly to either study or control group.
-The framework of the study was carried out according to 3 phases as the following:

1-Prepartion phase

-Before the beginning of the relaxation session, the researcher prepared both the environment and the child.
- The environment was quiet and non-distracting in order to relax, well ventilated, softly lighted and well cleaned.
- The researcher asked the child to wear comfortable clothes, evacuate the bladder and assume a comfortable position, which can be supine or sitting position to apply the session of a progressive muscle relation technique.

2-Implementation phase

-The researcher demonstrated the session of progressive muscle technique in front of child belonging to the study group then the child redemonstrate the session of progressive muscle relation technique under her supervision.
-Each muscle group is tensed according to the child's maximum ability about five to seven seconds, but not tensed to the point of pain with breathing-in deeply, and then the child relaxed for about ten seconds with

breathing-out slowly and rested through taking a deep breath for twenty to thirty seconds before moving to the next muscle.

-A systematic approach along all muscles from downward-upward or from up-ward-downward was followed until the child tensed and relaxed all muscle groups in his/her body.

- Each child performed the progressive muscle relaxation technique session after administering the dose of chemotherapy for about 15-30 minutes or abbreviated progressive muscle relaxation in which relaxation can be achieved in a single twenty minute session under the supervision of the researcher.

- The child started progressive muscle relaxation technique from hands, arms, forehead, eyes, cheeks, mouth and jaw, neck, shoulders, back, chest, stomach, buttocks and finally both legs [22].

- Regarding to children of the control group, the researcher ensured that they were received only anti – emetic medication(s) as a routine care.

3-Evaluation phase

-Rhodes Index of Nausea and Vomiting Form 2 (Tool II) estimated nausea, vomiting and retching experience, occurrence and distress before and immediately after sessions of progressive muscle relaxation technique and chemotherapy administered dose.

-Behavioral relaxation self-rating scale (Tool III) measured the relaxation feeling following sessions of progressive muscle relaxation before and immediately after session of progressive muscle relaxation technique and chemotherapy administered dose.

- A comparison was made between the study two groups to assess the effect of applying a progressive muscle relaxation technique on nausea and vomiting induced by chemotherapy among leukemic children.

3.5. Statistical Analysis

Data were fed to the computer and Data was fed to the computer and analyzed using IBM SPSS software package version 20.0. Qualitative data were described using numbers and percent. Quantitative data were described using median (minimum and maximum) for non-parametric data with mean and standard deviation for parametric data after testing normality using Kolmogorov-Smirnov test. The significance of the obtained results was judged at the 5% level.

4. Results

Table 1 presented the distribution of the participants' children according to their demographic characteristics, in which there were no statistical significant differences between the control and study group as regards; the gender, age and level of education at p=0.78, 0.78 & 0.52 respectively.

Figure 1: It observed that 66.7% of children in the study group and 54.5% of children in the control group were from urban origin.

Figure 2: presented the participant's children diagnosis, in which 90.9% of the study group and 84.8% of the other group were suffering from ALL.

The distribution of the participants' children according to their scores of assessing the frequency of nausea episodes pre and post intervention was revealed in the Table 2. It is obvious from the table that there were highly statistical significant differences in the day one, two and three of the intervention among the study group at p<0.001 while there were no statistical significant differences in the day one and two of application of routine care among the control group at p= 0.59 and 0.09 respectively but at the third day, there was highly statistical significant differences at p<0.001.

Table 3 illustrated the distribution of the participants' children according to their scores of assessing the duration of nausea episodes pre and post intervention, in which 48.5% of children among the study group experienced delayed nausea 2-3 hours at the third day pre-intervention, this percentage improved to 54.5% of children who didn't experience nausea post-intervention with a highly statistical significant difference at p<0.001 compared to 54.5% of children who experienced delayed nausea 1 hour or less in the control group pre-routine care which decreased to 45.5% post-routine care with a statistical significant difference at p= 0.02.

Table 4 demonstrated the distribution of the participants' children according to their scores of assessing the distress of nausea episodes pre and post intervention. It revealed that there were highly statistical significant differences at among the study group pre and post application of PMRT at the day one, two and three of interventions (at p=0.001, <0.001 and <0.001) respectively.

Furthermore, there was highly statistical significant differences at p=0.001 at the third day of application of routine care among the control group while there were no statistical significant differences in day one and two of application of routine care at p=0.36 and 0.30 respectively.

Table 5 clarified the distribution of the participants' children according to their scores of assessing the distress of retching feeling pre and post intervention, it is clear from this table that 45.5% of children in the study group experienced a mild distress associated with retching pre-intervention which improved to 54.5% of children who didn't experience any distress in the third day of intervention compared to 57.6% of children in the control group who experienced a mild distress from retching which getting worse to 54.5% of children who experienced a moderate distress with highly statistical significant differences among the two groups before and after intervention (at p<0.001 and =0.001) respectively.

Apparently, Table 6 42.2% of children of the study group threw up 3-4 times pre-PMRT implementation, this percentage improved to 39.4% who didn't throw up post-PMRT at the second day of the intervention with highly statistical significant difference at p<0.001 compared to 39.4% of children in the other group who threw up from 1-2 times/day pre-routine care and chemotherapy dose which had become worse after chemotherapy and routine care to 36.4% of children who threw up from 3-4 times/day with no statistical significance difference at p = 0.89.

Moreover, the same table proved that 48.5% children of the study group experienced vomiting 3-4 times before intervention, which improved to 54.5% who didn't have vomiting after intervention in the third day of the

intervention compared to 42.4% of children among the control group who experienced vomiting from 1-2 times, getting worse after routine care dose to 33.3% who experienced vomiting from 3-4 times. There were highly statistical significance differences among the study and control group at p<0.001 and 0.007 respectively.

Table 7 clarified the distribution of the participants' children according to their scores of assessing the distress of vomiting experience pre and post intervention. It was observed that, there was highly statistical significant differences in the study group at p<0.001 pre and post intervention at the first, second and third day of the intervention and among the control group pre and post application of routine care only at the third day.

Apparently, Table 8 revealed distribution of the participants' children according to their scores of assessing the relaxation feeling pre and post intervention. It was evident from this table that there were highly statistical significance differences at p<0.001 in the three days of the intervention among the study group in which children felt more relaxed compared to children among the control group who felt more tensed with no statistical significance differences at the three days of application of routine care (with p=0.84, 0.30 and 0.07) respectively.

Table 9 revealed the association between the total frequency and duration of nausea experience, and the behavioral relaxation self-rating scale, this table proved that there was a positive association between the total frequency, duration of nausea experience and total relaxation feeling after implementation of PMPT sessions in the three days of intervention at p<0.001 in which children in the experimental group felt less nauseated concerning frequency, duration and felt more relaxed compared to children in the other group.

Table 10 indicated the association between the total frequency of retching, distress accompanied with retching and the behavioral relaxation self-rating scale among the two study groups pre and post intervention, this table proved that there was a positive association between the total frequency and distress of retching, and total relaxation feeling after implementation of PMPT sessions at p<0.001 in the three days of intervention.

Table 11 Concerning association between total frequency and amount of vomiting, and the behavioral relaxation self-rating scale among the two study groups pre/post intervention, this table clarified that there was a positive association between the total frequency, amount of vomiting and total relaxation feeling in the three days of intervention after implementation of PMPT sessions at p<0.001 in which children in the experimental group were experienced less amount and frequency of vomiting and felt more relaxed than those in the other group.

Table 12 There was a positive association between the nauseating experience and the frequency of PMRT sessions in which children in the study group had experienced less episodes of nausea at day three of the application of PMRT at p=0.01 than the previous two days.

Table 13 Regarding the association between the total frequency, amount and distress vomiting subscale, and the frequency of PMRT sessions among the study group post intervention, there was a positive association between the vomiting experience and the frequency of PMRT sessions in which children had no vomiting at day three at p=0.001.

Table 1. Distribution of the participants' children according to their demographic characteristics (n=66)

Demographic characteristics	Control group n=33(%)	Study group n=33(%)	Test of Significance
Gender			
Boy	24(72.7)	23(69.7)	χ^2=0.07
Girl	9(27.3)	10(30.3)	p=**0.78**
Age/years			
7- <12	24(72.7)	22(66.7)	χ^2=0.2,
12- ≤18	9(27.2)	11(33.3)	p=0.59
Mean±SD	10.55±2.7	10.36±2.5	t=0.28, p=**0.78**
Level of education			
Can't read and write	1(3.0)	0(0.0)	MC p=**0.52**
Primary	19(57.6)	21(63.6)	
Preparatory	11(33.3)	8(24.2)	
Secondary	2(6.1)	4(12.1)	

t=Student t test p: probability χ^2=Chi-Square test
MC: Monte Carlo test *statistically significant (p<0.05).

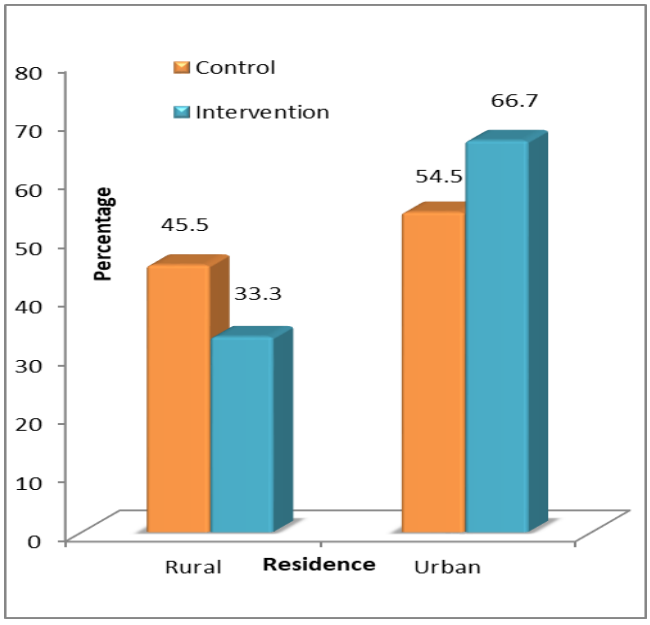

Figure 1. Distribution of the participants' children according to their residence (n=66)

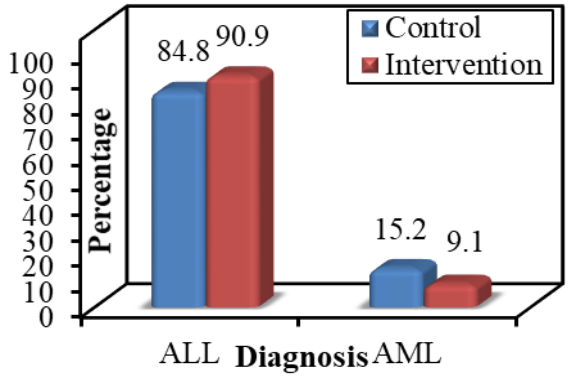

Figure 2. Distribution of the participants' children according to their diagnosis (n=66)

Table 2. Distribution of the participants' children according to their scores of assessing the frequency of nausea episodes pre and post intervention (n=66)

Nausea subscale	Control group (n=33)				$^{MH}p_1$	Study group (n=33)				$^{MH}p_2$
	Pre		Post			Pre		Post		
	No.	%	No.	%		No.	%	No.	%	
Felt nauseated or sick at stomach / times										
1st day										
None	0	0.0	0	0.0		1	3.0	6	18.2	
1-2 times	12	36.4	12	36.4	**0.590**	13	39.4	24	72.7	**<0.001***
3-4 times	20	60.6	18	54.5		16	48.5	3	9.1	
>4 times	1	3.0	3	9.1		3	9.1	0	0.0	
2nd day										
None	1	3.0	3	9.1		0	0.0	16	48.5	
1-2 times	22	66.7	11	33.3	**0.096**	15	45.5	17	51.5	**<0.001***
3-4 times	10	30.3	16	48.5		16	48.5	0	0.0	
>4 times	0	0.0	3	9.1		2	6.1	0	0.0	
3rd day										
None	13	39.4	4	12.1		1	3.0	21	63.6	
1-2 times	20	60.6	11	33.3	**<0.001***	20	60.6	10	30.3	**<0.001***
3-4 times	0	0.0	15	45.5		9	27.3	2	6.1	
>4 times	0	0.0	3	9.1		3	9.1	0	0.0	

MH: Marginal Homogeneity Test p: probability
*: Statistically significant at $p \leq 0.05$.

Table 3. Distribution of the participants' children according to their scores of assessing the duration of nausea episodes pre and post intervention (n=66)

Nausea subscale	Control group (n=33)				$^{MH}p_1$	Study group (n=33)				$^{MH}p_2$
	Pre		Post			Pre		Post		
	No.	%	No.	%		No.	%	No.	%	
Felt nauseated or sick at stomach / hours										
1st day										
Not at all	0	0.0	0	0.0		0	0.0	6	18.2	
1 hour or less	7	21.2	12	36.4		15	45.5	18	54.5	
2-3 hours	18	54.5	18	54.5	0.116	12	36.4	5	15.2	0.024*
4-6 hours	6	18.2	2	6.1		4	12.1	4	12.1	
More than 6 hours	2	6.1	1	3.0		2	6.1	0	0.0	
2nd day										
Not at all	1	3.0	3	9.1		0	0.0	13	39.4	
1 hour or less	15	45.5	16	48.5		16	48.5	17	51.5	
2-3 hours	14	42.4	13	39.4	0.343	13	39.4	3	9.1	<0.001*
4-6 hours	3	9.1	0	0.0		4	12.1	0	0.0	
More than 6 hours	0	0.0	1	3.0		0	0.0	0	0.0	
3rd day										
Not at all	10	30.3	4	12.1		1	3.0	18	**54.5**	
1 hour or less	18	**54.5**	15	**45.5**		14	42.4	15	45.5	
2-3 hours	5	15.2	14	42.4	**0.016***	16	**48.5**	0	0.0	**<0.001***
4-6 hours	0	0.0	0	0.0		2	6.1	0	0.0	
More than 6 hours	0	0.0	0	0.0		0	0.0	0	0.0	

MH: Marginal Homogeneity Test p: probability
*: Statistically significant at $p \leq 0.05$.

Table 4. Distribution of the participants' children according to their their scores assessing the distress of nausea episodes pre and post intervention (n=66)

Vomiting subscale	Control group (n=33)				$^{MH}p_1$	Study group (n=33)				$^{MH}p_2$
	Pre		Post			Pre		Post		
	No.	%	No.	%		No.	%	No.	%	
Threw up times										
1st day										
None	0	0.0	0	0.0		0	0.0	6	18.2	
1-2 times	6	18.2	6	18.2	0.336	9	27.3	9	27.3	0.030*
3-4 times	9	27.3	14	42.4		11	33.3	9	27.3	
> 4 times	18	54.5	13	39.4		13	39.4	9	27.3	
2nd day										
None	1	3.0	3	9.1		0	0.0	13	**39.4**	
1-2 times	13	**39.4**	10	30.3	**0.891**	10	30.3	12	36.4	**<0.001***
3-4 times	11	33.3	12	**36.4**		14	**42.4**	7	21.2	
> 4 times	8	24.2	8	24.2		9	27.3	1	3.0	
3rd day										
None	10	30.3	4	12.1		1	3.0	18	**54.5**	
1-2 times	14	**42.4**	10	30.3	**0.007***	9	27.3	13	39.4	**<0.001***
3-4 times	7	21.2	11	**33.3**		16	**48.5**	2	6.1	
> 4 times	2	6.1	8	24.2		7	21.2	0	0.0	

MH: Marginal Homogeneity Test p: probability *: Statistically significant at $p \leq 0.05$

Table 5. Distribution of the participants' children according to their scores of assessing the distress of retching episodes pre and post intervention (n=66)

Retching subscale	**Control group (n=33)**				$^{MH}p_1$	**Study group (n=33)**				$^{MH}p_2$
	Pre		**Post**			**Pre**		**Post**		
	No.	**%**	**No.**	**%**		**No.**	**%**	**No.**	**%**	
Felt distress from retching or dry heaves										
1st day										
No	0	0.0	0	0.0		0	0.0	6	18.2	
Mild	6	18.2	7	21.2	1.000	11	33.3	19	57.6	0.002*
Moderate	21	63.6	17	51.5		15	45.5	5	15.2	
Great	3	9.1	8	24.2		4	12.1	3	9.1	
Severe	3	9.1	1	3.0		3	9.1	0	0.0	
2nd day										
No	1	3.0	3	9.1		0	0.0	13	39.4	
Mild	15	45.5	11	33.3		12	36.4	19	57.6	
Moderate	16	48.5	16	48.5	0.724	15	45.5	1	3.0	<0.001*
Great	1	3.0	3	9.1		6	18.2	0	0.0	
Severe	0	0.0	0	0.0		0	0.0	0	0.0	
3rd day										
No	10	30.3	4	12.1		1	3.0	18	**54.5**	
Mild	19	**57.6**	10	30.3		15	**45.5**	15	45.5	
Moderate	4	12.1	18	**54.5**	**0.001***	13	39.4	0	0.0	**<0.001***
Great	0	0.0	1	3.0		4	12.1	0	0.0	
Severe	0	0.0	0	0.0		0	0.0	0	0.0	

MH: Marginal Homogeneity Test p: probability *: Statistically significant at $p \leq 0.05$

Table 6. Distribution of the participants' children according to scores of assessing frequency of vomiting experience pre and post intervention (n=66)

Vomiting subscale	Control group (n=33)				$^{MH}p_1$	Study group (n=33)				$^{MH}p_2$
	Pre		Post			Pre		Post		
	No.	%	No.	%		No.	%	No.	%	
Threw up times										
1st day										
None	0	0.0	0	0.0		0	0.0	6	18.2	
1-2 times	6	18.2	6	18.2	0.336	9	27.3	9	27.3	0.030*
3-4 times	9	27.3	14	42.4		11	33.3	9	27.3	
> 4 times	18	54.5	13	39.4		13	39.4	9	27.3	
2nd day										
None	1	3.0	3	9.1		0	0.0	13	**39.4**	
1-2 times	13	**39.4**	10	30.3	**0.891**	10	30.3	12	36.4	**<0.001***
3-4 times	11	33.3	12	**36.4**		14	**42.4**	7	21.2	
> 4 times	8	24.2	8	24.2		9	27.3	1	3.0	
3rd day										
None	10	30.3	4	12.1		1	3.0	18	**54.5**	
1-2 times	14	**42.4**	10	30.3	**0.007***	9	27.3	13	39.4	**<0.001***
3-4 times	7	21.2	11	**33.3**		16	**48.5**	2	6.1	
> 4 times	2	6.1	8	24.2		7	21.2	0	0.0	

MH: Marginal Homogeneity Test, p: probability, *: Statistically significant at $p \leq 0.05$.

Table 7. Distribution of the participants' children according to their scores of assessing the distress of vomiting experience pre and post intervention (n=66)

Vomiting subscale	Control group (n=33)				$^{MH}p_1$	Study group (n=33)				$^{MH}p_2$
	Pre		Post			Pre		Post		
	No.	%	No.	%		No.	%	No.	%	
Felt distress from vomiting or throwing up										
1st day										
No	0	0.0	0	0.0		1	3.0	6	18.2	
Mild	12	36.4	10	30.3	0.433	12	36.4	24	72.7	**<0.001***
Moderate	20	60.6	20	60.6		14	42.4	3	9.1	
Great	1	3.0	3	9.1		3	9.1	0	0.0	
Severe	0	0.0	0	0.0		3	9.1	0	0.0	
2nd day										
No	2	6.1	3	9.1		0	0.0	16	48.5	
Mild	23	69.7	13	39.4		13	39.4	16	48.5	
Moderate	8	24.2	15	45.5	0.086	15	45.5	0	0.0	**<0.001***
Great	0	0.0	2	6.1		5	15.2	1	3.0	
Severe	0	0.0	0	0.0		0	0.0	0	0.0	
3rd day										
No	13	39.4	4	12.1		1	3.0	20	60.6	
Mild	20	60.6	12	36.4		20	60.6	11	33.3	
Moderate	0	0.0	16	48.5	**<0.001***	8	24.2	2	6.1	**<0.001***
Great	0	0.0	1	3.0		4	12.1	0	0.0	
Severe	0	0.0	0	0.0		0	0.0	0	0.0	

MH: Marginal Homogeneity Test, p: probability, *: Statistically significant at $p \leq 0.05$.

Table 8. Distribution of the participants' children according to their scores of assessing the relaxation feeling pre and post intervention (n=66)

Behavioral relaxation self – rating scale	Control group (n=33)				$^{MH}p_1$	Study group (n=33)				$^{MH}p_2$
	Before routine care		After routine care			Before PMRT session		After PMRT session		
	No.	%	No.	%		No.	%	No.	%	
1st day										
Feeling extremely tense and upset throughout body	5	15.2	3	9.1		2	6.1	0	0.0	
Feeling generally tense throughout body	13	39.4	18	54.5		11	33.3	1	3.0	
Feeling some tension in some parts of body	15	45.5	10	30.3		19	57.6	13	39.4	
Feeling relaxed as in normal resting scale	0	0.0	2	6.1	**0.835**	1	3.0	16	48.5	**<0.001***
Feeling more relaxed than usual	0	0.0	0	0.0		0	0.0	3	9.1	
Feeling completely relaxed throughout body	0	0.0	0	0.0		0	0.0	0	0.0	
Feeling more deeply and completely relaxed than I ever have	0	0.0	0	0.0		0	0.0	0	0.0	
2nd day										
Feeling extremely tense and upset throughout body	2	6.1	15	45.5		1	3.0	0	0.0	
Feeling generally tense throughout body	11	33.3	13	39.4		6	18.2	5	15.2	
Feeling some tension in some parts of body	20	60.6	5	15.2		17	51.5	15	45.5	
Feeling relaxed as in normal resting scale	0	0.0	0	0.0	**0.297**	9	27.3	9	27.3	**<0.001***
Feeling more relaxed than usual	0	0.0	0	0.0		0	0.0	0	0.0	
Feeling completely relaxed throughout body	0	0.0	0	0.0		0	0.0	4	12.1	
Feeling more deeply and completely relaxed than I ever have	0	0.0	0	0.0		0	0.0	0	0.0	
3rd day										
Feeling extremely tense and upset throughout body	11	33.3	0	0.0		0	0.0	1	3.0	
Feeling generally tense throughout body	0	0.0	16	48.5		0	0.0	0	0.0	
Feeling some tension in some parts of body	15	45.5	13	39.4		10	30.3	0	0.0	
Feeling relaxed as in normal resting scale	7	21.2	4	12.1		19	57.6	10	30.3	
Feeling more relaxed than usual	0	0.0	0	0.0		4	12.1	8	24.2	
Feeling completely relaxed throughout body	0	0.0	0	0.0		0	0.0	5	15.2	
Feeling more deeply and completely relaxed than I ever have	0	0.0	0	0.0		0	0.0	9	27.3	

MH: Marginal Homogeneity Test, p: probability,*: Statistically significant at $p \leq 0.05$.

Table 9. Association between the total frequency and duration of nausea experience, and the behavioral relaxation self-rating scale among the two study groups pre/post intervention (n= 66)

Total nausea subscale	Behavioral relaxation self-rating scale			
	Study group		Control group	
	Total pre implementation of PMPT sessions	Total post implementation of PMPT sessions	Total pre demonstration of routine care	Total post demonstration of routine care
frequency of nausea	r = - 0.08 p = 0.63	r =-0.729 p< 0.001*	r = 0.14 p = 0.43	r = -0.14 p = 0.07
duration of nausea	r = - 0.14 p = 0.43	r = -0.73 p< 0.001*	r = 0.40 p = 0.08	r = -0.21 p = 0.14

r: Pearson correlation coefficient for continuous parametric and Spearman correlation for non-parametric and ordinal variables, p: probability, *statistically significant (p<0.05).

Table 10. Association between the total frequency and distress of retching experience, and the behavioral relaxation self-rating scale among the two study groups pre/post intervention (n= 66)

Total retching subscale	Behavioral relaxation self-rating scale			
	Study group		Control group	
	Total pre implementation of PMPT sessions	Total post implementation of PMPT sessions	Total pre demonstration of routine care	Total post demonstration of routine care
frequency of retching	r = 0.23 p = 0.20	r = 0.71 p< 0.001*	r = -.041 p = .820	r = -.059 p=.745
distress of retching	r=0.38 p=0.039	r=-0.76 p<0.001*	r = -.014 p=.938	r = -.076 p= .676

r: Pearson correlation coefficient for continuous parametric and Spearman correlation for non-parametric and ordinal variables, p: probability, *statistically significant (p<0.05).

Table 11. Association between the total frequency and amount of vomiting experience, and the behavioral relaxation self-rating scale among the two study groups pre/post intervention (n= 66)

Vomiting subscale	Behavioral relaxation self-rating scale			
	Study group		Control group	
	Total pre implementation of PMPT sessions	Total post implementation of PMPT sessions	Total pre demonstration of routine care	Total post demonstration of routine care
Total frequency of vomiting	r = -0.14 p = 0.44	r = -0.73 p< 0.001*	r = 0.274 p = 0.12	r = -0.18 p = 0.11
Total amount of vomiting	r = -0.12 p = 0.51	r = -0.73 p< 0.001*	r = 0.23 p = 0.20	r = -0.24 p = 0.27

r:Pearson correlation coefficient for continuous parametric and Spearman correlation for non-parametric and ordinal variables, p:probability, *statistically significant (p<0.05).

Table 12. Association between the frequency of PMRT sessions and the total frequency, duration, and distress of nausea among the study group post-intervention (n= 33)

Frequency of PMRT sessions	Total nausea subscale (Total frequency, duration, and distress of nausea)
	Study group
	Nausea experience post PMRT
Session one	r = 0.149 p = 0.41
Session two	r = 0.17 p = 0.34
Session three	r = 0.78 **p = 0.01***

r:Pearson correlation coefficient for continuous parametric and Spearman correlation for non-parametric and ordinal variables, p: probability, *statistically significant (p<0.05).

Table 13. Association between the frequency of PMRT sessions and the total frequency, amount and distress of vomiting experience among the study group post-intervention (n= 33)

Frequency of PMRT sessions	Total vomiting subscale (frequency, amount and distress of vomiting)
	Study group
	vomiting experience post PMRT
Session one	r = 0.08 p = 0.66
Session two	r = 0.26 p = 0.15
Session three	r = 0.89 **p = 0.001***

r:Pearson correlation coefficient for continuous parametric and Spearman correlation for non-parametric and ordinal variables, p: probability, *statistically significant (p<0.05)

5. Discussion

One of the current study findings revealed that, more than two thirds of children in both study groups were boys (Table 1). This result was in the same line with Hasanbegovic, Begic, Hasanbegovic & Begic [23] who carried out a study about "Socio-demographic characteristics of patients with diagnosis of leukemia in Bosnia and Herzegovina during six-year period" and mentioned that the incidence of leukemia are higher in boys than girls. In addition, this study is parallel to a study done by Sousa, Ferreira, Félix & Lopes [24] about "Acute lymphoblastic leukemia in children and adolescents: prognostic factors and analysis of survival" and mentioned that ALL is slightly most common in boys which is the commonest type of leukemia.

The finding of the current study showed that, more than two thirds in both two study groups were aged between 7 to less than 12 years old (Table 1). These finding is in accordance with the result of Ezzat et al. [25], who conducted a recent study about "Environmental, maternal, and reproductive risk factors for childhood acute lymphoblastic leukemia in Egypt: a case-control" and found that almost children were diagnosed with leukemia at ≤14 years old and it was high in the age groups from 5 to 10 years old. On the On the contrary, this result was in the same line with El-Shafey, Amer, Allam & El-Alfy [1], who found that leukemia is diagnosed in children younger than fifteen years old in their study about "Hematological studies in Egyptian children with acute lymphoid and myeloid leukemia". Additionally, this was agreed with Khaoula et al. [26] in their study in Setif-Algeria and confirmed that, a higher rate of children was observed diagnosed with leukemia at the youngest age commonly less than fifteen years old.

In relation to the educational level of the studied children, the present study showed that, a relatively lower percentage of children in both study two groups who were not educated (Table 1). This finding was in disagreement with Khalek, Sherif, Kamal, Gharib & Shawky [27] who mentioned that, less than half of the children were not educated which is relatively high percentage in their recent study about "Acute lymphoblastic leukemia: Are Egyptian children adherent to maintenance therapy? ".

The finding of this study cleared that, two thirds of children in the study group and more than half of children

in the control group were from urban origin (Figure 1). This finding was in disagreement with Amitay & Keinan-Boker [28] who conducted a study about "breast feeding and childhood leukemia incidence: a meta-analysis and systematic review" and found that, the higher percentage of children diagnosed with childhood leukemia were from rural origin. The researcher can interpret this result from her point of view in the context of this fact that, there were many risk factors that contribute the occurrence of leukemia such as exposures to solvents, pesticides, traffic and smoking that are common in urban than rural areas.

In relation to the children diagnosis, the present study showed that, the vast majority of the study group and majority of the control group were diagnosed with acute lymphoblastic leukemia (Figure 2). This result was in the same line with Cooper & Brown, [3] who conducted a study about "treatment of pediatric acute lymphoblastic leukemia" and found that, the most common cancer diagnosed in the pediatric oncology field is acute lymphocytic leukemia.

Furthermore, this previous finding goes in the line with Bhojwani, Yang & Pui [5] who reported that acute lymphoid leukemia is the most common among oncology children was about one quarter of all childhood cancers and in the United States about three thousand of children aged from one to nineteen years old are diagnosed with ALL every year. Additionally, this result is contrary to El-Shafey, Amer, Allam & El-Alfy [1] who found that, ALL occurs 5 times more frequently than AML and accounts for 78% of all childhood leukemia.

Concerning the nausea and vomiting frequency according to scores of Rhodes index items pre and post intervention, this result revealed that chemotherapy-induced nausea and vomiting occurred during the acute and delayed times and children in the control group had more experienced delayed nausea and vomiting in relation to frequency even after routine care demonstration (Table 2 & Table 6). This result is congruent with Rodgers et al. [29] in their study about "Children's coping strategies for chemotherapy-induced nausea and vomiting" who found that CINV occurred during the acute and delayed phase and the highest frequency during delayed post chemotherapy nausea and vomiting is greater than 50% even after anti-emetic prophylaxis.

It is illustrated from the current study that, the duration of nausea had decreased after application of PMRT in children of the study group than children in the control group with statistical significance difference in the three days of intervention, (Table 3). This finding was in an accordance with Molassiotis, Yung, Yam, Chan & Mok [30] who conducted a chinese study about "The effectiveness of progressive muscle relaxation training in managing chemotherapy-induced nausea and vomiting in Chinese breast cancer patients: a randomised controlled trial" and reported that, performing progressive muscle relaxation technique reduced the duration of nausea in the study group compared to the other group with statistical significance differences at $p<0.05$ in the first four days of intervention.

The result of current study pointed out that, the distress associated with nausea, vomiting and retching felt by children in the study group after the application of PMRT sessions was less than the control group after routine care demonstration with a highly statistical significance differences at $p \leq 0.001$ (Table 4, Table 5 & Table 7). Similarly, Charalambous et al. [31] who reported in their study that, the mean distress level accompanied with nausea, vomiting and retching in the study group decreased compared with the control group.

Furthermore, this previous result is proportionate with a study done by Mustian et al. [32], about "Treatment of nausea and vomiting during chemotherapy", who reported that PMRT, acupuncture, hypnosis, guided imagery and exercise could help in controlling of anticipatory, acute and delayed CINV with anti-emetic mediations than the use of pharmalogical methods alone.

The finding of the current study demonstrated that, there were statistically reduction in frequency of vomiting, in which children in the study group had less frequent vomiting post-PMRT compared to children in the other group who experienced more vomiting, (Table 6). This finding was supported by Kapogiannis, Tsoli & Chrousos [33] who conducted a study about "Investigating the effects of the progressive muscle relaxation-guided imagery combination on patients with cancer receiving chemotherapy treatment: A systematic review of randomized controlled trials" and stated that, frequency of vomiting had significantly reduced after application of progressive muscle relaxation technique in the experiential group than the control group.

Concerning the relaxation feeling of children pre and post intervention by behavioral relaxation self-rating scale, this study showed that the children in the study group felt less tensed after PMRT compared to children in the other group with a very high statistical significant difference at $p<0.001$ at the three days of application of PMRT (Table 8). The result is contrary to Tsitsi, Charalambous, Papastavrou & Raftopoulos [34], who found that the same finding in which study group felt less tension after PMRT application 2.93 ± 0.91 vs 2.26 ± 0.90 at $p = 0.001$ compared to the other group in their study about "Effectiveness of a relaxation intervention (progressive muscle relaxation and guided imagery techniques) to reduce anxiety and improve mood of parents of hospitalized children with malignancies: A randomized controlled trial in Republic of Cyprus and Greece".

Additionally, more than half of children in the study group felt tension in their bodies before PMRT application, which decreased after intervention to less than half in the first three days of intervention with highly statistical significance differences at $p<0.001$ (Table 8). This result was proportionate with Magor, Darwish, Elsayed, El-shanshory & Elsaadany [13] who conducted a study about "Effect of progressive muscle relaxation technique versus accpressure on chemotherapy induced nausea and vomiting in leukemic children", and reported that tension felt by children through their body before PMRT application, were reduced after performing PMRT among the study group at the first three days of intervention respectively.

Regarding the relationship between the total frequency of nausea, retching and vomiting, duration of nausea experience, the distress of retching and the amount of vomiting, and the behavioral relaxation self-rating scale pre/post intervention, there was a positive relation

between the two study groups, in which children in the intervention group were experienced less experience, occurrence and distress of nausea, retching and vomiting than the other group after intervention with highly statistical significant difference at p<0.001 (Table 9, Table 10 & Table 11). These findings are congruent with Charalambous et al. [31], whose conducted a study about "Guided imagery and progressive muscle relaxation as a cluster of symptoms management intervention in patients receiving chemotherapy: a randomized control trial" who demonstrated that nausea, vomiting and retching experience, occurrence and distress associated with chemotherapy were significantly lower in the experimental group compared to the control group post application of PMRT.

The result of the current study pointed out that, there was a positive relation between the total nausea and vomiting experience and the numbers of PMRT sessions in which children in the intervention group had less experienced nausea and vomiting at day three of the application of PMRT than the previous two days (Table 12 & Table 13). This finding was supported by Kim, Na & Hong [35] in their study about "Effects of progressive muscle relaxation therapy in colorectal cancer patients" who reported that, the degree of nausea and vomiting after chemotherapy in 60 breast cancer patients had significantly reduced in the study group receiving PMRT over the three days of the intervention.

6. Conclusion

Overall, the study proved the positive effect of applying a progressive muscle relaxation technique on reducing the nausea and vomiting induced by chemotherapy among leukemic children of the study group.

7. Recommendations

1- Self-practice of progressive muscle relaxation sessions from the first dose of chemotherapy in order to preserve energy and decrease the occurrence of nausea and vomiting through the treatment course of chemotherapy.

2- Distribute flyers about PMRT steps as a source (reference) to all children and nursing staff in the oncology centers.

3- Providing in-service training and regular educational programs or courses about progressive muscle relaxation as complementary and alternative medicine to internalize the natural methods for improving health and relieving nausea and vomiting associated with chemotherapy.

4-The daily practice of the progressive muscle relaxation technique can be help in restoring physical, psychological and decreasing tense feeling that includes being irritable and nervous.

5-Generally, the alternative modalities and progressive muscle relaxation in particular should be included in the nursing curriculum as most of these techniques are safe, inexpensive and easy to learn.

8. Approach for Further Studies

1- Replication of this study with larger sample in other fields and different setting so that the results could be generalized.

2- Study the effect of progressive muscle relaxation technique on the other side effects of chemotherapy, such as pain, fatigue, anxiety and depression etc. in order to improve overall patients' health condition.

3- Study patient's perception toward using new complementary alternative modalities of other non-pharmacological techniques than using of pharmacological techniques.

Acknowledgements

Special thanks should be given to the studied children and all staff members at the study setting for their help in conducting this study.

References

[1] El-Shafey, A. S., Amer, S. M., Allam, N. G., & El-Alfy, M. S. (2017). Hematological studies in Egyptian children with acute lymphoid and myeloid leukemia. *Int. J. Adv. Biomed*, *2*(1), 27-37.

[2] Ward, E., DeSantis, C., Robbins, A., Kohler, B., & Jemal, A. (2014). Childhood and adolescent cancer statistics, 2014. *CA: a cancer journal for clinicians*, *64*(2), 83-103.

[3] Cooper, S. L., & Brown, P. A. (2015). Treatment of pediatric acute lymphoblastic leukemia. *Pediatric Clinics*, *62*(1), 61-73.

[4] Madmoli, M. (2018). Clinical and Laboratory Finding in Children with Leukemia: a Systematic Review. *International Journal of Research Studies in Science, Engineering, and Technology*, *5*(10), 2018.

[5] Bhojwani, D., Yang, J. J., & Pui, C. H. (2015). Biology of childhood acute lymphoblastic leukemia. *Pediatric Clinics*, *62*(1), 47-60.

[6] Khan, M. I., Khan, S. A., Rahman, S. U., & Yasmeen, N. (2018). Response of induction therapy in different immmunological subtypes of acute lymphoblastic leukemia in children. *Journal Of Medical Sciences*, *26*(1), 28-32.

[7] Ahmed, A. Y., & Saad, A. H. (2017). Admissions and mortality in an Egyptian paediatric tertiary care hospital. *Egyptian Pediatric Association Gazette*, *1*(65), 25-29.

[8] UN published statistical data El-Mansoura University Oncology Center (2017).

[9] Rose-Inman, H., & Kuehl, D. (2017). Acute leukemia. *Hematology/Oncology Clinics*, *31*(6), 1011-1028.

[10] Lights, V., Reed-Guy, L., & Boskey, E. (2017). *Leukemia*. Available at: https://www.healthline.com/health/leukemia.

[11] Dhar, P. K., Naskar, T. K., & Majumder, D. (2018). Optimal Choice Between Chemotherapy and Immunotherapy for Leukemia Treatment Depends on Individual Patients' Patho-physiological State. *In Progress in Computing, Analytics and Networking* (pp. 643-653). Springer, Singapore.

[12] Escalante, J., McQuade, R. M., Stojanovska, V., & Nurgali, K. (2017). Impact of chemotherapy on gastrointestinal functions and the enteric nervous system. Maturitas, 105, 23-29.

[13] Magor, N., Darwish, A., Elsayed, E., El-shanshory, M., & Elsaadany, H. (2014). Effect of progressive muscle relaxation technique versus accpressure on chemotherapy induced nausea and vomiting in leukemic children. *International Journal of Current Research*, *6*(7), 7674-7682.

[14] Gibson, F., Shipway, L., Aldiss, S., Hawkins, J., King, W., Parr, M., ... & Taylor, R. M. (2013). Exploring the work of nurses who administer chemotherapy to children and young people. *European Journal of Oncology Nursing*, *17*(1), 59-69.

[15] Ślifirczyk, A., Piszcz, P., Michalczuk, T., Ślifirczyk, M., Urbańczuk, M., Celiński, M., ... & Nikoniuk, M. (2018). Nursing care of a child with acute lymphoblastic leukemia. *Progress in Health Sciences*, *8*(2), 168-173.

[16] Taha, N. M., Zatton, H. K., & Zatton, H. I. (2017). Nurses Knowledge and Practice Regarding Educational Needs for Patients with Leukemia. *J Nurs Care*, *6*(406), 2167-1168.

[17] Suh, E. E. (2012). The effects of P6 acupressure and nurse-provided counseling on chemotherapy-induced nausea and vomiting in patients with breast cancer. *Oncology nursing forum* , *39*(1).

[18] Frisch, N. C., & Frisch, L. E. (2011). *Psychiatric mental health nursing* (4th ed., pp. 307-334). Delmar, Cengage Learning Co.

[19] Satija, A., & Bhatnagar, S. (2017). Complementary therapies for symptom management in cancer patients. *Indian journal of palliative care*, *23*(4), 468.

[20] Rhodes, V. A., & McDaniel, R. W. (1999, June). The Index of Nausea, Vomiting, and Retching: a new format of the lndex of Nausea and Vomiting. *Oncology nursing forum*, *26* (5), 889-894.

[21] Norton, M., Holm, J. E., & McSherry II, W. C. (1997). Behavioral assessment of relaxation: The validity of a behavioral rating scale. *Journal of behavior therapy and experimental psychiatry*, *28*(2), 129-137.

[22] Selva., J. (2019). Progressive muscle relaxation (PMR): A positive psychology guide. Available at: https://positivepsychologyprogram.com/progressive-muscle-relaxation-pmr/. (Last accessed 21 August 2019).

[23] Hasanbegovic, E., Begic, N., Hasanbegovic, S., & Begic, Z. (2016). Socio-demographic characteristics of patients with diagnosis of leukemia in Bosnia and Herzegovina during six-year period. *Materia socio-medica*, *28*(6), 473.

[24] Sousa, D. W. L. D., Ferreira, F. V. D. A., Félix, F. H. C., & Lopes, M. V. D. O. (2015). Acute lymphoblastic leukemia in children and adolescents: prognostic factors and analysis of survival. *Revista brasileira de hematologia e hemoterapia*, *37*(4), 223-229.

[25] Ezzat, S., Rashed, W. M., Salem, S., Dorak, M. T., El-Daly, M., Abdel-Hamid, M., ... & Loffredo, C. (2016). Environmental, maternal, and reproductive risk factors for childhood acute lymphoblastic leukemia in Egypt: a case-control study. *BMC cancer*, *16*(1), 662.

[26] Khaoula, B., Lamia, K., Zoubida, Z., Souad, B., Hafida, B., Saddek, B., & Mokhtar, H. C. (2017). Age Characteristics of Patients with Diagnosis of Leukemia in Setif-Algeria: Intelligent Modeling System. *International Journal of Public Health Research*, *5*(2), 31.

[27] Khalek, E. R. A., Sherif, L. M., Kamal, N. M., Gharib, A. F., & Shawky, H. M. (2015). Acute lymphoblastic leukemia: Are Egyptian children adherent to maintenance therapy?. *Journal of cancer research and therapeutics*, *11*(1), 54.

[28] Amitay, E. L., & Keinan-Boker, L. (2015). Breastfeeding and childhood leukemia incidence: a meta-analysis and systematic review. *JAMA pediatrics*, *169*(6), e151025-e151025.

[29] Rodgers, C., Norville, R., Taylor, O., Poon, C., Hesselgrave, J., Gregurich, M. A., & Hockenberry, M. (2012). Children's coping strategies for chemotherapy-induced nausea and vomiting. In *Oncology Nursing Forum*. *39*, 2.

[30] Molassiotis, A., Yung, H. P., Yam, B. M., Chan, F. Y., & Mok, T. (2002). The effectiveness of progressive muscle relaxation training in managing chemotherapy-induced nausea and vomiting in Chinese breast cancer patients: a randomised controlled trial. *Supportive Care in Cancer*, *10*(3), 237-246.

[31] Charalambous, A., Giannakopoulou, M., Bozas, E., Marcou, Y., Kitsios, P., & Paikousis, L. (2016). Guided imagery and progressive muscle relaxation as a cluster of symptoms management intervention in patients receiving chemotherapy: a randomized control trial. *PloS one*, *11*(6), e0156911.

[32] Mustian, K. M., Devine, K., Ryan, J. L., Janelsins, M. C., Sprod, L. K., Peppone, L. J., ... & Morrow, G. R. (2011). Treatment of nausea and vomiting during chemotherapy. *US oncology & hematology*, *7*(2), 91.

[33] Kapogiannis, A., Tsoli, S., & Chrousos, G. (2018). Investigating the Effects of the Progressive Muscle Relaxation-Guided Imagery Combination on Cancer Patients Receiving Chemotherapy Treatment: A Systematic Review of Randomized Controlled Trials. *EXPLORE*, *14*(2), 137-143.

[34] Tsitsi, T., Charalambous, A., Papastavrou, E., & Raftopoulos, V. (2017). Effectiveness of a relaxation intervention (progressive muscle relaxation and guided imagery techniques) to reduce anxiety and improve mood of parents of hospitalized children with malignancies: A randomized controlled trial in Republic of Cyprus and Greece. European Journal of Oncology Nursing, 26, 9-18.

[35] Kim, K. J., Na, Y. K., & Hong, H. S. (2016). Effects of progressive muscle relaxation therapy in colorectal cancer patients. Western journal of nursing research, 38(8), 959-973.