Nursing Care Adherence regarding Management of Oral Mucositis in Children Undergoing Oncology Therapy

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Abstract: Oral mucositis is described as one of the most common distressing symptoms reported by pediatric oncology patients and nurses. The aim of this study was to evaluate the effect of the nursing care adherence regarding management of oral mucositis in children undergoing oncology therapy. Research design: A quasi experimental study was used. Settings: The study was conducted at Benha Specialized Pediatric Hospital and National Cancer Institute in Cairo. Sample: A Convenient sample of nurses (n=57) and purposive sample of children undergoing oncology therapy (n=140) were included from the above mentioned settings. Those children were divided equally into two groups (study and control) (n=70) in each group. Tools of data collection: Four tools were used; tool I; a structured questionnaire format; it consisted of 3 parts. Part 1: personal characteristics of the studied nurses, Part 2: Personal characteristics and medical data of the studied children, Part 3: nurses' knowledge regarding cancer and related concepts, oral mucositis and oral care in children undergoing oncology therapy. Tool II; An observational checklist to assess nurses' practice towards children undergoing oncology therapy. Tool III: Oral Assessment Guide (OAG) scale to assess oral condition in children undergoing oncology therapy. Tool IV; The combined Children's International Mucositis Evaluation Scale (ChIMES) and the World Health Organization (WHO) oral mucositis scale. Results: There was a statistical significant improvement in nurses' knowledge and practices pre nursing care adherence implementation compared with post implementation. The study group had improved symptoms regarding oral mucositis in the first, second and third weeks after implementation of nursing care adherence compared with the control group who received routine nursing care. Conclusion: This study concluded that nursing care adherence had a positive effect on the improvement of nurses' knowledge and practice about caring of children undergoing oncology therapy; as well as improvement of oral condition in children in the study group undergoing oncology therapy compared with the control group. Recommendation: The study recommended that continuous educational programs regarding caring nursing management of oncology therapy related complications in children. Also, continuous training sessions for nurses to improve and update their oral care knowledge and practice. Future, observational studies aiming to improve the overall management of oral mucositis should be conducted.

Keywords: Nursing Care adherence, Oral Mucositis, Children & Oncology Therapy.

1. INTRODUCTION

Oncology therapy considered a widely used treatment of cancer in different anatomic sites. Whereas, these drugs cause collateral effects in different organic systems, including the gastrointestinal system. Nausea, vomiting, lack of appetite and mucositis are the most common collateral effects in this system *(Lopes et al., 2016).*

Mucositis is defined as inflammatory lesions and/or ulcers in the oral and/or gastrointestinal tract, resulting in severe discomfort that can impair the child's ability to eat, swallow and talk and therefore, a significant impairment in a child's quality of life. The process of Oral Mucositis (OM) develops from an interaction between the oral environment and various mucosal components. As, the epithelium, extracellular matrix and blood vessels are affected and injured and this

provides an entry way for colonized organisms to invade the whole body producing a systemic infection or sepsis *(Assaf, 2012)*.

Besides these changes, it can also cause dry mouth, which in turn predisposes to secondary infections, mainly by fungi; other possible consequences are changes in the sense of taste, leading to low fluid and food intake, dehydration and malnutrition. Moreover, pain cannot be ignored, for chewing as well as swallowing, as the inflammation process can occur all over the digestive tract, as well as the increased risk of local and systemic infection. In addition to bleeding can also appear when the mucositis is more advanced. Severe cases may demand hospitalization for enteral or parenteral nutritional support, and even postponement or suspension of the antineoplastic treatment *(Lalla et al., 2014)*.

The risk factors for developing mucositis are vague. Rather more, there are some factors including; tumors, antineoplastic agent, radiation source, treatment dosage, treatment schedule, combination of treatment, duration of exposure to drug and systemic clearance of drug during treatment as well as genetic factors. According to the anti-neoplastic agent, the risk of developing OM increased with certain drugs, where the anti-metabolites agents were the most frequently associated with oral mucositis *(Nicolatou et al., 2013)*.

Mucositis can be classified in four levels. The first level is only characterized by the presence of erythema; the second by the appearance of white desquamatory plaques painful to touch; the third level is characterized by the appearance of epithelial crusts and fibrinous exudate, leading to the formation of pseudo membranes and ulcerations. While, the fourth level is the most severe form of mucositis, and occurs when stroma is exposed in the underlying conjunctive tissues *(Spolarich, 2014)*. In early stages the child exhibits oral erythema often accompanied by a burning sensation and intolerance of spicy foods; after accumulation of oncology therapy (usually after 2 weeks), painful oral ulcers begin to develop and the symptoms may persist up to 8 weeks after completion *(Damm et al., 2019)*.

Effective management should be achieved. Thus nurses must consider an assessment of the oral cavity as one of the daily routine practices. The oral cavity must be constantly assessed before and during chemotherapy. Assessment includes lips, mucosal membrane, tongue, saliva and teeth. The assessment of OM is affected by the child, the scoring tool and the evaluator. A skillful evaluator knows that children need an extra effort and the appropriate communication skills. In addition to deeply understanding the painful experience of OM in order to enhance the child's cooperation with the evaluator *(Melnyk & Fineout, 2011)*. Using simple instruments, quick and easy to use in almost all children can be appropriate. Moreover, the assessment and scoring criteria tend to be easy to use in daily nursing practice for both nurses and children. Both subjective and objective data are essential to document the overall score of mucositis. For children, it's believed that the functional aspect of mucositis such as swallowing and chewing is better to assess from a child's perspectives *(Rieber et al., 2015)*.

Effective management of mucositis is an important issue. So, diagnosis of mucositis appropriately should be achieved. There is a wide variety of assessment tools used in the diagnosis of mucositis in children. Nurses should diagnose mucositis using these diagnostic tools. After the diagnosis, they should manage mucositis within the framework of evidence-based applications *(Maloney, 2010)*.

Appropriate multi-professional intervention is needed, and this group of professionals includes nurses. The support system for making nursing care planning decisions includes care adherence, which represent a strategy that needs to be elaborated according to the clients' needs and the resources available. Moreover, nurses play a critical role in management and control of the symptoms, resulting in decreased costs and improved quality of life of patients *(Head et al., 2018)*. Nursing care are important parts of management and care of children undergoing oncology therapy, which are based on the needs of child, and assists the healthcare team in collaborative and informed decision making. In addition, nurses have more frequent access to children and their families for effective education *(Yüce & Yurtsever, 2017)*.

1.1 Significance of the study

Oral mucositis is a frequent and potentially severe complication induced by of chemotherapy and radiotherapy. It is a restless and painful condition and can result in Pain, impairment of nutritional status, risk of infections and delayed treatment outcomes, all contribute to the morbidity of oral mucositis. These serious complications can lead to treatment delays or treatment termination, hospitalization, and increased medical costs. Moreover, the incidence of oral mucositis is to be 52-80% in children with cancer *(Sarvizadeh et al., 2015)*. So, nurses at oncology department should provide the

most appropriate care regimen adherence for each pediatric patient. Although the importance of management of OM is well known, it is not carried out perfectly.

1.2 Aim of the study

The aim of this study was to evaluate the effect of the nursing care adherence regarding management of oral mucositis in children undergoing oncology therapy through:

1. Assessing nurses' knowledge and practice regarding oral mucositis in children undergoing oncology therapy.

2. Designing and implementing nursing care adherence for nurses who provide care for children undergoing oncology therapy based on their needs assessment.

3. Evaluating the effect of nursing care adherence on nurses' knowledge and practice.

4. Evaluating the effect of improved nurses' knowledge and practice levels on symptom improvement of oral mucositis in children undergoing oncology therapy.

1.3 Research hypotheses

1. The level of nurses' knowledge and practice will be improved significantly after implementing nursing care adherence.

2. There will be a statistically significant correlation between nurses' knowledge and practice scores after nursing care adherence implementation.

3. Children in study group who will receive care after implementing nursing care adherence will show improved symptoms of oral mucositis than those in control group who receive a routine nursing care.

2. SUBJECTS AND METHOD

2.1 Technical Design:

2.1.1 Research Design: A quasi-experimental design was utilized to achieve the aim of this study.

2.1.2 Research Setting: This study was conducted in oncology unit at Benha Specialized Pediatric Hospital affiliated to the ministry of health and population, it is found in the fourth floor and consisted of (3) rooms for oncology, first room contain (6) beds, second room contain (6) beds and the third room called isolation room contain (1) bed. Also, this study was conducted in pediatric oncology unit at National Cancer Institute in Cairo, it is found in the fifth floor and consisted of (5) rooms { (3) complimentary (free) rooms each room contain (4) beds, and (2) economical each room contain (3) beds}. Also, there is an intensive care room in the fifth floor for critical cases consisted of (10) beds

2.1.3 Subjects: The study subjects consisted of two groups:

First group: - A Convenient sample of all available nurses (n=57) working at the previously mentioned settings in the morning and afternoon shifts regardless their personal characteristics.

Second group: - A purposive sample of children (n=140) were included from the previously mentioned settings. Those children were divided equally into 2 constructed groups; study group (n= 70) who receive care after implementing nursing care adherence and control group (n= 70) who receive a routine nursing care.

The inclusion criteria:

- Children undergoing oncology therapy

- Children who were newly diagnosed with oncology diseases.

The exclusion criteria:

- Children who received radiotherapy in the head and neck region.

- Children on anti-platelet or anticoagulant therapy; and having pre-existing oral disease, such as; active oral infection, trauma to the oral mucosa, or having oral ulceration prior chemotherapy.

2.1.4 Tools of data collection

Tool I: A structured Interviewing questionnaire format: It was designed by the researchers after reviewing the related literatures (*Rieber et al., (2015), Yüce & Yurtsever, (2017)*, *Head et al., (2018)& Damm et al., (2019)*) it was written in an Arabic language. It comprised three main parts which are:

Part I: Personal characteristics of the studied nurses such as; age, gender, academic qualification, years of experience, attendance of training courses related to oncology therapy.

Part II: Personal characteristics and medical data of the studied children such as; age, gender, diagnosis, type of treatment.

Part III: Nurses' knowledge regarding cancer and related concepts, oral mucositis and oral care in the form of multiple choice questions. Whereas, cancer and related concepts; contained (15 questions), and oral mucositis and oral care contained (14 questions), with total of (29) questions.

Scoring system for knowledge: Nurses' knowledge were evaluated upon completion of the interviewing questionnaire as the studied nurses' knowledge was checked with a model key answer and accordingly, the complete correct answer was given two scores , the incomplete correct answer was given one score and zero for incorrect or don't know answers. The total score was ranged from (0-58). Then, their total knowledge were categorized as score of 75% and more was considered good, a score between 50% to less than 75% was considered average, while a score below50% was considered poor.

Tool II: An observational checklist to assess nurses' practice towards children undergoing oncology therapy: It was adopted from *Barrow, (2018)*. It included 12 steps.

Scoring system for practice: a score of (two) was given for correctly done, a score of (one) for incorrectly done and a score of (zero) for not done. Total scores converted into percent scores, where the score of $\geq$ 80% considered a competent practice. While, a score < 80% considered incompetent practices.

Tool III :- Oral Assessment Guide (OAG) scale ; It was validated and developed by *Cheng et al., (2004).* It provides parameters for the assessment of each child's mouth and assisting in determining oral health and function. This instrument enables the evaluation of 8 items according to scales of oral health impairment, scoring of each item ranged from 1 to 3,whereas, 1 representing normal conditions, 2 representing mild-to-moderate changes in epithelial integrity or function, and 3 representing severe impairment of oral mucosa. An OAG score of 8 items indicates a healthy oral cavity, score of 9 - 16 indicate mild to moderate mucositis and score of 17-24 indicates severe mucositis.

Tool IV:- Combined Children's International Mucositis Evaluation Scale (ChIMES) and the World Health Organization (WHO) oral mucositis scale: They were adopted from *Tomlinson et al., (2009);* They considered a valid and reliable instruments for the assessment of oral mucositis and mucositis-related symptoms in pediatric oncology patients aged 0–18 years. **The ChIMES** included 6 items that evaluate (a) the severity of oral pain, (b) the effects of pain on swallowing, (c) the effects of pain on eating, (d) the effects of pain on drinking, (e) intake of pain medication, and (f) the presence/absence of oral ulcers. The first 4 items in **the ChIMES** were scaled from 0 to 5 (0 being the lowest symptoms, 5 the highest symptoms); the fifth item is scaled from 0 to 2 (2 being the highest), and the sixth item is scaled from 0 to 1 (1 being the highest). If all of the items are completed, the minimum possible score is 0, and the maximum possible score is 23. Higher scores on the scale indicate more severe levels of oral mucositis. **The World Health Organization (WHO) oral mucositis scale** was used to record the responses of the child on a six point scale in each day. It consisted of five grades. Grade (0) no symptoms, grade (I) Oral soreness, erythema, no ulceration, grade (II) ulcers, solid diet tolerated, grade (III) Oral ulcers, liquid diet only, grade (IV) Oral alimentation impossible, unable to eat or drink.

3. OPERATIONAL DESIGN

3.1 Preparatory Phase: A review of the past and currently available literatures related to the research problem using books, evidence-based articles, periodicals, and magazines were done to be acquainted with all aspects of the study problem and also in order to develop relevant tools for data collection and designing the content of nursing care adherence. This period extended from the beginning of November 2018 to the end of December 2018.

3.2 Tool validity and reliability: Tools validity was tested through a jury of three experts in pediatric nursing field to test the tool clarity, relevance, comprehensiveness, simplicity and applicability. Modifications of the tools were done according to the expert's judgment on the clarity of sentences, appropriateness of content and sequence of items. The experts agreed on the content, according to their review and minor modifications were done in the contents. Testing reliability of all items of the tools was done by using Cronbach's alpha test. It was 0.789 for knowledge and 0.871 for practice checklist. This phase took one month (January 2019).

3.3 Ethical Considerations and human rights: A permission to carry out the study was obtained from the hospital manager and the supervisor of oncology unit in the previously mentioned study settings through submission of an official letter issued from the Dean of Faculty of Nursing, Benha University. All participants were assured that participation in the study was voluntary; each nurse was informed about the purpose, procedure, benefits and nature of the study and each nurse had the right to withdraw from the study at any time without any rationale, then oral consent obtained from them. Nurses were informed that obtained data will not be included in any further researches. Confidentiality and anonymity of each subject was assured through coding of all data and all information has taken was protected.

3.4 Pilot Study: The pilot study was carried out on 6 nurses and 14 children (7 for study and 7 for control groups) representing 10.0% of the study subject over a period of one month (February, 2019). The aim was to ascertain the feasibility of the study, the clarity, and applicability of the tools. It also helped to estimate the time needed for filling out the forms. Based on the results of the pilot, the necessary modifications on the study tools were done and pilot study subjects

3.5. Field work:

The actual field work was carried out from the beginning of March 2019 to the end of August 2019. The researchers were available at the previously mentioned settings two days/week (Sunday and Wednesday) in the oncology unit in the morning shift to collect data by using the previous tools.

3.5.1 Assessment phase: At the beginning, the researchers interviewed each nurse, introduced themselves to each participant included in the study, explained the aim of the study, duration, and activities and took an oral consent to participate in the study prior data collection. Then, each nurse was asked to fill the data collection tool individually to collect baseline data and to assess nurses' needs (Tool I). Then, the researchers observed each nurses' practice during demonstrating routine oral care for children to measure their competency (Tool II). Meanwhile, the researchers started to assess children oral condition for oral mucositis in the control group after receiving routine nursing care. The researchers measured oral mucositis in first week following start of oncology therapy and then conducted in second and third week (3 times in total) by using The Oral Assessment Guide (OAG) scale and The combined Children's International Mucositis Evaluation Scale (ChIMES) and the World Health Organization (WHO) oral mucositis scale (Tool III and tool IV). It took an average of 5 to 10 minutes to complete the overall evaluation of oral mucositis and mucositis -related symptoms for each child using a light source. This phase took two months.

Objectives of nursing care adherence:

At the end of the nursing care adherence the studied nurses were able to:

-Define cancer and oral mucositis.
-Explain how oncology treatment induces oral mucositis.
-List signs and symptoms of oral mucositis.
-Identify grades of oral mucositis.
-Identify time of appearance of oral mucositis during treatment.
-List methods of oral mucositis assessment.
-List methods of oral mucositis prevention.
-Identify methods of oral mucositis treatment.
-List complication of oral mucositis
-Identify how to prevent complications associated with oral mucositis.
-Explain how to control the associated pain.
-Demonstrate Oral care procedure for children with oral mucositis induced by oncology therapy.

Contents of the nursing care adherence:

-Introduction about cancer and oncology therapy, common side effects of oncology therapy, definition of oral mucositis, how oncology treatment induce oral mucositis.

-Signs and symptoms of oral mucositis, grades of oral mucositis, time of appearance of oral mucositis during treatment, methods of assessment of oral mucositis, methods of prevention of oral mucositis, methods of treatment of oral mucositis, control of associated pain, complication and prevention of oral mucositis, oral care of children with oral mucositis induced by oncology therapy.

3.5.2 Planning phase: The nursing care adherence was designed by the researchers after an extensive review of related literatures and the needs identified in the assessment phase. An Arabic booklet concerning management of oral mucositis in children undergoing oncology therapy was prepared and given to nurses.

3.5.3 Implementation phase: The nursing care adherence was implemented in about two months. It was carried out in 6 sessions (2 sessions for theory and 4 sessions for practice). A time schedule suitable for nurses was developed to conduct the sessions that includes; date, place, topic, time and duration of each session. The nursing care adherence consisted of two parts, the theoretical part and the practical parts cover the items of adherence. It was difficult to take all nurses at the same time; thus they were divided into 9 groups of about 6-7 nurses in every session (six groups each group include six nurses and three groups each group include seven nurses).

The duration of theory sessions 30-35 minutes for each session and practical sessions ranged between 40 to 50 minutes for three days/week. At the beginning of each session, the researchers started by a summary about what was given through the previous session and objectives of the new one, taking into consideration using simple and clear language to suit the nurses. Different teaching methods were used including small group discussion, lectures, brainstorming, role-playing, demonstration, and redemonstration. The teaching aids used were colored posters and PowerPoint presentation. Each nurse of all studied groups obtained a copy of nursing care adherence handout explaining all elements in an Arabic language.

3.5.4 Evaluation Phase: After the completion of the adherence contents; the nurses' knowledge and practice were evaluated immediately after implementing nursing care adherence, the post tests were administered by using same pretest tools. Additionally, the researchers asked nurses to apply nursing care adherence on children (study group) and evaluate their oral condition for oral mucositis by using The Oral Assessment Guide (OAG) scale and The combined Children's International Mucositis Evaluation Scale (ChIMES) and the World Health Organization (WHO) oral mucositis scale (Tool III and tool IV) using the same assessment method of control group. This phase took two months.

At the end of the nursing care adherence implementation, the researchers gave one smooth tooth brush to each child. The children were advised to brush the teeth at least twice a day using a new soft toothbrush.

3.6 Statistical analysis of data

The collected data were categorized, analyzed and tabulated using the SPSS computer program Version 21. Numerical data were expressed as the mean and standard deviation. Qualitative data were expressed as frequency and percentage. A comparison between qualitative variables carried out by using a parametric Chi-square test. Correlation among variables was done using Pearson correlation coefficient. A statistically significant difference was considered at p-value < 0.05, a highly statistically significant difference was considered at p-value < 0.001 and no statistically significant difference was considered at p-value > 0.05.

4. RESULTS

Table 1 shows the nurses' personal characteristics; it was observed that, the mean age of the studied nurses was 27.00 ± 6.279 years and less than two thirds (63.2%) of them were females. In relation to nurses' education more than two thirds (66.7%) of them had diploma of secondary nursing school. Additionally, it was noticed that, less than half (45.6%) of nurses had an experience from 5 to less than 10 years.

Table 2 shows children's personal characteristics, it was observed that, the mean age of the studied children was 7.6286 ± 3.9788 & 7.1471 ± 3.4815 in control group and study group respectively. It indicated that, there was no statistical significant difference (P >0.05) between the studied children.

Table 3 reveals nurses' knowledge regarding cancer and related concepts pre and post nursing care adherence implementation. It was found that, there was a highly statistical significant difference (P<0.001) pre and post nursing care adherence.

Table 4 reveals nurses' knowledge regarding oral mucositis and oral care. It was found that, there was a highly statistical significant difference (P<0.001) pre and post nursing care adherence implementation.

Table 5 reveals nurses' practice regarding oral care pre and post nursing care adherence implementation. It was found that, there was a highly statistical significant difference (P<0.001) pre and post nursing care adherence implementation.

Table 6 elaborates nurses' total knowledge and practice pre and post nursing care adherence implementation and indicated that there were a statistical significant differences (P<0.05) between the studied nurses regarding total knowledge and there were a highly statistical significant differences (P<0.001) regarding total practice level pre and post nursing care adherence implementation.

Table 7 elaborates a positive correlation between total nurses' knowledge and practice score in pre and post nursing care adherence implementation.

Table 8 demonstrates the total score of the studied children regarding The Oral Assessment Guide (OAG) Scale in the control and study group after receiving oncology therapy in first, second and third week, and indicated that there was a highly statistical significant difference between study and control groups (P < 0.001).

Table 9 demonstrates the total score of the studied children regarding The World Health Organization (WHO) oral mucositis scale in the control and study group after receiving oncology therapy in the first, second and third week and indicated that there was a highly statistical significant difference between study and control groups regarding grades of oral mucositis (P < 0.001).

Table 10 illustrates the total mean score regarding The Oral Assessment Guide (OAG) Scale, The Children's International Mucositis Evaluation Scale (ChIMES) and The World Health Organization (WHO) oral mucositis scale in the control and study group in the first, second and third week after receiving oncology therapy and indicated that there was a highly statistical significant difference between study and control groups (P < 0.001).

Figure 1 illustrates that, more than half (58%) of the studied nurses not attended any previous training courses related to oncology therapy.

Figure 2 shows less than half (47.1%) of study group had no symptom regarding oral mucositis in the first week after receiving oncology therapy. Meanwhile, more than one third (35.7%) of control group had no symptom, using The Children's International Mucositis Evaluation Scale (ChIMES).

Figure 3 portrays that, more than two fifth of the study group (41.4%) had no symptom regarding oral mucositis in the second week after receiving oncology therapy. Meanwhile, more than two fifth (41.1%) of control group had moderate symptoms regarding oral mucositis, using The Children's International Mucositis Evaluation Scale (ChIMES).

Figure 4 displays that the minority (7.1%) of both groups had severe symptoms regarding oral mucositis in the third week after receiving oncology therapy, using The Children's International Mucositis Evaluation Scale (ChIMES).

Table (1): Distribution of the studied nurses according to their personal characteristics (n=57)

Personal characteristics	Study sample (n=57)	
	No	**%**
Age in years		
Less than 20	6	10.5
25>20	16	28.1
30>25	22	38.6
35>30	4	7.0
≥ 35	9	15.8
Mean ±SD	27.00±6.279	
Gender		
Male	21	36.8
Female	36	63.2
Place of work		
Banha Specialized Pediatric Hospital	14	24.6
National Cancer Institute	43	75.4
Academic qualification		
Diploma of secondary nursing school	38	66.7
Technical institute of nursing	8	14.0
Bachelor of nursing science	11	19.3

Years of experience at oncology unit		
one year> 5 years	21	36.8
5 years>10 years	26	45.7
≥10 years	10	17.5
Mean ±SD	5.7544±3.434	

Figure (1): Distribution of the studied nurses according to their attendance to any previous training courses related to oncology therapy (n=57)
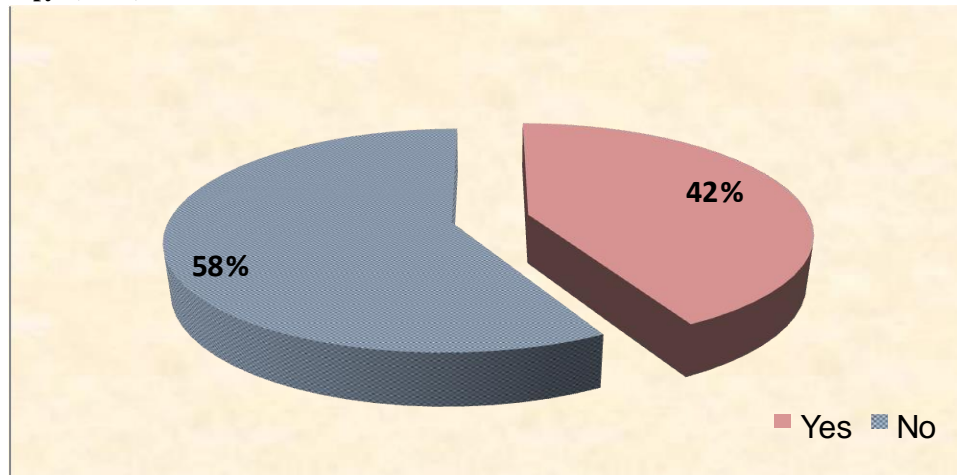

Table (2): Distribution of the studied children according to their personal characteristics (n=70) in each group.

Personal characteristics	Control group (n=70)		Study group (n=70)		X_2	P value
	No	%	No	%		
Age in years					1.694	>0.05
1>3	8	11.4	12	17.1		
3>6	17	24.3	15	21.4		
6>9	12	17.1	10	14.3		
9>12	20	28.6	16	22.9		
≥12	13	18.6	17	24.3		
Mean ±SD	7.6286±3.9788		7.1471±3.4815			
Gender					3.657	>0.05
Male	47	67.1	43	61.4		
Female	23	32.9	27	38.6		
Diagnosis					7.453	< 0.05 *
Acute Lymphocytic Leukemia (ALL)	39	55.7	41	58.6		
Acute Myeloid Leukemia (AML)	10	14.3	15	21.4		
Non-Hodgkin's disease	12	17.1	5	7.1		
Wilm's tumor	4	5.8	6	8.6		
Hepatic carcinoma	5	7.1	3	4.3		
Types of treatment					2.417	>0.05
Chemotherapy	49	70.0	53	75.7		
Radiotherapy	13	18.6	8	11.4		
Combined	8	11.4	9	12.9		

*A statistical significant at P value <0.05; no statistical significant at P value >0.05

Table (3): Distribution of the studied nurses according to their knowledge regarding cancer and related concepts pre and post nursing care adherence implementation (n=57).

Knowledge items	Pre nursing care adherence implementation (n=57)						Post nursing care adherence implementation (n=57)						X^2	P value
	Complete correct answer		Incomplete correct answer		Incorrect answer/ don't know		Complete correct answer		Incomplete correct answer		Incorrect answer/ don't know			
	No	%	No	%	No	%	No	%	No	%	No	%		
Definition of cancer	14	23.7	14	23.7	29	49.2	37	64.9	11	19.3	9	15.8	19.306	.000 (P<0.001)**
Most common pediatric cancers	18	31.6	19	33.3	20	35.1	38	66.7	13	22.8	6	10.5	10.882	.028 (P< 0.05)*
Definition of chemotherapy	13	22.0	10	16.9	34	57.6	34	59.6	13	22.8	10	17.5	11.996	.017 (P<0.05)*
Indications of chemotherapy	12	20.3	11	18.6	34	57.6	34	59.6	16	28.1	7	12.3	17.789	.000 (P<0.001)*
Routes of chemotherapy administration	22	38.6	14	24.6	21	36.8	29	50.9	16	28.1	12	21.1	8.316	.016 (P<0.05)*
Common side effect of cancer treatment with chemotherapy	26	45.6	13	22.8	18	31.6	37	64.9	11	19.3	9	15.8	25.684	.000 (P<0.001)**
Prevention of chemotherapy induced complications	10	17.5	14	24.6	33	57.9	30	52.6	16	28.1	11	19.3	15.895	.000 (P<0.001)**
Mode of action	11	19.3	27	47.4	19	33.3	32	56.1	12	21.1	13	22.8	13.368	.001 (P<0.05)*
The average of treatment duration	9	15.8	14	24.6	34	57.6	33	57.9	13	22.8	11	19.3	15.579	000. (P<0.001)**
Definition of radiotherapy	16	28.1	16	28.1	25	43.9	32	56.1	16	28.1	9	15.8	14.632	.000 (P<0.001)**
Indication of radiotherapy	13	22.8	25	43.9	19	33.3	33	57.9	16	28.1	8	14.0	17.158	.000 (P<0.001)**
Common side effect of radiotherapy	12	21.1	31	54.4	14	24.6	30	52.6	19	33.3	8	14.0	12.737	.002 (P<0.05)*
Prevention of radiotherapy induced complications	10	17.5	16	28.1	31	54.4	31	54.4	18	31.6	8	14.0	14.000	. 000 (P<0.001)**
Mode of action	18	31.6	15	26.3	24	42.1	33	57.9	14	24.6	10	17.5	15.895	.000 (P<0.001)**
The average duration for treatment	12	21.1	10	17.5	35	61.4	30	52.6	14	24.6	13	22.8	14.014	.000 (P<0.001)**

**A highly statistical significant at P value <0.001; *A statistical significant difference (P <0.05)

Table (4): Distribution of the studied nurses according to their knowledge regarding oral mucositis and oral care pre and post nursing care adherence implementation. (n=57)

Knowledge items	Pre nursing care adherence implementation (n=57)						Post nursing care adherence implementation (n=57)						X^2	P value
	Complete correct answer		Incomplete correct answer		Incorrect answer/ don't know		Complete correct answer		Incomplete correct answer		Incorrect answer/ don't know			
	No	%	No	%	No	%	No	%	No	%	No	%		
Definition of oral mucositis	15	26.3	11	19.3	31	54.4	31	54.1	19	33.3	7	12.3	15.158	.000 (P < 0.001)**
How oncology treatment induce oral mucositis	27	47.1	15	26.3	15	26.3	27	47.4	19	33.3	11	19.3	6.737	.034 (P <0.05)*
Signs of mucositis	12	21.1	13	22.8	32	56.1	27	47.4	19	33.3	11	19.3	14.257	.000 (P<0.001)**
When oral mucositis appear during treatment	9	15.8	28	49.1	20	35.1	31	54.4	17	29.8	9	15.8	13.053	.001 (P <0.05)*

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Item	No	%	No	%	No	%	No	%	No	%	No	%	X²	P value
Symptoms of mucositis	13	22.8	11	19.3	33	57.9	30	52.6	14	24.6	13	22.8	15.579	.000 (P <0.001)**
When child cure after finishing treatment	8	14.0	25	43.9	24	42.1	37	64.9	11	19.3	9	15.8	25.407	.000 (P <0.001)**
Methods of prevention	13	22.8	24	42.1	20	35.1	40	70.2	9	15.8	8	14.0	18.762	.000 (P <0.001)**
Dietary regimen	29	50.9	14	24.6	14	24.6	31	54.4	18	31.6	8	14.0	15.474	.000 (P <0.001)**
Frequent oral care	30	52.6	14	24.6	13	22.8	37	64.9	11	19.3	9	15.8	9.579	.008 (P <0.05)*
Methods of treatment	27	47.4	19	33.3	11	19.3	29	50.9	17	29.8	11	19.3	10.211	.006 (P < 0.05) *
Control of associated pain	12	21.1	12	21.1	33	57.9	38	66.7	13	22.8	6	10.5	18.789	.000 (P<0.001)**
Complication	27	47.4	15	26.3	15	26.3	30	52.6	19	33.3	8	14.0	14.000	.000 (P <0.001)**
Psychological reassurance and support	25	43.9	15	26.3	17	29.8	33	57.9	15	26.3	9	15.8	16.421	.000 (P <0.001)**
Educating child and care givers	19	33.3	16	28.1	22	38.6	35	61.4	16	28.1	6	10.5	20.842	.000 (P< 0.001)**

**A highly statistical significant at P value <0.001; * A statistical significant difference (P <0.05)

Table (5): Distribution of the studied nurses according to their practice regarding oral care pre and post nursing care adherence implementation (n=57)

Items	Pre nursing care adherence implementation (n=57)						Post nursing care adherence implementation (n=57)						X²	P value
	Correctly done		Incorrectly done		Not done		Correctly done		Incorrectly done		Not done			
	No	%	No	%	No	%	No	%	No	%	No	%		
Daily assessment of the oral mucosa.	16	28.1	19	33.3	22	38.6	29	50.9	20	35.1	8	14.0	37.543	.000 (P <0.001)**
Instruct the child Use a soft toothbrush to clean teeth	17	29.8	14	24.6	26	45.6	32	56.1	15	26.3	10	17.5	20.223	.000 (P< 0.001)**
Tell the child to use fluoride toothpaste and not eat or drink for 30 minutes post using toothpaste	16	28.1	15	26.3	26	45.6	30	52.6	19	33.3	8	14.0	24.425	.000 (P< 0.001)**
Instruct child should spit out excess gel or mouth rinse	20	35.1	16	28.1	21	36.8	35	61.6	18	31.6	4	7.0	44.093	.000 (P< 0.001)**
Effective analgesia should be provided prior to performing mouth care	24	42.1	16	28.1	17	29.8	32	65.1	19	33.3	6	10.5	40.258	.000 (P< 0.001)**
Applying ice chips to the mouth for 5 minutes prior the infusion	17	29.8	21	36.8	19	33.3	32	65.1	18	31.6	7	12.3	25.572	.000 (P< 0.001)**
Antifungal prophylaxis agents (oral or intravenous as tolerated)	23	43.9	17	40.4	17	40.4	41	71.9	11	19.3	5	8.8	43.343	.000 (P< 0.001)**
Encourage child to rinse the mouth after vomiting with water	23	40.4	21	36.8	13	22.8	34	59.6	19	33.3	4	7.0	41.030	.000 (P< 0.001)**
Apply a moisturizing cream to the lips	18	31.6	19	33.3	20	35.1	41	71.9	11	19.3	5	8.8	18.731	.000 (P< 0.001)**

Advise the child not to eat acidic, salty, dry, spicy, or hot foods	25	43.9	19	33.3	13	22.8	42	73.7	9	15.8	6	10.5	8.678	.070 (P<0.001)**
Flossing to remove plaque to be performed at least once a day	21	36.8	24	42.1	12	21.1	37	64.9	12	21.1	8	14.0	3.389	.495 (P>0.05)
Good hydration moisturizes the oral cavity	19	33.3	24	42.1	14	24.6	36	63.2	14	24.6	7	12.3	24.179	.000 (P<0.001)**

A highly statistical significant at P value <0.001; no statistical significant at P value >0.05**

Table (6): Distribution of the studied nurses according to their total knowledge and practice pre and post nursing care adherence implementation (n=57)

Items	Pre nursing care adherence implementation (n=57)		Post nursing care adherence implementation (n=57)		X2	P value
	No	%	No	%		
Total knowledge level					12.753	.013 (P < 0.05)*
Good (75-≥100%)	9	15.8	32	56.2		
Average (60-≥75%)	11	19.3	15	26.3		
Poor (0>60%)	37	64.9	10	17.5		
Total practice level					35.526	.000 P <0.000**
Competent (≥ 80)	6	10.5	39	68.4		
Incompetent (< 80)	51	89.5	18	31.6		

**A highly statistical significant at P value <0.001; *A statistical significant at P value <0.05

Table (7): Correlation between total knowledge score and total practice score of the studied nurses pre and post nursing care adherence implementation (n=57)

Variables	Pearson correlation coefficient			
	Total knowledge score			
	Pre nursing care adherence implementation (n=57)		Post nursing care adherence implementation (n=57)	
	r	P	r	P
Total practice score	.052	. 082*	.133	.068*

*A statistical significant difference at P <0.05

Table (8): Distribution of the studied children according to their total score regarding The Oral Assessment Guide (OAG) Scale in the control and study group in the first, second and third week after receiving oncology therapy (n=70) in each group.

The Oral Assessment Guide (OAG) Scale	Control group (n=70)						Study group (n=70)						X2	P value
	First week after receiving oncology therapy		Second week after receiving oncology therapy		Third week after receiving oncology therapy		First week after receiving oncology therapy		Second week after receiving oncology therapy		Third week after receiving oncology therapy			
	No	%	No	%	No	%	No	%	No	%	No	%	13.743	P<0.000**
Healthy oral cavity	26	37.2	13	18.6	11	15.7	37	52.9	30	42.9	28	40.0		
Mild to moderate mucositis	39	55.7	40	57.1	36	51.4	31	44.3	35	50.0	33	47.1		
Severe mucositis	5	7.1	17	24.3	23	32.9	2	2.8	5	7.1	9	12.9		

**A highly statistical significant difference at P <0.001

Figure (2): Distribution of the studied children in control and study groups regarding assessment of oral mucositis and mucositis-related symptoms in first week after receiving oncology therapy using The Children's International Mucositis Evaluation Scale (ChIMES) (n=70) in each group
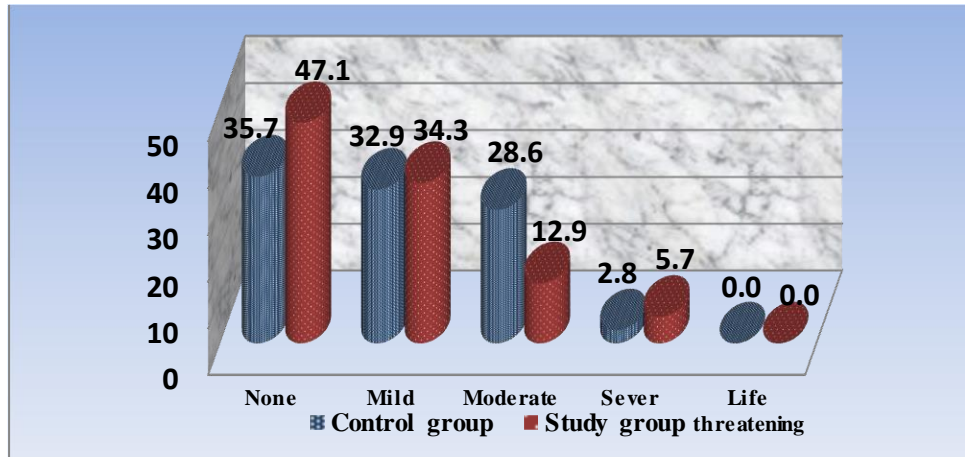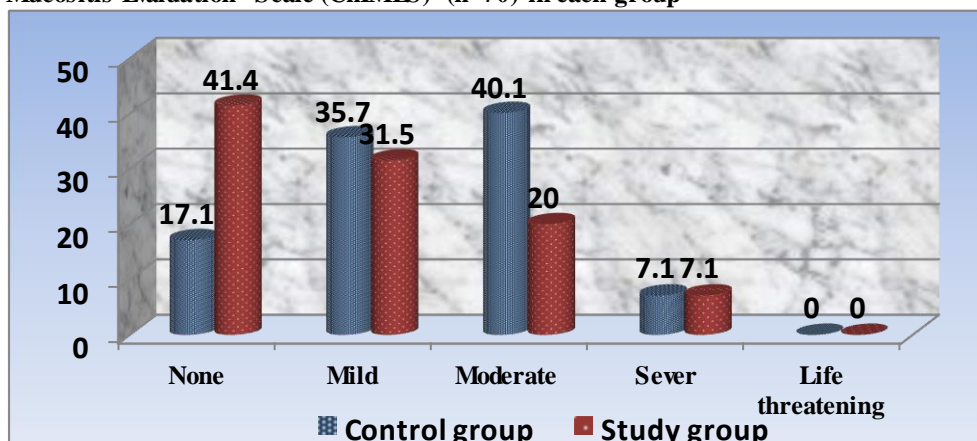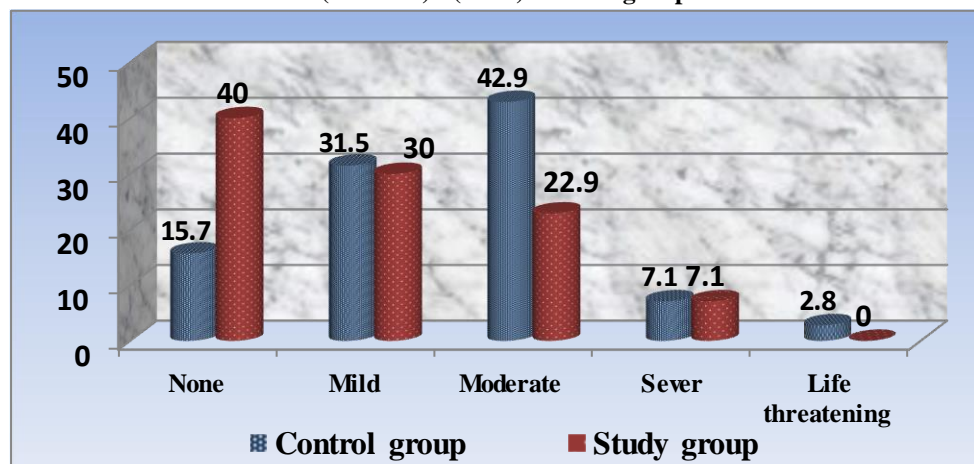

Figure (3): Distribution of the studied children in control and study groups regarding assessment of oral mucositis and mucositis-related symptoms in the second week after receiving oncology therapy, using The Children's International Mucositis Evaluation Scale (ChIMES) (n=70) in each group

Figure (4): Distribution of the studied children in control and study groups regarding assessment of oral mucositis and mucositis-related symptoms in the third week after receiving oncology therapy, using The Children's International Mucositis Evaluation Scale (ChIMES). (n=70) in each group

Table (9): Distribution of the studied children according to their total score regarding The World Health Organization (WHO) oral mucositis scale in the control and study group in the first, second and third week after receiving oncology therapy (n=70) in each group.

The World Health Organization (WHO) oral mucositis scale	Control group (n=70)						Study group (n=70)						X^2	P value
	First week after receiving oncology therapy		Second week after receiving oncology therapy		Third week after receiving oncology therapy		First week after receiving oncology therapy		Second week after receiving oncology therapy		Third week after receiving oncology therapy			
	No	%	No	%	No	%	No	%	No	%	No	%	10.806	P < 0.000**
Grade (0)	9	12.9	7	10.0	8	11.4	17	24.3	13	18.6	19	27.1		
Grade (I)	22	31.4	17	24.3	16	22.9	30	42.8	28	40.0	27	38.6		
Grade (II)	26	37.1	24	34.3	27	38.6	16	22.9	16	22.9	13	18.6		
Grade (III)	10	14.3	14	20.0	13	18.6	7	10.0	11	15.7	8	11.4		
Grade (IV)	3	4.3	8	11.4	6	8.5	0	0.0	2	2.8	3	4.3		

**A highly statistical significant difference at P <0.001

Table (10): Distribution of the studied children according to their total mean score regarding The Oral Assessment Guide (OAG) Scale, The Children's International Mucositis Evaluation Scale (ChIMES) and The World Health Organization (WHO) oral mucositis scale in the control and study group in the first, second and third week after receiving oncology therapy (n=70) in each group.

Oral mucositis assessment scales	Control group (n=70)			Study group (n=70)			Independent T test	P value
	First week after receiving oncology therapy	Second week after receiving oncology therapy	Third week after receiving oncology therapy	First week after receiving oncology therapy	Second week after receiving oncology therapy	Third week after receiving oncology therapy		
	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD		
The Oral Assessment Guide (OAG) Scale	11.2857±4.022	14.300±4.5184	14.2714±5.0416	9.3857±2.3974	9.7143±2.3783	10.7143±3.4352	11.583	P < 0.000**
The Children's International Mucositis Evaluation Scale (ChIMES).	9.6429±6.1527	14.911±5.3115	13.7143±4.2635	7.2857±5.4404	9.301±3.4947	9.6857±3.0576	10.952	P < 0.000**
The World Health Organization (WHO) oral mucositis scale	1.6571±1.0198	2.101±1.2412	1.9001±1.1053	1.1857±0.9214	1.7001±1.1715	1.2714±1.1153	6.038	P < 0.000**

**A highly statistical significant difference at P <0.001

5. DISCUSSION

Nurses are the main care providers for cancer children and choosing a suitable care strategy is a challenge faced by oncology nurses especially for children receiving oncology therapy. So, educating children and their caregivers about management of cancer therapy complications results in optimal use of healthcare services and improves quality of life of patients *(Bostanabad et al., 2019).* Nursing care are important parts of management and care of children undergoing oncology therapy. Whereas, any lack of nursing interventions directed to cancer children with oral mucositis was evidenced in this study. The administration of oncology therapy and fragmented nursing consultations were the predominant form of nursing care provided, So that, nurses should understand the profiles of susceptible pediatric patients, the main etiological factors, preventive and therapeutic measures to treat mucositis and support their practice.

Nowadays, cancer is considered as one of the most important health challenges. Although the number of childhood cancers are limited, these malignancies are the most common causes of death in children. Rather more, systemic therapies for cancer such as chemotherapy are often accompanied with some side effects, including oral mucositis. Whereas, mucositis refers to functional lesions of the oral cavity and associated with other problems, it may affect survival and treatment outcomes in cancer children *(Araújo et al., 2015).* The present study was focused on evaluating the effect of the nursing care adherence regarding oral mucositis in children undergoing oncology therapy.

Regarding nurses' personal characteristics, the findings of the current study revealed hat, more than one third were in the age group of twenty five to less than thirty. Moreover, less than two thirds of them were females and nearly two thirds of them had diploma of secondary nursing school. Additionally, it was noticed that, less than half of them had an experience from 5 to less than 10 years in oncology department. This not matched with *Avci & Sari, (2019)* in a study entitled" Oral mucositis in pediatric stem cell transplant unit" where as, the majority of nurses participating in the study had a bachelor's degree and more than two thirds of them in the age group of thirty to less than forty. The current study results regarding attendance of the studied nurses to any previous training courses related to oncology therapy revealed that, more than half of them hadn't attend any training courses regarding oncology therapy .This is may be attributed to hospital policies and the work overload at these units. This is in accordance with, *Bostanabad et al., (2019)* in a study entitled" Level of education provided by nurses to the parents of children with chemotherapy" who found in evaluation of the nurse's training on mucositis for children revealed that only 3.3% of the nurses received appropriate training in relation to chemotherapy induced oral mucositis, whereas more than half received no training and nearly two fifth received partial training .

Regarding the studied children's personal characteristics, it was observed that, more than one fifth in control group and study group; their age ranged from nine to less than twelve. This may be attributed to the most common age of onset was the school age. This is not in accordance with *Yavuz & Yılmaz (2015)* in a study entitled" Investigation of the effects of planned mouth care education on the degree of oral mucositis in pediatric oncology patients'' who found that, that the majority of the participants children were thirteen to eighteen years of age.

Regarding the most common type of cancer among studied children. It was found that, more than half of the study group and the control group have Acute Lymphocytic Leukemia (ALL). This may be due to the commonest oncology and hematological disease affecting children during childhood is leukemia. This in the same line with *Ebrahem et al., (2019)* in a study entitled "Children and parents' characteristics as factors causes depression, anxiety and stress among parents with children receiving chemotherapy" who found that, nearly two thirds of the studied children had Leukemia.

Concerning nurses' knowledge regarding cancer and its related concepts pre and post nursing care adherence implementation. It was found that, there was an improvement in their knowledge with a highly statistical significant difference pre and post implementation in most items. This is in accordance with *Abo Sharour (2019)* in a study entitled"

A cross-sectional study on oncology nurses' knowledge and practice of oral mucositis among cancer patients in Jordan" who found that, fifty-seven of the nurses had an unsatisfactory level of knowledge. Moreover, there was a significant difference existed among nurses with diploma, bachelor, and postgraduate degrees.

Regarding nurses' knowledge regarding oral mucositis and oral care. It was found that, there was an improvement in their knowledge with a highly statistical significant difference pre and post nursing care adherence implementation. This is in accordance with *Johnson (2013)* in a study entitled "Nursing interventions and supportive care for the prevention and treatment of oral mucositis associated with cancer treatment". who observed that more than three quarters of the staff nurses were not familiar with the self-care concerning oral health that should be used with inpatients, reinforcing the view that the care provided by nursing technicians is fragmented as they lack specific knowledge, are insecure or are not committed to providing integral care to patients.

Concerning nurses' practices in relation to oral care for children receiving oncology therapy pre and post nursing care adherence implementation. It was found that, there was a highly statistical significant difference pre and post intervention. This may be attributed to lack of training courses related to mucositis care in children receiving oncology therapy. This is in the same line with *Carlucci et al., (2016)* in a study entitled" Nursing care provided to hematologic cancer patients" who stated that, nurses should classify the oral conditions of patients daily and report the characteristics signs and

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symptoms of mucositis using instruments and recording these signs and symptoms in order to establish criteria to manage the condition, and define adherence and assessment routines with the staff.

Additionally, *Bostanabad et al., (2019)* found that the majority of pediatric patients had not received proper training for management of oral mucositis. Therefore, nursing authorities and planners should prepare the nursing personnel to provide care and special support to children with cancer. Also, *Zahn et al.., (2012)* in a study entitled" Relationship of protein and calorie intake to the severity of oral mucositis in patients with head and neck cancer receiving radiation therapy. Who stated that, nurses are supposed to implement and supervise oral care, always considering it a priority to provide information to the patient and help in the focus of the health education process, facilitating adherence and the success of nursing interventions when interventions are implemented as planned, they determine the outcome.

As regards to nurses' knowledge regarding oral mucositis and oral care. It was found that, there was an improvement in their knowledge with a highly statistical significant difference pre and post nursing care adherence implementation. In the same context *Southern, (2007)* in a study entitled "Oral care in cancer nursing: Nurses' knowledge and education" who found that there was a significant lack of training in terms of oral care in almost of the nurses. This is supported by, *Araújo et al., (2015)* in a study entitled " Cancer patients with oral mucositis: challenges for nursing care" who stated that, ideally when providing care to a cancer patient with oral mucositis, nurses should identify the level of severity and establish a classification of risk, giving priority to preventive measures for oral mucositis.

Additionally, *Toruner & Altay (2018*) in a study entitled "New trends and recent care approaches in pediatric oncology nursing " who reported that, a key component of a successful and effective pediatric cancer treatment is the delivery of care by skilled professional nurses. Whereas, the key initiatives of the pediatric oncology care include evaluation of models of nursing care and methods to optimize the transition process between research results and primary care providers; expansion of educational programs related to care for both nurses and children/families; development of evidence-based practices for health promotion and well-being.

From the researchers' point of view, there was decrease in nurses' knowledge in the present study before implementation of the nursing care adherence due to the fact that, more than two thirds of them had diploma of secondary nursing school and care of oral mucositis induced by oncology therapy is not included as a teaching subject in their curriculum before graduation. Also, work overload, insufficient in -services educational program regarding the previously mentioned subject together with inaccessibility or lack of provision of educational books, booklets, leaflets and manuals suite to the intellectual level of nurses with lack of time for reading led to lack of knowledge among nurses which obviously improved after implementation of nursing care adherence due to easy language of the guidelines content, relevance of the discussed items with repetition and discussion of the items. So that it is necessary to use appropriate continues educational program with more frequent sessions to sustain their impact.

In the same context *Araújo et al., (2015)* reported that, a way to ground the scientific nature and quality of care delivery, nurses should understand the profiles of susceptible patients, the main etiological factors, preventive and therapeutic measures to treat mucositis and support their practice on the nurse practitioners precepts and related theories.

Concerning the correlation between the total knowledge and total practice scores of the studied nurses. It was noticed a positive correlation between total nurses' knowledge and practice scores in pre and post nursing care adherence implementation. This may be attributed to enhancement in nurses' knowledge was reflected on skills improvement. This finding was supported by *Roe & Lennan, (2014)* in a study entitled" Role of nurses in the assessment and management of chemotherapy-related side effects in cancer patient" who stated that, chemotherapy nurses have been much respected for their technical, information-giving, and communication skills. Most recently, chemotherapy nurses have been developing assessment and management skills for supporting patients through their chemotherapeutic pathway. As, nurses have a real opportunity to add value to the patient pathway by undertaking this exciting new role.

Regarding the assessment of oral mucositis in the study group compared with the control group utilizing The Children's International Mucositis Evaluation Scale (ChIMES). It was noticed that, less than half of study group had no symptom regarding oral mucositis in the first week after nursing care adherence implementation. Meanwhile, more than one third of control group had no symptoms. Moreover, more than two fifth of the study group had no symptoms in the second week after nursing care adherence implementation. Meanwhile, more than two fifth of control group had moderate symptoms. Moreover, the minority of both groups had severe symptoms regarding oral mucositis in the third week after

receiving oncology therapy. This is may be rendered to the effect of the nursing care adherence on nurses' practice in caring for children with oral mucositis induced by oncology therapy. This is supported by *Toruner & Altay, (2018)* who pointed out that, the outcome of childhood cancer treatment can be improved substantially by implementations of programs. Whereas, there are different kinds of programs in pediatric oncology settings such as helping children and parents to reduce their anxiety, educate about illness and treatment, adhere the treatment, provide symptom control, improve the care and follow-up system, and school reentry program.

Additionally, *Yavuz & Yilmaz (2015)* found that, there was a significant difference between the median oral mucositis severity before and after the education. Moreover, both the degree of mucositis and pain intensity decreased when children were given a planned mouth care education before chemotherapy.

Concerning the total score of the studied children regarding the World Health Organization (WHO) oral mucositis scale in the control and study group after receiving nursing care adherence. It was indicated that, there was a highly statistical significant difference between study and control groups regarding stages of oral ulcers. This in the same context with *Sarvizadeh et al., (2015)* in a study entitled ―Morphine mouthwash for the management of oral mucositis in patients with head and neck cancer‖ who stated that, empowerment the nurses will improve the quality of care by reducing the feelings of exhaustion and incompetence in care. The roles of the pediatric hemato-oncology nurses are expanding within holistic care settings, and well-trained specialized nurses provide safe, effective, and quality care to children with oncology therapy related health problems.

Also, *Araújo et al., (2015)* added that, management of oral health during cancer therapy includes identifying at risk patients, patient education, appropriate pretreatment interventions and timely management of complications. Appropriate preventive and therapeutic measures will improve treatment outcomes as well as the patients' quality of life and help minimize the risk of oral and other complications of systemic therapy.

6. CONCLUSION

Based on the current study results it can be concluded that, nursing care protocol had a positive effect on the improvement of nurses' knowledge and practice about caring of children undergoing oncology therapy; as well as improvement of oral symptoms in the study group undergoing oncology therapy compared with the control group.

7. RECOMMENDATIONS

1- Conducting educational programs regarding nursing management of oncology therapy related complications in children.
2- Continuous training sessions for nurses to improve and update their oral care knowledge.
3- Future, observational studies aiming to improve the overall management of OM should be conducted.

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