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Impact of applying virtual reality computer games on complications among children undergoing chemotherapy

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***Abstract*---**Background: Virtual reality computer games are often used to district child attention during chemotherapy. As it is an attractive intervention to prevent complications such as nausea and vomiting among children undergoing chemotherapy. Therefore, this study aimed to determine the impact of applying virtual reality computer games on complications among children undergoing chemotherapy. Research design: A Quasi-experimental design was utilized for this study (study /control group). Subjects: A purposive sample of 100 children undergoing chemotherapy was equally and randomly assigned into two groups, the first was the control group and the second was the virtual reality computer games group. Setting: The study was conducted at the Oncology Institute in Sohag City. Tools: Tool one: A structured interviewing questionnaire and Tool two: Rhodes Index of Nausea and Vomiting Likert scale was utilized for collecting the data. Results: The current study results revealed that there a statistically significant difference was detected among the studied children as regards the occurrence frequency of nausea per 24 hours post the intervention compared to pre the intervention. A statistically significant difference was detected between the two groups

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as regards vomiting before and after the intervention. Conclusion: The current study results concluded that children who were exposed to virtual reality computer games experienced lower intensity of nausea and vomiting compared to children in the control group who received routine hospital care. Recommendations: Virtual reality computer games distraction method should be integrated as a part of the routine care of children undergoing chemotherapy. Parents' education should be recommended about non-pharmacological management of chemotherapy complications such as nausea and vomiting.

Keywords--- children, chemotherapy, virtual reality computer games, nausea and vomiting.

Introduction

Because pediatric cancer cannot be treated in the same way as adult cancers, which receive the majority of federal research money, childhood cancer is still a major problem. The current therapies are harmful, have an impact on a child's development, and maybe decades old. We must develop a specialized pediatric treatment to effectively combat pediatric cancer (Majid et al., 2020).

Chemotherapy is used to treat cancer. Chemotherapy is administered in cycles, with a rest interval following each treatment phase to allow the body to recover from the medication's effects. Cycles last two to three weeks, beginning on the first day of every cycle, chemotherapy follows a different schedule based on the medications being utilized (American Cancer Society, 2019). The nurse should assist the children in maintaining a comfortable position, provide support, and describe the necessary actions. Additionally, the nurse should coach the patient in relaxation techniques and daily rubber ball hand exercises in between appointments. This promotes vein growth and vein dilating (Li et al., 2019).

One of the most upsetting acute side effects of cancer treatment is chemotherapy-induced nausea and vomiting, which affects up to 80% of children (National Cancer Institute, 2019). Chemotherapy treatments could last for several months. So maintaining venous integrity during IV chemotherapy is crucial for the nurse (Sung et al., 2020).

Both aggressive and passive distractions are distractions. Through the use of an activity like playing video games to stimulate the audio-visual and tactile senses throughout the treatment, the active distraction encourages a child's involvement. Another cognitive-behavioral strategy for assisting kids in relaxing is guided visualization. When a child is passively distracted, they are simply seeing a stimulus rather than actively engaging in it, such as when they are watching television or films or listening to music. The most popular method for reducing anxiety and pain in children undergoing medical procedures is to distract them with fun activities like bubbles and video games (Semerci et al., 2020).

Healthcare workers are increasingly using the non-pharmacological strategy of distraction to lessen patients' discomfort and anxiety connected to medical

procedures. The fundamental process of distraction's potency depends on the attentional resources that each person has, which are finite. An engaging and attractive distractor can help patients cope with pain and anxiety by diverting their focus and impairing their ability to interpret externally unpleasant cues (Bani & Ahmad, 2018).

There are two types of distraction: passive (like watching television or listening to music) and active (like playing electronic games) (Buche et al., 2021). As a result, employing a distractor is a cognitive technique that can either actively engage patients in a task or passively refocus their attention. Virtual reality (VR) can provide a patient with varying degrees of involvement by placing them in a meditative or participatory environment that engages many senses (Chirico et al., 2019 Ahmadpour et al., 2020).

A subjective sense of being there in the world is created by the multimodal nature of VR (Chirico et al., 2019). On the one hand, the potency of virtual reality (VR) depends on how intense this multimodal immersion, also known as the sense of presence (Tennant et al., 2020), makes the user feel as though they are physically somewhere else. However, the level of acceptance of this instrument as well as the patients' sensory, cognitive, and emotional participation determines its success. The extent of interaction and engagement is closely related to the experience of presence and increased focus on distraction, which increases the benefits of VR (Birnie et al., 2018).

Children, especially those who are very ill, can have their attention diverted by using virtual reality, which has proven to be a useful additional technique. The children put on a head-mounted helmet that lets them see and hear what the real world is like. It gives both the capability of interacting with virtual reality videos and a high degree of seclusion from outside stimuli. No adverse effects related to using it have been recorded (Wochna Loerzel et al., 2020).

Virtual reality (VR) is a relatively new technique that provides distraction and is more effective than traditional methods. It involves a computer-generated environment that allows for orientation and three-dimensional interaction. This environment is projected directly in front of the user's eyes through advanced head-mounted displays (HMDs), which include wide fields of view and motion tracking systems (Virtual reality provides complete immersion and permits users to feel as if they are in a virtual environment (Rutkowski et al., 2020).

VR is an especially exciting method for children who are interested in imaginative play. Additionally, VR makes children feel comfortable and helps familiarize them with medical procedures, and environments. (Gerçeker et al., 2021) Virtual reality technology creates an immersive experience in a virtual environment that closely resembles the real world. VR-based interventions distract children's attention from active cognitive processing, which may result in higher pain thresholds and tolerance (Ahmadpour et al., 2020). Additionally; these interventions allow children to interact with simulated computing environments. The human brain has a limited ability to process details, so more complex VR programs tend to be more effective in reducing complications (Chow et al., 2021).

Passively redirecting a subject's attention using an audio-visual disruption, for example, a video game, is a straightforward technique that nurses can use to combat the issue of lack of attention (Wong et al., 2021). Video games can jog psychologically and classify the link between a child and his or her psychological pain by directing attention to others, shifting focus away from one's pain, emphasizing concern for others, thinking more positively, and disrupting other emotions (Zhang, 2019).

The nurse's responsibilities during chemotherapy include not preparing medications in the dining area but rather in a special room and performing these tasks while wearing plastic absorbent pads. The production of medicine should not be interrupted by anyone, according to nurses (King, 2019). Before administering the infusion, the nurse must check for clarity and use an arm board to protect the IV lines and placement of the needles (Altun & Sonkaya., 2019).

Significance of the study

Each year, 400,000 children receive a cancer diagnosis. The most frequent and unpleasant side effects of chemotherapy are nausea and vomiting. These side effects can make it difficult for patients to complete their treatments and can consume a lot of medical resources (Burke et al., 2016). In addition to the conventional use of antiemetics for the management of nausea and vomiting, alternative approaches must be developed for the better management of complications.

Virtual reality computer games are a diversion, and diversion is a crucial tactic for children (Chow et al., 2021). because it reduces the amount of distressing behavior that children generally exhibit as well as the complications of chemotherapy (Shapiro, 2018). There is a lack of studies that discuss the importance of virtual reality computer games as a type of distraction for children with cancer so the researchers done the current study to determine the impact of applying virtual reality computer games on complications among children undergoing chemotherapy.

Aim of the study

To determine the impact of applying virtual reality computer games on complications among children undergoing chemotherapy

- Assessing the complications among children undergoing chemotherapy.
- Evaluating the effect of applying virtual reality computer games on complications among children undergoing chemotherapy

Research hypothesis

Children undergoing chemotherapy who receive virtual reality computer games will exhibit less complications compared to children who do not receive them in the control group.

Operational definition

Virtual reality technology: It consists of a head-mounted gadget and a mobile phone that produces a 3-D real-time animation. In this study, it refers to employing mobile technology to access this 3D environment that has been artificially created. It can be used to divert a child's attention with the help of a head-mounted device (HMD) that has 3D-capable goggles, sensory input devices, and headphones. Virtual reality computer games are a diversion, and diversion is a crucial tactic for children. It has no harm on the children and is a quantitative benefit since it lessens the amount of distress behavior that is typically found in children and the complications of chemotherapy including nausea and vomiting.

Materials and Method

Research design

A Quasi-experimental design was utilized for this study (study /control group)

Setting

The study was carried out at the Oncology Institute in Sohag City. It has two buildings: an adult building and a pediatric building. The pediatric building has a chemotherapy unit on the second floor that has two rooms, one of which has three chaise lounges and the other of which has five chaise longue. Two sections make up the pediatric oncology ward on the third floor of the pediatric building. The first part consists of five rooms, each with two beds, two toilets, and a bathroom. Part two is divided into six rooms, each with two beds, two toilets, and a bathroom. This location was chosen because it serves the largest portion of the population from both rural and urban areas and because it has a high frequency of cancer in children in the specified settings.

Subjects
Sample calculation

Data collection employed the randomization technique. Children who received chemotherapy made up the study's purposive sample. They were randomly divided into two groups, one of which was the control group (consisting of 50 children), and the other was the study group (consisting of 50 children) virtual reality computer games. To choose the sample, we used a coin, with the face of writing being chosen for the control group and the face of the king being chosen for the study group.

The inclusion criteria were:

- Children 'aged (6 – 12) years who were undergoing chemotherapy.
- Conscious children.
- Both gender
- Children agreed to participate in the study.

The exclusion criteria were:

- Clinically unstable children participated.
- Children with cognitive impairments.
- Children with visual or hearing impairments.

Tools for data collection

There were two tools utilized to collect the required data. Those tools as the following:

Tools I: A structured interviewing questionnaire was developed by the researchers after reviewing related literature (Eijlers et al., 2019; Semerci et al., 2020; Tennant et al., 2020; & Sharifpour et al., 2021). It was written in the Arabic language to suit the study sample. The questionnaire is composed of two parts:
Part 1: Characteristics of the child, such as age, gender, child ranking, and educational level.
Part 2: Medical history of the children. This tool was designed by the researchers after reviewing literature and children's hospital sheets to collect data about each child, including any child's medical diagnosis, medical history of cancer which includes (family history, disease duration, methods of chemotherapy treatment) the side effects of chemotherapy such as nausea, vomiting, oral ulcer, joint pain, headache, anorexia.....etc.

Tool II: Rhodes Index of Nausea and Vomiting Likert scale

Rhodes and McDanial (1999) utilized this tool to evaluate nausea and vomiting in children receiving chemotherapy. They looked at the frequency, kind, and duration of vomiting as well as the severity and duration of nausea. The developed tool, which consists of 24 items in three parts, assesses all aspects of nausea and vomiting. The first part evaluates anticipatory nausea and vomiting and included eight items. The second part measures acute nausea and vomiting and also included eight items. Cronbach's alpha was used to measure internal consistency, and the result was 0.97.

Scoring system

1. "Yes" was given a value of "1" and "No" was given a value of "0" for questions with a "yes" or "no" answer.
2. If the length of nausea is less than one hour, the answer is "1," and if it is more than an hour, the answer is "2."
3. For the questions assessing the degree of nausea and vomiting, mild was given a value of "1," moderate a value of "2," severe a value of "3," and intolerable a value of "4".
4. "Once" was assigned a value of "1," "Twice" was assigned a value of "2," and so on for the questions asking about the frequency of nausea and vomiting.
5. "Small amount," "moderate amount," and "large amount" were given the values "1," "2," and "3," respectively, for the questions requesting an estimation of the amount of vomiting (Rhodes & McDaniel, 1999).

6. Scoring system: items of the scale are divided into 4 categories mild, moderate, severe, and intolerable in the study group, mild was 97 (97,0%), moderate was 2 (2,0%), severe was 1(1,0) intolerable 0 (0,0), wherein control group, it's also divided into 4 categories mild, moderate, severe, intolerable, where mild was 50(50,5%), moderate was 26 (26,3%), sever was 17(1,2) and intolerable 6 (6,1).

Tool validity

A panel of five pediatric nursing specialists and a professor of pediatric cancer medicine with more than ten years of expertise in the field reviewed the data collection instruments to determine the content validity. The tools were modified by the panel's assessments of the items' order, completeness, relevance, appropriateness, simplicity, and clarity.

Tool Reliability

Alpha Cronbach's test assessment tool was used to test the tools' internal consistency, and the results showed that the tool's reliability was high (0.88, 0, and 91). Cronbach's alpha was used to measure the internal consistency of the Rhodes scale, and the result was 0.97. The content reliability index was 0.88. The scoring system is as follows: mild = 1, moderate = 2, severe = 3, intolerable = 4, if nausea and vomiting are not present = 0 if they are present = 1.

Ethical Considerations

The study received approval from the Ethics Committee at the Faculty of Nursing, Sohag University. The researchers explained the purpose of the study and the anticipated results to all participating children during the initial interview. Oral approval was obtained from parents of children to participate in the study. The children were assured that all information would be kept confidential. Furthermore, they were informed that they could withdraw from the study at any time without needing to provide a reason.

Pilot Study

A pilot study was conducted on 10% of the total study sample, consisting of 10 children. The purpose of the pilot study was to assess the feasibility of the research process and the reliability, clarity, and applicability of the tools. No significant modifications were made to the study tools, which allowed for the inclusion of the study subjects in the final sample. Additionally, the pilot study helped estimate the time required for data collection, which was determined to be approximately 25-35 minutes.

Field of work

To achieve the aim of the current study, the following stages were followed: the pre-intervention stage, during the intervention stage, and the immediately after intervention stage. These stages were accomplished within six months, starting from February 2021 and concluding in August 2021.

Stage one: Pre-intervention stage: At the beginning of the study, the researchers conducted individual interviews with each child, introducing themselves and explaining the purpose and duration of the study. Oral approval was obtained from the parent and child before data collection. The researchers visited the study setting a week (Sunday and Wednesday) during the morning shift, to collect data using the established data collection tools.

During data collection, the researchers gathered information from the child's medical assessment sheet, including both the virtual reality computer games group and the control group underwent a child assessment at the start of the investigation. Researchers gathered and recorded data on the study's participants' demographics (pretest) such as diagnosis, disease onset, cancer therapy details, chemotherapy administration route, duration, and chemotherapy side effects. Additionally, the researchers assessed children for their complications from chemotherapy. The average interview duration for each child ranged between 25-35 minutes.

Stage two

Intervention Stage (Implementation)

- It included: Preparation the needed equipment: (Virtual reality (VR) 3D glasses (The researchers prepare the videos and games according to the studied children's needs, computer with a VR support system. 2-Children in the intervention group received training on the VR equipment to be familiar with the VR sets. "Virtual Reality Headset, 3D VR Glasses, Person computer, Theater Headset" using the following steps: Preparation and organization of the content videos and games according to children's age and ability. Preparation and organization of the content of videos and games: The content of videos and games were prepared and organized under various headings according to aim, objectives, and principles. Selecting the videos and games: The videos selected by the researchers to the following criteria: Videos and games should meet children's needs and interests. Videos and games should include section breaks. Videos and games should have acceptable technical quality. The length and pace of each video and game are appropriate to children's age and gender. Videos and games manipulating and rearranging create a flow add effects, graphics, and music, alter the style, pace, or mood of the video and games to adjust angle then watch it and take notes. Music, sound, color correction, and effects were added.

The prepared videos and games were edited by a video expert. -Using virtual reality glasses methods involving virtual reality glasses are used to minimize complications among children during and after chemotherapy. Each child should receive psychological preparation, which involves explaining the effects and importance of virtual reality glasses on their body muscles. Physical preparation includes helping the child assume relaxing positions, such as sitting with their entire back resting against the back of a chair, placing their feet flat on the floor with legs separated, or lying supine with a pillow under their head.

Virtual reality glasses (VRE) are connected to a mobile device, and children use them during chemotherapy administration. The virtual reality glasses intervention, which involves adjusting the lenses to match the interpupillary distance, is fitted with a mobile device and headphones, providing children with an opportunity to listen to and watch VR videos. They are allowed to choose from different videos that were previously reviewed based on their age and preferences.

Children received intervention using virtual reality video games in addition to receiving standard therapy. The intervention was implemented for children in the oncology unit's playroom by a research nurse. The time of implementation was flexible, and repeated sessions were held over the day to ensure that cancer children could play virtual reality video games. When they weren't undergoing any medical procedures or receiving bodily care, participants were invited to participate in the play activities.

The content includes a variety of group-playing activities, with one, in particular, involving the use of virtual reality through interactive stimulations produced by computer hardware and software to give kids the chance to interact in settings that resemble and feel like real-world objects and events. Some activities use more energy than others. The intervener can choose appropriate virtual reality video games for kids to play based on their sex, age, skill, and general health. Additionally, children may have a choice in the forms of play.

In the playroom of the pediatric cancer ward, a PlayMotion system was installed to create a virtual reality environment for kids to play in. A tool called the PlayMotion system turns commonplace surfaces like walls, floors, and ceilings into wildly interactive, virtual playgrounds. It blends video projector flexibility, computer vision algorithms, and in-game real-time special effects technologies. PlayMotion is a quick, absolutely intuitive, and natural experience because it doesn't require goggles, gloves, helmets, or markers. To enter thrilling, interactive projected play environments, only the shadows of moving arms are required; these places range from flying over a metropolis and producing trance-like waves, ripples, and colors to playing football, volleyball, or pool. The Rhodes index for nausea and vomiting was used to record the incidences of nausea and vomiting during and after chemotherapy as well as their characteristics.

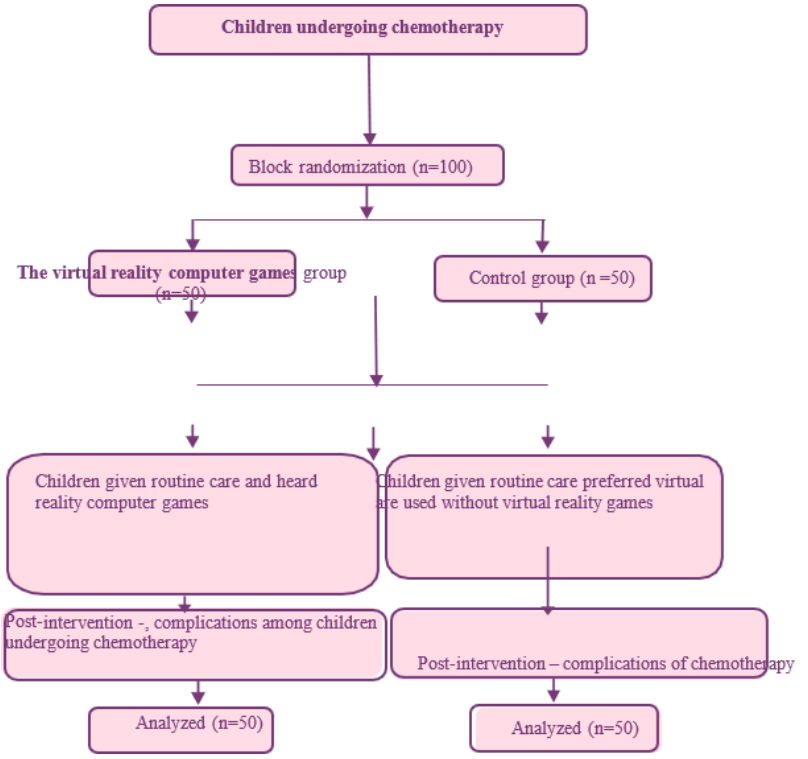
Stage three

Post-intervention stage

During this stage, the researchers conducted a reassessment of nausea and vomiting incidences documented after virtual reality glasses for each child undergoing chemotherapy using the same pretest tool II for the assessment as post-test tools.

Statistical analysis

The collected data were organized, tabulated, and analyzed using the statistical software SPSS version 20. Descriptive statistics were calculated, including the mean and standard deviation for quantitative data, and frequency and distribution for quantitative data. In analytical statistics, inter-group comparisons of categorical data were performed using the chi-square test (X2 value). Mann-Whitney test was used to compare quantitative variables between two groups. Additionally, the Pearson correlation coefficient test was used. A p-value of less than 0.05 was considered statistically significant (*), while a p-value greater than 0.05 was considered statistically insignificant. A p-value of less than 0.001 was considered highly significant (**), indicating strong statistical evidence in all analyses



Results

Table 1: Displays demographic information about virtual reality video games players and the control group. In terms of age, 50% of children in the virtual reality computer game group and 52% of children in the control group had mean SD (7.33±3.88 and 7.22 ±3.97, respectively) between 6 and 9 years old. Males dominated both the control and virtual reality computer gaming groups (56% and 54%, respectively). In terms of birth order, the majority (40 and 44%) of participants in virtual reality computer games and control groups, respectively, were in the second to third birth order. In terms of educational level, 32% of children in the control group and 30% of children playing virtual reality computer games were in third grade, respectively.

Figure 1 shows that both groups had a high percentage of leukemia diagnoses (50 and 42 percent, respectively).

Table 2: The medical history of cancer among children of the virtual reality computer game group and the control group is shown, and it was found that 60% of the virtual reality computer games group and 56% of the control group had no history of cancer in their families. In addition, only 68% and 73%, respectively, of both groups developed cancer within the previous year. According to the data, 74% of children in the control group received infusion treatments, compared to 70% of children who played virtual reality computer games, although there was no statistically significant difference.

Figure 2 shows that among children in the virtual reality computer game and control groups, nausea and vomiting were the two side effects of chemotherapy that were associated with the highest percentages of side effects (90% and 100%, respectively) during administration, followed by nausea (86% and 88% respectively) among children in both groups.

Table 3 shows the percentage distribution of children based on the items on the Rhodes Index of Anticipatory Nausea and Vomiting Scale. The results show that 72% and 74% of the virtual reality computer game and control groups, respectively, had no nausea before their last chemotherapy treatment. In terms of the length of nausea, the Mean SD for the virtual reality computer game group was 4.78 ±3.22, while it was 4.87 ±4.34 for the control group. Between the study and control groups, there were statistically significant variations regarding nausea frequency per 24 hours, with mean SD (1.45± 1.32 compared to 3.76± 2.65, respectively). Additionally, the findings showed that in terms of vomiting before treatment, there were statistically significant differences between the virtual reality computer game groups and the control groups ($p = 0.001$).

Table 4 shows that 100% of the children in the virtual reality computer game group had no nausea, compared to 74% in the control group concerning the Rhodes Index of Nausea and Vomiting Scale during Acute Nausea and Vomiting, with statistically significant differences ($p=0.000$). A statistically significant difference was found between the two groups in terms of vomiting during or within 24 hours of their last treatment ($p=0.00\%$), with virtually all children in the virtual reality computer games group (96%) reporting no vomiting compared to

(0.0%) in the control group. Regarding the severity, frequency, and volume of vomiting, there were no statistically significant differences found between the two groups.

Table 5: Displays that neither the virtual reality computer game nor the control groups had any vomiting for at least 24 hours after chemotherapy treatment (100% compared to 84%, respectively) regarding the Rhodes Index of Nausea and Vomiting Scale during Delayed Nausea and Vomiting. Additionally, 96% of children in the virtual reality gaming group experienced no vomiting, as opposed to just 0% of children in the control group. Regarding the presence of vomiting, a statistically significant difference was found between both groups, p= (0.001), but no statistically significant changes were found for the other items.

Table (1): Demographic data of the children in virtual reality computer games and control groups

Demographic data	Virtual reality computer games group(n= 50)		Control group(n= 50)		P-value
	No	%	No	%	
Age: (years)					
6 - < 9	25	50	26	52	0.524
9 - < 12	25	50	24	48	
Mean ± SD	7.33 ± 3.88		7.22 ± 3.97		0.313
Sex:					0.656
Male	28	56	27	54	
Female	22	44	23	46	
Birth order:					0.078
First	17	34	16	32	
2nd - 3rd	20	40	22	44	
Fourth or more	13	26	12	24	
Educational level:					
First level	5	10	6	12	0.085
Second level	6	12	5	10	
Third level	15	30	16	32	
Fourth level	10	20	9	18	
Fifth level	8	16	7	14	
Sixth level	7	14	6	16	

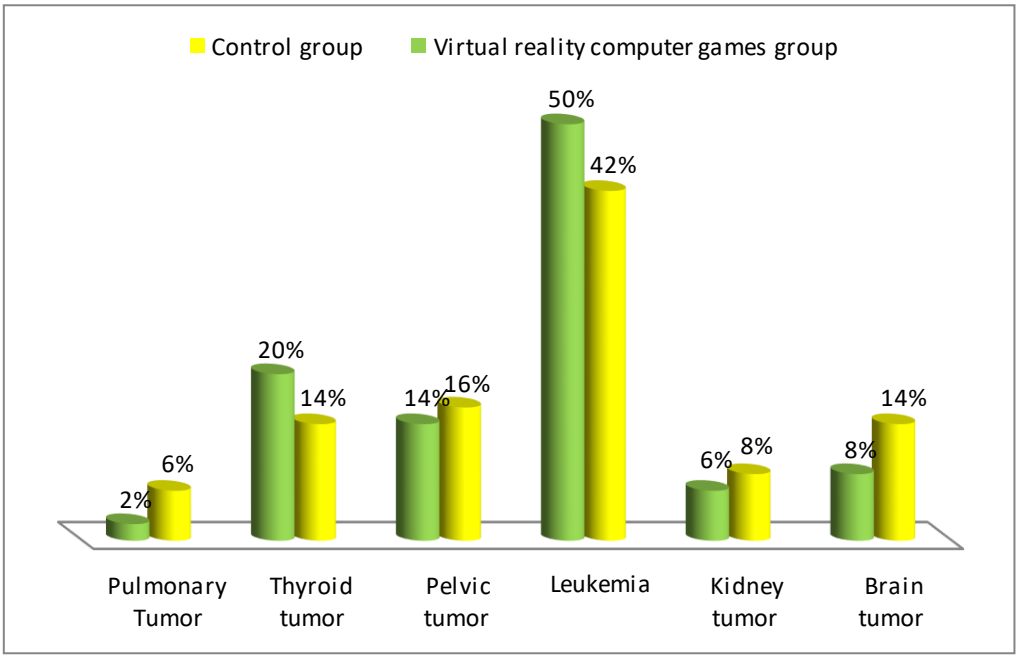


Figure (1): Medical diagnosis of the children in virtual reality computer games and control groups

Table (2): Distribution of medical history cancer of children in virtual reality computer games and control groups

Medical history	Virtual reality computer games group(n= 50)		Control group(n= 50)		P-value
	No	%	No	%	
Family history of cancer:					
Yes	20	40	22	44	0.197
No	30	60	28	56	
Duration of disease:					
One year	34	68	35	70	0.565
Two years	11	22	10	20	
Three years or more	5	10	5	10	
Chemotherapy treatment methods:					
Infusion	35	70	37	74	0.532
Infusion + IM	15	30	13	26	

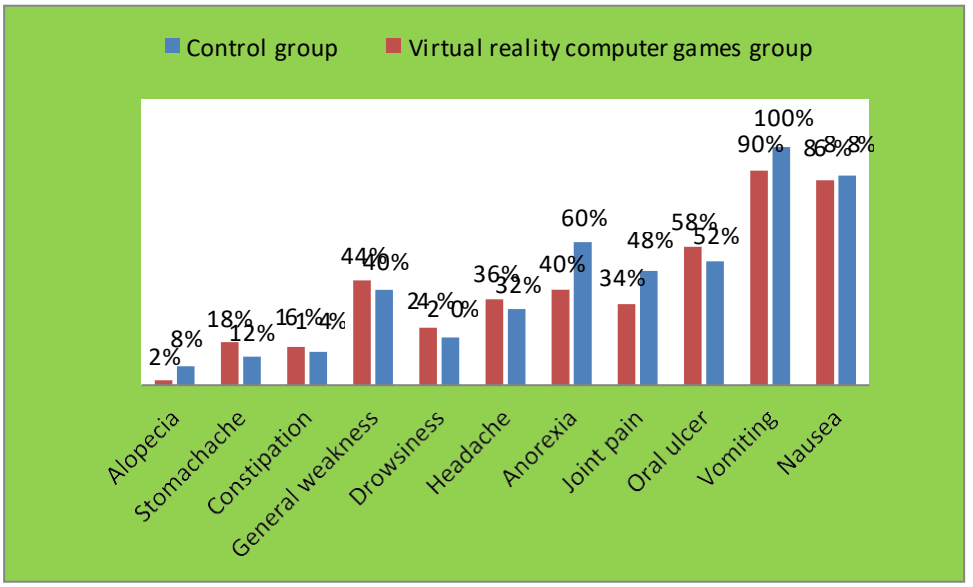


Figure (2): Side effects of chemotherapy distribution of the children in virtual reality computer games and control groups

Table (3): Children distribution concerning items of Rhodes index of nausea and vomiting scale during anticipatory nausea and vomiting

Items	Virtual reality computer games group(n= 50)		Control group(n= 50)		P-value
	No	%	No	%	
Nausea before children's last chemotherapy treatment:					1.000
Yes	14	28	13	26	
No	36	72	37	74	
Duration of nausea:					0.286
Mean ± SD	4.78 ± 3.22		4.87 ± 4.34		
The severity of nausea at its worst:					0.548
Mild	43	86	38	76	
Moderate	3	6	2	4	
Severe	4	8	10	20	
Several nausea times:					0.001*
Mean ± SD	1.45 ± 1.32		3.76 ± 2.65		
Vomiting before children's last chemotherapy treatment:					0.001*
Yes	40	80	12	24	
No	10	20	38	76	
The severity of vomiting at its worst:					0.086
Mild	45	90	42	82	
Moderate	2	4	0	0.0	
Severe	3	6	9	18	
Several vomiting times:					0.001*
Mean ± SD	1.53 ± 1.03		2.74 ± 1.56		
Amount of the vomiting before treatment:					0.001*

Small	46	92	39	78	
Moderate	2	4	0	0.0	
Large	2	4	11	22	

Table (4): Children distributed according to items of Rhodes index of nausea and vomiting scale during acute nausea and vomiting

Items	Virtual reality computer games group(n= 50)		Control group(n= 50)		P-value
	No	%	No	%	
Nausea during or within 24 hours of children last chemotherapy treatment:					
Yes	0	0.0	13	26	0.001*
No	100	100	37	74	
Vomiting during or within 24 hours of children last treatment:					
Yes	2	4	100	100	0.001*
No	48	96	0	0.0	
The severity of vomiting at its worst:					
Mild	1	0.0	35	70	
Moderate	0	50	10	20	0.567
Severe	1	0.0	2	4	
Intolerable	0	50	3	6	
Number of vomiting during or within 24 hours of treatment:					0.836
Mean ± SD	5.50 ± 6.36		3.35 ± 2.35		
Amount of the vomiting:					
Small	1	50	37	74	0.516
Moderate	0	0.0	3	6	
Large	1	50	10	20	

Table (5): Children distribution in virtual reality computer games and control group according to items of Rhodes index of nausea and vomiting scale during delayed nausea and vomiting

Items	Virtual reality computer games group(n= 50)		Control group(n= 50)		P-value
	No	%	No	%	
Nausea during 24 hours or more of children's last chemotherapy treatment:					
Yes	0	0.0	8	16	
No	100	100	42	84	0.001*
Duration of nausea :					
Mean ± SD	0		7.86 ± 3.98		0.001*
Nausea Severity:					
Mild	0	0.0	29	58	
Moderate	0	0.0	6	12	0.001*
Severe	0	0.0	15	30	
Several nausea times:					
Mean ± SD	0		4.56 ± 2.22		0.001*
Vomiting 24 hours or more of children's last treatment:					0.001*
Yes	2	4	100	100	

No	98	96	0	0.0	
Vomiting severity:					0.008*
Mild	0	0.0	37	74	
Moderate	0	0.0	6	12	
Severe	2	100	7	14	
Several vomiting times:					0.073
Mean ± SD	8.64 ± 3.87		3.33 ± 2.77		
Vomiting amount:					0.008*
Small	0	0.0	20	80	
Moderate	0	0.0	4	8	
Large	2	100	6	12	

Discussion

Chemotherapy 'side effects such as nausea and vomiting may increase hospitalization costs due to repeated hospitalizations, greater resource utilization, and loss of productivity for both children and carers. There are evidence supports the use of complementary and alternative methods like virtual reality. Non-pharmacological approaches may hold the greatest promise in relieving symptoms. Pediatric cancer patients consider chemotherapy-'side effects such as nausea and vomiting to be the most side effects of chemotherapy. Between 60 and 80 percent of pediatric cancer patients receiving chemotherapy are thought to have suffered nausea and vomiting (Kashaninia, 2016).

According to the present study's findings, children made up half of the entire sample, and the majority of them were children between the ages of 6 and 9. The findings of this study showed that the demographic data for the group receiving virtual reality computer games and the control group did not differ statistically substantially from one another. This, according to the researchers, can be observed in how similar the characteristics of the virtual reality computer game group and the control group are. Males dominated the two groups, the current study found, with the females coming in second. The World Health Organisation (2019) found that cancer incidence was higher in boys than girls in research, and our results are comparable to those findings.

According to the findings of the current study, a large majority of children had leukemia when it came to medical diagnoses. These findings are consistent with a study by Abdel Hadi (2019), who examined comprehensive care for pediatric cancer patients and noted that acute lymphatic leukemia was the most prevalent kind of cancer in children. Additionally, the findings are consistent with those of Elatter et al. (2018), who looked at cancer statistics and found that leukemia was the most prevalent type of cancer, followed by lymphoma and brain tumors.

The current study portrayed that three-fifths of the virtual reality computer game group and more than half of the control group had no medical history of cancer in their family. This is may be due to exposure to infectious agents, fetal or childhood exposure to environmental toxins such pesticides, solvents, other common home chemicals, and by radiation.

Less than three-quarters of participants in both groups had gotten cancer within the previous year, according to the current study's findings about the length of the disease. These results are consistent with a study by Hassan (2015) investigated the "Effect of Guided Imagery Relaxation Session on the Intensity of Nausea and Vomiting Among Children Undergoing Chemotherapy" and discovered that roughly half of the children had cancer for less than six months. These findings match with those of Abd El Razik (2019) investigated the "Effect of Educational Programme on Quality of Life for Patients with Cancer Undergoing Chemotherapy" and discovered that more than two-thirds of children get cancer within a year. This might be because cancer wasn't discovered until children were already young.

The latest findings showed that approximately three-quarters of children in the group playing virtual reality video games underwent infusion therapies. These findings are in line with those of Hassan (2015) found that chemotherapy was either given intravenously or intrathecally. Additionally, these findings are in line with those of Abd El Hadi (2019), who said that the majority of children underwent chemotherapy, which can be administered in a variety of ways depending on the cancer kind and the medications employed. Two separate administration methods could be employed when using two or more forms of chemotherapy. In addition, the administration routes are chosen based on the rates of drug absorption.

The results of this study demonstrated that among children in the virtual reality computer game and control groups, nausea and vomiting were the two chemotherapy side effects linked with the highest percentages during administration. This might have something to do with how toxic chemotherapy drugs are and how they destroy both healthy and cancerous cells. This result is congruent with that of Hassan (2015), who discovered that before practicing guided imagery relaxation, more than half of the kids in the three study groups experienced nausea and vomiting. These findings are similar to those of Abdel Hadi (2019) who claimed that nausea and vomiting were the most frequent side effects of chemotherapy.

The current findings regarding the impact of virtual reality computer games on nausea and vomiting showed that, while most virtual reality computer game players did not experience nausea and vomiting during 24-hour chemotherapy treatment, children in the control group continued to experience nausea and vomiting of varying degrees. The researchers concluded that this demonstrated the necessity for virtual reality computer game intervention among youngsters and that it was important to provide them with the knowledge they required to protect their health and decrease their discomfort.

The findings of the present study showed that there were significant differences between the groups that played virtual reality computer games and the control groups. This result, according to the researchers, shows the positive impact of virtual reality computer games interventions that meet children's needs and provide them with the knowledge they require to lessen chemotherapy consequences.

The results of the study showed that there was a statistically significant difference between the virtual reality computer games and control groups in terms of vomiting for at least 24 hours following chemotherapy treatment. These results were supported by the current investigation's goal and premise. The research by Niki et al., (2019) on " A novel palliative care approach using virtual reality for improving various symptoms of terminal cancer patients", is compatible with the current findings. The researchers claim that it was successful to put the training suggestions for cancer pediatric patients into the practice.

This result was consistent with Roy (2019) and Mohammed (2016), who found that playing virtual reality video games decreased nausea and vomiting. This might be a result of virtual reality computer game-related distractions. This outcome was consistent with that of Hassan's (2015) study, which found that nearly all children who played video games didn't experience nausea or vomiting. Additionally, children in the study group experienced nausea and vomiting less frequently, at lower intensities, and in smaller amounts than children in the control group. This could be due to children's attention being occupied by distraction tasks because activation was reduced in the areas of the brain that were responsible for the occurrence of nausea and vomiting such as the thalamus, insula, and the anterior cingulated cortex (Martin,2019).

The results of the present study illustrated the beneficial role of computer games during the intervention concern about the side effects of chemotherapy and the features of this game contributed to the successful results, which are supported by Beale et al.'s (2020) study, "Young Cancer Patients' Perceptions of a Video Game Used to Promote Self Care". Similarly to this, Vasterling et al. (2019) found that patients who used computer games to relax or divert their attention experienced significantly less nausea and vomiting after chemotherapy treatments than patients in the control group. Additionally, Kato (2018) discovered that playing video games helped people feel less worried about the negative effects of chemotherapy.

Virtual reality video games are a useful management and diversion aid for young cancer patients, and they may also lessen additional adverse effects of chemotherapy. According to the researchers, it reflected the positive effectiveness of virtual reality computer game applications, which improved and decreased the incidence of chemotherapy problems. These findings are comparable to those of earlier studies by (Zeng et al., 2019; Wochna Loerzel et al., 2020; Ahmad et al., 2020; Rutkowski et al., 2020; Semerci et al., 2021; Wong et al., 2021) which discovered that virtual reality computer games can lessen the severity of nausea and vomiting among children receiving chemotherapy.

Conclusion

Based on the findings of the present study and the research hypothesis, it was determined that children receiving chemotherapy who were exposed to virtual reality computer games had less intensity nausea and vomiting than children in the control group who received standard hospital care.

Recommendations

The following recommendations were made in light of the findings of the current study:

- Virtual reality computer games distraction method should be included in the standard care of children undergoing chemotherapy. Also, parents' education about non-pharmacological management of chemotherapy complications such as nausea and vomiting.
- To improve nurses' care of nausea and vomiting among children receiving chemotherapy, in-service education programs are required.
- Nursing staff training on non-pharmacological nausea and vomiting management for parents.
- To make generalizations, more research on a wider sample of kids is necessary.
- More research has to be done on the effectiveness of combining virtual reality computer games with music as a way to treat nausea and vomiting brought on by chemotherapy.

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