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MATERNAL-FETAL MEDICINE

Comparing birth experience and birth outcome of vaginal births between induced and spontaneous onset of labour: a prospective study

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Abstract

Purpose In developed countries, around 25% of all births involve labour induction. Studies have indicated that labour induction negatively influences the birth experience as well as the birth process. However, the impact of labour induction when only considering vaginal deliveries has not been studied yet, which was the purpose of the present study.

Methods 186 women who gave birth vaginally took part in this prospective study. 95 women gave birth after spontaneous onset of labour (SL-group) and 91 women received a labour induction (LI-group). Eight to 72 h after birth, the women filled in the revised version of the standardised Childbirth Experience Questionnaire, which examines the birth experience in four dimensions (*Own Capacity*, *Perceived Safety*, *Participation and Professional Support*). Medical details regarding birth and fetal outcomes were taken from the medical records.

Results Birth outcomes (the number of epidural anaesthesia, the duration of birth, birth risks and childbirth injuries) as well as fetal outcomes (APGAR after 1 and 5 min and arterial cord pH) did not differ between the groups. Regarding the subjective birth experience, the LI-group indicated significantly lower values for *Perceived Safety* and *Participation* compared to the SL-group, while there were no differences for the dimensions *Own Capacity* and *Professional Support*.

Discussion Successful labour induction resulting in a vaginal birth did not negatively influence birth and fetal outcomes and only partly affected the women's birth experience. The negative impact of labour induction on the dimensions *Perceived Safety* and *Participation* should sensitize midwives in order to provide optimal support.

Keywords Labour induction · Birth experience · Birth process · Vaginal deliveries

Introduction

Birth is a multi-layered experience for the expectant mother. It is often described as being the happiest moment but also the most painful experience in life [1, 2]. The birth experience is very individual and influenced by several factors such as parity, birth mode, medication and pain perception [3–6].

A positive birth experience is a good indicator for women when deciding to have a subsequent child and is positively correlated to mother–infant bonding [7]. Additionally, a study has shown that birth satisfaction correlates positively to breast-feeding confidence [8]. Consequently, a negative birth experience has a negative influence on the decision to have another child and also negatively influences mother's wellbeing and leads to high anxiety levels regarding subsequent deliveries [9]. Studies have shown that women with a negative birth experience have a longer gap before their succeeding pregnancy [10] and furthermore these women wish to receive an elective caesarean with their next child more often [11]. These findings emphasize the importance of research looking at factors influencing the birth experience. Here, we investigate how

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labour induction influences the subjective birth experience by comparing women who gave birth vaginally after labour induction to spontaneous onset of labour.

In developed countries, around 20–25% of all births involve induction of labour [12]. Overall, results of previous studies lead to the assumption that labour induction negatively influences the birth experience and birth outcome [3, 4, 13–15]. However, the picture is not that clear [16]; data are limited and results may be confounded. Retrospective studies have shown that labour induction negatively influences women's subjective birth experience and it has been shown that labour induction acts as a potential risk factor for a negative birth experience [3, 4]. Labour induction can last for many hours and even days and the situation can be very stressful and unsettling for the pregnant woman and increase anxiety regarding the upcoming birth [13]. Additionally, studies have reported that births after labour induction are perceived as being more painful than vaginal births with spontaneous onset of contractions [17, 18]. In relation to this, studies have shown that higher pain levels during labour are associated with a more negative birth experience [3, 4]. Additionally, it is under debate whether labour induction also negatively influences medical factors of the birth process [14, 19]. Studies investigating the influence of labour induction on the medical birth process have shown higher caesarean rates [15, 19], higher probabilities to receive regional anaesthesia [14] and a longer birth duration [20]. However, there are also studies that revealed that labour induction at or beyond 41 weeks of gestation age or in women 35 years or older does not increase the risk of operative delivery [19, 21, 22].

Most studies to date which have explored the influence of labour induction on birth experience and birth outcomes followed a retrospective study design. To the best of our knowledge, the present study is the first prospective study to explore the influence of labour induction on the subjective birth experience as well as the medical birth process. Furthermore, we believe that we are the first to evaluate the influence of onset labour type (induced vs spontaneous) on birth experience with a validated questionnaire (Childbirth Experience Questionnaire [23]). Additionally, in order to test a more homogeneous sample, we decided to only include patients who gave birth vaginally, as studies have shown that birth mode has a substantial influence on the birth experience [6]. Moreover, caesarean and instrumented vaginal deliveries are associated with a more negative birth experience than spontaneous deliveries [4, 24]. Based on previous studies, we hypothesised that women who received a labour induction would indicate a more negative subjective birth experience than women with spontaneous onset of labour. We also expected that the birth process is negatively affected by labour induction.

Methods

Participants

Two hundred and five women who gave birth vaginally were recruited at the Clinic for Gynecology and Obstetrics at the University Hospital in Düsseldorf. Women who were older than 18 years and gave birth after the end of the 37th week of pregnancy (with a minimum gestation age of 37 + 0 as the lower limit) were eligible to take part. Nineteen women returned blank questionnaires and were, therefore, excluded from further analysis.

The study was approved by the ethics committee of the Heinrich-Heine-University Düsseldorf in Germany. All participants gave written informed consent prior to participation.

Material

In order to evaluate the subjective birth experience, we used the German version of the revised Version of the Childbirth Experience Questionnaire (CEQ) [23, 25, 26]. The questionnaire consists of 25 items. Twenty-two statements require an answer on a four-point Likert Scale (from 1 = totally agree to 4 = totally disagree), whereas three items use a 10 cm-long Visual Analogue Scale. In order to match the VAS scores to the four-point Likert Scale the VAS-scales scores were converted to categorical values: 0–40 mm = 1, 41–60 mm = 2, 61–80 mm = 3 and 81–100 mm = 4. This approach is fixed by the original questionnaire [23]. The questionnaire comprises four domains: *Own Capacity* (8 items), *Perceived Safety* (6 items), *Professional Support* (5 items) and *Participation* (4 items) as well as an Overall Score (23 items; items 8, 11 excluded based on the factor analysis of the norm sample). The dimension *Own Capacity* includes items regarding experienced emotions, self-efficiency and sense of control. *Perceived safety* relates to items regarding feelings about security during childbirth and positive and negative memories. The dimension *Professional Support* aims at evaluating how well the women felt supported by the midwives and medical team and the dimension *Participation* contains items examining possibilities to influence the birthing situation [23]. Mean scores (range 1–4) are calculated for each dimension and the Overall Score with higher scores indicating a more positive childbirth experience.

Detailed information regarding the birth process was taken from the electronic medical record. We documented whether the women received a labour induction (which determined group allocation) and furthermore, whether an epidural anaesthesia was applied during birth, the duration

of birth (defined as the time between onset of labour with 3 cm dilation of the cervix and regular contractions [27] until the time of birth), birth risks, childbirth injuries and postnatal haemoglobin levels.

We also gathered data about the height and weight of the mother [in order to calculate their body mass index (BMI)] at first consultation (mean gestation age 10 ± 4 weeks), weight gain during pregnancy, parity, gestational age at birth, pregnancy risks (gestational diabetes mellitus and hypertension disease); classification into high-risk pregnancy as well as information about the new-born which includes birth weight and length, APGAR scores and arterial cord pH values. High-risk pregnancies were defined following the guidelines of the German maternity protection act. A high-risk pregnancy is indicated in the maternal health passport and consequently in the medical records if one of the following points is present: familial predisposition (diabetes, hypertension disease, genetic or psychological illnesses), severe comorbidities, increased bleeding propensity, allergies, rhesus incompatibility, diabetes mellitus, obesity, age below 18 or above 35, four or more previous pregnancies, previous preterm baby, previous stillbirth, complications in previous pregnancies, previous caesarean section or other uterus operation.

Procedure

Women who gave birth spontaneously between February and December 2017 were offered participation between eight and 48 h after giving birth. After giving their informed written consent, they received the questionnaires and were asked to fill in the forms within 24 h. The questionnaires were collected the next day and women were asked to leave the questionnaires in the maternity unit in case they were released from hospital before a team member collected the questionnaires (19 women left blank questionnaires). Medical details were taken from the electronic medical file.

The standard method of labour induction was that women first received a labour inducing cocktail containing castor oil, verbena, almond cream, orange juice and optional sparkling wine or mineral water. If this did not lead to contraction within 12 h the women received a testing dose of 25 µg misoprostol and 50 µg misoprostol every 4 h thereafter until they had regular contractions.

Group comparisons were calculated using independent samples *t* tests and Chi squared tests. When equality of variances was violated, corrected values are reported. In order to include the covariate *gestation age* in certain group comparisons, ANCOVAs were applied accordingly. Data are available from the first author upon request.

Results

The final cohort consisted of 186 women with a mean age of 32.3 years (SD = 5.0).

Table 1 Group characteristics and overview of dependent variables (mean ± SD for numerical variables and quantities for nominal variables)

	Spontaneous labour group	Labour induction group	*p* value
Group characteristics			
N	95	91	
Age (years)	32.3 ± 4.9	32.3 ± 5.3	0.970
Gestation age (days)	277 ± 7	279 ± 9	**0.035**
BMI	23.6 ± 4.5	26.3 ± 6.7	**0.003**
Weight gain	13.0 ± 5.3	12.6 ± 5.6	0.620
Primipara	40 (42.1%)	41 (45.1%)	0.685
High-risk pregnancy	24 (25.3%)	30 (32.9%)	0.326
GDM	5 (5.3%)	13 (14.3%)	**0.042**
Hypertension disease	3 (3.2%)	3 (3.3%)	0.979
Birth process			
PROM	20 (21.1%)	25 (27.5%)	0.285
Peridural anaesthesia	40 (42.1%)	47 (51.6%)	0.192
Duration of birth (h)	4.7 ± 3.5	5.6 ± 7.3	0.276
Childbirth injuries	59 (62.1%)	56 (61.5%)	0.788
Perineal lacerations	44 (46.3%)	33 (36.3%)	0.121
Vaginal tear	23 (24.2%)	28 (30.8%)	0.350
HB post birth	11.21 ± 1.33	11.01 ± 1.43	0.349
Fetal outcomes			
APGAR after 1 min	9.00 ± 0.42	8.90 ± 0.69	0.229
APGAR after 5 min	9.95 ± 0.27	9.89 ± 0.39	0.211
Arterial cord pH	7.28 ± 0.08	7.26 ± 0.07	0.119
Birth weight (g)	3385 ± 352	3536 ± 479	0.016[a]
Birth length (cm)	50.9 ± 2.0	51.7 ± 2.0	0.012[a]
Birth experience (CEQ)			
Own capacity	2.53 ± 0.42	2.51 ± 0.37	0.776
Perceived safety	3.02 ± 0.35	2.90 ± 0.43	**0.042**
Professional support	3.69 ± 0.44	3.64 ± 0.49	0.530
Participation	3.60 ± 0.49	3.35 ± 0.59	**0.002**
Overall Score	3.10 ± 0.29	3.00 ± 0.30	**0.023**

Bold values indicate a significant difference between groups ($p < 0.05$)

BMI body mass index, *CEQ* Childbirth Experience Questionnaire [23], *PROM* premature rupture of the membranes, *ns* not specified, *HB* haemoglobin level, *pH* power of hydrogen, *GDM* gestational diabetes mellitus

[a]If gestation age and BMI of the mother are included as covariates in the analysis the difference turns out non-significant

An overview of all results is given in Table 1.

Group characteristics

Ninety-five women (mean age 32.3 ± 4.9) gave birth vaginally after spontaneous onset of labour (SL-group), whereas 91 women (mean age 32.3 ± 5.3) received labour induction (LI-group). The most frequent reason for labour induction was premature rupture of the membranes (28%) followed by exceeding the expected date of delivery (27%), medical maternal reasons (26%) and medical foetal reasons (19%). From the 91 induced women, 88 women (96.7%) were induced by the castor oil cocktail. In 44 women (50%) labour induction by cocktail was successful and led to regular contractions, whereas 44 women (50%) received misoprostol for further induction. Three of the 91 induced women (3%) received misoprostol directly. Gestation age in the LI-group (279 ± 9) was significantly longer than in the SL-group (276 ± 11), $t(180) = 2.23$, $p = 0.027$. Additionally, the BMI significantly differed between the two groups: $t(161) = 2.98$, $p = 0.003$, with the LI-group (26.3 ± 6.7) having higher BMI values than the SL-group (23.6 ± 4.5). In the SL-group 56 women were primipara and 39 multipara and in the LI-group 49 were primipara and 41 multipara. The associations between type of onset and parity were non-significant ($p = 0.685$). The classification into a high-risk pregnancy was also not associated with labour onset type ($p = 0.326$).

Birth experience

Regarding the dimension *Own Capacity* the two groups did not differ ($p = 0.776$). However, ratings on *Perceived Safety* were significantly higher in the SL-group (3.02 ± 0.35) than in the LI-group (2.90 ± 0.43), $t(174) = 2.05$, $p = 0.042$. The SL-group (3.60 ± 0.47) also indicated higher values regarding *Participation* than the LI-group (3.35 ± 0.59), $t(177) = 3.13$, $p = 0.002$. Ratings for *Professional Support* did not differ between groups ($p = 0.530$). Additionally, the SL-group (3.10 ± 0.29) indicated higher Overall Scores than the LI-group (3.00 ± 0.30), $t(172) = 2.29$, $p = 0.023$ (Fig. 1).

Furthermore, ANCOVAs were calculated in order to control for the variable *gestation age*. The analysis revealed that the significant differences in the dimensions *Perceived Safety* and *Participation* as well as on the *Overall Score* remain significant when including gestation age as a covariate. The *p* values changed from 0.042 to 0.024 for *Perceived Safety*, from 0.002 to 0.001 for *Participation* and from 0.023 to 0.011 for the Overall Score. The *p* values for *Own Capacity* and *Professional Support* ($p > 0.460$) remained non-significant.

In the LI-group birth experience did not differ depending on the *induction method* (only cocktail vs. cocktail and misoprostol vs. misoprostol only) in all four dimensions as well as the Overall Score ($p > 0.189$).

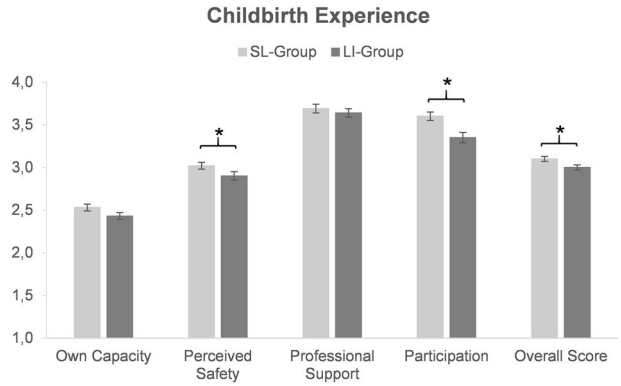

Fig. 1 Women who gave birth vaginally after receiving a labour induction (LI-group) indicated significantly lower values regarding *Perceived Safety* and *Participation* as well as on the *Overall Score* compared to women with spontaneous onset of labour (SL-group). No differences were revealed for the dimensions *Own Capacity* and *Professional Support*. *$p < 0.05$, error bars represent SEM

Medical birth process

There were no differences regarding the number of premature rupture of the membranes ($p = 0.285$) and the number of received peridural anaesthesias ($p = 0.192$) between the two groups. Additionally, the analysis revealed that the LI-group and the SL-group did not differ significantly regarding the overall duration of birth, $t(161) = 1.09$, $p = 0.276$. The groups did not differ regarding the number of overall childbirth injuries ($p = 0.788$), the number of perineal lacerations ($p = 0.121$) or vaginal tears ($p = 0.350$). Postnatal haemoglobin levels were also not different in the two groups ($p = 0.349$).

Fetal outcomes

APGAR scores after 1 and 5 min after birth and arterial cord pH values did not differ between the two groups ($p = 0.229$, $p = 0.221$ and $p = 0.191$). Fetal birth weight was significantly different in the two groups: $t(160{,}87) = 2.43$, $p = 0.016$, with babies having higher birth weight in the LI-group (3536 g ± 479) than in the SL-group (3385 g ± 352). Additionally, there was a significant difference of birth length of the baby in the two groups, $t(181) = 2.53$, $p = 0.012$. However, these differences turned out non-significant when gestation age and BMI were included as covariates in univariate ANCOVAs with birth weight and birth length accordingly as the dependent variable and group (SL vs. LI) as the independent variable ($p = 0.092$ for birth weight and $p = 0.063$ for birth length).

Discussion

The present study compared the subjective birth experience and medical birth outcomes of vaginal deliveries between women who received a labour induction and women with spontaneous onset of labour. Regarding birth experience, the results revealed that women with labour induction rate their *Perceived Safety* as well as their *Participation* lower than the women with spontaneous onset of labour. No difference on the dimension *Own Capacity* and *Professional Support* was found. This indicates that labour induction has a negative impact only on some aspects of the birth experience of vaginal births which is partly in line with previous studies showing that labour induction is associated with a negative birth experience [4, 24, 28]. To the best of our knowledge, this is the first study to investigate the influence of the type of labour onset on birth experience using a validated multidimensional questionnaire and showing that there is a differential effect on different aspects of the birth experience. Aspects regarding safety and the women's participation seem to be negatively influenced by labour induction. A recently published qualitative study investigating birth experience of women with a labour induction revealed that the birth experience was accompanied by anxiety and a sense of strangeness [29], which supports the data presented here. The fact that the present results showed that birth experience was similar between the groups in the dimension *Own Capacity*, could be due to the fact that we only included vaginal deliveries, whereas other studies all also included deliveries by caesarean or instrumental vaginal births. It could be shown repeatedly that the birth experience of caesarean deliveries is significantly worse than the birth experience of vaginal deliveries [4, 24]. In this respect, it would be desirable for future studies to include the multidimensional CEQ when also including caesareans and instrumented vaginal deliveries to investigate whether labour induction might influence specific dimensions of the birth experience differently depending on the birth mode.

Regarding the birth outcomes of vaginal deliveries the results show no significant negative influence of a labour induction, which is contrary to our hypothesis and other studies. However, it should be highlighted that we only included women with a successful labour induction and who delivered vaginally. The non-significant results regarding medical and fetal parameters strengthen the results of the evaluated birth experience. The significant differences in the dimensions *Perceived Safety* and *Participation* cannot be due to worse birth outcomes but can be traced back to the labour induction. The fact that the LI-group did not receive peridural anaesthesia more frequently is not in accordance with the results of other studies which revealed that epidural analgesia was more frequent after labour induction than after spontaneous onset of labour [14, 30]. A few studies have investigated the influence of a labour induction on birth duration. Contrary to our results some studies have reported that labour induction is associated with a longer overall birth duration [13, 20]. But it is important to note that, for example in the study by Hildingsson and colleagues [20], the duration values were subjective and retrospective reports of the patients. Therefore, it is likely that these were biased by several factors [31], whereas our data were taken from the standardized partograms within the medical record. In line with our results, a study by Cheng and colleagues showed that the duration of the first stage of labour did not differ between induced and spontaneous onset of labour [32]. Studies have shown that obese women are at higher risk for labour induction [33]. The details of the current sample support these findings as the LI-group had significantly higher BMI than the SL-group.

The fact that we only included women after a successful labour induction resulting in an envisaged vaginal birth warrants a comment. By doing so, it might be seen as a limitation that we cannot contribute to the debate on whether a labour induction leads to a higher risk to be in need of a caesarean [30, 34] or not [19, 35], but we would argue that retrospective cohort studies allowing to include a much larger sample size are better suited for this research question. On the other hand, we would argue that the strength of our study is that we looked at a much more homogeneous sample and especially regarding the results of the subjective birth experience received a pattern which is unbiased by the influencing factor birth mode. Also the method of labour induction warrants a comment here. Even though the results showed that labour induction method did not influence the birth experience, we only included the castor oil cocktail and misoprostol in the present study and, therefore, we cannot comment on whether other induction methods (i.e. mechanical methods, membrane sweeping or oxytocin) would show to the same results presented here regarding birth experience and birth outcomes of vaginal births. It would be highly interesting to compare the birth experience between different induction methods in a follow-up study as it is still under debate which induction method should be favoured [16].

As studies have shown that a negative birth experience negatively influences the decision to have another child [10] or to plan an elective caesarean for the succeeding pregnancy [11], the results are important for clinical practice. The fact that women in the LI-group perceive their birth more negatively on the dimensions *Perceived Safety* and *Participation* should increase awareness of gynaecologists and midwives that these patients are in need of additional emotional support during the birth process. As labour induction can be a tedious process, psychological

support is important. To this end, a study which investigated the perception and satisfaction of labour induction in a sample of 450 women revealed that more than 30% were not satisfied with the amount of information given beforehand [36]. Therefore, it might help to improve the satisfaction of the birth process if more information on the induction process is given. It has also been shown that intrapartum support leads to less reported dissatisfaction [37] which should especially be considered for women receiving labour induction.

The present study chose a fairly prompt evaluation of the birth experience up to 72 h after birth. In future studies, it would be interesting to examine how the time frame of data collection influences the birth experience and whether the negative impact of a labour induction on *Perceived Safety* and *Participation* would persist over a longer period of time or not. In this respect, a longitudinal study investigating birth experience from immediately after birth to, for example, 1 year after birth would be desirable to examine the cause of perceived birth experience over time.

Overall, the present study showed that the birth process and fetal outcomes were comparable in women with vaginal deliveries after labour induction and spontaneous onset of contractions. However, the birth experience between the two groups differed on the dimensions *Perceived Safety* and *Participation* in which women with a labour induction indicate lower scores. These factors are important to consider in order to optimize health care and in order to enable a positive birth experience. It would be desirable if midwives and medical staff could pay particular attention to these factors when caring for women who receive a labour induction, thus ensuring that these women feel safe and capable to manage vaginal delivery.

Author contributions NKS: protocol/project development, data collection or management, data analysis, manuscript writing/editing. TF: protocol/project development, manuscript writing/editing. JA: data collection or management, manuscript writing/editing. MH: protocol/project development, manuscript writing/editing. AP: manuscript writing/editing. MF: protocol/project development, manuscript writing/editing. PH: protocol/project development, data collection or management, data analysis, manuscript writing/editing.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval The study was approved by the ethics committee of the Heinrich-Heine-University Düsseldorf in Germany. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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