Effects of Date fruit (Phoenix Dactylifera) on Bishop Score and Frequency of Caesarean Section: A Systematic Review and Meta-Analysis

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Abstract

Background: The rate of cesarean section is increasing in the world with different drafts in various countries. This growth increases unpleasant outcomes of delivery. Recent studies explained benefits of date palm fruit on labor process improvement. Date fruit can be a factor to increase vaginal delivery and to reduce frequency of cesarean section to prevent its great complications. This systematic review has been designed to review clinical studies that investigate the effects of date palm fruit on labor outcomes (duration of labor stages, bishop score and frequency of cesarean section) compared with routine cares.

Methods: This study was performed in 2019. Required data has been gathered from electronic databases and manual searches. All randomized clinical trials evaluating the effects of date palm fruit on labor and delivery that have been published from January 2000 to August 2019 in English and Persian languages were included in this systematic review. The methodological quality of the included studies were evaluated according to the risk of bias assessment of Cochrane handbook of systematic reviews and were reported using Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement.

Results: Six studies were included in the qualitative and quantitative synthesis. Meta-Analysis showed that date fruit consumption significantly reduces active phase of labor (MD= -60.26, 95%CI (-107.18, -13.34), P=0.01) and significantly reduces duration of the first stage of labor (MD= -50.90, 95%CI (-100.63, -1.16), P=0.04) and significantly improves the bishop score (MD = 2.45, 95%CI (1.87, 3.04), P<0.00001) and it reduces the frequency of cesarean section but not significantly (Odds Ratio= 0.67, 95%CI (0.44, 1.02), P=0.06).

Conclusion: Date can reduce the duration of active phase and the first stage of labor and the rate of cesarean section and improves the bishop score, but due to from the low to moderate quality of the studies, it seems that the other studies are needed to prove these results better than this.

Key words : Date palm, date fruit, Phoenix dactylifera, delivery, labor, systematic review, meta-analysis.

1. Background

Delivery and its process

Since 1970 A.D, rate of cesarean section has increased in high income countries. However this rate in middle to low income countries increases with a specific rising draft [1, 2]. The growth of cesarean section rate increases unpleasant outcomes of delivery [3]. WHO (World Health Organization) has announced unnecessary the rate of cesarean section higher than 15% [3]. A few factors have led to the growth of cesarean section, such as: repeated cesarean, high maternal age in pregnancy, pregnancy with IVF (In vitro fertilization) or IUI (Intra uterine insemination), and pregnancy after recurrent abortions, desire of physicians to cesarean section and this belief that the prolapsed uterus and frequency don’t occur after cesarean section [4–8]. Abnormal progress of labor and ineffective contractions of uterus is the two common reasons of cesarean section [9, 10].

According to the WHO, normal birth is: “spontaneous in onset, low-risk at the start of labor and remaining so throughout labor and delivery. The infant is born spontaneously in the vertex position between 37 and 42 completed weeks of pregnancy” [11] There will be different methods for labor induction if the progress of labor is not appropriate that they are used alone or in combination together like the strip of membranes and the usage of prostaglandins or oxytocin. These methods accelerate labor progress and decrease cesarean section frequency [12]. Nevertheless a review study in Cochrane explained that the pregnant women are not satisfied about their labor because of the difficulties of labor [13]. Most recently, the researchers have been paying attention to removal of labor difficulties and following that reducing of cesarean section frequency [14, 15]. Pregnant women need energy during labor, so the amount of required energy for active phase of labor is 50 – 100 kcal (Kilo calories) [14, 15]. The drinking and eating are prohibited for pregnant women during labor in hospitals. It is important to know that it will lead to energy reducing and fatigue and lack of cooperation of pregnant women, and finally led to reducing the beneficial effects on mother and infant outcomes [10, 16, and 17]. Scheepers et al. showed that the consumption of carbohydrate during labor reduces the rate of augmented labor and decreases abnormal progress of labor [18].

Date and its role in the labor

Among the sugars that have been studied is the date palm fruit; it is known as the scientific name of Phoenix Dactylifera. Date fruit contains different vitamins (niacin, biotin, thiamin, folic acid and ascorbic acid), higher percentage of sugar and carbohydrates, proteins, fatty acids, salt and minerals like potassium and magnesium [19, 20]. Date fruit due to energy production and having enough calories can be helpful for pregnant women during labor and it can prevent physical weakness [21–23]. Furthermore, because it contains sugar, it is fast in digestion and absorption [23]. Date fruit in addition to generating energy, it contains necessary and unnecessary fatty acids that they can produce prostaglandins playing an important role in cervix ripening, acceleration of delivery progress, increase of uterine contractions and inducing labor [24, 25]. In addition, date fruit contains any hormones that they prepare uterine to stretching and birth [26]. Date can accelerate labor process, increases cervix dilatation and reduces need to induction [21, 22]. Moreover, date in Traditional Persian Medicine (TPM), has mentioned as a facilitator medicinal food for labor [27]. TPM is an ancient medical system and one of the important complementary and alternative medicines that has been utilized in Iran, India and the middle east from ancient eras to now [28, 29]. Nevertheless there are few studies that support relationship between labor and date.

Most recently, a systematic review about effects of date fruit on pregnancy and delivery has been published [30] but, there are some differences between its reviewed outcomes and this study. So in that study the reporting bias and publication bias have not been regarded in inclusion of studies to meta-analysis. For this reason that causes wrong changes in meta-analysis results.

Due to the studies about benefits of date palm fruit on labor process improvement, date can be a factor to increase vaginal delivery and to reduce frequency of cesarean section to prevent its great complications. This systematic review has designed to review clinical studies that investigate the effects of date palm fruit on labor outcomes (duration of labor stages, bishop score and frequency of cesarean section) compared with routine cares.
fruit on labor outcomes (duration of labor stages, bishop score and frequency of cesarean section) compared with routine cares.

2. Methods

This systematic review and meta-analysis is reported according to Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement.

2.1. Eligibility criteria

Inclusion and Exclusion criteria of studies

All randomized clinical trials evaluating the effects of date palm fruit on labor and delivery that have been published from 2000 until August 2019 in English and Persian languages were included in this systematic review. Editorials, reviews, books, case reports, case series, letter to editors, qualitative studies, and short communications were excluded. There was no limitation for the length of follow-up or treatment.

2.2. Inclusion criteria (PICOS format)

1) Participants: all pregnant women in 36–42 weeks of pregnancy with no restrictions on patient's age, nationality and the number of parity without any serious complication.

2) Interventions: consumption of date (fruit or extract) without restriction in the number of the fruit and the duration of intervention.

3) Controls: The routine cares of pregnant women.

4) Outcomes: The primary outcomes were duration of labor stages and the secondary outcomes were frequency of cesarian section and bishop score. Nasiri et al [30], in their systematic review investigated and explained the duration of labor stages but they included three duplicated published studies in their meta-analysis. They are publication bias and reporting bias.

5) Study type: Randomized Clinical Trials.

2.3. Search Strategy

This systematic review was performed in 2019 and the last search was conducted in August 2019. Data have been gathered from the databases, such as: PubMed, Scopus, Web of Knowledge, Clinical Keys, Embase, Google Scholar Search Engine, Scientific Information Database (SID) and IRCT (Iranian Registry of Clinical Trials) to search the relevant articles published from January 2000 to August 2019 by using the keywords Phoenix dactylifera, date palm, date fruit, labor and delivery, also manual search of the reliable journal data-bases which were accomplished and the references in all review articles that were checked for additional related articles. To search for unpublished articles (grey literature), European Association for Grey Literature Exploitation (EAGLE) and Health Care Management Information Consortium (HMIC) were searched. We have used following strategy for PubMed search: (((((date>Title/Abstract) AND palm) [Title/Abstract]) OR ( phoenix>Title/Abstract) AND dactylifera)[Title/Abstract] OR (date>Title/Abstract) AND fruit)[Title/Abstract]) AND ((labor)[Title/Abstract] OR (delivery)[Title/Abstract])) AND Clinical Trial[ptyp]). Searched data was transferred to Endnote software.

2.4. Study Selection

The selected studies which were extracted from the databases by Endnote software were evaluated by two authors independently. Disagreements between them were referred to the third inspector. First, the titles of all papers were reviewed and inconsistent studies with the objectives of the study were excluded from the study. In the next step, abstract of chosen studies were reviewed and incompatible studies were excluded. Then full texts of chosen studies were extracted. In the last stage, full-text articles were surveyed to exclude those that did not match the inclusion criteria and the study aims. The authors elicited data from all eligible studies and registered the elicited data in the appropriate forms. Data for the primary objective of the review was gathered from the full text of each paper consisted the trial name, year of publication, study design, sample size, participants, intervention protocol, used parts of plant, comparisons, results, and other characteristics.

2.5. Assessment of risk of Bias

The methodological quality of the included studies and their risk of bias were evaluated by two reviewers independently using RevMan 5.3.0 software, according to the risk of Bias assessment of the Cochrane handbook. The assessment criteria consist of five items: Selection bias (allocation concealment and random sequence generation); Performance bias (blinding of participants and personnel); Detection bias (blinding of outcome assessors); Attrition bias (dropouts and exclusion addressing and intention to treat analysis); Reporting bias (selective or nonselective reporting). Each study was evaluated as High, Low, or Unclear risk of bias for each item. Any disagreements between the two reviewers were resolved by discussion with the corresponding author. Because the number of included studies in meta-analysis was lower than 10 studies, therefore the graphical or statistical methods were not used to evaluate publication bias.

2.6. Statistical analysis

The results of the studies were analyzed by "Review Manager" software (RevMan 5.3.0 provided by Cochrane Collaboration). The types of intervention in included studies were the same. We integrated the studies according to the types of outcomes (labor phases duration, frequency of cesarian section and bishop score). Dichotomous data were summarized as risk ratio (RR) and continuous data as mean difference (MD). Heterogeneity between the studies was evaluated by using $X^2$ (chi-squared) test with p-value of p<.05 and I$^2$ statistic. I$^2$ was used to assess heterogeneity between studies, with $I^2 \geq 50\%$ was considered
to indicate a substantial heterogeneity. The fixed-effects model would be used if there was no significant heterogeneity between the studies, otherwise the random-effects model would be employed. 95%CI was calculated, and p<.05 was regarded as statistical significant.

3. Results

3.1. General characteristics

We gathered 1531 studies from databases and other hand search sources. 9 of 1531 studies had eligibility criteria [31–39] but three of them had the same ethic code (910732) (approval code of research ethics committee) [31–31]. One of them with higher numbers of participants was included to study and others were excluded. Two another studies were the same and were duplicated published [34–35]. One of them was included to this study. Finally six studies were included in qualitative and quantitative analysis after excluding duplicate published and inappropriate studies [31, 34, 36–39]. The flowchart of searching and inclusion process of studies is shown in Figure 1 (According to PRISMA statement). Five of included studies had used the date palm fruit and one study had used date fruit honey. Descriptions and characteristics of the reviewed studies are shown in Table 1. No side effects were observed for date palm in any of the studies. The minimum and maximum intervention durations of founded studies are two days and four weeks respectively. Date palm and that's extracts were utilized orally in all of the studies. Sample sizes of these studies were 89 to 210 people. 767 participants were included in the analysis, 394 participants in intervention group and 373 in control group. Ages of participants were 20 to 40. All of these studies had control groups that consists placebo and routine cares in one study and routine cares in other studies. But placebo control group was not included in meta-analysis and qualitative analysis.

Figure 1: Flowchart of selection strategy and method (PRISMA statement)

Table 1: Characteristics of included studies (PICOS)

| Number | Author/Year | Study design | Participants and Sample size | Intervention | Control | Duration of Intervention | Outcomes (considered in this study) | Results |
|--------|-------------|--------------|------------------------------|--------------|---------|--------------------------|-------------------------------------|---------|
| 1      | Ahmed et al., 2018 [37] | Randomized, controlled, clinical trial | 57 pregnant women, 26 intervention group, 31 control group | 7 date's fruits on the permission | Routine cares | Once | (1-3)Duration of first, second and third stage of labor | 1. ↓ Duration of the first and the third stage of labor in intervention groups significantly compare with control group 2. ↓ Duration of the second stage of labor in intervention groups but not significantly compare with control group |
| 2      | Razali et al., 2017 [38] | Randomized controlled clinical trial | 154 nulliparous singleton pregnant women, 77 intervention group, 77 control group | 7 date's fruits (approximately 80 gram) | Routine cares | Defined | (1-3)Duration of first, second and third stage of labor (4) Frequency of caesarian section | 1. ↓ Duration of the first and the third stage of labor in intervention groups but not significantly compare with control group 2. ↑ Duration of the second stage of labor in intervention groups but not significantly compare with control group 3. No significant difference between two groups in mode of delivery |
| 3      | Kariman et al., 2015 [34] | Randomized, controlled, clinical trial | 110 nulliparous pregnant women, 55 intervention group, 55 control group | 7 date's fruit per day | Routine cares | From week 38 of pregnancy to onset of delivery signs | (1)Duration of active phase of labor (2)Bishop score (3)Frequency of caesarian section | 1. Significant ↓ of active phase of labor in intervention group compared with control group 2. Significant ↓ in bishop score after intervention compared with control group 3. ↓ Frequency of cesarean section in intervention group compared with control group but not significant |

Table 1: Continue
| Number | Author/ Year | Study design | Participants and Sample size | Intervention | Control | Duration of intervention | Outcomes (considered in this study) | Results |
|--------|--------------|--------------|------------------------------|--------------|---------|--------------------------|-----------------------------------|---------|
| 4      | Kordi et al., 2014 [31] | Randomized, controlled, clinical trial | 210 pregnant women with gestational age of 37-38 weeks 105 intervention group 105 control group | 70-75 gram date's fruit per day | Routine cares until the onset of labor pain (1-3 weeks) | (1) Bishop score (2) Frequency of cesarean section | 1. Significant ↑ of the mean Bishop Score in intervention group compared with control group 2. No significant difference between two groups in mode of delivery (1 frequency of cesarean section in intervention group) |
| 5      | Al-Kuran et al., 2011 [39] | Randomized controlled clinical trial | 114 nulliparous and primiparous singleton pregnant women 69 intervention group 45 control group | Six date fruits per day in 4 weeks prior to their estimated date of delivery | Routine cares | (1-3) Duration of first, second and third stage of labor (4) Frequency of cesarean section | 1. ↓ Duration of the first and the third stage of labor in intervention groups significantly compare with control group 2. ↑ Duration of the second stage of labor in intervention groups but not significantly compare with control group 3. ↓ Frequency of cesarean section in intervention group compared with control group but not significant |
| 6      | Kordi et al., 2010 [36] | Randomized double blinded controlled clinical trial | 60 nulliparous pregnant women with gestational age of 37-42 weeks 30 intervention group 30 control group | 132 gram date's honey syrup from 4 cm cervix dilatation to labor | Routine cares | Maximum 1 day | (1) Duration of active phase of labor (2) Duration of second stage of labor | Significant ↓ in duration of active and second phases of labor |

3.2. Risk of bias within studies (Figs. 2, 3)

The details of risk of bias within included studies and authors judgment listed in table 2.

**Random sequence generation**

4 studies of 6 studies had used random number table, random generator or computer programmed random sequencing, and thus were evaluated as low risk of bias. Other 2 studies didn't use any reliable randomization method and were evaluated as high risk of bias.

**Allocation concealment**

One study of included studies had used sealed-envelopes method to the allocation concealment and was evaluated as low risk of bias. Three studies of six included studies did not determine the method of allocation concealment and were evaluated as unclear risk of bias. Two studies had not concealment and were evaluated as high risk of bias.

**Blinding of participants and personnel**

Due to the consumption of date fruit as intervention and routine care as control, all of the included studies had not performed blinding and were evaluated as high risk of bias.

**Blinding of outcome assessment**

All of these studies were evaluated as high risk of bias because they had no evidence of blinding of outcome assessors.

**Incomplete outcome data**

Of 6 studies, 3 studies have mentioned the dropped out and have analyzed the intention to treat and 2 studies had not any dropped out or lost to follow up, thus they were rated as low risk of bias. One study had attrition for missing participants but the statistical analysis had not followed by the intention to treat.

**Selective reporting**

One study had registered protocol but reported outcomes did not match with registered outcomes and were given high risk of bias. Expected outcomes of two studies had not determined and were evaluated as unclear risk of bias. Other included studies had reported their expected outcomes and were rated as low risk of bias.

Fig. 2 Risk of bias graph

Table 2: Risk of bias within studies
| Bias                              | Authors Judgment | Support for Judgment |
|----------------------------------|------------------|----------------------|
| Ahmed et al. (2018)              |                  |                      |
| Random sequence generation       | Low risk         | Simple random sampling has been used |
| Allocation concealment           | Unclear risk     | No specific information |
| Blinding of participants and personnel | High risk     | Open label manner |
| Blinding of outcome assessors    | High risk        | Open label manner |
| Incomplete outcome data          | High risk        | Intention to treat analysis has not conducted. |
| Selective reporting              | Unclear risk     | Protocol is unavailable and the authors have not mentioned their expected outcomes |
| Razali et al. (2017)             |                  |                      |
| Random sequence generation       | Low risk         | Sealed envelope numbers has been used |
| Allocation concealment           | Low risk         | It was done using "sealed envelope" manner |
| Blinding of participants and personnel | High risk     | Open label manner |
| Blinding of outcome assessors    | High risk        | Open label manner |
| Incomplete outcome data          | Low risk         | The dropped out has been mentioned and intention to treat has been analyzed |
| Selective reporting              | Low risk         | Protocol is unavailable but both primary and secondary outcomes have been reported |
| Kariman et al. (2015)            |                  |                      |
| Random sequence generation       | Low risk         | Random number generator has been used |
| Allocation concealment           | Unclear risk     | No specific information |
| Blinding of participants and personnel | High risk     | Open label manner |
| Blinding of outcome assessors    | High risk        | Open label manner |
| Incomplete outcome data          | Low risk         | The dropped out has been mentioned and intention to treat has been analyzed |
| Selective reporting              | High risk        | Protocol is available but secondary outcomes have not been reported |
| Kordi et al. (2014)              |                  |                      |
| Random sequence generation       | High risk        | The days of the Week have been used for randomization |
| Allocation concealment           | Unclear risk     | No specific information |
| Blinding of participants and personnel | High risk     | Open label manner |
| Blinding of outcome assessors    | High risk        | Open label manner |
| Incomplete outcome data          | Low risk         | The dropped out has been mentioned and intention to treat has been analyzed |
| Selective reporting              | High risk        | Protocol is unavailable and authors have not mentioned their primary and secondary outcomes |
| Al-Kuran et al. (2011)           |                  |                      |
| Random sequence generation       | High risk        | The participants have been asked to participate in one of two groups |
| Allocation concealment           | High risk        | Open label manner |
| Blinding of participants and personnel | High risk     | Open label manner |
| Blinding of outcome assessors    | High risk        | Open label manner |
| Incomplete outcome data          | Low risk         | No participant dropped out of the treatment |
| Selective reporting              | Low risk         | Protocol is unavailable but both primary and secondary outcomes have been reported |
| Kordi et al. (2010)              |                  |                      |
| Random sequence generation       | Low risk         | Simple random sampling has been used |
| Allocation concealment           | High risk        | There was no evidence for allocation concealment |
| Blinding of participants and personnel | High risk     | Open label manner |
| Blinding of outcome assessors    | High risk        | Open label manner |
| Incomplete outcome data          | Low risk         | There was no lost to follow up |
| Selective reporting              | Low risk         | Protocol is unavailable but both primary and secondary outcomes have been reported |

Fig. 3 Risk of bias summary

3.3. Outcomes

We considered common outcome among the included studies in quantitative integration, included active phase of labor duration, first stage of labor duration, second stage of labor duration and third stage of labor duration as primary outcomes, bishop score and frequency of caesarian section as secondary outcomes. We used Random effect in the moderate and high heterogeneity (H>75) and fixed effect in low heterogeneity.

Active phase of labor

Two studies were included with 170 participants (85 in intervention group and 85 in control group). There was moderate heterogeneity among the studies ($I^2 = 64\%$, $P = 0.09$). The quantitative synthesis showed that date consumption significantly reduce during of active phase of labor compared with control group ($MD = −60.26, 95\%CI (−107.18, −13.34), P = 0.01$). (Fig. 4)

Fig. 4 Forest plot of the duration of active phase of labor

First stage of labor

Three studies reported the duration of first stage of labor. 325 participants were included (172 in intervention group and 153 in control group). Moderate heterogeneity accompanied ($I^2 = 42\%$, $P = 0.18$). Intervention decreased duration of first stage of labor. The difference between intervention and control groups was statistically significant ($MD = −50.90, 95\%CI (−100.63, −1.16), P = 0.04$). (Fig. 5)

Fig. 5 Forest plot of the duration of first stage of labor

Second stage of labor

We gathered data from 4 studies involving 385 participants (202 in intervention group and 183 in control group). The heterogeneity was high ($I^2 = 90\%$, $P <0.0001$). There was no significant difference between two groups ($MD = 4.29, 95\%CI [−24.91, 15.01], P = 0.63$). (Fig. 6)
Third stage of labor

Three studies with 325 participants were described the duration of the third stage of labor. The intervention cannot decrease the duration of the third stage of labor (MD = 1.10, 95%CI (–1.32, 3.53), P = 0.37). The heterogeneity was moderate (I² = 73%, P = 0.02). (Fig. 7)

Bishop score

Two studies reported data on the bishop score with 320 participants. There was no heterogeneity (I² = 0%, P = 0.60). The intervention was improved significantly bishop score rather than control group (MD = 2.45, 95%CI (1.87, 3.04), P<0.00001). (Fig. 8)

Frequency of caesarian section

Four studies had showed the effect of intervention on frequency of caesarian section. 588 participants were included in this outcome meta-analysis (306 in intervention group and 282 in control group). Low heterogeneity was accompanied (I² = 6%, P = 0.36). The intervention had decreased frequency of caesarian section, but the difference between the two group is not significant (Odds Ratio = 0.67, 95%CI (0.44, 1.02), P = 0.06). (Fig. 9)

Adverse effects

No side effects have been reported in any of the included studies.

4. Discussion

Based on the performed searches, this is the first systematic review about effects of date on bishop score and frequency of caesarean section and second about effects of date on the duration of labor stages. Meta-analysis of this study that based on the random-effect model for high heterogeneity and fixed effect model for low heterogeneity and mean differences of outcomes showed that the consumption of date fruit significantly reduces the duration of active phase and first stage of labor and increases the bishop score in intervention group compared with control group. Also, the consumption of date fruit reduced the frequency of cesarean section in intervention group compared with control group, but this reduction was not significant. Based on meta-analysis, date palm fruit consumption resulted in a significant decrease in the duration of active phase and first stage of labor compared with control group but not in the second and the third stage of labor.

Nasiri et al, in their systematic review, have achieved different results about the duration of labor stages. Those results are not reliable, because they had included three duplicated published studies in their meta-analysis. In that study, bishop score and frequency of caesarean section had not been investigated [30].

Different mechanisms have been expressed on the effects of date palm on the labor process. Date palm fruit has high calorie and proposed as an energizer. The sugar in date fruit is glucose with simple digestion and absorption. Date fruit provide and maintain required energy for pregnant woman to prevent of tiredness. It leads to normal progress of labor because provides continual glucose and preserves body electrolytes [21, 23]. Oxytocin and prostaglandins have been utilized widely for ripening of cervix, stimulation of uterine contractions and induction and stimulation of labor especially when the duration of latent phase of labor has been expanded [40, 41]. Misuse of oxytocin and prostaglandins and insufficient maternal care in labor, lead to delivery complications [42,43]. Myometer oxytocin receptors increase in the last weeks of pregnancy. Estrogen and progesterone levels change in the 34–35 weeks of pregnancy that these changes led to the improvement of irritability of uterine and improvement of responsiveness of uterine to contractor factors and the improvement of cervical preparation to labor [44]. Therefore date fruit consumption in last weeks of pregnancy causes labor induction and stimulation, because date fruit acts on prostaglandin receptors and causes early stimulation of uterine contractions and improves response to syntocinon if it is necessary[40]. Fatty acids in date palm in addition to production and reservation of energy have important role in the prostaglandins production and following that reinforcement of uterine muscles [24, 25, and 45]. On the other hand, drinking water after consuming date fruit during labor is effective on labor progress and shortens the second and the third stages of labor [46]. As well as date palm can increase antioxidant capacity for 4 hours and following that increases pain tolerance, and this lead to reduce of the first and the third stages of labor [20, 24]. Also date fruit has anti-inflammatory and antioxidant properties and it is rich in calcium, serotonin and tannin and can play role in contraction of smooth muscles of uterine [20, 47]. As mentioned, consumption of date fruit had increased significantly the bishop score and cervical dilatation. Bishop score (that contains cervical dilatation and ...) has known as evaluation criteria of labor progress and the increasing factor of normal vaginal labor [48, 49]. Lack of preparation of cervix and induction of labor can lead to increasing of caesarean section rate and postpartum hemorrhage [50–52]. Whereas increasing of the bishop score and preparation of cervix increase normal vaginal labor rate and reduce the caesarean section rate [53]. Forasmuch as low dose of oxytocin causes the improvement of the bishop score and the preparation of cervix [54], thus the consumption of date fruit affects on the improvement of the bishop score by increasing the activity of myometer contraction. This is a confirmation of possible hypothesis of oxytocin in date fruit and that’s effect on uterine muscle contraction [21, 22, and 55]. Also date fruit contains saturated and unsaturated fatty acids linoleic, oleic and stearic. Linoleic acid breaks down to the arachidonate then to the eicosanoid. The eicosanoids finally convert to the prostaglandins and they
improve the preparation of cervix by increasing subserosal fluid and making changes in collagen bands and they cause the increasing of sensitivity of uterine to oxytocin [34, 47, and 56].

Generally the mechanism of cervical preparation is unknown, but changes in levels of estrogen and progesterone, increasing of the prostaglandins production, increasing of myometrium sensitivity to oxytocin and prostaglandins, and their interactions can be effective [44, 53].

Based on results of our systematic review, date fruit had reduced the rate of cesarean section, although not statistically significant. As we know the most common causes of cesarean section are abnormal progress of labor and non effective contractions of uterine [9, 10, 14]. Lack of eating energizer foods during labor lead to the increasing of non effective contractions of uterine and following that increasing of the augmented delivery and increasing the cesarean section rate [18]. Limited reserves of glycogen and body fluids in pregnant women that have limited consumption of food and liquids during labor, cause low perfusion and low nutrition of uterine, it follows by abnormal labor progress and prolonged labor and the increasing rate of cesarean section [34]. While date fruit can reduce the need to oxytocin for labor and increase spontaneous labor because date fruit has Pseudo-oxytocin effect that leads to the increasing of sensitivity and inducing the contractions of uterine and that leads to reducing of cesarean section rate [39].

**Limitations**

One of the limitations of this study was the lack of specified standard for the kind and the amount of date fruit that must be consumed that leads to positive effects on labor progression and cervix preparation. Also, it is not determined that, how long at what intervals of consumption of date fruit need to energy supply during labor and reducing of cesarean section rate and promotion of labor outcomes.

Another limitation of this study was the high risk of bias in done studies. Especially, due to the methods of studies and using the date palm fruit in the studies, blinding of participants and researchers was not possible. Therefore, that causes the rising of performance bias in included studies. Furthermore, none of these studies had not outcome assessor blinding.

The other one of this study was unknown time of intervention and duration of intervention in the most studies.

### 5. Conclusions

Despite widespread utilizing of date palm, there is not enough clinical evidence to support the clinical effects which mentioned in review articles and traditional medical systems. Based on this study results, date fruit can reduce the duration of active phase and the first stage of labor and the frequency of cesarean section and improves the bishop score. The growing trend of recent studies about date palm provides scientific rationale for date palm clinical abilities, but due to from the low to mediate quality of the studies, it seems that the other studies are needed to prove these results better than this.

### List Of Abbreviations

WHO: world health organization; IVF: in vitro fertilization; IUI: intrauterine insemination; Kcal: kilo calories; PRISMA: preferred reporting items for systematic reviews and meta-analyses; SID: Scientific Information Database; IRCT: Iranian Registry of Clinical Trials; EAGLE: European Association for Grey Literature Exploitation; HMIC: Health Care Management Information Consortium; RR: risk ratio; MD: mean difference.

### Declarations

- Ethics approval and consent to participate

Not applicable

- Consent for publication

Not applicable

- Availability of data and materials

All data generated during this study are included in this article, tables, figures and its supplementary information files.

- Competing interests

The authors declare that they have no competing interests.

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- Authors’ contributions

ABK performed initial search of databases and was a major contributor in writing the manuscript. AE and RBN reviewed studies to investigate eligibility criteria. MM regulated methods and performed meta-analysis. MM and AE supervised writing of the manuscript. All authors read and approved the final
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Figures

Figure 1
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