



Research Article

A CROSS- SECTIONAL RESEARCH TO ASSESS THE DETERMINANTS OF AHARA (DIET) AND SANGEET (MUSIC) WHICH AFFECT BEHAVIOUR OF FOETUS-IN UTERO- A RANDOMIZED CROSS- SECTIONAL RESEARCH

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ABSTRACT

Pregnancy is a dynamic phase characterized by complex physiological, psychological, and sensory adaptations in both the mother and the developing foetus. Ayurvedic literature describes gestation as a period during which maternal diet, emotional state, and sensory inputs significantly influence foetal growth. Contemporary scientific research increasingly supports these views by demonstrating foetal responsiveness to gustatory and auditory stimuli during late gestation. The present interventional study was undertaken to evaluate the influence of maternal dietary taste stimuli and musical exposure on foetal behaviour in utero and to explore their association with maternal *Prakriti* (body constitution). **Material & Methods:** A total of 144 healthy pregnant women fulfilling the inclusion criteria were randomized into two groups. Group I received powdered Sugar capsules along with exposure to *Raga Darbari*, while Group II received powdered *Karela* capsules and exposure to *Shiva Tandava*. Foetal facial expressions following dietary intervention were assessed using 4-D ultrasonography, whereas the effects of musical exposure were evaluated through maternal vital parameters and foetal cardiotocographic changes. Final analysis was performed on 120 participants after accounting for dropouts. **Results:** Distinct foetal facial expressions were observed in response to taste stimuli, with sweet taste predominantly eliciting smiling expressions and bitter taste associated with crying expressions. *Raga Darbari* induced parasympathetic dominance, whereas *Shiva Tandava* produced sympathetic arousal. An association between maternal *Prakriti* and foetal cardiotocographic patterns was also noted. **Conclusion:** Maternal diet and music significantly influence foetal behaviour in utero, supporting traditional Ayurvedic concepts through objective modern assessment tools and underscoring their potential integration into holistic antenatal care.

INTRODUCTION

During pregnancy, maternal nutrition, lifestyle, emotional well-being, and stress management influence foetal health. In Ayurveda, our *Acharyas* have described the *Masanumasika Garbhini Paricharya*. Antenatal care forms an important part of pregnancy care.

It plays a vital role in ensuring the health and well-being of both the mother and the developing foetus. Other than monitoring the progress of pregnancy and foetal development normally, it also helps in detecting and preventing potential complications early and also prepares the mother for childbirth and parenthood. The journey of pregnancy is not only about the physical growth of the foetus but also the gradual development of its senses- sight, sound, taste, touch and smell. These sensory abilities begin forming early in the womb and are significantly influenced by the mother's physical health, activities, and emotional state. The womb is not a silent, isolated world, it a dynamic environment where the foetus

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learns and responds. During the latter half of pregnancy, specifically the third trimester, the foetus has fully developed the ability to differentiate voices and taste preferences. Classical Ayurvedic texts emphasize that maternal diet and psychological state significantly influence foetal development and describe the foetus as capable of perceiving sounds heard by the mother.^[1,2] The concept of *Garbha Samvada* is deeply rooted in ancient literature, with references in texts such as the *Mahabharata* and *Garbhopanishad*. Contemporary scientific research supports these observations, demonstrating functional maturation of foetal taste receptors around 30 weeks and auditory responsiveness by approximately 27 weeks of gestation, measurable through changes in foetal movements and heart rate patterns.^[3,4] Keeping all these in consideration, it was decided to conduct a study to assess the determinants of *Ahara* (diet) and *Sangeet* (music) which affect the behaviour of foetus in utero with the aim to authenticate the literary references in Ayurvedic texts and classics supporting the theory that the foetus in-utero can actually perceive the tastes and the sounds perceived by the mother during her pregnancy and also evaluate the foetal response according to *Prakriti* of pregnant women.

METHODS

1. Consent of subjects (pregnant women) was taken after making them aware by detailed explanation of purpose and motive of the study.
2. Prior to the initiation of trial, ethical clearance was obtained from the Institutional Ethical Committee (IEC).
3. The research work was registered under CTRI.
4. Dietary capsules were tested & report of analysis were received.
5. Standard antenatal investigations were advised to her before study to check the health status.
6. Registration of the subjects fulfilling the inclusion criteria.
7. *Prakriti* analysis of the mother according to CCRAS.
8. Data so available and deducted clinically was statistically analysed.

Study Design: Randomized cross-sectional study

Criteria for Selection of Subjects: The healthy pregnant women were randomly selected from the OPD/IPD with first registration in May 2024 and last registration in August 2025 by considering the following exclusion and inclusion criteria.

Inclusion Criteria

1. Pregnant women who gave consent for the study irrespective of parity.

2. Subjects (pregnant women) in the age group of 20 to 35 years.
3. Subject in her 3rd trimester of pregnancy (32 to 38 weeks).
4. Subject having an uneventful antenatal period.

Exclusion Criteria

1. Subject with onset of labour pains.
2. Subject with bad obstetric history or having any associated medical/surgical ailment.

Withdrawal Criteria- If the subject felt uneasy during the course of observation or assessment.

Duration of Observation- 1.5 to 2 hours during a routine ANC visit in a single sitting and no further follow-ups.

Grouping of Subjects: A total of 144 subjects were initially enrolled in the study. The inclusion of an adequately sized sample ensured improved statistical power, reduced random error, and enhanced precision and reliability of the study results. Subject allocation was done using a simple randomization method to ensure unbiased group distribution. After obtaining informed consent, the data of all eligible participants were entered into the online randomization platform, Research Randomizer (www.randomizer.org), a widely accepted tool for clinical research. This web-based service generated a random sequence, which automatically assigned the 144 pregnant women into two groups- Group I and Group II- without any researcher influence. However, 24 subjects were dropped out due to inability to obtain outcome results during the intervention period. After accounting for these dropouts, final statistical analysis was performed on 120 subjects.

Study Group I

1. Dietary Intervention- Capsule powdered sugar (pink coloured) 500mg 2 Stat (combined dose-1gm) with water.
2. Musical intervention- *Raga Darbari*

Study Group II

1. Dietary Intervention- Capsule powdered *Karela* (green coloured) 500mg 2 Stat (combined dose-1gm) with water.
2. Musical intervention- *Shiva Tandava (Aarambh Hai Prachand)*

Intervention Study- The dietary intervention involved the administration of color-coded capsules containing specific formulations prepared for the study. A double-blind methodology was adopted in the present study for the dietary intervention to prevent bias. Both the study participants and the investigators responsible for outcome evaluation were blinded to group allocation. This approach minimized performance and detection bias, ensured uniform

administration of dietary capsules, and allowed for objective assessment of outcomes, thereby strengthening the validity and reproducibility of the study results. To maintain blinding, the capsules were uniform in size and appearance. They were prepared under hygienic conditions using standardized, food-grade ingredients to ensure safety and consistency. The musical intervention was conducted concurrently under controlled conditions. Participants were exposed, via headphones, to one of two contrasting audio stimuli in a quiet environment: *Raga Darbari*, a slow and calming classical *Raga* intended to induce relaxation, and *Shiva Tandava (Aarambh Hai Prachand)*, a fast-paced, intense composition designed to evoke heightened alertness.^[5,6,7,8]

The selection of dietary ingredients was based on the concept of foetal taste perception. In Ayurveda, the *Rasa* of maternal diet is believed to influence the foetus through *Rasa Dhatu*. *Karela (Momordica charantia L.)*, characterized by *Tikta* (bitter) *Rasa*, was chosen to elicit a potentially aversive response, while *Sharkara* (sugar), with *Madhura* (sweet) *Rasa*, represented a pleasant stimulus.^[9,10] These were prepared as powders and encapsulated at the institutional pharmacy under departmental supervision. Foetal facial expressions were observed using 4D ultrasonography to correlate traditional concepts with modern behavioural assessment.

For assessment, baseline maternal examinations, consent, and *Prakriti* evaluation of the subjects was performed in accordance with the standard protocol prescribed by the Central Council for Research in Ayurvedic Sciences (CCRAS) prior to the intervention. Foetal facial expressions were recorded before and 45 minutes after oral capsule consumption. In the musical intervention, subjects underwent a one-hour observation period, including 15 minutes pre- and post-music free phases. Foetal cardiotocographic parameters and maternal vital signs were monitored throughout, documented systematically, and analysed after standardization to ensure uniform comparison across observation periods.

Objective Criteria of Assessment

After dietary intervention

4D USG Scan- There were two kinds of in- utero foetal facial expression that were observed.

- A smiling/happy face which includes facial movements like 'lip pulling'.
- A crying/sad face which includes facial movements like 'lower lip depressor'.

Before, with and After the Musical Intervention

Maternal Parameters

- Blood pressure
- Pulse rate
- Respiration rate

Foetal Parameters- (On CTG Machine)

- Baseline foetal heart rate
- Baseline variability
- Accelerations
- Decelerations (if any)
- Active foetal movements during P/A examination
- Uterine muscular activity (Braxton- Hicks contractions)

Statistical Analysis of Data

The data obtained in clinical study before and after the interventions was expressed in terms of Mean, Standard Deviation (SD) and Standard Error (SE).

The obtained results were interpreted as:

Insignificant result- $p > 0.05$

Significant- $p < 0.05$

Highly significant- $p < 0.001$

RESULTS

In this clinical observational study, a total 144 subjects were enrolled, and the final analysis was conducted with sample size of 120 subjects. These subjects were randomly allocated into two groups. Of these 120 subjects, 84 were subjected to dietary intervention but 24 of these were dropped out of the study due to unfavourable circumstances like inability of visualize foetal face due to unfavourable position, delayed recording, etc. and remaining 60 were subjected to musical intervention. Paired t-test was applied to observe the statistical significance of observations before, with and after musical intervention.

Demographic data revealed that maximum participants i.e., 31 (51.67%) for dietary intervention were in the age group 20-25 years. In musical intervention group also, exactly same pattern was seen. It was observed in registered subjects under dietary intervention that out of the 60 subjects, the highest number of individuals, 17 subjects (28.33%), exhibited a *Kapha-Vata Prakriti* and in musical intervention, it was observed that out of the 60 subjects who were part of this observational study, the highest number of individuals, 16 subjects (26.67%), exhibited a *Kapha-Pitta Prakriti*; for the dietary intervention, majority of subjects i.e., 21 (35%) exhibited gestational age at time of registration between 32-33 weeks whereas for the musical intervention, the majority of subjects i.e., 19 (31.67%)

exhibited gestational age at time of registration between 32-33 weeks.

Foetal facial expression changes observed on 4D ultrasound after dietary intervention are depicted in Table 1.

Table 1: Foetal facial expression changes observed on 4D ultrasound after the dietary intervention

Criteria	Group I (Powdered Sugar Capsule) (N=30)	%	Group II (Powdered <i>Karela</i> Capsule) (N= 30)	%	Total (N= 60)	%
No changes in foetal expressions	5	16.67%	4	13.33%	9	15%
Smiling face/ lip movements like "lip pulling"	25	83.33%	0	0%	25	41.67%
Crying face/ lip movements like "lower lip depressor"	0	0%	26	86.67%	26	43.33%

(Values expressed as number and percentage. 4D= four- dimensional ultrasonography)

For dietary intervention, color-coded capsules were used in a double-blind study design and observations regarding changes in foetal facial expressions were noted. Out of total 60 subjects, the maximum fetuses i.e., 43.33% showed crying face/facial movements like "lower lip depressor", 41.67% showed smiling face/facial movements like "lip pulling" and remaining 15% which showed neutral reaction even after the dietary intervention. Following completion of data collection, the color codes were revealed by the guide for the purpose of analysis, allowing for accurate interpretation of the outcomes based on the specific dietary components each group had received.

After revealing the color-codes, it was observed that in this study after the dietary intervention in Group I (capsule sugar/ pink coloured), out of 30 subjects, in 25 subjects (83.33%), smiling face depicted by lip movements like "lip pulling" was observed as depicted in Image 1 whereas in Group II (Capsule *Karela*/ Green coloured) out of 30 subjects, in 26 subjects (86.67%), foetal facial expressions changed to crying face depicted by lip movements like "lower lip depressor" as depicted in Image 2.

Image 1



Image 1: Smiling expressions of the foetus at gestational age of 32 weeks 6 days depicted by upward lip pull movements 45 minutes after intake of pink coloured dietary capsule containing powdered sugar.

Image 2



Image 2 showing the sad expressions of the foetus at gestational age of 33 weeks 3 days depicted by lower lip depressor movements 45 minutes after intake of green coloured dietary capsule containing powdered *Karela*.

Effect of music therapy on objective criteria in both the study groups are depicted in Table 2-3 and Image 3-6.

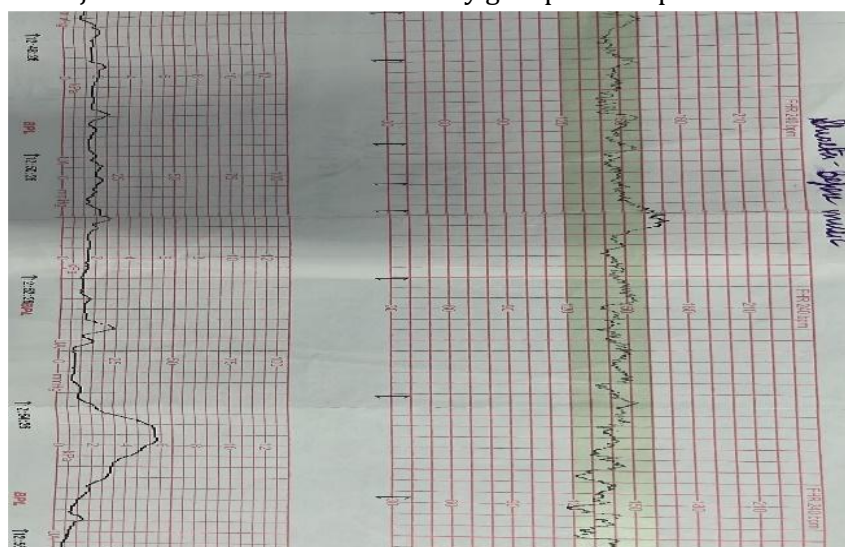


Image 3 showing CTG paper depicting foetal parameters at gestational age of 35 weeks 2 days such as Baseline Foetal Heart Rate, Baseline Variability, Foetal Heart Rate Accelerations, Foetal Heart Rate Decelerations (if any), Active Foetal Movements and Uterine Muscular Activity before musical intervention- *Raga Darbari*.

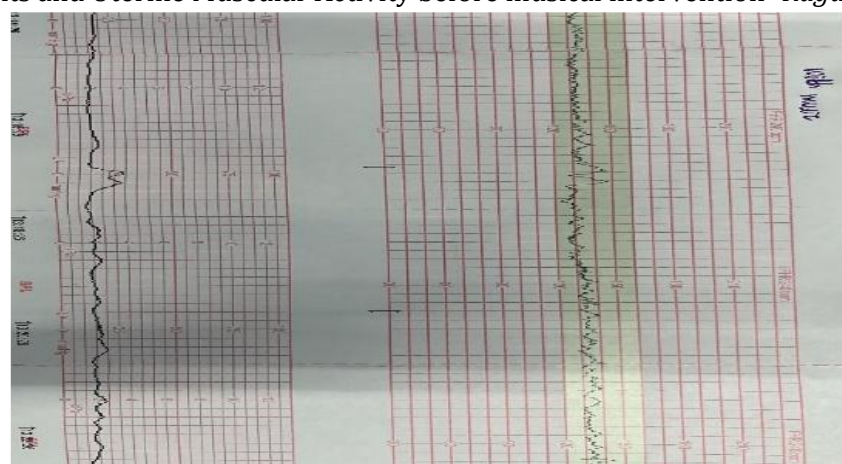


Image 4 showing CTG paper depicting foetal parameters of the same foetus as in Image 3 with musical intervention- *Raga Darbari*.

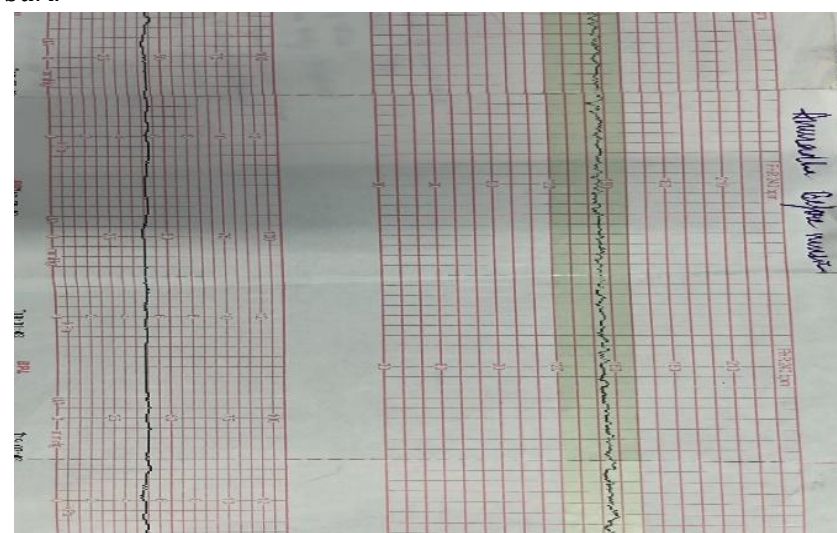


Image 5 showing CTG paper depicting foetal parameters at gestational age of 34 weeks 0 days such as Baseline Foetal Heart Rate, Baseline Variability, Foetal Heart Rate Accelerations, Foetal Heart Rate Decelerations (if any), Active Foetal Movements and Uterine Muscular Activity before musical intervention- *Shiva Tandava*.

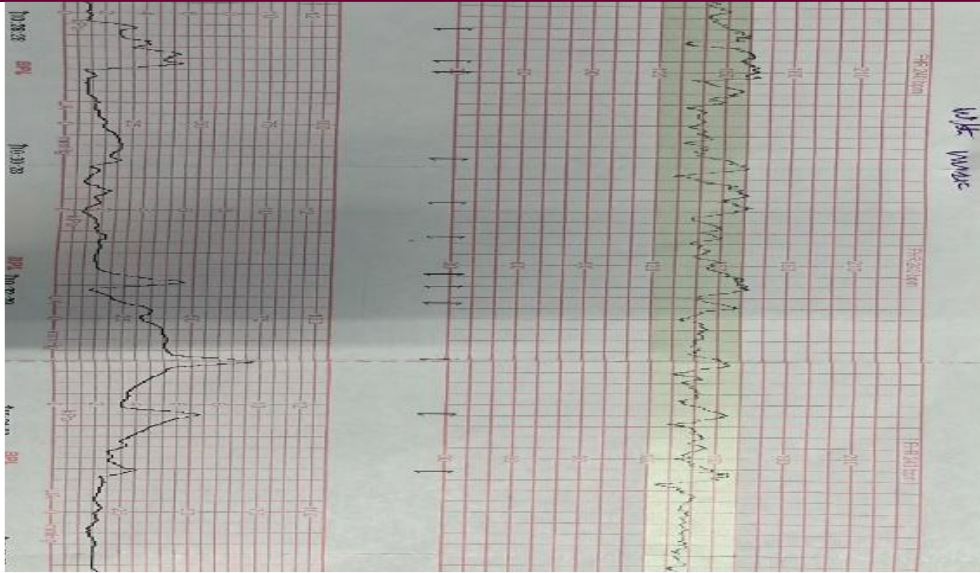


Image 6 showing CTG paper depicting foetal parameters of the same foetus as in Image 4 with musical intervention- *Shiva Tandava*

Table 2: Effect of Music Therapy on Objective Criteria in Study Group I- *Raga Darbari* (before and with musical intervention)

Criteria	Mean Score		Mean diff.	%	±S.D.	±S.E.	't'	p value	Results
	Before	With							
Maternal BP (Systolic)	110.933	110.933	0.000	0%	6.281	1.147	0.000	1.000	N.S.
Maternal BP (Diastolic)	71.267	70.800	0.467	0.65%	6.595	1.204	0.388	0.701	N.S.
Maternal PR	85.333	82.133	3.200	3.75%	7.039	1.285	2.490	0.019	S.
Maternal RR	18.933	18.433	0.500	2.64%	1.776	0.324	1.542	0.134	N.S.
Baseline FHR	138.333	133.333	5.000	3.61%	7.311	1.335	3.746	<0.001	H.S.
Accelerations	4.167	2.533	1.634	39.21%	2.484	0.454	3.601	0.001	S.
Decelerations	2.233	0.9	1.333	59.69%	1.561	0.285	4.678	<0.001	H.S.
Active foetal movements	4.767	5.067	0.3	6.29%	5.331	0.973	0.308	0.760	N.S.
Braxton Hicks Contractions	2.733	1.367	1.367	50.01%	2.141	0.391	3.496	0.002	S.

(Values expressed as mean ± SD and mean ± SE. Paired t-test was used for comparison. A p-value < 0.05 was considered statistically significant and exact p- values are reported. SD = standard deviation. SE = standard error.)

Table 3: Effect of Music Therapy on Objective Criteria in Study Group II- *Shiva Tandava (Aarambh Hai Prachand)* (before and with musical intervention)

Criteria	Mean Score		Mean diff.	%	±S.D.	±S.E.	't'	p value	Result
	Before	With							
Maternal BP (Systolic)	109.00	113.83	4.833	4.43%	6.069	1.108	4.362	<0.001	H.S.
Maternal BP (Diastolic)	71.333	73.667	2.333	3.27%	4.957	0.905	2.578	0.015	S.

Maternal PR	84.533	84.667	0.133	0.16%	7.895	1.441	0.092	0.927	N.S.
Maternal RR	18.833	20.367	1.533	8.14%	1.814	0.331	4.629	<0.001	H.S.
Baseline FHR	133.67	137.33	3.667	2.74%	8.087	1.477	2.483	0.019	S.
Acceleration	3.3	6.2	2.9	87.87%	3.689	0.674	4.306	<0.001	H.S.
Deceleration	0.667	2.567	1.9	74.01%	2.023	0.369	5.144	<0.001	H.S.
Active foetal movements	3.567	10.167	6.6	64.91%	11.17	2.039	3.237	0.003	S.
Braxton Hicks Contractions	1.333	3.067	1.733	56.50 %	1.76	0.321	5.393	<0.001	H.S.

(Values expressed as mean $\pm$ SD and mean $\pm$ SE. Paired t-test was used for comparison. A p-value < 0.05 was considered statistically significant and exact p- values are reported. SD = standard deviation. SE = standard error.)

Maternal Blood Pressure (Systolic and Diastolic)

For musical intervention, in Group I (*Raga Darbari*), systolic blood pressure showed non-significant changes with the musical intervention though percentage wise it was found to be elevated in 46.67% subjects and reduced in 40% subjects and diastolic blood pressure showed slight reductions which was statistically non- significant during music with percentage wise rise in 40% participants and fall in 36.67%. Group II (*Shiva Tandava- Aarambh Hai Prachand*) exhibited highly significant increase in systolic blood pressure and significant rise in diastolic blood pressure during high-tempo music with rise in 80% and 60% subjects respectively.

Maternal Pulse Rate- Group I (*Raga Darbari*) demonstrated a statistically significant reduction in maternal pulse rate during soft music which was observed in 60% subjects Group II (*Shiva Tandava- Aarambh Hai Prachand*) had a statistically non-significant rise in pulse rate during high-tempo music with percentage wise rise in 56.67% subjects.

Maternal Respiratory Rate- A statistically non-significant fall in maternal respiratory rate was observed in Group I (*Raga Darbari*) during soft music in even though it was reduced in 50% participants. A statistically highly significant rise was observed in Group II (*Shiva Tandava- Aarambh Hai Prachand*) during high-tempo music which was observed in 70% subjects.

Foetal Baseline Heart Rate- Group I (*Raga Darbari*) showed a statistically highly significant decrease in baseline FHR during soft music in 50% subjects. Group II exhibited a statistically significant rise in baseline FHR during high-tempo music as observed in 36.67% subjects.

Foetal Baseline Heart Rate Variability-In Group I (*Raga Darbari*), with the intervention, in 56.67% fetuses, no change was observed in Baseline FHR Variability. In Group II (*Shiva Tandava- Aarambh Hai*

Prachand) with the intervention, same observations were made.

Foetal Heart Rate Accelerations- Group I (*Raga Darbari*) statistically significant reductions in FHR accelerations were observed during the intervention, indicating a calming effect in 66.67% fetuses. Conversely, Group II (*Shiva Tandava- Aarambh Hai Prachand*) showed statistically highly significant increase in FHR accelerations observed with the musical intervention in 76.67% subjects.

Foetal Heart Rate Decelerations- In Group I (*Raga Darbari*), a statistically highly significant decline was observed in FHR decelerations with the musical intervention in 70% subjects. In Group II (*Shiva Tandava- Aarambh Hai Prachand*), with the musical intervention, a statistically highly significant increase in FHR decelerations was observed in 73.33% subjects.

Active Foetal Movements- In Group I (*Raga Darbari*), an increase in active foetal movements was observed which was statistically non-significant with the intervention as observed in 43.33% subjects likely due to foetal arousal. Group II (*Shiva Tandava- Aarambh Hai Prachand*) showed markedly increased foetal movements with the musical intervention which were statistically significant in 83.33% subjects.

Uterine Muscular Activity- In Group I (*Raga Darbari*), with the musical intervention, a statistically significant reduction was observed in uterine muscular activity in 60% subjects. In Group II (*Shiva Tandava- Aarambh Hai Prachand*), with the musical intervention, it was observed that there was a statistically highly significant rise in uterine muscular activity which was observed in 66.67% subjects.

Maternal Prakriti and CTG Observations- In Study Group I (*Raga Darbari*), the maximum number of mothers, i.e., 50%, had *Kapha* predominant *Prakriti* and with the intervention of *Raga Darbari*, 56.67% of fetuses also exhibited *Kaphaja* characteristics on CTG.

This concordance can be explained through the very nature of *Kapha*, which is described in the classics as *Manda* and *Sthira*- mild and stable. *Raga Darbari* is traditionally considered a deep, and calming *Raga*, usually employed for its tranquilising effect. On CTG this translates into features aligned with *Kapha*- more stable baseline, mild to moderate variability, and fewer abrupt shifts in accelerations and decelerations. In Study Group II (*Shiva Tandava- Aarambh Hai Prachand*), the maximum number of subjects (43.33%) were observed to have *Vata* predominant *Prakriti*. Interestingly, when musical intervention in the form of *Shiva Tandava* was introduced, nearly 60% of the fetuses exhibited *Vataja* characteristics on CTG, which was higher than the maternal proportion. This can be reasoned by considering the intrinsic properties of *Vata*. *Vata* is defined as *Laghu*, *Chala* etc., meaning it is light, rough and most importantly, mobile or dynamic in nature. The *Shiva Tandava*, being a forceful and rhythmically powerful composition with fast beats and strong tempo, naturally resonates with the *Chala* (mobility) quality of *Vata*. Thus, the foetal response on CTG reflected heightened variability and rapid accelerations, decelerations, foetal movements, hallmarks of *Vataja* dominance.

Overall Results

In Group I who were exposed to *Raga Darbari*, 46.67% of subjects showed reductions in maternal parameters, while 53.33% demonstrated decreased foetal parameters. In contrast, Group II subjects exposed to *Shiva Tandava* showed increases in maternal (66.67%) and foetal (62.70%) parameters following musical intervention.

DISCUSSION

Maternal and foetal physiological parameters reflect intrauterine well-being. Dietary and music-based interventions modulate maternal autonomic balance and foetal neurobehavior, aiding assessment and refinement of antenatal care strategies to improve pregnancy outcomes.

Key Results

In the present study, dietary intervention during pregnancy was associated with observable foetal responses, supporting both classical and contemporary perspectives. From the Ayurvedic standpoint, as described by *Acharya Vriddha Vagbhatta*, the foetus is influenced by the maternal emotional state and dietary intake, being nourished through *Matrja Rasa Dhatu* via *Upasneha* and *Upasveda* mechanisms.^[11,12] Correspondingly, modern evidence indicates that maternal diet alters the flavour profile of the amniotic environment, thereby transmitting sensory stimuli to the foetus.^[13,14] Distinct foetal facial movements were noted, with lip-pulling reflecting

activation of muscles associated with positive affect (*zygomaticus major*), while lower-lip depression involved muscles linked to distress expressions (*depressor labii inferioris*), suggesting differential foetal reactions in response to dietary-derived sensory cues.

With respect to musical intervention, distinct maternal and foetal physiological responses were observed between the two groups. In Group I exposed to *Raga Darbari*, maternal blood pressure remained largely unchanged, while a statistically significant reduction in pulse rate and a non-significant decrease in respiratory rate were recorded, reflecting parasympathetic predominance and vagal relaxation.^[15] Foetal parameters in this group demonstrated a reduction in baseline heart rate, variability, accelerations, decelerations, and uterine activity, indicating a calming foetal response.^[16] Although an initial increase in active foetal movements was noted during the intervention, this response was transient and subsided following cessation of the musical stimulus. In contrast, Group II exposed to high-tempo music (*Shiva Tandava- Aarambh Hai Prachand*) showed a highly significant rise in systolic blood pressure and a significant increase in diastolic blood pressure, accompanied by a non-significant elevation in maternal pulse rate and a highly significant increase in respiratory rate, consistent with sympathetic activation.^[15] Correspondingly, all foetal parameters were markedly elevated in this group, suggesting heightened foetal stimulation secondary to sympathetic predominance.^[16] The findings further indicated that maternal *Prakriti* imparted an inherent constitutional predisposition; however, the nature of the musical intervention significantly modulated the expression of these tendencies in the foetus. Exposure to *Raga Darbari*, characterized by *Kapha*-promoting qualities, was associated with an enhancement of *Kapha* responses, suppression of *Vata* expression despite its constitutional predominance among mothers, and a relatively greater manifestation of *Pitta* responses, suggesting transient heightened reactivity. Conversely, exposure to *Shiva Tandava*, with its fast-paced and intense attributes, predominantly aggravated the mobile qualities of *Vata*, elicited mild stimulation of *Pitta*, and markedly reduced *Kapha* expression, demonstrating that musical tempo and intensity can differentially influence foetal responses beyond baseline constitutional tendencies.

Study Limitations

The present study had certain limitations. The relatively small sample size may have introduced imprecision in estimating the magnitude of maternal and foetal responses to musical intervention, thereby limiting generalizability. Lack of participant blinding to

the type of music may have resulted in performance bias, potentially leading to an overestimation of relaxation effects in the *Raga Darbari* group; however, as objective physiological parameters such as blood pressure, pulse rate, respiratory rate, and foetal heart rate were used, observer and measurement bias is likely to be minimal. The relatively short pre- and post-intervention observation period may have underestimated the duration and sustainability of the observed effects, despite responses persisting for up to 15 minutes in several cases. Assessment was limited to maternal *Prakriti*, and omission of paternal *Prakriti* may have restricted evaluation of comprehensive parental constitutional influences on foetal responsiveness. Additionally, the cross-sectional design precludes assessment of long-term outcomes. Longitudinal studies with larger sample sizes, extended observation periods, postnatal follow-up, and evaluation of prenatal sensory exposures- including music and maternal dietary flavour preferences- are warranted to better elucidate sustained neurodevelopmental, behavioural, and sensory effects.

Overall Interpretation

Overall, the findings suggest that both maternal dietary and musical interventions may influence maternal-foetal physiological and behavioural responses, in accordance with the study objectives. Dietary exposure appeared to modulate foetal sensory responsiveness, supporting existing evidence that maternal diet alters the intrauterine sensory environment, while musical intervention demonstrated differential autonomic and foetal responses depending on tempo and quality. However, these observations should be interpreted cautiously in view of the limited sample size, short observation period, lack of participant blinding, and the multiplicity of maternal and foetal parameters analysed, which may increase the likelihood of chance findings. Although the results are biologically plausible and broadly consistent with previous studies, the cross-sectional design precludes causal inference and long-term conclusions. Consequently, the findings should be regarded as preliminary, highlighting potential trends that warrant validation through larger, controlled, and longitudinal studies.

CONCLUSION

Judicious maternal dietary selection supports optimal foetal growth and may influence postnatal taste preferences, while calming music such as *Raga Darbari* promotes maternal- foetal relaxation. Prenatal auditory exposure may also contribute to foetal imprinting, neurodevelopment, and epigenetic regulation. These findings align with *Garbha Sanskara*,

supporting the integration of evidence-based diet and music therapy into holistic antenatal care.

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