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The Effect of Applying Virtual Reality among Laboring Women during First Stage of Labor

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Abstract:

Background: 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 **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, Rofieda Hospital in 6 October Cairo in Egypt. **Sample**: purposive sample, the total sample divided into two groups equally study group (40) and control group (40) 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 and women's satisfaction questionnaire. **Result:** During -intervention revealed a highly significant improvement ($p<0.000$) among the study group than the control group. Additionally, the present study clarifies almost of them 80% were satisfied for using virtual reality. **Conclusion**: Applying of virtual reality had a positive effect on decrease labor pain and laboring women was satisfied after intervention. **Recommendations:** Shed light on the Virtual Reality is recommended as an alternative non- pharmacological therapy, which can be applied in maternity hospitals for effect in labor pain management.

Key wards: *Labor, Labor Pain, Virtual Reality*

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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 **(Prosser, Barnett & Miller., 2018).**

The process of labor is divided into four stages. The first stage is called the dilatation stage and this is the longest stage of labor in which the cervix dilates completely about 10 cm. The second stage is the birthing and pushing stage in which the baby is born. The third stage is the placental stage in which the placenta is born. Finally, the fourth stage is the recovery stage in which the first feeding and bonding between baby and parent occur **(Simkin., 2020).**

The first stage from the start of labor to full cervix dilation, this is the first stage (about 10 cm), The first stage was divided into two parts (latent and active). The cervix effaces and dilates to 4 cm during the latent phase, when irregular contractions become increasingly coordinated, discomfort is minimal, and the cervix effaces and dilates to 4 cm. the latent phase is difficult to time precisely, and its length varies between nulliparas and multiparas, averaging 8 hours in nulliparas and 5 hours in multiparas **(Gill, Henning and Van., 2021).**

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).**

The goal of nonpharmacologic pain management is not to make pain disappear, but rather to ease pain, improve the ability to cope with the pain, and improve the overall experience of childbirth. These strategies can be helpful when there is a personal preference to avoid medications or in low-resource settings. Practicing or getting coaching prior to labor can be helpful **(Jin & Son., 2021).**

The number of complementary and alternative methods used to reduce/relieve pain during labor in women is increasing worldwide This increasing interest has caused the use of new technological practices to be used in the field of healthcare like virtual reality **(Hrešanová, 2018).**

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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)**

Guided imagery is a relaxing technique that includes sitting or lying peacefully and imagining a favorite, relaxing place like a beach and meadow. It uses imagination to alter the thoughts of the patient by working on his or her senses (sound, vision, smell, taste, touch, movement) that's almost like daydreaming. patient's pain, stress, anxiety and other symptoms associated with his or her condition may be relieved by creating images in his or her brain **(SENSES., 2021).**

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).**

Severe labor pain affects maternal and fetal health negatively by deteriorating the mother's emotional and mental health. It causes increased cardiac output and pulmonary ventilation, oxygen need, ineffective uterine contractions, prolonged labor, decreased uterine perfusion, metabolic acidosis, and increased obstetric interventions, hypoxia in the fetus, and decreased Apgar scores. the effects of severe labor pain on the mother and fetus thus, labor pain should be relieved. VR is a cost – effective, safe, effective in pain and anxiety controlling, can be used as a self-management tool for pain relief and affordable **(El-Sayed .,2022).**

Aim of the study:

This study aims to evaluate the effect of applying virtual reality among laboring women during first stage of labor

Subjects and Methods

Research Design: A Quasi-experimental design

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Setting: study conducted in Hawaa Center is popular center in manshia nasar Cairo in Egypt, Rofieda Hospital in 6 October Cairo in Egypt

Sampling: sample type: purposive sample.

Sample size: the total sample (80) divided into two groups equally study group (40) and control group (40) was selected according to inclusion and exclusion criteria as the following:

Inclusion criteria:

1-Laboring women in first stage.

Exclusion criteria:

1- Laboring women with high risk pregnancy.

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

Tools of Data Collection four tools were used for data collection:

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 for laboring women 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 researcher used the faces rating scale (FRS) reported by Wong Baker Face Scale, to

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assess the pain category of each laboring women. The woman was select the face which denotes her pain status, then the researcher decided which score the chosen face denoted. If women unable to select the face from pain the researcher select. Score of evaluated from 0 to 2 evaluated as tolerable pain. If score from 3 – 6 evaluated as moderate pain, and if score from 7 – 10 evaluated as the worst possible pain.

The fourth tool: Laboring women's satisfaction questionnaire: This tool was prepared by the researcher for women's satisfaction about virtual reality; - such as using of virtual reality is reduce pain in future deliveries, virtual reality help to reduce anxiety, virtual reality help to divert attention, virtual reality help to relax and rest between contraction and virtual reality help to reduce fear.

Scoring system:

Women's satisfaction questionnaire contained 5 items each was three points Liker scale (1 – 3) as (1) for dissatisfy, (2) for uncertainly satisfy, and (3) for satisfy. The women 'satisfaction about virtual reality (VR) during labor was evaluated giving a total score of 5- 15.

Validity and reliability:

Validity was done by panels of four expertises; in the field of (Maternal and Newborn Health Nursing) who interviewed the three tools for content accuracy and internal validity. Cronbach alpha reliability test was done through SPSS computer package.

Ethical Consideration

The ethical research considerations in this study included the following:

- Obtaining approval from the Scientific Research Ethical Committee in the Faculty of Nursing at Helwan University before starting the study.
- Clarifying the objective and aim of the study to the women that were to be included in the study then oral consent obtained.
- Ensuring and maintaining anonymity and confidentiality of the subject data.
- Giving women the right to withdraw from the study at any time.
- Guaranteeing that no harm would occur to laboring women.

Pilot study:

A pilot study was conducted on a sample of 10% (8) 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.

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Fieldwork:

- 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.

- The laboring women interviewed through two days per week from 10 am - 2 pm.
- The researcher visited the study setting and met the nurse supervisor of setting and introduced herself and the aim of the study was explained and gave them a complete background about the study and sheet format which used to collect the required data-

The data collection stage was carried out in steps as the following:

I) 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.
- 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) Evaluation: A) Posttest: include assessment of pain level between two groups (pre and during intervention) by using the same tools .**B)Assessment**: of studied laboring women's satisfactions after applied virtual reality through tool of women's satisfactions prepared by the researcher.

Administrative design:

After explanation of the study aim and objectives, an official permission was obtained from the Dean of Faculty of Nursing and the general manager of Hawaa Center and Rofieda Hospital asking for cooperation and permission to conduct the study before starting the study.

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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.

Results

Table (I) demonstrates that , the majority of studied laboring women in control group were in age group (21 - 25years) (45%) , with mean of 24.8 ± 3.1years, while among study group, majority of participants were in age group (26-35 years) (47.5%) with a mean of 26.5±4.7 years, however, this difference was not significant statistically (P=0.51and 0.07 respectively). Concerning education, among study and control groups, more than one third of them were illiterate (37.5% and 35% respectively), approximately one third of them had secondry education (27.5% for each study and control group), and 15% of them had university degree (for each group). As regards occupation, 85% and 92.5% of them were house wives and 15% & 7.5% were workers.

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 ($P<0.0001$) for each Behavioral pain rating scale' items. In addition, the mean total pain score decreased from 6.5 ± 1.6 pre intervention to 3.97± 1.6 during intervention and the difference was highly significant $P<0.0001$).

Figure (1) presents that only three out of 40 laboring women in study group (7.5%) responded with yes for asking about any side effects they feel during using VR. Dizziness, Nausea and dizziness, and blurring of vision were mentioned with equal percentage (2.5% for each).

Figure (2) 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 ($P<0.0001$).This result also approved the first hypothesis in this study which stated that" Application of virtual reality in labor unit was decrease level of pain among laboring women."

Table (3) shows that, the distribution of study group laboring women according to their satisfaction during using virtual reality in first stage of labor. The table highlighted that almost of them 80% were satisfied for using virtual reality, while 10% were either dissatisfied or uncertainly satisfied.

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Table (I): Socio-demographic characters of studied laboring women. (N=80)

Socio-demographic characters	Study group		Control group		X^2	P value
	n°.	%	n°.	%		
Age groups: 18 - 20 years	6	15	8	20		
21 - 25 years	15	37.5	18	45	1.32	0.51
26 - 35 years	19	47.5	14	35		
Mean ± SD	**26.5±4.7**		**24.8± 3.1years**		**t= 1.82**	**0.07**
Education **Illiterate**	15	37.5	14	35		
Elementary	8	20	9	22.5	0.09	0.99
Secondary	11	27.5	11	27.5		
University	6	15	6	15		
Occupation : Housewife	34	85	37	92.5	LR=1.1	0.28
Employee	6	15	3	7.5		
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				
b-Facial muscle, tension, frown, grimace	23	57.5	23	57.5	34	85	23	57.5	=18.9	<0.001	LR=26.3	<0.001
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				
b. Occasional restless movement ,shifting position**.**	28	70	30	75	27	67.5	30	75	19.1	<0.001	=19.5	<0.001
c. Frequent restless movement may include extremities or head.	12	30	10	25	1	2.5	10	25				

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Muscle tone: a. Normal m. tone.	0	0	0	0	9	22.5	0	0	36.7	<0.0001	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	<0.0001	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	<0.0001	t=5.6	<0.001

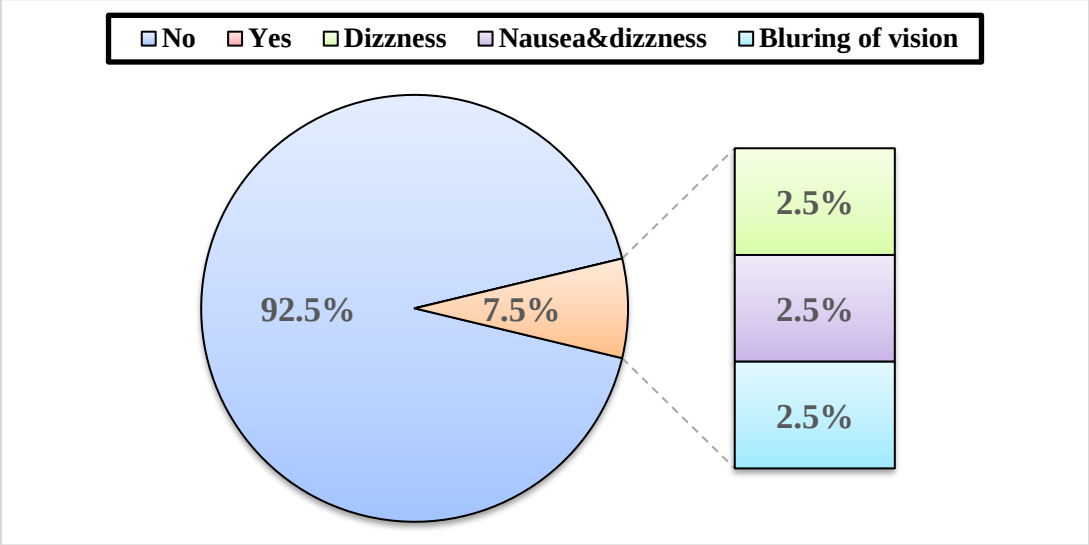

Figure (1): Side effects of Virtual reality among study group.(N=40)

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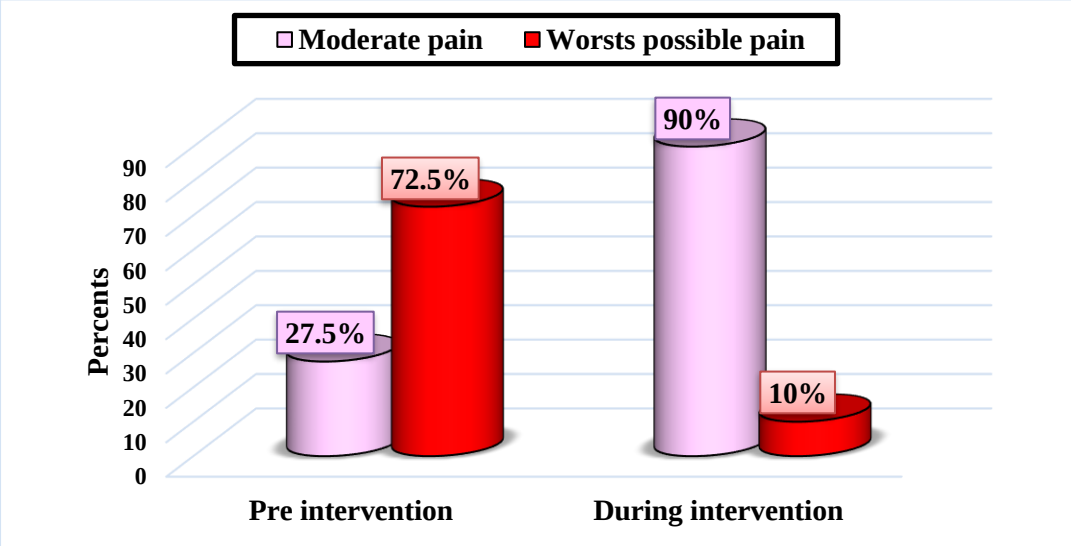

Figure (2): Distribution of total score of Visual analogue scale among study group pre and during intervention. (N=40)

Table (3): Distribution of studied laboring women in study group according to their satisfaction about virtual reality. (N=40)

Laboring women satisfaction about virtual reality	Dissatisfy		Uncertainly satisfy		Satisfy	
	n°.	%	n°.	%	n°.	%
Prefer to use virtual reality to reduce pain in future deliveries.	5	12.5	5	12.5	30	75
Virtual reality help to reduce anxiety.	5	12.5	10	25	25	62.5
Virtual reality help to divert attention.	1	2.5	5	12.5	34	85
Virtual reality help to relax and rest between contraction.	0	0	4	10	36	90
Virtual reality help to reduce pain.	5	12.5	5	12.5	30	75

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).**

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Pain management strategies for women in labor include pharmacological and non-pharmacological options. Pharmacological approaches aim at decreasing or eliminating the physical sensation of labor pain. On the other hand, non-pharmacological approaches are mainly directed at enabling the woman to cope with the pain and maintain a sense of personal control over the birth process, thus minimizing suffering **(World Health Organization., 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. **(Ioannou et al., 2020).** The objective of current study to evaluate the effect of applying virtual reality in the labor unit: a comparative study

As Regards socio-demographic characteristics of two groups, the present study showed that, nearly half of study group in age from (21 - 25years) with mean of 24.8 ± 3.1years and majority of control group from (26-35 years) with a mean of 26.5±4.7 years.

Concerning level of education, the findings of current study cleared that more than one third of study and control groups were illiterate, approximately one third of study and control groups were secondary education, and quarter of study and control groups were university degree. **Regarding** occupation, the findings of the present study showed that majority of study and control groups were house wives. This means that there was no statistically significant difference between study and control groups regarding sociodemographic characteristics.

This finding supported by a study of **(Amiri, et al., 2019)** who researched "The effect of distraction techniques on pain and stress during labor" the study conducted in Iran and revealed that, nearly half of study and control groups in age from(18-21 years) with a mean 23.55±4.33 age. Concerning level of education revealed that nearly half of study and control groups were secondary education. Also occupation nearly half of study and control groups were housewife. there was no significant difference regarding sociodemographic characteristics between the two groups.

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. 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.

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

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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.

On the other hand, these results disagree with **(Hurley.,2022)** who study about). " FDA Approves Virtual Reality System for Treating Lower Back Pain" in USA who mentioned that the Patients in VR system for treating lower back pain continued to reported that less than one third reduction in pain.

From the researcher point of view, this may be explained that; the lower back pain is chronic pain (permanent pain) relieve by treating the cause and VR application temporary decrease the pain and divert attention during application only thus the VR didn't decrease the pain.

Regarding side effects of VR the current study revealed that only three from 40 laboring women in study group (7.5%) reported dizziness, nausea and blurring of vision. This result was 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 confirmed that three patients in the VR group (4.9%) reported transient dizziness at some point during their VR therapy. From the researcher point of view, this result of side effect may be due to near of screen of VR from eyes, speed of video and increase of attention.

According to satisfaction for laboring women during using virtual reality in first stage of labor: the current study showed that, almost of them were satisfied for using virtual reality as (VR help to relax and rest between contraction, help to reduce anxiety, help to divert attention, virtual reality used to reduce pain and reduce pain in future deliveries), this finding is congruent with a study by **(Stewart, Mete& Groninger., 2019)** entitled " Virtual reality for pain management in patients with heart failure: Study rationale and design" the study conducted in USA and confirmed that pain management satisfied with study group.

This finding might explained by two explanations. first, Virtual Reality is significantly safe and beneficial in reducing pain compared to routine care in first stage of labor to decrease pain. Secondly, almost of laboring women were satisfied after applied VR. These finding support research hypothesis women's satisfaction will be improved after virtual reality application.

Conclusion

The present study concluded that:

Application of virtual reality at labor unit have a positive effect on decrease labor pain and increase the satisfaction among laboring women. Finally the results supported the study hypothesis.

Recommendations

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

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- Virtual reality is recommended as an alternative non- pharmacological therapy, which can be applied in maternity hospitals for effective effect in labor pain management.
- Increasing the awareness for pregnant women about role of virtual reality to decrease pain during labor (including in ante natal care).

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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