

Ginger Essence Effect on Nausea and Vomiting After Open and Laparoscopic Nephrectomies

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Background: Some studies reported that ginger was effective in prevention or treatment of post-surgical nausea and vomiting; however, there are controversies. In addition, no study compared the effects of ginger on nausea and vomiting after open and laparoscopic nephrectomies.

Objectives: The current study aimed to compare the effect of ginger essence on nausea and vomiting after open versus laparoscopic nephrectomies.

Patients and Methods: A randomized, placebo trial was conducted on two groups of patients, 50 open and 50 laparoscopic nephrectomy. Half of the subjects in each group received ginger essence and the other half received placebo. Using a visual analogue scale the severity of nausea was assessed every 15 minutes for the first two post-operative hours and the sixth hour. Frequency of vomiting was counted until the sixth hour. The placebo subgroups were treated similarly. Descriptive statistics were employed. Chi-square and Fisher's exact tests, paired and independent samples t-test and repeated measure analysis of variance were used to analyze the data.

Results: Repeated measure analysis of variance showed that the type of surgery and the type of intervention as factors had significant effects on the nausea severity scores in the nine successive measurements ($P < 0.001$). In the first two post-operative hours, the mean vomiting episodes was 2.92 ± 0.70 in the subjects who underwent open surgery and received placebo while it was 0.16 ± 0.37 in patients with the same surgery but receiving ginger essence ($P = 0.001$). The mean vomiting episodes was 6.0 ± 1.33 in the subjects who underwent laparoscopic surgery and received placebo while it was 1.39 ± 0.78 in patients with the same surgery but receiving ginger essence ($P = 0.001$).

Conclusions: Using ginger essence was effective in reducing nausea and vomiting not only in the subjects who underwent open nephrectomy but also in the subjects of laparoscopic nephrectomy. Using ginger essence is suggested as a complementary remedy to prevent and treat post-operative nausea and vomiting in patients with nephrectomy.

Keywords: Ginger; Laparoscopy; Nausea; Nephrectomy; Surgery; Vomiting

1. Background

Nausea and vomiting are the second most common post-operative complications. The incidence of these complications are about 20% - 30% (1). Post-operative nausea and vomiting (PONV) is not only discomforting, but also may result in serious aftermaths such as dehydration, electrolyte disturbances, aspiration, surgical sutures dehiscence, esophageal rupture, subcutaneous emphysema and pneumothorax that in turn would delay patient's recovery and hospital discharge (1). PONV is especially more prevalent after laparoscopic surgeries and 40% to 70% of the patients experience it (2). Therefore, it is necessary to take appropriate measures to prevent and treat the complications (2). Regional anesthesia, some special anesthetic agents such as propofol, and antiemetic drugs are commonly used to prevent PONV (2). Side effects of the drugs used for PONV are also a problem. Metoclopramide and droperidol may result in drowsi-

ness and extra pyramidal symptoms. Moreover, metoclopramide may cause headache and diarrhea. Ondansetron is also associated with headache, diarrhea, and transient increase in hepatic transaminase level (3). To prevent or decrease such side effects, alternative remedies might be used instead of these medications. Ginger is a herb (4, 5) native to Southeast Asia and is now cultivated in all tropical and subtropical regions (6). Ginger is effective to treat nausea and vomiting and no significant side effects are reported on it (6). Ginger has a swollen underground rhizome, which contains some active ingredients such as 6-shogaol and galanolacton that block serotonin receptors. Galanolacton also inserts an antiemetic effect through a competitive antagonist effect on HT5 receptors in the ileum (7). Some studies demonstrated the positive effect of ginger products on the treatment of nausea and vomiting (8). Ozgoli et al. (9) and Saberi et al. (10)

reported that ginger capsule decreased the intensity of pregnancy-induced nausea and vomiting (PINV). A recent study also compared the effect of ginger and vitamin B6 on the treatment of PINV, and reported that ginger capsule was more effective than vitamin B6 (11). Moreover, Ebrahimi et al. (12) and Ghanbari et al. (13) have reported that ginger reduced chemotherapy induced nausea and vomiting. Apariman et al. (14) also reported that ginger was effective in prevention of nausea and vomiting after gynecological laparoscopy. Also, Montazeri showed that ginger was effective in reducing nausea and vomiting after orthopedic, abdominal, urinary, reproductive, and eye, nose and throat surgeries (15). However, Eberhart et al. (16), and Vousooghian and Amini (17) reported that ginger was effective in preventing or treating PONV neither after laparoscopic nor after open gynecological surgeries. Modares et al. (18) also compared the antiemetic effects of ginger and chamomile capsules on pregnancy induced nausea and vomiting and reported that chamomile was more effective than ginger. Almost all previous studies used ginger capsules. The only study that examined the effect of ginger essential oil on post-operative nausea reported that ginger essence was more effective in reducing nausea after gynecological and gastrointestinal surgeries than isopropyl alcohol and normal saline (19).

2. Objectives

Given the high prevalence of PONV and the side effects of medicinal treatments, and considering the controversies on the effect of ginger on PONV, and also due to the fact that patients are usually not permitted to eat by mouth in the early post-operative hours; the current study aimed to compare the effect of ginger essential oil on nausea and vomiting after open versus laparoscopic nephrectomies.

3. Patients and Methods

This randomized, placebo-controlled, clinical trial was conducted on 100 nephrectomy patients; 50 open and 50 laparoscopic nephrectomy. The study was conducted from April to October 2014. Inclusion criteria were age 18 years old and above, ability to read and write in Farsi language, no recognized olfactory, hearing and balance problems, and no history of asthma, allergy, respiratory diseases and motion sickness, Nil Per Os (NPO) for at least eight hours, being at class II of American Society of Anesthesiologists, receiving no chemotherapeutic agent, aspirin, anticoagulants and calcium channel blockers in the last 48 hours, receiving no antiemetic drug in the last 24 hours, having no addiction to alcohol or other substances and having no sensitivity to ginger. Exclusion criteria were deciding to withdraw from the study, developing any allergic reactions or intolerance to ginger, and also developing acute hemodynamic instability during the study. Eligible subjects were recruited sequentially and then randomly assigned to two groups; therefore half of the subjects in each type of surgery received ginger

essence and the other half received placebo. To prevent the probable exposure of the subjects in the placebo group to ginger aroma, an alternation method was used to randomly assign patients to either the ginger essence or the placebo group. Therefore, the first day of the study was randomly assigned to the ginger essence through a coin-tossing method. Then, the following days were assigned to the placebo or the ginger essence alternately. Therefore, there were four subgroups of subjects (i.e. open surgery + ginger essence; laparoscopy + ginger essence; open surgery + placebo; laparoscopy + placebo). When the number of required subjects in each subgroup was completed, sampling was continued till the other subgroups reached the predetermined size (Figure 1). The sample size was calculated based on a previous study (18), in which 34% of the intervention group and 61% of the control group experienced PONV. Therefore, it was estimated that each group needed 50 subjects with a type one error of 0.05 and a power of 0.80. The severity of nausea was assessed using a Visual Analogue Scale (VAS). It consisted of a 10 cm column with descriptors at each end (10 = the most severe nausea experienced; 0 = the absence of nausea). Subjects were asked to mark an X on the place that corresponded with the severity of nausea they experienced. In the case of vomiting, frequency of vomiting was counted until the sixth post-operative hour. After surgery, subjects were transferred to the recovery room. In the open and laparoscopic nephrectomy subjects allocated to receive ginger essence, two drops of ginger essence (purchased from Zardband Pharmaceutical Co. Tehran, Iran) were applied on 5 × 5 cm gauze and attached to the collar of the patients' gown. Additional drops of ginger essence were then reapplied every 30 minutes for two subsequent hours. The severity of nausea was assessed every 15 minutes for the first two post-operative hours and also at the end of the sixth post-operative hour. The frequency of true vomiting was also calculated during the first two post-operation hours and also till the next four hours. The two placebo subgroups were treated similarly except that normal saline was used instead of ginger essence. If any of the patients had moderate to severe nausea and vomiting, it was reported to the attending physician and, if prescribed, antiemetic medication was used and the name, dose, and frequency of administration were recorded. All subjects were anesthetized using the same anesthesia protocol (i.e. the anesthesia was induced using fentanyl (1 µ/kg) and midazolam (2 mg) and then was continued through isoflurane 1% and thiopental sodium (4 mg/kg). The anesthesia procedure and the medication used were precisely documented for all subjects.

3.1. Ethical Considerations

The study was approved by the Institutional Review Board and Research Ethics Committee of Kashan University of Medical Sciences. Permissions were also obtained from the authorities in the Labbafinejad Hospital, Teh-

ran, Iran. All of the participants were briefed on the study aims without specifying the exact type of intervention they may receive. They also were assured of the confidentiality of their personal information and all of them signed a written informed consent before participation.

3.2. Data Analysis

Data analysis was performed using SPSS software version 11.5. Descriptive statistics (i.e. mean, standard deviation, frequency, and percentage) were calculated. Chi-square and Fisher's exact tests were used to compare the data in terms of nominal and categorical variables such as gender and type of nephrectomy. Paired t-test was used for within group comparisons of the quantitative variables. Independent samples t-test was used to compare the mean of physiological parameters, medications used, and vomiting episodes in the two groups. Repeated measure analysis of variance was used to evaluate the effect of the intervention on nausea in the nine subsequent measurements. P value < 0.05 was considered as significant.

4. Results

Totally, 100 subjects including 65 males and 35 females participated in the study. Fifty percent of subjects who underwent each type of surgery received ginger essence while the others received normal saline. No significant

differences were observed between the patients' demographics neither in terms of the type of surgery nor in terms of the type of intervention (i.e. receiving ginger essence or normal saline) (Table 1). Moreover, no significant differences were observed between the patients' physiological and pharmacological parameters neither in terms of the type of surgery nor in terms of the type of intervention except that the amount of ondansetron received, which was significantly higher in the patients who received placebo in both types of the surgeries (Table 2). The repeated measure analysis of variance showed that the type of surgery and the type of intervention as factors had significant effects on the nausea severity scores in the nine successive measurements ($P < 0.001$) (Figure 2). In the first two post-operative hours, the mean vomiting episodes was 2.92 ± 0.70 in the subjects who underwent open surgery and received placebo; while it was 0.16 ± 0.37 in the subjects with the same surgery type but receiving ginger essence ($P = 0.001$). At the same time, the mean vomiting episodes was 6.0 ± 1.33 in the subjects who underwent laparoscopic surgery and received placebo while it was 1.39 ± 0.78 in the subjects with the same surgery but received ginger essence ($P = 0.001$). Although the mean vomiting episodes significantly decreased in all the groups in the next four post-operative hours, the mean decreases were significantly evident in the subjects who received ginger essence ($P < 0.001$) (Table 3).

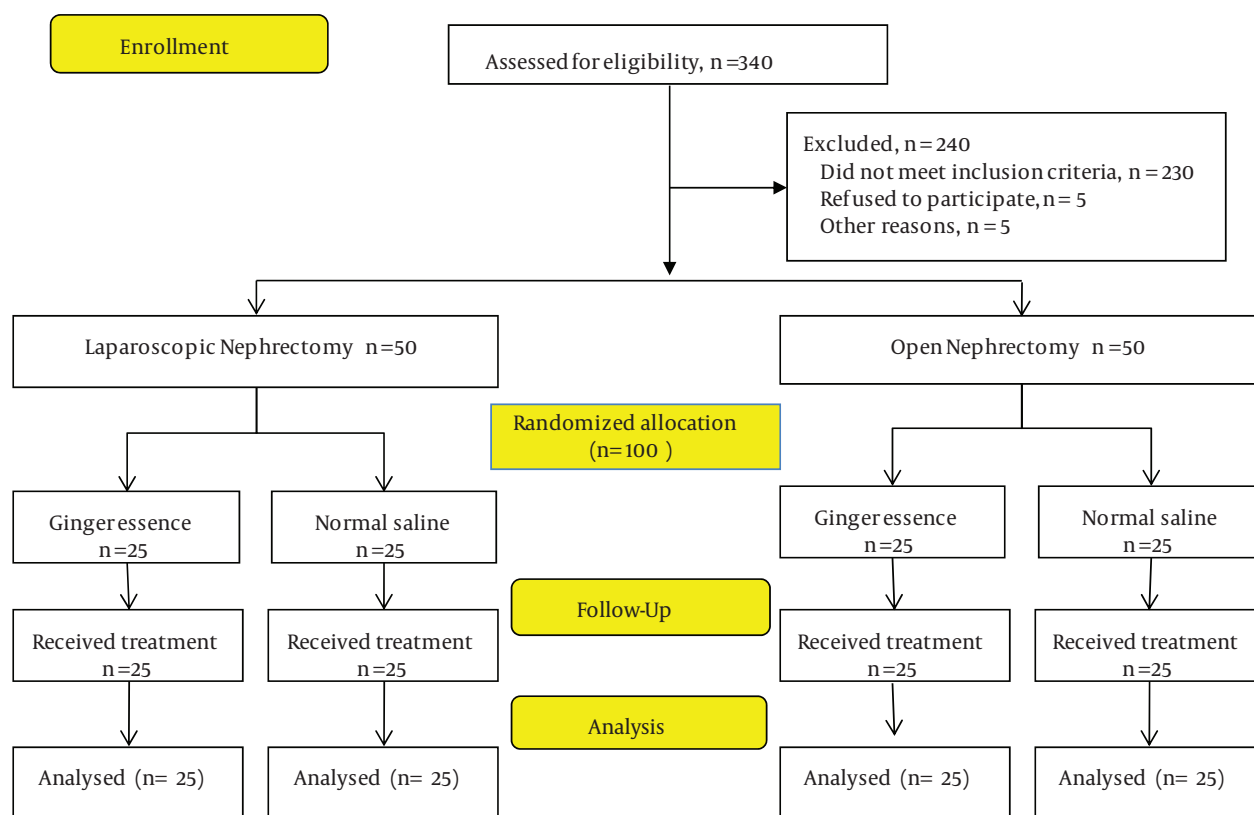


Figure 1. Consort Flow Diagram

Table 1. Demographic Characteristics of the Study Participants (n=50)^a

Variables	Open Nephrectomy			Laparoscopic Nephrectomy		
	Normal Saline	Ginger Essence	P value ^b	Normal Saline	Ginger Essence	P Value ^b
Gender			0.15			0.34
Female	13 (52)	8 (32)		5 (20)	9 (36)	
Male	12 (48)	17 (68)		20 (80)	16 (46)	
Marital status			0.7			0.46
Single	6 (24)	7 (28)		6 (24)	3 (12)	
Married	19 (76)	18 (72)		19 (76)	22 (88)	
Education level			0.06			0.74
Primary school	14 (56)	20 (80)		6 (24)	7 (28)	
Secondary school and higher	11 (44)	5 (20)		19 (76)	18 (72)	
Employment			0.05			0.77
Jobless	15 (60)	22 (88)		13 (52)	12 (48)	
Employed	10 (40)	3 (12)		12 (48)	13 (52)	
Reason for nephrectomy			> 0.99			0.72
Donation	0	0		16 (64)	13 (52)	
Tumor	19 (76)	19 (76)		6 (24)	9 (36)	
Non-functional kidney	6 (24)	6 (24)		3 (12)	3 (12)	

^a Data are presented as No. (%).

^b Chi-square test.

Table 2. The Mean and Standard Deviation of Physiological and Pharmacological Parameters in the Intervention and the Placebo Groups^a

Variables	Open Nephrectomy			Laparoscopic Nephrectomy		
	Normal Saline	Ginger Essence	P Value	Normal Saline	Ginger Essence	P Value
Age, y	53.24 ± 15.41	57.2 ± 14.83	0.35	34.37 ± 14.15	41.22 ± 14.7	0.1
Body mass index, kg/m²	25.35 ± 5.26	25.42 ± 4.24	0.95	25.61 ± 4.28	25.66 ± 3.73	0.96
Systolic blood pressure, mmHg	139.64 ± 21.16	130.20 ± 21.14	0.12	138.03 ± 18.87	131.30 ± 14.17	0.16
Diastolic blood pressure, mmHg	80.56 ± 17.83	72.36 ± 20.93	0.14	76.92 ± 20.75	78.21 ± 21.71	0.78
Heart rate, per min.	80.16 ± 9.20	81.96 ± 9.88	0.5	81.26 ± 6.71	81.70 ± 7.95	0.83
Respiratory rate, per min	14.49 ± 4.69	13.32 ± 1.28	0.23	13.93 ± 1.70	13.87 ± 1.66	0.9
Body temperature, °C	36.18 ± 3.79	36.90 ± 0.22	0.35	36.91 ± 0.32	39.1 ± 0.34	0.28
Times anesthesia, h	3.96 ± 0.67	3.07 ± 0.63	0.56	3.99 ± 0.88	3.75 ± 0.86	0.34
Fluid intake on operative room, mL	3400 ± 1645.70	2980 ± 1065.36	0.28	3870.37 ± 986.37	3717.39 ± 986.57	0.57
Fluid intake on recovery room, mL	524 ± 250.46	456 ± 104.40	0.21	537.04 ± 237.2	565.22 ± 228.84	0.67
Medication received						
Oxygen, L/min	4.96 ± 1.27	4.72 ± 1.33	0.51	4.96 ± 1.37	4.69 ± 1.10	0.45
Isofluran	0.94 ± 0.12	0.91 ± 0.04	0.11	0.92 ± 0.24	1.0 ± 0.001	0.13
Thiopental sodium, mg	252 ± 106.53	290.80 ± 80.04	0.15	305.56 ± 69.79	319.57 ± 41.93	0.4
Fentanyl, µ/kg	2.46 ± 1.13	2.08 ± 0.27	0.11	2.19 ± 1.07	2.30 ± 0.7	0.65
Midazolam, mg	1.38 ± 0.36	1.36 ± 0.56	0.9	1.48 ± 0.84	1.39 ± 0.49	0.65
Ondansetron, mg	2.38 ± 0.77	0 ± 0	< 0.001	4.74 ± 1.76	2.0 ± 0.81	< 0.001

^a Data are presented as mean ± SD.

Table 3. The Mean and Standard Deviation of Vomiting Episodes in the Two and Four Post-operative Hours in the Study Groups^a

Numbers of vomiting episodes	Laparoscopic Nephrectomy			Open Nephrectomy		
	Ginger Essence	Normal Saline	P value ^b	Ginger Essence	Normal Saline	P value ^b
In the recovery room	1.39 ± 0.78	6.0 ± 1.33	< 0.001	0.16 ± 0.37	2.92 ± 0.70	< 0.001
Third hour till the end of sixth hour	0.26 ± 0.44	3.22 ± 1.05	< 0.001	0 ± 0	1.40 ± 0.64	< 0.001
P Value	< 0.001	< 0.001	-	< 0.001	< 0.001	-

^a Data are presented as Mean ± SD.

^b Independent Samples Test.

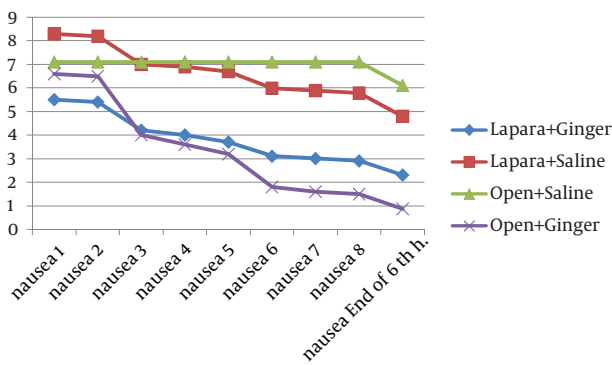


Figure 2. The Changes in Nausea Mean Scores in Nine Successive Measurements in the Study Subgroups

5. Discussion

The current study compared the effects of inhaling the ginger essence on PONV after laparoscopic and open nephrectomy surgeries. Results of the present study showed that in comparison with the placebo, ginger essence could effectively reduce the mean nausea severity in patients who underwent either open or laparoscopic nephrectomy. Moreover, the mean post-operative vomiting episodes were significantly lower in the subjects who received ginger essence than in the ones who received normal saline as placebo. The beneficial effect of ginger essence on PONV was also visible in the amount of antiemetic medication used for the participants; so that, the mean dose of ondansetron used was significantly lower in the subjects who received ginger essence than ones who did not. In addition, the beneficial effect of ginger was considerably visible in the subjects with open nephrectomy. Thus, the severity of vomiting was more in the subjects who underwent laparoscopic nephrectomy with placebo than in the other groups. Then, the dose of antiemetic medication used in this group (i.e. laparoscopic nephrectomy with placebo) was considerably more than the other groups. Results of the present study were consistent with some of the previous studies. Vousooghian et al. (17) investigated the effect of ginger on nausea and vomiting after gynecological surgeries and confirmed that ginger was significantly effective on reducing post-operative nausea though it could not significantly affect post-surgical vomiting (17). Phillips et al. (20) also compared the antiemetic effects of ginger and metoclopramide in females who underwent day case surgeries. They reported that ginger was as effective as metoclopramide in reducing PONV. Moreover, the amount of antiemetic medication used was significantly lower in the group who received ginger. A recent meta-analysis also confirmed the beneficial effects of ginger on prevention of PONV either in open or laparoscopic surgeries (21). In contrast to the current study results, Montazeri et al. (15) reported that though ginger could

reduce the nausea in the first two post-operative hours, this effect significantly diminished afterwards. Moreover, ginger showed no effect on post-operative vomiting in comparison with the control group. Similarly, Apariman et al. (14) reported that ginger exerts its antiemetic effects mostly in the first two hours after surgery and its effects on PONV would reduce afterwards. This phenomenon was attributed to the fact that patients are usually transported out of the recovery room approximately after two hours. The resultant movements may stimulate the mechanism of nausea and vomiting. Therefore, antiemetic effects of ginger may be reduced at this time. Eberhart et al. (16) and Morin et al. (22) conducted two reviews on the effect of ginger on prevention and treatment of PONV and concluded that ginger has no positive effect on prevention or treatment of PONV. Eberhart et al. (16) also reported the same finding after reviewing the studies that have been used ginger to prevent PONV in laparoscopic gynecological surgeries. However, they attributed this finding to the low dose of the ginger used in the reviewed studies (16). On the other hand, Arfeen et al. (23) and Visalyaputra et al. (24) reported that increasing the dose of ginger resulted in a slight increase in the severity of nausea after laparoscopic surgeries. The inconsistencies in the studies may not only be attributed to the amount and the frequency of the ginger used, but also to the type of the surgeries that ginger was administered in. As was the case in the present study, ginger may be more effective if can be used through inhalation (i.e. the ginger essence). In addition, it seems that it would be more effective if used as small frequent doses and this type of application was simply possible when its essence was used. Perhaps, the frequent use of the ginger essence in the present study helped the dosage of the remedy reach its therapeutic effect. On the other hand, as it was evident in the present study, ginger essence was more effective in the subjects who underwent open surgeries than the ones who tolerated a laparoscopic surgery. Perhaps the CO₂ used in laparoscopic surgeries and the upward displacement of diaphragm in such operations would delay the elimination of the anesthetics through respiration, then PONV decreased more slightly in such subjects. In conclusion, the present study showed that using ginger essence was effective in reducing nausea and vomiting not only in patient who underwent open nephrectomy, but also in the ones who underwent laparoscopic nephrectomy. However, it seems that the therapeutic effects of ginger start with a delay of about 30 minutes. Due to the effectiveness of the intervention in the current study, using ginger essence is suggested as a complementary remedy to prevent and treat PONV in patients with nephrectomy. However, the current study was conducted on a small sample size and therefore further studies with larger sample sizes are suggested. It is also recommend replicating the same study in patients with cluster and diaphragmatic breathing patterns. Moreover, since ginger essence is an aromatic material,

blinding the patients and the evaluators was not possible in the current study and it was a limitation that should be reminded.

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Authors' Contributions

Mohsen Adib-Hajbaghery is responsible for the study conception, design, data analysis, supervision of the study and preparation of the manuscript. Fatemeh Sadat Hosseini participated in the study conception and performed data collection.

References

- Nanthakom T, Pongrojpan D. The efficacy of ginger in prevention of postoperative nausea and vomiting after major gynecologic surgery. *J Med Assoc Thai*. 2006;**89** Suppl 4:S130-6.
- Apfel CC, Korttila K, Abdalla M, Kerger H, Turan A, Vedder I, et al. A factorial trial of six interventions for the prevention of postoperative nausea and vomiting. *N Engl J Med*. 2004;**350**(24):2441-51.
- Katzung BG, Masters SB, Terevor AJ. *Basic and Clinical Pharmacology*. Michigan: Lange Medical Books McGraw Hill; 2009.
- Carpenito Moyet LJ. *Nursing diagnosis: Application to clinical practice*. 8th ed, USA: Lippincott; 2000.
- Evans AT. *Manual of obstetrics*. USA: Lippincott: Williams & Wilkins; 2000.
- Vutyavanich T, Kraissarin T, Ruangsri R. Ginger for nausea and vomiting in pregnancy: randomized, double-masked, placebo-controlled trial. *Obstet Gynecol*. 2001;**97**(4):577-82.
- Sontakke S, Thawani V, Naik MS. Ginger as an antiemetic in nausea and vomiting induced by chemotherapy: a randomized, cross-over, double blind study. *Indian J Pharmacol*. 2003;**35**(1):32-6.
- Abolghasemi S, Razmjo N, Moalem A, Esmaele H. [Effect of ginger on nausea and vomiting in pregnancy.] *J Babol Univ Med Sci*. 2005;**6**(3):17-20.
- Ozgoli G, Goli M, Simbar M. Effects of ginger capsules on pregnancy, nausea, and vomiting. *J Altern Complement Med*. 2009;**15**(3):243-6.
- Saberi F, Sadat Z, Abedzadeh-Kalahroudi M, Taebi M. Effect of ginger on relieving nausea and vomiting in pregnancy: a randomized, placebo-controlled trial. *Nurs Midwifery Stud*. 2014;**3**(1):e11841.
- Ensiyeh J, Sakineh MA. Comparing ginger and vitamin B6 for the treatment of nausea and vomiting in pregnancy: a randomized controlled trial. *Midwifery*. 2009;**25**(6):649-53.
- Ebrahimi SM, Parsa Yekta Z, Nikbakht-Nasrabadi A, Hosseini SM, Sedighi S. [Salehi-Surmaghi M-H. Ginger effects on control of chemotherapy induced nausea and vomiting.] *Tehran Univ Med J*. 2013;**71**(6):395-403.
- Ghanbari A, Montazeri A, Niknami M, Atrkar Roshan Z, Najafi B, Sobhani A. [Effect of adding ginger to routine treatment on the intensity of chemotherapy-induced nausea and vomiting in cancer patients who referred to Razi Hospital, Rasht.] *J Ardabil Univ Med Sci*. 2011;**10**(4):352-61.
- Apariman S, Ratchanon S, Wiriyasirivej B. Effectiveness of ginger for prevention of nausea and vomiting after gynecological laparoscopy. *J Med Assoc Thai*. 2006;**89**(12):2003-9.
- Montazeri AS. [Effect of ginger on postoperative nausea and vomiting.] *Knowl Health*. 2012;**7**(3):118-23.
- Eberhart LH, Mayer R, Betz O, Tsolakidis S, Hilpert W, Morin AM, et al. Ginger does not prevent postoperative nausea and vomiting after laparoscopic surgery. *Anesth Analg*. 2003;**96**(4):995-8.
- Voussooghian M, Amini H. [The effect of ginger on post-operative nausea and vomiting in non-fertile women affect gynecological surgery.] *J Iran Soc Anaesthesiol Intensive Care*. 2012;**34**(79):58-64.
- Modares M, Besharat S, Mahmoudi M. Effect of Ginger and Chamomile capsules on nausea and vomiting in pregnancy. *J Gorgan Univ Med Sci*. 2012;**14**(1):46-51.
- Hunt R, Dienemann J, Norton HJ, Hartley W, Hudgens A, Stern T, et al. Aromatherapy as treatment for postoperative nausea: a randomized trial. *Anesth Analg*. 2013;**117**(3):597-604.
- Phillips S, Ruggier R, Hutchinson S. Zingiber officinale (ginger)-an antiemetic for day case surgery. *Anaesthesia*. 1993;**48**(8):715-7.
- Yakunapruk N, Akorn N, Nathisuwan S, Leeprakoboon K, Leelasetagoon C. The efficacy of ginger for the prevention of post operative nausea and vomiting: A meta-Analysis. *Am J Obstet Gynecol*. 2006;**194**(95):405-10.
- Morin AM, Betz O, Kranke P, Geldner G, Wulf H, Eberhart LH. [Is ginger a relevant antiemetic for postoperative nausea and vomiting?]. *Anesthesiol Intensivmed Notfallmed Schmerzther*. 2004;**39**(5):281-5.
- Arfeen Z, Owen H, Plummer JL, Ilesley AH, Sorby-Adams RA, Doecke CJ. A double-blind randomized controlled trial of ginger for the prevention of postoperative nausea and vomiting. *Anaesth Intensive Care*. 1995;**23**(4):449-52.
- Visalyaputra S, Petchpaisit N, Somcharoen K, Choavaratana R. The efficacy of ginger root in the prevention of postoperative nausea and vomiting after outpatient gynaecological laparoscopy. *Anaesthesia*. 1998;**53**(5):506-10.