

The Effect of Applying Virtual Reality in the Labor Unit: A Comparative Study

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Abstract: Due to the debilitating effects of severe labor pains, labor pain management continues to be an important subject that requires much attention. Application of VR can have a significant impact on nursing practice by providing a non-pharmacologic solution to reduce the pain and anxiety. Aim of this study to evaluate the effect of applying virtual reality in the labor unit: a comparative study Research design: A Quasi-experimental design Setting: study conducted in Hawaa Center is popular center in manshia nasar Cairo in Egypt. Sample: purposive sample (80 women (control-study) and convenient sample for 30 nurses) was selected according to inclusion and exclusion criteria. Tool: Data was collected through tools for laboring women include: A structured interviewing questionnaire, Behavioral rating scale, Visual analogue scale sheet. For nurses one tool was used that include Socio-demographic data, nurse's knowledge Questionnaire, nurse's satisfaction Questionnaire. Result: During - intervention program revealed a highly significant improvement ($p < 0.000$) among the study group than the control group. Additionally, the present study clarifies a highly significant improvement after intervention in the total knowledge score of studied nurses. Conclusion: Application of virtual reality at labor unit have a positive effect on decrease labor pain among laboring women. As well as increase nurses' knowledge and satisfaction after implementing the educational session and distributing the learning package. Recommendations: Shed light on the virtual reality is recommended as an alternative non- pharmacological therapy, raising awareness of maternity nurses regarding the effect of virtual reality application to decrease labor pain among laboring women.

Keywords: Virtual Reality, Visual analogue scale, Labor Pain.

1. INTRODUCTION

Normal labor is terms 'physiological birth', 'normal birth' and 'natural birth' are often used interchangeably but usually refer to birth which has not been managed by medical intervention. Normal birth includes the opportunity for uninterrupted skin to skin and breastfeeding in the first hour after birth. The World Health Organization defines normal birth as: spontaneous onset low risk at the start of labor · remains low risk throughout labor and birth · the baby is born: spontaneously, in the vertex position, between 37 and 42 completed weeks gestation (term). The woman and baby are in good condition after the birth (Weckend, Davison & Bayes., 2022).

Pain during labor is a universal experience, although the intensity of the pain may vary. Although labor and childbirth are viewed as natural processes, both can produce significant pain and discomfort. A woman's pain perception can be influenced by previous experiences with pain, fatigue, pain anticipation, positive or negative support system, labor and birth environment, cultural expectations, and level of emotional stress and anxiety. Recent evidence suggests that adequate relief of labor pain may be associated with a decreased risk of Postpartum depression (Zhang et al., 2018).

Virtual Reality (VR) is a nonpharmacological therapy and a distraction intervention to provide a pleasant environment by using a computer- stimulated technique that provide a visual image with accompanying sounds by wearing a headset connected to a computer or a smartphone. This technology allays pain and anxiety by allowing individuals to hear, feel and communicate with stimuli of virtual environment as a real world (**Linowes., 2020**).

Nurses have a critical and vital role in assessing the women's perception of pain by documenting and evaluating the pain and providing options for pain control by giving information about pain relief measures used by the hospital. In addition to, evaluating the maternal and fetal response to treatment as side effects, women's satisfaction with that treatment and modifying the plan of care when needed. Effective and competent nurses must be knowledgeable and understand maternal and fetal physiology, implications of treatment and usually try to diminish distress related to pain and respond quickly to reports of pain and will believe patients' reports of pain (**Murray & Huelsmann, 2020**).

Significance:

According to World Health Organization (WHO), that suggest that CS rate should lies between 5% and 15 % however the worldwide percentage is higher. This represents 21.1% worldwide (**Candel, et al., 2020**). The past decade has witnessed a sharp increase in CS rate in Egypt which has an alarming level in recent years. This estimated as 51.8 % according to Egypt Demographic and Health Survey (**Al Rifai., 2017**).

Aim of the study

The aim of this study is to evaluate the effect of applying virtual reality in the labor unit: a comparative study through the following objectives:-

- Assess pain level for laboring women before application of virtual reality.
- Apply of virtual reality during first stage of labor.
- Assess pain level for laboring women during application of virtual reality.
- Compare the pain level among laboring women who receive virtual reality technique and laboring women who receive traditional management.
- Prepare learning package for nurses regarding the effect of virtual reality on level of pain among laboring women.
- Assess nurse's knowledge related to using virtual reality with laboring women.
- Implement educational session using the previously prepared learning package for nurses.
- Evaluate the effect of applying educational session by using learning package on nurse's knowledge and satisfaction.

Research hypothesis:

- 1- Application of virtual reality in labor unit will decrease level of pain among laboring women.
- 2- Nurse's knowledge and satisfaction will be improved after application learning package of virtual reality.

2. THE SUBJECTS AND METHODS

1. Technical Item:

Includes research design, setting of the study, subjects of the study and tools for data collection.

Research design:

A quasi experimental design was utilized in this study. It is an empirical study used to estimate the causal impact of an intervention on its target population without random assignment.

Setting:

The study was conducted at labor unit in Hawaa center. Hawaa Center is located in Manshia Naser- Cairo in Egypt. Hawaa Center is consists of waiting area, nursing office, examination room, and ultrasound room, 1st stage area is consist of four private rooms, 2nd and 3rd stages area and 4th stage area same the 1st stage area .

Subjects of the study:
Sampling:
Sample type:

A convenient sample was used for nurses and a purposive sample was used for laboring women according to inclusion and exclusion criteria as following:

Inclusion criteria for laboring women:

1-Laboring women in first stage.

Exclusion criteria for laboring women:

1- Laboring women with high risk pregnancy.

2- Laboring women are taking pharmacological methods to relieve pain during first stage of labor.

Sample size:

The total sample divided into two groups equally (study group (40) and control group (40) and all nurses through morning shift (30 nurses) at Hawaa Center -Cairo city- Egypt.

Tools for data Collection:

- The data for this study was collected using four tools:

The first tool: Structured interviewing questionnaire:

This tool was prepared by the researcher used to assess the studied laboring women regard the following: It included two parts:

Part one: Socio-demographic data such as; - age, level of education, and occupation.

Part two: Past& Current obstetric history such as; -number of pregnancies, deliveries and abortion.

The second tool: Behavioral rating scale (qualitative pain assessment): that adopted from Payen et al., (2001) the behavioral pain assessment scale rated by each of the 5 measurement categories (face, restlessness, muscle tone, vocalization, and Consolability) (0, 1, or 2). add these together. Document the total pain score out of 10.

Scoring system

Concerning **behavioral pain assessment items** (qualitative pain assessment), it was five items each one was three points Liker scale (0 – 2) as (0) for tolerable pain sensation, (1) for moderate pain sensation, and (2) for sever intolerable pain sensation. The women 'behavioral pain during using virtual reality (VR) in first stage labor was evaluated giving a score of 0- 10.

The third tool: Visual analogue scale sheet (quantitative pain assessment): (Thong et al., 2018): This tool was used to assess labor pain. It consists of 10-cm horizontal line. The right end is marked 0& indicates no pain at all. The left is marked 10 indicate sever intolerable pain.

Scoring system

Concerning **Visual analogue scale sheet** (quantitative pain assessment) it was 0 – 10 numerical rating scale with 0 on the right end denoted no pain, 5 on the middle of the scale denoted moderate pain, and 10 on the left end denoted worst possible pain.

The fourth tool: Structured interviewing questionnaire for nurses: this tool was prepared by the researcher used to assess the studied nurses regard the following: **three parts:**

Part one: Socio-demographic data such as; - age, level of education, and Years of experience.

Part two: Assess nurses' knowledge Questionnaire about virtual reality: This tool was prepared by the researcher used to assess the studied nurses, questionnaire contained five items such as: -definition of virtual reality, uses of virtual reality at health field, advantages and disadvantages of virtual reality, and the role of nursing during application of virtual reality.

Scoring system

Concerning **nurses' knowledge** about VR, the questionnaire contained, five knowledge items each was three points Liker scale (1 – 3) as (1) for Don't 'know, (2) for Incomplete correct answer, and (3) for complete correct answer. The nurse 'knowledge about Virtual reality (VR) during labor was evaluated giving a score of 5- 15.

Part three: Assess nurses' satisfaction Questionnaire about virtual reality: This tool was prepared by the researcher used to assess the studied nurses' satisfaction.

Scoring system

Regarding nurses' satisfaction about using VR in their work in the labor unite, the nursing questionnaire contained, 5 satisfaction assessment items, each was three points Liker scale (1 – 3) as (1) for dissatisfy, (2) for uncertainly, and (3) for satisfy. The nurse 'satisfaction about virtual reality (VR) during labor was evaluated giving a range of 5- 15.

Validity:

Validity was done by panels of four expertises; in the field of (Maternal and Newborn Health Nursing) who interviewed the five tools for content accuracy and internal validity.

Reliability:

Cronbach alpha reliability test was done through SPSS computer package.

Pilot study:

A pilot study was conducted on a sample of 10% (8) of women and (3) of nurses to test the applicability, clarity and the efficiency of the tools. necessary modifications were carried out and tools finalized, so they were excluded from the study sample.

Field work:

- Actual field work was carried out in the period from the beginning of July 2021 to ending of January 2022, consuming 7 months. after obtaining all official permissions.

II) Assessment (Pre-test): (control and study group).

- Structured interviewing questionnaire was done to assess the women's socio-demographic characteristics and the women's previous obstetric history.
- Then assess the level of pain during contraction by 2 tools (Visual analogue scale (quantitative pain assessment)- Behavioral rating scale (Qualitative pain assessment) among the studied laboring women.
- Fulfilling of the pretest consumed around 20-30 minutes.

II) Implementation phase: (study group)

- It is done by applied glass of virtual reality for studied laboring women individually (study group) during first stage of labor.
- Before applied VR videos were prepared (videos create virtual environment to divert attention and relaxation in the phone, then applied the phone in the VR glass.
- Notified the laboring women that the researcher at the bedside for any needs or help.
- Then assess pain level during contraction by pain assessment tools.

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- After that stop the applied VR if laboring women felt with any discomfort.
- Finally disinfected the VR glass from laboring women to another by alcohol to prevent infection.

Control group: undergoing the routine care (according to policy of study setting as changing position, walking) during first stage of labor to assess pain level during contraction based on the previous assessment.

III)) Posttest: include assessment of pain level between two groups (pre and during intervention) by using the same tools.

Secondly, concerning for nurses: the data collection stage was carried out in 4 steps as following:

I) Pre-test knowledge assessment interviewing questionnaire was done to assess nurses' knowledge regarding virtual reality as:- (definition of virtual reality, uses of virtual reality at health field, advantages and disadvantages of virtual reality, and the role of nursing during application of virtual reality.). Fulfilling of the pretest consumed 15-20 minutes.

II) The educational session was given about virtual reality (definition- how virtual reality decrease pain, advantages and disadvantages of virtual reality, uses of virtual reality at health field, role of the nurse in of virtual reality).

- The nurses divided into groups to perform the educational session.
- The duration of every session consumed around from 1- 1:30 hours (theoretical and practical).
- Different methods of teaching were used such as lectures, group discussion, and audio-visual material as power point and videos.
- Simple Arabic language was used to fit all level of knowledge for all nurses.
- The researcher applied virtual reality during session for showing the studied nurses how virtual reality decrease pain, advantages of virtual reality, role of the nurse in operating the glass of virtual reality.
- At the end of the session, feedback was obtained; nurses' questions were discussed to explain any misunderstanding and provide explanation.
- A previously prepared educational booklet was distributed as guidance for them.
- Finally the researcher gave virtual reality glasses for nurses at research setting as a gift to continuous of virtual reality application in the future.

III) Posttest knowledge assessment tool was distributed to assess nurses' knowledge about virtual reality. The results of posttest were used to evaluate the effect of the educational session on nurses' knowledge immediately after session. Fulfilling of the posttest consumed 10 minutes by the nurses.

IV) Assessment of nurses' satisfaction after applied of virtual reality for laboring women and its effect on their work.

Ethical consideration

An official permission to conduct the proposed study was obtained from the Scientific Research Ethics Committee. The researcher clarified the objectives of the study to the laboring women and nurses included in the study to gain their confidence and trust. The researcher obtained consents from laboring women and nurses. The researcher assured maintaining anonymity and confidentiality. Laboring women and nurses were informed that they are allowed to choose to participate or not in the study and that they have the right to withdraw from the study at any time. Ethics, values, culture and beliefs will be respected.

Statistical Analysis: -

Data was entered and analyzed by using SPSS (Statistical Package for Social Science) statistical package version 22. Graphics were done using Excel program.

Quantitative data were presented by mean (X) and standard deviation (SD). It was analyzed using student t- test for comparison between two means, and ANOVA (F) test for comparison between more than two means.

Qualitative data were presented in the form of frequency distribution tables, number and percentage. It was analyzed by chi-square (χ^2) test. However, if an expected value of any cell in the table was less than 5, Fisher Exact test was used (if the table was 4 cells), or Likelihood Ratio (LR) test (if the table was more than 4 cells). Level of significance was set as P value <0.05 for all significant tests.

Significance of results:

- When $P > 0.05$, it is statistically insignificant difference.
- When $P < 0.05$, it is statistically significant difference.
- When $P < 0.01$, it is high significant difference.

3. RESULTS

Table 1 The table demonstrates that, near half of laboring women 40% study group have sever intolerable pain while control group quarter of them 25% have sever intolerable pain. concerning mild pain sensation regarding study and control groups the same 40%. the non-significant difference between study and control groups regarding the preintervention behavioral pain rating scale ($P = 0.22$).

Table 2 highlights the efficacy of the virtual reality (VR) intervention on the pain level during first stage of labor. During -intervention revealed a highly significant improvement ($p < 0.000$) in the five items as well as the total of behavioral pain score among the study group than the control group. The during intervention' normal pain level response was increased from 17.5 % pre intervention to 37.5% during intervention and the difference was highly significant ($P < 0.0001$).

Fig.1 highlights non-significant difference between study and control groups pre intervention ($P = 0.24$). However, there was a high significant difference between them during intervention ($P < 0.0001$). The figure also shows that among study group, there was decrease of percentage of worsts possible pain from 72.5% pre-intervention to 10 % during first stage labor. In addition, the number of moderate pain was increased from 27.5% pre intervention to 90% during intervention, and the difference was high statistically significant ($P < 0.0001$).

Table 3 reveals that the nurses needs to give them learning package about virtual reality because little of them 0%-6.7% were complete correct answer while, more than half of them 53.4%-66.7% were wrong answer & I don't know.

Fig.2 highlights the efficacy of the nursing learning package intervention on the total score of knowledge about the VR. post-intervention revealed a highly significant improvement ($p < 0.0001$) in the total knowledge score. Post learning package intervention good knowledge response was increased from 30% pre intervention to 66.7% post intervention and the difference was highly significant ($P < 0.0001$).

Table 4 The table shows that, approximately three quarters of nurses were satisfied (73.3%), while 26.7% were uncertainly satisfied for using virtual reality in labor unit. Taking the nurses' satisfaction items also showed that satisfied category has the highest percentages of nurse's responses. Both the items" virtual reality help to reduce consumption of pain killer use And "virtual reality help to reduce noise from laboring women ".

Table 1: Distribution of total Groups pre intervention behavioral rating scale among study and control groups. (N=80)

Groups of pain sensation	Study gr.		Control gr.		P value
	n°.	%	n°.	%	
Mild pain sensation (4 – 5)	16	40	16	40	$X^2 = 3.02$, $P = 0.22$ NS
Moderate pain sensation (6-7)	8	20	14	35	
Sever intolerable pain sensation (8 – 10)	16	40	10	25	
Total	40	100	40	100	

Table 2: Distribution of the studied laboring women according to their pain assessment using Behavioral rating scale pre and during intervention. (N=80)

Assessment using Behavioral rating scale' items	Pre intervention				During VR intervention				X ²	P 1	X 2	P 2
	Study group(40)		Control group(40)		Study group(40)		Control Group(40)					
	n°.	%	n°.	%	n°	%	n°.	%				
Face: a- Face muscle. Relaxed	0	0	0	0	5	12.5	0	0	=18.9	<0.001	LR =26.3	<0.001
b-Facial muscle, tension, frown, grimace	23	57.5	23	57.5	34	85	23	57.5				
c-Frequent to constant frown ,clenched jaw.	17	42.5	17	42.5	1	2.5	17	42.5				
Restlessness: a. Quiet, relaxed appearance ,normal movement.	0	0	0	0	12	30	0	0	19.1	<0.001	=19.5	<0.001
b. Occasional restless movement , shifting position.	28	70	30	75	27	67.5	30	75				
c. Frequent restless movement may include extremities or head.	12	30	10	25	1	2.5	10	25				
Muscle tone: a. Normal m. tone.	0	0	0	0	9	22.5	0	0	36.7	<0.001	LR =23.5	<0.001
b. Rigid tone.	12	30	12	30	30	75	28	70				
c. Increased tone ,flexion of fingers and toes.	28	70	28	70	1	2.5	12	30				
Vocalization: a. No abnormal sounds	6	15	4	10	21	52.5	4	10	6.3	<0.01	20.7	<0.001
b. Occasional moans, cries ,whimpers and grunts	23	57.5	30	75	11	27.5	30	75				
c. Frequent or continuous moans ,cries, whimpers or grunts	11	27.5	6	15	8	20	6	15				
Consolability: a. Content ,relaxed	0	0	0	0	0	0	0	0	11.7	<0.001	LR=13.6	<0.001
b. Reassured by touch ,distractible	9	22.5	4	10	23	57.5	6	15				
c. Difficult to comfort by touch or talk	17	42.5	36	90	31	77.5	34	85				
X ± SD Total behavioral pain score	3.97±1.6		6.2±1.5		6.5±1.6		5.96±1.2		t=11.7	<0.001	t=5.6	<0.001

P1= Comparison between study group pre and during intervention.

P2= Comparison between control group pre and during intervention.

LR= Likelihood Ratio

X² = Qui square test

RESULTS

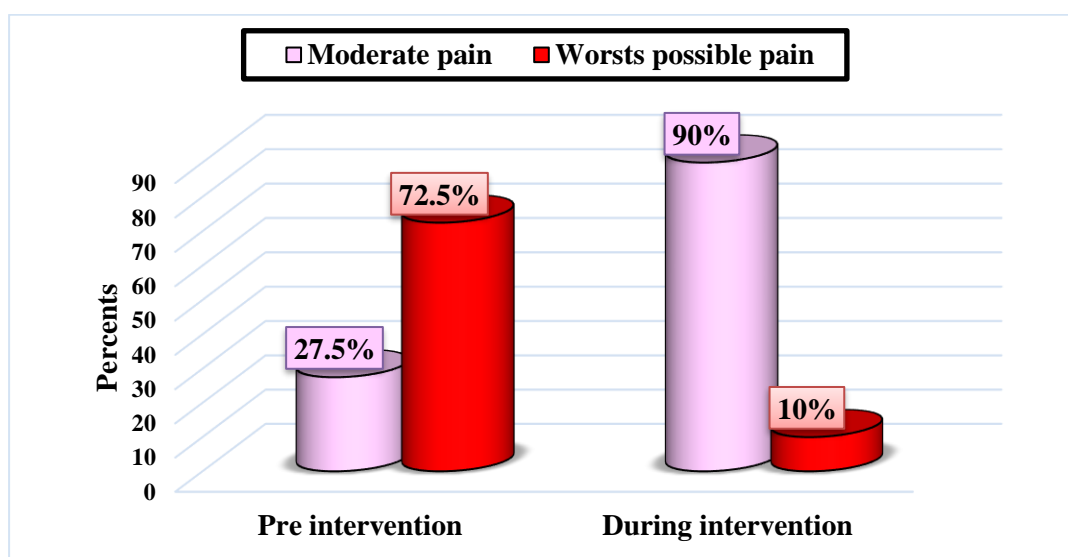


Fig.1: Distribution of total score of Visual analogue scale among study group pre and during intervention.(N=40)

Table 3: The nurses' knowledge about virtual reality pre intervention, among studied nurses. (N=30)

The nurses' knowledge about the VR before intervention	Wrong answer & I don't know		Incomplete correct answer		Complete correct answer	
	n°.	%	n°.	%	n°.	%
Meaning of virtual reality	19	63.3	11	36.7	0	0
Virtual reality to reduce pain	19	63.3	11	36.7	0	0
Uses of virtual reality at health field	12	40	16	53.3	2	6.7
Advantages and disadvantages of virtual reality	20	66.7	10	33.3	0	0
Role of the nurse in application of virtual reality	16	53.4	13	43.3	1	3.3
Mean total nurses' knowledge score	8.1 ± 1.3(range= 5 -15)					

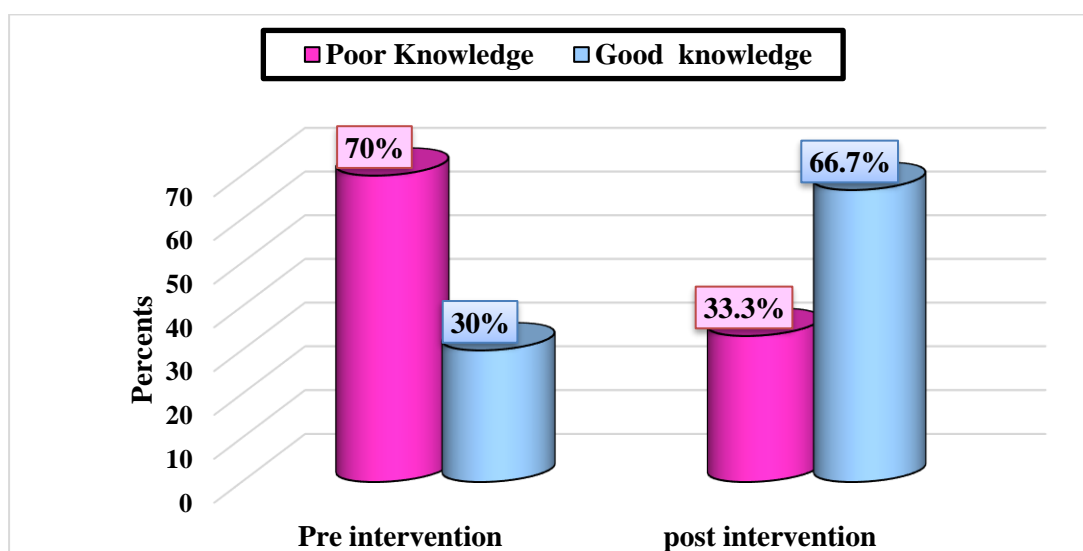


Fig.2: Effect of the nursing learning package intervention on the total score of knowledge about VR.(N=30)

Table 4: Distribution of studied nurses according to their satisfaction about virtual reality. (N=30).

Nurses' satisfaction about virtual reality	Dissatisfy		Uncertainly satisfy		Satisfy	
	n°.	%	n°.	%	n°.	%
Virtual reality help to reduce work load on nurses.	12	40	7	23.3	11	36.7
Virtual reality help to reduce consumption of pain killer.	0	0	3	10	27	90
Virtual reality help to reduce hospital resources.	12	40	17	56.7	1	3.3
Virtual reality help to reduce noise from laboring women.	0	0	3	10	27	90
Virtual reality help to reduce pain during labor.	2	6.7	6	20	22	73.3

4. DISCUSSION

Childbirth is a natural physiological process but it is also considered as one of the most painful experiences in a woman's life. As such, managing labor pain is one of the major goals in intrapartum care. Women's experiences of labor pain can vary. They are influenced by emotional, motivational, cognitive, social, and cultural circumstances, as well as previous birth experience. The expectation and desire for pain relief vary widely amongst women during labor and delivery (Oladapo et al., 2018).

In recent years, virtual reality (VR) has become an interesting alternative to traditional exposure-based therapies for many symptoms. VR involves immersion in a computer-generated virtual environment that minimizes avoidance and facilitates emotional processing (Cullen et al., 2021). Labor pain management is now accepted and implemented in many countries of the world; however, in Egypt, pain management during labor is not yet commonly practiced (Mousa et al., 2018). Thus, this study was conducted to evaluate the effect of applying virtual reality in the labor unit: a comparative study.

Concerning visual analogue scale this study shows that among study group, there was decrease of percentage of worsts possible pain from nearly three quarters pre-intervention to minority during first stage labor, This finding supported by a study of (Frey et al., 2019) that entitled " Virtual reality analgesia in labor: the VRAIL pilot study—a preliminary randomized controlled trial suggesting benefit of immersive virtual reality analgesia in unmedicated laboring women" the study conducted in Washington and reported that the visual analogue scale scores of the outcome for worst pain intensity were significantly decrease in the VR condition.

Regarding the current study for during intervention (study and control groups) in pain level revealed that a highly significant improvement ($p < 0.000$) in the five items as well as the total of behavioral pain score among the study group than the control group, This finding supported by (Spiegel et al., 2019) entitled virtual reality for management of pain in hospitalized patients: a randomized comparative effectiveness trial the study conducted in USA and reported that the virtual reality significantly in pain score during -intervention among the study group decreased more than the control group.

This study revealed that VR reduced the perceived pain level of the laboring woman with mean total pain score decreased from 6.5 ± 1.6 pre intervention to 3.97 ± 1.6 during intervention in using behavioral rating scale, this result agree with (Akin et al., 2021) in the study of (The Effect of Showing Images of the Fetus with the Virtual Reality Glass During Labor Process on Labor Pain, Birth Perception and Anxiety) the study conducted in turkey and reported that VR is effective in reducing labor pain like other nonpharmacological therapies.

From the researcher point of view, this may be explained that; the VR application focus on divert attention thus decrease the pain but routine care less effective on pain relieve.

Regarding efficacy of the nursing learning package intervention on the total score of knowledge about the VR. post learning package -intervention revealed a highly significant improvement ($p < 0.0001$) in the total knowledge score this finding is congruent with a study by (Vincent et al., 2021) entitled " Provider experiences of virtual reality in clinical treatment" the study conducted in USA who mentioned that, All the providers who received training on the VR content found the training to be beneficial.

The researcher believes that this improvement may be related to that almost of nurses in the sample has passion to know about VR application, the learning package included the needed information about VR application in simple, concise , clear language, videos and practical session as well as the written booklet which considered as a reference at any time.

According to distribution of studied nurses according to their satisfaction during using virtual reality in first stage of labor within the labor unit. approximately three quarters of nurses were satisfied this finding is congruent with a study by (Chung et al., 2021) entitled "Implementation of Therapeutic Virtual Reality Into Psychiatric Care: Clinicians' and Service Managers " the study conducted in Australia who mentioned that, the majority of providers ($n = 14$, 87.5%) agree that VR allows for treatment of patients.

On the same line (Brown & Foronda, 2020) entitled Use of Virtual Reality to Reduce Anxiety and Pain of Adults Undergoing Outpatient Procedures the study conducted in USA who mentioned that, Providers were satisfied with their VR experience. Eighty-six percent of providers rated their VR experience as a whole as "Very Satisfied".

These finding support research hypothesis women's satisfaction will be improved after virtual reality application. Thirdly Nurse's knowledge and satisfaction were improved after application learning package of virtual reality.

5. CONCLUSION

The present study concluded that:

Application of virtual reality at labor unit have a positive effect on decrease labor pain among laboring women. As well as increase nurses' knowledge and satisfaction after implementing the educational session and distributing the learning package. Finally the results supported the study hypothesis.

6. RECOMMENDATIONS

In the light of the present study findings, the following were recommended that:

- Virtual reality is recommended as an alternative non- pharmacological therapy, which can be applied in maternity hospitals for effective effect in labor pain management.

Further researches:

- Replicability of the research study with a large sample because the generalizing of findings makes confirm the benefit of virtual reality and analyze how to better to applying.

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