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A UTILIZAÇÃO DE BOLAS DE PARTO DURANTE O TRABALHO DE PARTO: UMA REVISÃO SISTEMÁTICA DA LITERATURA

THE USE OF BIRTHING BALLS DURING LABOUR: A SYSTEMATIC LITERATURE REVIEW

EL USO DE PELOTAS DE PARTO DURANTE EL TRABAJO DE PARTO: UNA REVISIÓN SISTEMÁTICA DE LA LITERATURA

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RESUMO

Introdução: As bolas de parto têm surgido como uma alternativa valiosa nos cuidados ao parto, promovendo não só o alívio da dor, mas também uma experiência mais positiva e fortalecedora, minimizando a necessidade de intervenções médicas invasivas. Esta abordagem holística e centrada na mulher pode transformar positivamente a experiência, contribuindo para resultados maternos e neonatais mais saudáveis e satisfatórios.
Objetivo: Analisar a evidência sobre a influência da utilização de uma bola de parto no alívio da dor e na progressão do trabalho de parto.
Métodos: Revisão sistemática da literatura, a busca foi realizada nas bases de dados Medline, Scielo, Cinahl e PubMed, utilizando o método de busca booleana "AND", "OR", com a utilização dos descritores DeCs/MeSH.
Resultados: Aplicando os critérios definidos, foram selecionados e analisados cinco artigos publicados entre 2018 e 2023. Os autores destacam que, apesar das preocupações com a dor e duração do parto, os resultados evidenciam que o uso das bolas de parto proporcionou uma experiência positiva e alívio da dor.
Conclusão: Através da análise dos artigos, percebe-se que o uso de bolas de parto contribui para uma experiência de parto mais positiva e para o empoderamento materno, minimizando os potenciais riscos associados às intervenções medicamentosas. Foi observado que o uso de bolas de parto também afeta a duração do trabalho de parto e a incidência de partos instrumentados.

Palavras-chave: parto normal; trabalho de parto; dor do parto; manejo da dor; terapias complementares

ABSTRACT

Introduction: Birthing balls have emerged as a valuable alternative in childbirth care, promoting not only pain relief but also a more positive and empowering experience while minimizing the need for invasive medical interventions. This holistic, woman-centered approach can positively transform the experience, contributing to healthier and more satisfying maternal and neonatal outcomes.
Objective: To analyze the evidence on the influence of using a birthing ball on pain relief and the progression of labor.
Methods: Systematic literature review; the search was carried out in the Medline, Scielo, Cinahl, and PubMed databases, using the Boolean search method "AND," and "OR," using the descriptors DeCs/MeSH.
Results: Applying the defined criteria, five articles published between 2018 and 2023 were selected and analyzed. The authors highlight that, despite concerns about pain and the duration of labor, the results show that the use of birthing balls provided a positive experience and pain relief.
Conclusion: Through the analysis of the articles, it is clear that the use of birthing balls contributes to a more positive childbirth experience and maternal empowerment while minimizing the potential risks associated with drug interventions. It was observed that using birthing balls also affects the duration of labor and the incidence of instrumented deliveries.

Keywords: natural childbirth; labor, obstetric; labor pain; pain management; complementary therapies

RESUMEN

Introducción: Las pelotas de parto han surgido como una valiosa alternativa en la atención al parto, ya que promueven no sólo el alivio del dolor, sino también una experiencia más positiva y empoderadora, al tiempo que minimizan la necesidad de intervenciones médicas invasivas. Este enfoque holístico, centrado en la mujer, puede transformar positivamente la experiencia, contribuyendo a unos resultados maternos y neonatales más saludables y satisfactorios.
Objetivo: Analizar las pruebas sobre la influencia del uso de una pelota de parto en el alivio del dolor y la evolución del parto.
Métodos: Revisión sistemática de la literatura, la búsqueda se realizó en las bases de datos Medline, Scielo, Cinahl y PubMed, utilizando el método de búsqueda booleana «AND», «OR», utilizando los descriptores DeCs/MeSH.
Resultados: Aplicando los criterios definidos, se seleccionaron y analizaron cinco artículos publicados entre 2018 y 2023. Los autores destacan que, a pesar de las preocupaciones sobre el dolor y la duración del parto, los resultados muestran que el uso de pelotas de parto proporcionó una experiencia positiva y alivio del dolor.
Conclusión: A través del análisis de los artículos, se evidencia que el uso de pelotas de parto contribuye a una experiencia de parto más positiva y al empoderamiento materno, a la vez que minimiza los riesgos potenciales asociados a las intervenciones farmacológicas. Se observó que el uso de pelotas de parto también afecta a la duración del parto y a la incidencia de partos instrumentados.

Palabras Clave: parto normal; trabajo de parto; dolor de parto; manejo del dolor; terapias complementarias

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INTRODUCTION

Labor is characterized by regular, painful uterine contractions that increase in frequency and intensity during the three stages of labor. The level of pain control a woman feels over pain during labor can indicate emotional well-being during childbirth (Cavalcanti et al., 2019).

The duration of each stage varies depending on the position the woman assumes during labor, and verticalization is recognized as a relevant factor in shortening the time of the first stage of labor (Biana et al., 2021).

Labor pain is considered to be an unpleasant sensory and emotional experience associated with or similar to that associated with actual or potential tissue damage (Raja et al., 2020). Pain perception during labor varies between individuals and can be influenced by physical, psychological, and relational factors. These factors include the birthing position, emotions such as fear and anxiety, and the quality of interaction with health professionals (Thomson et al., 2019).

Pain management in childbirth is a critical aspect of maternal care. In 2018, the World Health Organization (WHO) recognized that pain relief during childbirth is considered a standard of quality care. This includes access to pain relief options, such as epidural analgesia, if desired by the woman, as well as non-pharmacological approaches to pain control.

In this context, psychoprophylactic theory emerges, the aim of which is to cultivate psychological and emotional preparedness in both the woman and the couple through various trust and pain management techniques. Understanding the physical and emotional dimensions of pain is essential to providing comprehensive care during childbirth. In this context, pain relief is a priority to ensure the mother's well-being (Lowdermilk & Perry, 2008).

The use of birthing balls, such as the Swiss Ball and the Peanut Ball, has shown promise because they provide movements that help the mother adapt during labor, contributing to pain relief and improving the experience (Mendes et al., 2022).

In 1963, the "Stability Ball" or Swiss ball (pilates ball, bobath ball, gym ball, birth ball, fit ball, ballness, prana ball, pezzi ball, stability balls, exercise balls, physio-balls), was created as a toy in Italy by Aquilino Cosani, an Italian plastics manufacturer. However, it wasn't until the 1980s that its use was first recorded in the field of obstetrics in Germany, where midwives believed that its use had several benefits for childbirth, providing emotional advantages for parturients and giving them a sense of control and emotional comfort. The Swiss ball comes in different sizes (45, 55, 65, and 75cm) so that the parturient's knees form a 90-degree angle, and choosing the right size is essential to ensure its effectiveness and safety (Gallo et al., 2014; Silva et al., 2023).

The peanut ball, also known as the bean ball, is often derived from the Swiss ball. It was developed to address situations where the Swiss ball may not be suitable, especially in cases of coordination or balance problems. It comes in different sizes (40, 50, 60, and 70 cm) and must be adapted according to the height of the woman giving birth and the position chosen. It has a curvature specifically designed to be positioned between and below the pregnant woman's knees, thus allowing her to adopt lateral, supine, or sitting positions (Grant, 2022). The use of this type of ball in the second stage of labor promotes the progressive descent of the fetus and aids in its rotation (Kamath et al., 2022).

The aim of this study is to analyze the evidence on the influence of using a birthing ball on pain relief and the progression of labor.

1. METHODS

The systematic review method is a retrospective and secondary study, i.e. it is carried out on the basis of experimental studies that have already been published and aims to synthesize evidence on a specific problem/theme by analyzing these publications with primary research data (Casarin et al., 2020).

The research question of this systematic review was "What is the influence of using a birthing ball on pain relief and the progression of labor?". The research question is formulated using the anagram PICOD: participants (P), intervention (I), comparison (C), results (O) and study design (D) (Donato & Donato, 2019; Galvão & Pereira, 2014), with the methodology shown in Table 1.

Table 1 - Data analysis process according to the PICOD method

P	**Participants**	Who was studied?	Pregnant women in labor
I	**Interventions**	What was done?	Use of birthing ball and peanuts during labor
C	**Comparisons**	Comparing variables	Parturients who used the peanut ball and parturients who used the birthing ball
O	**Outcomes**	Results, effects or consequences	Effect of the different balls on pain relief, progression of labor, occurrence of instrumented deliveries and duration of labor
D	**Study design**	How was the evidence collected?	Quantitative and qualitative studies, with a time horizon of 5 years, in Portuguese, English or Spanish

Source: Adapted from (Donato & Donato, 2019)

A search was carried out in the following databases: Cinahl, PubMed, Medline and Scielo. The descriptors "natural childbirth", "parturition", "labor, obstetric", "labor pain" and "pain management" were applied, validated by DeCs/MeSH and the Boolean operators "AND" and "OR", obtaining a total of 1578 articles, in Medline (689), Scielo (439), Cinalh (284) and PubMed (166). Exclusion criteria: literature reviews; articles with inadequate samples; articles based on the approach or point of view of

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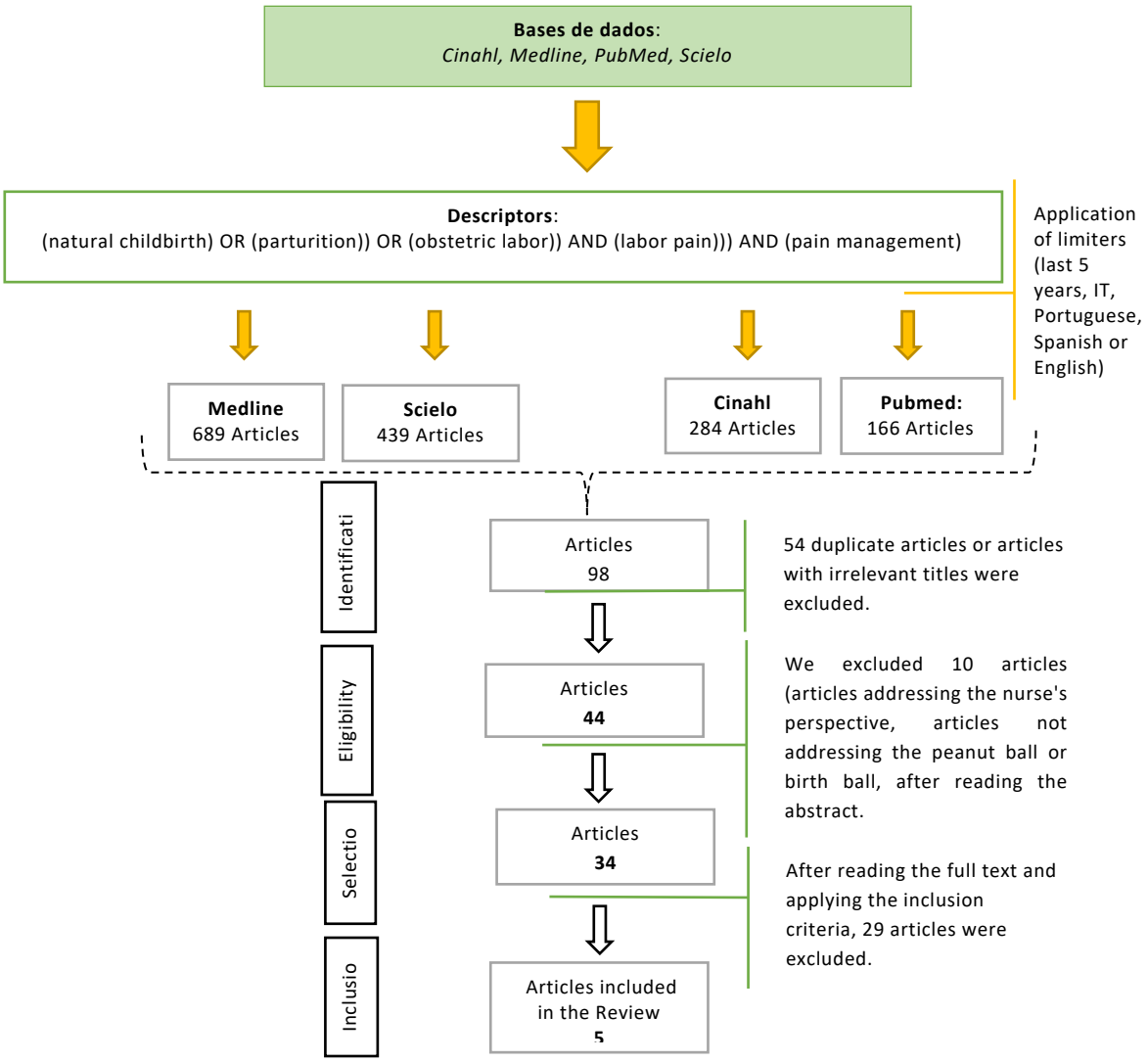
professionals; articles in a language other than Portuguese, Spanish or English. The inclusion criteria were articles covering a horizontal period of 5 years (2018-2023), articles published in English/Spanish/Portuguese, and articles exploring the relationship between birthing balls and labor.

After searching the aforementioned databases, the limiting factors were applied and then the title was read in order to exclude articles that were of little interest to the topic in question. After reading the title, the abstracts were read, applying the inclusion or exclusion criteria. The methodological quality of the selected articles was assessed, and the levels of evidence were classified, based on the criteria of the Joanna Briggs Institute (Joanna Briggs Institute, 2014). Finally, a careful reading of the full text (IT) was carried out, resulting in a total of 5 articles for analysis that met the objective of this study.

In order to facilitate the organization of the process of identifying and selecting evidence for the systematic literature review, the review protocol followed the Preferred Reporting Items for Systemic Review and Meta-Analyses (PRISMA) shown in Figure 1 (Page et al., 2021), so that the steps involved in conducting this systematic review can be visually understood. This whole process was carried out by the two authors; the full-text reading stage was carried out independently. The two authors resolved the points on which they disagreed through discussion.



Source: Adapted from (Page et al., 2021)

Figure 1- Prism Diagram

The entire research process was carried out by the two authors, and there was always consensus when selecting and analyzing the articles, although if there was no consensus, a third person would be included, which did not prove necessary.

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2. RESULTS

The results of the research were presented according to the research question formulated, based on the inclusion and exclusion criteria established previously. The articles were listed with the letter A (article) to facilitate data processing.

Table 2 - Summary of article analysis

Nº	Title of article/author(s)/year	Study objective	Methodology / Level of evidence	Results
A1	**Title:** Nonpharmacological Methods to Reduce Pain During Active Labor in A Real-life Setting (Silva et al., 2023) **Year**: 2023	To evaluate the association between the intensity of pain in the active phase of the first stage of labor and the use or not of non-pharmacological methods for pain relief in a real-life scenario.	This is observational cross-sectional study out at the Gynecology and Obstetrics department of the Mário Palmerio University Hospital (MPHU) in Uberaba, Minas Gerais, Brazil. The study took place between August 2019 and July 2021. A total of 439 puerperal women (48 hours after delivery) who delivered vaginally were selected and invited to complete a structured questionnaire on the use of non-pharmacological methods for pain relief during labor. They were divided into two groups: group I (n=53), who did not use any method for pain relief, and group II (n=386), who used at least one non-pharmacological method for pain relief. **Level of Evidence:** Level 2.d - Pre-test - post-test or historic/retrospective control group study	Various non-pharmacological methods of pain relief were used, including maternal mobility (72%) and the use of the Swiss or birth ball (46.7%), among others. Significant effects were observed between the groups about gestational age, duration of labor, and birth weight. They add that labor with complications increases the release of catecholamines caused by pain, which raises levels of emotional stress and interferes with the duration of labor. The use of non-pharmacological strategies was beneficial in the latent phase of labor.
A2	**Title:** The effect of delivery ball and warm shower on the childbirth experience of nulliparous women: a randomized controlled clinical trial (Sharifipour et al., 2022) **Year:** 2022	To determine the effect of birthing balls and hot baths on the birth experience in primiparous women	Randomized controlled clinical trial. The study was carried out at Motazedi Hospital in Jermanshah, Iran. The 105 parturients were divided into three groups: birthing balls plus hot water shower or A (n=35); birthing balls or B (n=35); and control or C (n=35). Two hours after giving birth, the participants filled in a questionnaire about their childbirth experience (childbirth experience questionnaire -CEQ) and their obstetric and personal history. The questionnaire is based on a 4-point Likert scale. **Level of Evidence:** Level 1.c - RC	It was concluded that the average score for childbirth experience, the support domain and professional participation was higher in both intervention groups (A and B) than in the control group (C). The use of both interventions during childbirth is recommended in order to achieve a more positive childbirth experience for women.
A3	**Title:** The Effect of Birthing Ball Exercises on Labor Pain and Labor Outcome Among Primigraviade Parturient Mothers at a Tertiary Care Hospital (Jha et al., 2023) **Year:** 2023	To evaluate the effect of birthing ball exercises on labor pain and labor outcomes in primiparous parturients in a tertiary care hospital.	This study adopted a quasi-experimental design. A total of 60 primiparous women were divided into the control and experimental groups. They were selected through consecutive sampling. In the experimental group, the primiparous women underwent two birthing ball exercise sessions, each lasting 20 minutes, with an interval of one hour between them during the active phase of labor.Pain intensity was assessed using the visual analog scale (VAS) during the transition phase of labor. **Level of Evidence:** Level 2.c - Quasi-experimental prospectively controlled study	The results suggest that the use of exercises with the birthing ball during labor in primiparous women had positive effects, resulting in improvements in labor pain, labor progression, as well as a reduction in dystocia. The use of the birthing ball also showed greater benefits for fetal well-being.
A4	**Title:** Birthing ball versus pethidine and haloperidol in satisfaction with childbirth (Fernández-Arranz et al., 2019) **Year:** 2019	To analyze the impact of using the birth ball as a pain relief technique compared to subcutaneous administration of pethidine (50mg) and haloperidol (2.5mg) on maternal satisfaction during the latent phase of labor.	Randomized clinical trial, unicenter, parallel, and controlled clinical trial. The study was carried out in the pathological pregnancy unit of the maternal and child building of the Gregorio Marañón University General Hospital in Madrid from November 2013 to November 2015. The sample consisted of 110 low-risk pregnant women (55 in the experimental group (EG) and 55 in the comparison group (CG). The intervention group performed predefined movements on the birth ball, while the comparison group received an identical subcutaneous dose of pethidine and haloperidol. In addition, between 48 and 72 hours after delivery, the Mackey Childbirth Satisfaction Scale was applied to assess the mothers' level of satisfaction with the childbirth experience. **Level of Evidence:** Level of Evidence: Level 1.a - Systematic review of Randomized Controlled Trials (RCTs)	The results indicate that the use of pethidine and haloperidol causes side effects in both mother and baby. The study, therefore, concludes that the use of birthing balls during the latent phase of labor increases women's satisfaction with the birth experience more than the administration of drugs such as pethidine and haloperidol.

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Nº	Title of article/author(s)/year	Study objective	Methodology / Level of evidence	Results
A5	**Title:** Effect of Peanut Ball and Position Changes in Women Laboring with an Epidural (Hickey & Savage, 2019) **Year:** 2019	To evaluate the influence of changes in position on the peanut ball (PB) during labor on the duration of labor and the incidence of caesarean sections in women who had epidural anesthesia.	Quasi-experimental study with control group. The study was carried out in a Magnet Hospital, characterized as a Baby-Friendly institution. Participants in the peanut ball- PB group (n=162) were selected through a convenience sample between November 2016 and October 2017. The peanut ball was placed after the administration of epidural anesthesia. The women alternated decubitus every 1/2 hour. **Level of Evidence:** Level 2.c Quasi-experimental prospectively controlled study	The results show a lower incidence of caesarean sections among women who used BP with epidural anesthesia. It was found that although the PB intervention alone did not reduce the duration of labor, frequent changes in position had a positive impact on reducing the duration of labor.

The results of the studies included in this review were analyzed using the software IRaMuTeQ version 0.7 alpha 2 (Camargo & Justo, 2013). Figure 2 shows the analysis of the similarity of the words present in the text, which makes it possible to identify co-occurrences between the words, providing evidence of the connection between the words.

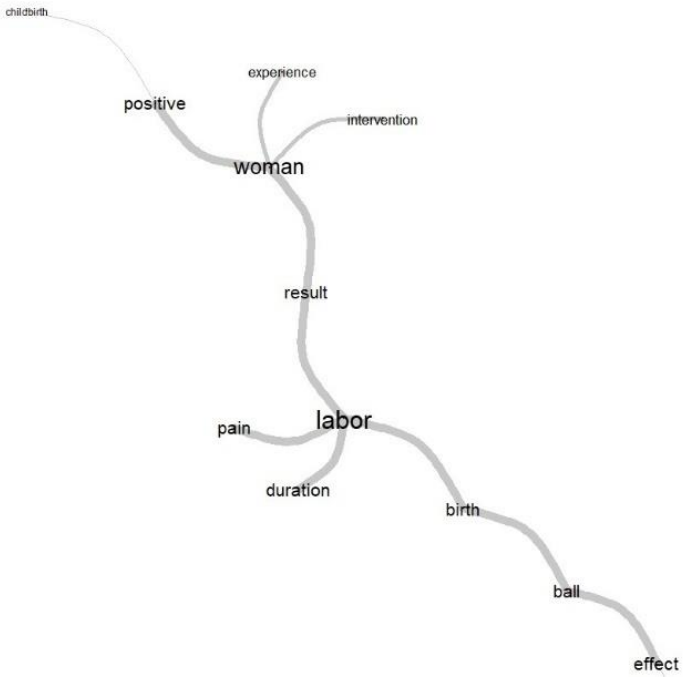

Figure 2 - Similarity analysis tree.

In both representations, we can see that childbirth is central to the authors' concerns, with worries about pain and the length of labor. On the other hand, we could see that the results show that the woman had a positive childbirth experience and that using the birthing balls had a positive childbirth effect and pain relief.

3. DISCUSSION

Analysis of the articles can shed light on the context in which birth balls are used and their benefits and limitations.
We will present the discussion by themes that emerged from the analysis of the articles to answer the research question "What is the influence of the use of birth balls on pain relief and the progression of labor?"

The use of birthing balls as non-pharmacological pain relief strategies for women in labor

Silva et al. (2023) state that the use of non-pharmacological pain relief strategies reduces the levels of catecholamines released into the bloodstream and thus reduces maternal and fetal stress. She adds that adopting non-pharmacological strategies increases the production of endogenous endorphins, which bind to pain relief receptors.
Using the ball during pregnancy promotes greater awareness of the body and changes in the center of gravity, reducing lumbar pelvic pain and increasing women's confidence and mobilization during labor (Biana et al., 2021). The study by Jha et al. (2023)

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corroborates the previous author's statement by presenting promising results that the use of the birthing ball allowed pain relief in parturients who used it compared to those who did not.

Many opioids are administered intramuscularly or intravenously, acting as analgesia during labor and delivery. Therefore, the recurrent use of these drugs can lead to unwanted side effects in the mother and fetus. These effects include pruritus, nausea/vomiting, respiratory depression, decreased fetal heart rate variability, neonatal respiratory depression, lower APGAR scores, and impaired early breastfeeding (Nanji & Carvalho, 2020).

In the author's article (Fernández-Arranz et al., 2019), there was a comparison between non-pharmacological strategies and the use of drugs. In this context, the use of the Swiss ball stood out as providing pain relief to parturients, as well as reducing the collateral risks associated with the use of drugs for both the pregnant woman and the fetus.

Various non-pharmacological approaches have been shown to be effective in relieving pain and improving labor, including the use of Swiss ball exercises (Silva et al., 2023).

The authors (Fernández-Arranz et al., 2019; Jha et al., 2023), report that the use of the birthing ball as a non-pharmacological strategy resulted in pain relief during labor.

Relationship between the use of birthing balls and the need for instrumented deliveries

According to Ingram et al. (2022), non-pharmacological pain relief strategies have shown great potential for reducing both maternal discomfort and anxiety. Unlike pharmacological approaches, these methods carry little or no risk to the health of the mother and fetus.

In the article by Silva et al. (2023), various non-pharmacological pain relief methods were applied, such as maternal mobility, showering, ambulation, Swiss or birth ball, massage, and relaxation techniques. The results showed that the group that used non-pharmacological methods had a higher prevalence of vaginal delivery.

Various studies (Hickey & Savage, 2019; Jha et al., 2023; Silva et al., 2023), corroborate the fact that the use of non-pharmacological strategies, such as the use of the Swiss ball, allows for a higher prevalence of vaginal deliveries and thus avoids instrumental deliveries.

In addition to avoiding instrumented deliveries, Jha et al. (2023) also mention that the use of the birthing ball during labor reduces the incidence of newborns in the neonatal intensive care unit, as well as showing a better percentage of newborns adapting to the extrauterine environment.

Promoting maternal empowerment and satisfaction with the use of the birthing ball during labor

Medical interventions, such as induction with oxytocin and the use of pharmacological methods for pain relief, are often adopted for various purposes during childbirth. Although they bring benefits, they also carry risks for the health of the mother and the fetus.

These adverse consequences can negatively influence the childbirth experience, leading women to opt for elective caesarean sections, which in themselves have a higher degree of associated risk. The childbirth experience has a direct impact on the mother's physical and mental well-being in the postpartum period.

The historical influence of the biomedical model, predominantly focused on pharmacological approaches, is being questioned as access to information and understanding of the maternal experience evolves.

The use of non-pharmacological methods of pain relief promotes a positive and rewarding experience of labor, allowing women to feel respected, empowered, and supported throughout the process (Martins Barbosa et al., 2023).

Although the importance of pain relief is undeniable, it is only one aspect of the overall childbirth experience. This experience goes beyond pain relief, encompassing feelings of control, autonomy, well-being, satisfaction, and the quality of the support provided by health professionals (Oskoui et al., 2023).

According to the study by Thomson et al. (2019), women who received non-pharmacological methods of pain relief expressed feelings of control, joy, and empowerment.

In agreement, the studies by Fernández-Arranz et al. (2019) and Sharifipour et al. (2022), reported that with the use of the birthing ball, parturients showed an increase in satisfaction with the perception of childbirth, a greater sense of safety and professional support and greater participation, as well as an increase in maternal satisfaction.

Understanding that the childbirth experience goes beyond pain relief encompasses control, autonomy, and satisfaction. In this way, the results highlight the importance of holistic, woman-centered approaches. The use of birthing balls aligns with this vision by providing a tool not only for pain relief but also for empowering parturients and improving their perception of childbirth as a natural and positive event.

The influence of the use of birthing balls on the duration of labor

Although pharmacological measures provide pain relief during labor, it is important to consider that additional doses of these drugs can paradoxically contribute to the extension of the labor process. This is due to the effects they can have on uterine contractions and maternal mobility, which can negatively influence the progression of labor (Biana et al., 2021).

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On the other hand, as noted by (Biana et al., 2021) the use of the Swiss ball during pregnancy and labor has a different purpose. It aims to promote pelvic mobilization, encouraging the adoption of vertical postures, which, in turn, facilitate the descent of the fetus. By adopting this approach, it is possible to contribute to a reduction in the duration of labor, highlighting the positive potential of non-pharmacological strategies.

Fernández-Arranz et al. (2019), Hickey and Savage (2019), and Jha et al. (2023) state that the use of the birth ball has results that directly influence the duration of labor. Also, the alternation of positions achieved through the use of the peanut ball, as mentioned by the study by Hickey & Savage (2019), reduces the duration of labor.

The use of Swiss ball exercises provides pain relief, as well as faster cervical dilation and, through the movements, a descent of the fetus (Silva et al., 2023). Also, the study by Kamath et al. (2022) states that the use of the peanut ball in the second stage of labor promotes the progressive descent of the fetus and aids in its rotation. The studies by Fernández-Arranz et al. (2019) and Jha et al. (2023), corroborate that parturients who performed exercises on the birthing ball showed faster cervical dilation, resulting in a shorter duration of labor.

The peanut ball, in turn, proved advantageous in circumventing the obstacles created by the use of epidural analgesia. One of the consequences of epidural analgesia can be a decrease in the sensitivity of the lower limbs, making it difficult to stand and walk. Thus, the results obtained show that the peanut ball helps to position the parturient in the most beneficial position, as well as in the pelvic opening.

In 2018, the World Health Organization (WHO) issued new guidelines aimed at establishing global standards of care for healthy pregnant women, with the aim of reducing unnecessary medical interventions. However, over the last 20 years, there has been an increase in the use of medical procedures that were once reserved only for risky situations—for example, the use of oxytocin or cesarean sections. The new recommendations, therefore, aim to reverse this trend (World Health Organization, 2018).

Thus, Goal 3 of sustainable development highlights health and well-being for all ages. The Global Strategy for Women's, Children's, and Adolescents' Health emphasizes that all women have the right to and should obtain the highest attainable standard of health, including physical and psychological care (United Nations, 2023).

Based on the interpretation and synthesis of the evidence identified, an infographic of the review carried out is presented with the particularities of the influence of the use of birthing balls on pain relief and the progression of labor (Fig. 3).

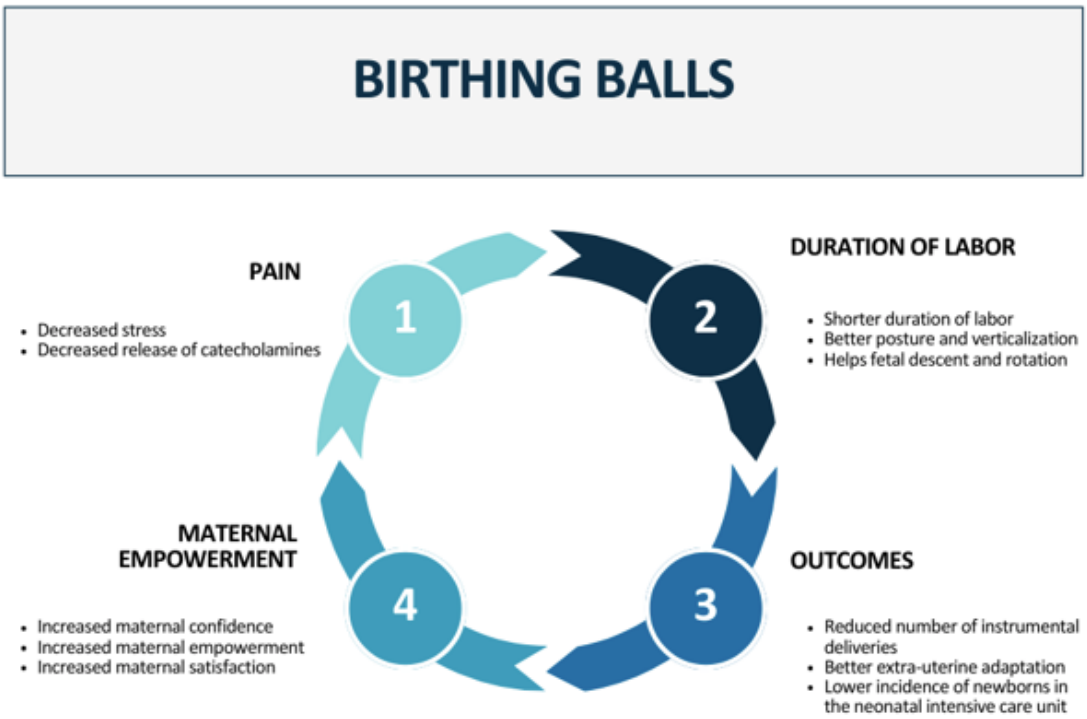

Figure 3 - Evidence synthesis infographic

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CONCLUSION

The use of birthing balls as non-pharmacological strategies has emerged as a valuable alternative for pain relief, duration of labor, promoting maternal satisfaction, as well as reducing invasive medical interventions.

The promotion of verticalization and pelvic mobilization, both facilitated using the birthing ball, also seem to directly impact the duration of labor. Therefore, as health systems and health professionals evolve, they must consider incorporating birthing balls as an integral part of the options available for care during childbirth.

Through the analysis of the articles, it is clear that non-pharmacological strategies, especially birthing balls, contribute to a more positive birth experience and maternal empowerment while minimizing the potential risks associated with pharmacological interventions.

This more comprehensive, woman-centered approach has the potential to positively transform the childbirth experience, contributing to healthier and more satisfactory maternal and neonatal outcomes.

AUTHOR CONTRIBUTIONS

Conceptualization, C.T. and M.O.Z.; data curation, C.T. and M.O.Z.; formal analysis, C.T. and M.O.Z; investigation, C.T. and M.O.Z.; methodology, C.T. and M.O.Z.; project administration, C.T. and M.O.Z.; resources, C.T. and M.O.Z.; software, C.T. and M.O.Z.; supervision, M.O.Z.; validation, C.T. and M.O.Z.; visualization, C.T. and M.O.Z.; writing-original draft, C.T.; writing-review and editing, M.O.Z.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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