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THE EFFECT OF TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION AND CHEWING MINT GUM ON LABOR PAIN INTENSITY AND ANXIETY LEVEL: A COMPARATIVE STUDY

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Abstract

Background: Non-pharmacological pain management strategies play an important role in reducing labor pain and anxiety during active phase of the first stage of labor. **Aim:** To compare the effect of transcutaneous electrical nerve stimulation (TENS) and chewing mint gum on labor pain intensity and anxiety level. **Design**: A quasi-experimental design was utilized. **Setting:** The study was conducted in the labor unit at Badr Hospital Capital University, Cairo, Egypt. **Sample:** A purposive sample of 90 pregnant women was recruited. **Tools:** Data were collected using four tools: (I) a structured interview questionnaire, (II) standardized labor pain assessment, (III) Hamilton Anxiety Rating Scale; and (IV) Pregnant Women`s Satisfaction Level. **Results:** Most pregnant women's reported severe pain before the intervention. After the interventions, TENS significantly reduced pain and anxiety compared to chewing mint gum. In the TENS group, 16.7% reported mild pain and 80% moderate pain, while 63.3% of the chewing mint gum group continued to experience severe pain. Anxiety improvement was 51.1% in the TENS group versus 20.4% in the chewing mint gum group. Pregnant women satisfaction was higher with TENS, with 80% reporting complete satisfaction compared to 36.7% in the chewing mint gum group. **Conclusion:** TENS was more effective than chewing mint gum in reducing labor pain and anxiety and improving pregnant women satisfaction, highlighting the value of non-pharmacological interventions during the active phase of labor. **Recommendation:** Implemented educational programs for pregnant women to promote non-pharmacological pain management methods during labor.

Keywords: Anxiety Level, Chewing Mint Gum, Labor Pain, Pregnant Women, Transcutaneous Electrical Nerve Stimulation.

I. INTRODUCTION

Non-pharmacological methods provide safe, low-risk approaches to reduce labor pain and anxiety. Methods such as transcutaneous electrical nerve stimulation (TENS), chewing mint gum, effleurage, thermal stimulation, sacral pressure, positioning, distraction techniques, aromatherapy, guided imagery, music, massage, and controlled breathing actively engage pregnant women in coping with contractions. The interventions

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offer alternatives to pharmacological analgesia and enhance pregnant women comfort **(Matabane .,2025)**.

Transcutaneous electrical nerve stimulation (TENS) reduces labor pain through electrical stimulation based on the gate control theory. Sensory signals transmitted via afferent fibers to the dorsal horn of the spinal cord inhibit pain transmission to the brain. Clinical studies demonstrate the TENS effectively decreases pain intensity during labor with minimal adverse effects (**Kaminsa.,2025)**.

Chewing mint gum serves as a non-pharmacological intervention by providing sensory stimulation and distraction, thereby reducing stress and anxiety. Evidence indicates chewing mint gum alleviates acute and chronic stress, enhances alertness, and improves comfort during labor. The method is safe, non-invasive, easy to implement, and highly acceptable among pregnant women. **(Abbasi etal.,2026)**.

Nursing care plays a critical role in the assessment and management of pain and anxiety during labor. Comprehensive evaluation of pain intensity, provision of information regarding pain relief measures, and continuous monitoring of pregnant women responses are essential components of effective care.

Timely modification of nursing care plans based on pregnant women condition enhances comfort and reduces distress. Evidence indicates competent nursing interventions significantly improve pregnant women satisfaction and support safe and positive labor experiences (**Mohsenzadeh etal.,2025)**.

II. SIGNIFICANCE OF THE STUDY

Labor pain and anxiety are common experiences among pregnant women worldwide and represent major challenges in maternity care. Globally, approximately 16–20% of pregnant women experience severe fear and anxiety related to labor, which is strongly associated with increased perception of labor pain and adverse birth outcomes.

In African countries, the prevalence of labor-related anxiety is markedly higher, ranging from 20% to 61%, reflecting limited access to effective pain relief methods, inadequate antenatal education, and increased psychosocial stressors (**Vaid etal .,2025).**

In Egypt, although comprehensive national statistics remain limited, available evidence indicates the a large proportion of pregnant women experience moderate to severe labor pain accompanied by high anxiety levels, particularly during the active phase of the first stage of labor. Conditions may result in prolonged labor, increased obstetric interventions, reduced pregnant women dissatisfaction, and negative labor experiences **(Zeleke etal.,2025)**.

The aim of the current study was to:

The aim of the current study was to compare the effect of transcutaneous electrical nerve stimulation (TENS) and chewing mint gum on labor pain intensity and anxiety levels among pregnant women during the first active phase of labor.

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The present study aim will be achieved through the following objectives:

1) Assess labor pain intensity and anxiety level for pregnant women study group (A,B,C) before and after intervention transcutaneous electrical nerve stimulation and chewing mint gum during the first active phase of labor.
2) Apply transcutaneous electrical nerve stimulation during the first active phase of labor for pregnant women group (A) .
3) Apply chewing mint gum during the first active phase of labor for pregnant women group (B).
4) Evaluate the effect of transcutaneous electrical nerve stimulation on labor pain and anxiety for pregnant women during the first active phase of labor (A).
5) Evaluate the effect of chewing mint gum on labor pain and anxiety for pregnant women during the first active phase of labor in group (B).
6) Compare the effect of transcutaneous electrical nerve stimulation (A) and chewing mint gum (B) labor pain intensity and anxiety level.

Research Hypotheses:

The current study is proposed to answer the following research hypotheses:

- There is a significant difference between transcutaneous electrical nerve stimulation and chewing mint gum in controlling labor pain intensity and anxiety levels during the first active phase of labor.

Research design:

A quasi-experimental design (pre-posttest for pregnant women during first stage of labor) was utilized to fulfill the aim of the study.

Setting:

Labor unit in obstetrics and gynecology department affiliated with Capital University Hospital (Badr Hospital).

Subject:

➢ **Type of sample:**

- A purposive sample was used in the current study.

➢ **Sample size:**

90 pregnant women who are attending the study setting for a period of six months from beginning of April 2025 and end in September 2025 selected according to inclusion criteria pregnant women.

Inclusions criteria:

- Pregnant women in the first stage of labor (active phase).
- Gestation with a single fetus in the cephalic position.

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Exclusion Criteria:

- Pregnant women who had high-risk pregnancies such as abortion, ectopic pregnancy.

Tools for data collection:

Four data collection tools:

Tool (I): A structured interviewing questionnaire: was designed by the researcher and consisted of the following four parts**:**

- **Part one: Demographic Data** including (age of pregnant women, education level, marital status, occupation, residence, and husband's education).

Tool (II): Assessment of Labor Pain through the following method:

The Numerical Rating Scale (NRS); means Verbal Rating Scale (VRS): (for studied groups). Adopted from **(Kamal Abd Elkhalek etal., 2022)** was used to measure pregnant women pain severity consisted of a line divided by numbered points ranged from (0-10).

Scoring system:

Pregnant women`s answers were sorted as follows:

- No pain (zero)
- Mild pain (1-3)
- Moderate pain (4-6)
- Severe pain(7-10)

Alpha Cronbach test = 0.86 used to test its reliability.

Tool III: Assessment of Anerxity during Active First Stage of Normal Labor Through Hamilton Anxiety Rating Scale (HAM-A):

Adopted from (**Norhapifah etal.,2024)** was used to assess pregnant women`s. The Hamilton anxiety rating scale anxiety inventory is a standard questionnaire consists of 14 items of explicit anxiety section. In the range of 5 Likert options, scores range from 0 to 4 (0= Not present, 1=Mild, 2=Moderate, 3=Severe, 4= Very severe) and on a general scale, 0 to 56 are measured. Each of the test terms is assigned a score of 0 to 4 based on the answer. Scoring is inverted for expressions that indicate anxiety. Depending on the item, the response scores were used assigned to (0-1-2-3-4). Phrases indicate the absence of anxiety is reversed when scoring. The reliability of the questionnaire was calculated by Cronbach anxiety's alpha method of 0.889**.**

Scoring System:

This scale formed of 5 variables. Each item is scored on a scale of 0 (not present) to 4 (severe):

- 0 = Not present.
- 1 = Mild.

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- 2 = Moderate.
- 3 = Severe.
- 4 = Very severe.

Scoring System: With a total score range of 0 –56 indicate:

- Less than 17 indicate mild severity.
- From 18 to 24 moderate severity.
- From 25 to 30 severe.
- More than 30 very sever.

Tool IV: Pregnant Women` s Satisfaction Level (Likert –Scale Rating):

Adapted from and modify by researcher **(Kamal Helmy etal.,2022)** it was used to assess pregnant women`s satisfaction level regarding this scale formed of 5 variables:

Scoring system:

Likert scale consists of 7 statements and will base on a five points:

- 1 = completely satisfied.
- 2 = Satisfied.
- 3 = Fair.
- 4 = Dissatisfied.
- 5 = completely dissatisfied.

Pilot study:

A pilot study was conducted on 10% of the total study sample (9 pregnant women) to assess the availability of participants and the clarity and applicability of the data collection tools, the pilot participants were excluded from the total study sample.

Administrative item:

Written approval letter was obtained from the dean faculty of Nursing Capital University to antenatal clinic at Badr Hospital, Capital University Hospital in Egypt for conducting study; the approval letter was including the aim of the study.

Field work:

Preparation and Planning Phase: The study was conducted over a six-month period, commencing in April 2025 and concluding by the end of September 2025. To facilitate data collection, the researcher was present in the labor unit's waiting area at the hospital every Saturday and Monday, from 9:00 AM to 3:00 PM. The sample was distributed across these six months, employing different methods aimed at reducing pain and anxiety levels during natural labor.

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The intervention strategy involved three distinct phases over the six-month period:

- **Months 1-2 (Control Group):** During the first two months, pregnant women received no specific intervention, adhering to the hospital's standard protocol.
- **Months 3-4 (Mint Gum Group):** The subsequent two months involved a group of pregnant women who applied chewing mint gum.
- **Months 5-6 (TENS Group):** For the final two months, a group of pregnant women received transcutaneous electrical nerve stimulation (TENS).

Before participation, the researcher explained the study's aim to gain the confidence and trust of the pregnant women and obtained their verbal consent. The structured interviewing questionnaire was administered individually, taking approximately 30 minutes per pregnant women. The session served to clarify the study's objectives, explain the questionnaire's content, and build rapport. Initial assessment of general characteristics was performed using the first tool (structured interviewing questionnaire) while pregnant women were in the labor unit's waiting area. Following consent, each selected pregnant woman was interviewed individually to collect necessary data and assess labor pain intensity and anxiety levels in study groups (A, B, C). Assessment was conducted both before and immediately after the intervention (TENS or chewing mint gum) during the first active phase of labor. Upon completion of the questionnaire, the researcher provided detailed health education to each pregnant woman, covering the definition, types, new trends, indications, and side effects of non-pharmacological methods for pain and anxiety relief during the first active stage of normal labor, specifically focusing on TENS and chewing mint gum.

Implementation Phase:

- For pregnant women in group (A), the researcher applied transcutaneous electrical nerve stimulation during the first active phase of labor.
- For pregnant women in group (B), the researcher applied chewing mint gum during the first active phase of labor.

Evaluation Phase: The evaluation phase aimed to determine the effect of transcutaneous electrical nerve stimulation on labor pain and anxiety for pregnant women in group (A) during the first active phase of labor. Similarly, evaluated the effect of chewing mint gum on labor pain and anxiety for pregnant women in group (B) during the first active phase of labor, this evaluation was successfully and satisfactorily achieved by comparing pre- and immediately post-intervention with 30 minutes results using the previously mentioned data collection tools.

Statistical Analysis

All data were collected, tabulated and statistically analyzed using IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp. Quantitative data were expressed as the mean ± SD &median (range), and qualitative data were expressed as number & (percentage).

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Check data for normal distribution using Shapiro wilk test. Anova f test was used to compare between more than two groups of normally distributed variables. Students' test was used to compare between two groups of normally distributed variables.

Mann Whitney u test was used to compare between two groups of normally distributed variables. Percent of categorical variables were compared using, Chi square test or Fisher Exact test or F-ANOVA test, Cochran's Q test When appropriate. Paired t test was used to compare between paired normally distributed variables.

Pearson' correlation coefficient or spearman correlation ranked was calculated to assess relationship between various study variables, (+) sign indicate direct correlation & (-) sign indicate inverse correlation, also values near to 1 indicate strong correlation & values near 0 indicate weak correlation. All tests were two sided. p-value < 0.05 was considered statistically significant, p-value ≥ 0.05 was considered statistically insignificant.

% of improvement = (after value – before value) / before value)

Ethical consideration:

Official permission to conduct the study at the Faculty of Nursing, Capital University, was obtained from the Scientific Research Ethics Committee (Approval NO.40, dated 18-3-2024). Participation in the study was voluntary, and the participants were provided with complete information about the study and their role before signing the informed consent form.

Ethical considerations included explaining the purpose and nature of the study, informing participants of their right to withdraw at any time without penalty, and ensuring the confidentiality of the collected data, which were not accessed by any other party without the participants' permission. Ethical principles, values, cultural norms, and beliefs were respected throughout the study.

III. RESULTS

Part (I): Demographic data of the studied Groups

Table (1): Distribution of the studied Groups according to their demographic data (n = 90)

Variables	Tens Group (N=30)		Chewing mint gum Group (N=30)		Control Group (N=30)		Cochran's Q test	
	No.	%	No.	%	No.	%	Q value	p-value
Age (years)								
<25 years	4	13.3	7	23.3	4	13.3	2.708	0.951
25-30 years	8	26.7	6	20.0	7	23.3		
>30-35 years	7	23.3	5	16.7	6	20.0		
>35-40 years	9	30.0	8	26.7	10	33.4		
>40 years	2	6.7	4	13.3	3	10.0		
Age per years								
Mean± SD	29.2±6.1		30.03±6.81		32.43±9.09		*F*:1.523	0.224

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Range	19-42		21-47		20-47			
Education								
Not read or write	2	6.7	2	6.7	4	13.3	8.193	0.224
Read and write	8	26.7	5	16.7	12	40.0		
Secondary education	17	56.6	19	63.3	9	30.0		
University education	3	10.0	4	13.3	5	16.7		
Marital status								
Married	30	100	30	100	30	100	0.000	1.000
Occupation								
Working	5	16.7	3	10.0	6	20.0	1.184	0.553
Housewives	25	83.3	27	90.0	24	80.0		
Residence								
Urban	9	30.0	8	26.7	9	30.0	0.108	0.947
Rural	21	70.0	22	73.3	21	70.0		
Education husband								
Not read or write	2	6.7	3	10.0	3	10.0	4.525	0.606
Read and write	9	30.0	5	16.7	12	40.0		
Secondary education	17	56.6	19	63.3	13	43.3		
University education	2	6.7	3	10.0	2	6.7		
Occupation husband								
Employee	19	63.3	14	46.7	10	33.3	5.433	0.066
Private work	11	36.7	16	53.3	20	66.7		

Using: F-ANOVA test, Cochran's Q test

*p-value >0.05 is insignificant; *p-value <0.05 is significant; **p-value <0.001 is highly significant*

Table (1):

The analysis of demographic characteristics revealed notable variations in specific parameters across the pregnant women. In terms of age, the highest proportion was observed in the TENS group among women aged >35–40 years (30.0%), whereas the lowest was in the >40 years category (6.7%). For the Chewing Mint Gum group, the highest proportion was in the <25 years category (23.3%) and the lowest in the 30–35 years category (16.7%).

Mean ages ranged from 29.2 ± 6.1 years in the TENS group to 32.43 ± 9.09 years in the control group, with no statistically significant differences (F=1.523, p=0.224). Regarding educational level, secondary education was predominant, with the highest representation in the Chewing Mint Gum group (63.3%) and the lowest proportion of illiterate women in the TENS group (6.7%) compared to 13.3% in the control group (Q=8.193, p=0.224).

All pregnant women were married (100%), and housewives represented the majority in all groups, reaching 90% in the Chewing Mint Gum group. Concerning residence, rural living predominated (~70%) across all groups, with no significant differences (Q=0.108, p=0.947).

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Part (V): Subjective and observation pain level pre intervention and post intervention during labor of the studied groups.

Table (6): Distribution of the studied groups according to their subjective and observation pain level pre intervention during labor (N= 90).

Variables	Tens Group (N=30)		Chewing mint gum Group (N=30)		Control Group (N=30)		Cochran's Q test	
	No.	%	No.	%	No.	%	Q value	p-value
Pre subjective pain								
Moderate	7	23.3	2	6.7	2	6.7	5.178	0.075
Severe	23	76.7	28	93.3	28	93.3		
Mean ±SD	7.5±1.1		8±1.02		8.1±1.04		*F:* 2.681	0.481
Range	6-9		6-10		6-10			
Pre observation pain								
Severe	7	23.3	2	6.7	2	6.7	5.348	0.253
Very Severe	16	53.4	19	63.3	18	60		
Worst Pain	7	23.3	9	30	10	33.3		
Mean ±SD	7.5±1.1		8±1.02		8.1±1.04		*F:* 2.791	0.067
Range	6-9		6-10		6-10			

Using: F-ANOVA test, Cochran's Q test

*p-value >0.05 is insignificant; *p-value <0.05 is significant; **p-value <0.001 is highly significant*

Table (6): Demonstrated that the majority of pregnant women in all study groups experienced severe subjective pain before the intervention, with the highest proportion reported in the chewing mint gum and control groups (93.3%), while the TENS group showed a relatively lower proportion (76.7%).

Moderate pain was less frequently reported, ranging from 6.7% to 23.3%. The mean subjective pain scores ranged from 7.5 ± 1.1 in the TENS group to 8.1 ± 1.04 in the control group, with no statistically significant differences among groups (F = 2.681, p = 0.481).

Regarding observational pain, very severe pain was the most commonly observed category across all groups (53.4–63.3%), followed by worst pain (23.3–33.3%), while severe pain represented the lowest proportion (6.7–23.3%). The mean observational pain scores ranged from 7.5 ± 1.1 in the TENS group to 8.1 ± 1.04 in the control group, with no statistically significant differences detected (F = 2.791, p = 0.067).

These findings indicate comparable baseline pain levels among the studied groups before the intervention, ensuring group homogeneity prior to evaluating the effectiveness of the interventions.

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Table (7): Distribution of the studied groups according to their subjective and observation pain level post intervention during labor (n = 90)

Variables	Tens Group (N=30)		Chewing mint gum Group (N=30)		Chi-square test	
	No.	%	No.	%	χ 2	p-value
Post subjective pain						
Mild	5	16.7	0	0.0	26.029	<0.001**
Moderate	24	80.0	11	36.7		
Severe	1	3.3	19	63.3		
Post observation pain						
Mild	5	16.7	0	0.0	31.117	<0.001**
Moderate	17	56.7	3	10.0		
Severe	7	23.3	8	26.7		
Very severe	1	3.3	15	50.0		
Worst pain	0	0.0	4	13.3		

χ 2: Chi-square test

*p-value >0.05 is insignificant; *p-value <0.05 is significant; **p-value <0.001 is highly significant*

Table (7): The findings demonstrated that a significant reduction in subjective pain levels was observed in the TENS group compared to the Chewing Mint Gum group after the intervention. Mild pain was reported only in the TENS group (16.7%), whereas none of the pregnant women in the Chewing Mint Gum group reported mild pain. Moderate pain was predominant in the TENS group (80.0%), while severe pain was significantly higher in the Chewing Mint Gum group (63.3%) compared to only 3.3% in the TENS group. These differences were statistically highly significant ($\chi^2 = 26.029$, $p < 0.001$).

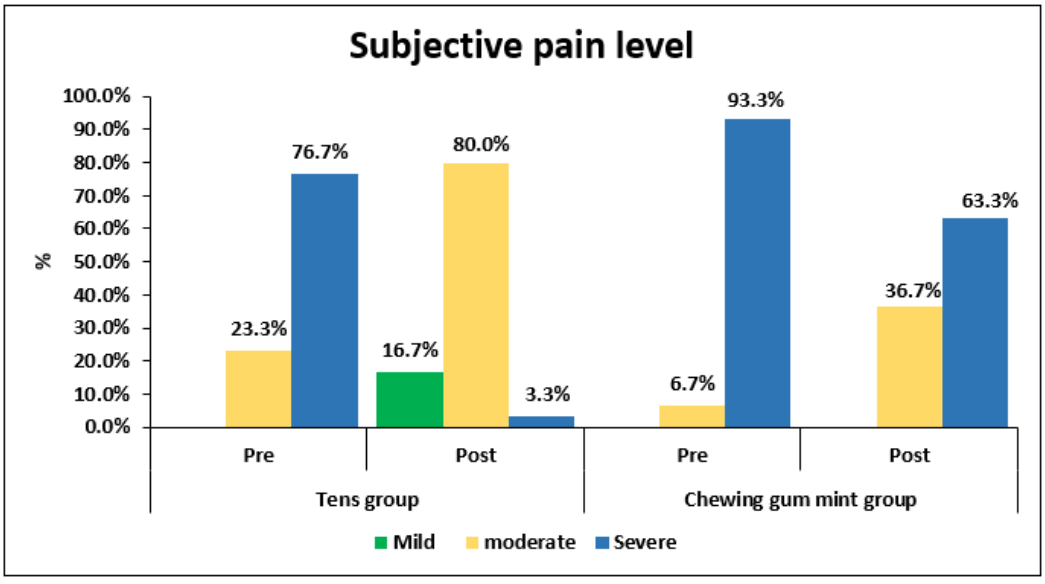

Figure (2)

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Figure (2): Subjective pain level pre and post intervention during labor in both groups:

Figure (2): Demonstrated that before the intervention, the majority of pregnant women in both the TENS and Chewing Mint Gum groups experienced severe subjective pain, with the highest proportion observed in the Chewing Mint Gum group (93.3%) compared to 76.7% in the TENS group.

Moderate pain was less frequent in both groups, and no pregnant women reported mild pain before the intervention. After the intervention, a noticeable improvement in pain levels was observed in the TENS group, where moderate pain predominated (80.0%) and mild pain was reported in 16.7% of pregnant women, while severe pain was markedly reduced to 3.3%.

In contrast, the Chewing Mint Gum group continued to report higher levels of severe pain (63.3%) with only 36.7% reporting moderate pain and none reporting mild pain. Overall, the figure illustrates a substantial reduction in subjective pain severity following TENS intervention compared to chewing mint gum, indicating the superior effectiveness of TENS in alleviating labor pain.

Table (8): Distribution of the studied groups according to their effect of tens and chewing mint gum modalities in reducing vas score during labor (n = 90)

Variables	Tens Group (N=30)	Chewing mint gum Group (N=30)	T- test	
			t	p-value
Pre VAS score				
Mean ±SD	7.5±1.1	8±1.02	1.826	0.073
Median(range)	6-9	6-10		
Post VAS score				
Mean ±SD	4.7+1.1	6.9+1.3	7.076	<0.001**
Median(range)	3-7	4-9		
Paired t	13.8	7.6		
P-value	<0.001**	<0.001**		
Percent of improvement of pain	37.3%	13.8%		

Using: Student' t test, Paired t-test

*p-value >0.05 is insignificant; *p-value <0.05 is significant; **p-value <0.001 is highly significant*

Table (8): Illustrates the effect of TENS and chewing mint gum on reducing VAS scores during labor among the studied groups (n = 90). The highest post-intervention improvement was observed in the TENS group, with a mean VAS score reduction from 7.5 ± 1.1 pre-intervention to 4.7 ± 1.1 post-intervention, reflecting a 37.3% improvement.

The lowest improvement was reported in the chewing mint gum group, with VAS scores decreasing from 8 ± 1.02 pre-intervention to 6.9 ± 1.3 post-intervention, corresponding to a 13.8% improvement. The paired t-test showed that both interventions led to a statistically significant reduction in pain within each group ($p < 0.001$). Comparison

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between groups revealed that TENS was significantly more effective than chewing mint gum in reducing labor pain post-intervention ($t = 7.076$, $p < 0.001$).

Part (VII): Anxiety level pre and post intervention during labor of the studied groups.

Table (9): Distribution of the studied groups according to their anxiety level pre and post intervention during labor (n = 90).

Variables	Tens Group (N=30)		Chewing mint gum Group (N=30)		Control Group (N=30)		Cochran's Q test	
	No.	%	No.	%	No.	%	Q value	p-value
Pre anxiety level								
Moderate anxiety	5	16.7	5	16.7	6	20.0	2.711	0.607
Severe anxiety	6	20.0	6	20.0	2	6.7		
Very severe anxiety	19	63.3	19	63.3	22	73.3		
Mean ±SD	31.3±8.9		34.3±7.6		35±9.03		*F*-1.591	0.210
Range	318-53		20-47		18-52			
Post anxiety level								
Mild anxiety	21	70.0	2	6.7			x^2: 32.896	<0.001**
Moderate anxiety	9	30.0	11	36.7				
Severe anxiety	0	0.0	7	23.3				
Very severe anxiety	0	0.0	10	33.3				

Using: F-ANOVA test; Cochran's Q test; χ 2: Chisquare test

*p-value >0.05 is insignificant; *p-value <0.05 is significant; **p-value <0.001 is highly significant*

Table (9): presents the anxiety levels of the pregnant women before and after the intervention during labor (n = 90). Pre-intervention, the highest proportion of pregnant women with very severe anxiety was observed in the control group (73.3%), while the lowest proportion of severe anxiety was also in the control group (6.7%). Post-intervention, the highest improvement was seen in the TENS group, where 70% of pregnant women reported mild anxiety, whereas the lowest improvement was in the chewing mint gum group, with only 6.7% reporting mild anxiety. Statistical analysis indicated a highly significant reduction in anxiety levels post-intervention in the TENS group compared to the other groups ($\chi^2 = 32.896$, $p < 0.001$).

Figure (3): Anxiety level pre and post intervention during labor in both groups:

Illustrates the distribution of anxiety levels before and after the intervention during labor for the TENS and chewing mint gum groups, the TENS group demonstrated the highest improvement, with 70% of pregnant women reporting mild anxiety post-intervention, compared to only 16.7% pre-intervention. In contrast, the chewing mint gum group showed a smaller improvement, with only 6.7% of pregnant women achieving mild anxiety post-intervention. The figure clearly highlights that TENS was more effective in reducing anxiety levels during labor.

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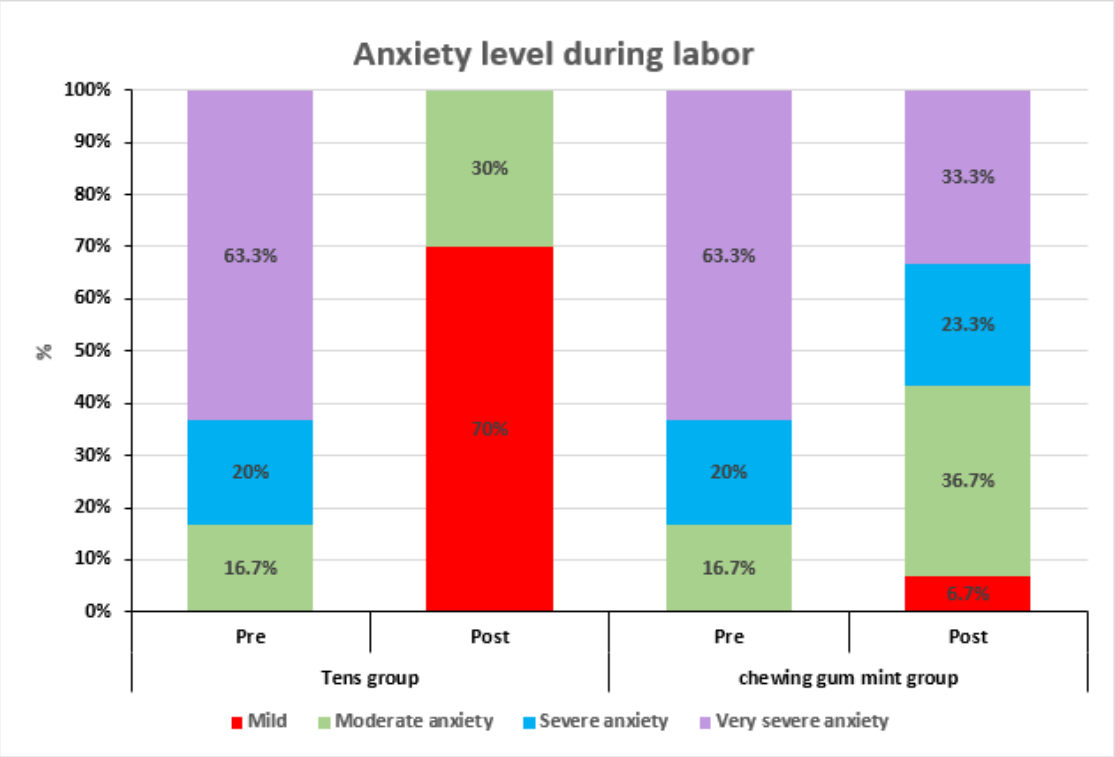

Figure (3)

Part (VII): Effect of tens and chewing mint gum modalities in reducing anxiety score during labor of the studied groups.

Table (10): Distribution of the studied groups according to their Effect of tens and Chewing mint gum modalities in reducing anxiety score during labor (n = 90)

Variables	Tens Group (N=30)	Chewing mint gum Group (N=30)	T- test	
			t	p-value
Pre anxiety score				
Mean ±SD	31.3±8.9	34.3±7.6	1.404	0.165
Range	18-53	20-47		
Post anxiety score				
Mean ±SD	15.3±3.2	27.3±7.5	8.061	<0.001**
Range	9-23	12-41		
Paired t	11.7	6.02		
P-value	0.001*	0.001*		
Percent of improvement of anxiety	51.1%	20.4%		

Using: t: Student' t test, Paired t-test

*p-value >0.05 is insignificant; *p-value <0.05 is significant; **p-value <0.001 is highly significant*

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Table (10): Demonstrates the effect of TENS and chewing mint gum on reducing anxiety scores during labor (n = 90). The highest reduction in anxiety was observed in the TENS group, with a 51.1% improvement, as the mean anxiety score decreased from 31.3 ± 8.9 pre-intervention to 15.3 ± 3.2 post-intervention. The lowest reduction was reported in the chewing mint gum group, with a 20.4% improvement, where the mean score decreased from 34.3 ± 7.6 to 27.3 ± 7.5.

Paired t-test analysis indicated that both interventions significantly reduced anxiety within each group ($p = 0.001$), while comparison between groups showed that TENS was significantly more effective than chewing mint gum in lowering anxiety scores post-intervention ($t = 8.061$, $p < 0.001$).

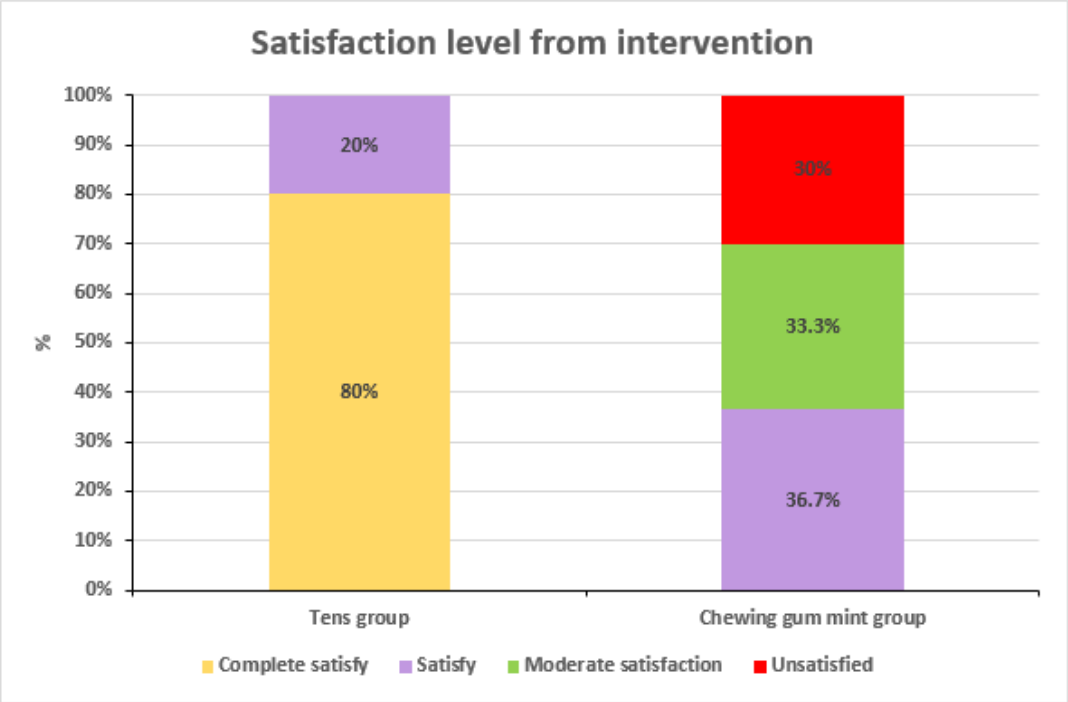

Figure (4)

Figure (4): Pregnant women satisfaction grade from intervention modalities:

Illustrates the satisfaction levels of pregnant women following the two intervention modalities, the TENS group, the majority of pregnant women (80%) reported complete satisfaction, while 20% reported being satisfied.

In contrast, the chewing mint gum group showed a more distributed pattern of satisfaction: 36.7% were satisfied, 33.3% reported moderate satisfaction, and 30% were unsatisfied. These findings suggest that TENS was associated with higher overall satisfaction compared to chewing mint gum.

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Part (VIII): Pregnant women satisfaction from intervention modalities during labor of the studied groups:

Table (11): Distribution of the studied groups according to their pregnant women satisfaction from intervention modalities during labor (N = 90)

Variables	Studied groups				Chi-square test	
	Tens Group (N=30)		Chewing mint gum Group (N=30)			
	No.	%	No.	%	χ 2	p-value
Degree of Satisfaction						
Complete satisfy	24	80.0	9	30.0	18.289	<0.001**
Satisfy	6	20.0	11	36.7		
Moderate satisfaction	0	0.0	10	33.3		
Unsatisfied						
Mean ±SD	32.53±1.59		21.8±4.9		*t:* 11.408	<0.001**
Range	28-35		15-37			

Using: χ 2: Chi-square test; t: Student' t test, Paired t-test

*p-value >0.05 is insignificant; *p-value <0.05 is significant; **p-value <0.001 is highly significant*

Table (11): The findings demonstrated that pregnant women in the TENS group reported significantly higher satisfaction with the intervention modalities compared to the Chewing Mint Gum group. In the TENS group, 80.0% of pregnant women reported being completely satisfied and 20.0% satisfied, whereas in the Chewing Mint Gum group only 30.0% were completely satisfied, 36.7% satisfied, and 33.3% reported moderate satisfaction. No pregnant women in the TENS group reported being unsatisfied.

The mean satisfaction scores further confirmed these results, with the TENS group achieving a significantly higher mean score (32.53 ± 1.59) compared to the Chewing Mint Gum group (21.8 ± 4.9), with statistical significance ($t = 11.408$, $p < 0.001$).

These results indicate that TENS intervention was markedly more effective in enhancing pregnant women satisfaction during labor than chewing mint gum, highlighting the clinical value of TENS as a preferred non-pharmacological pain relief method.

IV. DISCUSSION

Regarding the residence of the pregnant women, the results revealed a predominance of rural residents across the three groups. In Group A (TENS) and Group C (control group), 70% of the pregnant women resided in rural areas, while 30% lived in urban areas. Similarly, in Group B (chewing gum), rural residents accounted for 73.3%, compared to 26.7% from urban areas. This distribution reflects a high level of homogeneity among the three groups, indicating that environmental and geographical factors were comparable across the pregnant women.

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The current study is supported by a similar socio-demographic pattern observed in an Iranian study conducted by **Saedi, Mohebbifar & Kazemzadeh (2026).** In a study entitled “Effect of transcutaneous electrical nerve stimulation on pain and anxiety during labor in the state of Iran " who reported that the majority of pregnant women receiving non-pharmacological interventions during labor were between 20 and 30 years of age, married, and living in urban areas, which aligns with the demographic distribution of the current study sample.

In disagreement, an Indian study conducted by **Mane & Bhatbolan (2025),** titled “Effect of OBG-TENS on labor outcome in the state of India', reported that a majority of pregnant women originated from rural communities with lower educational attainment. The authors emphasized that accessibility challenges and socioeconomic disparities significantly shift demographic patterns in developing regions.

From the researcher’s perspective, the homogeneity of demographic characteristics across the three groups can be attributed to the standardized selection criteria, which ensured baseline comparability and minimized the influence of potential confounding variables. The absence of statistically significant differences regarding age, educational level, and residence further strengthens the internal validity of the study.

In addition, the predominance of educated pregnant women reflects the nature of the study setting and suggests that higher educational attainment is associated with increased health literacy. This level of awareness may encourage pregnant women to seek professional maternity care and actively engage in clinical research, viewing pregnant women as a means to improve pregnant women and neonatal health outcomes.

Regarding the pre-intervention subjective and observed pain levels, the present study revealed no statistically significant differences among the groups. The majority of pregnant women across all groups reported severe pain prior to any intervention, specifically 76.7% in the TENS group, 93.3% in the chewing mint gum group, and 93.3% in the control group. Furthermore, mean pre-intervention VAS pain scores were comparable, ranging from 7.5 ± 1.1 to 8.1 ± 1.04.

The high baseline pain levels can be attributed to the fact that all pregnant women were in the active stage of labor at the time of assessment, where intense physiological pain is expected and typically uniform across groups, conducting the baseline assessment immediately before the intervention further minimized variability, as most pregnant women were experiencing similar contraction intensities at that specific temporal point.

This result was in agreement with **Ebrahimian, Bilandi, Bilandi & Sabzeh (2025)**. In a study entitled “Comparison of virtual reality and chewing mint gum on labor pain and anxiety: A randomized controlled trial in the state of Beni-Suef University, Egypt”. who found that, intra-partum pain interventions report high baseline VAS scores and similar pre-intervention pain across groups, supporting internal validity.

Meanwhile this is in disagreement with **Huang, Chen, Liu & Wang (2024)**. In a study entitled “Perceived labor pain, anxiety, and fear of childbirth: Correlational analysis in a

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multicenter study in the state of China", who found that, some observational cohorts show heterogeneity at baseline especially when parity or fear of childbirth differs, which can produce baseline imbalance in pre-intervention pain for non-randomized samples.

From the researcher's perspective, the absence of statistically significant differences in pre-intervention subjective and observed pain levels among the studied pregnant women indicates baseline comparability of the groups.

The majority of pregnant women reported severe pain prior to any intervention, and mean pre-intervention VAS scores were similar across the groups, suggesting that all pregnant women started from a comparable pain level before the interventions.

The high baseline pain levels are consistent with the fact that all pregnant women were in the active stage of labor at the time of assessment, where intense physiological pain is expected.

Conducting the baseline assessment immediately before the intervention helped minimize variability, as most participants were experiencing similar contraction intensities at the specific time. This homogeneity supports the reliability of subsequent comparisons between intervention effects on labor pain.

Regarding post-intervention subjective and observed pain levels, the present study revealed a significant reduction in pain intensity within the TENS group, where 80% of pregnant women reported moderate pain and 16.7% reported mild pain. In contrast, the chewing mint gum group showed fewer efficacies, as 63.3% of women continued to experience severe pain, and none reported mild pain.

The superior effect of TENS may be attributed to its ability to produce segmental gate-control analgesia and stimulate endogenous opioid release, providing more substantial pain relief compared to simple oral-motor distraction, such as chewing gum.

Additionally, the perception of TENS as a specialized "therapeutic" device may enhance expectation-induced analgesia. These findings also highlight that correct electrode placement and adequate stimulation intensity are pivotal factors in the clinical efficacy of TENS relative to simpler interventions.

The current finding is in consistent with **Mohsenzadeh-Ledari, Omidvar, Ghanbarpour, Behmanesh & Ahangar (2025)**. In a study entitled "The Effect of chewing gum in managing labor pain intensity and anxiety level in primiparous women in the state of Belgium", who found statistically significant reductions in labor pain with TENS vs. control/placebo.

However, this finding is not supported **Yu, Zhang & Chen (2024)**. In a study entitled "Comparative effectiveness of non-pharmacologic interventions for labor pain in the state of China", who stated some high-quality trials and reviews note heterogeneity in TENS effects (parameters, timing) and argue that certain trials find only modest or no benefit when sham controls are used; likewise, distraction-based methods have shown benefit in some trials, reducing pain and anxiety though often to a smaller extent.

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From the researcher's perspective, the post-intervention findings indicate that TENS was significantly more effective in reducing labor pain compared to chewing mint gum. The majority of pregnant women in the TENS group reported moderate (80%) or mild (16.7%) pain, whereas most women in the chewing gum group continued to experience severe pain (63.3%) with none reporting mild pain. This demonstrates a clear superiority of TENS in alleviating pain intensity during the active first stage of labor.

The superior efficacy of TENS may be attributed to its ability to produce segmental gate-control analgesia and stimulate endogenous opioid release, offering more substantial pain relief than simple oral-motor distraction techniques. Furthermore, the perception of TENS as a specialized therapeutic device may enhance expectation-induced analgesia. These results highlight that correct electrode placement and adequate stimulation intensity are pivotal factors for the clinical effectiveness of TENS relative to simpler interventions, emphasizing its value as a non-pharmacological pain management strategy during labor.

Concerning anxiety levels pre- and post-intervention among the studied pregnant women, the results revealed no statistically significant differences between the groups at baseline ($p > 0.05$), indicating comparable pre-intervention anxiety levels. However, post-intervention anxiety decreased markedly and was significantly lower in the TENS group, with 70% of pregnant women reporting mild anxiety, compared to only 6.7% in the chewing mint gum group ($p < 0.05$). These findings suggest a superior anxiolytic effect of TENS during the active first stage of labor.

The current result was in agreement with **Saedi, Mohebbifar & Kazemzadeh (2026)**. In a study entitled "Effect of transcutaneous electrical nerve stimulation on pain and anxiety during labor: A randomized controlled clinical trial in the state of Iran", who found that trials of TENS reported reductions in anxiety contemporaneous with pain reduction as non-pharmacological interventions also find anxiety eased alongside pain relief.

The current study was inconsistent with **Ebrahimian, Bilandi, Bilandi & Sabzeh (2025)**. In a study entitled "Comparison of virtual reality and chewing mint gum on labor pain and anxiety: A randomized controlled trial, in the state of beni-suef university, Egypt", who found that, some distraction interventions such as chewing mint gum have produced anxiety reductions similar to device-based approaches in certain samples.

From the researcher's perspective, the absence of statistically significant differences in pre-intervention anxiety levels among the studied pregnant women indicates baseline comparability of the groups. This similarity suggests that all pregnant women started from a comparable psychological state, minimizing the potential influence of initial anxiety differences on post-intervention outcomes.

Post-intervention results demonstrated a marked reduction in anxiety levels; with the TENS group showing superior effects: 70% of pregnant women reported mild anxiety, compared to only 6.7% in the chewing mint gum group. This indicates that TENS is more effective in alleviating labor-related anxiety, likely due to its analgesic properties and the perception of being a specialized therapeutic device, which may enhance expectation-

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induced anxiolysis. These findings support the use of TENS as a reliable non-pharmacological intervention for managing both pain and anxiety during the active stage of labor.

Regarding satisfaction with the intervention among the pregnant women, the results revealed that satisfaction levels were significantly higher in the TENS group (Group A) compared to the chewing mint gum group (Group B). Specifically, 80% of pregnant women in the TENS group reported being completely satisfied, while the remaining 20% reported being satisfied.

In contrast, the chewing mint gum group showed more varied results, with 36.7% expressing satisfaction, 33.3% reporting moderate satisfaction, and 30% being unsatisfied. These findings indicate a clear preference and higher acceptability of TENS as a non-pharmacological intervention for labor pain relief.

The high level of satisfaction in the TENS group likely reflects its superior clinical effectiveness, as it provides greater relief from both pain and anxiety, which naturally drives higher pregnant women's satisfaction. Furthermore, being a non-invasive, patient-operated device, TENS enhances the user's sense of control. The professional appearance of TENS as a "medical treatment" may also contribute to expectation-induced satisfaction, compared to the simpler and less formal nature of the chewing gum intervention.

The current study is supported by **Yu, Zhang & Chen (2024)**. In a study entitled "Comparative effectiveness of non-pharmacologic interventions for labor pain: A network meta-analysis. Medicine (Baltimore), in the state of United States of America "**,** who demonstrated several trials and reported improved pregnant women satisfaction with TENS compared with standard care or less active methods, particularly when pain relief is subjectively meaningful.

On the other hand, this result was contradicted by **Saxena (2024)**. In a study entitled "Non pharmacological techniques of labor analgesia. Journal of Indian college of anesthesiologists, in the state of India"**,** who stated that satisfaction is multifactorial and not determined by pain intensity; factors such as midwifery support, information, and birth control/agency strongly influence satisfaction; thus an intervention that reduces pain but is poorly explained or limits mobility may not increase overall satisfaction.

From the researcher's perspective, the results indicate that satisfaction with the intervention was significantly higher in the TENS group compared to the chewing mint gum group. In the TENS group, the majority of pregnant women reported being completely satisfied (80%) or satisfied (20%), whereas satisfaction in the chewing mint gum group was more variable, with only 36.7% expressing satisfaction, 33.3% reporting moderate satisfaction, and 30% being unsatisfied. These findings demonstrate a clear preference for TENS among the participants and highlight its higher acceptability as a non-pharmacological intervention for labor pain relief.

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The high satisfaction levels observed in the TENS group may be attributed to its superior clinical effectiveness in reducing both labor pain and anxiety, which naturally enhances pregnant women satisfaction. Additionally, being a non-invasive, pregnant women-operated device, TENS increases the user's sense of control over the intervention. Its professional appearance as a specialized "medical treatment" may also contribute to expectation-induced satisfaction, compared to the simpler and less formal nature of the chewing gum intervention. Overall, these findings support the feasibility, effectiveness, and acceptability of TENS as a reliable non-pharmacological pain management strategy during the active stage of labor.

V. CONCLUSION

Based on findings of the current study, it can be concluded that:

The findings of the current study demonstrated a significant reduction in labor pain intensity and anxiety levels in both study groups. However, a comparative analysis between the two interventions revealed that Group A (TENS) showed a significantly greater reduction in pain intensity compared to Group B (Chewing Mint Gum) during the active phase of the first stage of labor. Regarding anxiety, both interventions were effective, yet TENS demonstrated superior analgesic potency. Furthermore, pregnant women in both groups reported high levels of satisfaction with the interventions. These results confirm the research hypotheses and establish TENS as a highly effective non-pharmacological modality for normal labor pain and anxiety management.

VI. RECOMMENDATIONS

Based on the results of the present study, the following recommendations are suggested:

1) Conduct large-scale multicenter studies with diverse populations to confirm and generalize the effectiveness of TENS and chewing mint gum.
2) Evaluate the long-term maternal and neonatal outcomes associated with non-pharmacological interventions during labor.
3) Investigate the efficacy of TENS and chewing mint gum during postoperative and immediate postpartum periods, including cesarean section recovery.

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