



Original Research Article

## Is Digital Thermometer is Equivalent to Mercury Thermometer- A Comparative Prospective Cohort Study

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### Abstract

**Background:** Glass mercury thermometers are historically the most acceptable standard methods of temperature measurement. However glass mercury thermometers has some disadvantages such as danger of breakage, potential harm and toxic vapour effects to health workers and the patients. Because of toxicity of mercury & mercury based compounds, instruments are banned worldwide, digital thermometer replaced Mercury Thermometer and studies are conducted to understand the efficacy and correlate the recordings with Thermistor.

**Aims & Objectives:** Evaluate the accuracy of thermometer readings in Newborn of various gestation and Birth weight. Determine the accuracy of temperature recordings by various thermometers and to correlate the efficacy of the results with the mercury Thermometer.

**Methodology:** Hospital based prospective, cohort study. Samples collected randomly by computer generated random numbers from 100 Neonates. Data were analyzed by Pearson coefficients, mean, standard deviation, and range using an SPSS statistical software.

**Results:** Of 100 Neonates in our study. Neonates in term age group is less than preterm age group. Males are more than females, Thermistor correlates more with Mercury Thermometer than Digital Thermometer in all gestations and with various Birth weights. Digital Thermometer is less correlating with Mercury Thermometer and thermistor.

**Keywords:** Mercury Thermometer, Digital Thermometer, Thermistor, Neonate.

### Introduction

Hypothermia among newborns is considered an important contributor to neonatal morbidity and mortality in low resource settings. Neonatal hypothermia as a factor contributing to morbidity and mortality risk of newborns has been

recognized by the World Health Organization (WHO)<sup>[1]</sup>. Warmth is one of the basic needs of a newborn baby; it is critical to the baby's survival and well being. Unlike adults, newborn babies are often not able to keep themselves warm particularly if the environmental temperature is

low. This results in low temperature or hypothermia. Maintenance and monitoring of the thermoregulation of newborn infants is a basic requirement of good neonatal management and play a key role for neonatal nursing care in the neonatal intensive care unit (NICU). Determining accurate measurement of temperature is very important because abnormal temperature is strongly associated with a serious condition<sup>[1,2]</sup>. That's why here in this study we want to evaluate the accurate thermometer to measure the neonatal temperatures.

### Aims & Objectives

Evaluate the accuracy of thermometer readings in Newborn of various gestation and Birth weight. Determine the accuracy of temperature recordings by various thermometers and to correlate the efficacy of the results with the mercury Thermometer.

### Methodology

It is a hospital based prospective cohort study done during the period of six months from 2018 January to June at Niloufer hospital, Hyderabad .A comparative design was used to evaluate the level of agreement between three thermometers in preterm and term infants. The infants ranged from 27 weeks gestation to post term. Sample size calculated from Epi info as 100 based on previous study<sup>[3]</sup>. All Neonates of any gestation or mode of delivery after intial stabilization preferably within 1 hr of birth without congenital anomalies, or any sickness or distressed were included .Newborn with sepsis, congenital anomalies, in distress are excluded from the study. Temperature instruments included glass Mercury thermometer, Digital

thermometer, Thermistor. Under controlled temperature of room, temperature recordings of neonates present under Radiant Warmer using Mercury Thermometer, Digital Thermometer and Thermister was taken. Temperature recorded by thireed person who not involved in study and statistical analysis also done by another person who not aware of study. In our study we used Digital thermometer Omron MC 246 and standard clinical oval mercury thermometer.

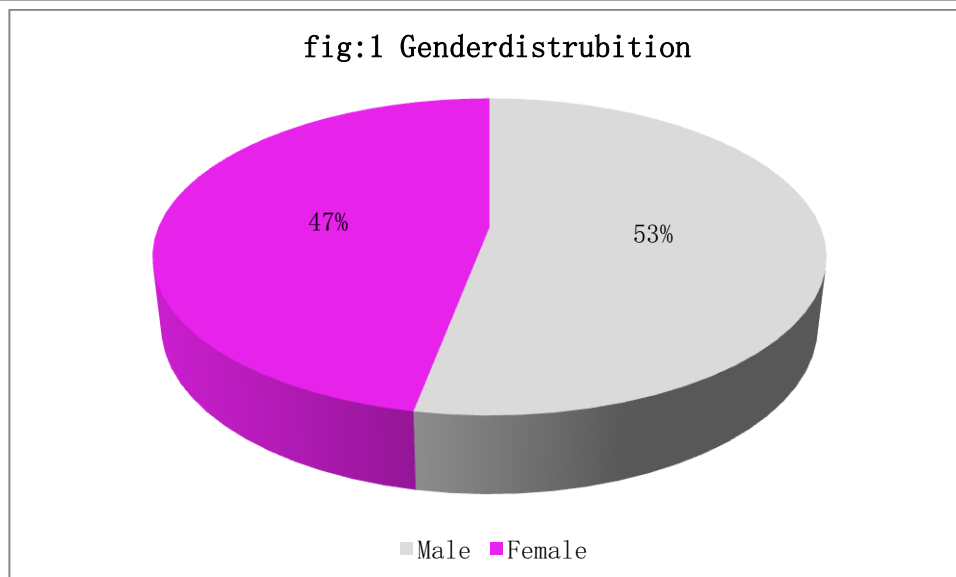
Temperature recorded according to WHO guidelines with mercury thermometer for 5mins, Digital thermometer until the Beep sound will come. Recordings from the thermister taken upto 3mins and 5 mins, all these recordings were correlated with one another and also correlated with Gestational Age of the Neonate and Birth weight of the Neonate. Data analyzed by Pearson coefficients, mean, standard deviation, and range using an SPSS software. Before enrolment into the study, a written informed consent was obtained from each neonate's parents. Parents were given a full explanation of the purpose of the study and the different methods of temperature measurement being used in the study

### Results

A Total of 100 Neonates were enrolled in the study males were 47 and females were 53 (**Fig: 1**), 18 infants with 27- 34 weeks gestation, 33 neonates with 35- 36 weeks, 42 infants with 37-38 weeks (**Table: 1**). Seven infants with 39- 42 weeks. Neonates in term age group is less than preterm age group in our study. Twenty-five Neonates with birth weight in between 1.3- 2.3 kgs, 24 neonates were in between 2.4 - 2.5 kg, 28 neonates were between 2.81 to 4 kg (**Table: 2**).

**Table: 1** Gestational Age Distribution

Age in Weeks	Number of Babies	Percentage(%)
27-34	18	18.0
35-36	33	33.0
37-38	42	42.0
39-42	7	7.0
<b>Total</b>	<b>100</b>	<b>100.0</b>



**Table 2 Birth Weight**

Weight in Kilogram	Frequency	Percent
1.3-2.3	25	25.0
2.4-2.5	24	24.0
2.60-2.80	28	28.0
2.81-4.0	23	23.0
<b>Total</b>	<b>100</b>	<b>100.0</b>

**Table: 3 Correlation of different Thermometers according to gestional age**

		Mercury_Thermo_Meter5min	Termister_F	Digital_Thermo
Mercury_Thermo_Meter5min	Pearson Correlation	1	.187	.131
Termister_F	Pearson Correlation	.187	1	.159
Digital_Thermo	Pearson Correlation	.131	.159	1

**Table: 4 Correlation of different Thermometers according to Birth weight**

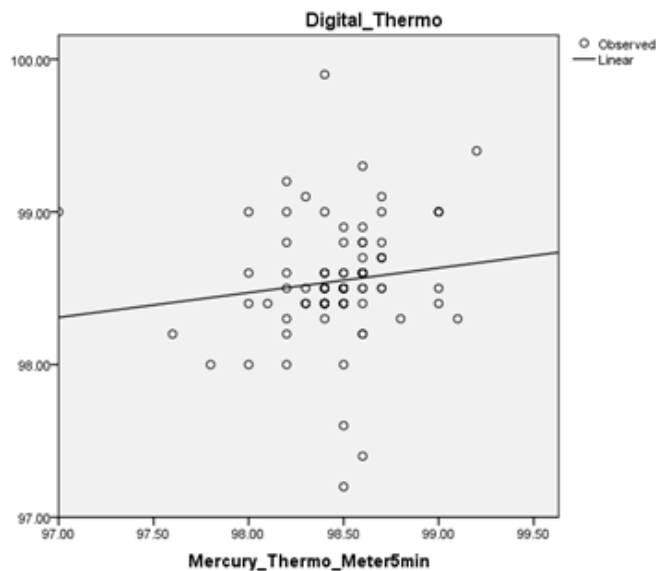
		Mercury_Thermo_Meter5min	Termister_F	Digital_Thermo
Mercury_Thermo_Meter5min	Pearson Correlation	1	.187	.131
Termister_F	Pearson Correlation	.187	1	.159
Digital_Thermo	Pearson Correlation	.131	.159	1

In the neonatal age group of 27-32 weeks Mercury thermometer correlates more with Thermister than Digital Thermometer which has coefficient of 0.067 .In 32-37 wks group also Mercury thermometer readings more correlated with Thermister than Digital thermometer with correlation coefficient of 0.175 and 0.164 respectively. Mercury thermometer correlates more with digital thermometer than thermister in the age group of 37-38 weeks. Mercury

thermometer correlates more with Thermister than digital Thermometer in the age group of 39 - 42 weeks (Table 3).

Mercury thermometer correlates more with Thermister than digital Thermometer in the neonates with birth weight of 1.3 to 2.3 kg and 2.81 to 4 kg group but in weight group 2.4 to 2.8 kg it was more correlated with digital thermometer. Thermister correlates more with Mercury Thermometer than Digital Thermometer in all gestations and with various Birth weights.

Digital Thermometer is less correlating with Mercury Thermometer (Table: 4).



**Fig: 1** regression analysis curve indicates that there is much less correlation between thermister and digital thermometer than mercury Thermometer

### Discussion

Though importance of speed of application and ease of use digital thermometer is better accuracy of measurement of temperature was very important particularly in neonates as mild cold stress also causes severe morbidity in preterm neonates. Temperature measurement by the axillary method has become the accepted neonatal nursing care<sup>[3]</sup>. Glass mercury thermometers and axillary region have been considered the gold standard method of temperature measurement in newborns<sup>[4]</sup>. There are many studies conducted in pediatric and adult populations less studies were there in neonates<sup>[5]</sup> and different other thermometers like less time consuming non touch infrared thermometers are less useful in neonates as noticed by Somashekar and Fortuna EL<sup>[6]</sup> we conducted this study in neonates. As mentioned earlier as we are in large setup it is better to use digital thermometer but accuracy also important this why we correlated both thermometers to know how much correlation will present. We taken as thermister as standard one in our study mercury thermometer more correlated with

thermister than digital thermometer. Some other studies done by Sganga and Smith<sup>[7,8]</sup> found that the digital thermometer had a high correlation with the mercury thermometers.

### Conclusion

Good correlation with glass mercury thermometer, rapid result delivery, improved patient comfort, being an easy and noninvasive procedure and lacking the disadvantages of glass mercury thermometer are the advantages of Thermister. Though Digital thermometer as all these advantages and cost effective and portable there is poor correlation with mercury thermometer which is taken as accurate.

### Recommendations

Neonatal temperature Monitoring is accurate with Mercury Thermometer as these mercury compounds are banned Thermister can be used for accurate results. In lower setups where Thermister is not available, Digital Thermometer can be used but recording time should not take up to the beep sound but it must be recorded up to 5 mins for accurate results.

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