

Effect of Virtual Reality on Labor Pain intensity, Duration of the first stage, Anxiety and Satisfaction levels among Primigravidae

Afaf Hassan Ahmed¹, Samia I Hassan², Hanan Elsayed Mohammed², Naglaa Zaki Hassan Roma³

¹Obstetric and Gynecologic Nursing, Faculty of Nursing, Alexandria University, Egypt

²Woman's Health & Midwifery, Nursing Department, Faculty of Nursing, Mansoura University, Egypt

³Lectuer of Obstetric and Gynecologic Nursing, Faculty of Nursing, Alexandria University, Egypt

Abstract

Background: Labor pain is a highly distressing physical sensation that women experience during their lifetime. Over 90% of women undergoing childbirth experience symptoms of tension-anxiety-pain syndrome. Virtual reality (VR) is a non-pharmacological approach utilized to alleviate pain. **Aim of the study:** to evaluate the effect of virtual reality on labor pain intensity, duration of the first stage, anxiety, and satisfaction levels among primigravidae. **Design:** A quasi-experimental design. **Setting:** This study was conducted at the labor and delivery unit of Sherbin Central Hospital, Dakahlia Governorate, Egypt. **Sample:** A convenient sample of 112 laboring women. **Tools:** Data was collected through four tools, A structured Interview Schedule, A Numerical Pain Rating Scale (NPRS), A partograph, a State-Anxiety scale (STAI Form Y-1), and a Virtual Reality Satisfaction questionnaire. **Results:** This study found no statistically significant difference regarding labor pain intensity and anxiety level before intervention among the virtual reality (VR) and the control group, while there was a highly statistically significant difference regarding labor pain intensity & anxiety level after the first intervention on (4-5cm cervical dilation) and the second intervention on (6-7cm cervical dilation) between the former and the latter group $P \leq 0.05$. In addition, No statistically significant difference was found between the two groups in relation to the duration of the active phase of the first stage of labor after intervention ($P= 0.064$), but this value in the VR group was lower than that of the control group. Moreover, laboring women in the intervention group (VR) were more satisfied by using virtual reality. **Conclusion:** This study concluded that virtual reality application during the active phase of the first stage of labor significantly reduced labor pain intensity and anxiety level as well as decreased duration of the active phase of the first stage of labor. It also achieved satisfaction of laboring women with using it. **Recommendations:** Trials for including virtual reality as a one of routine hospital care during childbirth to improve the childbirth experience.

Keywords: Anxiety, Duration of the first stage, Labor Pain, primigravidae, Satisfaction, Virtual Reality.

Introduction

Childbirth is a very great ailment in the life cycle of a woman. It is a complex and close process whose issue is physiological, while also being significantly impacted by cultural norms and practices (Akin et al., 2021; Carus et al., 2021; Ebrahimian & Bilandi, 2021). Labor pain is nearly a universal phenomenon experienced by women in labor with the threshold of this pain varying among them. This threshold is influenced by a complex interplay of physiological and psychosocial factors (Pratiwi et al., 2017; Wu et al., 2020).

Mothers who will give birth often experience feelings of apprehension, unease, and nervousness. The mother's psychological well-being during labor is a vital component, as anxiety can impede the birthing process. Research has shown that women who are fearful or anxious during labor tend to have longer labor durations, particularly among nulliparous women, and are at an increased risk of protracted labor (Ebrahimian & Bilandi, 2021).

It is of utmost importance for nurses to recognize the reasons why women undergo anxiety during the process of labor, and the

impact they have on women's cognitive, emotional, and behavioral states. Nurses have a multifaceted role in labor wards, encompassing obstetrical procedures and advocating for women's physical and psychological well-being. Additionally, they establish a milieu that is psychologically supportive and reassuring. In actuality, nurses face a great challenge to mitigate labor pain psychologically. Thus, Nurses who are employed in labor units bear the responsibility of evaluating the pain perception of women, documenting and appraising the pain, and furnishing choices for the management of pain (Murray & Gayle Huelsmann, 2020).

One of the non-pharmacological alternatives for managing pain and anxiety in various clinical contexts that has emerged from recent innovations is Virtual Reality (VR). It is a novel technology that provides individuals with a virtual experience that simulates the real world. Through this technique, users can redirect their attention away from painful stimuli and toward external forms of stimulation, thereby reducing their perception of pain (Gür & Apay, 2020; Wu et al., 2020).

Virtual Reality (VR) is an innovative computer-simulated technique that involves the utilization of a headset, which is connected to either a computer or a smartphone, to provide a visual image that is accompanied by sounds. This particular technology assuages both pain and anxiety by incorporating a multitude of sensory distractions, including visual and auditory stimuli, as well as other sensory experiences. The employment of a head-mounted display (HMD), headphones, and a joystick for head tracking, music, manipulation, and navigation respectively, enables an individual to engage as an active participant within the simulated realm. This immersive experience enables the individual to perceive and engage with stimuli in a manner that closely resembles the actual world, as well as communicate with them (Linowes, 2020; Momenyan et al., 2021; Wu et al., 2020).

It is widely believed that virtual reality (VR) with enhanced immersion, results in a heightened sense of presence. It has the potential to serve as an effective diversionsary

method for attaining the desired analgesic outcomes. This is in contrast to less immersive VR systems, traditional video games, and music alone. Notably, the labor ward presents numerous visual and auditory distractions for women, including loud requests for help and sounds of distress from other women can intensify the feelings of pain and anxiety. Viewing scenic imagery may also help to lessen pain perception because it elicits positive emotional responses (JahaniShoorab et al., 2015; Momenyan et al., 2021).

Significance of the study

Fear of childbirth is a frequent occurrence, resulting in a rise in cesarean deliveries that are requested by the mother. This phenomenon has contributed to an already high cesarean rate in Egypt. In recent years, there has been an observable elevation in the rate of cesarean births as demonstrated by data from the Central Agency for Public Mobilisation and Statistics (CAPMAS) on the Health of the Egyptian Family (HEF) to 72 percent in 2021, up from 52 percent in 2014 (CAPMAS, 2021).

Considering the aforementioned fact, it is unequivocal that there is a compelling need to enhance the overall experience of childbirth beyond mere pain alleviation. In contemporary times, the proclivity towards non-pharmacological modalities has been on the rise, owing to their non-invasive nature, absence of deleterious side effects, cost-effectiveness, and minimal complications. It is noteworthy that virtual reality distraction constitutes one of the cognitive-behavioral interventions that can be employed in this regard (Williams et al., 2016; Rao et al., 2019).

The implementation of a particular approach serves as a significant catalyst, which effectively transforms the negative and discouraging perceptions that women have towards the experience of labor pain (Niharika et al., 2018). Nevertheless, with the emergence of high-resolution screens utilized in mobile devices, the reduced cost of premium virtual reality headsets has made it a practical and scalable method for managing pain (Frey et al., 2019; Sehhatie et al., 2015). Since labor is known to be linked with anticipatory

psychological distress, it has become imperative to employ the latest evidence-based practice (EBP) that promotes adaptive psychological coping and serves as a viable outlet for these stressful situations. Consequently, it is highly recommended that nurses embrace such strategies both before and during the provision of labor care (Akin et al., 2021). So, this study aims to determine the effect of virtual reality on labor pain intensity, duration of the first stage, anxiety, and satisfaction levels among primigravidae.

Aim of the study:

This study aimed to evaluate the effect of virtual reality on labor pain intensity, duration of the first stage, anxiety, and satisfaction levels among primigravidae.

Study Hypotheses:

H1: Laboring women who use virtual reality experience less labor pain intensity than those who don't use it.

H2: Laboring women who use virtual reality experience less duration of the active phase of the first stage of labor than those who don't use it.

H3: Laboring women who use virtual reality experience less anxiety level than those who don't use it.

H4: Laboring women who use virtual reality experience more satisfaction level than those who don't use it.

Operation definition:

Duration of the first stage: means duration of the active phase of the first stage of labor from 4-7cm cervical dilation.

Materials and Method:

Study design: A quasi-experimental design.

Study Setting: This study was conducted at the labor and delivery unit of Sherbin Central Hospital, Dakahlia Governorate, Egypt. This specific setting was selected due to high turnover as it provides free and affordable services to all women seeking

maternity care either from rural or urban residents.

A study subjects: A convenient sample of 112 laboring women was selected from the previously mentioned setting based on the following inclusion criteria:

- 18-35 years old
- Primigravida women
- 37-42 weeks gestation with a singleton pregnancy
- Vaginal delivery
- Active phase of the first stage of labor from (4-7 cm) cervical dilation,
- Cephalic presentation
- No history of chronic medical conditions
- No pregnancy complications
- No mental illness
- No abnormal hearing or vision problems.

The study subjects were assigned into 2 equal groups:

- The study group included 56 laboring women, who used VR.
- The control group included 56 laboring women, who didn't use VR and received routine hospital care

The sample size was calculated by the following formula:

Based on information obtained from the literature (Pratiwi et al., 2017), taking into account a level of significance of 5%, and power of study of 80%, The calculation of the suitable sample size can be determined by utilizing the subsequent formula (Charan & Biswas, 2013) $\frac{(Z\alpha/2 + Z\beta)^2 \times 2(SD)^2}{d^2}$, where SD = standard deviation obtained from previous study; $Z\alpha/2$, for 5% this is 1.96; $Z\beta$, for 80% this is 0.84; and d is expected mean difference. Therefore,

$$n = \frac{(1.96 + 0.84)^2 \times 2(0.8)^2}{(0.424)^2} = 55.8.$$

According to the aforementioned formula, it has been ascertained that the required sample size for each group is 56.

Tools of Data Collection:

Four tools were used in data collection:

Tool I- Structured Interview Schedule:

- General characteristics of studied sample such as: socio-demographic data of laboring women such as age, education, residence, and occupation.

Tool II: Numerical Pain Rating Scale (NPRS):

It was adopted from (Beilin et al., 2003). The numerical rating scale enables the woman to rate their level of labor pain on a scale of 0 to 10 either orally or by marking a line. It is categorized into four distinct classifications.: 0 (no pain), 1-3 (mild pain), 4-6 (moderate pain), and 7-10 (severe pain). The level of pain is recorded through using a dot or symbol on the pain continuum corresponding to the time at which the pain intensity was reported.

Tool III - Partograph

It was adopted from the WHO version (1994) (Organization., 1994). It is a graphical record for labor monitoring /flow up sheet. This instrument encompasses three principal sections: the fetal condition, which comprises (the fetal heart rate, liquor color, and degree of molding), the progress of labor, which includes (cervical dilation, head descent, and uterine contractions) and the maternal condition, which encompasses (vital signs, received drugs and IV infusions as well as urine analysis for albumin, protein, and volume).

Tool IV: The State-Anxiety Scale (STAI Form Y-1)

It was adopted from (Spielberger, 1983). It is composed of 20 statements that evaluate the current state of anxiety through four levels of scale ranging from one (not at

all), two (somewhat), three (moderately so), and four (very much so). The range of scores is from 20-80, with a higher score indicating greater anxiety. The women in both groups choose the most appropriate level based on their own experience. No anxiety < 35, Mild anxiety 35 -< 50 Moderate anxiety 50- < 65, and Severe ≥ 65.

Tool V: Virtual Reality Satisfaction Questionnaire.

This was developed by the researcher following a comprehensive review of pertinent literature. to evaluate the degree of maternal satisfaction experienced by laboring women through the application of virtual reality (Mohamed et al., 2022). The questionnaire is comprised of eight items that serve to elicit information regarding a range of factors, including the application's ease of use; effectiveness in reducing labor pain, the extent to which the application has generated interest, its immersive qualities, the degree of discomfort experienced when wearing a head-mounted display (HMD), the absence of any side effects, the extent to which it would be recommended for use in the future, and as a component of routine hospital care.

A satisfaction Likert scale with three points was utilized, with agree scoring 2, uncertain scoring 1 and disagree scoring 0. The total score for the questionnaire ranged from 8 to 24, with scores of >18 indicating satisfaction, scores of 13-<18 indicating moderate satisfaction, and scores of < 13 indicating dissatisfaction.

Field Work:

First phase (Preparatory phase):

- Ethical approval was attained from the Committee of Mansoura University, Faculty of Nursing prior to conducting the research.

- Official permission to collect data was obtained from the responsible authority of the study setting after providing a thorough explanation regarding the objectives of the study.

- Tool I, and Tool V were developed by the researchers after conducting a

comprehensive evaluation of contemporary and pertinent literature, while tools II & III & IV were adopted and translated into Arabic language to better align with the Egyptian language.

- The content validity of these tools was thoroughly evaluated by a committee consisting of three expert professors who specialize in the field of maternity nursing.

- Tools were ascertained for reliability by Cronbach's alpha test & it was reliable for Tool II (0.80), Tool III (0.71), Tool IV(0.91), and Tool V(0.77).

- A pilot study was undertaken consisting of six laboring women (who were not included in the sample) to assess the practicality, clarity, and feasibility of the tool components over time. Following the pilot study, the tool components underwent a meticulous revision process and were subsequently reconstructed to ensure optimal functionality. Consequently, the tools are now fully prepared for utilization.

Second phase (Implementation phase):

- Data were collected throughout 4 months, starting from the beginning of December 2022 till the end of March 2023.

- Data from tool one was obtained from women upon their arrival at the labor ward through an interview schedule carried out on an individualized basis.

- Each woman in labor who was available during the data collection period and met the inclusion criteria was assigned to either the control or intervention group.

- The researchers introduced themselves and established a friendly and empathetic rapport with the participants hailing from both groups at the labor unit. This was carried out in a manner that conveyed care, tolerance, and simple communication, which was accompanied by verbal reassurance and compassion.

1. Women allocated to the control group:

The control group provided with routine care conforming to the guidelines of the

Standard of Routine Hospital Care (SRHC) from the time of admission until delivery such as continuous observation of the progress of labor (cervical dilatation, condition of membrane, uterine contraction, and descent of fetal head). To prevent any possibility of sample contamination, the researcher initiated the study with the control group and concluded it prior to the intervention group.

2. Women allocated to the study group:

- The study group provided with a concise explanation from the researchers about the objectives behind the utilization of virtual reality.

-Subsequently, labor pain intensity and anxiety level were evaluated before intervention utilizing tools II and IV.

- The technique utilized by the researchers in presenting the VR headset (Figure 1) was the tell-show-do approach. This approach involved the provision of detailed explanations on the utilization of a headset in a virtual reality setting (tell), accompanied by a simultaneous demonstration of the process of selecting and displaying various virtual environments (show), and finally, allowing the laboring woman to apply it

- Each laboring woman in the VR group was presented with a variety of virtual environments to select from, which included options such as the blue ocean, blue deep, black beginning, green meadows, blue moon, red savannah, orange sunset, red fall, and white winter, that include different natural view with calm music sound. The Nature Trek application's photos were printed out to create cards that represented these innovative immersion alternatives, and these cards were given to the laboring women to assist them in selecting their chosen setting in advance.

• Upon adapting the VR device headset to the appropriate size for the woman's head and precisely aligning it in front of her eyes, the chosen virtual environment, namely the 3D Aquarium VR, was subsequently implemented.

• The researchers enhanced the women to be more relaxed, so they feel as if they live in or visiting novel environments.

- VR device used for 20 minutes during each intervention (first intervention (4-5cm) cervical dilation and second intervention (6-7cm) cervical dilation.

Third phase (Evaluation phase):

- The researchers evaluate all study variables by measuring labor pain intensity & duration of the first stage and anxiety for both groups after intervention at different cervical dilation (4-5cm) and (6-7cm) using tool II, III, IV.

- Before discharge, a woman's satisfaction level about the intervention was measured among the intervention group using Tool V.

- Finally, A comparison was performed between the two groups to ascertain the effect of immersive virtual reality on labor pain intensity, duration of the first stage, anxiety, and satisfaction levels among primigravidae.



Figure (1) Virtual reality headset

Statistical analysis:

The statistical analysis shall be executed using the Statistical Packages for Social Science (SPSS) version 21.0. The data shall be illustrated utilizing descriptive statistics, specifically in the form of frequencies and percentages of qualitative variables, as well as means and standard deviations of quantitative variables. The quantitative variable will be compared using the t-paired t-test. Statistical significance shall be determined at a rate of $p < 0.05$.

Ethical considerations:

For every woman who was recruited, informed consent will be obtained from each laboring woman prior to the intervention after explaining the aim of the study. Participant privacy was ensured and the right to discontinue from involvement in the study at any time was rigorously maintained. The confidentiality of all data was maintained. The study maneuvers did not result in harm to the laboring women nor did the data collection tools touch upon moral,

religious, or cultural issues. Moreover, the dignity and rights of the parturient women were not compromised.

Results:

Table (1) displays the number and percent distribution of laboring women according to their socio-demographic data. The mean age was 22.10 ± 3.32 years & 22.33 ± 3.01 years for the VR and control group respectively. Level of education revealed that (58.9%&48.2%) of the latter and former group had secondary education or its equivalent respectively. In addition, (58.9% & 46.4%) of the VR and the control group respectively were urban residents. Moreover, (51.8% & 50%) of the former and latter group respectively were housewives. There was no statistically significant difference between the two groups regarding socio-demographic data.

Table (2) manifests the mean distribution of laboring women according to labor pain intensity using the Numerical Pain Rating Scale (NPRS). No statistically significant difference

was found between the two groups before intervention ($P=0.204$). Nevertheless, a highly statistically significant difference was found between them after the 1st & 2nd interventions where the mean labor pain score was (3.73 ± 0.52 & 6.50 ± 0.60) for the intervention group (VR), compared to (5.09 ± 0.84 & 8.38 ± 9.71) for the control group respectively.

Table (3) demonstrates the mean distribution of laboring women according to their anxiety level using the State-Anxiety scale. The relationship between the two groups was not statistically significant before intervention ($P=0.381$). However, it was highly statistically significant ($P=0.0001$) between them after the 1st, 2nd intervention where the mean anxiety level was (40.51 ± 8.6 & 38.46 ± 4.33) for the intervention group (VR), compared to (57.48 ± 10.65 & 58.80 ± 8.53) for the control group respectively.

Figure (2) demonstrates the percent change of laboring women according to their anxiety level using the State-Anxiety scale. The percent change

in anxiety level was (24%) among the VR group compared to 13% of the control group.

Table (4) demonstrates the mean distribution of laboring women according to the duration of the active phase of the first stage of labor using a partograph. No statistically significant difference was found between the two groups after intervention ($P= 0.064$), but this value in the VR group was lower than that of the control group where the mean duration of the active phase of the first stage was 4.89 ± 0.70 hours for the VR group compared to 5.16 ± 0.80 hours for the control group.

Figure (3) illustrates the percent distribution of the VR group according to their satisfaction with the intervention using the Virtual Reality Satisfaction questionnaire. Fortunately, the majority (83.9%) of the VR group was completely satisfied, while only 5.4% of them were unsatisfied regarding the application of virtual reality during the active phase of the first stage of labor.

Table (1): Number and percent distribution of laboring women according to their socio-demographic data

Socio-demographic data	Intervention group (VR) (n=56)		Control group (n= 56)		t-test (P) F/ χ^2 (P)
	No.	%	No.	%	
Age (years)					
·18 -	31	55.4	32	57.1	
·22 -	17	30.4	17	30.4	0.083(0.960)
·26	8	14.2	7	12.5	
Mean \pm SD	22.10 \pm 3.32		22.33 \pm 3.01		1.41(0.709)
Level of education					
·Read & Write	3	5.3	1	1.8	
·Basic	9	16.1	11	19.6	3.086(0.379)
·Secondary/its equivalent	27	48.2	33	58.9	
·University	17	30.3	11	19.6	
Residence					
·Rural	23	41.1	30	53.6	0.256(0.128)
·Urban	33	58.9	26	46.4	
Occupation					
·Working	27	48.2	28	50.0	0.100(0.50)
·Housewife	29	51.8	28	50.0	

χ^2 (P): Chi-Square Test & P for χ^2

Test F (P): Fisher Exact test & P for F Test

*: Significant at $P \leq 0.05$ **: Highly Significant at $P \leq 0.05$

Table (2): Mean distribution of laboring women according to labor pain intensity using the Numerical Pain Rating Scale (NPRS)

Labor Pain	Intervention group (VR) (n= 56)	Control group (n=56)	t-test (P)
Before intervention	3.60 ±0.65	3.76±0.63	1.28 (0.204)
After first intervention (4-5cm)	3.73±0.52	5.09±0.84	10.21 (0.000) **
After second intervention (6-7cm)	6.50±0.60	8.38±9.71	12.28 (0.001) **

t: Student t-test

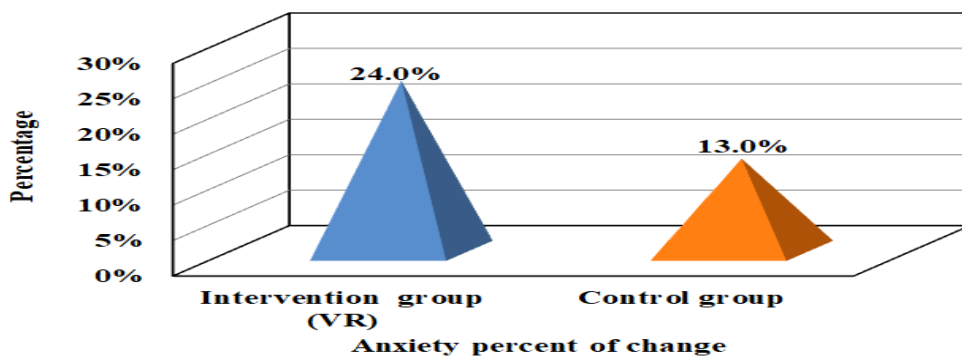
*: Significant at P ≤0.05 **: Highly Significant at P ≤0.05

Table (3): Mean distribution of laboring women according to their anxiety level using the State-Anxiety scale (STAI Form Y-1).

Anxiety score Level	Intervention group (VR) (n= 56) Mean ± SD	Control group (n=56) Mean ± SD	t-test (P)
Before intervention	51.94±9.97	53.64±10.44	0.88 (0.381)
After first intervention (4-5cm)	40.51±8.6	57.48±10.65	9.25(0.0001)**
After second intervention (6-7cm)	38.46 ±4.33	58.80±8.53	15.89(0.0001)**

t: Student t-test

*: Significant at P ≤0.05 **: Highly Significant at P ≤0.05

Figure (2): Percent change of laboring women according to their anxiety level using the State-Anxiety scale**Table (4): Mean distribution of laboring women according to their duration of the active phase of the first stage of labor using partograph**

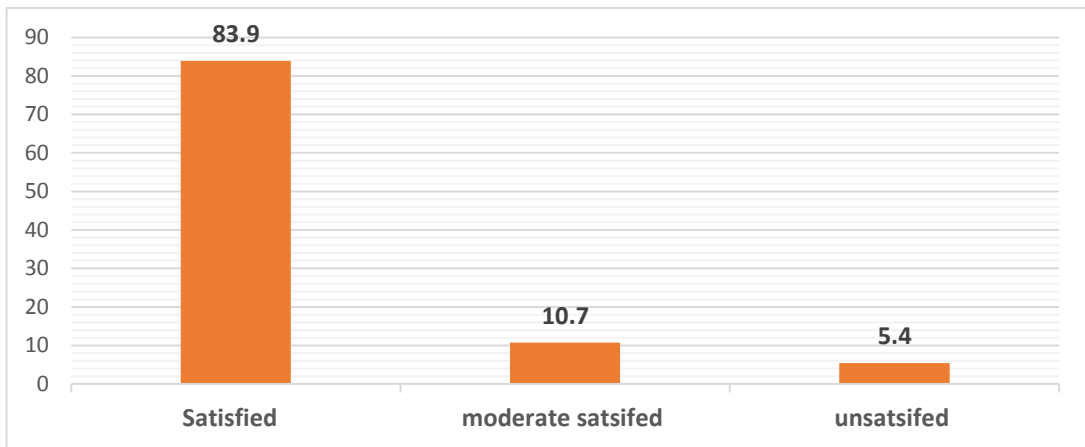
Variable	Intervention group (VR) (n= 56) Mean ± SD	Control group (n=56) Mean ± SD	t-test (P)
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Duration of the active phase of the first stage of labor	4.89±0.70	5.16±0.80	1.87(0.064)
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t: Student t-test

*: Significant at P ≤0.05 **: Highly Significant at P ≤0.05

Figure (3): Percent distribution of the VR group according to their satisfaction with intervention using the Virtual Reality Satisfaction questionnaire.



Discussion

Maternal and fetal complications restrict the use of pharmacological modalities to promote labor. Consequently, there is a growing preference for more accessible, non-prescriptive, economical methods that are associated with decreased expenses and fewer complications **Ebrahimian and Rahmani Bilandi (2021)**. One of the effective non-pharmacological interventions for reducing sensitivity is the implementation of cognitive-behavioral techniques such as Virtual Reality. Specifically, this approach involves redirecting the individual's focus away from a painful stimulus towards an external stimulus **Indovina et al. (2018)**.

This technological innovation aids in mitigating the sensations of discomfort, birthing process duration, and anxiety by allowing the user to engage with the virtual world, thus redirecting their focus from the real world **Yokoyama et al. (2019)**. As a result, the purpose of this study was to determine the Effect of Immersive Virtual Reality on Labor Pain intensity, duration of the first stage, Anxiety, and Satisfaction levels among Primigravidae.

On evaluating labor pain, the results of the present study revealed a highly statistically significant decrease in the mean scores of labor pain among the intervention group (VR) than the control group during the active phase of the

first stage of labor after implementing virtual reality. This may be attributed to the effect of VR goggles which put women in novel environments that restrict the mind from processing pain signals, so it cut the pain cycle likely as a result of distraction as well as the copious amount of data introduced in the simulated setting occupy the individual's brain, thereby impeding the mind's capacity from interpreting sensations of pain **Carus et al. (2021)**.

This finding corresponds with a study of **Araby and Abou-Elazab (2022)**, who reported the efficacy of implementing virtual reality applications as a method of distraction for primiparous women in the first stage of labor on managing pain levels. A randomized controlled trial of **Carus et al. (2021)** also revealed that immersive virtual reality reduces pain scores and makes the labor process more pleasant overall. In addition, It conforms to a study of **Wong et al. (2021)**, who explained that those assigned to the control group showed a remarkable surge in pain, whereas the VR group manifested a significant decline in pain. The results indicate that the implementation of VR was efficient in diminishing pain among women during labor in comparison to the control group, who were not subject to any intervention.

Moreover, the current finding coincides with a randomized controlled trial of **Gür and Apay (2020)**, who observed that posttest mean score of labor pain were statistically significant

as a result, the utilization of virtual reality has been observed to have a mitigating effect on the experience of labor pain during the active phase of the first stage. It is also in a harmony with **Momenyan et al. (2021)**, who explained that a significant reduction in sensory pain was observed in the VR group exclusively during the first stage of labor in contrast to the control group ($P = 0.033$). **Cowles et al. (2019)** also observed that the pre-existing mean pain score, prior to the implementation of virtual reality (VR) technology, was recorded to be 2.74 ± 2.73 . Subsequently, following the use of VR technology, the pain score exhibited a decrease, with an average score of 2.35 ± 2.67 ($p = 0.063$).

Further, the present study finding is in agreement with a study of **Wong and Gregory (2019)**, who found that Virtual Reality (VR) has been proven to be an efficacious intervention for alleviating pain experienced by women during the process of childbirth. **Pratiwi et al. (2017)** reported that during the latent and active phases of labor, the pain score between the virtual reality group and the non-VR group displayed statistically significant differences ($P < 0.01$). Moreover, the study finding are in agreement with a study of **Amiri et al. (2019)**, who found that the average pain intensity score experienced during labor was discovered to be lower in the intervention group who employed the distraction technique as opposed to the control group ($P < 0.001$).

Concerning the anxiety level, the current study finding revealed that there was a decrease in anxiety level among the intervention group (VR) compared to the control group with a highly significant differences between both group after intervention ($p = 0.000$). This could be due to the fact that Virtual Reality has the ability to divert an individual's mental state from experiencing stress, fear, anger, and discomfort. This approach is founded on the principle that the mind possesses the characteristic of being unable to simultaneously engage in two thought processes. Consequently, when one's mind is engrossed in a state of heightened excitement, the senses serve as a distraction from the excitement. Additionally, the employment of this diversionary technique serves to mitigate the impact on the central nervous system **Amiri et al. (2019)**.

Likewise, the present study finding is supported by a study of **El Sharkawy et al. (2022)**, who found that virtual reality exhibited a favorable impact on the anxiety levels of the individuals involved during the initial phase of labor. **Akin et al. (2021)** showed that utilizing virtual reality to display images of the fetus to women has been observed to result in a reduction of anxiety level. In addition, It agrees with **Momenyan et al. (2021)**, who reported that mothers who were part of the study group exhibited lower levels of anxiety in comparison to their counterparts in the control group ($P < 0.05$). Moreover, the finding is consistent with those of **Sahin and Basak (2020)**, who discovered a statistically significant decrease in level of anxiety of VR group compared to the control group. Furthermore, it is noteworthy that a study of **Wu et al. (2020)** is in a harmony with the present result which indicate that Virtual Reality (VR) has demonstrated significant potential in mitigating anxiety experienced by primipara mothers during labor.

The current study finding is in the same line with the results of a previously mentioned study of **Amiri et al. (2019)**, who indicated that the utilization of distraction technique by the intervention group produced a substantial variance in the levels of anxiety and stress experienced during labor in comparison to the control group $p = 0.01$. **Li et al. (2019)** found that all of study subjects indicated that VR reduce their anxiety. Virtual reality is a highly effective and practical technology that can be utilized to alleviate anxiety caused by labor without side effects. Moreover, the present finding is in agreement with a previously mentioned study of **Wong and Gregory (2019)**, who found that all subjects report with full confidence that the implementation of Virtual Reality (VR) technology effectively mitigates their anxiety levels.

On the other hand, this present finding is not in a line with a study of **Carus et al. (2021)**, who revealed that the anxiety scores exhibited no significant differentiation in the intervention group when compared to the control group ($p = 0.103$).

On investigating the duration of the active phase of the first stage of labor, the

current study reported a shorter duration of the active phase of the first stage among the intervention (VR) group compared to the control group. This is attributed to the fact that pain and anxiety encountered during the process of labor contribute to an increase in the levels of catecholamines and cortisol, leading to the occurrence of malfunctions in uterine contractions and ultimately elongating the length of the labor stages. Virtual Reality possesses the potential to alleviate pain through the reduction of its intensity and the mitigation of anxiety. Consequently, this modification can effectively prevent the surge in levels of catecholamines and adrenaline, thereby resulting in the shortening of the duration of the first stage **Ebrahimian and Bilandi (2021)**.

The findings of this study go partially with **El-Sayed Hussein et al. (2022)**, who indicated that there was a significant difference in the length of the 1st stage of labor in the intervention group (VR) than that of the control group. Moreover, it relatively matches with a study of **El Sharkawy et al. (2022)**, who found that there was a significant statistical difference with regard to the duration of various stages of labor. It is noteworthy that the present study finding partially agrees with **Ebrahimian and Bilandi (2021)**, who found that the mean duration of the active phase of labor exhibited a statistically significant difference between the virtual reality and control group.

On the other hand, **Amiri et al. (2019)** stated that there was no statistically significant variance identified in the duration of labor after using VR.

Women's satisfaction with maternity services, specifically with regard to the provision of care during labor and childbirth, has recently gained a significant importance among healthcare providers and administrators. The results of the present study revealed that the majority of women were satisfied with VR applications. Women conveyed that they found the intervention to be a constructive experience, facile to operate, user-friendly, and devoid of any adverse effects or complications. This may be attributed to the efficacy of VR application as they have been found to reduce pain and anxiety, resulting in decreased catecholamines.

This decrease, in turn, has been associated with improved blood flow from mother to fetus, leading to more efficient uterine contractions and the prevention of protracted parturition. Therefore, it positively affects the mother's satisfaction with delivery **Ebrahimian and Bilandi (2021)**

The current finding is consistent with a study of **El Sharkawy et al. (2022)**, who illustrate that the majority of women were satisfied with virtual reality application. It is also matches with **Ebrahimian and Bilandi (2021)**, who indicated that there was a noteworthy discrepancy observed in the level of maternal satisfaction with their childbirth experience between the subjects who were exposed to virtual reality in relation to those who were not. **Carus et al. (2021)** observed that the application of immersive virtual reality technology in the realm of labor has resulted in a noteworthy level of patient satisfaction. Moreover, the majority of women in the VR group expressed their desire to continue using this technology in future labor. In addition, the results of this study agreed with a study of **Sridhar et al. (2020)**, who illustrated that overall participants exhibited a favorable experience with regard to the VR intervention. In this regard, **Rahman et al. (2021)** spotlighted that the mean score for maternal childbirth satisfaction was found to be higher in the virtual reality group as compared to the control group. This indicates that the use of virtual reality positively impacted maternal childbirth satisfaction ($P < 0.001$).

Furthermore, the results of the present study are in accordance with **Wong and Gregory (2019)**, who found that all of laboring women prefer VR intervention. **Wu et al. (2020)** also in a harmony with the current finding who reported that VR significantly improved the women's overall satisfaction ($P = 0.000$). Additionally, the results of the present study come in the same line with **Cowles et al. (2019)**, who reported that many women express a desire to utilize virtual reality technology again for future childbirth experiences.

Increasingly, these results of the present study are supported by **Frey et al. (2019)**, who stated that the vast majority of women indicated

that they completely and comprehensively valued the implementation of virtual reality technology throughout the process of childbirth.

Conclusion:

Based on the findings of the present study, it can be concluded that virtual reality application during the first stage of labor significantly reduced labor pain intensity and anxiety level as well as decreased the duration of the active phase of the first stage of labor. It also achieved satisfaction of laboring women with using it.

Recommendations:

- Emphasize on enhancing the knowledge of women and healthcare professionals regarding the positive impact of virtual reality as a potent non-pharmacological approach for alleviating pain and anxiety during the process of labor.

- Trials for including virtual reality as a one of routine hospital care during childbirth to improve childbirth experience so it can play a role in reducing elective cesarean section.

Further studies:

- Evaluate the effect of virtual reality during 2nd stage of labor on pain intensity during episiotomy repair.

- Evaluate the effect of application of virtual reality on pain intensity after major gynecological operation.

- Replicate the study on larger samples and in different settings to enable a broader generalization of the findings

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Conflict of Interest Disclosure :

The researchers made a declaration affirming the absence of any conflict of interest in the conducted research..

References

- Akin, B., Yilmaz Kocak, M., Küçükaydın, Z., & Güzel, K. (2021). The effect of showing images of the foetus with the virtual reality glass during labour process on labour pain, birth perception and anxiety. *Journal of Clinical Nursing*, 30(15-16), 2301-2308.
- Amiri, P., Mirghafourvand, M., Esmaeilpour, K., Kamalifard, M., & Ivanbagha, R. (2019). The effect of distraction techniques on pain and stress during labor: a randomized controlled clinical trial. *BMC pregnancy and childbirth*, 19(1), 1-9.
- Araby, O. A.-W. A., & Abou-Elazab, R. A. (2022). Efficacy of Virtual Reality Application as a Distraction for Primiparity Women at 1st stage of Labor on Pain and Anxiety Control.
- Beilin, Y., Hossain, S., & Bodian, C. A. (2003). The numeric rating scale and labor epidural analgesia. *Anesthesia & Analgesia*, 96(6), 1794-1798.
- CAPMAS. (2021). Health of the Egyptian Family (HEF) *Central Agency for Public Mobilization and Statistics*.
- Carus, E. G., Albayrak, N., Bildirici, H. M., & Ozmen, S. G. (2021). Immersive Virtual Reality Improves Labor and Delivery Experience for Women: A Randomized Controlled Trial.
- Charan, J., & Biswas, T. (2013). How to calculate sample size for different study designs in medical research? *Indian journal of psychological medicine*, 35(2), 121-126.
- Cowles, S. D., Norton, T., Quiner, T., Hannaford, K., & Foley, M. (2019). 806: Virtual reality may decrease pain during labor. *American Journal of Obstetrics & Gynecology*, 220(1), S527-S528.
- Ebrahimian, A., & Bilandi, R. R. (2021). Comparisons of the effects of watching

- virtual reality videos and chewing gum on the length of delivery stages and maternal childbirth satisfaction: A randomized controlled trial. *Iranian Journal of Medical Sciences*, 46(1), 15.
- Ebrahimian, A., & Rahmani Bilandi, R. (2021). Comparisons of the Effects of Watching Virtual Reality Videos and Chewing Gum on the Length of Delivery Stages and Maternal Childbirth Satisfaction: A Randomized Controlled Trial. *Iran J Med Sci*, 46(1), 15-22.
<https://doi.org/10.30476/ijms.2019.82782.1119>
- El-Sayed Hussein, D., Ahmed El-Sheikh, M., Mohamed Abd-El Hady, R., & Afifi, A. E.-W. (2022). Usability of Virtual Reality for Alleviating Pain and Anxiety for Primiparity Women during 1st Stage of Labor and its Reflection on Labor Outcomes. *Journal of Nursing Science Benha University*, 3(1), 416-431.
- El Sharkawy, T. A. E.-W., Mohamed Abd-El Hady, R., Abdelhalim Said, S., Abdel-Wahab Afifi Araby, O., & Taha Ahmed Abou-Elazab, R. (2022). Efficacy of Virtual Reality Application as a Distraction for Primiparity Women at 1st stage of Labor on Pain and Anxiety Control. *Egyptian Journal of Health Care*, 13(1), 1267-1284.
- Frey, D. P., Bauer, M. E., Bell, C. L., Low, L. K., Hassett, A. L., Cassidy, R. B., . . . Sharar, S. R. (2019). 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. *Anesth Analg*, 128(6), e93-e96.
<https://doi.org/10.1213/ane.00000000000003649>
- Gür, E. Y., & Apay, S. E. (2020). The effect of cognitive behavioral techniques using virtual reality on birth pain: a randomized controlled trial. *Midwifery*, 91, 102856.
- Indovina, P., Barone, D., Gallo, L., Chirico, A., De Pietro, G., & Giordano, A. (2018). Virtual reality as a distraction intervention to relieve pain and distress during medical procedures. *The Clinical journal of pain*, 34(9), 858-877.
- JahaniShoorab, N., Zagami, S. E., Nahvi, A., Mazluom, S. R., Golmakani, N., Talebi, M., & Pabarja, F. (2015). The effect of virtual reality on pain in primiparity women during episiotomy repair: a randomized clinical trial. *Iranian Journal of Medical Sciences*, 40(3), 219.
- Li, Y., Zheng, L., & Wang, X. (2019). Flexible and wearable healthcare sensors for visual reality health-monitoring. *Virtual Reality & Intelligent Hardware*, 1(4), 411-427.
- Linowes, J. (2020). *Unity 2020 virtual reality projects: Learn VR development by building immersive applications and games with Unity 2019.4 and later versions*. Packt Publishing Ltd.
- Mohamed, H. A. O., Sweelam, M. Y. M., Mohamed, S. H., Mohamed, A., Abuzaid, A.-A., Abd Elkhalek, N. K., & Mohamed, N. H. A. (2022). Effect of Virtual Reality Application on Pain and Anxiety among Primiparous Women with Episiotomy.
- Momenyan, N., Safaei, A. A., & Hantoushzadeh, S. (2021). Immersive virtual reality analgesia in un-medicated laboring women (during stage 1 and 2): a randomized controlled trial. *Clinical and Experimental Obstetrics & Gynecology*, 48(1), 110-116.
- Murray, M., & Gayle Huelsmann, B. (2020). *Labor and delivery nursing: a guide to evidence-based practice*. Springer publishing company.
- Organization., W. H. (1994). The Partograph: the application of the WHO partograph in the management of labour, report of a WHO multicentre study, 1990-1991 (No. WHO/FHE/MSM/94.4). World Health Organization..
- Pratiwi, I., Husin, F., Ganiem, A. R., Susiarno, H., Arifin, A., & Wirakusuma, F. (2017). The effect of virtual reality on pain in primiparity women. *International Journal of Nursing and Health Science*, 4(4), 46-50.

- Rahman, W. K. S. A. E., Soliman, H. A. E., & Saber, N. M. (2021). Effect of virtual reality application on the delivery stages length and maternal satisfaction. *International Journal of Health Sciences*, 5(S1), 582-596. <https://doi.org/10.53730/ijhs.v5nS1.13908>
- Sahin, G., & Basak, T. (2020). The effects of intraoperative progressive muscle relaxation and virtual reality application on anxiety, vital signs, and satisfaction: A randomized controlled trial. *Journal of PeriAnesthesia Nursing*, 35(3), 269-276.
- Sehhatie, F., Mirghafourvand, M., & Niri, Z. (2015). The Effect of Non-Pharmaceutical Methods of Labor Pain Relief on Mothers' Postpartum Depression: A Randomized Controlled Trial. *International Journal of Women's Health and Reproduction Sciences*, 3, 48-55. <https://doi.org/10.15296/ijwhr.2015.08>
- Spielberger, C. D. (1983). State-trait anxiety inventory for adults.
- Sridhar, A., Shiliang, Z., Woodson, R., & Kwan, L. (2020). Non-pharmacological anxiety reduction with immersive virtual reality for first-trimester dilation and curettage: a pilot study. *The European Journal of Contraception & Reproductive Health Care*, 25(6), 480-483.
- Wong, M. S., & Gregory, K. D. (2019). Patient reported outcomes on the use of virtual reality for pain Management in Labor [17E]. *Obstetrics & Gynecology*, 133, 55S.
- Wong, M. S., Spiegel, B. M., & Gregory, K. D. (2021). Virtual reality reduces pain in laboring women: a randomized controlled trial. *American Journal of Perinatology*, 38(S 01), e167-e172.
- Wu, H., Zhu, B., & Jiang, P. (2020). The Relationship between Virtual Reality Technology and Anxiety State of Parturient Women with Labor Pain. *Science Insights*, 35(5), 236-243.
- Yokoyama, I., Sarai, T., Asai, T., Kitou, N., Nozaki, H., Kondo, Y., . . . Liu, D. (2019). Virtual reality and augmented reality applications and simulation in vascular access management with three-dimensional visualization. *The Journal of Vascular Access*, 20(1_suppl), 65-70.