

Effect of Therapeutic Massage on nausea and vomiting among Children with Leukemia following Chemotherapy

Youssria El- SayedYousef¹, Nora Abd- Elhamid Zaki², AsmaaAbd- Alasis³,
Heba Abdel- RazikSayed⁴, Fatma El- Zahraa Kamal El- Sayed⁵

¹Assistant Prof. of Pediatric Nursing- Faculty of Nursing- Sohag University, ²Assistant Prof. of Pediatric Nursing- Faculty of Nursing- Assiut University., ³ Assistant Prof. of Pediatric Nursing- Faculty of Nursing- Assiut University, ⁴Assistant Prof. of Pediatric Oncology- South Egypt Cancer Institute- Assiut University,

⁵Assistant Lecturer in Pediatric Nursing- Faculty of Nursing- Sohag University

Corresponding Author: Youssria El- SayedYousef

Abstract: Chemotherapy- induced nausea and vomiting are the most undesirable and common side effects of chemotherapy among children undergoing cancer treatment account for 70- 80%. **So this study aimed to determine the effect of therapeutic massage on nausea and vomiting among children with leukemia following chemotherapy.** A quasi- experimental research design was used to conduct the study. The study was conducted at Pediatric Oncology Department in South Egypt Cancer Institute at Assiut University and Pediatric Oncology Department at Sohag Cancer Center. A convenience sampling of 66 children with leukemia of aging 4- 16 years were divided into two groups study and control group (33 children for each group). Sample was collected for a period of 6 months. Two tools were utilized in the study, Sociodemographic and clinical interview questionnaire was developed to assess data about children and Rhodes Index of Nausea and Vomiting likert Scale was used to assess nausea and vomiting among the studied children.

The study revealed that, highly statistical significant difference was found between both groups in relation to frequency, distress and severity of nausea and frequency, duration and severity of vomiting ($p= 0.000$).

Conclusion: Children with leukemia who are receiving therapeutic massage were experiencing less incidence and severity of nausea and vomiting than those who are receiving only the routine hospital care.

Recommendations: Encourage health care professionals to use therapeutic massage techniques to reduce chemotherapy induced nausea and vomiting in children.

Key words: Therapeutic massage, Nausea and vomiting, Leukemia, Children and Chemotherapy.

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I. Introduction

Leukemias are the most common malignant neoplasm in childhood, accounting for about 31% of all malignancies that occur in children under 15 years (Metayer et al., 2013). Incidence and survival of childhood leukemia varies universally, and this variation may be due to genetics, environmental risk factors and/or disparities in diagnosis and treatment (Demanelis et al., 2015).

A thirteen year retrospective study of pediatric cancers in South Egypt Cancer Institute, Assiut University in Egypt, stated that, from January 2001 to December 2013, leukemias, myeloproliferative diseases and myelodysplastic diseases estimate 33.4% of all malignancies in the pediatric oncology department. Acute lymphoblastic leukemia (ALL) is the most common hematological malignancy. It estimates 29.3% of total malignancies and 87.8% of leukemias, myeloproliferative diseases and myelodysplastic diseases and 58% of hematological malignancies during period of study with peak incidence at the age group 1-<5 years (Ali et al., 2016).

Chemotherapy is a long-lasting treatment and leads to many side effects (Hayat, 2013; Can et al., 2011). Acute side effects after chemotherapy include nausea, vomiting, mucositis, diarrhea, constipation, rash, alopecia, dark skin, nail changes, ocular toxicity, arrhythmia, pericarditis, myocarditis, left ventricular changes, hypotension, pneumonitis, electrolyte disturbances, acute pancreatitis and leukoencephalopathy (Tomlinson and Kline, 2010).

Chemotherapy- induced nausea and vomiting are considered one of the most distressful side effects, causing much distress to the child and family. Nausea and vomiting are common symptoms in children with cancer with an incidence 90 % among patients receiving chemotherapy (Rodgers et al., 2012). Acute nausea and vomiting frequently begins within several hours of receiving chemotherapy and resolves within 24–48 hours. However, delayed symptoms can last up to 2 weeks (Phillips et al., 2016).

Nausea and vomiting stay a problem for children receiving treatment for malignancies despite new antiemetic drugs (Lou et al., 2014). Massage therapy is one of the more commonly used practices of complementary therapies used by children in general and specially children with cancer (Jacobs, 2014). It is considered as the use of therapeutic touch for reducing fatigue and pain and restoring function and structure of the nervous and musculoskeletal systems. The techniques of therapeutic massage vary, and involve manipulation of soft tissue manually, including holding, causing movement, and/or applying pressure to the body (Tomlinson and Kline, 2010). Pediatric massage is technically very easy to learn and requires cheap and little equipment however it needs time (Hughes et al., 2008). Massage therapy controls many side effects in patients with cancer such as fatigue, nausea, and anxiety (Lee et al., 2015).

Massage therapy applies its effects through psychological, physiological and mechanical pathways. Also, it decreases muscular tension, relieves pain, promotes relaxation, improves circulation, and increases flexibility. The theory of gate control suggests that massage may provide stimulation which helps to block pain signals sent to the brain. Serotonin and Endorphins can be released through therapeutic massage, which can improve mood. It may increase activity of autonomic nervous system causing combined effect at the hypothalamic level leading to a relaxation response. These effects may vary according to the patient's perception of touch (Mitchinson et al., 2014; Abrams et al., 2016).

Pediatric nurses are significant members of medical health groups and have vital role in pediatric cancer care; quality of the care could be improved through improving their performances and skills. So there is a need to develop educational tools for training nursing students, patients, and families on the use of therapeutic massage techniques (Hughes et al., 2008).

Significance of the study

Nausea and vomiting are the most common and unpleasant side effects of chemotherapy, they may be associated with extensive healthcare resource consumption, and may prevent successful treatment completion (Burke et al., 2011). Antiemetics not only cannot control nausea and vomiting completely but also have many side effects. So it is necessary to find other methods to improve control (Mazlum et al., 2013).

In spite of the popularity of CAM in children, there is few research on the effectiveness of most CAM in pediatrics. The use of CAM as part of a healthy lifestyle may provide support to survivors coping with effects of cancer and its treatment (Cindy et al., 2015).

Aim of the Study

This study aimed to determine the effect of therapeutic massage on nausea and vomiting among children with leukemia following chemotherapy.

Hypothesis

Children with leukemia who were receiving therapeutic massage are experiencing less incidence and severity of nausea and vomiting than those who were receiving only the routine hospital care.

II. Materials and Method

Research Design:

The quasi- experimental research design was used in the study.

Setting:

The study was conducted at Pediatric Oncology Department in South Egypt Cancer Institute in Assiut University and Pediatric Oncology Department at Sohag Cancer Center, Sohag.

Patients:

Convenience sampling of 66 children with leukemia. They were divided into two group study and control group (33 children for each group). Sample was collected for a period of 6 months.

The criteria for the selection of the study subjects were as follow:

- Children diagnosed with leukemia and hospitalized for at least 3 days for receiving chemotherapy protocol.
- Children aged 4- 16 years.
- Children with gastrointestinal and nervous system cancer, loss of consciousness, injury in the massage area and children under radiation were excluded from the study.

Two groups were distributed as follows:

Group one for control group: consisted of children with leukemia undergoing chemotherapy who were receiving only the routine hospital care.

Group two for study group: consisted of children with leukemia undergoing chemotherapy who were receiving therapeutic massage in addition to routine hospital care.

Tools of the study:

Two tools were used in this study:

Tool one: Demographic and clinical data interview questionnaire.

It was developed by the researcher after reviewing literature and consists of two parts:

Part one: - Sociodemographic data about children. It included questions about age, sex, residence and family history of oncological disorders.

Part two: - Clinical data which included questions about the child's diagnosis, stage of disease and side effects of chemotherapy.

Tool two: Rhodes Index of Nausea and Vomiting likert scale:

It was developed by **Rhodes and McDaniel (1999)**. It was used to assess nausea and vomiting over the previous 12 hours in patient receiving chemotherapy. It was translated into Arabic language and modified by **Hassan et al. (2011)** to assess Egyptian children. It consists of six questions in the form of five points likert scale to assess the number of vomiting episodes per day, the quality and quantity of vomiting, degree and length of nausea, as well as the distress associated with nausea and vomiting after 12 hours of chemotherapy induction. The scale was used to assess nausea and vomiting during receiving chemotherapy and after chemotherapy for 48 hours.

Scoring system: 0= none; 1= mild; 2= moderate; 3=severe; 4= very severe. Item scores are summed for a total score.

Method of data collection

1. Research proposal was approved by Ethical Committee in the Faculty of Nursing, Assiut University.
2. Official permission was obtained from the Dean of Ethical Committee of South Egypt cancer Institute in Assiut University and Sohag Cancer Center.
3. Written informed consent from parents of studied children was obtained after explaining the nature and purpose of the study.
4. Confidentiality and anonymity was assured.
5. Pilot study was carried out on 10% (8 children) to evaluate the clarity, competence and applicability of tools. The data obtained from the pilot study was analyzed; no change was done in the assessment sheet, so the 8 children selected for the pilot study were included in the study. Children were assigned to control and study groups according to parent preferences.
6. The developed tool (I) was tested for content validity by 5 experts three in the field of pediatric nursing and two in pediatric oncology medicine, the needed modification was done, accordingly.
7. Reliability of tools II was done using the cronbach's alpha test to examine the internal consistency (0.93).
8. Assessment of children condition was done by the researcher through using tools I and II for both control and study groups.
9. Therapeutic massage was used with effleurage, petrissage, friction, and tapotement movements with mild to moderate pressure using non-scented olive oil. The pressure was guided by the child's feedback and tolerance. The children's massage included the back, legs, arms and neck. In three sessions (two session before receiving chemotherapy and one session after receiving chemotherapy), children in study group were massaged for 20 min, 24 hour and half an hour before receiving chemotherapy and 24 hour after chemotherapy administration. The researcher was trained by physical therapist before study implementation.
10. Nausea and vomiting were assessed for both control and study groups during and after chemotherapy administration for 48 hours.

Ethical Considerations

Children in study group had the right to refuse participation or withdraw from the study without any rational. The privacy of the included patients was considered during collection of data.

Statistical analysis:

Date entry and data analysis were done using SPSS version 19 (Statistical Package for Social Science). Data were presented as number, percentage, mean, standard deviation. Chi-square was used to compare between qualitative variables. Mann-Whitney test was used to compare quantitative variables between two groups and Kruskal Wallis Test for more than two groups due to data was non-parametric. P-value considered statistically significant when $P < 0.05$.

III. Results

Table (1): Sociodemographic characteristics of children in control and study groups (n= 66).

Items	Control (n= 33)		Study (n=33)		p- value
	No	%	No	%	
Age (years)					0.678
4:< 8	19	57.6	17	51.5	
8:<12	8	24.2	7	21.2	
12: ≤ 16	6	18.2	9	27.3	
Mean± SD	8.07 ± 3.76		8.24 ± 3.88		
Sex					0.453
Male	18	54.5	21	63.6	
Female	15	45.5	12	36.4	
Residence					0.580
Rural	23	69.7	25	75.8	
Urban	10	30.3	8	24.2	
Family history of oncological diseases					0.792
+ve	11	33.3	10	30.3	
-ve	22	66.7	23	69.7	

Table (2): Clinical data of children in control and study groups (n= 66).

Items	Control (n= 33)		Study (n=33)		p- value
	No	%	No	%	
Diagnosis					0.642
ALL*	30	90.9	31	93.9	
AML**	3	9.1	2	6.1	
Stage of disease					0.225
Induction	3	9.1	7	21.2	
Remission	28	84.8	22	66.7	
Relapse	2	6.1	4	12.1	
Side effects of chemotherapy #					
Diarrhea	11	33.3	19	57.6	0.048*
Nausea and vomiting	33	100	33	100	--
Alopecia	28	84.8	28	84.8	1.000
Anorexia	28	84.8	28	84.8	1.000
Bruising/ bleeding	7	21.2	7	21.2	1.000
Infection	16	48.5	13	39.4	0.457
Fatigue	33	100	33	100	--
Mouth sores	21	63.6	25	75.8	0.284
Type of chemotherapy #					
Ara-C	4	21.1	5	15.2	1.000
VePesid	2	6.1	3	9.1	1.000
Pharmorubicin	4	21.1	5	15.2	1.000
Triple intrathacecal chemotherapy	15	45.5	21	63.6	0.138
Asparaginase	2	6.1	7	21.2	0.149
Endoxan	2	6.1	1	3	1.000
Vincristine sulfate	9	27.3	6	18.2	0.378
Methotrexate	18	54.5	17	51.5	0.805

More than one answer might be given.

*ALL; Acute lymphoblastic leukemia.

* AML; Acute myeloid leukemia.

Table 3: Comparison between mean± SD of four measurements (every 12 hours) of Rhodes index of nausea and vomiting scale in studied children during 48 hours from beginning of chemotherapy administration.

Items	Control	Study	p- value
	Mean± SD	Mean± SD	
Nausea and vomiting at first 12hrs.	6.87± 5.22	1.42± 2.56	0.000***
Nausea and vomiting at second 12hrs.	4.69± 4.53	0.42± 1.93	0.000***
Nausea and vomiting at third 12hrs.	2.72± 4.65	0.24± 0.93	0.005**
Nausea and vomiting at fourth 12hrs.	1.81± 4.31	0.18± 0.76	0.059

** Statistical significant difference at p <0.01, *** Statistical significant difference at p <0.001

Table 4: Comparison between mean scores of children in control and study groups according to Rhodes index of nausea and vomiting scale during 48 hours from chemotherapy administration.

Items	Control (n= 33)	Study (n= 33)	p- value
	Mean± SD	Mean± SD	
Vomiting frequency	0.52± 0.49	0.12± 0.25	0.000***
Vomiting distress	0.49± 0.49	0.03± 0.10	0.000***
Vomiting severity	0.59± 0.46	0.15± 0.36	0.000***
Nausea duration	0.88± 0.69	0.09± 0.24	0.000***
Nausea severity	0.79± 0.53	0.06± 0.23	0.000***
Nausea frequency	0.74± 0.56	0.08± 0.20	0.000***

*** Statistical significant difference at p < 0.001

Table (5): Factors affecting mean scores mean of nausea and vomiting during 48 hours from the beginning of chemotherapy administration in the study group.

Item	Nausea and vomiting		P-value
	Mean ± SD		
Age	4 - < 8 yrs	0.41 ± 0.77	0.565
	8 - < 12 yrs	0.25 ± 0.32	
	12 - 16 yrs	1.11 ± 1.60	
Sex	Male	0.61 ± 1.15	0.147
	Female	0.47 ± 0.81	
Stage of disease	Induction	0.14 ± 0.24	0.511
	Remission	0.76 ± 1.20	
	Relapse	0.25 ± 0.50	

* Statistical significant difference at P < 0.05, Kruskal-Wallis and Mann-Whitney tests.

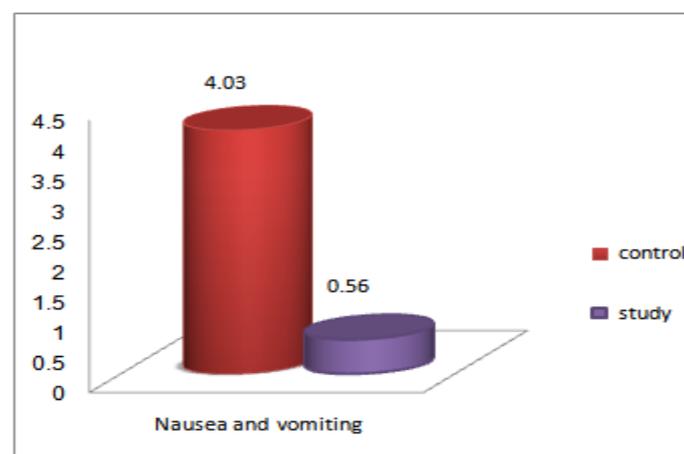


Figure 3: Comparison between total mean scores of children in control and study groups according to Rhodes index of nausea and vomiting scale (score= 0- 24).

Table 1 shows that children in control and study groups are well matched regarding their demographic characteristics and no statistical significant difference were found regarding their age, sex, residence and family history of oncological diseases.

The mean age of children was 8.07 ± 3.76 years for control group and 8.24 ± 3.88 years for study group. More than half of children in both groups (57.6 % and 51.5 % respectively) were aged 4 < 8 years. Males were prominent in both control and study groups accounting for 54.5 % and 63.6 % respectively and about two thirds in both groups were living in rural areas (69.7 % and 75.8 % respectively). As regards family history the results revealed that nearly about one third of children in control and study groups had positive family history of oncological diseases (33.3 % and 30.3% respectively).

Table 2 shows that children in control and study groups are well matched regarding their clinical data and no statistical significant difference was found regarding their diagnosis, stage of disease, type of chemotherapy and side effects of chemotherapy except diarrhea ($p= 0.048$).

As regard type of leukemia the majority of children had ALL (90.9 % in control group and 93.9 % in study group), while minority of children had AML (9.1 % and 6.1 % respectively). Most of children in control and study groups were in remission stage (84.8 % and 66.7 % respectively) followed by 9.1% and 21.2 % respectively in induction stage while only 6.1 % and 12.1% respectively were in relapse. Fatigue, nausea and vomiting were the main side effects of chemotherapy suffered by all children in this study (100%) followed by anorexia and alopecia (84.8 %) in both control and study groups. In control and study group, more than half of children were receiving Methotrexate and 45.5% and 63.6% respectively were receiving triple intrathecal chemotherapy (Methotrexate, Cytarabine and Hydrocortisone).

Table 3 shows that the most prominent statistical significant differences reported between control and study groups at 1st and 2nd 12 hours ($p=0.000$). Also, statistical significant differences was found between control and study groups at 3rd 12 hours while no statistical significant difference was found between control and study groups at 4th 12 hours ($P=0.005$ and 0.059 respectively).

Table 4 shows mean scores of chemotherapy induced nausea and vomiting from beginning of chemotherapy administration and for 48 hours in the study group compared to the control group with a high statistical significant difference between control and study groups in relation to frequency, distress and severity of nausea and frequency, duration and severity of vomiting at $p= 0.000$.

Table 5 shows that no statistical significant difference was found among age groups, both sexes and different stages of disease as regards mean scores of nausea and vomiting. As regards fatigue mean scores, a statistically significant difference was found among different age groups ($p= 0.030$) that was most prominent in 4:< 8 years age group while no statistical significant differences were found between both sex and different stages of disease.

Figure 1 shows that children in the study group significantly suffered from lower nausea and vomiting ($p= 0.000$) compared to children in control group. Mean \pm SD of nausea and vomiting were 4.0303 ± 2.644 and 0.5682 ± 1.035 respectively.

IV. Discussion

Chemotherapy-induced nausea and vomiting are one of the most distressing acute side effects of cancer treatment; they occur in up to 80% of patients. Beside traditional use of antiemetics for control of nausea and vomiting, it is essential to find other methods for better control of them (**Mazlum et al., 2013**). Therefore the aim of this study was to determine the effect of therapeutic massage on nausea and vomiting in children with leukemia following chemotherapy.

In the present study, both groups were well matched and no statistical significant difference were found regarding their age, sex, type of leukemia, stage of disease, family history of oncological diseases and side effects of chemotherapy ($p > 0.05$) except diarrhea ($p= 0.048$). More than half of children in control and study group were in the 4 < 8 years age group. The mean age was 8.07 ± 3.76 years for control group and 8.24 ± 3.88 years for study group. In both control and study groups more than half were males, also about two thirds in control group and three quarter in study groups were living in rural areas. It was observed that, majority of children in both groups had ALL while minority of children had AML. The highest percent of children in control and study groups were in remission; about one tenth and two tenth respectively were in induction. No statistical significant difference was found regarding type of chemotherapy.

These results were in the same line with **Mazlum et al., (2013)** who studied effect of therapeutic massage on 70 cancer children 4-18 years in Iran and found that mean age was 8.6 years, more than half of children were males and majority of children had acute lymphocytic leukemia and no significant difference regarding vomiting following chemotherapy. Also, **Salama et al., (2011)** in Egypt, reported that more than half of children were aged $3 \geq 6$ years, more than half of them were males, and the majority of children live in rural areas.

In the present study about two thirds of children in control and study groups had negative family history while about one third had positive family history of oncological diseases. That result is consistent with **Salama et al., (2011)** who found that two thirds of children didn't have family history of malignancies. This may indicate the effect of environmental factors that may cause childhood cancer. This result is different from those of **Perrillat et al., (2001)** who demonstrated that, among 279 children with acute leukemia, nearly half of children had family history of malignancies.

In the present study all children in both control and study groups were suffering from fatigue, nausea and vomiting and the majority were suffering from anorexia and alopecia, about two thirds and three thirds respectively were suffering from mouth sores, nearly half and more than one third respectively were suffering from infection, one third and more than half respectively were suffering from diarrhea and minority of them were suffering from bruising or bleeding.

This results is in the same line with those of **Khalil et al., (2013)** who evaluate nutritional status of 105 children suffering from cancer under chemo-radiotherapy, found that, majority of children were suffering from anorexia, vomiting and nausea, about half of children were suffering from diarrhea and stomatitis and minority of them were suffering from bleeding. Also, **Esmail et al., (2014)** stated that the highest percent of leukemic children were suffering from anorexia, more than one third were suffering from stomatitis.

From the researcher point of view, this may be due to passing of chemotherapeutic agents to GIT through blood stream causing GIT inflammation and damage leading to mouth sores, anorexia, nausea, vomiting and diarrhea. Also, chemotherapy affect rapidly growing normal cells as well as malignant cells such as the hair follicles and the lining of the mouth and intestines, and with result in many side effects e.g., alopecia, anorexia, nausea, vomiting and diarrhea.

The results of this study revealed a high statistical significant differences between control and study groups in relation to frequency, distress and severity of nausea and frequency, duration and severity of vomiting ($p= 0.000$) 48 hours from beginning of chemotherapy administration. These results were in agreement with **Mazlum et al. (2013)** in their study about "The Effect of Massage Therapy on Chemotherapy-Induced Nausea and Vomiting in Pediatric Cancer" in Iran, they found a significant difference in frequency ($p = 0.001$), duration ($p = 0.002$), and severity ($p = 0.002$) of nausea 48 hours after chemotherapy. There were no differences in vomiting at the time of chemotherapy, but there were a significant differences in the severity ($p = 0.005$) and frequency ($p = 0.013$) of vomiting 48 hours post administration.

These results were consistent with **Mohammed et al., (2015)** in their study in Egypt about "Effect of massage therapy on the occurrence of nausea and vomiting in children receiving chemotherapy" stated that, using of massage therapy has favorable effect on decreasing chemotherapy side effect nausea and vomiting without inducing any negative side effects or complications on the children. **Miladinia et al., (2015)** suggested that, slow- stroke back massage is effective in controlling chemotherapy-induced nausea and vomiting in the pediatrics with acute leukemia and showed that, statistically significant difference between trends of both nausea intensity and frequency of vomiting, between two groups ($P= 0.001$ and $P= 0.001$). **Abusaad and Ali, (2016)** who studied 60 cancer adolescents undergoing chemotherapy in Egypt found significant reduction in the mean score nausea, vomiting and retching frequency, duration and severity was observed from the second to fourth week of chemotherapy cycle in study group using acupressure than control group. **Esmail et al., (2014)** who studied 90 children aged 7- 18 years diagnosed as ALL at Tanta governorate in Egypt stated that, the mean value of total acute nausea and vomiting was lower among children receiving acupressure technique than those experience progressive muscle relaxation technique and those receiving only routine hospital care.

Hussein and Abdel Sadek (2013) was conducted to the effect acupressure on chemotherapy-induced vomiting in 50 leukemia pediatrics in Egypt stated that acupressure could be effective in controlling vomiting associated with chemotherapy in pediatrics with leukemia. **Han et al., (2005)** in Korea found that hand massage could be effective in decreasing nausea and vomiting in children with acute leukemia receiving high dose chemotherapy.

From the researcher point of view, results of this study may be attributed to physiological effects of massage which can release endorphins and serotonin (can positively affect mood), may also enhance autonomic nervous system activity causing an integrated effect at the hypothalamic level leading to a relaxation response. Massage reduces muscle tension and neurological excitability, and increases sense of well-being.

Results of this study were in contrast with **Post-White, (2006)** who stated that, nausea were not significantly improved with massage and children reported that, massage made them feel better. **Post-White et al., (2009)** in another study stated that, there were no significant changes in nausea in children with cancer after receiving massage therapy for four weeks (only 17 children completed the study). Also, **Wulff et al., (2009)** stated that no significant improvement was detected for children receiving verum acupressure in CINV.

The results of the present study revealed that no statistical significant difference was found among age groups, both sexes and different stages of disease as regards mean scores of nausea and vomiting. These results matched with **Hussein and Abdel Sadek (2013)** who found that there was no relation between age, sex and

frequency of nausea and vomiting. Also, **Mohammed et al., (2015)** found that no differences in sex related to severity of nausea while, females tended to have more severe vomiting than males. On the other hand this result disagree with those of **Esmail et al., (2014)** who found highly statistical significant relation between age, sex and severity of acute and delayed nausea and vomiting (girls had sever acute nausea and vomiting compared to boys and younger children had a sever level of nausea and vomiting compared to older children).

V. Conclusion

Based on the results of this study, it can be concluded that:

Children with leukemia who were receiving therapeutic massage were experiencing less incidence and severity of nausea and vomiting than those who were receiving only routine hospital care.

Recommendations

Based on the findings of the current study, the following recommendations are suggested:

- Encourage health care professionals to use therapeutic massage techniques to reduce chemotherapy- induced nausea and vomiting children.
- Educational programs should be provided to increase knowledge and skills of health care professionals in applying therapeutic massage techniques to manage chemotherapy- induced nausea and vomiting in children.
- Further studies should be expanded to address research questions, such as whether other problems of cancer and cancer treatment could be controlled by therapeutic massage techniques.

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