International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 10 Issue 7 ǁ July 2022 ǁ PP. 829-832

Infant Cry Analysis: A Comparative Study between Low Birth Weight Infants and Normal Infants

Dr. Satish Kumaraswamy, Nabeel Musthafa, Shivani Rajeev, Aswani Baby

Date of Submission: 14-07-2022 Date of acceptance: 28-07-2022

I. Introduction

Voice refers to the laryngeal modification of the airstream. Normal voice is characterized by 5 aspects:

1. Loudness: normal voice must be loud enough to be heard over the noise of most environment sounds.
2. Hygiene: voice should be produced in such a manner that does not result in damage to the vocal structure.
3. Pleasantness: normal voice should have a pleasing vocal quality.
4. Flexibility: it refers to the person ability to bring about changes in speech based on the situations, conditions, moods of the person etc.
5. Representation: normal voice helps us to represent the person's age, gender and personality.

(Boone, 1997)

Voice in human's start with birth cry in newborn in response to different stimuli and also birth cry has acoustic properties that are known to be perceptually salient to infants, because an infant's vocal folds are much more shorter and lighter than those of adults or even a toddler, the infant voice pitch range is much higher. Volitional voice production in infants include cry, humming, speech and singing.

Crying is a complex neurophysiologic act. It results from the intense expulsion of air from the lungs under pressure, causing the approximated vocal cords to perform rhythmic oscillations. The alternate condensation and refraction of the stream of air particles lead to the formation of sound waves. The anatomical cavities above and below the cords act as a resonator. The acoustic characteristics of a cry depends upon the intensity of air expulsion: the tension, length, thickness and shape of the vocal cords, length and tension of resonator.

Dudek, Farees, Bornstein and Haley (2016) support the notion that infant cries elicit a negative arousal bias that is distracting: they also identify, for the first time, the neural dynamics underlying the unique influence that infant cries and laughs have on cognitive control.

Chattopadhyoay and Mitra (2015) found that the incidence of neurodevelopment delay among high risk newborns is significantly high with LBW, prematurity and neonatal illness are major contributors.

The cry mechanism in infants resembles the speech production process in adults.

The first stage of the cry production mechanism is initiated in the infant's brain upon external or internal stimuli.

In the second stage of brain command is translated into series of commands through the nervous system to the speech and respiratory limbs which are responsible for the creation of acoustic sounds at the physiological level. This process continues with the ejection of air from the lungs to the vocal tract. The vocal tract starts at the vocal cords and ends at the lips or nozzle. The tracts are constructed from the pharynx which interconnects between the mouth to the esophagus, the mouth cavity and the nasal cavity which starts at the velum and ends at the nozzle.

Types of cry

1. Pain cry due to pain
2. Discomfort cry due to irritation caused by external environment
3. Emotional cry when the baby wants to go back to parents
4. Ailment cries due to fever, cold, cough
5. Environmental cry
6. Hunger / thirst cry

Guoleis & Yuttongzhi (2013) they analyzed the pitch of the infant cry and found that there is o relationship between gender and fundamental frequency of infant crying signal. The co variation of acoustic features of infant cries and automatic state by Stewart concluded that overall, significant correlations was observed between several acoustic features of the infant vocalization and autonomic state.
Naithani (2015) found that fundamental frequency is an important acoustic parameter of cry signals.
Sriram and Tejaswini (2012) for automatic classification of infant cry state that the cry of baby cannot be predicted accurately where it is very hard to identify for what it cries for .
Dagas (2011) on the topic acoustical analysis of pain cries in neonates; fundamental frequency and concluded that fundamental frequency for cry due to pain is found to be around 400Hz. The male fundamental frequency is higher than that female cries mean fundamentals.
The first postnatal cry is an important measure of the general physiological status of the newborn, it helps to clear the air passage, the switch-over from the fetal to neonatal circulation and the maintenance of body temperature. A feeble or delayed first cry may be an early indication of birth asphyxia.

NEED OF THE STUDY
From the above review it clearly indicates that infant cry analysis provides a window into the neurological, physical a medical status of the infant which points to the importance of including infant cry analysis in routine infant screening programs. Hence need arises to analyze the cry aspects of normal as well as high risk infants to prepare the baseline aspects.

AIM OF THE STUDY
The aim of the present study was to compare the cry analysis between low birth weighted premature infants and normal infants.

II. METHODOLOGY

The aim of the present study was to compare the cry analysis between low birth weighted premature infants and normal infants.

Subjects
The study included 40 infants divided into two groups with equal gender and sample size divisions.
Group 1: twenty normal infants with equal gender divisions.
- Chronological age below 6 moths
- Normal APGAR scores
- Normal delivery
- A normal birth history
- Gestational age range from 37-42 weeks
- No prenatal complications

Group 2: twenty low birth weighted premature infants with equal gender division
- Chronological age below 6 moths
- Birth weighted below 1500 grams
- Gestational age below 36 weeks at birth

Recording environment
The cry samples were audio recorded using microphone attached to voice recorder. The recording environment was a quiet room in the hospital building.

Procedure
The cry signals used in this paper were recorded from the neonatal intensive care unit (NICU). This cry signal of babies ranging from 0-6 moths. Concern letter were signed by the parents before taking the cry sample. 10-20 sec duration of cry sample were taken during the testing or in natural cry, digital voice recorder is used to collect the samples and analyzed using the PRAAT software.

III. ANALYSIS

The samples recorded were analyzed to find the acoustic characteristic like f0, f1, f2, f3 jitter, shimmer and harmonic to noise ratio as well as cry duration and respiratory phase. The values for these parameters were obtained and were tabulated statistically and analyzed.

IV. RESULTS AND DISCUSSION

The present study aimed at comparing the cry analysis of twenty high risk infants and twenty normal infants.

Groups	**gender**	**N**	**Mean**	**Std deviation**
Normal's	Male	10	273.333	28.049
	Female	10	316.198	25.524
	Total	20	294.766	34.129
High risk	Male	10	392.230	47.279
	Female	10	393.587	35.163
	Total	20	392.909	40.559

Dependent variable f0 Hz	source	ANOVA	P	
	Groups	78.469	.000	HS
	Gender	3.983	.054	
	Groups*gender	3.509	.069	

Table 1; showing mean fundamental frequency at high risk (male and female) infants and normal infants (male and female)

From the above table 1, it is clearly evident that the mean fundamental frequency for normal male and female infants is less compared to high risk male and female infants and it is statistically showing high significant at P= (0.000) when compared across group and group versus gender there is no significant difference observed.

Groups	**gender**	**N**	Mean	Std deviation
Normal's	Male	10	1.275	.749
	Female	10	1.975	.617
	Total	20	1.625	.758
High risk	Male	10	1.429	.681
	Female	10	1.622	.763
	Total	20	1.520	.712

Jitter %	source	ANOVA	P
	Groups	.221	.641
	Gender	4.097	.050
	Groups*gender	1.245	.272

Table 2; showing mean jitter of high risk (male and female) infants and normal infants (male and female)

From the above table 2, it is clearly evident that the jitter values for normal male and female infants showing slight variations to high risk male and female infant and no significant difference observed.

Groups	**gender**	**N**	Mean	Std deviation
Normal's	Male	10	1.201	.581
	Female	10	1.535	.195
	Total	20	1.368	.455
High risk	Male	10	0.925	.244
	Female	10	1.072	.265
	Total	20	1.015	.254

Shimmer %	source	ANOVA	P	
	Groups	9.980	.003	HS
	Gender	4.097	.054	
	Groups*gender	0.961	.333	

Table 3; showing mean Shimmer of high risk (male and female) infants and normal infants (male and female)

From the above table 3, it is clearly evident that mixed values for mean Shimmer values for normal male and female infants showing slight variations to high risk male and female infant and Highly significant difference observed for group at P= (0.003) and no significant difference for gender and group versus gender.

V. DISCUSSION

The present study aimed at comparing the cry analysis of twenty high risk infants and twenty normal infants, the cries were recorded using Olympus DS-400 digital voice recorder for least 30 seconds and the samples were then analyzed using PRAAT software for acoustical analysis and the following parameters were studied from the spectrogram.

- Fundamental frequency

- Formant frequency
- Jitter
- Shimmer
- Harmonic to noise ratio
- Cry duration
- Minimum and maximum pitch

Based on the analysis and interpretation of the spectrograms the various cry characteristics the following conclusion have been drawn.

1. Significant difference exists between the cries in normal and high risk infants in characteristics like fundamental frequency, formant frequency, shimmer, harmonic to noise ratio, cry duration and maximum pitch.
2. No significant difference were observed between normal and high risk infants in cry characteristics like formant frequencies, jitter and minimum pitch.

The present study in accordance with Chattopadhiya and Mithra (2015) found that the incidence of neurodevelopment delay among high risk newborns is significantly high with LBW, prematurity and neonatal illness are major contributors.

VI. SUMMARY AND CONCLUSION

Birth cry is a reflection of complex neurophysiologic function and that analysis of the infant cry can be utilized to assess the infant's status. Analysis of the cry as a non invasive diagnostic tool is most important while dealing with disorders in which early diagnosis is not available. The present study aims to analyze infant cry recordings in order to find the potential markers which would help in early assessment of neurological development problems in infants and results shows that overall fundamental frequency is higher for low birth weight infants but the jitter shimmer and formant frequency shows only slight difference and respiratory duration is more for low birth weight infants did not show much difference.

This study provides a window into the neurological, physical and medical status of the infant using the cry analysis.

The present study who accordance with LaGassen, Neal & Lester (2005) who studies infant cries and they found that infant because the acoustic characteristics of the cry from infants because the acoustic characteristics of the cry from infants with neural damage, sudden infant death syndrome, prematurity and various medical conditions deviate from the typical cry characteristics.

Limitations of the present study

- Limited samples only 40 samples (20 each)
- Only considered low birth weight, high risk register, other are not taken
- Not taken samples according to types of cry

Future implications

- More sample size
- More high risk categories
- Include infant cries according to type and risks

REFERENCES

[1]. Bang A.T., Bang R. A, Baitule & Deshmukh (2001) burden of morbidities and the unmet need for health care in rural neonates- a prospective observational study in Gadchiroli, India
[2]. Dudek, J., Faress A Bornstein MH & Haley (2016) infant cry rattle adult cognition
[3]. Newman J.D., (2007) neural circuits underlying crying and cry responding in mammals. Behavioural Brain Research, 182 (2)
[4]. Robb M.P., Crowell D.F & Dunn-Rankin (2007) cry analysis in infants resusicated for apmea of infancy
[5]. Stewart A.M Lewis G.F., Heilman K.J (2013) The covariation of acoustic feature of infant cries and autonomic state.
[6]. Venuti., P Caria A., Esposito G., Bornstein (2012) differential Brain responses to cries infants with autistics disorder and typical development
[7]. Retrieved from
[8]. https:// www.ncbi.nlm.nih.gov/pubmed/15856439
[9]. https://www.aicit.org/JDCTA/ppl/JDCTA2969PPL.pdf