

Music in Obstetrics: An Intervention Option to Reduce Tension, Pain and Stress

Musik in der Geburtshilfe: eine Interventionsmöglichkeit zur Anspannungs-, Schmerz- und Stressreduktion

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Key words

music, pregnancy, spontaneous delivery, caesarean section, relaxation

Schlüsselwörter

Musik, Schwangerschaft, Spontangeburt, Sectio caesarea, Entspannung

received 26.7.2017

revised 15.8.2017

accepted 15.8.2017

Bibliography

DOI <https://doi.org/10.1055/s-0043-118414>

Geburtsh Frauenheilk 2017; 77: 967–975 © Georg Thieme Verlag KG Stuttgart · New York | ISSN 0016-5751

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Deutsche Version unter:

<https://doi.org/10.1055/s-0043-118414>

ABSTRACT

In recent years, the effect of music interventions and music therapy has experienced increased attention in the literature. It has been shown that music has positive effects on cognitive and physical performance, such as concentration and endurance, as well as on psychological parameters, such as anxiety and relaxation. Studies within the context of medicine in par-

ticular are increasingly indicating that music may be used as an intervention for relief against anxiety, stress and pain. Music is therefore seen in actual practice as a supplement to conventional pharmacological and non-pharmacological forms of treatment – and the trend is rising. Studies involving music interventions in the field of obstetrics have shown, amongst other things, that music improves the ability to relax during pregnancy and can reduce anxiety. It was also discovered that during childbirth music interventions resulted in a reduction of pain and stress. Music also has the effect of reducing stress, pain and anxiety in expectant mothers during deliveries by caesarean section. This review intends to provide an overview of the literature on music interventions in the field of obstetrics and to give a resume on the current state of research around the topic of music in relation to pregnancy, spontaneous deliveries and caesarean sections. Furthermore, the relevance of music for everyday obstetrics will be illustrated.

ZUSAMMENFASSUNG

In den letzten Jahren wurde die Wirkung von Musikinterventionen und Musiktherapie in der Literatur vermehrt dargestellt. Dabei konnten positive Effekte der Musik auf kognitive und körperliche Leistungen, wie Konzentration oder Ausdauer, sowie auf psychologische Parameter, wie Angst oder Entspannung, gezeigt werden. Vor allem im medizinischen Kontext weisen Studien zunehmend darauf hin, dass Musik als angst-, stress- und schmerzlindernde Intervention eingesetzt werden kann. Daher wird Musik in der Praxis mit steigender Tendenz als Zusatz zu herkömmlichen pharmakologischen und nicht pharmakologischen Behandlungen gesehen. Bei Untersuchungen von Musikinterventionen im Bereich der Geburtshilfe zeigte sich unter anderem, dass Musik während der Schwangerschaft die Entspannungsfähigkeit verbessert sowie Ängste vermindern kann. Auch während der Geburt konnte festgestellt werden, dass Musikinterventionen eine Schmerz- und Stressreduktion zur Folge haben. Bei Geburten durch eine Sectio caesarea wirkt sich Musik ebenfalls stress-, schmerz- und angstreduzierend auf die werdenden Mütter aus. Dieses Review soll einen Überblick über die Literatur der musiktherapeutischen Interventionen im Bereich der Geburtshilfe geben und den aktuellen Forschungsstand zum Thema Musik in Bezug auf Schwangerschaft, spontane Gebur-

ten sowie Sectio caesarea zusammenfassen. Des Weiteren wird die Relevanz von Musik für den geburtshilflichen Alltag aufgezeigt.

Introduction

In many areas of life, music can have an effect on physiological and mental health. It may be used to create certain emotions and, depending on the type of music, can influence tension, mood and cognitive performance [1]. Especially during stress, music has a positive effect on the constitution of the stressed individual [2] and may even be used prophylactically prior to negative, stress-induced reactions [3]. This positive effect can not only be evaluated with the aid of subjective parameters, but also objectively by applying physiological parameters [4, 5].

Within a medical context too, a large number of studies have demonstrated a positive effect of adjuvant music interventions during stressful and anxiety-ridden surgical interventions [6]. Studies from various specialties of medicine have shown that listening to music before, during and after surgery can reduce anxiety, stress and pain and even lower the use of analgesics [7, 8]. For example, patients treated in hospital for burn injuries who listened to their preferred instrumental music on several consecutive days demonstrated a lower anxiety level, perceived pain after treatment as less intense and altogether felt more relaxed. A control group which did not listen to music did not show any of these changes [9]. Furthermore, anxiety-lowering and stress-reducing effects were demonstrated in patients who listened to music during root canal treatment [10], colonoscopy [11] and heart surgery [12]. This shows the scope in which music can have a positive effect in the field of medicine in order to render operations associated with stress and anxiety more comfortable.

Pregnancy and childbirth are for the expectant mother personal experiences which are not necessarily associated exclusively with positive emotions. The pregnant woman is faced with many new challenges and especially the thought of the approaching birth and the changes associated with it can create stress and cause discomfort. Feelings of stress, on the other hand, can have negative effects on the health of the pregnant woman and that of the unborn child as well as on the process of labour [13, 14]. Approaches to help the pregnant woman minimise stress are important to reduce the risk posed by these negative effects.

Usually expectant mothers are already braced before giving birth to undergo severe pain during labour and to bear it, possibly for several hours. This can in advance already lead to the pregnant woman experiencing stress and anxiety at the very thought of the birth. If she is then exposed to additional stress during childbirth, this may, for example, adversely affect lactation [15]. In addition, stress increases pain perception [16, 17]. Thus, women who are stressed or very anxious at the time of labour experience pain more intensely [18, 19]. More intense pain perception during delivery can, on the other hand, result in less childbirth satisfaction, whereas less pain is associated with higher childbirth satisfaction and an altogether more positive birth experience [20]. It is therefore important, both on a physiological and an emotional level, to

minimise stress and pain as much as possible. Under the assumption that adjuvant music therapy can reduce pain and stress [21], music could also help the expectant mother to relax during labour, be less stressed, experience less pain and be more satisfied both during and after childbirth.

Over the past years, therefore, a number of studies have examined to what extent music can be employed during pregnancy and childbirth as a cost-effective and simple way to reduce stress [22–24]. These studies were able to demonstrate that music has a positive effect on the stress experience and well-being of the expectant mother and can therefore be used as an uncomplicated means of reducing stress and pain and for enhancing satisfaction. Nevertheless, in many delivery rooms today it is often not usual for music to be routinely offered and used in daily clinical practice. Also, the type of music used for the interventions in the various studies varies. However, so far there are no consistent results as to whether the music should be selected by the patient herself and which type of music with respect to genre and tempo has the best possible effect on the patients. The objective of this review is to provide an overview of findings to date which have shown the effect and the opportunities of music as a supplementary intervention option in the different areas of obstetrics.

Music During Pregnancy

Pregnancy is an eventful time for expectant mothers and many psychological and physiological changes take place during this period. Depending on personality, experience and number of previous pregnancies, this process differs from one woman to the other [25] and can involve varying degrees of stress. Various studies have shown that music may be employed as a stress-reducing intervention for relaxation during pregnancy.

In one study, Shobeiri et al. [22] were able to demonstrate the positive effect of music interventions on pregnancy-associated sleep problems. They examined over a period of four weeks the effect of daily music interventions and registered sleep quality of the pregnant women using the Pittsburgh Sleep Quality Index. At the beginning of the intervention period, between the 30th and 34th week of pregnancy, the women of the experimental group participated in two 60-minute counselling sessions in which the correct use of passive music therapy was conveyed. The pregnant women were instructed to continue with the music intervention on a daily basis during the following four weeks and to listen to a music CD they were provided with. The music intervention brought about a significant improvement in the women with regard to various parts of the Pittsburgh Sleep Quality Index as well as an improvement of the index “Total sleep quality”. The control group did not demonstrate these effects.

Music interventions also appear to have a positive effect on the psychological health of pregnant women. With a two-week intervention, during which the pregnant women listened to music on a

daily basis, Chang et al. [26] showed that after the intervention the women had a significantly lower stress and anxiety level in comparison to the control group. This was assessed using the Perceived Stress Scale, the State Scale of the State-Trait Anxiety Inventory and the Edinburgh Postnatal Depression Scale. The researchers concluded from their study that music is a simple and cost-efficient method to improve the psychological health of pregnant women. The positive effect of music on the psychosocial stress level and on stress perception, especially with regard to aspects of pregnancy, was demonstrated in another study by Chang et al. [27]. They once again conducted a daily music intervention over a period of two weeks and were able to show that the women who listened to music reported a lower level of psychosocial stress on the Pregnancy Stress Rating Scale than the control group.

Another study demonstrated that listening to music also has an effect on somatic symptoms of expectant mothers. Cao et al. [28] showed that music as a supplementary intervention improved the efficacy of conventional treatment of pregnancy-induced hypertension. Unlike the control group which only received conventional therapy, women in the intervention group who listened to music daily over a period of four weeks had significantly lower systolic and diastolic blood pressure and, as a biochemical correlate of this, lower levels of serum angiotensin which causes a rise in blood pressure. After music intervention, the systolic blood pressure in the intervention group decreased on average by 23.88 from 155.38 to 131.50 mmHg, whereas in the control group it fell by only 7.1 from 155.42 to 148.32 mmHg. Furthermore, the women in the intervention group had a significantly lower anxiety and depression score on the Hamilton Anxiety Scale and the Hamilton Depression Scale, thus reflecting an improved quality of life. In this study, music therefore had an effect on the objectively measurable physiological parameters as well as on the subjectively felt quality of life.

Apart from simply listening to music, active singing and playing music has a positive effect on the quality of life and on mother-to-infant bonding [29]. In the study by Carolan et al. [29] pregnant women were taught to sing lullabies during four group sessions. After three months, semi-structured interviews confirmed that contentment and ability to relax had improved and the women experienced a closer connection with the unborn child, especially when singing. Thus, music appears to make a positive contribution to mother-to-infant bonding, which is regarded, amongst other things, as a predictor for various competences, for example in social aspects [30]. When interpreting the results of Carolan et al., however, the small number of participants of only six pregnant women should be given serious consideration as well as their methodology of gathering results purely by using semi-structured interviews.

Persico et al. [31] also examined the effect of active singing during pregnancy. During one of the sessions of their antenatal classes, a musician taught the women of the intervention group several lullabies, of which each woman chose her preferred song to be sung regularly during the remaining pregnancy. In the 24th and 36th week of pregnancy as well as two days and three months after delivery, mother-to-infant bonding and some other behavioural and biographical data of the mother and child were assessed with the aid of the Prenatal Attachment Inventory and the

Mother-to-Infant Bonding Scale. The study showed that the women in the intervention group experienced significantly less stress than those in the control group. Furthermore, those in the intervention group reported significantly less often that their baby awoke more than four times per night. At the measurement time of three months after delivery, mother-to-infant bonding was significantly better in the intervention group than in the control group. Thus, Persico et al. were able to show that singing during pregnancy can have a positive effect on both mother and child.

The positive effect of music was also evident during prenatal examinations during pregnancy [32, 33]. In a comparison of the interventions “Relaxation music”, “Sitting and reading magazines” and “Sitting in the waiting room” before an amniocentesis examination, a greater fall in cortisol levels was evident in the music group than in both control groups [32]. During transvaginal ultrasound examinations, Shin and Kim [33] showed with the aid of the State Scale of the State-Trait Anxiety Inventory, the Pregnant Women’s Stress Scale and the Maternal-foetal Attachment Scale that a 30-minute music intervention during the examination can reduce the anxiety level of pregnant women and that they are more relaxed during the examinations. A control group which did not hear music during the examination did not demonstrate any reduction in anxiety.

Experiencing music does not only influence the condition of the expectant mother, but also has an effect on the foetus in the womb. Kafali et al. [34] were able to show that, during cardiotocography (CTG), the foetus demonstrated a higher number of movements and an accelerated heart rate during exposition to music. Completion of Spielberger’s State and Trait Anxiety Inventory also revealed a significantly lower anxiety level of the expectant mothers in the music group during CTGs, whereas the level of anxiety in the control group rose. Thus, music had a positive effect both on the state of the foetus as well as the condition of the mother.

Lopez-Teijon et al. [35] assessed whether the way that the music intervention was offered to the pregnant women has an effect on the behaviour of the foetus. They divided the pregnant women, who were at least in their 16th week of pregnancy, into the groups “Intravaginal Music”, “Abdominal Music” and “Intravaginal Vibration”. At the same time as the intervention, the facial movements of the foetus were registered with the aid of 3-D-ultrasound. The unborn children showed more facial and tongue movements during the intravaginal music intervention than during abdominal music intervention or pure vibration intervention. These results allow the conclusion that music interventions directed at the foetus have the greatest effect during transvaginal ultrasound and this has a direct effect on the foetus. However, the results of the study do not allow the deduction of whether increased mouth and tongue movements of the foetus are a positive sign and which conclusions may be drawn from this behaviour.

The effect of music on the condition of the foetus was also demonstrated during music stimulation between two CTGs [36]. In a comparison between music stimulation and vibroacoustic stimulation, the foetuses in the music group showed more movements during the second CTG than those who were subjected to vibroacoustic stimulation. Based on these results, music stimula-

tion of fetuses with decreased movements within the mother's womb could be utilised to encourage them to move and so reduce the mother's anxiety with regard to the health of her unborn child [36].

Music During Spontaneous Delivery

The birth of a child and the pain of contractions associated with labour are one of the most painful experiences in the life of a woman [37]. Nevertheless, birth is a very beautiful and positive life experience for the majority of women, despite the pain. In order to facilitate pain perception and coping with labour and to render the birth experience as positive as possible, there are, apart from pharmacological interventions, various non-pharmacological methods available which can be used before and during childbirth. For example, it has been shown that women who practised yoga during childbirth had less pain and greater childbirth satisfaction than women who do not relax with the help of yoga [38]. Use of massage or acupuncture demonstrated a significant effect on pain perception, painkiller use and satisfaction during delivery [39]. Music, as a non-pharmacological intervention during the process of labour, appears to have both a relaxing and a pain-reducing effect on expectant mothers [40].

If pregnant women already learn to relax with the aid of music before giving birth, listening to music during labour may be exploited as a helpful coping strategy and ensure that the expectant mother is better distracted and can therefore relax more easily [41]. Tabarro et al. [42] conducted a music intervention in twelve pregnant women from the fifth month of pregnancy. At the beginning of the study the women selected preferred music and listened to it regularly until childbirth. On the day of delivery, the pregnant women listened to the music they had initially selected throughout the entire labour. Every two hours the intervention was interrupted for 30 minutes. In subsequent interviews the women reported 24 hours and two and three months after childbirth a feeling of pain relief and the experience of anxiety reduction as well as a positive effect of the music on the baby. It should be kept in mind, however, when interpreting these results that there was no control group to compare the effect of the music and the sample included only twelve women.

Music intervention only offered to the expectant mothers at the time of delivery appears to have a positive effect too. With the aid of visual analogue scales for pain and emotional stress, Phumdoung and Good [40] were able to demonstrate that music intervention over a period of three hours during the active phase of labour results in reduction of stress and pain sensation. A control group did not experience this form of relief. Liu et al. [23] examined the effect of adjuvant music therapy both during the latent phase and during the active phase of labour. The expectant mothers in the intervention group listened to music during every phase for a period of 30 minutes. Evaluation of the visual analogue scales for the perception of pain and anxiety and of finger temperature showed that the intervention group had significantly less pain and anxiety exclusively during the latent phase than the control group. Liu et al. [23] found no difference in the active phase between the intervention group and the control group.

Adjuvant music intervention during labour also appears to have an effect on mental health in addition to the effect on the perception of anxiety and pain [43]. In the study by Simavli et al. [43], the expectant mothers in the intervention group listened at the time of labour to music which they were able to choose for themselves. After giving birth the women in the intervention group demonstrated significantly lower scores on visual analogue scales for pain intensity and anxiety as well as on the Edinburgh Postpartum Depression Scale than the control group. Satisfaction, which was also measured using a visual analogue scale, was also higher in the intervention group than in the control group, allowing an overall positive effect of the music intervention on the well-being of the women to be deduced.

Music During Caesarean Sections

Even though the majority of women have the wish to deliver spontaneously, in Germany 31.1% of expectant mothers had caesarean sections in 2015 [44]. Caesarean section is an anxiety-ridden surgical operation which usually causes considerable discomfort in the women involved [45,46]. In order to make the situation of surgery easier for the women and to reduce the associated stress, several studies have examined the effect of music during caesarean section.

In 2012 Kushnir et al. [24] investigated whether listening to music while waiting for a caesarean section had positive effects on the condition of the expectant mothers. The women in the intervention group listened to the music they had chosen themselves for 40 minutes before the operation. Before and after the waiting time, several vital parameters were assessed in the women in addition to the Mood State Scale and Perceived Threat of Surgery Scale. The participants of the intervention group showed significantly less negative emotions after the waiting time as compared with the control group and a significant reduction in systolic blood pressure, which indicates a reduction in stress and anxiety. There were no significant differences between the groups on all the other parameters.

Li and Dong [47] also conducted a study in which they played music to expectant mothers during the waiting time before their caesarean section. The women in the intervention group heard music for 30 minutes which they had previously selected from a given repertoire of classical Chinese music. Six hours after the operation, the women who had listened to music during the waiting time showed a significantly lower anxiety score on the Zung Self-Rating Anxiety Scale and a significantly lower pain score on the visual analogue scale for pain than the control group. The intervention group also showed significantly lower values in the measured heart rate and heart rate variability than the control group. On the whole, the results of Li and Dong thus indicate a positive effect of music on both subjective and objective parameters.

With regard to the effectiveness of music interventions during caesarean section, the available studies do not show any uniform and unequivocal results. Whereas Reza et al. [48] showed that, from the induction of anaesthesia to skin suture, music intervention had no positive effects, Chang and Chen [49] found a positive effect of music intervention during the operation on the women's feelings of anxiety and satisfaction. In the study by Reza et al. [48],

► **Table 1** Study Overview – Music during pregnancy and during spontaneous delivery and caesarean section.

Trial	Type of intervention	Number of participants	Control group	Measuring tools	Results
Music during pregnancy					
Shobeiri et al., 2005 [22]	4 weeks, 45 min every evening CD with calm music 2 sessions of music counselling	n = 88	yes	Pittsburgh Sleep Quality Index (PSQI)	EG: sign. reduction of PSQI Scores (except 5th component) CG: no change
Chang et al., 2008 [26]	2 weeks, at least 30 min every day 4 different CDs (lullabies, classical music, nature sounds, crystal music)	n = 236	yes	Perceived Stress Scale (PSS) State Scale of the State-Trait Anxiety Inventory (S-STAI) Edinburgh Postnatal Depression Scale (EPDS) Music diary to document the intervention in the EG	Baseline → Post-test comparison: EG: sign. reduction in PSS, S-STAI and EPDS sign. difference between CG: sign. reduction in PSS, S-STAI and EPDS no difference
Chang et al., 2015 [27]	2 weeks, at least 30 min every day 5 different CDs (crystal music, nature sounds, classical music, lullabies, symphonic music)	n = 320	yes	Pregnancy Stress Rating Scale (PSRS) Perceived Stress Scale (PSS) Maternal-Fetal Attachment Scale (MFAS)	PSS and MFAS no interaction group * time PSRS interaction group * time sign.
Cao et al., 2016 [28]	4 weeks, twice daily for 30–60 min each session personalised/favourite CDs	n = 60	yes	systolic and diastolic blood pressure (SBP, DBP) Hamilton Anxiety Scale (HAM-A) Hamilton Depression Scale (HAM-D) serum angiotensin II (Ang II)	SBP: CG (M = 155.42 → M = 148.32); EG (M = 155.38 → 131.50) DBP: CG (M = 95.51 → 92.64); EG (M = 95.37 → M 81.60) HAM-A + HAM-D: EG sign. less than CG after the intervention
Carolan et al., 2012 [29]	4 group sessions of singing lessons (45 min), after which continued to sing during pregnancy	n = 6	no	3 months post partum: qualitative interview (semi-structured) with the aid of an Interview Question Guide	benefit for pregnant woman/mother: reduction of maternal stress, increased contentment and bonding with the child
Ventura et al., 2012 [32]	listening to music for 30 min in the waiting room before the amniocentesis	n = 154	yes, CG "Sitting and reading in the waiting room" and CG "Sitting in the waiting room"	Spielberger's State and Trait Anxiety Inventory blood sample (cortisol)	reduction of cortisol levels: Music > Reading > Sitting music group: strongest reduction State Anxiety
Shin and Kim, 2010 [33]	30-min session of music therapy during transvaginal ultrasound	n = 232	yes	State Scale of the State-Trait Anxiety Inventory Pregnant Women's Stress Scale Maternal-fetal Attachment Scale	in EG sign. less anxiety than in the CG no differences in stress and mother-to-infant bonding between the groups
Kafali et al., 2011 [34]	music during a non-stress test (CTG)	n = 201	yes	Spielberger's State and Trait Anxiety Inventory Foetal heart rate (FHR) number of foetal movements	EG: Reduction of the STAI Scores; CG: increase of the STAI Scores EG more movements, higher FHR than CG
López-Teijón et al., 2015 [35]	abdominal music vs. intravaginal music vs. intravaginal vibration during 3-D-/4-D-ultrasound	n = 106	yes, CG "intravaginal vibration"	mouth and tongue movements of the foetus (baseline, during stimulation and 5 min after stimulation) as registered by 3-D-/4-D-ultrasound	sign. increase of mouth and tongue movements during intravaginal music as compared with abdominal music and intravaginal vibration
Pirhadi, 2015 [36]	music between the first and second non-stress test (CTG)	n = 64	yes, CG "vibroacoustic stimulation"	Foetal Heart Rate (FHR) number of foetal movements	no sign. difference between EG and CG for FHR in the EG sign. more foetal movements than in the CG

Continued next page

► **Table 1** Study Overview – Music during pregnancy and during spontaneous delivery and caesarean section. (Continued)

Trial	Type of intervention	Number of participants	Control group	Measuring tools	Results
Music during spontaneous deliveries					
Browning, 2000 [41]	daily music from a CD for at least 90 min	n = 12	yes	72 h after delivery: Interview	report by the women that music is a helpful coping strategy (above all distraction)
Tabarro, 2010 [42]	music previously selected by the women played during labour (interrupted for 30 min every 2 h)	n = 12	no	interview (24 h, 2 and 3 months post partum)	report by the women that music reduces stress during labour and the baby reacts positively to the music
Phumdoung and Good, 2003 [40]	3 h of music during the active phase of labour	n = 110	yes	visual analogue scale for pain and emotional stress (before the intervention and then 1 × every hour)	EG: reduction of pain and stress
Liu et al., 2010 [23]	at least 30 min of music during the latent and active labour phases (classical, light, popular, crystal children's, Chinese religious music)	n = 60	yes	visual analogue scales for pain and for anxiety observation of behaviour intensity by the nurse measurement of finger temperature 24 h post partum questionnaire on the effectiveness of music therapy	latent phase: EG had sign. less pain and anxiety scores and behaviour scores than the CG, finger temperature in the CG was sign. higher active phase: no differences
Simavli et al., 2014 [43]	music, previously selected by the participants, during labour with 20-min interruptions every 2 h (classical, light, popular, Turkish art, Turkish folk, Turkish Sufi music)	n = 161	yes	visual analogue scales for post partum pain intensity, anxiety and satisfaction Edinburgh Postpartum Depression Scale (EPDS) measurements 1, 4, 8, 16 and 24 h post partum	EG: sign. less pain, anxiety and depression levels and greater satisfaction than in CG
Music during caesarean sections					
Reza et al., 2007 [48]	Spanish guitar music from induction of anaesthesia until wound dressing	n = 100	yes, CG with white noise from induction of anaesthesia until wound dressing	visual analogue scale for pain and for anxiety 0.5 to 6 h after caesarean section documentation of the amount of painkillers	no difference between the groups for pain and anxiety and the amount of painkillers
Kushnir et al., 2012 [24]	music previously selected by the participants for 40 min while waiting for the operation	n = 60	yes	Mood State Scale Perceived Threat of Surgery Scale vital parameters (blood pressure, heart rate and respiratory rate)	sign. less levels of negative emotions (Mood State Scale) in the EG, no differences in positive emotions (Mood State Scale) sign. interaction group * time for all subjective parameters in the EG sign. less systolic blood pressure after music
Li and Dong, 2012 [47]	30 min Chinese classical music before surgery	n = 60	yes	Zung Self-Rating Anxiety Scale (SAS) visual analogue scale for pain Measurement of heart rate and heart rate variability	in the EG sign. lower mean heart rate and heart rate variability after music intervention, no difference in the CG in the EG sign. lower anxiety score after music intervention, no difference in the CG pain score 6 h after surgery in the EG sign. less than in the CG
Chang and Chen, 2005 [49]	music which the women had previously selected (western classical, new age, Chinese religious music), for at least 30 min during the operation	n = 64	yes	visual analogue scale for anxiety Measurement of oxygen saturation, finger temperature, respiratory rate, heart rate and blood pressure childbirth satisfaction using the Satisfaction of Cesarean Delivery Scale designed for the study	sign. less anxiety and greater satisfaction in the EG than in the CG no significant differences between the groups in the physiological parameters

the women heard Spanish guitar music during the time from the induction of anaesthesia to the time of skin suture. The control group heard white noise during the operation. Postoperative pain and anxiety were registered on visual analogue scales half an hour and six hours after the operation. No difference, however, was evident between the intervention and the control group. After measuring pain and anxiety, the amount of painkillers which the women requested after the caesarean section was registered. Here too, there was no difference between the two groups. Since there appears to be some degree of vagueness in this study, with shortcomings of methodology and evaluation, the authors' results warrant a critical assessment. Chang and Chen's [49] study showed that a music intervention may also be beneficial during the operation. The researchers examined the effect at the time of surgery of a 30-minute music intervention on the condition of the expectant mothers. Both subjective and objective parameters were registered with the aid of a visual analogue scale for anxiety, the Satisfaction of Cesarean Delivery Scale and the measurement of the physiological parameters oxygen saturation, finger temperature, respiratory rate, pulse rate and blood pressure. The women in the intervention group experienced less anxiety and reported a higher degree of satisfaction during the caesarean section than the control group. However, there were no differences between the groups in the physiological parameters. Thus, the positive effects of music intervention were evident exclusively on the subjective parameters.

Discussion

Almost all published studies (► **Table 1**) suggest that music interventions or the use of adjuvant music therapy during pregnancy and childbirth can be used as an effective aid for relaxation and pain reduction. It is evident that music has, on the whole, positive effects on the condition of pregnant women and those giving birth. This is of particular relevance in obstetrics because the perception of stress and anxiety during pregnancy can have negative effects on the expectant mother and the unborn or new-born child [14, 50]. The results of the majority of studies also suggest that music has a large potential as a form of intervention for relaxation, anxiety reduction and pain reduction, although this has by no means been exhausted in its frequency of application and its type of use in the gynaecologist's office and in daily practice in hospitals.

Based on current studies, no unequivocal statement can be made about which point in time and for which duration a music intervention is most beneficial and most effective. Thus, the studies by Phumdoung and Good [40] and by Liu et al. [23] achieved different results with regard to the appropriate moment of the music intervention during labour. Whereas Phumdoung and Good [40] were able to demonstrate a positive effect on the expectant mother during the active phase of labour, Liu et al. [23] showed that the music intervention resulted in a reduction of pain and anxiety only during the latent phase and not during the active phase. Chang and Chen [49] discovered that a music intervention during caesarean section resulted in positive changes in the women, whereas Reza et al. [48] with a similar intervention during the caesarean section did not achieve any results which would allow

the conclusion of a positive effect of the music at the time of surgery. Further studies are required here in order to reach clearer conclusions regarding the ideal moment of music delivery and optimal duration of music interventions in obstetrics.

The comparability of the studies listed here is also difficult to assess. A sometimes very low number of participants of only six [29] or twelve [42] women per study limits the validity of the results of some of the studies. Furthermore, all the studies resorted to very different types of music. The researchers did not use uniform genres or styles for the music interventions, but instead supplied the women sometimes with country-specific pieces or self-compiled CDs. Further research is required to find out which type of music intervention is most suited for relaxation since, for example, it was shown that preferred music has a more positive effect than preselected non-preferred music [51, 52]. It should also be examined on which parameters the effect of music depends, as it was not possible to explain whether the relaxing effect of music is possibly entirely due to the process of distraction or whether music-specific parameters favour relaxation. In order to examine this, further studies could, for example, integrate another control group with a different auditory intervention, such as for example listening to an audiobook.

During the research of the literature for the present review it was also noticed that the literature only reports positive effects of the use of music in obstetrics. An exception is the study by Reza et al. [48], which reported no effects of music. The literature provided here may have been the result of a publication bias, as negative or non-existent effects of music are not often published. Selection bias during sampling could also be a reason why the literature only exclusively contains reports of positive effects. Women who do not relate to music in daily life and in whom even the very thought of possibly having to hear music creates an uneasy feeling, will, from the start, decline to give their consent to participate in studies designed to provide a music intervention. Therefore, it would also be interesting to examine what effect the presence of certain personality traits has on the use and effect of music interventions. Studies examining these questions would also be necessary to further optimise the use of music interventions.

A higher expression of an anxious personality often causes the women to be also more anxious during caesarean sections than comparative expectant mothers with a lower expression of an anxious personality [46]. This could mean that more anxious women in particular could profit from a music intervention. There are also indications in the literature that music produces greater effects of relaxation in people with a high degree of extraversion than in people with other personality traits [53]. It would therefore be interesting to examine in future studies how the personality of the expectant mother affects receptibility for music interventions and influences the effect of the intervention. It should be noted in this respect that the personal attitude to music in general should also be considered. Listening to music should be felt as something pleasant and only be used with the patient's consent so that a positive effect might be possible. Depending on the situation and personality of the patient, the perception and reaction to musical stimuli can vary [54]. Each individual case should therefore be assessed as to whether music should be considered as a supplementary intervention.

It should also be borne in mind when interpreting the results of the studies listed here that the outcome of the majority of these studies relies on subjective parameters. Effects demonstrating a subjective improvement are indeed a positive and important result, especially for the patients. However, objective parameters, such as measuring physiological values for example, allow more reliable results [55].

Despite the apparently positive effect of music, the use of music interventions has so far found no mention in German clinical guidelines for obstetrics. Only in the S3-consensus guidelines on analgesia, sedation and delirium management in intensive care brought out by the German Association of Scientific Medical Professional Societies (AWMF) [56] is there a short mention of the possibility of using music as a non-pharmacological strategy to create more relaxed environmental conditions. Outside Germany too, music attracts little attention as an alternative intervention option in obstetrics. In the WHO guidelines “Care in Normal Birth: a practical guide” [57], music is also mentioned only as a subsection of several non-invasive and non-pharmacological intervention options for pain management. Particularly in the field of obstetrics it would be desirable for guidelines to refer to music interventions as an additional treatment alternative. Furthermore, obstetric staff should receive more information about offering and using music as an intervention option in obstetrics.

We hope that with this review we have drawn your attention to music as a form of non-pharmacological treatment alternative in obstetrics and have shown its various possible uses. Altogether it may be stated that music can be used as a simple, cost-efficient and effective intervention in obstetrics, even though specification of the intervention options and modes of action still require further research. Music could be used significantly more often as a form of intervention by doctors, midwives and expectant mothers and appears to be an exclusively positive method of rendering the experience of pregnancy and childbirth more pleasant. In everyday practice of hospitals and of gynaecologists in private practice, music is currently only mentioned in isolated cases as a treatment alternative and against the background of better known interventions such as massage, acupuncture and aroma oil therapy, for example, often tends to be neglected as a treatment option. At the moment, there is still no systematic study available on the frequency of use of music interventions in the daily routine of obstetrics, for which reason it is difficult to undertake a clear classification of the use of, and attitude towards, music in day-to-day obstetric practice. Altogether it would be desirable that music would be offered and used more often in everyday clinical practice in order to allow expectant mothers an as pleasant birth experience as possible.

Acknowledgements

The authors would like to thank the Else-Kroener-Fresenius Foundation for their financial support.

Conflict of Interest

The authors declare that there is no conflict of interest.

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