

Effect of Flute Music on Human Milk Production and Depression Among Lactating Mothers

Running Title: Flute Music and Human Milk Production

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MeSH terms: Human Milk, Lactation, Infant care, Mental Health, Post partum Depression

The Abstract

Background -Listening to music prior to feeding mothers' own milk to the newborn calms down anxiety and beats stress, making the mother happy and relieved. This increase in the supply of mother's own milk may be attributed to stress relief in postpartum period.

Research aim-The primary objective was to assess the post partum depression based on validated Edinburgh post partum depression scale. The secondary objective was to study the effect of listening to music on human milk production during the first postnatal week.

Methods- A case- control study involving 60 lactating mothers was performed in a tertiary hospital. Among these participants, 30 mothers were given relaxing music prior to mothers' own milkfeeding to the newborn. The amount of human milk produced was compared to controls. Post partum stress was also evaluated with postpartum depression scales in both groups.

Results -The control group showed an average milk of 31.30/22.60 ml (mean/SD). Case group showed an average milk of 60.50/25.30 ml (mean/SD), which was significantly

higher than control group ($p < 0.0001$). Standard validated Edinburgh post partum depression questionnaire found that there was a significant effect of music on prevention of post partum depression.

Conclusion-Listening to relaxing, calm music before breastfeeding reduces the odds of post partum depression and increases the quantity of human milk production in term lactating mothers.

1. BACKGROUND

The ideal nutrition for infants and newborns is mother's own milk. It provides all nutrient requirements including calories, proteins, fat, vitamins, minerals, trace elements and DHA (docosa hexaenoic acid) for infants in adequate proportion. Human milk also contains antibodies IgA for the immunity of infants. Mother's own milk is highly beneficial for both infants and mothers. It helps the infant by protecting against bacterial and viral infections, respiratory tract infection, necrotizing enterocolitis, malignancy and childhood obesity according to the American Academy of Pediatrics(1). Exclusive human milkfeeding to the newborn prevents infections and reduces infant mortality due to common childhood illnesses such as diarrhea and pneumonia (2-5). Fat in human milk ensures good IQ in infants (6, 7).Maternal benefits are decrease in postpartum bleeding, protection against breast and ovarian cancers, birth spacing and reduced chance of obesity (8).

World health organization and American academy of pediatrics strongly recommend mother's own milk feeding to be given exclusively for 6 months. It was found in the National Family Health Survey4 (NFHS4) that the prevalence of exclusive mothers' own milk feeding was only 54.9% among Indian infants aged between 0 and 6 months. The prevalence of exclusive mother's own milk feeding in Southern India was found to be 79.2% (9). There is a definite need to spread awareness about importance of mother's own milk feeding and to reduce the factors, which inhibit healthy human milk feeding.

Previous studies have proven association of stress and its harmful impact on mothers' own milk feeding (10). Some stressful pregnancy events like post partum hemorrhage, postpartum depression, anxiety, pain, and financial and traumatic stress may lead to inadequate mothers' milk feeding. Post- partum depression is found to be high in India (11). Post partum stress can affect lactogenesis, galactopoiesis, galactokinesis and let down reflexes essential for mothers' own milk feeding (12).Coping with stress can be made possible by listening to calm and soothing meditational music as a relaxation technique.

Post partum "blues" or "depression" is very common in mothers due to abrupt alteration of prolactin, estrogen and progesterone hormones that occur at the time of parturition and milk let down. Music therapy has a long history in clinical practice and research that supports the use of music therapy to reduce or manage stress, fatigue, and accompanying symptoms. A meta-analysis of 22 quantitative studies revealed that music therapy is an effective means of reducing stress (13). In earlier studies, the failure of lactation has been correlated to the severity of depression. Hence, this study was done to determine the effect of music listening on improvement of post partum stress.

The primary objective was to study the effect of the music on post partum depression scale based on validated Edinburgh post partum depression scale (14).The secondary objectives was to study the effect of relaxing music listening on human milk production in lactating mothers in first one week post delivery.

2. MATERIALS AND METHODS

Design:

The present prospective study was conducted in a private tertiary care hospital.This study is a case-control study involving sixty lactating motherswho had antenatal care and delivery at our hospital.After getting approval from the Institutional Research Board (SMC/IEC/2020/03/501)and getting written informed consent from the participants in local language, the study was initiated.

Sample:

The sampling technique was consecutive enumerative sampling. Case group consisted of thirty mothers who listened to specific relaxing flute music available online. Control group consisted of thirty mothers who did not listen to any music for three days postpartum. Cases and controls were matched by age, socio-economic status, BMI (Body Mass Index), parity and mode of delivery.

All mothers were made to listen to the same music for three hours. The mothers listened to music whenever they felt comfortable for a minimum of three hours each day for three days beginning from postpartum day one. The amount human milk produced was measured on fourth postnatal day early morning.

Setting:

Thirty mothers on post delivery day one were made to listen to uniform flute music available at <https://youtu.be/6ixhN9umyp4> for at least three hour a day for 3 days. They were made to listen via earphones at their leisure. All mothers agreed that they felt relaxed listening to the music.

Measurement:

The mothers' own milk production quantity was measured using artificial human milk expression pump.Mothers' milk production quantity was measured on the fourth day post partum day with a pre calibrated measuring cups. The mother based the time for breast milk suction on subjective feeling of breast fullness early at the morning on postnatal day 4 prior to infant suckling.

Data Collection

On post partum day 4, both group mothers were interviewed by a blinded investigator and validated Edinburgh post partum depression questionnaire was filled. From post partum day 4 the control group mothers were also played the same music for 3 hours for 3 days according

to the declaration of Helsinki to administer the therapy to control group as an ethical principle.

Data Analysis

Descriptive and inferential statistics were used to analyze the data. For continuous variables the unpaired t -test with Welch' s correction was used. Data in all tables are shown as Mean/SD. For categorical variables comparisons of the case and control group were performed with the use of chi-square tests and Fischer's exact tests. The data were entered in Microsoft Excel 2007 and analysis was done using Statistical Package for Social Sciences (SPSS) Software (Version 19). Differences were considered significant when p was < 0.05. Logistic regression was used to obtain the Odd's ratio (OR) and 95% CI.

3. RESULTS:

Baseline Characteristics Of Mothers:

Of the 60 women who were suckling their newborns, 30 mothers listened to flute music, while the rest 30 mothers did not. There was no statistically significant difference between the baseline characteristics of the two groups. The demographic, socioeconomic and obstetric characteristics of the participating mothers were similar in both groups. Various age groups are shown in Table 1. All mothers were married and most of the mothers were homemakers (Table 1).

The maternal characteristics of both groups are shown in Table 1. All mothers delivered at term. The co-morbidities present in the mothers were also similar in both groups are elaborated in Table 1.

Mother's own Milk Production Quantity:

In the control group, the average amount of mothers' milk production was found to be 31.30/22.61 ml (mean/SD), whereas the average amount of mothers' milk production was found to be 60.50/25.32 ml (mean/SD) in case group. The amount of milk production in both groups is shown in Table 2 and Table 3. There was a significant difference in the amount of milk produced by the mothers who listened to music.

Edinburgh post partum depression scale:

In Edinburgh post partum depression scale (EPDS) questionnaire, the score ranged from 8 to 14. On analysis, this scale predicted the prevalence of postpartum depression in control group more than case group. The EPDS score is given in Table 4.

4. DISCUSSION:

The results of the present study suggest that listening to music in postpartum had a significant effect on the quantity of human milk production in the postnatal period. On postpartum day 4 at early morning, the difference in average quantity of mothers' own milk in case and control

was found to be 29.20 ml($p < 0.0001$, significant). This is similar to other studies conducted with preterm mothers at Georgia and term gestation mothers in Thailand (15,16,17).

Studies on nursing women who feed their own babies with mothers' own milk have shown that depression has an effect on hormones involved in lactation and hence the milk production and secretion (18,19).

In this study, there was a significant change in the depression score following music therapy on comparing the control and case groups, and all participants who listened to music agreed that they felt less stress after listening to music. This is similar to a study conducted at Taiwan (20). Moreover, music therapy was also found to have significant impact on postoperative pain and anxiety in a study conducted at Iran (21)

The average daily duration of listening to music in the present was 3 hrs. The music was wind instrument, bamboo flute and did not have any meaningful syllable. The diet of the mother was provided by hospital. These are the unique parameters of this study, which are different from the other studies that have been conducted prior.

Considering the various compounding factors, BMI of mothers from both groups were comparable and mothers of all BMI benefitted from music in this study. In a meta-analysis conducted in America, it was proven that overweight mothers have problem with initiation of breastfeeding and also the duration of breastfeeding (22). However in their study, the control group had more primigravida compared to case group. Multipara mothers were found to have increased quantity of mothers' own milk production and faster initiation compared to primipara mothers in a study conducted at Pennsylvania (23). Mothers with hypothyroidism have been associated with overweight and high BMI and it has been proven that it alters the levels of oxytocin and affects the human milk production to a significant level (24). Animal models have demonstrated the requirement for levothyroxine (T4) and liothyronine (T3) in initiation and maintenance of lactation, and human mothers with suboptimal levels may have lower milk supply and reduced oxytocin release in response to suckling (25).

There are few studies that establish the significance of concurrent gestational diabetes mellitus and gestational hypertension on the quantity of human milk production. The nourishment of the mother has been found to have impact on the milk production quantity, which has been taken into consideration in this study as all mothers were on standard hospital diet (26).

Limitations:

The improvement of human milk quantity and quality after any intervention needs to be correlated in context of gestational age at delivery, newborn weight, maternal nutritional status, Body Mass Index (BMI), Body Fat Index (BFI), daily dietary intake and prior experience of mothers' own milk feeding to the newborn.

This particular research has some limitations. There were 30 mothers in the case group and 30 mothers in the control group. The sample size is small. This is also not further sub-classified to find the subgroup that benefits maximum from the intervention. For any

statistical test to have meaningful implications the sample size should be reasonable. A future detailed prospective study analyzing both the quantity and quality of human milk with more sample size is required to confirm these preliminary findings.

5. CONCLUSION

The results of the present study suggest that listening to music has significant impact on the human milk production in term mothers in the immediate post partum period. It is also associated with decreased odds of post partum depression. This practice can be inculcated in various postnatal wards, neonatal intensive care units and human milk expression rooms located at milk banks. Music therapy is safe, economical, helps to de-stress and would encourage mothers to feed their own milk to their babies in a relaxed environment.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

SOURCE OF FUNDING: NIL

Acknowledgements: The authors are thankful to the Department of Neonatology, for providing the infrastructure and support for conduct of study

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Table 1: Demographic characteristics of lactating mothers in immediate post partum (N=60). n1(30) is the control group who did not hear flute music* for 3 days and n2(30) is the case group who listened to flute music for 3hrs/day for 3 days form postpartum day 1-3.

S.No	Maternal Characteristics (N=60)	Control M/SD(n1=30)	Case M/SD (n2=30)
1	Age in years (number of women)	25.07/3.84	25.47/3.42
a	≤20(5)	3 (10%)	2 (6.7%)
b	21-25(27)	15 (50%)	12 (40%)
c	26-30(21)	9 (30%)	12 (40%)
d	>30(7)	3 (10%)	4 (13.3%)
2	BMI (M/SD)	28.60/5.66	27.10/5.28
3	Occupation		
a	Homemakers	28 (93.3%)	27 (90%)
b	Others	2 (6.7%)	3 (10%)
3	Parity		
a	Primigravida	19(63.3%)	8 (26.7%)
b	Multigravida	11(36.6%)	22 (73.3%)
4	Mode of delivery		

a	NVD-vaginal delivery	5 (16.6%)	11 (36.7%)
b	LSCS: C-section	25(83.4%)	19 (63.3%)
5	Co-morbidities		
a	Present (Hypothyroid, GDM, Preeclampsia, others)	15 (50%)	12 (40%)
b	Absent	15 (50%)	18 (60%)
6	Gender of baby		
a	Male	14(46.6%)	15(50%)
b	Female	16(53.4%)	15(50%)

*Flute music available at <https://youtu.be/6ixhN9umyp4>

Table 2: Quantity of human milk production in lactating mothers in immediate postpartum. n1 (30) is the control group who did not hear flute music for 3 days and n2 (30) is the case group who listened to flute music* for 3hours/day for 3 days form postpartum day 1-3.

S.No	Amount of mothers' own milk produced (in ml)	Control (n1=30)	Case (n2=30)
1	<30	13 (43.3%)	0 (0%)
2	30-59	15 (50%)	16 (53.3%)
3	60-90	1 (3.3%)	8 (26.7%)
4	>90	1 (3.3%)	6 (5%)

*Flute music available at <https://youtu.be/6ixhN9umyp4>

Table 3: Statistical analysis comparing the quantity of mothers' own milk in lactating mothers in immediate postpartum (N=60). n1(30) is the control group who did not hear flute music* for 3 days and n2(30) is the case group who listened to flute music for 3hrs/day for 3 days form postpartum day 1-3.

<u>Case Group</u> (M/SD)	<u>Control Group</u> (M/SD)	Standard error	6.19
60.50/25.30 ml	31.30/22.60 ml	95% CI	16.80 to 41.59
		t-statistic	4.71
		DF	58

		Significance level	P < 0.0001
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*Flute music available at <https://youtu.be/6ixhN9umyp4>

Table 4: Edinburgh post partum depression scale interpretation in the lactating mothers in immediate postpartum (N=60). n1(30) is the control group who did not hear flute music* for 3 days and n2(30) is the case group who listened to flute music for 3 hours/day for 3 days form postpartum day 1-3 (Odds ratio=8.83, 95%CI=1.01-76.96, Z statistic=1.97, p value =significant).

Edinburgh Post partum Depression SCORE	CONTROL (n1=30)	CASE (n2=30)	Total (N=60)
≤8-11	23	29	52
12-14	7	1	8
Total	30	30	60

*Flute music available at <https://youtu.be/6ixhN9umyp4>