



Effects of Herbal Medicines on Nipple Fissures: A Systematic Review

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Abstract

Context: As a prevalent problem on the first days of childbirth, nipple fissures can cause pain and discomfort and lead to the early cessation of breastfeeding. Effectively treating this complication is therefore crucial. This systematic review investigated the effects of herbal medicines on the treatment of nipple fissures.

Data Sources: Keywords such as “treatment”, “nipple fissure”, “fissure”, “medicinal plants”, “sore nipple” and “herbal ingredients” were used individually and in combination to extract relevant articles published by March 2020 from English databases, i.e., Science Direct, PubMed, Scopus and Google Scholar. The Persian equivalents of these keywords were used for extracting articles from Google Scholar, SID and Magiran. The selected articles were qualitatively evaluated using the checklist issued by Consolidated Standard of Reporting Trials (CONSORT) in 2017.

Results: Out of 132 articles retrieved, 10 eligible ones were included in this study. Investigating the full text of the articles found herbal medicines such as purslane, *Aloe vera*, olive oil, frankincense, *Pistacia atlantica*, curcumin and *Ziziphus jujuba* effective in treating nipple fissures.

Conclusions: Given the effects of herbal medicines on treating nipple fissures, it is recommended that comprehensive studies be conducted on different forms and doses of these compounds.

Keywords: Herbal Medicine, Nipple Fissure, Pain, Medicinal Plant, Systematic Review

1. Context

Experiences during the postpartum period as an important stage in women's life affect all members of a family (1). Women should adapt themselves to biological, psychological and social changes and numerous concerns and problems they face during this period (2). Breastfeeding problems, including nipple fissures, constitute a major postpartum challenge. Given breastfeeding as the ideal method of feeding babies and providing them with all the nutrients they need to grow (3), necessary measures should be adopted to solve the associated problems and prolong and effectively maintain exclusive breastfeeding (4). With a reported prevalence of 34 - 96%, nipple fissures are a major cause of the early cessation of breastfeeding (5).

Treating nipple fissures is challenging (6) given that nipple is constantly traumatized by the baby's sucking (7) and the lesion can be infected through its contact with the mother's skin flora and the baby's oral flora. Shortening the wound healing can thus greatly help with its improvement (4).

Fast and effective treatment of nipple fissures plays a key role in enhancing self-confidence in mothers and their breastfeeding duration (3). Research suggests no topical medications for the definitive prevention and treatment of nipple fissures (5-7); nevertheless, the proposed medications include expressed milk, tea bag compress (8), hot water compress, hydrogel dressing, lanolin, calendula, Vaseline, vitamin A ointment and mupirocin 2% (9).

A systematic review on different treatments for nipple fissures by Niazi et al. (2018) found the most effective methods to include using menthol and hot compresses and teaching correct breastfeeding techniques to mothers (10).

Given the failure of conventional treatments for nipple fissures, herbal medicines were proposed in literature to solve this problem (11), and different results obtained can be explained by differences in the clinical trial designs and control groups. The herbal compounds cited include *Aloe vera* (12), *Ziziphus jujuba* (13), purslane (14), olive oil (12), curcumin (15), *Pistacia atlantica* (16), frankincense (17), pepper-

mint, herbal tea (18) and yarrow (19).

Given the different studies conducted on the effects of herbal compounds on the treatment of nipple fissures, a comprehensive review study is required for summarizing the results. Neither of the two systematic reviews conducted in this context (10, 16) focused on herbal compounds.

2. Objectives

This review study was therefore conducted to investigate the effectiveness of herbal compounds on nipple fissures.

3. Data Sources

3.1. Search Strategy

Keywords such as “treatment”, “nipple fissure”, “fissure”, “medicinal plants”, “sore nipple” and “herbal ingredients” were used to extract relevant articles from English databases, i.e. Science Direct, PubMed, Scopus and Google Scholar. The Persian equivalents of these keywords were used for extracting articles from Google Scholar, SID and Magiran. “AND” and “OR” operators were employed to perform this search, and the references of the relevant articles were also searched.

Original articles published in Persian or English and mainly aiming at investigating the effect of a medicinal plant on the treatment of nipple fissures were included in the study. Review articles, short studies and those whose full text was inaccessible were excluded.

4. Data Extraction

The initial search retrieved 22 articles from PubMed, 50 from Science Direct, 30 from Scopus, 8 from Google Scholar, 9 from SID, 8 from Magiran and 5 from other sources (Figure 1). Out of these 132 articles, 46 duplicate ones were excluded. After investigating the titles and abstracts of 86 remaining articles, 64 irrelevant and 9 ineligible articles were excluded and 10 were included for full-text review. The Preferred reporting items for systematic reviews and meta-analysis (PRISMA) flowchart in Figure 1 shows the process of article selection.

4.1. Quality Assessment

The selected articles were qualitatively evaluated using the 2017 CONSORT checklist, comprising six general categories, i.e. title and abstract, introduction, methods, results, discussion and other information. These categories included 25 subcategories. A score of 0-44 was obtained

from this standard checklist by respectively assigning a score of 1 or 0 to the articles for every item they included or failed to address. This review was performed by dividing the CONSORT score into three categories as follows:

- (1) Scores exceeding 29.34: High-quality studies
- (2) Scores of 14.67-29.34: Medium-quality studies
- (3) Scores of below 14.67: Low-quality studies

The first two authors qualitatively examined the articles and achieved consensus through discussion in case of disagreements. If the issue remained unresolved, the fourth author was consulted to resolve the conflict. Table 1 presents the results of the article quality assessments.

5. Results

5.1. Characteristics of Included Studies

All the included articles were clinical trials, 3 were in English and the remaining 7 in Persian. Six studies measured the pain intensity with a Visual Analogue Scale (VAS) (25) and 7 with the Storr Scale (26). One study used breastfeeding self-efficacy as a variable and another employed the Amir Scale (27). Different studies measured the intensity of pain and fissures at different time points after childbirth.

Breast milk was mainly utilized in controls, in contrast to two studies using lanolin ointment in the control group. All the herbal compounds used in the studies contained saponins, flavonoids and terpenoids. Table 2 presents the characteristics of the included studies.

5.2. Herbal Ingredients for Treatment Nipple Fissure

This section details the herbal compounds used and the articles assessing their effect on nipple fissures. This review focused on herbal compounds such as purslane, frankincense, *Pistacia atlantica*, *Ziziphus jujuba*, olive oil, *Aloe vera* and turmeric. The scientific name and properties of these plants are listed in Table 3.

5.2.1. Purslane

The leaves and seeds of purslane as a popular plant in traditional Iranian medicine have oral applications and its ointment can help relieve pain and inflammation (28). This plant belongs to the Portulacaceae family with anti-inflammatory, analgesic, antifungal, antiseptic and bacteriostatic properties. Wound healing is accelerated by flavonoids, tannins, saponins and terpenoids in purslane and through collagen synthesis and angiogenesis. The analgesic effects of purslane are mediated by opioid pathways and postsynaptic α_2 receptors (29, 30). A double-blind randomized clinical trial (2018) taught the correct

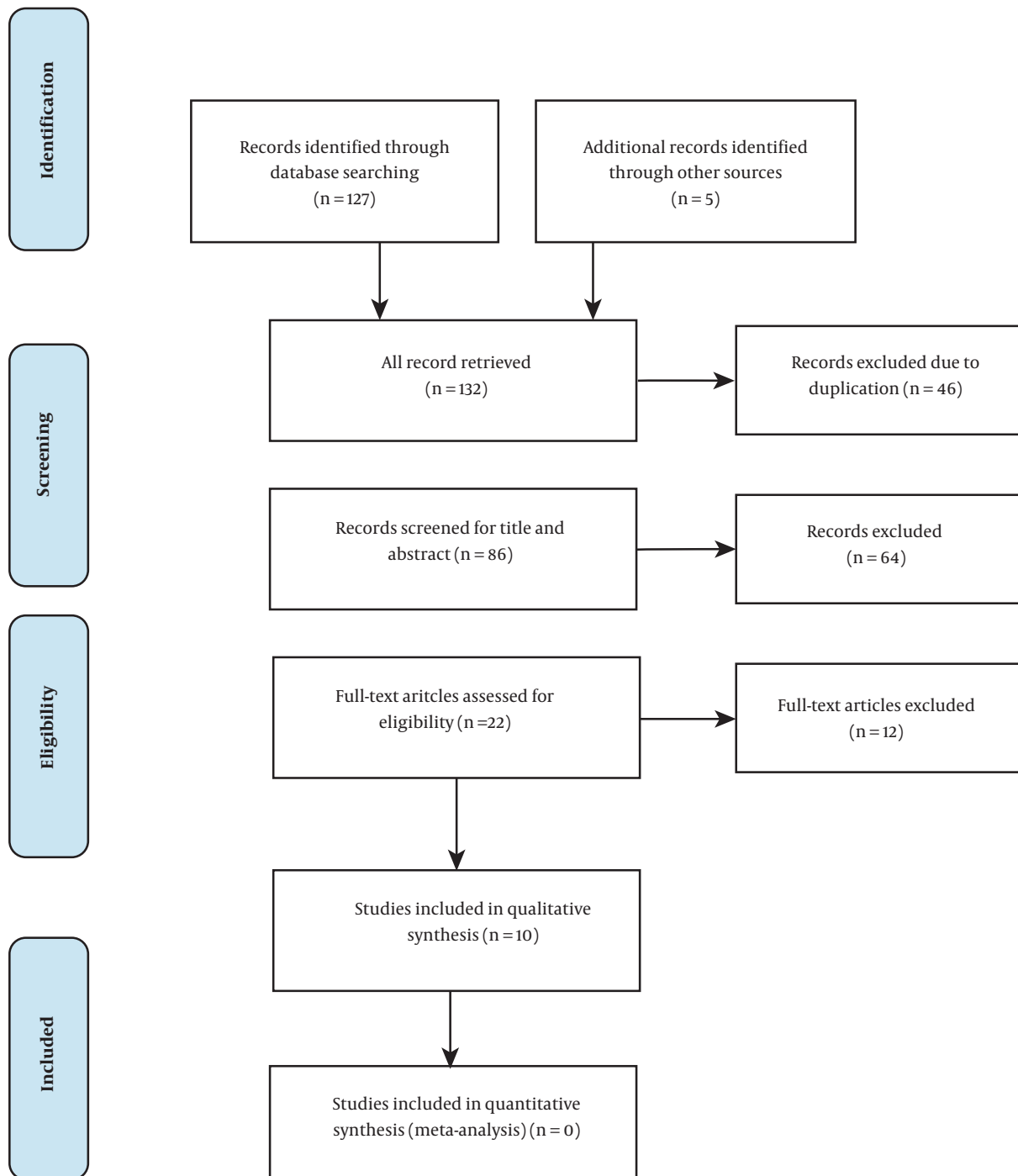


Figure 1. Preferred reporting items for systematic reviews and meta-analysis (PRISMA) flowchart

methods of breastfeeding and medication to breastfeeding women with nipple fissures in two groups of purslane ointment 2% (n = 43) and lanolin (n = 43). Measuring the

pain score and fissures on the first, third and eighth days of the intervention using a VAS showed significant reductions on the third and eighth days in the purslane group

Table 1. Scores Assigned to Each Article by the Main Sections of the 2017 Consort Checklist

Author	Title and Abstract	Introduction	Methods	Results	Discussion	Other Information	Total Score	Article Quality
Niazi et al. (2018) (20)	2	2	19	8	3	3	40	High
Niazi et al. (2019) (21)	2	2	17	11	3	3	35	High
Mobaraki et al. (2019) (17)	2	2	17	11	3	3	35	High
Eshghizadeh et al. (2017) (12)	2	2	18	8	1	1	32	High
Niazi et al. (2017) (14)	2	2	14	6	3	3	30	High
Shahrahmani et al. (2016) (22)	1	2	11	7	1	3	25	Medium
Shinizadeh et al. (2015) (15)	2	2	9	6	3	3	25	Medium
Asa'adi et al. (2017) (16)	1	2	9	8	2	2	24	Medium
Tafazoli et al. (2010) (23)	2	2	8	7	2	2	23	Medium
Alamolhoda et al. (2014) (24)	1	2	8	6	2	3	22	Medium

compared to in the lanolin group ($P < 0.001$) (14). Comparing purslane with lanolin in terms of their effects on nipple fissures and breastfeeding self-efficacy, Niazi et al. (2018) reported a significant increase in breastfeeding self-efficacy on the third and eighth days after the intervention in the purslane group ($P < 0.001$) (20).

5.2.2. Frankincense

Frankincense is an aromatic gum resin belonging to genus *Boswellia*, and boswellic acids are a mixture of pentacyclic triterpenoids. The anti-inflammatory properties of resin as the main ingredient of frankincense have been proven (31, 32). Frankincense was used to treat bruises and septic wounds in ancient China (33). Terpenoid acids in frankincense improve nipple fissures by reducing pro-inflammatory products through inhibiting the synthesis of leukotrienes, which lowers the number of WBCs in inflammation.

A triple-blind clinical trial by Mobaraki et al. (2019) examined the effect of frankincense ointment 2% on nipple fissures in 68 breastfeeding women assigned to two groups of frankincense ointment 2% and lanolin. Recording the pain score on the day before and three and seven days after the intervention showed decreased pain intensity in the frankincense ointment 2% group ($P < 0.001$) (17).

5.2.3. Pistacia atlantica

Pistacia atlantica is an oleoresin that is obtained by scratching the trunk of a tree with the same name. The antimicrobial, antioxidant, antifungal and antiviral properties of flavonoids, glycosides, terpenoids and phenols

in this plant make it effective in wound healing. Its ointment is also used to treat wounds, swelling, cracked lips and anal fissures. A clinical trial investigating the effect of 1 g of *Pistacia atlantica* ointment 29% on the severity of pain using a VAS and fissure severity scale found the ointment more effective than breast milk in decreasing the pain and severity of nipple fissures in 100 breastfeeding women with nipple fissures on the third and seventh days postpartum (16).

5.2.4. Ziziphus jujuba

As a fruit and a species belonging to the Rhamnaceae family, jujube or *Ziziphus jujuba* is used to treat wounds and burns. This fruit is described as the fruit of life. Ancient Chinese discovered the unique medicinal properties of this fruit thousands of years ago (34, 35). Fatty acids, beta-carotene, alpha-tocopherol, phenolic compounds, vitamins A, E and C, tannins, cyclopeptides, caffeic acid and flavonoids in this fruit cause its anti-inflammatory, antiviral, antifungal and antibacterial properties and accelerates wound healing by affecting collagen formation and tissue epithelialization (36-38). A clinical trial on the effect of *Ziziphus jujuba* on nipple fissures in 100 breastfeeding mothers reported significant reductions in the severity of pain and nipple fissures on days 3, 7 and 14 in an intervention group receiving the ethanolic lotion 60% of *Ziziphus jujuba* fruit compared to in the other one receiving breast milk. Nipple fissure and pain were respectively measured using a VAS and Amir scale (22).

Table 2. Main Characteristics of the Included Studies

Authors / Year	Design	Sample Size	herbal Ingredient/ Dosage	Control Group	Measurement Tools	Findings
Niazi et al. (2019) (21)	Clinical trial	86	Purslane ointment %2 /thrice a day/7 days	lanolin ointment/ thrice a day/7 days	Storr	Significant decreases in fissure severity on days 3 and 8 ($P < 0.001$); Accelerated healing of fissures in the purslane group compared to in the lanolin group ($P < 0.001$)
Mobaraki et al. (2019) (17)	Triple-blind randomized clinical trial	68	Frankincense ointment 2%/twice a day/7 days	Lanolin ointment/twice a day/7 days	VAS* and Storr	On the 3rd day, the pain was less severe in the frankincense group than in the lanolin group ($P < 0.001$); On the 7th day, no statistically-significant differences were observed ($P = 0.40$).
Niazi et al. (2017) (14)	Randomized clinical trial	86	Purslane ointment extract %2/thrice a day/7 days	Lanolin ointment/ thrice a day/7 days	VAS	Pain severity was lower in the purslane intervention group on the 3rd and 8th days ($P < 0.001$).
Niazi et al. (2018) (20)	Randomized clinical trial	86	Purslane ointment extract %2/thrice a day/7 days	Lanolin ointment thrice a day/7 days	BSES**	Improvement was faster in the purslane group and the self-efficacy score significantly increased in both groups ($P < 0.001$); The self-efficacy score was higher in the purslane group than in the lanolin group
As'adi et al. (2017) (16)	Clinical trial	100	One g of <i>Pistacia atlantica</i> ointment %29/thrice a day/1 month	Breast milk/thrice a day/1 month	VAS and Storr and Storr	Reduced fissures severity by 83% and pain intensity by 85% in the intervention group compared to in the controls ($P < 0.001$).
Shahrahmani et al. (2016) (22)	Clinical trial	100	Ethanollic extract of <i>Ziziphus jujuba</i> lotion (60%)/0.5 ml five times a day/14 days	Breast milk/5 times a day/ 14 days	VAS, Amir and measurement of nipple discharge	A significant difference was observed between the two groups in the extent of nipple damage before intervention on the 3 days after childbirth and after intervention on the 7th and 14th days after childbirth ($P = 0.02$, $P = 0.000$); No significant differences in nipple discharge between the two groups on the 7th day ($P = 0.1$); Nipple discharge was significantly and statistically lower in the jujube fruit lotion group on the 14th day ($P = 0.01$).
Eshghizadeh et al. (2017) (12)	randomized clinical trial	90	The first group applied olive oil %100; the second <i>Aloe vera</i> extract %100/thrice a day/7 days	3 - 4 drops of breast milk/ thrice a day/ 7 days	VAS and Storr	In the <i>Aloe vera</i> group, severity of fissures and pain was the lowest ($P = 0.001$); No differences between olive oil and breast milk ($P = 72.02$).
Shinizadeh et al. (2015) (15)	Randomized clinical trial	88	Curcumin hydro alcoholic extract %5/twice daily/7 days	Leaving a drop of breast milk /twice daily/7 days	Storr	On day 3, the fissure score in the curcumin group was lower than that in the breast milk group ($P = 0.001$); On day 7, no significant differences were observed in the mean score of fissures between the two groups ($P > 0.05$).
Tafazoli et al. (2010) (23)	Randomized clinical trial	100	<i>Aloe vera</i> gel twice daily/7 days	Lanolin/twice daily/7 days	Storr	The fissure severity score was lower on the 3rd ($P = 0.048$) and 7th ($P = 0.003$) days in the <i>Aloe vera</i> group.
Alamolhoda et al. (2014) (24)	Clinical trial	110	<i>Aloe vera</i> gel 75 mL/twice daily/14 days	Breast milk/twice daily/14 days	VAS and AMIR	Severity of fissures and pain was significantly lower in the <i>Aloe vera</i> gel group on days 10 and 14 postpartum ($P < 0.001$); Nipple discharge was significantly lower in the <i>Aloe vera</i> group on days 10 and 14 postpartum ($P < 0.001$).

Abbreviations: VAS, Visual Analogue Scale; BSES, Breastfeeding Self-Efficacy Scale.

Table 3. Scientific Name and Properties of the Plants Used in This Study

Plant	Scientific Name	Properties
Pursley	<i>Portulaca oleracea</i>	Anti-inflammatory, analgesic, antiseptic, antifungal, bacteriostatic, antiviral and wound healing
Frankincense	<i>Boswellia sacra</i>	Antimicrobial, antifungal, anti-inflammatory and effective in wound healing
Saqez	<i>Pistacia atlantica</i>	Antioxidant, antimicrobial and antifungal
Jujube	<i>Ziziphus jujuba</i>	Anti-inflammatory, anti-allergy, antiseptic, antiviral, antioxidant, antibacterial and antifungal
Olive	<i>Olea europaea</i>	Antiviral, antimicrobial, antibacterial, antifungal, antioxidant and effective in wound healing
Aloe vera	<i>Aloe vera</i>	Antiviral, antibacterial, antifungal, anti-inflammatory, antioxidant, antiseptic and effective in wound healing
Turmeric	<i>Curcuma longa</i>	Antiviral, antibacterial, anti-inflammatory, antioxidant, analgesic and effective in wound healing

5.2.5. Olive Oil

Olive belongs to the Oleaceae family and its oil has been recommended in traditional Iranian medicine for wound healing owing to its analgesic and anti-inflammatory properties (39). The constituents of olive oil include oleuropein with anti-oxidant and anti-inflammatory properties (40), polyphenol containing free radical scavengers with cell repair properties (39) and oleocanthal and oleuropein with prostaglandins effects on improving nipple fissures (41), episiotomy wounds (39), surgical wounds (42) and burns (43). A quasi-experimental study assigning 116 breastfeeding mothers with nipple trauma to two groups of olive oil intervention and routine treatment control reported significantly faster improvements in nipple trauma in the intervention group. The trauma was examined before and 7 and 14 days after the intervention ($P < 0.001$) (43).

5.2.6. Aloe vera

Aloe vera has anti-inflammatory, anti-viral, antibacterial, antifungal and moisturizing properties. Salicylic acid inhibiting the formation of bradykinin and histamine and oxidation of arachidonic acid inhibiting prostaglandin synthesis explain the anti-inflammatory effects of this plant (44). Glucomannan can contribute to the restorative properties of *Aloe vera* by increasing collagen synthesis through stimulating fibroblasts. Research suggests the anti-inflammatory and analgesic effects of *Aloe vera* on nipple fissures (45, 46), episiotomy wounds (47) and bedsores (48). A randomized clinical trial assigning 90 breastfeeding women to three groups, i.e., *Aloe vera* extract 100% plus breast milk, only olive oil 100% and only breast milk, evaluated the severity of fissures and pain before and 3 and 7 days after the intervention and reported the reduced severity of fissures in the group receiving *Aloe vera* plus breast milk ($P < 0.001$) (12). A clinical trial assigning 100 breastfeeding women with nipple fissures to an *Aloe vera* intervention group and a lanolin control group and evaluating the fissure severity using the

Storr scale before and 3 and 7 days after the intervention reported statistically-significant differences between the two groups in the mean score of fissure severity on the third ($P = 0.048$) and seventh ($P = 0.003$) days. *Aloe vera* was therefore found more effective than lanolin ointment in improving nipple fissures (23). A clinical trial assigning 110 breastfeeding women to two groups receiving *Aloe vera* gel or breast milk reported significant differences in the severity of fissures and pain between the two groups on the 10th and 14th days postpartum ($P < 0.001$). *Aloe vera* was therefore found more effective than placebo (breast milk) in improving nipple fissures and pain severity (24).

5.2.7. Turmeric

Turmeric (*Curcuma*) is an old medicinal plant in the ginger family with curcumin as its active ingredient. This plant has anti-inflammatory, analgesic, antibacterial, antifungal and antioxidant properties and a long history of application in traditional Asian medicine for treating skin diseases and wounds (49). This plant is also effective in the fast regeneration of the epithelium and increasing the proliferation of fibroblasts by participating in tissue regeneration and granular tissue formation and increasing collagen deposition and vascular thickness. A clinical trial examining 88 breastfeeding women with nipple fissures in two groups receiving the hydro-alcoholic extract of curcumin (5%) or breast milk reported insignificant differences between the two groups in terms of the severity of fissures before the intervention ($P = 0.001$) and on the third and seventh days after the intervention ($P < 0.05$). Insignificant differences were therefore observed between the curcumin extract and breast milk in terms of their effects on nipple fissures (15).

6. Discussion

This systematic review was conducted to investigate the effects of medicinal plants on the treatment of nipple

fissure. Reviewing the results of the articles showed the effectiveness of plants such as *Aloe vera*, olive oil (12), *Ziziphus jujuba* (22), purslane (14), *Pistacia atlantica* (16) and frankincense (17) in treating nipple fissures.

A systematic review of 11 articles by As'adi and Kari-man on the effects of medicinal plants on nipple trauma and pain investigated certain herbal compounds, including *Pistacia atlantica*, *Ziziphus jujuba*, turmeric, *Aloe vera*, peppermint extract, menthol and calendite-E cream. Given compounds such as flavonoids and terpenoids in these plants and their anti-inflammatory and antimicrobial effects on skin collagen, they recommended these herbal medicines coupled with medical treatments for solving numerous breastfeeding problems and improving damaged nipples (50).

A systematic review by Niazi et al. reported hydrogel and lanolin, phototherapy (LED), low-dose laser therapy, silver cap, polyethylene, tea bag compress, hot water compress, calendula and seaweed, *Ziziphus jujuba*, *Aloe vera* and guaiazulene to be used to prevent and treat nipple fissures and pain. They concluded that properly teaching breastfeeding techniques to mothers is more effective than the other interventions and recommended further studies for finding effective treatments for nipple fissures (10).

A systematic review on comparing the effects of *Aloe vera*, breast milk, calendite-E, curcumin, lanolin, olive oil and purslane on nipple fissures analyzed six studies with a sample size of 546. The results showed the beneficial effects of these herbal compounds on nipple fissures, and these medications were recommended for healing nipple fissures given their cost effectiveness and limited side effects (51).

Page et al. reviewed clinical trials that aimed at evaluating different methods of treating nipple lesions such as using hot water compress versus breast milk, correctly teaching breastfeeding to mothers versus using lanolin ointment, utilizing aerosol spray, dressings versus no treatment, hydrogel dressing versus lanolin, collagenase versus dexpanthenol, hot water and soap and breast protection and lanolin versus glycerin gel. This review recommended hot water compress and breast milk for preventing nipple fissures, hot water compress for reducing pain and frequent breastfeeding for shortening fissures. Hydrogel dressing with a high prevalence of infection was not recommended, whereas hot water compress was more effective than hydrogel in reducing nipple pain (52).

A systematic review was conducted to provide appropriate solutions for treating and preventing nipple pain in breastfeeding mothers. The included articles investigated the effects of different treatments on nipple fissures such as hot water compress, tea bag compress, topical heat, expressed milk, lanolin, vitamin A, hydrogel, glycerin gel

therapy and teaching correct breastfeeding positions. According to the results, none of the treatment modalities were superior to the others in terms of relieving nipple discomfort and teaching correct breastfeeding techniques was the most effective method in reducing the incidence of nipple pain (7).

A study entitled "The effect of peppermint on the treatment of nipple fissure during breastfeeding: A systematic review" by Bolourian et al. (2020) examined six relevant articles. They reported insignificant differences between lanolin, mint and dexpanthenol in terms of their therapeutic effects on the damaged nipples. Significant differences were observed between the three intervention groups, i.e., mint tea bag, mint cream and breast milk, in terms of treating nipple fissures. Positive effects of mint on treating nipple fissures were also confirmed (53).

All the systematic reviews, including the present study, conducted on the effects of herbal compounds and other interventions on preventing and treating nipple fissures have failed to introduce an effective and definitive compound for treating nipple fissures. Commenting on this subject is therefore impossible based on existing studies.

Failing to perform a meta-analysis was the main limitation of the present systematic review given the diversity of the methods and doses of the compounds and their daily frequency of usage as well as the number of follow-up days. It is recommended that this study be repeated in the future to investigate the feasibility of a meta-analysis on the effects of herbal compounds on nipple fissures.

6.1. Conclusions

The results of the present systematic review showed the confirmed healing effects of different herbal products on wounds and nipple fissures. Given the key role of nipple fissures in the early cessation of breastfeeding in mothers and the cost effectiveness and simplicity of preparing medicinal plants and their accessibility, these herbal products are recommended for treating nipple fissures in breastfeeding women.

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Footnotes

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