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Original Research Article

Effects of Using Birth Ball and Peanut Ball For Pregnant Women in Labour: Randomised Control Trial

Lijaswi Y*[1], Mahendra G,*[2] Anupama R,*[3] Chaitra R P,*[4]

DepartmentofObstetricsandGynaecology, SriRamachandraInstituteofHigherEducationandResearch, Chennai

Corresponding Author: Anupama R
Email: anurgowda97@gmail.com

Article Information:
Received: 2 April 2026 | Revised: 5 May 2026 | Accepted: 03 June 2026 | Published: July 01, 2026

Cite this article:
Lijaswi Y, Mahendra G, Anupama R and Chaitra R P (2026). Effects of Using Birth Ball and Peanut Ball For Pregnant Women in Labour: Randomised Control Trial. *Public Health Open Journal*. 11(1):663–671. 10.17140/PHOJ-11-663

Abstract

Introduction: Childbirth, while a natural physiological process, poses significant challenges due to intense labour pain caused by ischemic changes in the uterus, cervical stretching, and tissue damage in the perineum. Non-pharmacological methods, such as the use of birth balls and peanut balls, have emerged as effective tools to alleviate pain, reduce anxiety, and improve labour outcomes without the side effects associated with pharmacological interventions. This study aimed to evaluate the impact of these interventions on labour progress, pain relief, and delivery outcomes.

Methodlogy: This randomized controlled trial was conducted at Adichunchanagiri Hospital and Research Centre over 18 months. Participants included primigravida and multigravida women with singleton pregnancies in cephalic presentation and gestational ages over 37 weeks. Using block randomization, 128 women were divided into two groups: a trial group utilizing birth and peanut balls and a control group receiving standard care. The trial group underwent training sessions to perform exercises such as pelvic rocking and squatting, designed to improve pelvic mobility and fetal alignment. Pain levels were assessed using the Visual Analog Scale (VAS), and outcomes were analyzed using SPSS software with a significance threshold of $p < 0.05$.

Results: The trial group exhibited significantly better outcomes in labour progress and pain management compared to the control group. Cervical dilation rates were higher in the trial group (Bishop's Score 6–8: 84.4% vs. 51.6%; p=0.00), and total labour duration was shorter (621.47 ± 158.414 minutes vs. 702 ± 149.603 minutes; p=0.022). Pain scores after exercise were significantly reduced in the trial group (VAS score: 5.75 ± 0.617 vs. 8.92 ± 0.27; p<0.001). Normal vaginal deliveries were more frequent in the trial group (84.3% vs. 65.6%; p=0.045), and cesarean section rates were lower (12.5% vs. 26.6%; p=0.045).

Conclusion: Birth and peanut balls offer a gentle, non-invasive, and effective method for pain relief and improved labour outcomes. They present a valuable addition to routine obstetric care and should be incorporated into clinical practice to enhance maternal and neonatal health. Future multi-center trials are recommended to validate these findings and explore their long-term impacts.

Keywords: Birth ball, Peanut ball, Labour pain, Non-pharmacological pain relief, Vaginal delivery, Maternal outcomes, Labour management, Pain reduction.

Introduction

Childbirth is a normal physiological process, yet it is often a life-changing and challenging experience for many women, marked by painful uterine contractions. Labour pain, characterized by sensory, emotional, and perceptive components, is caused by ischemic changes in the uterus, stretching of the cervix, and the lower uterine segment. It is considered one of the most intense pains experienced by women, profoundly affecting them physically and emotionally. Improper handling of childbirth may lead to complications such as prolonged labour or labour dystocia, increasing risks for both maternal and neonatal outcomes[1].

Prolonged labour is associated with complications, including neonatal infections, low Apgar scores, NICU admissions, and cesarean deliveries. Cesarean sections often result in extended recovery periods and heightened risks of complications during the postpartum period and future pregnancies. Therefore, strategies to address prolonged labour and enhance maternal and neonatal outcomes are critical.[2–3] Labour progresses through four stages, with the first stage being the longest, lasting 12–16 hours for primipara and 6–8 hours for multipara. During the active phase, marked by intense and frequent contractions, women often experience shakiness, nausea, and irritability.[4]

Efforts to reduce labour duration and improve birth outcomes have garnered significant attention.[5–7] The World Health Organization (WHO) recommends frequent position changes and movements during labour to prevent prolonged labour and cesarean sections. However, traditional practices in many hospitals, such as labour induction, epidural anesthesia, and continuous fetal monitoring, may limit mobility. To address these issues, tools like the birth ball provide an alternative for achieving frequent position changes without disrupting medical procedures.[8]

Non-pharmacological methods, including the use of birth balls, have gained popularity due to the adverse effects and high costs associated with pharmacological analgesia. Such methods promote comfort, well-being, and a sense of control, making labour a more positive experience. Non-pharmacological techniques include massage, hypnosis, transcutaneous electrical nerve stimulation (TENS), acupuncture, ice massage, hydrotherapy, aromatherapy, herbal therapy, music therapy, and birth ball exercises.[9–11]

The birth ball, also known as a fitball or Swiss ball, typically has a diameter of 55–65 cm. Initially used by physiotherapists for back pain relief, it was introduced as a childbirth tool in the 1980s. It allows women to sit or lean against it while performing exercises that relieve pain and anxiety, shorten labour duration, and facilitate fetal rotation and descent. Exercises include pelvic tilts, circular hip movements, gentle bouncing, and leaning forward. These exercises enhance pelvic mobility and alignment, promoting natural labour progress.[12–13]

Another variation is the peanut ball, a plastic ball shaped like a peanut, used during labour to position the fetus optimally in the pelvis. Its design supports various postures, including side-lying positions, helping to expand the pelvis and align the infant for easier delivery. The peanut ball is particularly useful for women unable to ambulate due to medical circumstances, promoting a C-curve spinal alignment that facilitates fetal passage through the pelvis.[14–15]

Both the birth ball and peanut ball are low-cost, non-invasive tools that can be reused and sterilized. They are effective in enhancing labour outcomes, especially in settings where maternal mortality remains high due to complications during labour and delivery. Despite their benefits, some healthcare providers restrict mobility during labour, limiting the potential advantages of such tools. The introduction of the peanut ball as a complementary, non-pharmacological intervention is gaining traction in reducing labour discomfort and duration.[16–18] While the peanut ball is increasingly used in labour and birth units, research on its efficacy remains limited. This study aims to evaluate the impact of the birth ball and peanut ball on labour progress, pain relief, and birth outcomes, contributing to the body of evidence supporting their use.[19]

Methodology

The study was conducted in the Department of Obstetrics and Gynecology at Adichunchanagiri Hospital and Research Centre, BG Nagar, as a two-arm randomized control study with block randomization. The duration of the study was 18 months, spanning from September 2022 to May 2024. Allocation concealment was achieved using sequentially numbered opaque sealed envelopes containing group assignments determined by computer-generated random sequences. These envelopes were handed over by the principal investigator to the healthcare worker responsible for carrying out the intervention. The study was single-blinded, with data collectors unaware of the intervention assignments.

Participants included in the study were primigravida and multigravida women with singleton pregnancies in cephalic presentations for vaginal birth, a gestational age of more than 37 weeks, and an uncomplicated obstetric history. Women with normal extremities were also included. Exclusion criteria were set for women with psychiatric disorders, hypertension, cephalopelvic disproportion, malpresentation, unwillingness to participate, complicated pregnancies requiring close monitoring or restricted mobility, and abnormal placental sites such as placenta previa or abruptio placentae.

Sample size was calculated considering the formula:

$$N = 2 \times \left(\frac{z_{1-\alpha} + z_{1-\beta}}{\delta_0} \right)^2 \times s^2$$

Visual Analogue Score (VAS) for pain $= 0.25$,
Alpha $= 0.05$
Power $= 80\%$

Using G Power software, it was determined that 64 participants per group were required, making the total sample size 128.

Approval for the study was obtained from the Institutional Ethics Committee of Sri Adichunchanagiri Hospital and Research Centre. Written informed consent was collected from all participants who met the inclusion criteria. The study's objectives, procedures, and expected outcomes were explained to each participant in detail before enrollment. Participants were randomized into either the intervention or control arm using computer-generated random sequences, with block randomization (block size of 5) ensuring equal distribution across both groups.

In the intervention arm, participants attended training sessions starting at 38 weeks of pregnancy, lasting one hour daily, and were asked to practice at home. These sessions were continued during the latent phase of labour. Birth balls of varying sizes (55 cm, 65 cm, and 75 cm) were provided, and participants were guided to select the appropriate size. They were taught four types of positions with eight exercises, including pelvic rocking, hula-hoop movements, and leaning forward. The exercises also included standing, kneeling, and squatting positions to enhance pelvic mobility, fetal descent, and alignment.

They also performed exercises using the peanut ball, including squatting, bouncing, side-lying, and semi-sitting positions. Exercises such as the tuck position, asymmetrical lunge, and kneeling with forward leaning were performed for 20–30 minutes to ensure bilateral pelvic opening. The exercises were designed to enhance maternal comfort and the effectiveness of the technique.

Patients who did not participate in any exercises are taken as the control group; they are asked to rest in their comfortable positions and given standard obstetric care. All participants answered questionnaires during labour at two points: when cervical dilation reached 4 cm and when it reached 7–8 cm. Standard care was provided for both groups. Investigations included blood group and Rh factor, complete blood count (CBC), random blood sugar (RBS), venereal disease research laboratory (VDRL) test, HIV, Hepatitis B antigen (HBsAg), urine routine and microscopy, obstetric scans, and non-stress tests (NST). The primary outcomes of the study included cervical dilation, total labour duration after using the birth ball, the overall childbirth experience, and the mode of delivery. Secondary outcomes focused on the requirement for assisted vaginal delivery or cesarean section, neonatal intensive care unit (NICU) admissions, and variations in neonatal APGAR scores.

The data was collected and compiled in MS Excel. Descriptive statistics have been used to present the data. To analyse the data, SPSS (Version 26.0) was used. Significance level was fixed as 5% ($\alpha = 0.05$). Qualitative variables are expressed as frequency and percentages, and quantitative variables are expressed as mean and standard deviation. To compare the proportion between groups, chi-square test was applied, and to compare the mean values between groups, student t-test was used.

Positions of birth-ball

Kneeling and forward leaning

Positions of Peanut-ball

Results

The socio-demographic analysis (Table 1) showed that the age distribution among participants was similar across the trial and control groups, with the majority aged between 21–30 years and no significant differences noted ($p = 0.188$). Primigravida women comprised 60.9% of the trial group and 67.2% of the control group, while multigravida women accounted for 39.1% and 32.8%, respectively, also showing no significant difference ($p = 0.461$). The gestational age distribution indicated a higher percentage of participants in the 39–40 weeks category in the trial group (57.8%) compared to the control group (39.1%), but this was not statistically significant ($p = 0.105$). Vital parameters (Table 1) such as pulse rate, systolic blood pressure (BP), and diastolic BP were comparable between the groups. The trial group had a mean pulse rate of 80.17 ± 5.403 bpm compared to 77.64 ± 6.121 bpm in the control group ($p = 0.342$). Systolic BP was 116.91 ± 7.928 mmHg in the trial group and 115.97 ± 8.526 mmHg in the control group ($p = 0.874$), while diastolic BP was 75.44 ± 6.042 mmHg and 71.06 ± 6.91 mmHg in the respective groups ($p = 0.423$).

The analysis of obstetric characteristics (Table 2) highlighted significant differences between the trial and control groups in terms of Bishop's Score and PV dilatation. A higher percentage of participants in the trial group had a Bishop's Score of 6–8 (84.4%) compared to the control group (51.6%), while the control group showed a higher proportion of participants with a score of 3–5 (48.4% vs. 15.6% in the trial group), with a statistically significant difference ($p = 0.00$). PV dilatation of > 3 cm was observed in 70.3% of the trial group compared to 64.1% in the control group, whereas < 3 cm dilation was more common in the control group (35.9%) than in the trial group (29.7%) ($p = 0.018$). Pain perception during exercise revealed marked differences, with all participants experiencing severe pain without exercise in both groups ($p = 1.000$). However, the trial group reported milder pain levels with exercise, including mild (46.9%) and moderate pain (53.1%), in contrast to the control group, where all participants reported severe pain with exercise ($p < 0.001$) (Table 2, Figure 1). The Visual Analog Scale (VAS) scores before exercise were similar across groups ($p = 0.873$), but post-exercise scores were significantly lower in the trial group (5.75 ± 0.617 vs. 8.92 ± 0.27; $p < 0.001$) (Table 2, Figure 2).

Labour characteristics (Table 3) showed comparable rates of labour induction, with 48.4% of the trial group and 43.8% of the control group requiring induction ($p = 0.122$). Spontaneous labour was also similar, with 39.1% in the trial group and 29.7% in the control group. The duration from 4 cm to full cervical dilatation was shorter in the trial group (511.02 ± 248.362 minutes) compared to the control group (624.14 ± 194.256 minutes). Second-stage labour was also significantly shorter in the trial group (28.68 ± 4.407 minutes vs. 34.69 ± 7.323 minutes, $p = 0.050$). The total labour duration was markedly lower in the trial group (621.47 ± 158.414 minutes) compared to the control group (702 ± 149.603 minutes, $p = 0.022$). Regarding the mode of delivery, normal vaginal deliveries were more frequent in the trial group (84.3%) than in the control group (65.6%), while the rate of cesarean sections was higher in the control group (26.6% vs. 12.5% in the trial group, $p = 0.045$). Instrumental deliveries were less common in both groups, with rates of 3.13% in the trial group and 7.8% in the control group (Table 3). Indications for cesarean sections, including failure to progress and fetal distress, were similar between groups, with no significant differences noted.

The maternal and perinatal outcomes (Figure 3) indicated excellent results in both groups, with 100% good outcomes for mothers and neonates in both the trial and control groups. The interventions were associated with improved maternal comfort and enhanced neonatal well-being, as reflected by the comparable and favourable outcomes in both groups.

Figure 1: Impact of exercise on pain

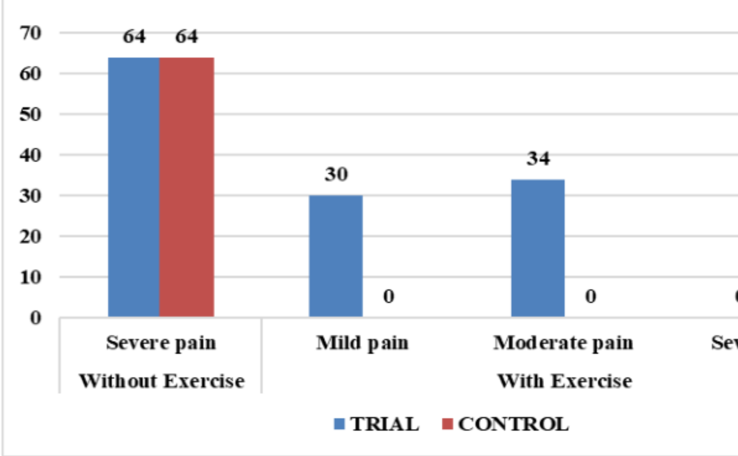


Table 1. Socio-demographic characteristics

Socio-demographic characteristics		Trial Group	Control Group	P value
Age Group	18-20 years	3 (4.7%)	2 (3.1%)	0.188
	21-25 years	34 (53.1%)	24 (37.5%)	
	26-30 years	25 (39.1%)	32 (50.0%)	
	31-35 years	2 (3.1%)	6 (9.4%)	
Obstetric Score	Primigravida	39 (60.9%)	43 (67.2%)	0.461
	Multigravida	25 (39.1%)	21 (32.8%)	
Gestational Age	37-37+6 weeks	5 (7.8%)	7 (10.9%)	0.105
	38-38+6 weeks	22 (34.4%)	32 (50.0%)	
	39-40 weeks	37 (57.8%)	25 (39.1%)	
Vital Parameters	Pulse Rate (bpm)	80.17 ± 5.403	77.64 ± 6.121	0.342
	Systolic BP (mmHg)	116.91 ± 7.928	115.97 ± 8.526	0.874
	Diastolic BP (mmHg)	75.44 ± 6.042	71.06 ± 6.91	0.423

Table 2. Obstetric characteristics

Obstetric characteristics		Trial Group	Control Group	P value
Bishop's Score	3-5	10 (15.6%)	31 (48.4%)	0.00
	6-8	54 (84.4%)	33 (51.6%)	
PV Dilatation	<3 cm	19 (29.7%)	23 (35.9%)	0.018
	>3 cm	45 (70.3%)	41 (64.1%)	
Exercise	Severe Pain without Exercise	64 (100%)	64 (100%)	1.000
	Mild Pain with Exercise	30 (46.9%)	-	<0.001
	Moderate Pain with Exercise	34 (53.1%)	-	<0.001
	Severe Pain with Exercise	-	64 (100%)	1.000
VAS Score	Before Exercise	8.41 ± 0.583	8.92 ± 0.27	0.873
	After Exercise	5.75 ± 0.617	8.92 ± 0.27	<0.001

Table 3. Labour characteristics

Labour characteristics		Trial Group	Control Group	P value
Induction	Induced	31 (48.4%)	28 (43.8%)	0.122
	Spontaneous	25 (39.1%)	19 (29.7%)	
4 cm to Full Dilatation (mins)		511.02 ± 248.362	624.14 ± 194.256	-
Second Stage (mins)		28.68 ± 4.407	34.69 ± 7.323	**0.050**
Total Labour Duration (mins)		621.47±158.414	702±149.603	**0.022**
Mode of Delivery	LSCS	8 (12.5%)	17 (26.6%)	**0.045**
	NVD	54 (84.3%)	42 (65.6%)	
	Instrumental Deliveries	2 (3.13%)	5 (7.8%)	
Indication for LSCS	CDMR	0 (0%)	3 (4.7%)	0.174
	CPD in Labour	1 (1.6%)	2 (3.1%)	
	Failure to progress	6 (9.4%)	11 (17.2%)	
	Fetal distress	1 (1.6%)	1 (1.6%)	

Figure 2: VAS score before and after exercise

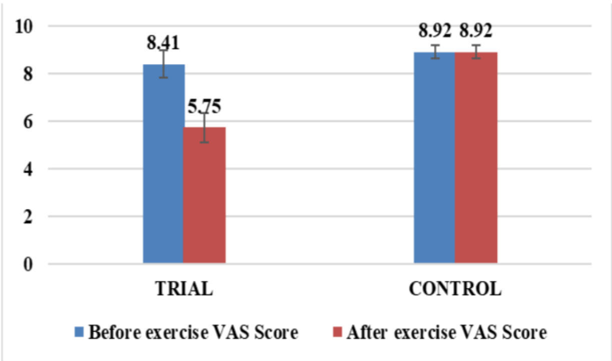
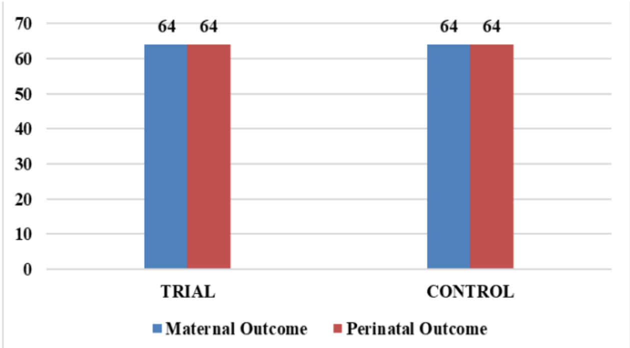


Figure 3. Good maternal and perinatal outcome



Discussion

Labour is the active phase of delivering the fetus, as the mother experiences painful and regular uterine contractions. This pain is associated with ischemic changes of the uterus, which are observed during the alternating phase of contractions, as well as dilatation of the cervix and lower uterine segment leading to tissue damage of the perineum. Non-pharmacological management techniques include positioning, massage, hypnosis, acupuncture, transcutaneous electrical nerve stimulation, water immersion, music therapy, hydrotherapy, aromatherapy, herbal remedies, birthing ball, and others, used to reduce pain and make the patient comfortable during labour without any harm or side effects to both mother and fetus. In our study, the majority of participants were aged 21–25 years. This is consistent with findings by Tussey, Delgado, and Stulz, where participants' ages ranged from 18 to 35 years, indicating that younger maternal age groups are commonly involved in these interventions. Tussey et al. included women aged 18–35 years, similar to our study, emphasizing the relevance of peanut ball interventions across young maternal populations.[14] Delgado et al. also reported that the use of peanut balls was beneficial across this age group, aligning with our study's demographic. Stulz et al. found similar age ranges, reinforcing the broad applicability of birth ball interventions.

Our study included a mix of primigravida and multigravida women, with 60.9% being first-time mothers. Delgado et al. included both primiparous and multiparous women, reflecting the broad applicability of peanut balls across different obstetric histories. This finding aligns with our inclusion of first-time and experienced mothers, indicating that both groups benefit from the use of peanut balls. The BMC Pregnancy and Childbirth study also considered the parity of women and found that birth ball exercises were effective for both first-time and experienced mothers, similar to our findings.

In our study, the duration from 4 cm to full cervical dilatation was significantly shorter in the trial group using peanut balls. Delgado et al. reported that the use of peanut balls reduced the first stage of labor by an average of 87 minutes and the second stage by 22 minutes. This reduction is consistent with our findings of shorter labor durations in the trial group. Roth et al. also found that using peanut balls during labor resulted in shorter labor durations, which supports our study's outcomes. Tussey et al. reported that using a peanut ball significantly decreased the length of the first stage of labor, corroborating our findings of reduced labor durations.[20]

Our study found that the trial group had a higher rate of normal vaginal deliveries and a lower rate of cesarean sections compared to the control group. Bell et al. showed that incorporating birth ball exercises into a labor support protocol reduced the cesarean delivery rate and increased the likelihood of vaginal delivery, aligning with our findings of improved labor outcomes in the trial group.[21] Delgado et al. noted that while the reduction in cesarean risk with peanut ball use was not statistically significant, there was a trend towards higher vaginal delivery rates, which supports our observations. Stulz et al. reported improved labor outcomes with birth ball use, including increased rates of spontaneous vaginal deliveries and reduced need for cesarean sections, similar to our findings.[22]

Our study showed significant pain reduction in the trial group using birth balls, with many participants reporting mild to moderate pain levels. The Cochrane Systematic Review found significant pain relief and higher satisfaction levels in women using birth balls compared to those receiving standard care, aligning with our results of effective pain management using birth balls during labor.[23] The BMC Pregnancy and Childbirth study demonstrated that birth ball exercises significantly reduced labor pain and improved maternal satisfaction, consistent with our findings of reduced pain levels and positive labor experiences in the trial group.[24] In the meta-analysis report by Alexandre and associates in 2019, there is evidence of using the peanut ball in the first stage of labour, which helped in reducing pain within 20–90 minutes of using it.

The mechanism by which a birth ball might reduce labour pain is not established. The birth ball works by supporting the perineum, reducing the pressure on pelvic floor muscles, and providing comfort to the patient by reducing the pain. The ball blocks pain by acting on the sensory discriminative component of pain (Pain Gate Theory). These tools are beneficial across various age groups and obstetric histories, significantly reducing labor duration, managing pain effectively, and increasing the likelihood of normal vaginal deliveries.

Strengths

The study demonstrated that birth ball and peanut ball exercises effectively alleviated pain, reduced anxiety, and resulted in fewer cesarean sections with more normal vaginal deliveries. These non-pharmacological methods offer a side-effect-free, resource-efficient alternative to pharmacological therapies for managing labour pain.

Limitations

The study's limitations include a relatively small sample size, restricting generalizability, and its single-center design, which may not reflect broader clinical settings. Selection bias due to non-randomized participant selection and reliance on subjective pain assessment through the Visual Analog Scale (VAS) further limit the robustness of the findings.

Implications

Incorporating birth ball and peanut ball exercises as routine practice in labour wards can reduce labour pain, decrease cesarean delivery rates, and shorten labour duration without drug-related side effects. Educating patients and ensuring the availability of these cost-effective tools, even in low-resource settings, is essential for improving maternal outcomes.

Recommendations

Future studies should address these limitations through larger, multi-center randomized controlled trials with stratified sampling to reduce bias and improve generalizability. Combining objective and subjective measures of labour outcomes and exploring the long-term maternal and neonatal health impacts, as well as cost-effectiveness, would provide stronger evidence for integrating these interventions into clinical practice.

Conclusion

A human body can typically endure up to 45 dels of pain, yet during childbirth, women experience pain reaching up to 57 dels. This highlights the extreme discomfort mothers face during labour, a journey that transforms both their lives and their identity as a mother. It is crucial to prioritize the comfort and support of women during the 10 to 12 hours of intense labour pain. Modern mothers increasingly opt for cesarean sections or pharmacological methods for painless deliveries, leading to a rise in cesarean rates and delivery costs. To mitigate the complications associated with these methods, non-pharmacological approaches like the use of birth balls and peanut balls offer effective alternatives. These methods help alleviate pain and anxiety, reduce cesarean section rates, and can be implemented even in low-resource settings.

Birth balls provide a simple yet powerful solution for reducing labour pain. They are associated with shorter labour durations, lower pain levels, and higher rates of normal vaginal deliveries. Beyond being an exercise tool, the birth ball serves as a supportive partner in pain relief, enhancing the comfort of expectant mothers during pregnancy and labour. Incorporating these exercises, along with passive workouts at home during term gestation, should be recommended in all healthcare institutions to improve maternal and fetal outcomes. While this study underscores the benefits of birth balls and peanut balls, further research is needed to confirm these findings across diverse populations and settings. By addressing the limitations and expanding on the current results, future studies can strengthen the evidence for clinical use, ultimately enhancing maternal and neonatal care. Birth balls emerge as a gentle yet profound tool for pain relief, making labour a more bearable and positive experience for mothers.

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