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Original Article

Nursing Section

Knowledge of Mothers on Multisensory Intervention for Preterm Babies: A Hospital-based Cross-sectional Study from Mangaluru, India

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ABSTRACT

Introduction: Multisensory intervention for preterm babies is developmentally appropriate and has the capacity to integrate information from different senses-Auditory, Tactile, Visual, and Vestibular (ATVV). Involving mothers in the intervention may help mimic the preterm babies' intrauterine environment. Mothers need to be systematically and effectively guided through the ATVV intervention. Before implementing the practice, it is important to ensure that mothers are sensitised with the necessary knowledge about multisensory intervention. Hence, assessing mothers' knowledge of multisensory intervention is a significant step preceding any intervention.

Aim: To assess the knowledge of multisensory intervention among mothers of preterm babies with the intention of preparing an educational package on multisensory intervention.

Materials and Methods: A cross-sectional study was conducted among mothers of preterm babies admitted to the Neonatal Intensive Care Unit (NICU) of a selected hospital in Mangaluru, Karnataka, India. A total of 97 mothers were selected using a simple random sampling technique. Data on mothers' knowledge were gathered using a proforma on baseline characteristics and a structured knowledge questionnaire on multisensory intervention for preterm babies. The data were analysed using descriptive and inferential statistics.

Results: The overall knowledge scores of mothers on multisensory intervention showed a mean±SD of 7.42±2.06 with a mean percentage of 24.74%. Most mothers, 91 (93.8%), had inadequate knowledge, and 6 (6.2%) had moderate knowledge. The area-wise knowledge score of mothers revealed that in the concept of multisensory intervention, the mean±SD was 1.93±0.89 with a mean percentage of 38.56%. In the components of multisensory intervention, the mean±SD was 2.20±1.18 with a mean percentage of 24.40%. In understanding preterm babies' behaviour, the mean±SD was 2.67±1.15 with a mean percentage of 29.67%. In aspects of practice in multisensory intervention, the mean±SD was 0.63±0.69 with a mean percentage of 8.98%. This indicates that most mothers had inadequate knowledge in the areas of multisensory intervention. A significant association between knowledge scores and the sex of the preterm babies was found (p-value=0.03).

Conclusion: Most mothers had inadequate knowledge on multisensory intervention. Consequently, an educational package was developed, which included a video on multisensory intervention for preterm neonates and a handout to help mothers acquire knowledge and guide their practice.

Keywords: Auditory tactile visual and vestibular intervention, Behavioural cues, Bonding, Neonatal intensive care unit, Sensory stimulation

INTRODUCTION

Preterm babies are defined as those born alive before completing 37 weeks of intrauterine life [1]. They have immature body systems, making survival without the support of the NICU difficult [2]. Life in the NICU is challenging, as these fragile neonates confront a highly mechanical environment with intense medical and nursing care [3,4]. Preterm babies must adapt to an extrauterine environment filled with negative sensory stimuli (pain, loud noise, excessive light), stress, and the deprivation of a safe prenatal environment [3,5,6]. Early sensory interventions aid brain development in premature babies by controlling negative stimuli and providing positive sensory experiences [3]. Early intervention programs in NICUs involve providing unisensory or multisensory stimulation to prevent and detect complications in preterm babies [7]. Multisensory intervention is developmentally appropriate for preterms, with the capacity to combine information from different senses-auditory, tactile, visual, vestibular, kinaesthetic, gustatory, and/or olfactory. It promotes stability and nurtures competencies in preterm babies by improving stimulus representations and behaviour. It signifies the need to modify the physical environment to reduce stress and prevent developmental delays and complications [8,9]. The uncertainty of survival and the consequences of preterm birth on a child's development can traumatise mothers of preterm babies [3]. Maternal distress can continue even after discharge, affecting mother-infant bonding and infant development [5]. When mothers are involved in providing multisensory intervention, it mimics the intrauterine environment. This creates an ideal extrauterine environment for the preterm baby to survive and develop [10]. The ATVV provides the preterm baby with 10 minutes of auditory (mother's voice), tactile (moderate stroking or massage), and visual (eye contact) stimulation, followed by 5 minutes of vestibular stimulation (horizontal rocking). The ATVV is effective if administered twice a day before feeding to preterms in the NICU. After discharge, the ATVV can be administered twice a day after feeding [11]. The multisensory intervention ATVV has benefits for both the preterm baby and the mother, as proven by multiple studies. In the preterm baby, it facilitates behavioural organisation [12-14], neuromotor development [15,16], feeding progression [17-20], decreases the length of hospital stay, accelerates growth [17,21], and optimises development [7,20]. Advantages for the mother include better

mother-preterm bonding [22], reduced maternal stress and anxiety, and boosted maternal confidence [23,24].

Upon conducting an extensive review of the literature, the researcher observed that among the early developmental interventions for preterms, such as kangaroo mother care [25], unisensory [26,27], and multisensory stimulation [7], the multisensory intervention (ATVV) had many positive effects on the mother-preterm dyad [7,10,12-24]. Moreover, the results of previous studies on multisensory intervention highlight on the practice [11-17,21,22]. The knowledge of mothers was investigated among mothers of term infants in a study by Krisnana I et al., which aimed to study the influence of health education participant modeling on mothers' knowledge and skills about multisensory stimulation in term infants [28]. The postnatal circumstances and length of hospital stay differ for preterm-mother dyads compared to term-mother dyads. Mothers of preterm babies need to be prepared to face this challenge. Assessing the knowledge of mothers would guide the practice of multisensory intervention. Thus, the researcher recognised the need to assess the knowledge of multisensory intervention among mothers of preterms and to develop an educational package.

MATERIALS AND METHODS

A cross-sectional study was conducted with 97 mothers of preterm babies admitted to the postnatal ward of Yenepoya Medical College and Hospital in Deralakatte, Mangaluru, Karnataka, India from July 8, 2021, to November 12, 2022. Permission for the study was obtained from the hospital authorities, and ethical clearance was secured from the Institutional Ethical Committee (IEC) (Protocol no. YEC-1/2021/027).

Mothers of preterm babies in the postnatal ward of Yenepoya Medical College and Hospital were screened according to the inclusion and exclusion criteria. Those who met the criteria were randomly selected using the lottery method until the desired sample size was reached. Informed consent was obtained from each participant after they were given detailed explanations about the study and its necessity.

Inclusion criteria: Mothers of preterm babies who were willing to participate in the study and could read and write in Kannada or English were included in the study.

Exclusion criteria: Mothers of preterm babies with serious medical or surgical conditions were excluded from the study.

Sample size estimation: The sample size for the study was calculated using the following formula:

$$n=\frac{Z_{\alpha}^{2}\, p(1-p)}{e^{2}}$$

where, Z_{α}=1.96 at 95% confidence interval, p=5% based on the results of the pilot study, and e=available error at 5%. The calculated sample size was 73 samples. The sample size was increased to 100 for better generalisation of findings. The final sample size consisted of 97 mothers of preterm babies as three questionnaires were incomplete.

The baseline characteristics of the preterm babies were recorded by the researcher using information provided by the mothers and by referring to the babies' case files. All mothers were administered a socio-demographic proforma and a knowledge questionnaire on multisensory intervention for preterm babies.

A structured knowledge questionnaire on multisensory intervention for preterm babies was developed by the investigator, comprising 35 items [13,22]. The baseline proforma and questionnaire were given to seven experts in the subject area to assess the tool's validity. There were no changes in the baseline proforma. However, modifications were made to the questionnaire based on the experts' suggestions, resulting in a final version with 30 questions across four areas the concept of multisensory intervention (5 items), components of multisensory intervention (9 items), preterm behaviour (9 items), and aspects of practice in multisensory intervention (7 items). Each correct response was scored as '1' and wrong response as '0'; there was no penalty for incorrect responses. For this study, knowledge scores was arbitrarily graded as inadequate knowledge (1-10), moderately adequate knowledge (11-20), and good knowledge (21-30). Seven experts validated the tool along with the grading system.

The reliability of the tool was assessed by pretesting the questionnaire on 20 mothers of preterm babies. The average time taken by the subjects to complete the questionnaire was between 25 and 30 minutes. Reliability and internal consistency were determined using the split half method, yielding a reliability coefficient obtained was 0.75, indicating that the tool is reliable.

A pilot study conducted on 20 mothers helped in estimating the sample size by providing data on the likely responses to the questionnaire's items. The pilot study's results indicated that among 20 mothers, 19 (95%) had inadequate knowledge, and only 1 (5%) had moderately adequate knowledge of multisensory intervention for preterm neonates.

STATISTICAL ANALYSIS

The statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 23.0. The results were expressed in terms of frequency, percentage, mean, standard deviation, median, and mean percentage. The association of mothers' practices with selected demographic variables was assessed using the chi-square test. A p-value <0.05 was considered statistically significant.

RESULTS

[Table/Fig-1] shows a predominance of males, with 55 (56.7%) among the preterm babies. The majority, 73 (75.3%), were moderate to late preterms with a Gestational Age (GA) at birth of 32-37 weeks, and most preterm babies, 68 (70.1%), had an Apgar score of 9 at 5 minutes after birth.

Preterm characteristics		n (%)
Sex	Male	55 (56.7)
	Female	42 (43.3)
Gestational age at birth (weeks)	28-32	24 (24.7)
	32-37	73 (75.3)
Apgar at 5 min	7-8	29 (29.9)
	9	68 (70.1)
New Ballard score	10-15	9 (9.3)
	20	25 (25.8)
	25	33 (34)
	30	30 (30.9)
Birth weight (gm)	1000-1500	24 (24.7)
	1500-2000	41 (42.3)
	2000-2500	32 (33)

[Table/Fig-1]: Distribution according to preterm characteristics (N=97).
The data is presented is frequency (n) with percentage in parenthesis (%)

[Table/Fig-2] shows that most mothers 64 (66%) were aged 21-30 years and an equal number, 64 (66%), were homemakers. The majority, 68 (70.1%), underwent Lower Segment Caesarean Section (LSCS), most, 61 (62.9%), were multiparous, and none of the mothers had been exposed to multisensory intervention.

The overall knowledge scores of mothers on multisensory intervention show poor knowledge with a mean±SD of 7.42±2.06 and a mean percentage of 24.74 [Table/Fig-3].

[Table/Fig-4] indicates that the majority, 91 (93.8%), of the mothers had inadequate knowledge of multisensory intervention for preterm babies.

Maternal characteristics		n (%)
Age (in years)	18-20	16 (16.5)
	21-30	64 (66)
	31-40	17 (17.5)
Education	Non formal	2 (2.1)
	Primary	18 (18.5)
	Secondary	43 (44.3)
	Graduation and above	34 (35.1)
Occupation	Homemaker	64 (66)
	Daily wager	2 (2.1)
	Professional	11 (11.3)
	Non professional	20 (20.6)
Type of family	Nuclear	43 (44.3)
	Joint	54 (55.7)
Monthly family income (in rupees)	Less than 10,000/-	22 (22.7)
	10,000-20,000/-	47 (48.5)
	Above 20,000/-	28 (28.8)
Residence	Rural	50 (51.5)
	Urban	47 (48.5)
No. of children	One	25 (25.8)
	Two	40 (41.2)
	Three	26 (26.8)
	Three and above	6 (6.2)
Delivery	Normal vaginal	29 (29.9)
	Lower Segment Caesarean Section (LSCS)	68 (70.1)
Parity	Primipara	36 (37.1)
	Multipara	61 (62.9)
Previous exposure to multisensory intervention		0

[Table/Fig-2]: Distribution according to maternal characteristics (N=97).
The data is presented is frequency (n) with percentage in parenthesis (%)

	Min score	Max score	Max possible score	Mean±SD	Median	Mean %
Overall knowledge	2	11	30	7.42±2.06	8	24.74

[Table/Fig-3]: Overall knowledge of mothers on multisensory intervention (N=97).
SD: Standard deviation, Mean percentage=Mean/Number of items X100

Knowledge score	Grade	n (%)
21-30	Adequate	0
11-20	Moderately adequate	6 (6.2)
1-10	Inadequate	91 (93.8)

[Table/Fig-4]: Knowledge level of mothers on multisensory intervention (n=97).
The data is presented is frequency (n) with percentage in parenthesis (%)

The areas of knowledge of mothers on multisensory intervention showed low scores in all four areas, with the lowest in the aspects of practice in multisensory intervention where mean±SD was 0.63±0.69 with mean percentage 8.98%. This reflects inadequate knowledge of multisensory intervention [Table/Fig-5].

Areas	Max score obtained	Max possible score	Mean±SD	Median	Mean %
Concept of multisensory intervention (5)	4	5	1.93±0.89	2	38.56
Components of multisensory intervention (9)	5	9	2.20±1.18	2	24.40
Preterm behaviour (9)	6	9	2.67±1.15	3	29.67
Aspects of practice in multisensory intervention (7)	2	7	0.63±0.69	1	8.98

[Table/Fig-5]: Area-wise knowledge of mothers on multisensory intervention (N=97).
SD: Standard deviation

[Table/Fig-6] item-wise knowledge of mothers on multisensory intervention for preterm baby. Among the five items in the concept of multisensory intervention for preterm baby, few mothers 22 (22.7%) knew when a newborn is called a preterm baby based on the gestational age at birth. In the area concerning components of multisensory intervention, nearly an equal number of mothers 21 (21.6%), were aware of why each multisensory intervention should be introduced step by step and the benefits of ATVV intervention. Among the ATVV intervention, some mothers were aware of auditory, 22 (22.7%), and tactile stimulation, 23 (23.7%), compared to visual and vestibular stimulations, 34 (35.1%), respectively. It was also found that 35 (36.1%) of the mothers knew who the right person to provide multisensory intervention to the preterm baby was. In the area of understanding preterm behaviour, only 8 (8.2%) mothers understood when a preterm baby's alertness is termed 'quiet sleep'. Among the items assessing mothers knowledge on the aspects of practice in multisensory intervention, only 1 (1.4%) mother knew about the preparations to be made before administering the ATVV intervention, the action to be taken if the baby did not like a certain part of the massage, and the action to be taken if the baby looked

S. No.	Items	n (%)
Concept of multisensory intervention for preterm baby		
1.	A preterm is a baby born before	22 (22.7)
2.	A preterm baby is admitted to NICU for	45 (46.4)
3.	The hazardous stimulation a preterm baby is exposed to in the NICU	56 (57.7)
4.	Multisensory intervention is	35 (36.1)
5.	ATVV intervention is	29 (29.9)
Components in multisensory intervention		
6.	Multisensory intervention must be introduced step by step to	21 (21.6)
7.	The right person to provide multisensory intervention to the preterm baby	35 (36.1)
8.	The auditory (ear) stimulation in the ATVV intervention is	22 (22.7)
9.	The tactile (skin) stimulation in the ATVV intervention is	23 (23.7)
10.	The visual (eyes) stimulation in the ATVV intervention is	34 (35.1)
11.	The vestibular (balance) stimulation in the ATVV intervention is	34 (35.1)
12.	The benefits of ATVV intervention to the preterm baby	21 (21.6)
13.	ATVV intervention helps the mother by	22 (22.7)
14.	ATVV intervention helps both the mother and baby by	23 (23.7)
Preterms behaviour		
15.	Before learning ATVV technique mother must understand	30 (30.9)
16.	A preterm baby's alertness is called 'quiet sleep' when	8 (8.2)
17.	A preterm baby's alertness is called 'drowsy' when	39 (40.2)
18.	A preterm baby's alertness is called 'active alert' when	32 (33)
19.	The indication to stop ATVV intervention	38 (39.2)
20.	Preterm babys 'engagement cues' show	15 (15.5)
21.	An 'engagement cue' shown by a preterm baby	27 (27.8)
22.	Preterm babys 'disengagement cues' mean	29 (29.9)
23.	A 'disengagement cue' shown by a preterm baby	41 (42.3)
Aspects of practice in multisensory intervention		
24.	Mother gives the baby ATVV intervention while in the hospital	14 (14.4)
25.	Mother gives the baby ATVV intervention at home	22 (22.7)
26.	Mother needs to prepare for giving ATVV by	1 (1.4)
27.	The sequence to follow while giving the ATVV intervention	13 (13.4)
28.	The sequence of the 'massage' in ATVV intervention	12 (12.4)
29.	Action to be taken if the baby does not like a certain part of the massage	1 (1.4)
30.	Action to be taken if the baby looks upset or is crying during the ATVV intervention	1 (1.4)

[Table/Fig-6]: Item-wise distribution of study samples with correct response.
The data is presented in frequency (n) with percentage in parenthesis (%). NICU: Neonatal intensive care unit; ATVV: Auditory, tactile, visual, vestibular

upset or crying during the ATVV intervention. There were 22 (22.7%) mothers who knew when the ATVV intervention was given at home when compared to only 14 (14.4%) who knew the right time to administer the intervention during hospitalisation.

[Table/Fig-7] shows the association of mothers' knowledge with the baseline characteristics of preterm. A significant association was found with the sex of the preterm baby χ^2=4.35 (p-value=0.03).

[Table/Fig-8] shows association of mothers' knowledge with maternal characteristics. There was no association of mothers' knowledge with any of the maternal characteristics.

Variables		<Median	≥Median	df	Chi-square value	p-value
Sex	Male	21	34	1	4.35	0.03*
	Female	25	17			
Gestational age at birth (weeks)	28-32	11	13	1	0.03	0.86
	32-37	35	38			
Apgar at 5 min	7-8	16	13	1	0.99	0.32
	9	30	38			
New Ballard score	10-15	5	4	3	2.22	0.53
	20	9	16			
	25	18	15			
	30	14	16			
Birth weight (gm)	1000-1500	13	11	2	5.17	0.07
	1500-2000	14	27			
	2000-2500	19	13			

[Table/Fig-7]: Association of mother's knowledge with baseline characteristics of preterm.
*significant

Variables		<Median	≥Median	df	Chi-square value	p-value
Age (in years)	18-20	5	11	2	3.72	0.15
	21-30	30	34			
	31-40	11	6			
Education	Non-formal	1	1	-	-	0.91†
	Primary	8	10			
	Secondary	22	21			
	Graduation and above	15	19			
Occupation	Homemaker	32	32	3	7.01	0.71
	Daily wager	0	7			
	Professional	2	4			
	Non professional	12	8			
Type of family	Nuclear	17	26	1	1.93	0.16
	Joint	29	25			
Monthly family income (in rupees)	<10,000	12	10	2	0.60	0.74
	10,001-20,000	21	26			
	>20,000	13	15			
Residence	Rural	26	24	1	0.87	0.35
	Urban	20	27			
No. of children	On	9	16	-	-	0.46†
	Two	19	21			
	Three	14	12			
	More than three	4	2			
Type of delivery	Normal vaginal	11	18	1	1.49	0.22
	LSCS	35	33			
Parity	Primipara	16	20	1	0.20	0.65
	Multipara	30	31			

[Table/Fig-8]: Association of mothers knowledge with maternal characteristics (N=97).
†Fishers-exact test

DISCUSSION

The study outcome showed that the overall knowledge scores (7.4±2.06) of mothers on multisensory intervention was suboptimal. Further in the level of knowledge it was found that majority, 91 (93.8%), of the mothers had inadequate knowledge. To understand the shortcomings, an area-wise analysis was conducted, in which the most deficient area was knowledge of the aspects of practice in multisensory intervention, with a mean score of 0.63±0.69 and a mean percentage of 8.98. The present research findings were supported by a study conducted by Krisnana I et al., on participant modeling regarding mothers' knowledge and skills about multisensory stimulation in term infants. This study adopted a health education approach to educating mothers, which involved rational explanations, modeling, guided participation, and reinforcement of multisensory (ATVV) interventions. The results showed a significant difference in knowledge scores between the experimental (p-value=0.005) and control (p-value=0.039) groups. There were differences in knowledge (p-value=0.019), technical skills (p-value=0.013), and interpersonal skills (p-value=0.020) between the experimental and control groups [28]. This study emphasises the need to educate mothers on multisensory intervention. Furthermore, mothers' compliance with multisensory intervention is assured when knowledge is assessed before introducing practice.

In the present study the item-wise analysis revealed that most mothers were unaware of the preparation for ATVV, care of the preterm during ATVV, the sequence of administering ATVV, and in understanding the preterm's behaviour. The researcher recommends that mothers' knowledge can be improved by developing and providing sensitisation programmes on multisensory intervention for preterm babies. Staff nurses must be equipped with the knowledge and skills to implement the multisensory programme at regular intervals. The NICU policy should include ATVV intervention along with kangaroo mother care for preterm babies. Health education material can be developed and validated to enhance mothers knowledge and guide practice. In the present study, the knowledge of mothers on multisensory intervention for preterm babies was assessed with the aim of developing an educational package on multisensory intervention. The educational package included a video on multisensory intervention for preterms and a handout to help mothers acquire knowledge and guide practice.

Research studies have proven the effectiveness in practice of multisensory intervention in preterm newborns and infants in the hospital [5,10,13]. Mothers have been trained and guided in administering multisensory intervention to their preterm babies before delivery, during the immediate postnatal period, and throughout the NICU stay of the preterm baby. There are studies that follow-up the multisensory intervention even after discharge from the hospital [11,12,17]. However, research studies have not addressed the assessment of mothers' knowledge on multisensory intervention for preterm babies, and there is no statistical data on the knowledge area.

The present study reveals that none of the mothers were exposed to the intervention. Furthermore, the mothers were found to have inadequate knowledge.

According to the principles of adult learning by Knowles MS et al., adults are relevancy-oriented. Adults need to understand the relevancy in terms of why, what, and how in every learning experience to apply it in real life [29]. It is important to assess whether the adult has retained the information taught to benefit from the learning. Therefore, assessing whether mothers have knowledge of multisensory intervention is crucial, as most of these positive sensory experiences, mentioned as ATVV stimulations, are naturally provided by the mother when in contact with the baby. The mother may not grasp the why, what, and how of administering ATVV if the necessary theoretical concepts are not introduced before practice. Moreover, a structured knowledge questionnaire

may help to understand the mothers' knowledge before and after teaching the multisensory intervention. This assessment may assist in one-to-one teaching that can aid in the transition from known to unknown concepts associated with the intervention.

Limitation(s)

The generalisability of the study findings was limited as the study was delimited to one setting. The knowledge questionnaire that was used was prepared based on literature review and was not a standardised tool.

CONCLUSION(S)

Mothers of preterm babies had inadequate knowledge of multisensory intervention. It was inferred that all the mothers were new to the concept of multisensory intervention. It to assess the knowledge of mothers regarding multisensory intervention before initiating practice is important. Moreover, based on the study findings, an educational package was developed for mothers, which included a video on multisensory intervention for preterm infants and a handout to help the mothers acquire knowledge and guide practice. Use of an educational package to educate mothers on multisensory intervention for preterm babies should be a mandatory requirement in hospitals. Furthermore, experimental studies should be conducted to find the effectiveness of the educational package on the knowledge and practice of mothers with preterm babies.

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