Effect of Immersive Virtual Reality as a Distraction Method on Anxiety, Stress and Hemodynamic Parameters of Women Undergoing Cesarean Section

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Abstract:

Background: Cesarean section is a common surgery to deliver viable fetus through laparotomy and hysterotomy. Many women experience significant levels of perioperative anxiety and stress that negatively affect physiological and psychological status of both mother and fetus. **Aim of this Research** was to evaluate the effect of immersive virtual reality as a distraction method on anxiety, stress and hemodynamic parameters of women undergoing cesarean section. **Research Design:** A quasi-experimental research design (two groups, the study and control groups) was used. **Research Setting:** The research was conducted at Benha University Hospital's Obstetrics and Gynecology Department. **Subjects:** A purposive sample included 170 women undergoing cesarean sections and divided equally into the study and control groups. **Tools of data collection:** Five tools were used; **Tool 1)** structured interviewing questionnaire, **Tool 2)** maternal hemodynamic parameters assessment sheet, **Tool 3)** novel visual facial anxiety scale, **Tool 4)** brief measure of emotional preoperative stress & 5) postoperative cesarean section satisfaction among delivered mothers questionnaire. **Results:** There were statistically significant differences in total mean scores of visual facial anxiety, and mean scores of both pulse rate and blood pressure during and after application of virtual reality in the study group compared to the control group. Besides, there were highly statistically significant differences in total mean scores of emotional intraoperative and postoperative stress items, also all satisfaction dimensions after application of virtual reality in the study group compared to the control group $P \leq 0.001$. **Conclusion:** Immersive virtual reality application as a distraction method had a positive effect on reduction of anxiety and stress of women undergoing cesarean section in addition to a positive effect on hemodynamic parameters. **Recommendation:** Encouraging hospitals administration for preparing virtual reality as a supportive measure for women during cesarean section to lessen anxiety and stress and maintain stabilize hemodynamic parameters.

Keywords: Anxiety, Cesarean Section, Hemodynamic Parameters, Satisfaction, Stress, Virtual Reality

Introduction:

Cesarean section is the most common surgical procedure to deliver a viable fetus through abdominal and uterine incisions **(Sung, et al., 2024)**. The World Health Organization (WHO) recommends that the rate of cesarean sections in any population should be between (5-15%) without justification for exceeding (10-15%) of births. But there are rising trends in elective cesarean section **(Dewedar, 2025).**

Although cesarean section is considered a relatively popular delivery method, many

women experience high levels of anxiety and stress before and during surgery **(Mohammadi, et al., 2025)**. There was previous study revealed that cesarean section-related anxiety and stress are associated with psychological risks such as postpartum depression and post-traumatic stress **(Grisbrook, et al., 2024)**. As well, physiological risks as changes in hemodynamic parameters like tachypnea, tachycardia and alteration in blood pressure levels **(Araj, et al., 2020)**, in addition, fetal risks in form of low fetal Apgar score, fetal hypoxemia and increased fetal mortality rate **(Yuda, et al., 2025)**.

Perioperative anxiety and stress can be managed pharmacologically and non-pharmacologically. Concerning pharmacological methods, which include hypnotics, sedatives and anxiolytics. But these drugs carry some risks such as respiratory and central nervous systems depression **(Simone and Bobrin, 2024)**. Pertaining non-pharmacological methods, which include religious or spiritual activity, hypnosis, meditation, guided imagery relaxation, acupuncture, aromatherapy, massage and virtual distraction by virtual reality **(Demirci, et al., 2023; Wang, et al., 2022)**.

Virtual reality is a modern, noninvasive, evidence-based and non-pharmacological distraction technique, which simulates a real-life environment by integrating 3D virtual objects to create a completely virtual environment **(Maghalian, et al., 2024)**.

The development of virtual reality led to its application possibility in the field of obstetrics to reduce anxiety and stress especially in the significant and stressful situations of pregnancy and delivery as cesarean sections, as virtual reality can generate relaxation that improves the surgery outcomes **(Xu, et al., 2024)**.

Nurses have a critical and vital role in effective virtual reality application that requires well trained health care team to select suitable virtual reality materials, address ethical issues related to data protection and obtaining informed consent from women for enabling responsible virtual reality usage in nursing **(Ibrahim, et al., 2025)**.

Significance of the Research:

Cesarean section rates have increased over the past three decades. A similar worrisome trend has been observed in Egypt **(Saleh, et al., 2025)**. Like any surgery, the percentage of women that faced unpleasant emotional experiences as anxiety and stress was (73.3%) to (86%) of women undergoing cesarean delivery which was one of the causes of increased mortality during anesthesia and surgery, as anxiety and stress has a negative impact on the stability of hemodynamics of women, causing acute myocardial infarction, heart failure, pulmonary edema and increasing the incidence of hypotension after spinal anesthesia **(Maghalian, et al., 2024)**.

Virtual reality is a novel intervention that serves as an advanced alternative traditional psychological technique and approved in lessening operative anxiety and stress. Virtual reality has many advantages such as being immersive, promising, non-invasive, less side effects, interactive, cheap and user-friendly **(Ahmed, et al., 2025)**. Furthermore, no prior research has addressed this issue in hospitals at Benha University.

Aim of the Research:

The research aim was to evaluate the effect of immersive virtual reality as a distraction method on anxiety, stress and hemodynamic parameters of women undergoing cesarean section.

Research Hypotheses:

- **H1:** Women who would apply virtual reality during cesarean section would experience less anxiety and stress than those who wouldn't apply it.
- **H2:** Women who would apply virtual reality during cesarean section would experience more stable hemodynamic parameters than those who wouldn't apply it.
- **H3:** Women who would apply virtual reality would be satisfied with cesarean section more than who wouldn't apply it.

Operational definitions:

Immersive virtual reality is a new and distractive technology that is applied during the entire operation after regional anesthesia, to shift the woman's attention from anoxious operative stimuli to these new virtual environments for keeping the woman more relaxed.

Hemodynamic parameters include body temperature, pulse rate, respiration, blood pressure (systolic and diastolic blood pressure) and peripheral oxygen saturation. It was assessed before, during and after cesarean section to determine the effect of applied intervention.

Research Setting:

The research was conducted at Benha University Hospital's Obstetrics and Gynecology department.

Subjects:

Sample type: A purposive sample was used.

Sample size: The total sample size was 170 pregnant participant women undergoing elective cesarean section for period of (9) months from the time of starting data collection.

Sample technique:

The total sample was divided equally into two groups (the study group who applied virtual reality and routine hospital care was (85) women) and the control group (who receive routine hospital care only was (85) women).

Inclusion criteria:

Women undergoing elective cesarean section with spinal or epidural anesthesia, of age 18-35 years old, free from any medical diseases and obstetrical complications, free from mental or psychological diseases, with normal vision and hearing abilities and willing and active participation in the study.

Tools of data collection:

Five tools were used for data collection:

Tool I: A structured interviewing questionnaire: The researchers prepared it to collect basic data after reviewing related literatures **(Noben, et al., 2019; Almedhesh, et al., 2022; Hussein, et al., 2022; Elsharkawy, et al., 2022)** and then translated it into Arabic language. It included two parts such as:

Part (1): General characteristics of participant pregnant women: it included 5 items (age, residence, marital status, level of education and occupation).

Part (2): Obstetrical history: it included 6 items (gravity, parity, current gestational age, mode of previous delivery, compliance with antenatal care follow up and duration of current cesarean section).

Tool II: Maternal hemodynamic parameters assessment sheet: This tool was developed by the researchers, based on current and relevant literatures **(Cybulski, 2021; Gunusen, et al., 2022; Almedhesh, et al., 2022)** and used to assess and record hemodynamic indicators as temperature, heart rate, respiration, blood pressure and peripheral oxygen saturation of the studied sample.

Tool III: A novel visual facial anxiety scale (NVFAS): It was developed by **(Cao, et al., 2017)** and adapted by the researchers to assess (acute state) of anxiety. This tool was composed of (11) different facial expressions

in which the researchers assessed different degrees of anxiety from (0) no anxiety to (10) the highest anxiety level. Total anxiety score was classified as the following:

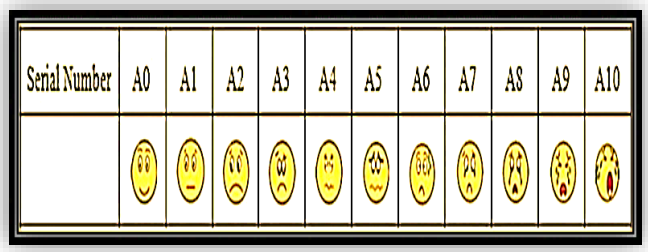
- **No anxiety** when score was → (0).
- **Mild anxiety** when score was → (1-3).
- **Moderate anxiety** when score was→(4-7).
- **Sever anxiety** when score was → (8-10).

Tool IV: The brief measure of emotional preoperative stress (B-MEPS): This tool was developed by **(Wolmeister, et al., 2020)** and adapted by the researchers to assess emotional stress. This tool was composed of (12) items that were rated on a 4-point Likert scale ranging from "Not at All" (0) to "Very So Much" (3). The score was reversed for positive emotions items, the higher score indicated higher stress and the total scale score ranged from (0-36). Total stress score was classified as the following:

- **No stress** when score was→ (0).
- **Mild stress** when score was→ (1-12).
- **Moderate stress** when score →(13-24).
- **Sever stress** when score was→ (25-36).

Tool V: Postoperative cesarean section satisfaction among delivered mothers questionnaire: This questionnaire was developed by **(Sarhan, et al., 2022; Abubakar, et al., 2023)** and adapted by the researchers to measure women's satisfaction with cesarean section after application of provided interventions for both groups. This tool had three dimensions (structural aspect of care "7 items", interpersonal dimension of care "11items" and outcome dimension of care "6 items"). Totally, it was composed of (24) statements rated on a 2-point Likert scale. Statements in structural aspect of care and interpersonal dimension of care were ranging from Unsatisfied (1) to Satisfied (2), and statements in outcome dimension of care were ranging from No (1) and Yes (2). The higher score indicated higher satisfaction and the total questionnaire score ranged from (24-48). Total satisfaction score was classified as the following:

- **Unsatisfied** when score was → (24-36).
- **Satisfied** when score was → (37-48).



Administrative design:

During this phase an official approval to conduct the study was obtained by submission an official letter from both the Director of Benha University Hospital and the Head of Obstetrics and Gynecology Department to obtain agreement to conduct the study after explaining its purpose.

Tools validity:

The tools of data collection was reviewed by a panel of three expert professors in Obstetrics and Gynecological Nursing to test content validity and modifications were done according to the panel's judgements on the clarity of sentences and the appropriateness of content.

Tools reliability:

The tools reliability were satisfactory by Cronbach's alpha coefficient test for tool III, tool IV, and tool V which revealed that; the internal consistency of tool III (NVFAS) was 0.71, the internal consistency of tool IV (B-MEPS) was 0.83 and the internal consistency of tool V (Postoperative cesarean section satisfaction among delivered mothers questionnaire) was 0.98.

Ethical considerations:

Ethical aspects were considered before starting the research as the following: An approval was obtained from the Scientific Research Ethical Committee (REC-OBSN-DP98) at Faculty of Nursing at Benha University for fulfillment of the research. An official permission from the selected research settings was obtained for the fulfillment of the research.

Before applying the tools, the researchers explained the aim and importance of the research to gain participant pregnant women's trust. The researchers obtained a written informed consent from participant pregnant women to participate in the research and confidentialities were assured. The research didn't have any physical, social or psychological risks on the participant pregnant woman. All tools of data collection were burnt after statistical analysis to promote the confidentiality of the participant pregnant women. Also, research tools didn't include any immoral statements and respect human rights. The participant pregnant woman had the right to withdraw at any time freely.

Pilot study:

The pilot study was conducted on (10%) of the total duration that was 4 weeks, which were 12 women. It was conducted to test the simplicity, feasibility, clarity and applicability of the developed tool, also to find out the possible obstacles and problems that faced the researchers and interfered with data collection. According to the result of the pilot study, tool IV and V were required to be modified. So that, the pilot study sample was excluded from the total study sample.

Field work:

The current research was carried out from the beginning of November, 2023 to the end of July, 2024 (covering nine months) for completing the research. The researchers visited the previously mentioned setting two consecutive days per week (Saturdays and Sundays) from 9 a.m. to 3 p.m. The researchers interviewed 3-5 women per week individually to collect data.

Preparatory phase:

The preparatory phase was the first phase of the field work of this research; the research was carried out through reviewing past and recent local and international related literature covering the various aspect of this research study using books, articles, magazines and network about the related studies to evaluate the effect of virtual reality on anxiety, stress and hemodynamic parameters of women undergoing cesarean section. This helped the researchers to become acquainted with the magnitude and importance of the problem also, guided the researchers to prepare the required data collection tools.

The researchers prepared wearable Shinecon headset virtual reality glasses as well as a suitable mobile phone as Xiaomi Redmi 10 2022 smartphone, for applying the virtual reality videos. The researchers prepared playlists of immersive virtual reality environments videos that were accompanied by either Holy Quran surah recitations or calm relaxing music on the mobile phone to be applied during the entire duration of the cesarean section for about (60) minutes, as these videos created 360° audiovisual virtual environments during the operation. Examples of immersive virtual reality environments videos that were used during cesarean section were tours inside (Al-Masjid Al-Haram, The Prophet's Mosque, Al-Masjid Al-Aqṣā, the Italian countryside, forests, beaches, the island of Maldives and the sea world).

Virtual reality headset

Besides, the researchers prepared the printed-out representative photo cards of virtual reality environments videos to help participants make an informed and favorite choice for immersive experience in advance.

Then the researchers conducted the pilot study on of the total duration that was 4 weeks. The pilot study sample was excluded from the total study sample due to the tool IV and V were required to be modified.

Interviewing and assessment phase:

At the beginning of the interview, the researchers visited the research setting at Benha University Hospital two consecutive days per week (Saturdays and Sundays) and prepared a separated place at the waiting hall of the Obstetrics and Gynecology outpatient clinic away from over crowdedness for interviewing participant pregnant women to keep women's privacy, confidentiality and trust. The researchers introduced themselves and greeted with each pregnant woman undergoing elective cesarean section, then the researchers explained the aim of the research to pregnant woman, provided the pregnant woman with all information about the research and the researchers obtained the written informed consent from all women that were included in the research.

The researchers interviewed each participant pregnant woman using the following tools: Structured interviewing questionnaire (Tool I) was used to assess general characteristics and obstetrical history of participant pregnant women in the waiting hall of Obstetrics and Gynecology outpatient clinic on (Saturdays), the day before the operation. The average time for the completion of this tool was around (5-10) minutes. Besides, the researchers assessed maternal hemodynamic parameters (Tool II), visual facial anxiety (Tool III) and emotional preoperative stress (Tool IV) at entering the operating room before application of virtual reality on (Sundays), the day of the operation. The average time for the completion of tool (II) was around (5-10) minutes and the average time for the completion of both tools (III and IV) was around (7-13) minutes. All of these data gathered to serve as a baseline for subsequent comparisons to explore the virtual reality applicability for relieving anxiety and stress levels as well as stability of hemodynamic parameters during cesarean section.

Planning phase:

The researchers screened all pregnant women who underwent elective cesarean section on the day before the operation at Obstetrics and Gynecology outpatient clinic. Moreover, the pregnant woman's file was examined to ensure that woman was eligible for the study and compatible to the inclusion criteria.

Then, the researchers divided the study sample into two equal groups (the study group was (85) women and the control group was (85) women). As the researchers began the study application with one participant pregnant woman for the study group, followed by one participant pregnant woman for the control group alternately.

The researchers provided a verbal explanation about how the virtual reality device and mobile phone were operating with immersive virtual reality environments. Also,

the researchers informed the pregnant participant woman about how the virtual reality glasses were applied during cesarean section. As well as the duration of wearing of virtual reality glasses.

The researchers told the pregnant participant woman about the variety of offered selections of relaxing audio-visual virtual reality environments videos to choose from.

The researchers clarified to the pregnant participant woman the time points for measuring data collection tools before, during and after application of virtual reality to evaluate the effect of immersive virtual reality as a distraction method on anxiety, stress and hemodynamic parameters of women undergoing cesarean section.

Implementation phase:

For the study group (virtual reality group):

The routine hospital care was given to the study group by the hospital staff in addition to application of virtual reality.

Before entering the operating room, the researchers informed the participant pregnant woman about the different and available kinds of virtual reality videos and ask the woman to choose the videos to be watched from the preprepared cards.

The researchers prepared a playlist of these selected videos with approximate duration of (60) minutes on mobile phone in standby mode for starting to avoid the video display termination before finishing cesarean section for better audio-visual distraction.

Also, the researchers kept the mobile phone in aeroplane mode to avoid receiving phone calls or any mobile notifications while watching videos.

While the participant pregnant woman was prepared for regional anesthesia, the researchers sterilized virtual reality glasses and mobile phone with alcohol (70%) to avoid transmission of contamination or nosocomial infection between participant pregnant women.

The researchers opened the virtual reality glasses' cover and put the mobile phone inside virtual reality glasses. Then, the researchers closed the cover well to avoid the mobile phone falling and connected the headphone socket with the mobile phone.

After that, the researchers put the virtual reality glasses on the participant pregnant woman's head and adjusted them to fit participant pregnant woman's head circumference and eye orbit. Additionally, the researchers adjusted the depth of vision field to focus on videos for clear and better vision. Also, the researchers ensured that virtual reality headset was adjusted to her ear to for better video sounds hearing and external environmental sounds isolation.

Then, the researchers pressed the video play button on the virtual reality glasses and enhanced the participant pregnant woman to be more relaxed, feeling as living in, visiting and exploring new environments.

The desirable list started playing after regional anesthesia and continued during the entire operation until the skin suturing was completed (the time of removing the virtual reality glasses).

During the operation the participant woman was assessed at two points a time as following:

Tool II (maternal hemodynamic parameters) was assessed at skin incision "during application of virtual reality" and at 2 hours postoperative "after application of virtual reality".

Tool III and **Tool IV** (a novel visual facial anxiety scale (NVFAS) and the brief measure of emotional preoperative stress (B-MEPS)) were assessed at the end of skin suture "during application of virtual reality" and at 2 hours postoperative "after application of virtual reality".

Finally, the researchers assessed the

women's satisfaction regarding (structural aspect of care, interpersonal dimension of care and outcome dimension of care) at 2 hours postoperative "after application of virtual reality" by **Tool V** (Postoperative cesarean section satisfaction among delivered mothers questionnaire). The average time needed to complete this tool was around (5-10) minutes.

For the control group:

The participant pregnant women received the routine hospital care by health care provider. The researchers visited the previously mentioned research setting two days per week from 9 a.m. to 3 p.m., the researchers interviewed the participant pregnant women and collected tools (II, III, IV and V): The same time measurements for (hemodynamic parameters, (NVFAS), (B-MEPS) and postoperative cesarean section satisfaction among delivered mothers questionnaire) were followed without applying virtual reality glasses as a method of relieving anxiety and stress.

Evaluation phase:

After application of virtual reality technology on the study group, the researchers evaluated the effect of virtual reality on hemodynamic parameters, anxiety, stress and woman's satisfaction regarding (structural aspect of care, interpersonal dimension of care and outcome dimension of care) by using tools (II, III, IV and V) at 2 hours postoperative "after application of virtual reality" as well as the control group.

Statistical analysis:

The researchers verified data prior to computerized entry and used the statistical package for social sciences (SPSS version 25) for that purpose, followed by data tabulation and analysis. Descriptive statistics were calculated for the data (e.g., mean and standard deviation for quantitative data and (frequency and distribution for qualitative data). As well as, the significance of difference was tested using one of the following tests: (Chi square test and fisher exact test for intergroup comparison of categorical data) and (independent t-test was used to compare mean of two groups of quantitative data).

- When p-value was < 0.05, it was considered statistically significant (*).
- While p-value was > 0.05, it was considered statistically insignificant and p-value was < 0.01, it was considered highly significant (**) in all analyses.

Results:

Table (1) clarifies that 60.0% of the study group and 59.9% of the control group in age group from 24 - ≤ 29 years old with mean age 27.73±4.25 years old of the study group and 26.86±4.62 years old of the control group respectively. Moreover, 68.2% of the study group meanwhile, 71.8% of the control group respectively lived in rural area. Also, 100% of the control groups meanwhile 97.6% of the study group were married. Concerning level of education, it was cleared that 47.1% of the study group and 49.4% of the control group respectively had secondary education. As regards occupational status, 52.9% of the study group and 64.7% of the control group respectively were housewives. Generally, there was no statistically significant difference between the study and control groups regarding general characteristics $p > 0.05$. That is reflected groups homogeneity.

Table (2) displays that 58.8% of the study group and 68.2% of the control group respectively were multigravida. Increasingly, 57.6% of the study group and 65.9% of the control group respectively were multipara. Moreover, 41.2% of the study group and 43.5% of the control group respectively had gestational age from 39-40 weeks with a mean

gestational age of 39.07±1.51 weeks of the study group and 39.25±1.44 weeks of the control group respectively. In relation to mode of last delivery, 66.1% of the study group and 64.3% of the control group respectively performed cesarean section for the last delivery. Also 56.5% of the study group and 61.2% of the control group respectively were compliant with antenatal care follow up. As well as, the mean duration of current cesarean section of both the study and control groups were 42.87±6.07 minutes of the study group and 44.60±6.22 minutes of the control group respectively. Generally, there was no statistically significant difference between the study and control groups regarding obstetrical history $p > 0.05$. That is the two groups under study homogenous.

Table (3) denotes that there was no statistically significant difference at any time point between both the study and control groups regarding temperature, respiratory rate and peripheral oxygen saturation $P > 0.05$. before application of virtual reality "at entering the operating room and before anesthesia", there was no statistically significant difference between both the study and control groups regarding pulse rate, systolic blood pressure and diastolic blood pressure $P > 0.05$. While, there were statistically significant differences in the study group compared to the control group regarding pulse rate, systolic blood pressure and diastolic blood pressure "at the end of skin suture and at 2 hours postoperative during and after application of virtual reality $P \leq 0.05$.

Table (4) describes that there was a marked decrease in total mean scores of visual facial anxiety among the study group at entering the operating room and before anesthesia, at the end of skin suture and at 2 hours postoperative with total mean scores of 7.46±2.06, 3.76±1.81 and 1.91±1.66 respectively. In contrast, the control group revealed an obvious increase in total mean scores of visual facial anxiety higher than the study group at the same time points with total mean scores of 7.74 ± 1.56, 5.58 ± 1.69 and 3.01 ± 2.07 respectively. Also there were statistically significant differences found in the study group compared to the control group in total visual facial anxiety scores "at the end of skin suture and at 2 hours postoperative "during and after application of virtual reality" $P \leq 0.05$.

Table (5) clarifies that there was an observed lessening in total mean scores of all items of the emotional preoperative stress among the study group at entering the operating room and before anesthesia, at the end of skin suture and at 2 hours postoperative with total mean scores of 23.11±3.04, 12.03±2.70 and 7.42±2.75 respectively. Oppositely, the control group showed an observed increase in the total mean scores of emotional preoperative stress higher than the study group at the same time points with mean scores of 23.29±2.66, 19.84±3.47 and 14.67±3.70 respectively. In addition, there were highly statistically significant differences observed in total mean scores of emotional preoperative stress were in the study group compared to the control group at the end of skin suture and at 2 hours $P \leq 0.001$.

Table (6) displays that there was a marked improvement in total mean score of satisfaction dimensions among the study group at 2 hours after application of virtual reality with total mean scores of 40.49±3.13 that was higher than the control group with total mean scores of 31.81±3.64. Increasingly, there was a highly statistically significant difference found in the study group compared to the control group "at 2 hours postoperative "after application of virtual reality $P \leq 0.001$.

Table (7) clarifies that, there was a statistically significant relation between total visual facial anxiety score and only the age of

the women in the study group “at entering the operating room and before anesthesia "before application of virtual reality p ≤ 0.05. While, there was no statistically significant relation between total visual facial anxiety score and general characteristics of participant pregnant women in the study group “at the end of skin suture "during application of virtual reality P > 0.05.

Table (8) demonstrates that, there was a statistically significant relation between total emotional preoperative stress score and only the age of the women in the study group “at entering the operating room and before anesthesia before application of virtual reality" P ≤ 0.05. While, there was no statistically significant relation between total emotional preoperative stress score and general characteristics of participant pregnant women in the study group at the end of skin suture during application of virtual reality P > 0.05.

Table (9) reveals that, there was a statistically significant relation between total visual facial anxiety score and (gravidity and parity**)** of the women in the study group “at entering the operating room and before anesthesia before application of virtual reality P ≤ 0.05. While, there was no statistically significant relation between total visual facial anxiety score and selected items of obstetrical history of the women in the study group at the end of skin suture during application of virtual reality P > 0.05.

Table (10) illustrates that, there was a statistically significant relation between total emotional preoperative stress score and (gravidity and parity) of the women in the study group at entering the operating room and before anesthesia" before application of virtual reality P ≤ 0.05. While, there was no statistically significant relation between total emotional preoperative stress score and selected items of obstetrical history of the women in the study group at the end of skin suture during application of virtual reality P > 0.05.

Table (1): Distribution of studied sample according to general characteristics of participant pregnant women for both groups (the study and control groups) (n=170).

General characteristics	Control group (n=85)		Study group (n=85)		Chi square test/FET	P-value
	No.	%	No.	%		
Age (in years)					1.720	4.220
18 - ≤23.	22	25.9	15	17.6		
24 - ≤29.	45	59.9	51	60.0		
30 - ≤35.	18	21.2	19	22.4		
Mean ±SD	**26.86±4.62**		**27.73±4.25**			
Residence					0.252	0.616
Rural.	61	71.8	58	68.2		
Urban.	24	28.2	27	31.8		
Marital status					2.020	0.3640
Married.	85	100.0	83	97.6		
Divorce.	0	0.0	1	1.2		
Widowed.	0	0.0	1	1.2		
Level of education					0.640	0.887
Illiterate.	5	5.2	6	7.1		
Primary education.	9	10.6	12	14.1		
Secondary education.	42	49.4	40	47.1		
High education.	29	34.1	27	31.8		
Occupation					2.420	0.119
Housewife.	55	64.7	45	52.9		
Work.	30	35.3	40	47.1		

No statistical significant p > 0.05.

Table (2): Distribution of studied sample according to obstetrical history for both groups (the study and control groups) n=170.

Obstetrical history	Control group (n=85)		Study group (n=85)		Chi square test	P-value
	No.	%	No.	%		
Gravidity					1.620	0.202
Primigravida.	27	31.8	35	41.2		
Multigravida.	58	68.2	50	58.8		
Parity					1.220	0.269
Primipara.	29	34.1	36	42.4		
Multipara.	56	65.9	49	57.6		
Current gestational age (in weeks):					0.781	0.677
37-38.	20	23.5	25	29.4		
39-40.	37	43.5	35	41.2		
> 40.	28	32.9	25	29.4		
Mean ±SD	**39.25±1.44**		**39.07±1.51**		**Independent t-test =1.680**	**0.095**
Mode of previous delivery	**n=56**		**n=49**		1.550	0.213
Vaginal delivery.	20	35.7	12	24.5		
Cesarean section.	36	64.3	37	66.1		
Compliance with antenatal care follow up					0.389	0.533
Yes.	52	61.2	48	56.5		
No.	31	36.5	37	43.5		
Duration of current cesarean section (in minutes)					**Independent t-test =1.830**	**0.069**
Mean ±SD	**44.60±6.22**		**42.87±6.07**			

Table (3): Mean scores of hemodynamic parameters of the studied women in both groups (the study and control groups) before, during and after application of virtual reality (n=170).

Time of assessment	Phase of intervention	Hemodynamic parameters	Control group n=85	Study group n=85	Independent t-test	P-value
			Mean ± SD	Mean ± SD		
At entering the operating room and before anesthesia.	Before application of virtual reality.	Temperature (C°)	37.05±0.11	37.02±0.09	**1.680**	**0.094**
		Respiratory rate (c/m)	18.14±0.86	17.87±1.05	**1.830**	**0.069**
		Pulse rate (b/m)	88.76±7.91	89.55±10.23	**0.562**	**0.575**
		Systolic Blood Pressure (mmHg)	118.12±8.77	120.08±7.05	**1.600**	**0.110**
		Diastolic Blood Pressure (mmHg)	61.08±8.11	65.50±7.02	**0.871**	**0.385**
		Peripheral Oxygen Saturation (SpO2%)	98.51±0.73	98.33±0.86	**1.430**	**0.153**
At skin incision.	During application of virtual reality.	Temperature (C°)	37.03±0.12	37.01±0.10	**1.210**	**0.226**
		Respiratory rate (c/m)	17.66±1.15	17.48±1.18	**0.987**	**0.325**
		Pulse rate (b/m)	79.40±6.04	76.85±4.85	**3.030**	**0.003***
		Systolic Blood Pressure (mmHg)	113.16±8.80	116.60±7.78	**2.690**	**0.008***
		Diastolic Blood Pressure (mmHg)	66.12±10.46	69.24±8.38	**2.140**	**0.034***
		Peripheral Oxygen Saturation (SpO2%)	98.19±0.90	98.35±0.82	**1.230**	**0.217**
At 2 hours postoperative.	After application of virtual reality.	Temperature (C°)	37.15±0.12	37.12±0.11	**1.350**	**0.126**
		Respiratory rate (c/m)	17.82±0.80	17.68±0.87	**1.090**	**0.275**
		Pulse rate (b/m)	79.39±5.43	77.11±4.84	**2.880**	**0.004***
		Systolic Blood Pressure (mmHg)	116.64±7.36	119.00±5.01	**2.440**	**0.015***
		Diastolic Blood Pressure (mmHg)	67.84±6.42	69.98±6.10	**2.22**	**0.027***
		Peripheral Oxygen Saturation (SpO2%)	98.80±0.55	98.92±0.27	**1.750**	**0.081**

No statistical significant p > 0.05. * A statistical significant p ≤ 0.05.

Table (4): Mean scores of total visual facial anxiety score of studied sample in both groups (the study and control groups) before, during and after application of virtual reality n=170.

Time of assessment	Phase of intervention	Visual facial anxiety score		Independent t t-test	p-value
		Control group n=85	Study group n=85		
		Mean ±SD	Mean ±SD		
At entering the operating room and before anesthesia	Before application of virtual reality.	7.74±1.56	7.46±2.06	1.000	0.316
At the end of skin suture	During application of virtual reality.	5.58±1.69	3.76±1.81	6.730	0.016*
At 2 hours postoperative	After application of virtual reality.	3.01±2.07	1.91±1.66	3.830	0.005*

No statistical significant p > 0.05. * A statistical significant p ≤ 0.05.

Table (5): Total mean scores of emotional preoperative stress in both groups (the study and control groups) before, during and after application of virtual reality n=170.

Emotional preoperative stress subscales	Possible score	Control group n=85	Study group n=85	Independent t-test	P-value
		Mean ± SD	Mean ± SD		
Negative Emotions					
At entering the operating room and before anesthesia "before application of virtual reality".	0-27	16.90±2.46	16.83±2.18	0.198	0.844
At the end skin suture "during application of virtual reality".		14.51±3.04	8.52±2.29	14.470	0.000**
At 2 hours postoperative. "after application of virtual reality".		10.60±3.08	5.20±2.28	12.960	0.000**
Positive Emotions					
At entering the operating room and before anesthesia "before application of virtual reality".	0-9	6.21±0.97	6.45±0.98	1.640	0.102
At the end skin suture "during application of virtual reality".		5.32±1.06	3.50±1.11	10.890	0.001**
At 2 hours postoperative. "after application of virtual reality".		4.07±1.34	2.22±1.18	9.490	0.000**
Total score					
At entering the operating room and before anesthesia "before application of virtual reality".	0-36	23.11±3.04	23.29±2.66	0.403	0.688
At the end skin suture "during application of virtual reality".		19.84±3.47	12.03±2.70	16.340	0.000**
At 2 hours postoperative. "after application of virtual reality".		14.67±3.70	7.42±2.75	14.460	0.000**

No statistical significant p > 0.05. **A Highly Statistical significant p ≤ 0.001.

Table (6): Total mean scores of satisfaction dimensions in both groups (the study and control groups) at 2 hours postoperative after application of virtual reality (n=170).

Satisfaction dimensions	Possible score	Control group n=85	Study group n=85	Independent t-test	P-value
		Mean ± SD	Mean ± SD		
Satisfaction with the structural aspect of care	7-14	8.79±1.38	10.65±1.30	9.010	0.000**
Satisfaction with the interpersonal dimension of care	11-22	15.32±2.67	19.25±2.10	10.630	0.000**
Satisfaction with outcomes dimension of care	6-12	7.71±1.18	10.60±1.03	16.590	0.000**
Total score	24-48	31.81±3.64	40.49±3.13	16.640	0.000**

**A Highly Statistical significant p ≤ 0.001.

Table (7): Relation between general characteristics of women in the study group and their total visual facial anxiety score before and during application of virtual reality phases n=85.

General characteristics	Total visual facial anxiety score															
	Before application of virtual reality "at entering the operating room"								During application of virtual reality "at the end of skin suture"							
	Mild n=14		Moderate n=52		Severe n=19		X^2	P-value	Mild n=46		Moderate n=30		Severe n=9		X^2	P-value
	No.	%	No.	%	No.	%			No.	%	No.	%	No.	%		
Age (in years)																
18 - <23	2	14.3	5	9.7	8	42.1	**12.130**	**0.016***	8	17.4	6	20.0	1	11.1	**0.518**	**0.972**
23 - <29	9	64.3	32	61.5	10	52.6			27	58.7	18	60.0	6	66.7		
29 - ≥ 35	3	21.4	15	28.8	1	5.3			11	23.9	6	20.0	2	22.2		
Residence																
Rural	11	78.6	34	65.4	13	68.4	**0.885**	**0.642**	30	65.2	21	70.0	7	77.8	**0.614**	**0.735**
Urban	3	21.4	18	34.6	6	31.6			16	34.8	9	30.0	2	22.2		
Marital status																
Married	13	92.9	51	98.1	19	100.0	**5.750**	**0.219**	45	97.8	29	96.7	9	100.0	**2.680**	**0.611**
Divorced	0	0.0	1	1.9	0	0.0			1	2.2	0	0.0	0	0.0		
Widowed	1	7.1	0	0.0	0	0.0			0	0.0	1	3.3	0	0.0		
Level of education																
Illiterate	1	7.2	4	7.7	1	5.2	**1.560**	**0.955**	3	6.5	2	6.6	1	11.1	**2.960**	**0.813**
Primary education	3	21.4	6	11.5	3	15.8			7	15.2	5	16.7	0	0.0		
Secondary education	7	50.0	24	46.2	9	47.4			20	43.5	14	46.7	6	66.7		
High education	3	21.4	18	34.6	6	31.6			16	34.8	9	30.0	2	22.2		
Occupation																
Housewife	9	64.3	25	48.1	11	57.9	**1.400**	**0.496**	24	52.2	16	53.3	5	55.6	**0.037**	**0.981**
Work	5	35.7	27	51.9	8	42.1			22	47.8	14	46.7	4	44.4		

No statistical significant p>0.05. * A Statistical significant p ≤ 0.05.

Table (8): Relation between general characteristics of women in the study group and their total emotional preoperative stress score before and during application of virtual reality phases n=85.

General characteristics	Total emotional preoperative stress score															
	Before application of virtual reality "at entering the operating room"								During application of virtual reality "at the end of skin suture"							
	Mild n=13		Moderate n=51		Severe n=21		X^2	P-value	Mild n=45		Moderate n=32		Severe n=8		X^2	P-value
	No.	%	No.	%	No.	%			No.	%	No.	%	No.	%		
Age (in years)																
18 - <23	2	15.4	4	7.8	9	42.9	**14.690**	**0.005***	7	15.6	7	21.9	1	12.5	**1.370**	**0.849**
23 - <29	8	61.5	32	62.7	11	52.3			27	60.0	18	56.2	6	75.0		
29 - ≥ 35	3	23.1	15	29.5	1	4.8			11	24.4	7	21.9	1	12.5		
Residence																
Rural	10	76.9	33	64.7	15	71.4	**0.845**	**0.656**	29	64.4	22	68.8	7	87.5	**1.670**	**0.433**
Urban	3	23.1	18	35.3	6	28.6			16	35.6	10	31.2	1	12.5		
Marital status																
Married	12	92.3	50	98.0	21	100.0	**6.250**	**0.181**	44	97.8	31	96.9	8	100.0	**2.550**	**0.635**
Divorced	0	0.0	1	2.0	0	0.0			1	2.2	0	0.0	0	0.0		
Widowed	1	7.7	0	0.0	0	0.0			0	0.0	1	3.1	0	0.0		
Level of education																
Illiterate	0	0.0	4	7.8	2	9.5	**2.820**	**0.830**	3	6.7	2	6.3	1	12.5	**4.610**	**0.594**
Primary education	3	23.1	6	11.8	3	14.3			6	13.3	6	18.7	0	0.0		
Secondary education	7	53.8	23	45.1	10	47.6			20	44.4	14	43.8	6	75.0		
High education	3	23.1	18	35.3	6	28.6			16	35.6	10	31.2	1	12.5		
Occupation																
Housewife	8	61.5	24	47.1	13	61.9	**1.770**	**0.412**	23	51.1	17	53.1	5	62.5	**0.354**	**0.838**
Work	5	38.5	27	52.9	8	38.1			22	48.9	15	46.9	3	37.5		

No statistical significant p>0.05. * A Statistical significant p ≤ 0.05.

Table (9): Relation between selected items of obstetrical history of women in the study group and their total visual facial anxiety score before and during application of virtual reality phases n=85.

Selected items of obstetrical history	Total visual facial anxiety score															
	Before application of virtual reality "at entering the operating room"								During application of virtual reality "at the end of skin suture"							
	Mild n=14		Moderate n=52		Severe n=19		X^2	P-value	Mild n=46		Moderate n=30		Severe n=9		X^2	P-value
	No.	%	No.	%	No.	%			No.	%	No.	%	No.	%		
Gravidity																
Primigravida	2	14.3	20	38.5	13	68.4	**10.160**	**0.006***	20	43.5	12	40.0	3	33.3	**0.346**	**0.841**
Multigravida	12	85.7	32	61.5	6	31.6			26	56.5	18	60.0	6	66.7		
Parity																
Primipara	2	14.3	21	40.4	13	68.4	**9.880**	**0.007***	21	45.7	12	40.0	3	33.3	**0.573**	**0.751**
Multipara	12	85.7	31	59.6	6	31.6			25	54.3	18	60.0	6	66.7		
Compliance with antenatal care follow up																
Yes	6	42.9	27	51.9	15	78.9	**5.390**	**0.067**	25	54.3	17	56.7	6	66.7	**0.465**	**0.792**
No	8	57.1	25	48.1	4	21.1			21	45.7	13	43.3	3	33.3		

No statistical significant p>0.05. * A Statistical significant p ≤ 0.05.

Table (10): Relation between selected items of obstetrical history of women in the study group and their total emotional preoperative stress score before and during application of virtual reality phases n=85.

Selected items of obstetrical history	Total emotional preoperative stress score															
	Before application of virtual reality "at entering the operating room"								During application of virtual reality "at the end of skin suture"							
	Mild n=13		Moderate n=51		Severe n=21		X^2	P-value	Mild n=45		Moderate n=32		Severe n=8		X^2	P-value
	No.	%	No.	%	No.	%			No.	%	No.	%	No.	%		
Gravidity																
Primigravida	5	38.5	16	31.4	14	66.7	**7.690**	**0.021***	19	42.2	13	40.6	3	37.5	**0.069**	**0.966**
Multigravida	8	61.5	35	68.6	7	33.3			26	57.8	19	59.4	5	62.5		
Parity																
Primipara	5	38.5	17	33.3	14	66.7	**6.860**	**0.032***	20	44.4	13	40.6	3	37.5	**0.197**	**0.906**
Multipara	8	61.5	34	66.7	7	33.3			25	55.6	19	59.4	5	62.5		
Compliance with antenatal care follow up																
Yes	9	69.2	26	51.0	13	61.9	**1.730**	**0.491**	24	53.3	18	56.2	6	75.0	**1.290**	**0.523**
No	4	30.8	25	49.0	8	38.1			21	46.7	14	43.8	2	25.0		

No statistical significant p>0.05. * A Statistical significant p ≤ 0.05.

Discussion:

Virtual reality is a developed, advanced, distractive and non-pharmacological technology which is applied in operative field to reduce operative anxiety and stress for women scheduled for elective surgical procedures **(Chiu, et al., 2023)**. So that, the present research aim was to evaluate the effect of immersive virtual reality as a distraction method on anxiety, stress and hemodynamic parameters of women undergoing cesarean section.

According to general characteristics of participant pregnant women, the current research study demonstrated that less than two-thirds of the study group and more than half of the control group in age group from 24 - ≤ 29 years old with mean age 27.73±4.25 years old of the study group and 26.86±4.62 years old of the control group respectively. Moreover, more than two-thirds of the study group meanwhile, less than three-quarters of the control group respectively lived in rural area.

Concerning level of education, it was cleared that less than half of the study and control groups respectively had secondary education. As regards occupational status, more than half of the study group and less than two-thirds of the control group respectively were housewives. Generally, there was no statistically significant difference between the study and control groups regarding general characteristics. That is reflected groups homogeneity.

According to the researchers' perspectives, homogeneity was useful in the present study for generalization of the current study results and avoiding the effect of confounding variables.

The results of the present study agreed with **Xu, et al., (2024)** who studied "Virtual reality treatment could reduce anxiety for women undergoing cesarean section with spinal anesthesia: a randomized controlled trial" demonstrated that the mean age was 34±4 years old of virtual reality group and 34±5 years old of the control group, respectively. Also there was homogeneity between two groups. Increasingly, the results of the current study were similar to **Almedhesh, et al., (2022)** who examined "The effect of virtual reality on anxiety, stress and hemodynamic parameters during cesarean section: a randomized controlled clinical trial" illustrated that analysis of the basic data showed the mean age was 31.20 years in the virtual reality group compared to 32.28 years in the control group. Also there was homogeneity between two groups.

As regard obstetrical history, more than half of the study group and more than two-thirds of the control group respectively were multigravida. Increasingly, more than half of the study group and less than two-thirds of the control group respectively were multipara. Moreover, more than two-fifths of the study and control groups respectively had gestational age from 39-40 weeks with a mean gestational age of 39.07±1.51 weeks of the study group and 39.25±1.44 weeks of control group respectively.

In relation to mode of last delivery, less than two-thirds of the study and control groups respectively performed cesarean section for the last delivery. More than half of the study group and less than two-thirds of the control group respectively were compliant with antenatal care follow up. As well as, the mean duration of current cesarean section of both the study and control groups were 42.87±6.07 minutes of the study group and 44.60±6.22 minutes of the control group respectively. Generally, there was no statistically significant difference between the study and control groups regarding obstetric

history. That is the two groups under study homogenous.

According to the researcher point of view, this homogeneity was due to specific standards in form of inclusion and exclusion criteria that the researcher was adhering to. Homogeneity was useful in the present study for generalization of the current study results and avoiding the effect of confounding variables

The findings of the present were congruent with **Almedhesh, et al., (2022)** who revealed that the mean gravidity, parity and gestational age were 4.25±2.36, 3.63±2.49 and 38.53±1.12 of virtual reality group compared to 4.68±2.20, 3.86±2.02 and 38.43±1.01 of the control group. Also, clinical data showed homogeneity of two groups.

In addition, the results of the current study were consistent with **Elsharkawy, et al., (2022)** who researched "Efficacy of virtual reality application as a distraction for primiparity women at 1st stage of labor on pain and anxiety control" showed that mean gestational age were 39.56±1.35 weeks of virtual reality group and 39.40±1.44 weeks of the control group respectively. Also, there was homogeneity between two groups.

Regarding maternal hemodynamic parameters, there was no statistically significant difference in the mean scores at any time point between both the study and control groups regarding temperature, respiratory rate and peripheral oxygen saturation. While application of virtual reality during cesarean section led to obvious improvements in the mean scores of systolic blood pressure, diastolic blood pressure and pulse rate with statistically significant differences among the study group compared to the control group.

From the researchers' point of view, the results of the current study might be due to the positive and relaxing effects of virtual reality on monitoring women's physiological responses such as heart rate and blood pressure through adapting the virtual environment in real time to help manage both anxiety and stress. As, if women's anxiety and stress levels rise, the virtual reality could change to a more calming scene or provide soothing visual and auditory elements.

The results of the current study were supported by **Ibrahim, et al., (2025)** who studied "Effect of virtual reality on anxiety, satisfaction level and hemodynamic parameters among women during cesarean section" clarified that a highly statistically significant difference was observed in maternal hemodynamic parameters as blood pressure and pulse between the study and control groups during various stages of the cesarean section. Although no significant differences were found at admission to the operating room immediately. In addition, the findings of present study agreed with **Xu, et al., (2024)** who commented that there were no significant differences between the two groups in respiratory rate.

The above mentioned results reinforce and confirm the benefits of virtual reality in improving hemodynamic parameters, as it has a great effect in distracting the woman which leads to stability of vital signs. These results of current study supported the present research hypothesis (2) that was: Women who would apply virtual reality during cesarean section would experience more stable hemodynamic parameters than those who won't apply it.

Oppositely, the results of the present study were in disagreement with **Goodier, (2020)** who examined "Virtual reality may help

relieve pain during childbirth" revealed that there was no statistically significant difference between the groups in blood pressure after application of virtual reality.

From the researchers' perspective, the reason for the discrepancy in hemodynamic parameters between these results and the result of the current study might be due to different study samples, where the current study was applied to women undergoing cesarean section, while the other two studies were applied to vaginal delivery women.

Pertaining maternal anxiety, the distractive effect of virtual reality caused a marked decrease in total mean scores of visual facial anxiety among the study group at entering the operating room and before anesthesia, at the end of skin suture and at 2 hours postoperative respectively with statistically significant differences found at the end of skin suture and at 2 hours postoperative. In contrast, the control group revealed an obvious increase in total mean scores of visual facial anxiety higher than the study group at the same time points respectively.

The results of the current study were supported by reticular activation theory that proposed that audio and visual distraction could overcome anxiety through receiving sufficient and excessive sensory input, thereby causing anxiety impulses to be blocked to the brain so that anxiety is reduced or not felt. As well as, pleasant sensory stimulus inputs would stimulate pituitary gland to secrete endorphins which is (feel good chemicals) **(Purnomo, et al., 2024)**.

The findings of present study were symphonic with both **Xu, et al., (2024)** and **Almedhesh, et al., (2022)**, both showed that virtual reality significantly reduced anxiety among women undergoing cesarean section.

As well as, the results of current study in the same line with **Mahalan and Smitha, (2023)** who tested "Effect of audio-visual therapy on pain and anxiety in labor: a randomized controlled trial" mentioned that the virtual reality application reduced anxiety among women compared to standard care.

In contrast, the results of the current study incongruent with **Noben, et al., (2019)** who researched "A virtual reality video to improve information provision and reduce anxiety before cesarean delivery: randomized controlled trial" commented that virtual reality didn't not lead to a decrease in preoperative anxiety. These variations might be due to lower level of study group education, but in current studied women were relatively highly educated.

Concerning maternal stress, the calming effect of virtual reality led to an observed lessening in total mean scores of all items of the emotional preoperative stress among the study group at entering the operating room and before anesthesia, at the end of skin suture and at 2 hours postoperative respectively with highly statistically significant differences observed at the end of skin suture and at 2 hours postoperative. Oppositely, the control group showed an observed increase in the total mean scores higher than the study group at the same time points respectively.

According to the researchers' opinion, virtual reality can guide relaxation and reduce stress, through mindfulness meditation to help calm nerves. These relaxation practices can lower cortisol levels, subsequently reduce overall stress and improve overall health outcomes. Stress reduction during cesarean section can lead to more stable hemodynamic parameters such as blood pressure and heart rate.

The findings of the present study were in the same line with **Mashak, et al., (2023)** who studied "Effect of virtual reality camera on stress, anxiety, maternal and neonatal outcomes during cesarean section under

spinal anesthesia, the protocol of a randomized clinical trial study" demonstrated that virtual reality technology can reduce stress and anxiety levels during cesarean section. Moreover, the results of the present study were consistent with a systematic review of (23) studies by **Ioannou, et al., (2020)** who researched "A virtual reality and symptoms management of anxiety, depression, fatigue, and pain: a systematic review" found that virtual reality effectively decreases symptoms of anxiety and stress in various contexts and diseases.

These results of current study supported the present research hypothesis (1) that was: Women who would apply virtual reality during cesarean section would experience less anxiety and stress than those who wouldn't apply it.

Regarding maternal satisfaction with cesarean section, there was a marked improvement in total mean score of satisfaction dimensions among the study group at 2 hours post intervention that was higher than the control group with highly statistically significant difference found in the study compared to control groups after application of virtual reality.

According to the researchers' perspective, this might be due to the marked and positive effect of virtual reality, as well as, the women's desire to try a novel, non-pharmacologic, non-invasive, nature and less side effects technology. So that, virtual reality can be added to routine perioperative care due to its emotional healing and calming effects.

The results of the current study were in the same line with **Özer, et al., (2024)** who examined "Effects of virtual reality interventions on the parameters of normal labor: a systematic review and meta-analysis of randomized controlled trials" commented that virtual reality applications are effective methods and increase satisfaction with provided care. Moreover, the findings of the present study agreed with **Almedhesh, et al., (2022)** who revealed that virtual reality significantly improved women's satisfaction who undergoing cesarean section under regional anesthesia.

Concerning, relation between both total visual facial anxiety, emotional preoperative stress scores and sociodemographic characteristics, the present research study clarifies that there was a statistically significant relation between both total visual facial anxiety and emotional preoperative stress scores with only the age of the women in the study group "at entering the operating room and before anesthesia before application of virtual reality. While, there was no statistically significant relation between both total visual facial anxiety and total emotional preoperative stress scores with general characteristics of the women in the study group at the end of skin suture "during application of virtual reality. This might be due to young age pregnant women haven't yet reached emotional and cognitive maturity status. These women are unable to make future decisions and fear of making a wrong decision leading to high-risk from different mental disease as anxiety, stress and psychological agitation.

The results of the present study were harmony with **SeiedKaboli and Hashemi, (2021)** who studied "Relationship between demographic characteristics, stress and anxiety before and after cesarean section in pregnant women" showed that there is a negative and significant relationship between mother's age and anxiety and stress before and after cesarean section. As well as, the results of the present study were consistence

with **Wang, et al., (2022)** who researched "Non-pharmacologic approaches in preoperative anxiety, a comprehensive review" mentioned that age is a protective factor of preoperative anxiety, as each (1) year increase in age reduces five percent of the chance of preoperative anxiety that subsequently reducing stress.

Oppositely, the results of the present study were incongruent with **Lei, et al., (2025)** who researched "Relationship between anxiety symptoms and age-related differences in tic severity" revealed that there was positive correlation between severity of anxiety associated symptoms which increased linearly with age. These variations might be due the study sample was from adolescents who are often fear of social reactions, stigma, bullying from society, social isolation and failure to adequately control anxiety symptoms. These might exacerbate anxiety and lead to more severe symptoms.

Pertaining, relation between both total visual facial anxiety and emotional preoperative stress scores and obstetrical history, there was a statistically significant relation between both total visual facial anxiety and emotional preoperative stress scores and (gravidity and parity) of the women in the study group "at entering the operating room and before anesthesia before application of virtual reality. While, there was no statistically significant relation between total visual facial anxiety score and selected items of obstetrical history of the women in the study group "at the end of skin suture during application of virtual reality. This might be due to fewer experiences of both primigravida and primipara with cesarean section's indications, care knowledge, complications during operation or anesthesia and no familiarity with the settings of cesarean section.

The results of the current study were harmony with **Schaal, et al., (2020)** who studied "Comparing the course of anxiety in women receiving their first or repeated cesarean section: a prospective cohort study" reported that women undergoing an elective repeated cesarean section (multipara) had less anxiety levels than women undergoing their first cesarean section (primipara). Increasingly, the finding of the current study were symphonic with **Grisbrook, et al., (2022)** who tested "Associations among cesarean section birth, post-traumatic stress, and postpartum depression symptoms" commented that primiparity to be a risk factor for developing postpartum psychological stress and post-partum depression.

Vice versa, the results of the present study were in congruent with **Asali, et al., (2023)** who researched "Correlates of higher anxiety scores reported by women admitted for elective cesarean section" mentioned that history of a previous cesarean section (multipara) was associated with higher anxiety scores without statistical significance. These variations might be due to the presence of maternal and fetal indications of cesarean sections that leads to high levels of maternal anxiety and stress.

Conclusion:

Based on the results of the current study, it could be concluded that immersive virtual reality application as a distraction method was an effective method in reduction of anxiety and stress of women undergoing cesarean section in addition to a positive effect on hemodynamic parameters.

Recommendations:

- Encouraging hospitals administration for preparing virtual reality as a supportive measure for women during cesarean section to lessen anxiety and stress and maintain stabilize hemodynamic parameters.

- Considering virtual reality as a part of routine hospital care in Obstetrics and Gynecology Departments.
- Enhancing woman awareness about virtual reality and it's benefits during antenatal visits through developing antenatal mothers' classes or distribution of leaflets.
- Virtual reality designers should take into account the weight of virtual reality devices headsets for effective implementations and boosting users' satisfaction.

Further studies need to be performed:

- On larger sample sizes to ensure the effect of virtual reality.
- Confirming the anxiolytic and sedative effects of virtual reality on both elective and selective cesarean sections.

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تأثير الواقع الإفتراضي الغامركوسيلة إلهاء على القلق والتوتر ومعايير الدورة الدموية للسيدات اللاتي يخضعن للولادة القيصرية

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تعد الولادة القيصرية عملية جراحية شائعة لإخراج جنين سليم من خلال فتح البطن والرحم. ولكن تعاني العديد من السيدات من مستويات عالية من القلق والتوتر أثناء العملية، مما يؤثر سلبًا على الحالة الفسيولوجية والنفسية للأم والجنين. **الهدف من الدراسة:** تقييم تأثير الواقع الإفتراضي الغامر كوسيلة إلهاء على القلق و التوتر ومعايير الدورة الدموية للسيدات اللاتي يخضعن للولادة القيصرية. **تصميم الدراسة:** تم إستخدام تصميم بحثي شبه تجريبي (مجموعتان، مجموعة الدراسة والمجموعة الضابطة. **مكان الدراسة:** وأجريت الدراسة في قسم أمراض النساء و التوليد بمستشفى جامعة بنها. **عينة الدراسة**:عينة غرضية مكونة من (١٧٠) سيدة حامل خضعت للولادة القيصرية وقسمن بالتساوي إلى مجموعتي الدراسة والضابطة. **أدوات جمع البيانات**: تم إستخدام خمس أدوات لجمع البيانات:١) إستمارة الإستبيان و المقابلة الشخصية،٢) إستمارة تقييم معايير الدورة الدموية للأم، ٣) مقياس القلق الوجهي البصري المبتكر،٤) المقياس الموجز للتوتر العاطفي قبل الجراحة و ٥) إستبيان رضا الأمهات بعد الولادة القيصرية. **النتائج:** كشفت النتائج أنه كانت هناك فروق ذات دلالة إحصائية في متوسط درجات القلق الوجهي البصري و معدل النبض وضغط الدم أثناء وبعد تطبيق الواقع الإفتراضي في مجموعة الدراسة مقارنةً بالمجموعة الضابطة. إلى جانب ذلك، كانت هناك فروق ذات دلالة إحصائية عالية في متوسط درجات عناصر التوتر العاطفي أثناء وبعد الجراحة وكذلك جميع أبعاد الرضا بعد تطبيق الواقع الإفتراضي في مجموعة الدراسة مقارنةً بالمجموعة الضابطة. **الاستنتاج**: تطبيق الواقع الإفتراضي الغامر كوسيلة إلهاء له تأثير إيجابي على تقليل القلق والتوتر للسيدات الخاضعات للولادة القيصرية، بالإضافة إلى تأثيره الإيجابي على معايير الدورة الدموية. **التوصيات**: تشجيع إدارة المستشفيات على إعداد الواقع الإفتراضي كإجراء داعم للسيدات أثناء الولادة القيصرية لتقليل القلق والتوتر والحفاظ على إستقرار معايير الدورة الدموية.