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REVIEW ARTICLE

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Use of the peanut ball during labour: A systematic review and meta-analysis

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Abstract

Aim: This study aimed to determine effectiveness of peanut ball on the duration of the stages of labour and frequency of caesarean section.

Design: A systematic review and meta-analysis.

Method: A comprehensive electronic search was carried out with no time limit until December 2020. Collected data were analysed using software RevMan- version 5.3. Heterogeneity was assessed using I^2, T^2, and ^{2}. GRADE approach was used to assess the certainty of evidence.

Results: The meta-analysis on six clinical trials with 645 participants showed no statistically significant difference between the two groups in caesarean surgery rate (RR = 0.82) and length of the first (MD = −15.64).

Conclusions: Therefore, further clinical trials with stronger evidence should be carried out to assess the effectiveness of peanut ball on caesarean surgery rate and length of first and second stages of labour.

KEYWORDS

caesarean section, labour, labour ball, peanut ball, systematic review

1 | INTRODUCTION

Labour pain is unique, complex and multifactorial (Chao et al., 2007) with pain management being a key factor in gynaecological care and the main goal of delivery care (Qu & Zhou, 2007). Nevertheless, women who are not too afraid of labour can easily tolerate the pain. In this regard, personal experience, the expectation of family support and relationship with caregivers also affect women's perception of labour pain (Hodnett, 2002). Patients' preferences about labour are associated with both labour duration and pain relief (Favilli et al., 2018). Meanwhile, childbirth education classes focus on pain management during delivery, either through pharmaceutical or non-pharmaceutical interventions (Brown et al., 2001).

Pharmaceutical approaches only relieve the physical sensation of pain while non-pharmacological methods mainly help prevent pain through emotional, mental and spiritual interventions (Simkin & Bolding, 2004). Intravenous and intramuscular analgesic injection and local anaesthetic nerve block have different side effects and risk factors and are often used in hospitals (Lee & Ernst, 2004). However, various non-pharmacological interventions for pain relief not only relieve the physical sensation of pain but also offer psychological intervention to inhibit feelings of pain (Brown et al., 2001; Simkin & Bolding, 2004). Non-pharmacological interventions solely regard pain as a side effect of a normal delivery process (Tournaire & Theau-Yonneau, 2007). These interventions include relaxation, breathing techniques, positioning, massage, hydrotherapy, hot and cold water therapy, music therapy,

acupuncture, aromatherapy, electrical nerve stimulation and birth ball. These methods can be either used in combination or in a sequential manner for enhancing the overall effectiveness (Zwelling et al., 2006).

On average, 61% of pregnant women with singleton gestations are more likely to receive epidural anaesthesia in the United States (Osterman & Martin, 2011). According to the American College of Obstetrics and Gynecology, epidural anaesthesia is the most effective method of pain relief and the first analgesic of choice for women during vaginal delivery (American College of Obstetricians and Gynecologists Committee on Obstetric Practice, 2006). Women who receive epidural anaesthesia feel less pain and have more satisfaction than women who do not receive this method (de Orange et al., 2012). Although epidural anaesthesia significantly reduces labour pain, it is expected to slow the progress of labour and increase the rate of vacuum (Obstetricians & Practice, 2006). Women under epidural analgesia are less mobile during labour, with mobile women experiencing a shorter labour length than women in recumbent positions. Mobility and upright position reduce the length of labour without negative maternal and neonatal outcomes (Lawrence et al., 2013). Indeed, positioning techniques reduce the risk of complications in women under epidural analgesia (Clutter & Grant, 2015).

The prolonged first stage of labour is associated with maternal complications including chorioamnionitis and postpartum haemorrhage (Cheng et al., 2010) as well as neonatal complications including NICU admission (Cheng et al., 2009). Thus, effective interventions can safely reduce the length of labour without any maternal and neonatal complications. The active control of maternal position during labour helps the mother to cope with labour pain and supports progress labour (Zwelling, 2010).

The peanut ball is a proper alternative for the traditional birth ball. The former is a curved and an egg-shaped ball located between the knees at either the lateral or supine position, which helps widen pelvic opening (Roth et al., 2016). These positions form a C-shape curve in the spine. Theoretically, it imitates the position of the birth ball with the same benefits of rotating and moving down the baby. The difference is that use of peanut balls is comfortable without constant support to hold the right position during labour in women under epidural analgesia (Mercier & Kwan, 2018).

Regarding the benefits, the peanut ball is an inexpensive and non-invasive method made of durable plastic, which allows sterilization and repeated use. It is most likely a cost-effective method in women who receive epidural anaesthesia. The peanut ball shortens the labour length and reduces the rate of caesarean delivery (Tussey & Botsios, 2011; Tussey et al., 2015), which no side effects have been reported (Zhang et al., 2010).

The identification of evidence-based techniques can contribute to reducing the length of labour and increasing vaginal delivery. Maternal and neonatal health depends on uncomplicated vaginal delivery. Thus, peanut ball can be used to shorten the labour length and increase vaginal delivery in case the positive effects of this method are confirmed.

2 | OBJECTIVES

This systematic review and meta-analysis aimed to evaluate and collate the findings of already published articles examining the effectiveness of peanut ball during labour on the length of labour stages and rate of caesarean section. The primary outcomes included the length of first stage of labour and the rate of caesarean section while the secondary outcome was the length of the second stage of labour.

3 | METHODS

3.1 | Inclusion and exclusion criteria

All published individual randomized controlled clinical trials (RCTs) and quasi-RCTs in English and Persian databases were reviewed. All studies that had compared the effectiveness of peanut ball with the routine or non-pharmacological care on the length of labour and rate of caesarean section in pregnant women with or without epidural analgesia were included. Letters to the editor, qualitative, and observational studies and those papers on women with multiple pregnancies were excluded from the study.

3.2 | Data source and identification of studies

We searched multiple databases including English databases (Cochrane Library, Medline, Web of Science, Embase, Scopus, ProQuest) and Persian databases (Magiran, SID, and Barakat) using the related keywords from the inception of the databases until December 2020. For example, the search strategy for Scopus was as follows: ((ALL (pregnan* OR labor* OR labour* OR midwi* OR cesarean OR deliver*)) OR (ALL (patient W/5 position*))) AND ((TITLE-ABS-KEY (peanut AND ball*)) OR (ALL (peanut W/6 ball*))). Also, the search strategy for PubMed was as follows: (Peanut ball*) AND (((((((("Pregnancy"[Mesh]) OR "Labor, Obstetric"[Mesh]) OR ("Patient Positioning/instrumentation"[Mesh] OR "Patient Positioning/methods"[Mesh])) OR "Midwifery/instrumentation"[Mesh]) OR "Cesarean Section"[Mesh]) OR "Delivery, Obstetric"[Mesh]) OR (((((((pregnan*) OR (labor*)) OR (labour*)) OR (Patient Position*)) OR (Midwi*)) OR (Cesarean)) OR (deliver*))). The references of included studies were also searched to find further articles.

3.3 | Data extraction

Two authors (PA; RD) checked the titles and abstracts of the studies independently to evaluate the eligibility criteria. In case of insufficient information in the titles and abstracts of studies, the full text was reviewed to decide whether the paper was related to the study. If the two authors disagreed on an article, they discussed the issue. If they did not reach a consensus, a third person (MM) was consulted to decide on the matter. The study design, research setting, number of

TABLE 1 Characteristics of included studies

Study (Year)	Country	Study design	Final sample size	Intervention details	Comparison group	Results
Payton, 2015	Louisville, Kentucky (s a state located in the east south-central region of the United States)	Quasi-RCT	I:200 C:200	Use of the Peanut Ball	Not Use of the Peanut Ball	The duration of the second stage of labour was significantly longer in the intervention group (75.63 min) when compared with the control group (57.84 min).
Mercier & Kwan, 2018	Philadelphia USA	RCT	I:43 C:43	Use of the Peanut Ball	Not Use of the Peanut Ball	"There was no statistically significant difference in rates of cervical dilation (0.98 cm/hr vs. 0.79 cm/hr, (p =.27) or length of labour (315 min vs. 387 min, (p =.14) between the groups. There was no difference in the rates of caesarean delivery (33% vs. 35%, p =.8) or occiput posterior presentation. (28% vs. 9%, p =.09)"
Tussey et al., 2015	South western United States	RCT	I:107 C:94	Use of the Peanut Ball	Not Use of the Peanut Ball	Women who used the peanut ball (n = 107) versus those who did not (n = 91) demonstrated shorter first stage of labour by 29 min (p =.053) and second-stage labour by 11 min (p <.001). The intervention was associated with a significantly lower incidence of caesarean surgery (OR = 0.41, p =.04)
Roth et al., 2016	California	RCT	I:78 C:71	Use of the Peanut Ball	Not Use of the Peanut Ball	In women having use of a peanut ball reduced first stage of labour duration for primiparous patients significantly more than multiparous patients, p =.018. There was no significant difference in the reduction of length of first stage labour for multiparous women, p =.057 with the use of the peanut ball.
D'Angelo, 2015	Winston-Salem, North Carolina, United States	RCT	I:39 C:42	Use of the Peanut Ball	Not Use of the Peanut Ball	The duration of first stage of labour was longer in the control group (441 min) when compared with the peanut ball group (387 min). The incidence of caesarean surgery was equal in both groups.
Evans, 2014	Cincinnati, Ohio, United States	RCT	I: 91 C: 100	Use of the Peanut Ball	Receiving standard care for positioning during labour using pillows and wedge	The duration of first stage of labour was longer in the control group (322.7 min) when compared with the peanut ball group (331.3 min). The incidence of caesarean delivery was higher in the control group than the intervention group.

Abbreviations: C, Control; I, Intervention; RCT, Randomized Controlled Trial.

TABLE 2 Use of the peanut ball versus no use of the peanut ball

No. of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Use of the peanut ball	Not using the peanut ball	Pooled effect relative (95% CI)	Final judgement
Caesarean section delivery										
5	Randomized Controlled Trials (RCTs)	No serious	No serious[a]	No serious indirectness	Serious imprecision[b]	No serious	64/322	81/323	0.82 (0.62, 1.08)	⊕⊕⊕O Moderate
First stage of labour										
6	5 RCTs and 1 quasi-RCT	No serious	Very serious inconsistency	No serious indirectness	Very serious imprecision[b]	No serious	372.1/507	355.6/489	−15.64 (−64.91, 33.62)	⊕OOO Very low

[a] I^2 is higher than 40%.

[b] Not met optimal information size/CI is very wide.

participants in study groups, intervention details, comparison group and results were independently extracted by the authors (Table 1).

3.4 | Assessment of risk of bias in included studies

The two authors (PA; RD) independently assessed the risk of bias in all the studies using the criteria listed in the Cochrane Handbook. The risk of bias per item was categorized as low risk, high risk and unclear. If the authors disagreed on an issue, they discussed it. If their ideas did not converge, they consulted a third person (MM) to decide on the matter.

3.5 | Statistical method

The collected data were analysed using RevMan- software version 5.3 and STATA version 14.2 (Stata crop, College Station, TX, USA). They were categorized into three categories of the rate of caesarean section as well as the length of the first and second stages of labour. The rate of caesarean section was reported as dichotomous in all collected studies. The average length of the first and second stages of labour was reported as continuous. The length of the first phase of labour was reported in terms of minute based on mean ± standard deviation by groups in all studies except one (Tarsilla, 2016). The length of the second stage of delivery was reported as minute by groups in two studies (Mercier & Kwan, 2018; Tussey et al., 2015). Accordingly, the meta-analysis results for caesarean section were reported as risk ratio (RR) and 95% confidence interval, while meta-analysis results for the first and second stages of labour were reported as mean difference and 95% confidence interval. Heterogeneity was assessed using I^2, T^2 and χ^2. The Grades of Recommendation, Assessment, Development and Evaluation Working Group (GRADE) approach was used to assess the certainty of evidence. The GRADE approach recommended by Cochran to examine the quality of evidence (Langendam et al., 2013; Tarsilla, 2016) (Table 2). Also, sensitivity analysis was conducted by excluding the Payton's study (2015) due to high risk of selection bias. Since the number of studies in the meta-analysis did not exceed 10, graphical or statistical methods were not used to assess publication bias (Tarsilla, 2016).

4 | RESULTS

4.1 | Selection and characteristics of included studies

In total, 89 articles were found through the databases. Of these, 48 articles were eliminated for duplication. Forty-one articles with title, abstract or full-text review were screened. Two studies were selected from the website clinicaltrials.gov since they had been completed, and the results were available (D'Angelo, 2015; Evans, 2014).

Nine articles were found through searching for references of the papers. From them, one paper was chosen. Finally, six articles were included in the meta-analysis. One article (Evans, 2014) was not available through the author was contacted (Figure 1).

Six trials were carried out in parallel. The participants were divided into two groups (use of peanut ball and routine care without its usage). The sample size varied from 86 in Mercier et al.'s study (Mercier & Kwan, 2018) to 400 in Payton's study (2015). The participants consisted of nulliparous and multiparous women in labour under epidural analgesia. The intervention was the use of a peanut ball in women who received epidural anaesthesia. The control group received routine care without the peanut ball. In all studies except one (Hickey & Savage, 2019), the length of the first phase of labour is expressed in minutes based on the mean (standard deviation) by groups and in two studies (Mercier & Kwan, 2018; Tussey et al., 2015) The length of the first and second stages of labour was reported in minutes by groups. All included studies reported frequent caesarean sections.

4.2 | Risk of bias of included studies

The bias about different areas was found as follows: random sequence generation was low risk in five studies (D'Angelo, 2015; Evans, 2014; Roth et al., 2016; Tussey et al., 2015; Mercier, & Kwan, 2018), and high risk in one study (Payton, 2015);

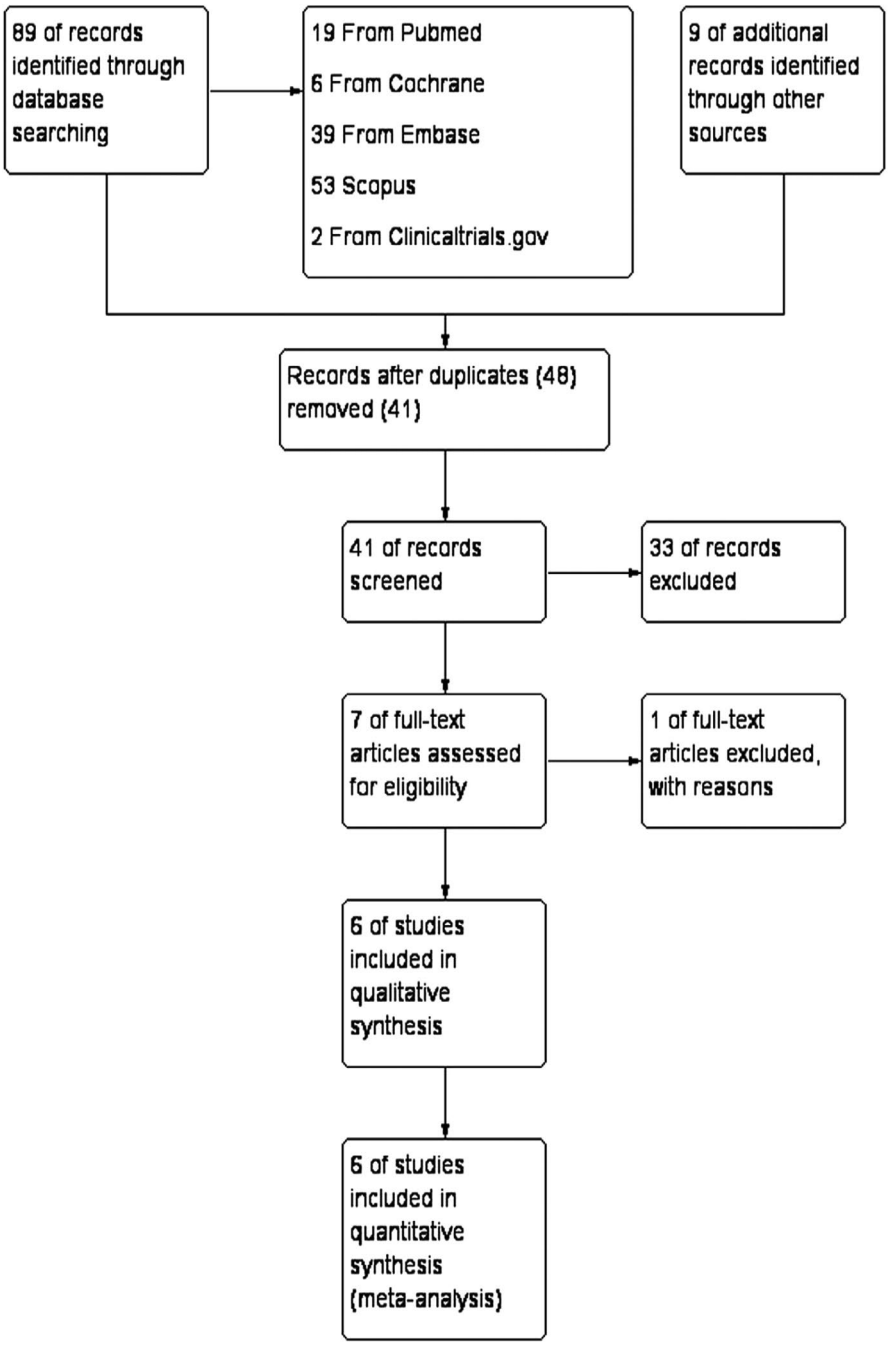

FIGURE 1 Study flow diagram

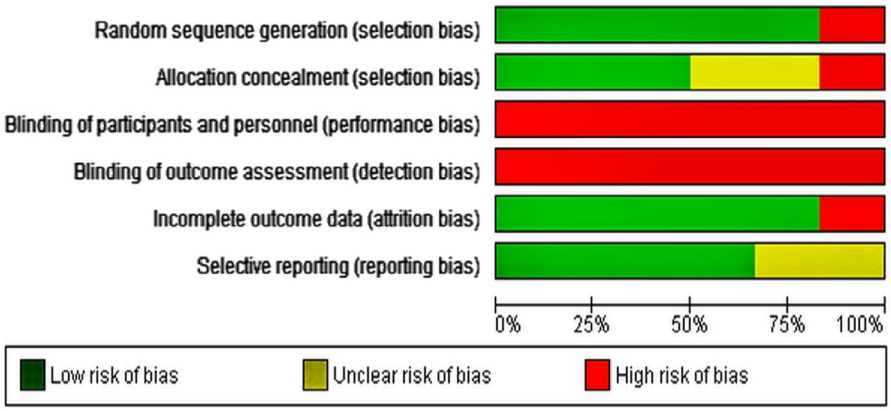

FIGURE 2 Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies

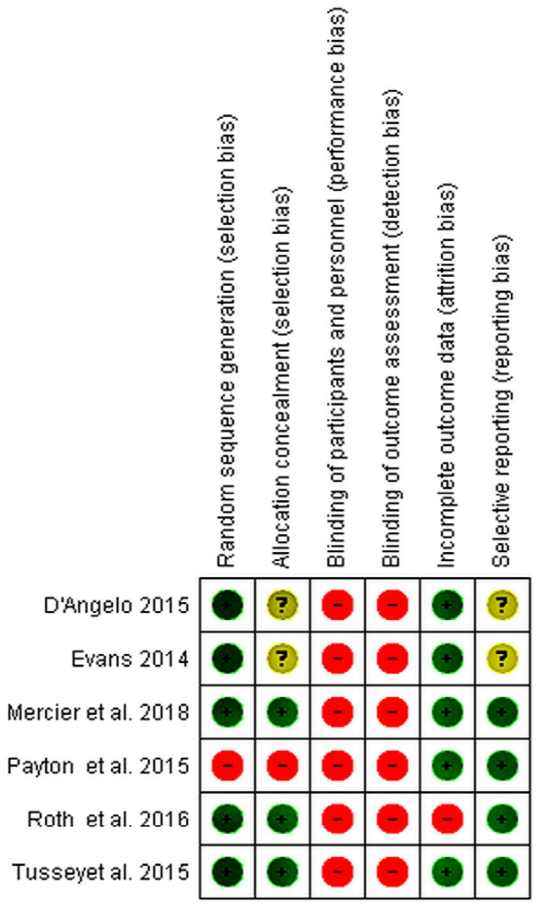

FIGURE 3 Risk of bias summary: review authors' judgements about each risk of bias item for each included study

allocation concealment was high risk in one study (Payton, 2015), unclear in two studies (D'Angelo, 2015; Evans, 2014) and low risk in three studies (Mercier & Kwan, 2018; Roth et al., 2016; Tussey et al., 2015); blinding participants and staff was high risk in all studies (Evans, 2014; Roth et al., 2016; Tussey et al., 2015; Mercier, & Kwan, 2018; Payton, 2015; D'Angelo, 2015); blinding assessor of outcome was high risk in all studies (Evans, 2014; Roth et al., 2016; Tussey et al., 2015; Mercier, & Kwan, 2018; & Payton, 2015; & D'Angelo, 2015); incomplete outcome data were low risk in five studies (D'Angelo, 2015; Evans, 2014; Mercier & Kwan, 2018; Payton, 2015; Tussey et al., 2015) and high risk in one study (Roth et al., 2016); and selective reporting was low risk in four studies (Mercier & Kwan, 2018; Payton, 2015; Roth et al., 2016; Tussey et al., 2015) and unclear in two studies (D'Angelo, 2015; Evans, 2014) (Figures 2 and 3). There is no published article for two studies (D'Angelo, 2015; Evans, 2014), and judgements about the risk of bias for these studies were made based on Clinicaltrials.gov.

4.3 | Rate of caesarean section

The overall result of meta-analysis on 645 participants showed that although the rate of caesarean section in the peanut ball group was 0.82 times that of the control group, no statistically significant difference was found between them (RR = 0.82; 95% CI: 0.62 to 1.08; p =.15). There was a low heterogeneity across the studies (I^2 = 14%; Chi2 = 4.64; p =.33) (Figure 4).

4.4 | The length of the first stage of labour

The overall result of meta-analysis on 996 participants revealed that although the use of peanut balls reduced the length of the first stage of labour, no statistically significant difference was found between the intervention and control groups (MD = −15.64; 95% CI: −64.91 to 33.62; p =.53). Because of the high heterogeneity (I^2 = 71%; Tau^2 = 2,521.14; Chi2 = 17.01; p =.004), random effects was used instead of fixed effects (Figure 5). Based on the results of ssensitivity analysis by excluding the Payton's study (2015), no statistically significant difference was also found between the intervention and control groups (MD = −30.42; 95% CI: −86.56 to 25.72; p =.29).

4.5 | The length of the second stage of labour

In two of the included studies (Payton, 2015; Tussey et al., 2015), the length of the second stage was examined. In the Payton's study (2015), the length of the second stage was longer in the peanut ball

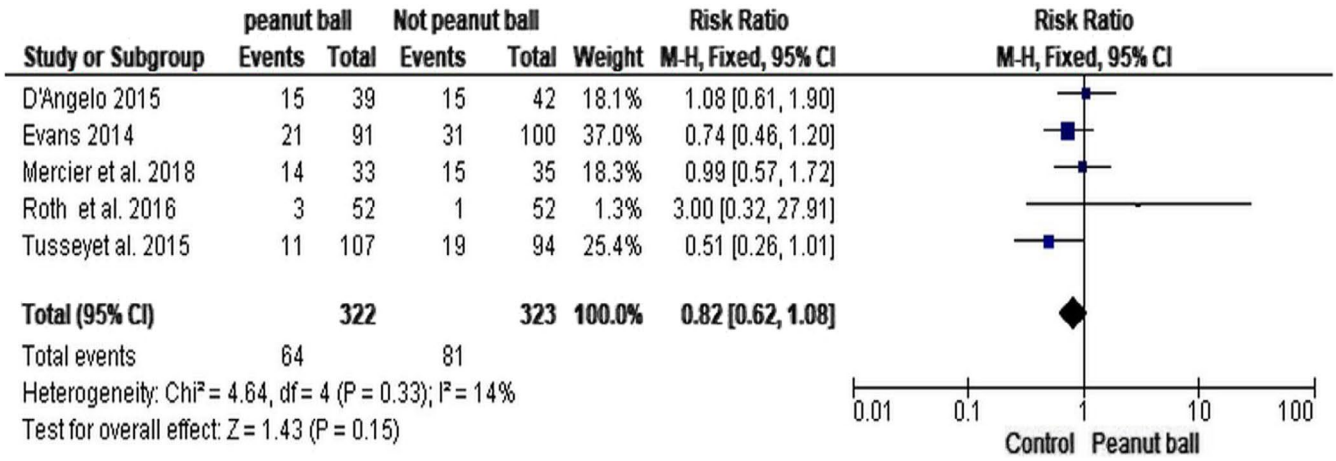

FIGURE 4 Peanut ball group versus control group; Outcome: Caesarean section delivery

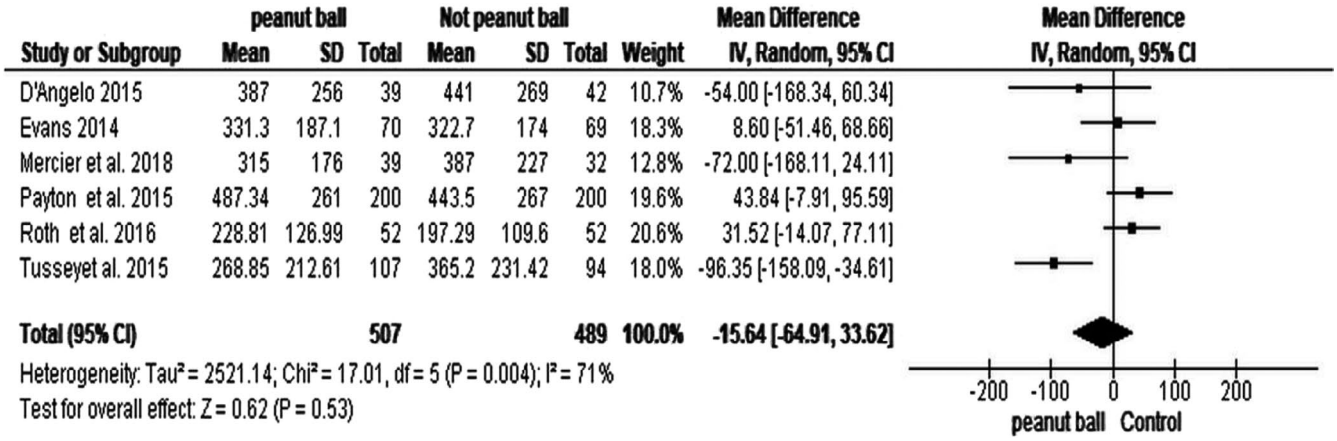

FIGURE 5 Peanut ball group versus control group; Outcome: First Stage of Labour

group than in the control group; however, in the Tussey et al.'s study (2015), the length of the second stage of labour was shorter in the peanut ball group than in the control group.

5 | DISCUSSION

This was the first meta-analysis on the effectiveness of peanut ball on the rate of caesarean section and length of the first and second stages of labour in women under epidural analgesia. The results revealed that the rate of caesarean section in the peanut ball group was lower than in the control group, but the difference was not statistically significant. The difference in the length of stages of labour was not significant between the peanut ball group and the control group.

Since the primary cause of the caesarean section is its repetition (Spong et al., 2012), maternal morbidity, placental abnormalities and the bleeding increase as the rate of caesarean delivery rises (Marshall et al., 2011). A woman experiencing a caesarean section in the first delivery would be more likely (>90%) to undergo caesarean surgery in the second delivery (Kacica et al., 2017). Women undergoing caesarean section are at the risk of delayed skin-to-skin care and lactogenesis as well as an increase in the use of formula milk. Caesarean section is also associated with several adverse outcomes including abdominal adhesions, chronic pelvic pain, placental implantation disorders, surgical injuries and placental abruption in subsequent pregnancies (Marshall et al., 2011). Since vaginal delivery is safer and has fewer side effects than caesarean delivery, it is essential to give some recommendations to mothers to reduce the rate of caesarean section in the first delivery (Caughey et al., 2014).

The peanut ball is an inexpensive and non-invasive intervention made of durable plastic which allows repeated use and sterilization. It shortens the length of labour and reduces the rate of caesarean section in women who receive epidural anaesthesia (Tussey et al., 2015). The use of these balls can also improve maternal and neonatal outcomes (Clutter & Grant, 2015). Epidural analgesia results in pelvic floor relaxation which supports rotation of the foetal head and mitigates the desire to push due to a diminution of the bearing down reflex and reduced uterine activity (Mayberry et al., 1999). One study reported that epidural analgesia was associated with an increased rate of occiput posterior and high-risk delivery (Lieberman & O'Donoghue, 2002). Tussey et al. reported

shortened first and second stages of labour and a significant decline in the rate of caesarean section in the peanut ball group. In their study, pharmacological interventions (labour induction and assisted delivery using forceps and vacuum) were less common in the peanut ball group but the difference was not statistically significant (Tussey et al., 2015).

The results of a qualitative study recommended the use of peanut balls. In that study, 118 women were satisfied with peanut balls and reported a positive experience of childbirth including comfort, facilitated progress of labour and proper labour positioning. Psychologically, three-quarters (71%) of the women had used peanut balls and experienced favourable childbirth and recommended peanut ball. This positive experience may also have other psychological benefits both during and after the delivery (Tussey et al., 2015). Hospitals can use these balls to reduce the costs of prolonged labour. However, further studies are required to recommend these balls in clinical practice.

Although the obstetric complications or epidural analgesia can influence the rate of caesarean section and length of labour stages, in all included studies, low-risk women without obstetric complications had been assessed where epidural analgesia had also been used in all included studies.

5.1 | Limitation

Studies on the effectiveness of the peanut ball on maternal outcomes were limited. Nevertheless, one study was ongoing and in the sampling phase. Heterogeneity was high in two of the meta-analyses. The certainty of evidence was very poor according to the GRADE guidelines. Thus, the effectiveness of the interventions and the results of the present study should be reported with caution.

6 | CONCLUSIONS

The results of the meta-analysis suggested that the use of peanut ball in women under labour had no statistically significant effect on the rate of caesarean section or the length of the first and second stages of labour. Further clinical trials with a stronger study are required.

ACKNOWLEDGEMENTS

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

MM, PA, SMAC and RD: Study design. PA and RD: Literature research. MM, SMAC and PA: Data analysis. MM, PA, SMAC and RD: Writing the manuscript. All authors were responsible for the manuscript drafting and have read and approved the final version.

ETHICAL APPROVAL

Not applicable.

PATIENT CONSENT

Not applicable.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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