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Efficacy of Acupressure versus Deep Breathing Exercise on Post-Operative Nausea and Vomiting in Children

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Abstract:
Background: After an appendectomy, post-operative nausea and vomiting still cause problems. It is still the most typical anesthesia related post-operative complications. **Aim** of the preset study was to determine the efficacy of acupressure versus deep breathing exercise on post-operative nausea and vomiting in children. **Subjects and method:** This study was conducted at Assiut University Children Hospital's pediatric surgery unit; a quasi-experimental research design was used. This trial involved ninety children, who were split randomly into three groups: the acupressure group, the deep breathing exercise group and the control group. **Four tools** were used to get the data of this study. Tool (I): Biosocial demographic questionnaire form. Tool (II): Nausea assessment form. Tool (III): Vomiting assessment form. Tool (IV): Rhodes index of nausea and vomiting. The **results** of this study showed that a statistically significant difference (p-value of 0.001) was seen between the intervention groups and the control group, indicating that acupressure and deep breathing exercise were beneficial in reducing post-operative nausea and vomiting. The researchers **concluded** that acupressure was marginally more beneficial than deep breathing exercise, but there were no statistically significant differences between the two intervention groups. Researchers **recommended that** one of the post-operative modalities for managing nausea and vomiting should be the regular use of acupressure and deep breathing exercise.

Keywords: Acupressure, Children, Deep breathing exercise, Nausea, Post-operative & Vomiting

Introduction
The most frequent abdominal surgery in children that needs anesthesia is an appendectomy, which carries some risks and possible side effects **(Ergin et al., 2022).** An increased risk of post-operative nausea and vomiting (PONV) has been linked to appendectomy. Notably, children are twice as likely as adults to experience PONV. Severe nausea and vomiting during surgery can result in a number of problems, including dehydration, electrolyte imbalance, aspiration of stomach contents and pneumothorax. Furthermore, PONV may result in unanticipated readmissions and extended hospital stays **(Urits et al., 2020).**

There are pharmaceutical and nonpharmacological ways to treat nausea and vomiting. Preventive anti-emetic medication prescriptions are frequently written, especially in cases where the patient has fewer risk factors. These medications are ineffective and highly costly. Indeed, a number of studies indicate that these medications cause more harm than benefit; they have been linked to agitation, headache, constipation, neuroleptic syndrome, extended QT intervals and fatal arrhythmias. Additionally, these medications carry a black box warning in the United States **(Gan et al., 2020).**

Behavioral therapies such as self-hypnosis, aromatherapy, acupressure, acupuncture, deep breathing exercise and cognitive distraction are used in the nonpharmacological treatment of PONV. When weighing the costs and benefits, drug management is more expensive, while non-drug therapy has fewer side effects and is less costly. It may also help the patient become less dependent on medications **(ZHAO et al., 2021).**

An alternate form of treatment for PONV is acupressure. Because of its ease of use, great level of safety, and efficacy for treating visceral abdominal disorders including the reduction of nausea and vomiting, acupressure point 6 (PC6) is widely recognized. Conventional Chinese medicine holds that anesthesia or surgery upsets the body's natural equilibrium and disrupts the flow of blood and qi. The stomach qi reverses course and moves upward as a result of this stagnation, resulting in nausea and vomiting. Both qi and blood flow can be controlled by acupressure **(Yang et al., 2019).**

Deep breathing exercise reduces nausea and vomiting because it modifies the autonomic nervous system, which is essential to the peripheral nervous system that keeps the internal environment of the person in a state of homeostasis. Using this method results in an increase in the flow of oxygen into the cells. This

could reduce the generation of lactic acid. Additionally, the relaxed response may increase endorphin hormone levels, which would result in a calming feeling. As a result, it reduces the work of the abdominal vagal nerve and inhibits the work of the Chemoreceptor Trigger Zone (CTZ) as a center for nausea and vomiting **(Sari et al., 2021).**

Pediatric nurses should be knowledgeable about the risk factors linked to PONV and skilled in the use of nonpharmacological therapies as well as pharmacological treatment, as the pharmacological treatment has side effects and expensive consequences. In addition to antiemetic medications, nonpharmacological treatment is proven to be beneficial for PONV **(Von Peltz et al., 2021).**

Significance of the study

Post-operative nausea and vomiting (PONV) continues to be problematic even after anesthesia. PONV is still the most common adverse effect of anesthesia, despite a decline in its frequency as a result of pharmaceutical advances. Electrolyte imbalance, dehydration and delayed discharge can result from prolonged nausea and vomiting **(Martin et al., 2019).** Acupressure and deep breathing exercise have been suggested by certain studies as useful interventions for reducing PONV. Therefore, the purpose of this study was to determine if acupressure and deep breathing exercise were effective in alleviating post-operative nausea and vomiting, as well as to compare the effectiveness of the two methods.

Aim of the Study

The aim of the present study was to:

Determine the efficacy of acupressure versus deep breathing exercise on post-operative nausea and vomiting in children.

Research hypotheses

H 1: Conducting acupressure at pericardium point six is expected to reduce post-operative nausea and vomiting among children in the experimental group than children in the control group.

H 2: Performing deep breathing exercise is expected to reduce the incidence of post-operative nausea and vomiting among children in the experimental group than children in the control group.

H 3: The incidence of post-operative nausea and vomiting may vary between the acupressure group and the deep breathing exercise group.

Operational definitions:

Acupressure: acupressure is one type of massage. Pressure was applied to point P-6. Put pressure by the thumb and do massage in a circle. The muscles become more relaxed and blood flow is enhanced by pressing this acupoint.

Deep breathing exercise: the child is taught by the researcher how to breathe deeply by nose and hold inspiration for a maximum amount of time and exhale slowly.

Subjects and Method

Research design:

Quasi-experimental (non-randomized control group design) research was utilized in this study.

Setting:

This study was carried out at the pediatric surgery unit in Assiut University Children Hospital, which serves children in Upper Egypt from Beni-Suef to Aswan.

Subjects:

Ninety children, aged twelve to eighteen years old who had undergone appendectomy, were incorporated into the purposive sample of study participants. After the children's names were written on paper slips, put them into a bowl and the slips were then randomly selected. First slip was related to the acupressure group, second slip was related to the deep breathing exercise group and third slip was related to the control group.

Inclusion Criteria:

- Children from both sex between the ages of 12 and 18 years who have had appendices removed.
- Children with no injuries, discomfort, or necrosis in the pericardium point six area who were alert, able to follow instructions, and completely awake.

Sample size:

The study's sample size was determined using G Power Software. A one-way ANOVA test with fixed effects, an effect size (f) = 0.68, α error of 0.05, and an actual power (1- β) =0.89 was conducted. The sample size in each group was 30 children and the total sample size was 90 children to ensure sufficient statistical power.

Tools of data collection:

Data were collected using four tools.

Tool (I): Biosocial demographic questionnaire form: It has two parts that the researchers created in order to gather the necessary data:

Part (1): Personal data of the studied children such as age, sex, residence and education.

Part (2): Medical data related to child's surgery (reason of surgery, type of surgery, type of anesthesia and duration of surgery).

Tool (II): Nausea assessment form: It included two parts:

Part (1): Frequency of nausea assessed by how many times nausea occurs after 1 hour, 3 hours and 7 hours from surgery.

Part (2): The Visual Analogue Scale (VAS), which was adapted from **Boogaerts et al. 2000,** is used to

rate the severity of nausea. The VAS had a 10-centimeter line that was marked from 0 to 10, where 0 represented no nausea and 10 represented the greatest nausea that a person had ever experienced. The children were asked to put a mark on a line that best represented how sick they felt, with 0 representing no nausea, 1–3 mild nausea, 4–6 moderate nausea and 7–10 severe nausea.

0 [----------] 10
No Nausea Worst

Tool (III): Vomiting assessment form: it included two parts:

Part (1): Frequency of vomiting assessed by how many times vomiting occurs after 1 hour, 3 hours and 7 hours.

Part (2): The severity of vomiting was adopted from **American Academy of Pediatrics, 2014** and included classification based on the frequency of vomiting episodes, with 0 representing no vomiting, 1-2 episodes being considered mild, 3-7 episodes being considered moderate and 8 or more episodes being considered severe vomiting.

Tool (IV): Rhodes index of nausea and vomiting:

This tool was developed by **Rhodes & Daniel, 1999**. Rhodes index of nausea and vomiting form. This is five point likert type self-report questionnaire that have an eight-item.1- In the last 12 hr., I threw up __ times, 2- In the last 12 hr., from retching and dry heaves, I have felt __ distress, 3- In the last 12 hr., from vomiting or throwing up, I have felt __ distress, 4- In the last 12 hr., I have felt nauseated or sick to my stomach __ times, 5- In the last 12 hr., from nausea/sickness to my stomach, I have felt __ distress, 6- In the last 12 hr., each time I threw up, I produced a __ amount, 7- In the last 12 hr., I have felt nauseated or sick to my stomach __ times, 8- In the last 12 hr., I have had periods of retching/dry heaves without bringing anything up __ times. After translating the sentences into Arabic, in each row, the children are instructed to circle or mark through the one that best captures their experience. The range of the eight questions' total score is 0-32. None (0), mild (1-8), moderate (9-16), severe (17-24) and great (25-32).

Method

1. Official consent to gather the data required for this study was granted by the director of the pediatric surgery unit at the Assiut University Children Hospital.
2. To evaluate the application and clarity of the sheet and to determine how long it would take to complete each one, a pilot study involving 10% of the children (9) was conducted. The final form was established once the required adjustments were made. Every child who took part in the pilot study was not included in the study's overall sample.
3. Five experts in the disciplines of pediatric nursing and pediatric surgery evaluated the content validity of the tools. Their content validity index was 98%. The reliability of the tool I, tool II and tool III was checked using the alpha Cronbach test and it was 0.63, 0.80 and 0.71 respectively.
4. Tool IV was valid and reliable by **Basuony et al., 2022.** The content validity index was 98.5%. The reliability was checked using the alpha Cronbach test and it was 0.92.
5. To guarantee proper acupressure techniques, the researchers received seven days of training from Assiut University Hospital physical therapists.

Field of the work:

This study was carried out over a period of six months, from the beginning of May 2023 to the end of November 2023. The researchers went to the hospital two days per week .This study was carried out through four consecutive phases the interviewing and assessment phase, planning phase for experimental groups, the intervention phase for experimental groups and evaluation phase.

The interviewing and assessment phase:

During this phase, the researchers explained the aim and nature of the study to the caregivers of children and also obtained written consent for participation of their children in this study, the components of the tools and collected the needed information using tool I.

Planning Phase for experimental groups:

- Getting the children ready by dressing them in loose, comfortable clothing and teaching them and their mothers how to do acupressure and deep breathing exercise separately in each group.
- Preparing the room. In addition to being comfortable and well-ventilated, the room preserved privacy.
- The researchers' preparation. In order to protect the child's skin in the acupressure group, the researcher kept their fingernails short. The researchers were very calm, cheerful and kind with all groups.

The intervention phase for acupressure group:

Pressure was applied to point P-6, which is situated on the inside arm, close to the wrist, for the acupressure group. Place the first three fingers across the child's wrist as shown in figure (1) to locate pressure point P-6. Then, as shown in figure (2), put the thumb just below the index finger on the inside of the wrist. Under the thumb, the researcher felt two thick tendons tissue that joins muscles to bones. Pressure point P-6 is located here. Press on this spot for ten minutes using the thumb. Put pressure by the thumb and do massage in a circle. Maintain a firm but non-aggressive grip without causing pain. On the opposite wrist, repeat this technique **(Basuony et al., 2022)**.

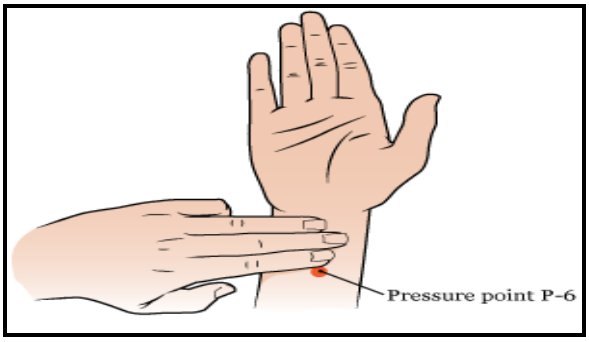

Figure (1): Placing 3 fingers across wrist to measure where to put thumb
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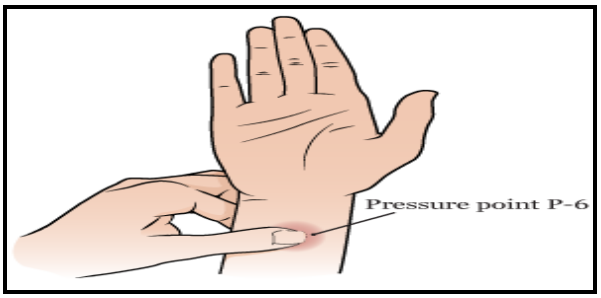

Figure (2): Placing thumb on point below index finger
https://www.researchgate.net/figure/Acupressure-for-Nausea-and-Vomiting-Available-from_fig1_351924046

The intervention phase for deep breathing exercise group:
Children in the deep breathing exercise group are first taught how to breathe deeply by nose, gently (holding inspiration for as long as possible), and slowly exhale from lips for ten minutes **(Ibrahim et al., 2020)**.

Time of intervention in both groups:
The first treatment was given 1 hour before the operation; the second treatment was given immediately before the child was moved from the recovery room to the unit; and the last treatment was given 3 hours after the operation **(Ming et al., 2002).**

Control group:
Control group in which nausea and vomiting observed without any intervention using tool II, tool III and tool IV. The children received routine hospital care, including monitoring vital signs and administering medication. Each of the three groups received the same routine hospital care.

Evaluation phase:
The frequency and severity of nausea and the frequency and severity of vomiting was measured three times including 1, 3, and 7 hours postoperatively **(Eslami et al., 2019**) using tool II and tool III and finally by Rhodes index of nausea and vomiting after 12 hours using tool IV **(Kushner et al., 2020).**

Ethical consideration
The director of the pediatric surgery unit at the Children University Hospital officially approved the study after it was reviewed and approved by the Ethics Committee of the Assiut University Faculty of Nursing on 24/3/2022 under the number 1120240373. It was followed by the submission of a formal letter detailing the study's objectives. Next, make sure that every participant understands the aim, benefits, and methods of data collection of this study. It was explained to the participants that they can pause at any moment without incurring any penalties and that their participation was completely voluntary. Next, signed consent was requested from the parents of each child included in this study. All data collected would be kept strictly confidential and used only to advance the objectives of the study.

Statistical analysis
Statistical Package for Social Sciences (SPSS) V.26 was used to organize, categorize, code, tabulate, and analyze the acquired data. Numbers, percentages, averages, and standard deviations were used to portray data in tables and charts. Chi-square test and Kruskal-wallis test were used to show relation between variables. A P-value of less than 0.05 was declared statistically significant.

Results:

Table (1): Percentage distribution of the studied children according to their personal data in the three groups (n=90):

Personal data	Acupressure group		Deep breathing exercise group		Control group		P-value
	N (30)	%	N (30)	%	N (30)	%	
Age/years:							
12-<14	16	53.3	18	60.0	15	50.0	0.064
14-<16	6	20.0	4	13.3	9	30.0	
16-18	8	26.7	8	26.7	6	20.0	
(Mean±SD)	(13.57±3.014)		(13.10±3.76)		(13.90± 1.73)		
Child's sex :							
Male	22	73.3	20	66.7	24	80.0	0.104
Female	8	26.7	10	33.3	6	20.0	
Residence:							
Rural	23	76.7	21	70.0	25	83.3	0.109
Urban	7	23.3	9	30.0	5	16.7	
Education:							
Don't read and write	3	10.0	1	3.3	2	6.7	0.068
Primary school	17	56.6	19	63.3	15	50.0	
Preparatory school	5	16.7	2	6.7	9	30.0	
Secondary school	5	16.7	8	26.7	4	13.3	

Chi-square test

Table (2): Percentage distribution of the studied children according to their medical data in the three groups (n=90):

Medical data	Acupressure group		Deep breathing exercise group		Control group		P-value
	N (30)	%	N (30)	%	N (30)	%	
Reason of surgery :							
Acute appendicitis	16	53.3	14	46.6	12	40.0	0.272
Chronic appendicitis	6	20.0	8	26.7	11	36.7	
Raptured appendicitis	8	26.7	8	26.7	7	23.3	
Type of surgery:							
Open	30	100.0	30	100.0	30	100.0	NA
Laparoscopic	0	0.0	0	0.0	0	0.0	
Type of anaesthesia:							
General	27	90.0	29	96.7	28	93.3	0.612
Spinal	3	10.0	1	3.3	2	6.7	
Duration of surgery:							
0.5-< 1hr.	16	53.3	14	46.6	13	43.4	0.091
1-< 2hrs.	6	20.0	8	26.7	9	30.0	
2- <3hrs	6	20.0	3	10.0	4	13.3	
3 hours and more	2	6.7	5	16.7	4	13.3	

Chi-square test

Table (3): Percentage distribution of the studied children according to their frequency of nausea in the three groups (n=90):

Variable	Categories	Acupressure group		Deep breathing exercise group		Control group		P-value 1	P -value 2	P-value 3
		N (30)	%	N (30)	%	N (30)	%			
Frequency of nausea after 1 hour from surgery	**None**	16	53.3	12	40.0	0	0.0	**0.001****	**0.001****	0.301
	<5 times	14	46.7	18	60.0	10	33.3			
	≥ 5 times	0	0.0	0	0.0	20	66.7			
Range		(0-4)		(0-4)		(1-9)				
Frequency of nausea after 3 hours from surgery	**None**	20	66.7	18	60.0	2	6.7	**0.001****	**0.001****	0.325
	<5 times	10	33.3	12	40.0	13	43.3			
	≥ 5 times	0	0.0	0	0.0	15	50.0			
Range		(0-4)		(0-4)		(0-9)				
Frequency of nausea after 7 hours from surgery	**None**	26	86.7	22	73.3	4	13.3	**0.001****	**0.001****	0.197
	<5 times	4	13.3	8	26.7	17	56.7			
	≥ 5 times	0	0.0	0	0.0	9	30.0			
Range		(0-2)		(0-2)		(0-8)				

Chi-square test

(**) highly statistical significant difference

P-value 1 *between Acupressure group and Control group*

P-value 2 *between Deep breathing exercise group and Control group*

P-value 3 *between Acupressure group and Deep breathing exercise group*

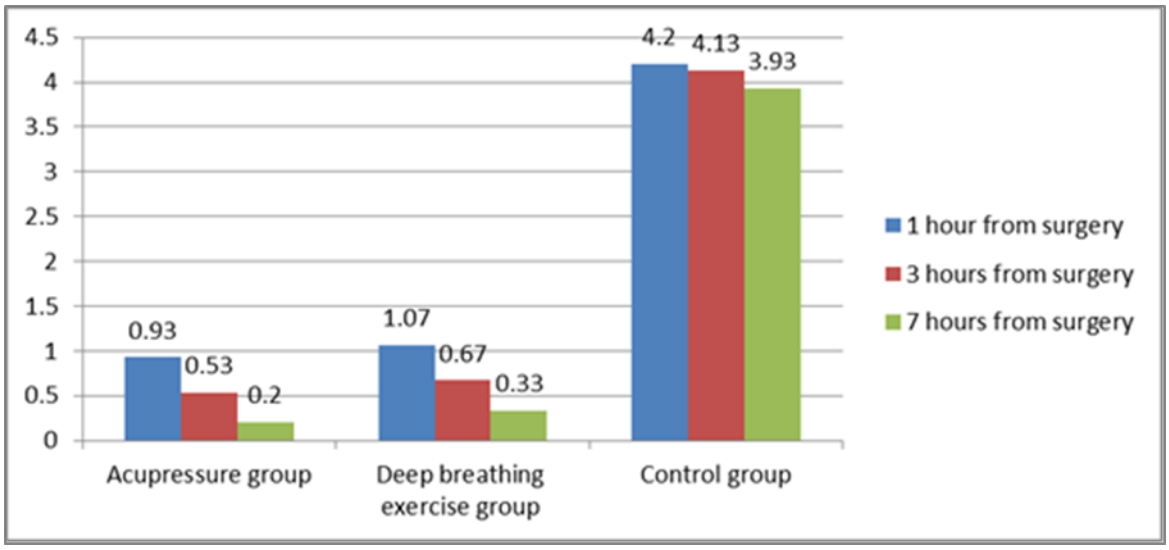

Figure (1): Mean of the frequency of nausea in the three groups

Table (4): Percentage distribution of the studied children according to their severity of nausea in the three groups (n=90):

Variable	Categories	Acupressure group		Deep breathing exercise group		Control group		P-value 1	P-value 2	P-value 3
		N (30)	%	N (30)	%	N (30)	%			
Severity of nausea after 1 hour from surgery	**None**	16	53.3	12	40.0	0	0.0	**0.001****	**0.001****	0.499
	Mild	12	40.0	14	46.7	10	33.3			
	Moderate	2	6.7	4	13.3	14	46.7			
	Severe	0	0.0	0	0.0	6	20.0			
Severity of nausea after 3 hours from surgery	**None**	20	66.7	18	60.0	2	6.7	**0.001****	**0.001****	0.431
	Mild	9	30.0	10	33.3	13	43.3			
	Moderate	1	3.3	2	6.7	10	33.3			
	Severe	0	0.0	0	0.0	5	16.7			
Severity of nausea after 7 hours from surgery	**None**	26	86.7	22	73.3	4	13.3	**0.001****	**0.001****	0.212
	Mild	4	13.3	8	26.7	17	56.7			
	Moderate	0	0.0	0	0.0	6	20.0			
	Severe	0	0.0	0	0.0	3	10.0			

Chi-square test

(**) highly statistical significant difference

P-value 1 *between Acupressure group and Control group*

P-value 2 *between Deep breathing exercise group and Control group*

P-value 3 *between Acupressure group and Deep breathing exercise group*

Table (5): Percentage distribution of the studied children according to their frequency of vomiting in the three groups (n=90):

Variable	Categories	Acupressure group		Deep breathing exercise group		Control group		P-value 1	P-value 2	P-value 3
		N (30)	%	N (30)	%	N (30)	%			
Frequency of vomiting after 1 hour from surgery	**None**	22	73.3	18	60.0	2	6.7	**0.001****	**0.001****	0.273
	<5 times	8	26.7	12	40.0	22	73.3			
	≥ 5 times	0	0.0	0	0.0	6	20.0			
Range		(0-3)		(0-3)		(0-9)				
Frequency of vomiting after 3 hours from surgery	**None**	24	80.0	23	76.7	6	20.0	**0.001****	**0.001****	0.243
	<5 times	6	20.0	7	23.3	19	63.3			
	≥ 5 times	0	0.0	0	0.0	5	16.7			
Range		(0-2)		(0-3)		(0-8)				
Frequency of vomiting after 7 hours from surgery	**None**	28	93.3	26	86.7	8	26.7	**0.001****	**0.001****	0.389
	<5 times	2	6.7	4	13.3	18	60.0			
	≥ 5 times	0	0.0	0	0.0	4	13.3			
Range		(0-1)		(0-1)		(0-8)				

Chi-square test

(**) highly statistical significant difference

P-value 1 *between Acupressure group and Control group*

P-value 2 *between Deep breathing exercise group and Control group*

P-value 3 *between Acupressure group and Deep breathing exercise group*

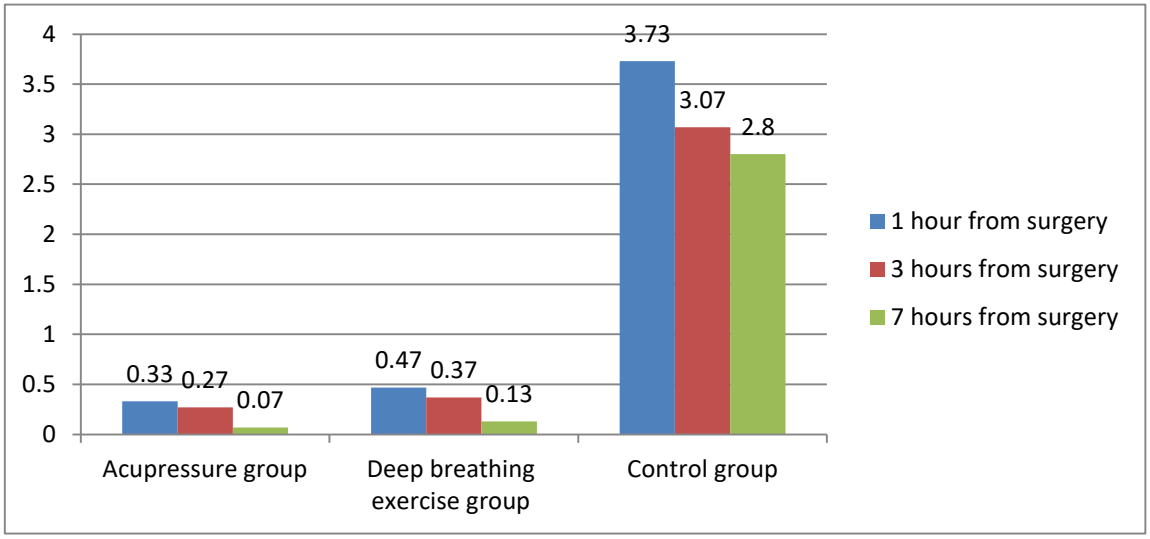

Figure (2): Mean score of the frequency of vomiting in the three groups

Table (6): Percentage distribution of the studied children according to their severity of vomiting in the three groups (n=90):

Variable	Categories	Acupressure group		Deep breathing exercise group		Control group		P-value 1	P-value 2	P-value 3
		N (30)	%	N (30)	%	N (30)	%			
Severity of vomiting after 1 hour from surgery	None	22	73.3	18	60.0	2	6.7	**0.001****	**0.001****	0.261
	Mild	6	20.0	9	30.0	8	26.7			
	Moderate	2	6.7	3	10.0	15	50.0			
	Severe	0	0.0	0	0.0	5	16.7			
Severity of vomiting after 3 hours from surgery	None	24	80.0	23	76.7	6	20.0	**0.001****	**0.001****	0.541
	Mild	6	20.0	5	16.6	10	33.3			
	Moderate	0	0.0	2	6.7	11	36.7			
	Severe	0	0.0	0	0.0	3	10.0			
Severity of vomiting after 7 hours from surgery	None	28	93.3	26	86.7	8	26.7	**0.001****	**0.001****	0.438
	Mild	2	6.7	4	13.3	13	43.3			
	Moderate	0	0.0	0	0.0	8	26.7			
	Severe	0	0.0	0	0.0	1	3.3			

Chi-square test
(**) highly statistical significant difference
P-value 1 *between Acupressure group and Control group*
P-value 2 *between Deep breathing exercise group and Control group*
P-value 3 *between Acupressure group and Deep breathing exercise group*

Table (7): Percentage distribution of the studied children according to their total score of Rhodes index of nausea and vomiting in the three groups (n=90):

Categories	Acupressure group		Deep breathing exercise group		Control group		P-value 1	P-value 2	P-value 3
	N (30)	%	N (30)	%	N (30)	%			
None	16	53.3	12	40.0	0	0.0	**0.001****	**0.001****	0.206
Mild	11	36.7	13	43.3	6	20.0			
Moderate	3	10.0	5	16.7	15	50.0			
Severe	0	0.0	0	0.0	5	16.7			
Great	0	0.0	0	0.0	4	13.3			

Kruskal-wallis test
(**) highly statistical significant difference
P-value 1 *between Acupressure group and Control group*
P-value 2 *between Deep breathing exercise group and Control group*
P-value 3 *between Acupressure group and Deep breathing exercise group*

Table (1): Represents percentage distribution of the studied children according to their personal data in the three groups. Regarding their age (53.3%, 60%, 50%) respectively were in age group ranged from 12-<14 years, more than two third of them (73.3%, 66.7%, 80%) respectively were male, (76.7%, 70.0%, 83.3%) were from rural area and minimum of them (10.0%, 3.3%, 6.7%) respectively don't read and write. There were no statistically significant differences between the three groups regarding personal data.

Table (2): Clarifies percentage distribution of the studied children according to their medical data in the three groups. Regarding reason of surgery more than half of children (53.3%) in acupressure group undergone appendectomy due to acute appendicitis and less than half of them (46.6%, 40.0%) respectively in the other two groups undergone appendectomy for the same reason. The surgery in all of them (100%) was open. In almost of them (90%, 96.7%, 93.3%) respectively anesthesia was general. Duration of surgery take from 0.5-< 1hr. in more than half of children (53.3%) in the acupressure group and less half of them (45.6%, 43.4%) respectively in the other two groups. There were no statistically significant differences between the three groups regarding medical data.

Table (3): Shows percentage distribution of the studied children according to their frequency of nausea in the three groups after 1, 3 and 7 hours from surgery. It was detected that there were a highly statistically significant differences between acupressure group and control group and between deep breathing exercise group and control group **(p.value 0.001**).** There were no statistically significant differences between acupressure group and deep breathing exercise group regarding frequency of nausea.

Figure (1): Illustrates the mean score of the frequency of nausea in the three groups after 1, 3 and 7 hours. It was (0.2, 0.33, 3.93) respectively after 7 hours in the three groups.

Table (4): Describes percentage distribution of the studied children according to their severity of nausea in the three groups after 1, 3 and 7 hours from surgery. It was detected that there were a highly statistically significant differences between acupressure group and control group and between deep breathing exercise group and control group **(p.value 0.001**).** There were no statistically significant differences between acupressure group and deep breathing exercise group regarding severity of nausea.

Table (5): Demonstrates percentage distribution of the studied children according to their frequency of vomiting in the three groups after 1, 3 and 7 hours from surgery. It was found that there were a highly statistically significant differences between acupressure group and control group and between deep breathing exercise group and control group **(p.value 0.001**).** There were no statistically significant differences between acupressure group and deep breathing exercise group regarding frequency of vomiting.

Figure (2): Illustrates the mean score of the frequency of vomiting in the three groups after 1, 3 and 7 hours. It was (0.07, 0.13, 2.8) respectively after 7 hours in the three groups.

Table (6): Describes percentage distribution of the studied children according to their severity of vomiting in the three groups after 1, 3 and 7 hours from surgery. It was detected that there were a highly statistically significant differences between acupressure group and control group and between deep breathing exercise group and control group **(p.value 0.001**).** There were no statistically significant differences between acupressure group and deep breathing exercise group regarding severity of vomiting.

Table (7): Represents percentage distribution of the studied children according to their total score of Rhodes index of nausea and vomiting in the three groups. It was detected that there were a highly statistically significant differences between acupressure group and control group and between deep breathing exercise group and control group **(p.value 0.001**).** There were no statistically significant differences between acupressure group and deep breathing exercise group regarding Rhodes index of nausea and vomiting.

Discussion:

Post-operative nausea and vomiting has detrimental effects for the patient, surgical recovery, the healthcare professional and the institution. Non-pharmacological strategies has been shown to be superior to placebo and demonstrates similar results to antiemetic drugs in suitable high-risk patients without the risks associated with drug therapy **(Morrison & Wilmshurst, 2019).** So this study aimed to determine the efficacy of acupressure versus deep breathing exercise on post-operative nausea and vomiting in children.

The findings of this study demonstrated that acupressure had a positive effect on post-operative nausea and vomiting in children after appendectomy and there were statistically significant differences between the acupressure group and control group related to the frequency and severity of both nausea and vomiting.

These results are in the similar line with **Basuony et al., 2022** who evaluated the effect of implementing acupressure technique on gastrointestinal problems and pain control for children post abdominal surgeries and they found that there were statistically significant differences in the occurrence of postoperative nausea and vomiting after application of acupressure also, **Pouy et al., 2019** who conducted a similar study on the effect of acupressure on post tonsillectomy nausea and vomiting in pediatrics and they found that the acupressure reduces the intensity of nausea and vomiting after tonsillectomy in children.

Furthermore, this outcome was corroborated by **Sadri et al., 2006**, who examined the impact of acupressure on nausea and vomiting following adenotonsillectomy and discovered that applying acupressure right away following surgery reduces the intensity of nausea and vomiting. The effectiveness of intraoperative acupuncture and postoperative acupressure as supplemental treatments for postoperative vomiting in children aged 1-11years undergoing tonsillectomy with or without adenoidectomy was assessed by **Linddon et al., 2011**, who discovered that both acupuncture and acupressure are useful in the treatment of pediatric PONV.

The total Rhodes index score for nausea and vomiting differed statistically significantly between the acupressure and control groups, according to this study. This explains why it has been demonstrated that applying acupressure at Pericardium 6 (PC6) can effectively reduce post-operative nausea and vomiting. These results are consistent with those obtained by **Basuony et al., 2022**.

Many non-pharmacological studies have employed acupressure to treat postoperative nausea, vomiting, and postoperative pain. The theory behind acupressure states that pain, illness, or discomfort can result from any imbalance or obstruction of energy flow throughout the body. Acupressure therefore aims to bring the body back into equilibrium. Acupoints are locations on the body that are designated by Chinese medicine. Applying pressure at these spots will help the person feel more comfortable, boost blood circulation and vital energy, relieve muscle spasms, and restore the body's inner equilibrium. In many nations around the world, particularly China, acupressure has long been utilized as a traditional treatment for nausea and vomiting **(Doran & Halm, 2010)**. An excellent acupoint for reducing nausea and vomiting is PC6, as one of its tasks is to prevent the unfavorable flow of qi **(Matos et al., 2021)**. The results of this study showed that deep breathing exercises improved children's post-operative nausea and vomiting following appendectomy; additionally, there were statistically significant differences in the frequency and severity of nausea and vomiting between the deep breathing exercise group and the control group. This might be caused by increased oxygen uptake into the cell, which lowers lactic acid generation, and increased endorphin hormone levels, which lower vagal nerve activity.

This is supported by a study by **Sari et al., 2021**, who investigated the impact of deep breathing relaxation techniques on intraoperative patients' responses to nausea and vomiting while under spinal anesthesia in the central surgical installation of Padang Panjang City Hospital. They discovered a significant relationship between deep breathing techniques and nausea and vomiting.

The overall Rhodes index score for nausea and vomiting differed statistically significantly between the deep breathing exercise group and the control groups, according to this study. The same findings were published by **Ibrahim et al., 2020** in their investigation into the impact of diaphragmatic breathing exercise on post-operative nausea, vomiting, and retching in patients undergoing orthopedic surgery. The researchers discovered that there were significant statistical differences in the participants' overall scores on the Rhodes index of nausea and vomiting.

This can be explained by the fact that deep breathing exercise lower the incidence of nausea and vomiting because they regulate gastrointestinal movements, induce relaxation, and lower anxiety. They also have a relaxing and stabilizing effect on the autonomic nervous system and vagus nerve stimulation. Moreover, it eases the spastic contraction of the abdominal and respiratory muscles that occurs during nausea and vomiting **(Chen et al., 2017)**.

When comparing the effectiveness of deep breathing exercise and acupressure for treating children's post-operative nausea and vomiting, it was discovered that there were no statistically significant differences between the two groups in terms of the frequency and severity of nausea and vomiting as well as the overall score of the Rhodes index for nausea and vomiting. No research was discovered to corroborate these conclusions because some studies focus just on acupressure, while others focus only on deep breathing exercise.

Between the three groups, there were no statistically significant differences in the personal characteristics and medical data of the children under study. The results aligned with the research conducted by **Schlager et al., 2000** in Korean hand acupressure reduces postoperative vomiting in children after strabismus surgery. The study found no statistically significant differences between the groups regarding age, gender, physical status, weight, duration of anesthesia, and length or extent of surgery.

Additionally, **Pouy et al., 2019** who found no significant relationship between the demographic characteristics of the samples in terms of age, sex, and cause of tonsillectomy in the three groups.

Conclusion:

The researchers found that there were statistically significant differences between the intervention groups and the control group, and that acupressure and deep breathing exercise had a beneficial effect on the frequency and severity of both nausea and vomiting. Regarding the efficacy of acupressure versus deep breathing exercise on post-operative nausea and vomiting in children. The results indicated that acupressure was marginally more effective than deep breathing exercise, but no statistically significant differences were observed between the two groups.

Recommendations:

- Performing an additional trial with a larger sample and other regions of Egypt to compare the effectiveness of acupressure and deep breathing exercise on post-operative nausea and vomiting in children.
- Deep breathing exercise and acupressure should be included in routine practice as a means of managing postoperative nausea and vomiting.
- The knowledge and abilities of nurses in using non-pharmacological interventions to lessen nausea and vomiting following abdominal surgery should be enhanced through educational program.

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