

Comparison of the effect of entonox gas and aromatherapy with lavender on the severity of labor pain

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Introduction: Pain is one of the main and unavoidable stages of labor. The purpose of this study was to compare the effects of entonox gas and aromatherapy with lavender on the severity of labor pain.

Methods: The present study was a double-blind randomized controlled trial with random allocation on 60 nulliparous women in Sanandaj-Kurdistan Be'sat hospital. The intervention was performed in two groups of 30 in active phase of labor. In the Entonox group, Entonox gas was smelled by the mother in contractions. In the lavender group, aromatherapy with lavender was performed in contractions. The severity of pain was measured in dilatations of 4-5, 6-7, 8-9, and 10 cm before and after the intervention with vas instrument.

Results: The severity of pain before and after intervention was significantly different in each group ($p < 0.05$). The severity of pain was significant between the two groups in dilatations of 8-9 and 10 cm. After intervention, the mean pain severity in the Entonox group was 6.8 in dilatations of 8-9 cm and 8.3 in the lavender group ($p < 0.05$). Also it was 7.7 in dilatation of 10 cm in Entonox group and 8.9 in lavender group ($p < 0.05$). Entonox gas significantly increased maternal complications including mouth dryness, dizziness, nausea, and headache ($p < 0.05$).

Conclusion: The present study showed that Entonox gas and aromatherapy with lavender both can reduce the severity of labor pain. But the effect of Entonox gas is greater in reducing labor pain than lavender.

Keywords: Labor pain, Lavender, Entonox, Pregnancy

Introduction

Pregnancy and childbirth are physiological processes and exciting and important events in women's lives. Pain is one of the unavoidable stages of labor. The labor pain is considered to be an acute pain which is caused by stimulation of the neuronal receptors caused by uterine contractions and transmitted to the visceral regions of the pelvis and lumbosacral [1]. Almost all women of different descents experience pain in the abdominal region in the labor. 15%-75% of

them experience pain in the flank area [2]. Labor pain varies from person to person. However, nulliparous women feel more pain due to lack of experience, feelings of fear and anxiety, but multiparous women are more likely to experience labor pain less severely [3].

Labor pain can increase cardiac output, blood pressure and heart rate by releasing the chemical intermediates of the sympathetic system and increasing catecholamine in the plasma. Increasing the breathing depth and respiratory rate of the mother in response to pain of labor can lead to hypocapnea and contraction of the vessels that can reduce the blood flow in the uterus and cause dizziness, nausea, lightheadedness and severe pain in the brain. The result of an increase in body metabolism in response to pain is a weakly responsive insulin hyperglycemia, which leads to the decomposition of fats and the release of ketones and lactate. The ketones and lactate from this process, passes the umbilical cord and reduces oxygen supply to the fetus, and as long as the labor is prolonged, it is possible to reduce the umbilical cord PH and metabolic acidosis in the fetus [3,4].

There are two major pharmacological and non-pharmacological methods to reduce labor pain. Pharmacological methods include systemic administration of drugs, inhalation anesthesia, general anesthesia and local anesthesia [5]. Non-pharmacological methods include: massage, warming and cooling, hydrotherapy, hypnosis, change of position, relaxation and training of respiratory techniques [6,9].

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One of the pharmacological methods of pain relief is the use of Entonox gas. This gas was discovered in 1700. Entonox is an inhaler pain killer and a mixture of oxygen and nitrous oxide in a ratio of 50-50. Entonox is a gas without odor, color and taste, and is easily used by the mother herself^[10]. Since Entonox is rapidly excreted through the lungs, it seems that it has no effect on the fetus and can be used in patients with liver and kidney diseases. Enantox gas is the mostly used inhaler pain killer in the United States, and 60% of women use it during childbirth^[11]. In England, Entonox gas is present in 100% of the delivery units^[12]. Despite the benefits mentioned above, Entonox gas is contraindicated in cases of head trauma, head stiffness and severe asthma.

Aromatherapy is one of the complementary or alternative therapy methods that is believed to be effective in relieving pain, reducing anxiety, insomnia, depression, fatigue, asthma, anti-inflammatory and anti-microbial. In fact, the aromatherapy is both science and art^[13,14]. The aromatherapy is the use of aromatic herbal extracts and basic oils for massage in reducing pain. Various studies have shown that when oily essences are used as an inhaler, endorphin is produced and pain will be reduced^[4,15]. The aromatherapy affect the most important part of the senses by touching and the smelling. When the aromatic essence is inhaled, aromatic impulse reaches the brain through the olfactory receptor, resulting in the release of the nervous substances and endorphin hormones, which causes physical and mental changes^[16]. Today, in developed countries, complementary medicine is used to reduce the pain of normal labor, replacing the delivery of cesarean section. This issue is very rare in Iran^[17]. The prevalence of the use of complementary medicine in pregnancy is reported as between 20% and 60% worldwide. So far, no evidence of complications from aromatherapy in pregnancy and childbirth has been reported^[6,18,19]. Also, the results of various studies showed that aromatherapy with aromatic essences was effective in reducing labor pain^[15,20]. One of the essences used in aromatherapy is lavender. Linalyl acetate is one of its compounds, which has an analgesic effect. The roots of this plant are used to produce anticonvulsants and their leaves are used to reduce pain. The benefits of lavender essence are sedative, analgesic, anti-inflammatory and anti-depressant effects^[15]. The study by Vakilian et al. showed that inhalation of lavender essence leads to reduced labor pain^[21].

Normal delivery is the best known method for mother and baby. Therefore, providing appropriate methods can increase the normal delivery rate and leave a pleasant memorable delivery to the mother. Delivery pain can lead to irreparable physical and psychological complications in mother. It also can endanger the natural process of delivery. One of the most important duties of the midwife and doctor in delivery sector is providing the mother with appropriate analgesia and maintaining the physiological process of delivery. The aim of this study was to compare the effect of Entonox gas inhalation with lavender on the severity of labor pain.

Methods

Patient

The present study was a double blind randomized controlled trial with random allocation. It was conducted on 60 pregnant women nulliparous in Be'sat hospital of Sanandaj, Iran in 2018. The subjects were randomly selected and divided into two groups of Entonox gas and lavender aroma with random enrollment.

Ethical consideration

After the registration of the project in IRCT website

(IRCT20170906036081N2) and confirmation by the Ethical Committee of Kurdistan University of Medical Science IR.MUK.REC.1396.317 the study method was explained to the participants and a written consent was received.

Inclusion criteria

Women aged 18 to 35 years old, nulliparous, cephalic presentation, normal AFI, normal fetal weight in the last trimester ultrasound, gestational age of 38-40 weeks, and healthy mothers in terms of smell and respiratory system.

Exclusion criteria

Hypertension, gestational diabetes mellitus, maternal thyroid problems, macrosomal embryos, embryos with growth limitation (IUGR), and low birth weight embryos (LBW), PROM, polyhydramnios and oligohydramnios, diagnosed anomalies in fetus, mothers with allergies and respiratory disease, fetus unsafe heart rate, SPO₂ less than 95%, and those who have contraindications to Entonox gas, such as head injuries, head stiffness, severe asthma.

Intervention

The delivery rooms of this hospital were LDR, so the Entonox gas and Lavender did not interfere. Intervention started in dilatation at 3-5 cm in active phase. In the Entonox group, gas was smelled by the mother in contractions. In lavender group, 2 drops of lavender essence made by Zarband Company (Iran) were poured on sterilized gas and placed at a distance of 7 to 10 cm from the mother nose at the time of contractions. Due to the escape of essence, it was renewed every 15 minutes. The severity of pain in each group was measured once before and once after the intervention in dilatations of 4-5, 6-7, 8-9, and 10 cm with the VAS ruler. Mother and baby monitored throughout the duration of the intervention. Apgar was also recorded after delivery.

Data collection tools

Data gathering tools included a demographic questionnaire, a midwifery history questionnaire and a VAS ruler. The VAS ruler is a visual tool to measure the severity of pain, which is graded from 0 to 10. 0 means no pain and 10 means the peak of pain. How to express the intensity of pain was explained for patients in latent phase. Because in the latent phase, the mother is more relaxed and higher quality learning is done. The duration of training depends on the patients' learning and the pain was recorded before and after the intervention by the researcher.

Statistics analysis

For data analysis, STATA software version 12 was used. To examine the demographic variables, Chi-square and Mann-Whitney tests were used in two experimental groups. To compare pain before and after intervention, Wilcoxon test was used in each group. Mann-Whitney test was used to compare pain between groups (before and after intervention). Significance level was considered as $p < 0.05$.

Results

Mean and standard deviation of participants age was 25 ± 11.3 years. There was no significant difference in age between the two groups ($p > 0.05$). There was no significant difference in terms of education, place of residence and occupation between the groups ($p > 0.05$). The highest degree of education (%50) in the two groups was under the diploma (%43) and the majority of participants were

urban (%86) residences. Most of the mothers were housewives (%96).

In the Entonox group, the severity of pain after intervention in all stages was significantly lower than baseline ($p < 0.05$) (Table 1). Also in the lavender group, the severity of pain after the intervention, in all stages was significantly lower than the basal state ($p < 0.05$) (Table 2).

The severity of pain was not significant in dilatations of 4-5 and 6-7 cm between the two groups ($p > 0.05$). The severity of pain was significant in dilatations of 8-9 and 10 cm between the two groups

($p < 0.05$), so that the severity of pain in the Entonox gas group was lower than that of the lavender group (Table 3). In the Entonox gas group, 80% had mouth dryness, 66% had confusion and 43% had nausea. In the lavender group, prevalence of above mentioned complications was 0, 0 and 13% respectively (Figure 1). 10% in the lavender group and 6% in the Entonox group had meconium excretion. FHR (147.8 ± 5.60) was normal in all embryos. Maternal vital signs and SpO_2 ($96.5 \pm \%74$) were normal in all participants.

Table 1
Severity of pain before and after intervention in the Entonox gas group

Group (Before and after intervention)	Before intervention Mean \pm SD	After intervention Mean \pm SD	p
4-5 cm	7.30 \pm 2.25	4.6 \pm 2.23	<001
6-7 cm	8.6 \pm 1.40	6.1 \pm 1.72	<001
8-9 cm	9.53 \pm 0.86	6.8 \pm 1.60	<001
10 cm	9.93 \pm 0.18	7.4 \pm 1.86	<001

Table 2
Severity of pain before and after intervention in the lavender group

Group (Before and after intervention)	Before intervention Mean \pm SD	After intervention Mean \pm SD	p
4-5 cm	6.36 \pm .71	4.63 \pm 1.99	<001
6-7 cm	8.5 \pm 1.19	6.86 \pm 1.61	<001
8-9 cm	9.63 \pm 0.53	8.3 \pm 1.41	<001
10 cm	10 \pm 0	8.9 \pm 1.47	<01

Table 3
Comparison of pain severity after intervention between the two groups

Group (Before and after intervention)	Before intervention Mean \pm SD	After intervention Mean \pm SD	p
4-5 cm	4.63 \pm 1.99	4.6 \pm 2.23	>0.05
6-7 cm	6.86 \pm 1.61	6.1 \pm 1.72	>0.05
8-9 cm	8.3 \pm 1.41	6.8 \pm 1.60	<01
10 cm	8.9 \pm 1.47	7.4 \pm 1.86	<01

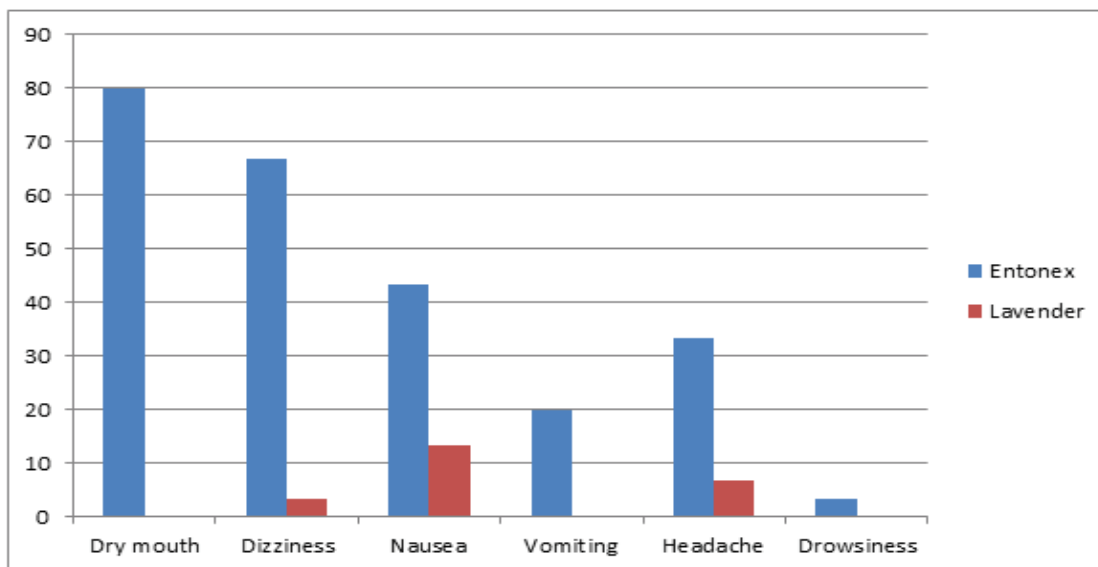


Figure 1. Complications of intervention in two groups.

Discussion

The present study was conducted to compare the effects of Entonex gas and aromatherapy with lavender on labor pain. In the present study, the mean age of samples in the group using lavender and Entonex were 25.26 ± 4.44 and 25.76 ± 4.48 respectively. Most participants had elementary and under diploma degrees in both groups. Also, 28 people from the group using lavender and 29 from the group using Entonex were housewives, which was not statistically significant between groups. The closeness of the average age, education, and residence of the participants in the two groups indicated that the population was homogenous according to the inclusion and exclusion criteria. Because the mentioned demographic characteristics are the factors involved in changing the threshold of pain. In the lavender group 16% and in the group using Entonex gas, 3% of pregnancies were unwanted. Pregnancy satisfaction seems to be an effective factor in determining the threshold of pain in people under different conditions. In addition, this statistic was not significant in the two groups in the present study and indicates the homogeneity of the groups.

In the present study, the severity of pain before and after intervention in the Entonex gas group was investigated in 4 stages of labor. The results showed that Entonex can reduce the intensity of labor pain significantly compared to baseline at all stages of labor. A study by Donder et al. on 200 pregnant women found that Entonex alone can reduce the severity of labor pain [22]. Also, a study by Pasha et al. on 98 pregnant women showed that Entonex gas can reduce the intensity of labor pain at all stages of labor [17]. After inhalation of Entonex, nitrous oxide gas quickly enters the bloodstream (about 15 seconds after inhalation) and, because of its very low solubility in the blood, it is placed in the brain and the spinal cord with a suitable concentration of effective particle pressure and causes analgesia, calmness, lack of attention to the environment and up to a certain level, euphoria possibly through the weakening of the brain centers and the increase of endorphins. These effects start within 30 seconds and peak up to 2 minutes.

In the present study, the severity of pain before and after intervention in the lavender group was also assessed in 4 stages. The results showed that in all stages, lavender can significantly reduce the intensity of labor pain compared to baseline. The study by Valilian et al. revealed that the aromatherapy with lavender can reduce the intensity of labor pain [21]. A study by Yazdkhasti also confirmed these findings [15]. It seems that oily essences are absorbed through breathing and affect enzymes, canals and ion receptors, leading to brain stimulation, anxiety relief, anti-depressant effects, and increased brain blood flow. These oils can also pass through the blood-brain barrier through respiration and take action with the central nervous system receptors. It seems that aromatherapy with lavender can reduce the severity of pain through having an effect on pain receptors in the central nervous system.

One of the important results of this study was a significant difference between the two intervention groups in dilatations of 9-8 and 10 cm. The results showed that the mean pain intensity in dilatation of 8-9 cm in the group using Entonex was 6.8 after intervention and in the group using lavender was 8.3, also the mean pain intensity in dilatation of 10 cm in the Entonex group was 7.4 and 8.9 in the lavender group. Therefore Entonex gas can reduce the pain intensity more than lavender. Entonex gas affects the central nervous system and increases endorphins, causing analgesia, relaxation, and euphoria [22]. The half-life of lavender in the body seems to be lower, and its effect has not been sustained for a long time, but slowly with increase in dose of Entonex gas in the body, its

effect was increased in comparison with lavender. Though a study have shown that the duration of the Entonex effect in the body is 2 minutes [22]. But this difference is probably due to the effects of Entonex on the central nervous system.

In the present study, the effects of maternal complications in both groups were measured throughout the intervention. The results showed that headache, nausea, vomiting, diplopia, confusion and mouth dryness were significantly higher in the Entonex gas group. Perhaps one of the reasons that Entonex gas can reduce the intensity of pain more than lavender in two final stages, is its negative effects on the central nervous system, which caused headaches, confusion and diplopia, and thus the patient has difficulty understanding the severity of pain.

Mouth dryness, confusion and nausea were the most common maternal complications associated with Entonex use, with the prevalence of 80%, 66% and 43%, respectively. Pasha et al. in a study showed that the most maternal complications due to Entonex gas use, 65% were related to oral dryness. Also a review study showed that mouth dryness, drowsiness, confusion, nausea, vomiting, and headache were inevitable effects of Entonex gas [17,23]. The results of these studies are consistent with the present study. During the intervention fetal heart rate, vital signs and SPO₂ were normal at all stages. Apgar score of 1 and 5 minutes was normal in all infants. Also, 3 patients in the group using lavender and 2 in the Entonex group had meconium excretion, which was not statistically significant between the two groups. A study by Agah et al. showed that Entonex gas has no negative effects on fetuses and mothers [24]. Also, the results of Pasha et al. showed that lavender is safe for mother and fetus [17]. The results of these studies are consistent with the present study. Entonex and lavender seem to have no negative effects on the fetus.

Conclusion

The present study showed that Entonex gas and lavender aromatherapy both can reduce the intensity of labor pain, but the effect of Entonex gas on reducing labor pain is more than lavender. Maternal complications from lavender consumption were also lower than Entonex. It is anticipated that the effects of Entonex gas in future studies will be further explored in order to make the process of reducing maternal pain safe.

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Conflict of Interest

The author declares no conflict of interest with regard to the content of this article.

References

- [1] Howie LA, Robinson C. Non-neuraxial analgesia in labour. *Anaesth Intens Care Med* 2013;14:272-275.
- [2] Lowe NK. The nature of labor pain. *Am J Obstet Gynecol* 2002;186:S16-S24.

- [3] Kulkarni S, Sia ST. Hazards of labour pain and the role of non-neuraxial labour analgesia. *Trends in Anaesthesia and Critical Care* 2014;4(4):109-14.
- [4] Setayesh VPN, Kheirkhah M, Neisani L, et al. Comparison of the effects of aromatherapy with essential oils of damask rose and hot footbath on the first stage of labor anxiety in nulliparous women. *Complement Ther Nurs Midwifery* 2012;2:9-1.
- [5] Koyyalamudi V, Sidhu G, Cornett EM, et al. New labor pain treatment options. *Curr Pain Headache Rep* 2016;20:1-9.
- [6] Sibbritt DW, Catling CJ, Adams J, et al. The self-prescribed use of aromatherapy oils by pregnant women. *Women Birth* 2014;27:41-45.
- [7] Kooti W, Daraei N. A review of the antioxidant activity of celery (apium graveolens l). *J Evid Based Complementary Altern Med* 2017;22:1029-34.
- [8] Kooti W, Mansouri E, Ghasemiboroon M, et al. Protective effects of celery (apium graveolens) on testis and cauda epididymal spermatozoa in rat. *Iran J Reprod Med* 2014;12:365-6.
- [9] Mansouri E, Kooti W, Bazvand M, et al. The effect of hydro-alcoholic extract of foeniculum vulgare mill on leukocytes and hematological tests in male rats. *Jundishapur J Nat Pharm Prod* 2015;10:e18396.
- [10] Agah J, Baghani R, Tabaraei Y, et al. Maternal side-effects of continuous vs. intermittent method of entonox during labor: a randomized clinical trial. *Iran J Pharm Res* 2016;15:641.
- [11] Jafarzadeh L, Shabani S, Jafari F. The effect of entonox on severity of pain and mother hemodynamic and fetus apgar in natural vaginal delivery. *J Shahrekord Univ Med Sci* 2012;14:92-99.
- [12] O'Sullivan G. Non-neuraxial analgesia during labour. *Anaesth Intens Care Med* 2010;11:270-273.
- [13] Meghani N, Tracy MF, Hadidi NN, et al. Part II: The effects of aromatherapy and guided imagery for the symptom management of anxiety, pain, and insomnia in critically ill patients: an integrative review of current literature. *Dimens Crit Care Nurs* 2017;36:334-348.
- [14] Sharghi M, Mansurkhani SM, Larky DA, et al. An update and systematic review on the treatment of primary dysmenorrhea. *JBRA Assist Reprod* 2018.
- [15] Yazdkhasti M, Pirak A. The effect of aromatherapy with lavender essence on severity of labor pain and duration of labor in primiparous women. *Complement Ther Clin Pract* 2016;25:81-86.
- [16] Kaviani M, Maghbool S, Azima S, et al. The effect of aromatherapy with salvia officinalis on the severity of labor pain in nulliparous women. *J Urmia Nurs Midwifery Fac* 2014;12:79-85.
- [17] Pasha H, Basirat Z, Hajahmadi M, et al. Maternal expectations and experiences of labor analgesia with nitrous oxide. *Iran Red Crescent Med J* 2012;14:792-7.
- [18] Kooti W, Moradi M, Peyro K, et al. The effect of celery (apium graveolens l.) on fertility: a systematic review. *J Complement Integr Med* 2017;15.
- [19] Kooti W, Servatyari K, Behzadifar M, et al. Effective medicinal plant in cancer treatment, part 2: review study. *J Evid Based Complementary Altern Med* 2017;22:982-95.
- [20] Namazi M, Akbari SAA, Mojab F, et al. Effects of citrus aurantium (bitter orange) on the severity of first-stage labor pain. *Iran J Pharm Res* 2014;13:1011-1018.
- [21] Vakilian K, Karamat A, Mousavi A, et al. The effect of Lavender essence via inhalation method on labor pain. *J Shahrekord Univ Med Sci* 2012;14:34-40.
- [22] Naddoni DB, Balakundi SK, Assainar KK. The effect of nitrous oxide (entonox) on labour. *Int J Reprod Contracept Obstet Gynecol* 2017;5:835-9.
- [23] Attar AS, Feizabadi AS, Jarahi L, et al. Effect of entonox on reducing the need for pethidine and the relevant fetal and maternal complications for painless labor. *Electron Physician* 2016;8:3325-32.
- [24] Agah J, Baghani R, Safiabadi Tali SH, et al. Effects of continuous use of entonox in comparison with intermittent method on obstetric outcomes: a randomized clinical trial. *J Preg* 2014;245907:1-5.