Journal of Pioneering Medical Sciences
Received December 16, 2023 Accept Febuary 08, 2024 Publish April 29, 2024.
Volume 13, Issue 2, Pages 86-92

DOI https://doi.org/10.61091/jpms202413212

Pelvic Floor Complications During Childbirth- a Systematic Review and Meta-Analysis

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Abstract **Background:** Worldwide, there are regional and demographic differences in the prevalence of pelvic floor complications (PFCs) during childbirth. Pelvic floor complications have been found to occur more frequently in some studies than others, despite some studies reporting a low incidence. This systematic review and meta-analysis sought to identify which types of PFCs were seen to occur most frequently in the studies chosen, as well as to provide an updated and thorough summary of the incidence and risk factors associated with various types of PFCs during childbirth. **Methods:** Search terms derived from free text words and medical topic headings (MeSH) were used to comb through a number of significant web databases. The first stage in the study selection strategy involved a search using keywords related to "pelvic floor," "childbirth," "complications," and "risk factors," which originally produced 759 papers. **Results:** 10 studies relevant to our objectives were ultimately selected for the investigation. In majority of the studies, urinary incontinence (UIT) and anal incontinence (AIT) were found to be the most commonly occurring PFCs, with stress urinary incontinence (SUT), overactive bladder syndrome (OAB), pelvic organ prolapse (POP) being incidental in decreasing order. The meta-analysis also reported the effects of UIT to be of significant impact in the studies in which it occurred. Although one study did report the occurrence of certain depressive symptoms following childbirth, the inference obtained was not very significant. **Conclusion:** The findings highlight the need for further research on the prevention and management of pelvic floor complications during childbirth, particularly in relation to UIT and AIT. Clinicians should be aware of the high prevalence of these conditions and their associated risk factors (especially psychosocial and psychological health) to provide appropriate care for affected women.

Key Words childbirth, maternal health, pelvic floor disorders, pelvic floor dysfunction, pregnancy

1. Introduction

About a third of adult females experience one of the main health issues known as PFCs, which include urinary incontinence (UIT), stress urinary incontinence (SUT), overactive bladder syndrome (OAB), pelvic organ prolapse (POP), and anal incontinence (AIT). PFDs are linked to adverse effects on health care costs and quality of life (Qol). As the prevalence of these disorders rises with an ageing population, the impact of PFDs is expected to increase [1]–[6]. The correlation between parity, childbirth, and PFDs has been established by extensive, population-based epidemiological and cross-sectional observational research [6]–[14]. It is unclear how much pregnancy, as opposed to delivery method, affects the formation of PCDs in later life. Few longitudinal studies have provided objective quantitative evidence to support this relationship. This narrative review focuses on prospective studies that used objective measurement methods to evaluate the effects of pregnancy and delivery methods on pelvic floor function before, during, and after childbirth. Urodynamics, urethrocystography, ultrasound, magnetic resonance imaging (MRI), Pelvic Organ examinations, and neurophysiologic tests are some of the measurement methods. In order to better understand the pathophysiology at play, quantification data collected before and after childbirth are useful [13], [14]. Eventually, this could enhance treatment approaches.

The incidence of pelvic floor complications (PFCs) during childbirth varies across different populations and regions worldwide [4]. While some studies have reported a low incidence of pelvic floor complications, others have reported a higher incidence. It is therefore essential to understand the prevalence of different types of pelvic floor complications during childbirth and their associated risk factors to inform clinical management and preventive strategies [5]–[9].

Systematic reviews and meta-analyses are powerful tools for synthesizing evidence from multiple studies and estimating the overall effect size of an intervention or exposure [15]. To date, several systematic reviews and meta-analyses have been conducted on the topic of pelvic floor complications during childbirth, but the results have been inconsistent [16], [17]. Some studies have reported a significant association between specific risk factors and the development of pelvic floor complications, while others have not found any significant association [16], [17].

Therefore, this systematic review and meta-analysis aimed to provide an updated and comprehensive summary of the incidence and risk factors associated with different types of pelvic floor complications during childbirth. Specifically, this study mainly aimed to estimate the overall pooled effect size of different types of pelvic floor complications during childbirth, identify the risk factors associated with the development of each type of pelvic floor complication, and determine which types of PFCs were the observed to be the most commonly occurring in the studies selected. This study's findings will provide valuable insights into the epidemiology and prevention of pelvic floor complications during childbirth and inform clinical management strategies for affected women

2. Materials and Methods

A. Clinical Hypotheses

The incidence and severity of pelvic floor complications during childbirth are affected by multiple factors, including maternal age, parity, mode of delivery, fetal weight, and duration of labor. A systematic review and meta-analysis of existing literature will reveal that vaginal delivery, particularly instrumental delivery, is associated with a higher risk of pelvic floor complications compared to cesarean section delivery. Additionally, the review will indicate that women with advanced maternal age, multiple pregnancies, prolonged second stage of labor, and higher fetal weight are at increased risk of developing pelvic floor disorders following childbirth. Finally, the analysis will suggest that preventative interventions, such as antenatal pelvic floor muscle training, may reduce the incidence and severity of pelvic floor complications during childbirth.

B. Database Search Strategy

PubMed, Embase, Cochrane Library, Scopus, Web of Science, CINAHL, and PsycINFO were scoured using search terms that were derived from medical subject headings (MeSH) and free text words. The search included keywords related to "pelvic floor," "childbirth," "complications," and "risk factors" such as "pelvic organ prolapse," "urinary incontinence," "fecal incontinence," "vaginal delivery," "cesarean section," "maternal age," "fetal weight," and "duration of labor." The primary objective of the search strategy involved combining the search terms using Boolean operators (AND, OR). The search was limited to human studies and published articles. The search strategy was adapted to suit the syntax and features of each database.

C. Inclusion and Exclusion Protocol

Studies were included if they met the following criteria: (a) observational studies, including cohort, case-control, and cross-sectional studies, (b) randomized controlled trials reporting on the incidence and severity of pelvic floor complications during childbirth, (c) studies that reported on the comparison of different modes of delivery or risk factors for pelvic floor complications, (d) studies that reported on the incidence and severity of pelvic floor complications as an outcome, and (e) studies published in English. Studies were excluded if they were not related to pelvic floor complications during childbirth, animal studies, conference abstracts, letters, comments, and editorials.

D. Data Synthesis And Selection

Two or more independent reviewers screened all titles and abstracts identified from the database search to determine eligibility for full-text review. Full-text articles were then assessed independently by two or more reviewers to determine whether they met the inclusion criteria. Any discrepancies between reviewers were resolved through discussion, and a third reviewer was consulted if necessary. Studies that met the inclusion criteria were included in the systematic review and meta-analysis. The reasons for excluding studies that did not meet the inclusion criteria were also recorded.

The selection process was documented in a flow diagram, as recommended by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement represented in Figure 1. The figure also demonstrates the various reasons for exclusion of studies at each stage of the study selection process [18].

E. Assessment of Bias in Studies

The RoB-2 tool was employed to carry out this systematic study. The RoB-2 tool, shown in Figure 2 [19], can be used to evaluate bias in a variety of cross-sectional studies, clinical trials, and other types of randomized/non-randomized control trials. The RoB-2 tool assesses the risk of bias in studies by evaluating five domains. For each domain, a judgment of low, some concerns, or high risk of bias will be made based on the study's description and relevant evidence. The overall risk of bias assessment for each included study was classified as low, some concerns, or high. The RoB-2 tool is recommended by the Cochrane Collaboration as well in view of its efficacy.

F. Statistical Analysis

After extracting data on the incidence and severity of pelvic floor complications during childbirth from each included study, including the number of cases and controls, mean age, parity, mode of delivery, and risk factors, a meta-analysis to estimate the pooled effect size for each type of pelvic floor complication during childbirth (e.g., urinary incontinence, fecal incontinence, pelvic organ prolapse) using the fixed-effects model was conducted and we calculated the odds ratio (OR), with corresponding 95% confidence intervals (CIs). After this, a separate forest plot for each type of pelvic floor

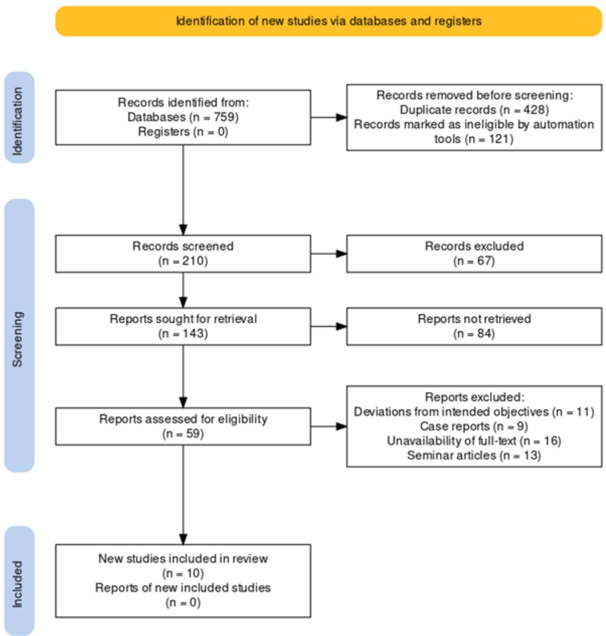

Figure 1: Selection of articles for the systematic review

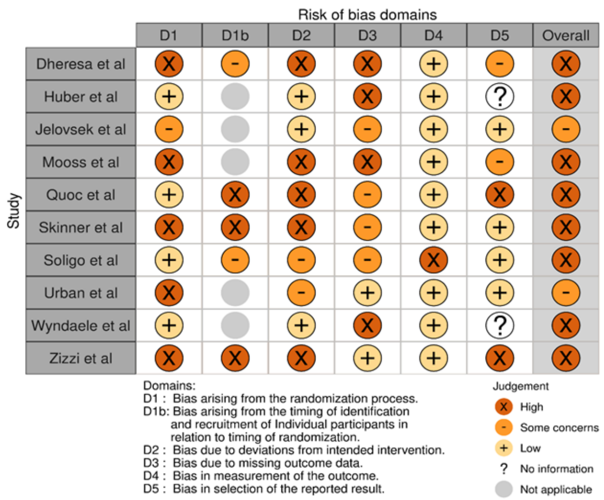

Figure 2: Bias evaluation in the selected studies

complication during childbirth was generated. Each forest plot included the summary estimate and its 95% CI for each study, as well as the overall pooled estimate and its 95% CI. The findings from the forest plots generated can be used to visualize the heterogeneity between studies, the size of the effect estimates, and the precision of the estimates.

3. Results

The reason for this constrained timeframe is that we wanted to provide an updated review and assessment for PFCs and as such decided not to include studies prior to 2015 in an effort to keep the methodologies as well as the conclusions drawn from the selected studies up-to-date. We began our search strategy by conducting a keyword search of the database from the years 2015 to 2022. Initially, 759 documents were produced. On the basis of their applicability to the study question, we chose 210 papers from among these. We eliminated 67 articles that were duplicates or extremely identical to ensure that we only included original papers. We were left with 59 documents after this screening, which went again.

These 59 papers' titles and abstracts were examined, and 47 extra papers that didn't fit the inclusion/exclusion criteria were disregarded. Finally, we chose ten papers—including retrospective studies, comprehensive reviews, and randomised control trials—that satisfied the necessary criteria. The final group of 11 papers for our evaluation was composed of these.

The 10 papers included 2 cross-sectional studies [20]–[28], 1 retrospective study [27], 1 qualitative interview-based investigation [24], 5 prospective clinical trials [21]–[23], [25], [26], and 1 systematic review [17].

The forest plots from the 10 studies that were taken into consideration for the research are shown in Figures 3- 6, respectively. After considering all pertinent elements related to the papers, the data was entered into the RevMan 5 software, and four distinct forest plots displaying the odds ratio associated with the effect of the respective PFC that was noted in that study were generated and assessed. The meta-analysis employed a fixed effects model with a 95% confidence range. For each research, the total sample size was the total number of events, and a fixed effects model was applied (Table 1).

4. Discussion

The significance of this systematic review and meta-analysis is its ability to provide an updated and thorough summary of the incidence and risk factors associated with various types of pelvic floor complications (PFCs) during childbirth. The identification of the most commonly occurring types of PFCs and their relative impact can help inform healthcare providers in developing targeted interventions to reduce the incidence of PFCs. The study's findings also highlight the need for continued research to better understand the regional and demographic differences in the prevalence of PFCs and to identify effective preventive measures. The meta-analysis provides a comprehensive overview of the current state of research on PFCs, making it a valuable resource for researchers and clinicians in this field. Overall, this study's findings can contribute to improving the quality of care and quality of life for women experiencing PFCs during and after childbirth.

Among women and doctors alike, the effect of pregnancy and delivery on pelvic floor function is a subject that is gaining popularity. However, it can be challenging to assess the true impact of PFCs after delivery due to its complexity.

Epidemiological data indicate that about one-third of deliveries have detectable PFCs within a few hours of delivery [29], [30]. Fortunately, only a small minority of patients experience clinically significant symptoms and quality of life impairment, making pelvic floor rehabilitation a successful first line of treatment [31]. The overwhelming majority

Study ID	Year	Methodology	Sample strength (n)	Mean age (in years)	Complication(s) observed
Dheresa et al [20]	2018	Cross-sectional	3432	36.5	Pelvic organ prolapse, urinary incontinence, anal incontinence
Huber et al [21]	2021	Prospective cohort-based	776	29.1	Degrees of perineal tear
Jelovsek et al [22]	2017	Prospective cohort-based	8754	29 (at the time of childbirth)	Pelvic organ prolapse, urinary incontinence, faecal incontinence
Mooss et al [17]	2021	Systematic review	24 studies	-	Urinary incontinence
Quoc et al [23]	2019	Prospective observational	158	30	Urinary incontinence, bowel dysfunction and sexual dysfunction
Skinner et al [24]	2018	Qualitative (using semi-structured interviews)	504	32.9 (at the time of childbirth)	Symptoms of PTSD associated with levator ani muscle dysfunction
Soligo et al [25]	2016	Prospective observational	1293	34	Vacuum extractor use and degrees of perineal tears
Urban et al [26]	2019	Prospective observational	987	30.4	Urinary incontinence, anal incontinence, pelvic organ prolapse and levator ani muscle dysfunction
Wyndaele et al [27]	2021	Retrospective	448	>18	Urinary incontinence
Zizzi et al [28]	2017	Cross-sectional	128	18-42	Urinary incontinence and anal incontinence

Table 1: Studies included in the review and the variables observed

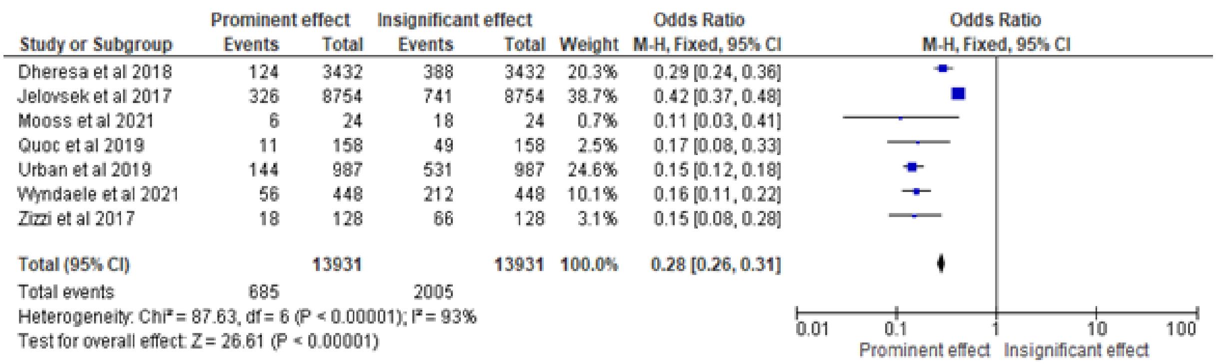

Figure 3: Forest plot representing the odds ratio of the effect of urinary incontinence and anal/faecal incontinence in studies which documented their incidence in their sample population

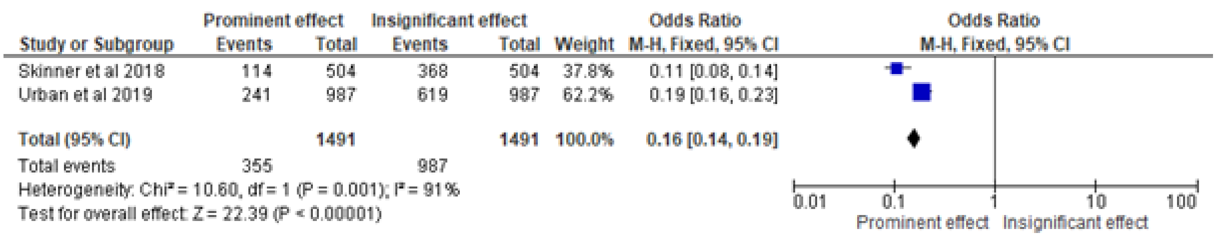

Figure 4: Forest plot representing the odds ratio of the effect of levator ani muscle dysfunction in studies which documented their incidence in their sample population

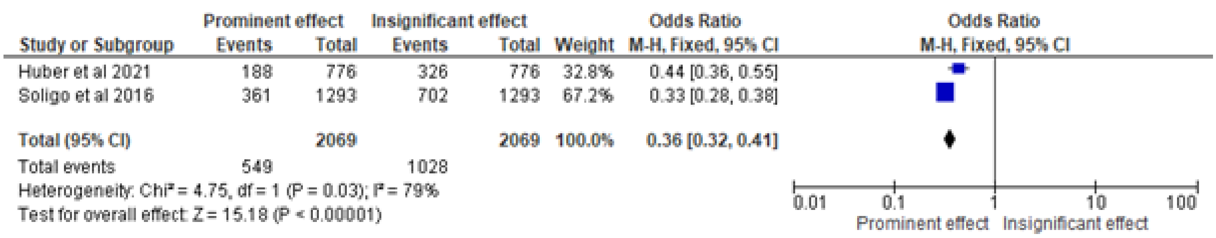

Figure 5: Forest plot representing the odds ratio of the effect of perineal tear injury in studies which documented their incidence in their sample population

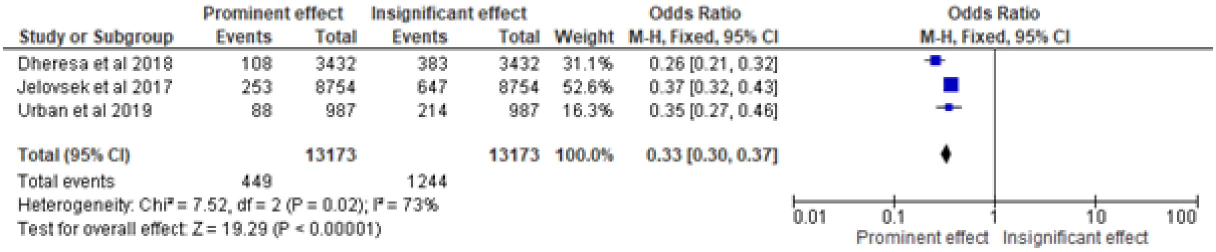

Figure 6: Forest plot representing the odds ratio of the effect of pelvic organ prolapse in studies which documented their incidence in their sample population

of the time, physiological compensatory and regenerative mechanisms step in to lessen or eliminate symptoms over time [32]. In reality, mammals are the only species in which the reorganisation of the nervous system after trauma is well-documented [33]. The epidemiological evidence of a link between childbirth and the UI and prolapse symptoms that appear later in life [29], [34] shows that this reflects a transient biological "exit strategy".

The idea of taking action to enhance pelvic floor health after delivery is now generally accepted [30], [32], [34]. However, it is unclear how to put this concept into practise. Every woman should, in theory, be provided with conservative pelvic floor treatment after delivery, but practical considerations and costs make this choice unfeasible. How to choose postpartum women for this kind of follow-up assessment is then a crucial issue. Health policy makers would also benefit from knowing more details about the patient adherence rate to this kind of therapy.

It can be difficult to develop parameters to pinpoint women who are vulnerable to PDFs after delivery. In order to forecast the risk of future PFCs based on a number of key predisposing factors, Wilson et al. [30] advocated for validating a scoring system. To the best of our knowledge, no findings from this research have yet been published, though it may be an ongoing study. But this notion is not brand-new. A nomogram was created and confirmed by Jelovsek et al. [22] to forecast each woman's unique likelihood of experiencing urinary incontinence (UI) or faecal incontinence (FI) after giving birth.

The literature on risks for PFCs after delivery is redundant and contradictory, which is the main obstacle to these endeavours. Differences in obstetric procedure are one of many factors that can affect the outcomes [35]. Original data from various contexts are therefore valuable. There haven't been many studies on this subject in Italy. In over 967 women who underwent vaginal birth, Serati et al's [32] evaluation of de novo PFCs revealed a prevalence of UI and AI of 27% and 7.1% of patients, respectively, at 6 months postpartum. A second stage of labour lasting more than an hour was found in the multivariable analysis to be related to the emergence of postpartum urinary leakage. 960 nulliparous women participated in a multicenter prospective research that was carried out in six Italian obstetric departments. 3 months after birth, the prevalence rates for UI and AI were 21.6% and 16.3%, respectively. Positive family history, vaginal delivery, and new onset of UI or AI during pregnancy have all been identified as separate risks [17]. Our research, which took place over a 6-month period in a tertiary referral maternity hospital and included 1606 women, is the biggest Italian single-center study that we are aware of. Major advantages of the research include the high proportion of women from a single centre and the high degree of accuracy in data collection. The parameters we used to define dysfunction at the time of the 3-month follow-up may be viewed as a limitation. The "post partum screening card" provided by the SIUD, which isn't actually a validated instrument.

However, it is a protocol that was created by a group of experts working under the direction of the SIUD, and it employs validated surveys for every dysfunctional area. It's also important to note that the research by Soligo et al [25] found a very low overall incidence of severe perineal tears (1.2%), especially in light of the rising rates of obstetric anal sphincter injury diagnoses reported globally [36]. The year prior to the start of this study, our unit adopted a specific management strategy and an educational programme that included hands-on courses on perineal tears. Every effort is being made to increase the diagnostic efficacy of OASIS. In light of this, we believe that underestimating the number of diagnoses only partly explains our data, and that other pertinent factors, mainly involving variations in obstetric management, may also contribute to our results. Lower-segment Caesarean sections (LSCS) were performed on 396 women (24.7%) during the study period (216 after unsuccessful labour attempts), and 207 women (17.1%) had operative vaginal deliveries solely using a vacuum extractor because forceps are no longer used in our unit.

In the study by Soligo et al. [25], 3 months after delivery, 35% of puerperal women were examined had at least one PFD; severe perineal tears, operative delivery, and a history of pelvic disorders before or during pregnancy emerged as possible risk factors. Based on the sensitivity and specificity analysis results for PFCs of 82% and 39%, respectively, with a negative predictive value (NPV) of 79.3%, they would have only invited 865 (67%) women of the 1293 who agreed to participate in the study if they had adopted the combination of these four risks as the selection criteria for follow-up in puerperal women. The women who were not included in the follow-up had a significant likelihood of not having PFCs, per this model. It is a fact that high sensitivity and NPV are more pertinent when a model to screen a large population is evaluated, despite the low specificity, which may reflect a limitation of their risk factor model. Nevertheless, given that patient adherence to treatment is another crucial factor to consider when modifying clinical services, these numbers might overestimate the number of women who actually suffer from PFCs. It is common knowledge that Interface goes unreported. Only 25% of the 13 6 6 symptomatic women who were 40 years old in a recent population-based research on the natural history of UI sought medical attention [37].

Sadly, little is understood about help-seeking behaviours following delivery, especially with respect to PFCs. In their study of more than 20 postpartum women between 12 and 18 months after giving birth, Herron-Marx et al. [38] used the Q-methodology. They concluded that women highlighted the lack of services available for these issues and that both health-care professionals and society at large frequently dismissed or trivialised their experiences with postnatal perineal and pelvic floor morbidity. From one month to a year after a vaginal birth, Buurman and Lagro-Janssen [39] conducted interviews with 26 women from the patient populations of two-family doctors in the Netherlands. Women are "uninformed about postpartum pelvic floor problems," they found. Therefore, improving communication about how delivery affects the pelvic floor reflects a key objective in contemporary obstetric care. The implementation of PFCs services would need to be sufficient for informational and motivational support campaigns to be effective.

There are a few limitations that could be attributed to this investigation of ours. The number of studies included in the meta-analysis was relatively small, which may limit the generalizability of the findings to other populations or settings. The studies included in the meta-analysis also slightly varied in their definitions of PFCs, which may have led to inconsistencies in the reporting of outcomes and prevalence estimates. The search strategy was limited to specific keywords, which may have missed relevant studies that did not use the same terms. Moreover, although the risk of bias was thoroughly assessed across several domains, the methodological quality of the included studies was not assessed, which may have influenced the accuracy and reliability of the meta-analysis findings. Also, we were unable to investigate the potential impact of interventions or treatments for PFCs, which could be an important area for future research.

5. Conclusion

In summary, this systematic review and meta-analysis aimed to shed light on the prevalence and risk factors associated with pelvic floor complications during childbirth. Through a thorough search of various databases, the study identified 10 relevant papers that reported on the incidence of different types of PFCs. The findings of the meta-analysis revealed that urinary incontinence (UIT) and anal incontinence (AIT) were the most commonly occurring PFCs, while stress urinary incontinence (SUT), overactive bladder syndrome (OAB), and pelvic organ prolapse (POP) were reported less frequently. Furthermore, the effects of UIT were found to be significant in the studies in which it occurred. Although one study reported the occurrence of certain depressive symptoms following childbirth, the inference obtained was not very significant. These results highlight the need for further research to better understand the causes and risk factors associated with pelvic floor complications during childbirth. Clinicians should be aware of the high incidence of UIT and AIT and provide appropriate care to affected women to improve their quality of life. Moreover, the findings of this study can guide the development of preventive strategies and clinical management protocols for PFCs during childbirth. Overall, this systematic review and meta-analysis provides valuable insights into the epidemiology of pelvic floor complications during childbirth, and its results can be used to inform future research and clinical practice in this area.

Acknowledgment

I would like to thank the Deanship of Scientific Research, Majmaah University for supporting me as researcher and faculty.

Conflict of interest

The author declares no conflict of interests. Author read and approved final version of the paper.

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