DISSERTATION ON

TO MEASURE MID ARM CIRCUMFERENCE AND STUDY ITS CORRELATION WITH THE BIRTH WEIGHT OF THE BABIES

MD PEDIATRICS DEGREE EXAMINATION

BRANCH - VII

THANJAVUR MEDICAL COLLEGE

TAMIL NADU DR.M.G.R. MEDICAL UNIVERSITY CHENNAI

APRIL 2016

CERTIFICATE

This is to certify that this dissertation entitled "**TO MEASURE MID ARM CIRCUMFERENCE AND STUDY ITS CORRELATION WITH THE BIRTH WEIGHT OF THE BABIES**'' is the bonafide original work of **Dr.B.MATHIANA,** in partial fulfillment of the requirements for M.D. Branch – VII (paediatrics) Examination of the Tamilnadu Dr.M.G.R. Medical University to be held in APRIL - 2016. The period of the study was from October --2014 to July --2015.

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DECLARATION

I, **Dr.B.MATHIANA,** solemnly declare that dissertation titled **"TO MEASURE MID ARM CIRCUMFERENCE AND STUDY ITS CORRELATION WITH THE BIRTH WEIGHT OF THE BABIES".** is a bonafide work done by me at Thanjavur Medical College and Hospital during October 2014 to July 2015 under guidance and supervision of **Prof.Dr.M.SINGARAVELU M.D.(Paed),DCH,DNB,MNAMS** Professor and head of the Department of Paediatrics and my unit chief **Prof.Dr.S.RAJASEKAR,M.D.,DCH.,.**

This dissertation is submitted to The Tamilnadu Dr.M.G.R.Medical University, towards partial fulfillment of requirement for the award of **M.D. Degree (Branch – VII) in Paediatrics.**

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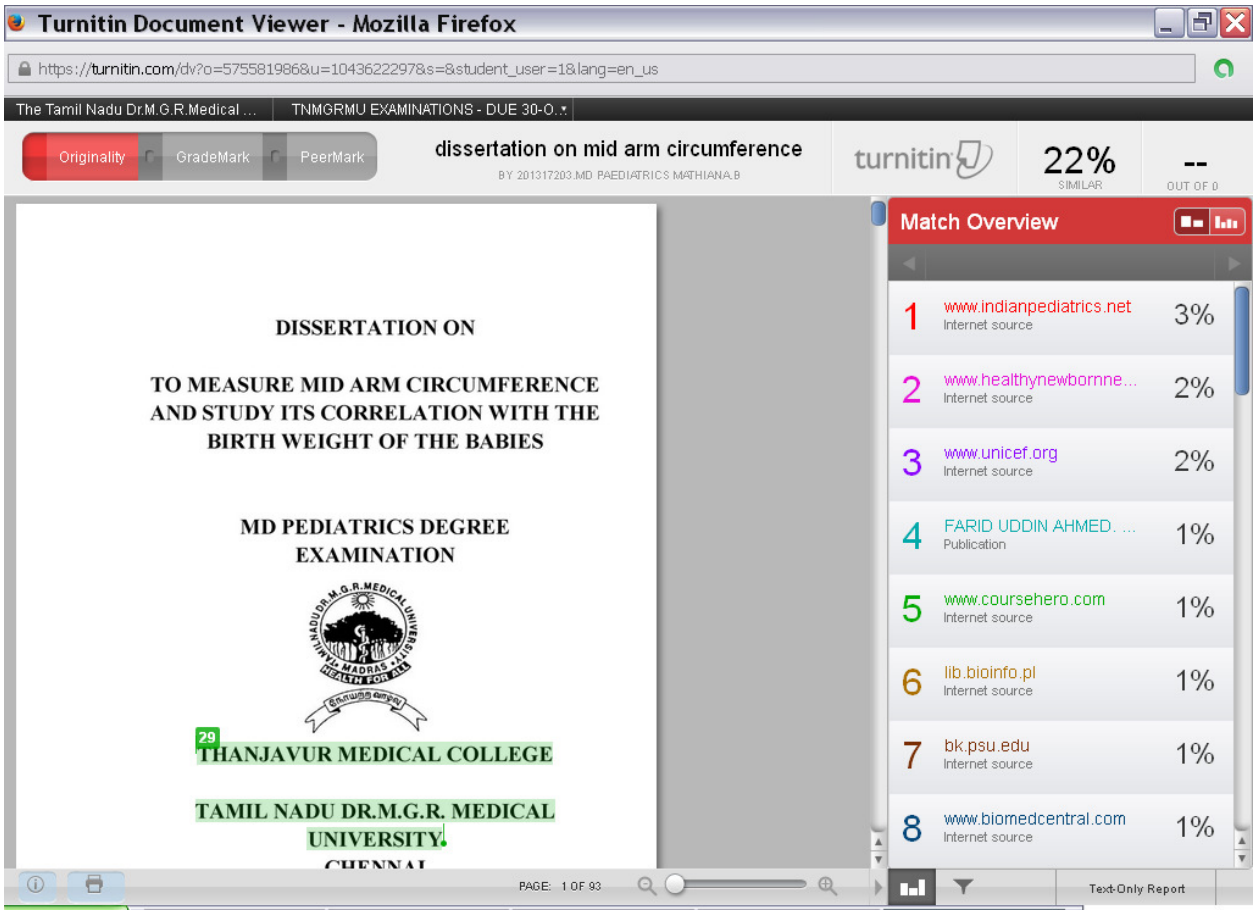
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CONTENTS

ABSTRACT

➢ Objective:

- To know the correlation between birth weight and mid arm circumference.
- To test the sensitivity and specificity of different cut off limits of mid arm circumference for the identification of low birth weight babies,viz.,<2000gm and <2500gm.
- To measure the foot length and analyse its correlation with the birth weight.
- To compare Mid arm circumference and foot length with respect to their influence over birth weight.

➢ **Methods:** Three hundred children were enrolled in the study.Birth weight was measured using electronic weighing scale of accuracy 10 grams within 24 hours of life.

- MAC was measured using non-stretchable tap to the nearest of 0.1cm. Foruniformity right MAC was measured at the midpoint between tip of olecranon process of ulna and the acromian process of scapula.
- Foot length was measured by vernier's caliper from right big toe to heel.

- Data was analyzed using SPSS
- Different cut offs for MAC and their sensitivity, specificity to identify LBW babies <2.5kg was analysed through ROC.

- **Results:**Mid arm circumference, highly correlated with weight (P<0.001). A mid arm circumference of <10 cm, predicts a birth weight of <=2500gm, with a sensitivity of 93% and specificity of 49% Mid arm circumference of <=9 cm, predicts a birth weight of <=2000 gm, with a sensitivity of 95% and specificity of 87%.

In this study,foot length highly correlated with birth weight(P<0.001).A foot length of <8 cm, predicts a birth weight of <=2500gm, with a sensitivity of 33% and specificity of 99% .Foot length of <=7 cm, predicts a birth weight of <=2000 gm, with a sensitivity of 55% and specificity of 100%.Regression values were analysed and formula for detecting birth weight for the given mid arm circumference was derived. Multiple regression show mid arm circumference affected by birth weight (P<0.000) and not affected by age of the mother (P<0.210). ANOVA correlating birth weight with age of the mother had high significance (P<0.045),ANOVA correlating mid arm circumference with age of the mother had no significance (P<0.495).

- Conclusion: Mid arm circumference is a reliable indicator for low birth weight. A positive correlation existed between mid arm circumference and birth weight (P<0.001).

A cut off value of 10 cm of mid arm circumference for identification of low birth weight babies weighting <=2500 gm, and 9 cm of mid arm circumference for identification of low birth weight babies <=2000 gm, with optimum sensitivity and specificity.A cut off value of 8 cm of foot length for identification of low birth weight babies weighting <=2500 gm, and 7 cm of foot length for identification of low birth weight babies <=2000 gm, with optimum sensitivity and specificity.

On comparing mid arm circumference and foot length in determining birth weight of babies,both of them are found to have their influence over birth weight.In this study,mid arm circumference has got more sensitivity in determining the weight of low birth weight babies when compared to foot length.

- **Keywords:**Mid arm circumference,footlength,birth weight.

INTRODUCTION

Birth weight is one of the most reliable and sensitive predictor of the health and survival of new born in any community. *"There is no indicator in human biology, which tells us so much about the past events and the future trajectory of the life as the weight of the infant at birth"*.

Babies with a birth weight of less than 2500 gm, irrespective of the period of their gestation are classified as low birth weight babies. But, in Indian population a birth weight of 2000gm is considered as appropriate criteria for defining low birth weight. (1)

About 30% of the babies in India are low birth weight, which constitutes 7 to 10 million annually. Nearly 80% of the Neonatal deathsand 50% of infant deaths occur among the low birth weight neonates. Low birth weight is also a major determinant of malnutrition during infancy because, 40% of low birth weight babies are malnourished at the age of 1 year. (1)

Birth weight is an important determinant of success, and duration of breastfeeding, which is a well-known protective asset against infant deaths in developing world. Low birth weight also increases risk of mortality due to the infections more than two to three times.

The neuro developmental sequalae due to birth asphyxia, *atherosclerotic coronary artery disease,* hypertension and diabetes mellitus may complicate life during adult life in low birth weight babies.

In India, early identification of low birth weight babies is difficult, as majority of deliveries are conducted, either by untrained *dhais*or by primary health care workers, at rural areas. Non-availability of the weighing scales makes it difficult to record birth weight and also in some communities, weighing of the newborns is not accepted.

Early identification and transfer of low birth weight babies, to higher centers, can avoid unnecessary neonatal deaths.

So, there is a search for an alternate, non-invasive and inexpensive method to predict birth weight.

Anthropometric measurements, has been identified as a proxy measure for finding birth weight, during the first week of life.

This study also discusses the correlation between maternal age with mid arm circumference of their babies.

Our potential to connect newborns to life saving interventions just took another step forward.

We are beginning to have a robust body of evidence to promote simple, affordable and effective interventions for high risk newborns. But identifying the newborns who urgently need that extra care continues to be problematic - even though as many as 80% of them could be recognized by their low birth weight.

Why? Because in sub-Saharan Africa, for example, over half of babies are born at home and are not weighed at birth. Measuring newborn midarm circumference and foot length could provide the tool needed to help such women, and their birth assistants, decide whether their baby needs extra care.

With the intention to develop a user-friendly low birth weight screening tool for use in communities where there are no scales, researchers in many studies tested how well the Mid arm circumference and length of a baby's foot can predict whether the baby is low birth weight (<2500g) and in need of extra care. Fromsuch studies measuring MAC and foot length could be used as a screening tool to identify and connect high risk babies born at home to extra care, but there would be some over-diagnosis.These studies were similar to previously reported from Asia,Uganda and Tanzania.

MATERIALS AND METHODS

- Birth weight will be measured using electronic weighing scale of accuracy 10 grams within 24 hours of life.

- MAC will be measured using non-stretchable tap to the nearest of 0.1cm. For uniformity right MAC measured at the midpoint between tip of olecranon process of ulna and the acromian process of scapula.

- Foot length measured by vernier's caliper from right big toe to heel.

- Data will be analyzed using SPSS.

- Different cut offs for MAC and their sensitivity, specificity to identify LBW babies <2.5kg will be analysed through ROC.

MID-UPPER ARM CIRCUMFERENCE (MUAC) MEASURING TAPES

Background:

A range of Mid-Upper Arm Circumference (MUAC) Measuring Tapes are available through UNICEF Supply Division. MUAC tapes are predominately used to measure the upper arm circumference of children but also that of pregnant women, helping identify malnutrition.

There are different types of MUAC tape available. All are graduated in millimetres and some are colour coded (red, yellow and green) to indicate the nutritional status of a child or adult. The colour codes and graduations vary depending on the tape type.

In May 2009, the Word Health Organization (WHO) and UNICEF issued a joint statement on WHO child growth standards and the identification of severe acute malnutrition in infants and children. To reflect this, a new standard MUAC tape (S0145620 MUAC, Child 11.5 Red/PAC-50) was made available.

MUAC tapes available through Supply Division

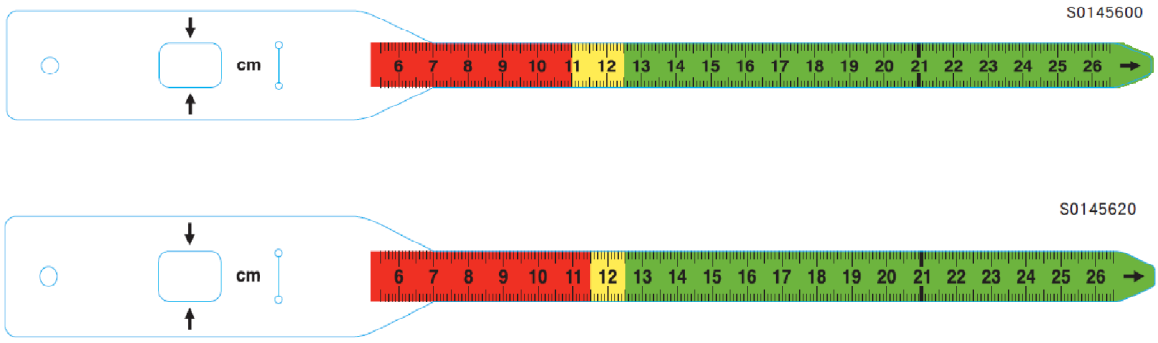
S0145620 MUAC, Child 11.5 Red/PAC-50 This is a new item. It was created in order to support implementation of the new standards.

CUT OFF POINTS:

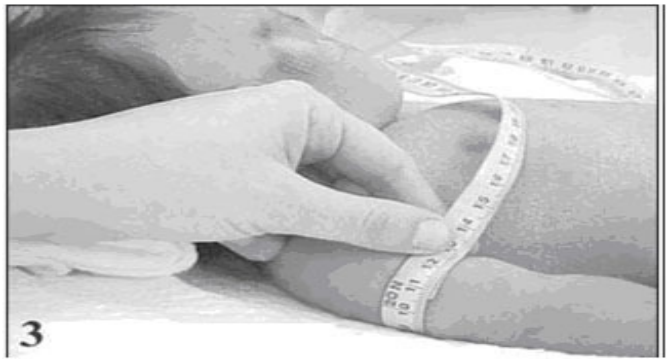
Red: 0-11.5 cm

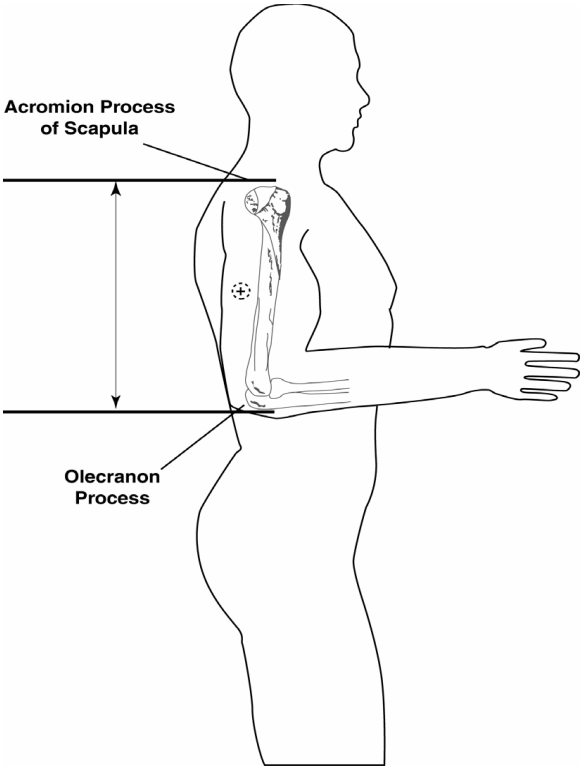
Yellow: 11.5-12.5 cm

Green: above 12.5 cm



METHOD OF MEASURING MID ARM CIRCUMFERENCE

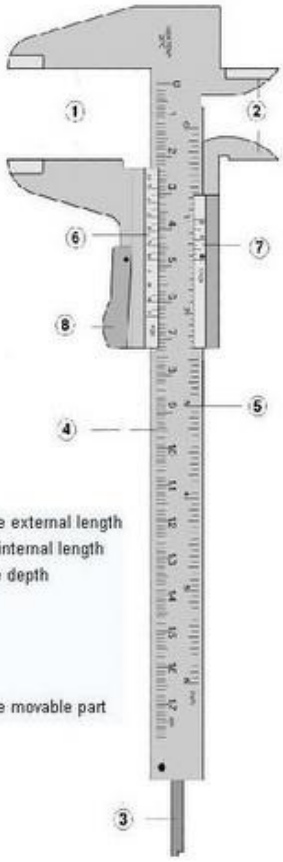




Foot length is measured by vernier's caliper in this study. For most measurements with a rules scale, it is desirable to estimate fractionof the smallest division on the scale. The common scale attachment thatincrease the accuracy of these estimates is the vernierscale.A *caliper* is an instrumentwith two jaws, straight or curved, used to determine the diameters of objects or the distances between two surfaces. A caliper with a vernier scale is called a *vernier caliper.*

The Vernier Principle. The vernier is an auxiliary scale, invented by Pierre Vernier in 1631, which has graduations that are of different length from those on the main scale but that bear a simple relation to them. The vernier scale has 10 divisions that correspond in length to 9 divisions on the main scale. Eachvernier division is therefore shorter than a main-scale division by 1/10 of a main-scale division. The zero mark of the vernier scale coincides with the zero mark of the main scale. The first vernier division is 1/10 main-scale division short of a mark on the main scale, the second division in 2/10 short of the next mark on the main scale, and so on until the tenth vernier division is 10/10, or a whole division, short of a mark on the main scale. It therefore coincides with a mark on the main scale.

A community volunteer in southern Tanzania using the foot length indicator printed onto her counselling card to determine whether this newborn baby requires counselling about extra care for small babies.



1. **Outside jaws**: used to measure external length
2. **Inside jaws**: used to measure internal length
3. **Depth probe**: used to measure depth
4. **Main scale** (cm)
5. **Main scale** (inch)
6. **Vernier** (cm)
7. **Vernier** (inch)
8. **Retainer**: used to block/release movable part

AIM OF THE STUDY

- To know the correlation between birth weight and mid arm circumference.

- To test the sensitivity and specificity of different cut off limits of mid arm circumference for the identification of low birth weight babies, viz., < 2000 gm and < 2500 gm.

- To develop a tri-coloured tape for measuring mid arm circumference, to enable easy identification of low birth weight babies based on the results.

- To measure the foot length and analyse its correlation with the birth weight.

- To compare Mid arm circumference and foot length with respect to their influence over birth weight.

REVIEW OF LITERATURE

Life begins, when the ovum is fertilized by the sperm and a microscopic mono-cellular zygote is formed. It is endowed with a tremendous growth potential from a weight of about 0.005 mg at conception. Zygote grows to achieve average weight of 3000 grams at birth, accounting for almost 65 million percent increase in size. During the early level or embryonic life, virtually all growth is due to increase in cell number. But in later part of pregnancy, there is an increase in cell number and size, including increase in intracellular material.

Intrauterine malnutrition has profound effect on somatic and organ growth. Body weight is significantly reduced because of lack of subcutaneous fat and muscle mass. So by measuring the muscle mass, we can assess the degree of foetal malnutrition and indirectly, the birth weight. Moreover, the abdominal viscera such as liver, spleen and adrenals are severely reduced in size, during the state of intrauterine malnutrition.

The anthropometric measurements, measuring the muscle mass and abdominal viscera, can be used as a surrogate for assessing birth weight. This principle is used in many studies.

Various studies conducted all over the world, show the correlation between various anthropometric measurements and birth weight differently.

Bhat IA et al (2003) conducted a study on efficiency of various anthropometricmeasurements in determining low birth weight babies at Department of Community-Medicine at SKIMS. The study was conducted in 199 randomly selected normal newborn babies within hours of birth. The significant high correlation ($P<0.001$) was obtained between birth weight and mid arm circumference ($r=0.68$). A cut off value of 9.94 cm corresponded well with birth weight of 2500 gm, with 93.55% of sensitivity and 76.92% specificity.

CS Yajnik et al (2003) conducted a study on neonatal anthropometry (Pune Maternal Nutrition Study) comparison in rural India and UK. Study conducted by King Edward Memorial Hospital, Pune and Agarkar Research Institute, Pune, in India and Epidemiology Unit, University of South Hampton in UK. Study conducted in 6 rural villages near Pune, 631 term babies and 338 term babies, born in Princess Anne Hospital, UK. The mid arm circumference in Indian newborns are with a score of (S.D.Score – 1.82) 95% C I:-1.89 to -1.75.

SL Sood, GL Saiprasad, C.G.Wilson (2002), conducted a study on mid arm circumference at birth, a screening method for detection of low birth weight babies, at Department of Pediatrics and Social Preventive Medicine in Armed Forces Medical College, Pune. The cross sectional study was conducted on 1272 newborns within 24 to 48 hours of life. The significant high correlation ($P<0.001$) was obtained. A cut off value of 8.6 cm of mid arm circumference to predict a birth weight of 2500 gm with sensitivity of 97.9% & 60.4% specificity, was derived.

CS Ergie (2000), conducted a study to identify a new method, with the aid of anthropometric measurements for maturity determination in newborn infants, a two-port study conducted in several centers in Nigeria. This study shows relationship of anthropometric measurements with other features, having significant correlation with birth weight.

Dr. GC Samal (2000) conductd a study on efficiency of various anthropometric measurements, in determining low birth weight babies at Department of pediatrics, VSS Medical College, Orissa. The study included 1580 consecutively delivered neonates (620 low birth weight babies). The

significant high correlation was obtained (P<0.001) with mid arm circumference of 8.3 cm to predict the birth weight <2500gm.

Ahmed FU, Karim E, Bhuiyan SN (2000), conducted a study on mid arm circumference at birth, as a predictor of low birth weight of neonatal mortality at Chittagong Medical College Hospital. A total of 1670 live births constituted the study sample. This showed high correlation between mid arm circumference and birth weight (r=0.792, P<0.000). A mid arm circumference of 9 cm had the best sensitivity &specificity for identifying the newborns with a birth weight <2500gm.

JusterBenzer and Reiner Saurborn (1998), conducted a rapid risk, house hold screening study, by measuring neonatal mid arm circumference, to know the association between mid arm circumference, low birth weight and neonatal deaths. The study was conducted at rural Barkinofaso at France in a cohort of 1367 new born children. This study shows explanation of survival pattern, by mid arm circumference correlating with birth weight and neonatal mortality.

Mohanty C, Das BK (1997), conducted a study on mid arm circumference, for the identification of low birth weight babies at birth. Study

conducted by Department of Pediatrics and Department of OG, at Institute of Medical Sciences, Banaras Hindu University, Varanasi. A total of 385 newborns with in their first week of life, were selected for the study. This showed high correlation (P<0.001) between birth weight and mid arm circumference. Mid arm circumference of 8.5 cm corresponding with the birth weight of <2500gm, with the sensitivity of 100% and specificity of 73.1%. From the findings of the study a tape with 3 colour zones was devised, Red (at risk) <8.5 cm of MAC, Yellow (border line) 8.5 to 9.5 cm of MAC, Green (Normal)>9.5cm of MAC.

A.U.Chara, Soe A, Cosieloek (1997), conducted a study on relationship between birth weight and anthropometric indices, such as mid arm circumference/OFC in 163 pre term babies. There was a highly significant correlation between gestational age and mid arm circumference /OFC (P<0.0001) but none with ponderal index.

Kapoor SK, Kumar G, Anand K (1996), concuted a study on use of mid arm and chest circumference, to predict the birth weight in rural north India. The study conducted on 733 singleton newborns, delivered at Secondary Level Hospital Ballabgarh. Cut off point of 8.5 cm mid arm circumference was

obtained to predict the birth weight below 2500gm with the sensitivity and specificity around 80%.

Anisoy AE, Sarman G (1995), conducted a study to find out the usefulness of mid arm circumference for the identification of low birth weight in Turkey. A total of 874 neonates between 32 and 43 weeks of gestational age were measured within 24 hours of birth. The study showed a significant correlation ($P<0.001$) between mid arm circumference of 9 cm ($r=0.791$) had the best sensitivity and specificity for identifying neonates with a birth weight of less than 2500 grams.

Raymond EG et al (1994), conducted a study to develop a practical screening tool to identify pre term, low birth weight neonates in Ethiopia, which establishes the usefulness of mid arm circumference of 9 cm for the identification of low birth weight babies less than 2500 gm.

Sachar RK, Sony RK et al (1994), conducted a study to develop colour coded stripes for estimating mid arm circumference and maximum thigh circumference of the new born based on regression equation obtained after

studying 483 normal singleton new born babies. When used in combination, it classified 87% of the babies with low birth weight.

Kulkarni AP, Sathe PV (1993), conducted a cross sectional study to determine the relationship between birth weight and anthropometric measurements of new born, at Rural Training Centre, by Dept. of Government Medical College, Aurangabad. The study showed relationship between birth weight & mid arm circumference than any other anthropometric measurements. The most sensitive for screening low birth weight less than 2500 grams is 9 cm of mid arm circumference.

AV Mohan et al (1991), conducted a study to construct standards of mid arm circumference to substitute weight, to identify low birth weight neonates. A study of 2925 consecutive live births showed significant correlation of mid arm circumference with birth weight (r=0.808). Mid arm circumference of <= 8.6 cm and <= 7.4 cm had the best sensitivity and specificity for identifying neonates, with a birth weight of <= 2500 gm, and 2000 gm respectively.

Diamond et al (1991) conducted a study to know the relationship between birth weight, arm and chest circumference in Egypt. The result shows the mid

arm circumference is the better predictor of birth weight and cut off points are then identified.

AH Hugue F, Hussain AM (1991), conducted a study to detect low birth weight babies, by anthropometric measurements in Bangladesh. In this study, 41% of the babies found to have low birth weight. The mean chest, thigh and mid arm circumference at birth were 30.89 cm, 15.06 cm and 9.27 cm respectively with standard derivation of 1.83 cm, 1.30 cm, and 1.04 cm. Correlation co-efficient for mid arm circumference is 0.842. A linear aggression curve shows a mid arm circumference of 8.90 cm corresponding well with a birth weight of <2500 gm.

Rogok et al conducted a study of mid arm and chest circumference, as predicators of low birth weight. A total of 999 babies were examined in order to determine the relationship of mid arm and chest circumference. The study shows high significant correlation with birth weight ($r=0.872$, $P<0.0001$ and $r=0.918$, $P<0.001$) respectively.

Singh et al (1988) conducted a study to derive simple tri colouredmeasuring tapes, for identification of low birth weight babies by community health workers. A total of 446 singleton neonates were subjected to

measurements of birth weight, chest circumference and mid arm circumference. Mid arm circumference of 9 cm correlates well with birth weight <2500 gm& 8.5 cm with 2000 gm. Tri coloured tapes proposed as simple screening tool for use by primary health workers, for identifying low birth weight neonates in community, without resorting to weighing scales.

JN Sharma, BS Sharma, ML Gupta, S Saxena, U Sharma (1986), conducted a study on mid arm circumference, as a predictor of low birth weight and neonatal mortality. The study was conducted at State Zanana Hospital, Jaipur, by Department of Pediatric Medicine, SMS Medical Collge, Jaipur. 1000 newborns were screened within 24 hours of birth. Mid arm circumference highly correlated with birth weight (P<0.001) and mid arm circumference of <=8.6, <=7.4, <=6.1 cm, had the best sensitivity and specificity for identifying babies with weight of <=2500 gm, <=2000gm, <=1500 gm respectively.

METHODOLOGY

Study Place:

The babies included in this study were the babies delivered at Raja Mirasudar Hospital, attached to the Thanjavur Medical College, Thanjavur.

Study Period:

Study Period was over a period of 10 months from October 2014 to July 2015.

Inclusion criteria:

Babies delivered at GRMH, attached to Thanjavur Medical College.

Exclusion Criteria:

- Babies more than 24 hours of life.
- Babies with gross congenital anomalies of extremities.

Sample selection:

By a random sampling, 300 babies were included in this study by the above criteria.

Background of the study:

All the selected babies are clinically examined, and their birth weight midarm circumferences and foot length were recorded. Age of the mother, were recorded with a fair degree of accuracyin the following proforma.

Name and inpatient number of the baby	Birth weight (in gm)	Mid arm circumference (in cm)	Foot length (in cm)	Age of the mother

Weight of the new-born were measured using electronic weighing scale of accuracy 10 grams. Weighing machines were calibrated each time before measurement with a known weight and corrected to zero error.

The mid arm circumference was measured by using a non stretchable tape, to the nearest 0.1 cm.

For uniformity, the right mid arm circumference was measured at a point between the tip of the Olecranon process of ulna and the Acromian process of scapula. While measuring the circumference, the tape was pressed gently.

Foot length measured by vernier's caliper from right Big toe to heel.

STATISTICAL ANALYSIS

Principles:

Birth weight was the gold standard against which mid arm circumference was evaluated as a surrogate in his study to detect low birth weight.

Frequency, mean birth weight and mid arm circumference were calculated. All the values were tabulated. From the table, sensitivity and specificity, positive and negative predictive values, for various values of mid arm circumference, corresponding to birth weight of <2500 gm and <2000gm, were calculated.

Simple regression between various mid arm circumferences and birth weights constructed and equation derived, to calculate the birth weight, if mid arm circumference is known.

Multiple regression between and mid arm circumference and birth weight, age of the mother were tabulated, to know their influence over mid arm circumference.

Frequency, mean birth weight and foot length were calculated. All the values were tabulated. From the table, sensitivity and specificity, positive and

negative predictive values, for various values of mid arm circumference, corresponding to birth weight of <2500 gm and <2000gm, were calculated.

Oneway ANOVA study between age of the mother with birth weight, age of the mother with mid arm circumference was done and its results were analyzed.

Analysis:

All the values, birth weight in gm, mid arm circumference in cm, foot length in cm, age of the mother were tabulated.

In this study, cut off point for low birth weight babies, of weights <2500, <2000 gm, against various mid arm circumferences (dependent variable) like 8, 9, 10, 11, 12 cm and foot length as < 7 cm, 7-8 cm, > 8 cm are evaluated.

From the above values, by using various statistical methods the following, were derived.

- **Frequency –** of birth weight and mid arm circumference, foot length
- **Mean –** of birth weight and mid arm circumference, foot length

- **Simple and Multiple correlation –** between various birth weights and mid arm circumferences, foot length
- **Chi – square test –** For testing the efficiency of the hypothesis, birth weight (constant) and mid arm circumference (dependant variable).

Determining diagnostic efficiency of values, (Bayes theorem)

MAC	Birth Value 1	Weight Value II	
Value I	A	b	a+b
Value II	C	d	c+b
Total	a+c	b+d	N

Sensitivity (a/a+c):

This is the probability that a diseased individual will have a positive test result, hence the true positive rate of the test.

Specificity (d/b+d):

This is the probability that a diseased individual will have a negative test result, hence the true positive rate of the test.

Predictive Value Positive (a/a+b):

This is the probability that an individual with a positive test result has the disease.

Predictive Value Negative (d/c+b):

This is the probability that anindividual with a negative test result does not have the disease.

REGRESSION

This is used to describe the dependence of one characteristic (y) upon the other characteristic (x). Both x and y, representing the value of two characteristics (a,b are constants are computed from the data).

- Y= a+bx

If y, is mid arm circumference, by using this formula, mid arm circumference for the given birth weight, can be calculated. If y is birth weight, birth weight with for the given mid arm circumference, can be calculated.

- **Simple regression –** Mid arm circumference (dependant variable), birth weight (constant variable).

- **Multiple regression –** In the multiple regression model, the study assumes that a linear relationship exists between some variables y (dependant variable) and independent variables x1, x2, x3 like that. Independent variables are also known as explanatory variables or predictor variables, because of their use in predicting y. The study improves our predicting. Here, y is mid arm circumference, xl is birth weight, x2 is age of the mother.

ANOVA study (Analysis of variance)

It is used when simltaneous comparisons are made of measurements from more than two samples. When measurement data are influenced by several kinds of effects operating simultaneously this statistical technique is adopted to decide which effects are important and to estimate such effects.

In this study

- Effects of age over the birth weight
- Effects of age over the mid arm circumference of the baby are evaluated.

Duncan's post HOC test is used when the ANOVA shows significant difference. It is used for forming homogenous sub groups.

Charts:

Histogram and Scatter plot are drawn by using mid arm circumference as a dependant variable.

Frequency of birth weight:

Birth weight (in grams)	Number of babies	Frequency
<2000	21	7%
<=2500	109	36%
>2500	190	64%

Frequency of mid arm circumference:

Mid arm circumference	Number of babies	Frequency
<=8	6	2.1%
<9	54	18%
< 10	199	66%
< 11	283	94.8%
< 12	297	99%
> 12	3	1%

Mean of mid arm circumference for birth weight <2000 gm:

Number of babies	Mean MAC in cm
21	8.519

Mean of mid arm circumference for birth weight <=2500 gm:

Number of babies	Mean MAC in cm
109	9.178

Mean mid arm circumference and birth weight for the study population

	Valid	Mean statistics	Standard	Standard deviation
MAC	300	9.803	3114E/02	0.830
Birth weight	300	2711.74	16.60	442.51

Standard error is measure, which enable us to judge whether the mean of a given sample is within the set confidence limit or not.

In the above study,

The standard error for mean mid arm circumference is 0.031 cm with a standard deviation of 0.830

The standard error for mean birth weight is 16.60 gm with standard deviation of 442.51

In this tabular column birth weight of 2500 gm is used as a cut off, mid arm circumference of below and above 8 cm correlated against birth weight of below and above 2500gm.

	<=2500gm	> 2500gm	Total
MAC <=8 cm	5 (a)	1 (b)	6
MAC > 8 cm	104 (c)	190 (d)	294
	109	191	300

P value < 0.001

If 8 cm of mid arm circumference is used as cut off value of 2500 grams of birth weight, the following values are derived.

- Sensitivity - 0.04%
- Specificity - 99.4%
- Positive predictive value - 83.3%
- Negative predictive value - 64.6%

Chi-square test: (x2 test – test of significance)

It offers the alternate method of testing the significance of difference between two proportions derived from the following formula.

X2=Ep (0-E) 2/E

Ep – summation; 0-sample counts of individual; E-expected frequency.

If birth weight of 2500gm used as a cut off mid arm circumference of less than and above 8 cm correlated against the birth weight of less than and above 2500 gm.

	Value	Degree of freedom	Significance
Pearson Chi-square	21.286b	1	0.000

b – 0 cells (0%) have expected counts less than 5. The minimum expected count is 5.49.

The test of significance is 0.000 and it is highly significant.

In this tabular column birth weight of 2500 gm is used as a cut off, mid arm circumference of below and above 9 cm correlated against birth weight of below and above 2500 gm.

	<=2500gm	> 2500gm	Total
MAC <=9 cm	45 (a)	9 (b)	54
MAC > 9 cm	64 (c)	182 (d)	246
	109	191	300

P value < 0.001

If 9 cm istaken as cut off value of 2500 grams of birth weight, the following values are derived.

- Sensitivity - 41%
- Specificity - 95%
- Positive predictive value - 83%
- Negative predictive value - 73%

Chi-square test: (x2 test – test of significance)

	Value	Degree of freedom	Significance
Pearson Chi-square	153.808	1	0.000

b – 0 cells (0%) have expected counts less than 5. The minimum expected count is 46.81.

The test of significance is 0.000 &it is highly significant.

In this tabular column birth weight of 2500 gm is used as a cut off, mid arm circumference of below and above 11 cm correlated against birth weight of below and above 2500 gm.

	<=2500gm	> 2500gm	Total
MAC <=11 cm	109 (a)	174 (b)	283
MAC >11 cm	0 (c)	17 (d)	17
	109	191	300

P value < 0.001

If 11 cm is taken as cut off value of 2500 grams,then the following values are derived.

- Sensitivity - 100%
- Specificity - 8%
- Positive predictive value - 39%
- Negative predictive value - 100%

Chi-square test

	Value	Degree of freedom	Significance
Pearson Chi-square	23.788	1	0.000

b – 0 cells (0%) have expected counts less than 5. The minimum expected count is 14.26

The test of significance is 0.000 and it is highly significant.

In this tabular column birth weight of 2000 gm is used as a cut off, mid arm circumference of below and above 8 cm correlated against birth weight of below and above 2000gm.

	<=2000gm	> 2000gm	Total
MAC <=8 cm	4 (a)	2 (b)	6
MAC > 8 cm	17 (c)	277 (d)	294
	21	279	300

P value < 0.001

If 8 cm is taken as cut off value for birth weight 2000 grams, then the following values are derived.

- Sensitivity - 19%
- Specificity - 99%
- Positive predictive value - 66%
- Negative predictive value - 94%

Chi-square test:

	Value	Degree of freedom	Significance
Pearson Chi-square	98.526	1	0.000

b – 1 cells (25 %) have expected counts less than 5. The minimum expected count is 1.10.

The test of significance is 0.000 & it is highly significant.

In this tabular column birth weight of 2000 gm is used as a cut off, mid arm circumference of below and above 9 cm correlated against birth weight of below and above 2000gm.

	<=2000gm	> 2000gm	Total
MAC <=9 cm	20 (a)	34 (b)	54
MAC >9 cm	1 (c)	245 (d)	246
	21	279	300

P value < 0.001

If 9 cm is taken as cut off value for birth weight 2000 grams, then the following values are derived.

- Sensitivity - 95%
- Specificity - 87%
- Positive predictive value - 37%
- Negative predictive value - 99%

Chi-square test:

	Value	Degree of freedom	Significance
Pearson Chi-square	178.518	1	0.000

b – 0 cells (0 %) have expected counts less than 5. The minimum expected count is 9.36.

The test of significance is 0.000 & it is highly significant.

In this tabular column birth weight of 2000 gm is used as a cut off, mid arm circumference of below and above 10 cm correlated against birth weight of below and above 2000gm.

	<=2000gm	> 2000gm	Total
MAC <=10 cm	21 (a)	178 (b)	199
MAC >10 cm	0 (c)	101 (d)	101
	21	279	300

P value < 0.001

If 10 cm is taken as cut off value for birth weight 2000 grams, then the following values are derived.

- Sensitivity - 100%
- Specificity - 36%
- Positive predictive value - 11%
- Negative predictive value - 100%

Chi-square test:

	Value	Degree of freedom	Significance
Pearson Chi-square	28.408	1	0.000

b – 0 cells (0 %) have expected counts less than 5. The minimum expected count is 17.48.

The test of significance is 0.000 & it is highly significant.

This study employs regression equations to lend support to the hypothesis regarding the possible causation of changes in mid arm circumference by changes in birth weight.

	Unstandardized Coefficients	Standard error	Unstandardized Coefficients	t	Significance
Constant	-1390391 (a)	121.941		-11.402	0.000
MAC	418.442 (b)	12.394	0.785	33.761	0.000

P value <0.000

a=-1390.391} both are constant

b=418.442 }

y=birth weight

x=mid arm circumference

So birth weight can be calculated by using this formula

y=a+bx

for example :

the mid arm circumference is 9.5 cm

birth weight (y) = -1390.391 + (418.442 X 9.5)

= 2584 gm

The strength of the relationship between the dependant variable and the explanatory variable can also be estimated by calculating co efficient of multiple correlation (R). R2 measures the population of the total variation in the dependantvariable, which can be explained by variations in the explanatory variable. The unexplained variations may be due to other variables, which have not been included in the regression equations. The R2 for the table is as follows.

R	R2	Standard error for equation
0.785a	0.617	0.515

a=constant (birth weight)

the R2 value is 0.617 which mean the accuracy of the above formula is 61%. It is affected by other variables, which is not included in this study.

Multiple regression coefficients

Model	Unstandardized B	Coefficients Standard error	Unstandardized Coefficients	T	Significance
Constant	5.674	0.166		34.179	0.000
Birth weight	1.436 E-03	0.000	0.809	27.724	0.000
Mother's age (x2)	3.838E-03	0.003	0.037	1.256	0.210

dependant variable is (y), mid arm circumference

independent variable x 1 = birth weight

x 2 = mother's age

The significance value for age is more than 0.05. So it is not a useful tool in this study. The R2 value for the above table is as follows:

Model	R	R2	Standard error
1	0.818 a	0.669	0.459

The R2 value is 0.669, which means, the accuracy of the above regression coefficient is 66%. It is affected by other variables, which is not included in this study.

ANOVA is used for testing the equality of 3 or more means. Here it is used for testing the equality of mean birth weight of new born babies between the 3 age group of their mothers viz: 15 to 24, 25 to 34 & above 35. The results are given below.

Descriptive:

BW & Age Group	N	Mean	Standard deviation	Standard error	95% confidence lower bound	Interval for mean Upper bound
15-24	81	2711.66	419.52	30.20	2652.10	2771
25-34	96	2760.84	450.88	29.99	2701.74	2819
Above 35	123	2673.80	448.49	26.25	2622.15	2725
Total	300	2711.74	442.51	16.60	2679.16	2744

The above table given the mean weight of the newborn babies for the 3 age groups of mother. The mean weight of the babies for the women in the age group of 15 to 24 is 2712 grams. It is 2761 grams for the women in the of 15 to 24 is 2712 grams. It is 2761 grams for the women in the group of 25 to 34 and it is 2764 grams for the women above 35 years of age.

ANOVA

Birth Weight	Sum of squares	Mean square	F	Significance
Between groups	965147.2	482573.6	2.475	0.045
Within groups	1.4E+08	195006.1		
Total	1.4E+08			

From the above ANOVA table, the significant value is 0.045 is less than 0.05, the level of significance. This study concludes, the mean weight, of the newborn babies are significantly different between the 3 age groups of their mothers.

Post Hoc Tests – Homogeneous Subsets Birth weight

Age group	N	Subset for 1	Alpha = 0.05 2
Above 35	123	2673.80	
15-24	81		2711.66
25-34	96		2760.84
Significance		1.000	0.232

Duncans' post hoc test is used when the ANOVA shows significant difference. It is used for forming homogeneous sub groups. The mean birth weight of the babies for the mothers' above the age of 35 is only 2674 grams, which is significantly lower than birth weight of the new born babies for the mothers in the age group of 15-24 and 25-34 with mean weight of 2712 & 2761 gram respectively.

In this tabular column birth weight of 2000 gm is used as a cut off,foot length of below and above 7 cm correlated against birth weight of below and above 2000gm.

	<=2000gm	> 2000gm	Total
FL <=7 cm	2 (a)	0(b)	2
FL > 7 cm	50(c)	248 (d)	298
	52	248	300

P value < 0.001

If 7 cm of foot length is used as cut off value of 2000 grams of birth weight, the following values are derived.

- Sensitivity - 55%
- Specificity - 100%
- Positive predictive value - 100%
- Negative predictive value - 83%

X2=9.564

Df=1

0.002<0.05(significant)

In this tabular column birth weight of 2000 gm is used as a cut off,foot length of below and above 8 cm correlated against birth weight of below and above 2000gm.

	<=2000gm	> 2000gm	Total
FL <=8 cm	29 (a)	7(b)	36
FL > 8 cm	23(c)	241 (d)	264
	52	248	300

P value < 0.001

If 8 cm of foot length is used as cut off value of 2000 grams of birth weight, the following values are derived.

- Sensitivity - 38%
- Specificity - 97%
- Positive predictive value - 80%
- Negative predictive value - 91%

The test of significance is 0.000 and it is highly significant.

In this tabular column birth weight of 2500 gm is used as a cut off,foot length of below and above 7 cm correlated against birth weight of below and above 2000gm.

	<=2500gm	> 2500gm	Total
FL <=7 cm	2 (a)	0(b)	2
FL > 7 cm	105(c)	193 (d)	298
	107	193	300

P value < 0.001

If 7 cm of foot length is used as cut off value of 2500 grams of birth weight, the following values are derived.

- Sensitivity - 2%
- Specificity - 100%
- Positive predictive value - 100%
- Negative predictive value - 65%

X2=3.613

Df=1

0.002<0.05(significant)

In this tabular column birth weight of 2500 gm is used as a cut off,foot length of below and above 8 cm correlated against birth weight of below and above 2500gm.

	<=2500gm	> 2500gm	Total
FL <=8 cm	36 (a)	1(b)	37
FL> 8 cm	71(c)	192 (d)	263
	107	193	300

P value < 0.001

If 8 cm of foot length is used as cut off value of 2500 grams of birth weight, the following values are derived.

- Sensitivity - 33%
- Specificity - 99%
- Positive predictive value - 97%
- Negative predictive value - 73%

The test of significance is 0.000 and it is highly significant.

INTERPRETATION OF STATISTICAL ANALYSIS

From a total of 300 babies, 109 babies (36%) had birth weight of <=2500 gm. 21 babies weighing <2000gm, constitutes 6% of the study population.

In this study, various mid arm circumference values from 8 cm to 11 cm evaluated for predict birth weight of <2000 & 2500 gm.

In this study, foot length values from 7 cm to 9 cm evaluated for predicting birth weight of <2000 & 2500 gm.

Analysis of different cut off limits of mid arm circumference, with various sensitivity and specificity, for the identification of low birth weight babies<=2500gm, given below:

MAC in cm	8	9	10	11
Sensitivity	0.04%	41%	93%	100%
Specificity	99%	95%	49%	8%
Positive predictive value	83%	83%	51%	39%
Negative predictive value	65%	73%	93%	100%
Chi- square test	21.286%	153.808%	130.862%	23.788%

P value < 0.001

In this study the best cut off limit of mid arm circumference is <=10 cm for identification of babies weighing 2500 gm& less.

Analysis of different cut off limits of mid arm circumference for the identification of low birth weight babies <=2000 gm, with various sensitivity and specificity as given below:

MAC in cm	8	9	10	11
Sensitivity	19%	95%	100%	100%
Specificity	99%	87%	36%	6%
Positive predictive value	63%	37%	11%	8%
Negative predictive value	94%	99%	100%	100%
Chi- square test	98.526%	178.518%	24.40%	3.25%

P value < 0.001

In this study the best cut off limit of mid arm circumference is <=9 cm for identification of babies weighing 2000 gm& less.

Analysis of different cut off limits of foot length, with various sensitivity and specificity, for the identification of low birth weight babies<2500gm, given below:

Foot length in cm	8	9
Sensitivity	19%	33%
Specificity	100%	99%
Positive predictive value	100%	97%
Negative predictive value	65%	93%

P value < 0.001

In this study the best cut off limit of foot length is <8 cm for identification of babies weighing 2500 gm& less.

Analysis of different cut off limits of foot length for the identification of low birth weight babies <2000 gm, with various sensitivity and specificity as given below:

Foot length in cm	7	8
Sensitivity	55%	4%
Specificity	100%	97%
Positive predictive value	100%	80%
Negative predictive value	83%	91%

P value < 0.001

In this study the best cut off limit of foot lengthis <=7 cm for identification of babies weighing 2000 gm& less.

Multiple regression:

Mid arm circumference:

Affected by birth weight (P<0.000) and not affected by age of the mother (P<0.210)

Analysis of Variance:

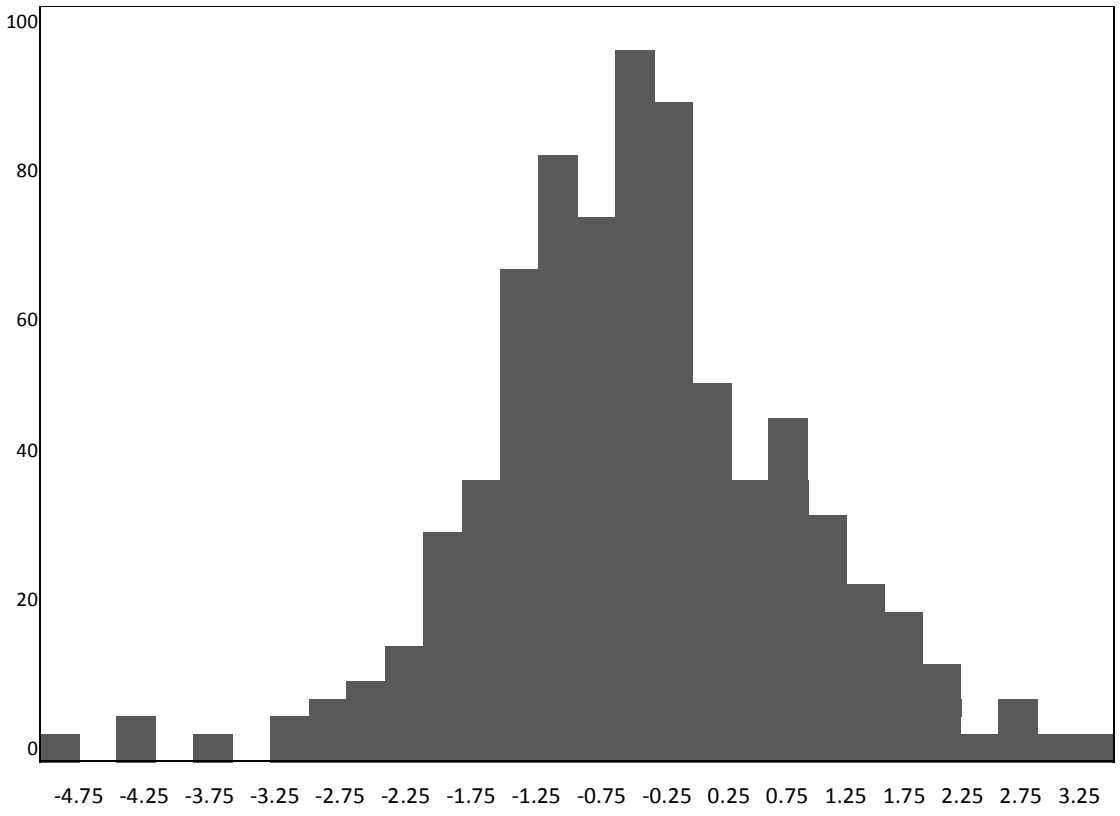
Birth weight influenced by age of the mother (P<0.045).

Mid arm circumference of the baby not influenced by age (P<0.495).

CHARTS

Histogram

Dependent Variable: MAC

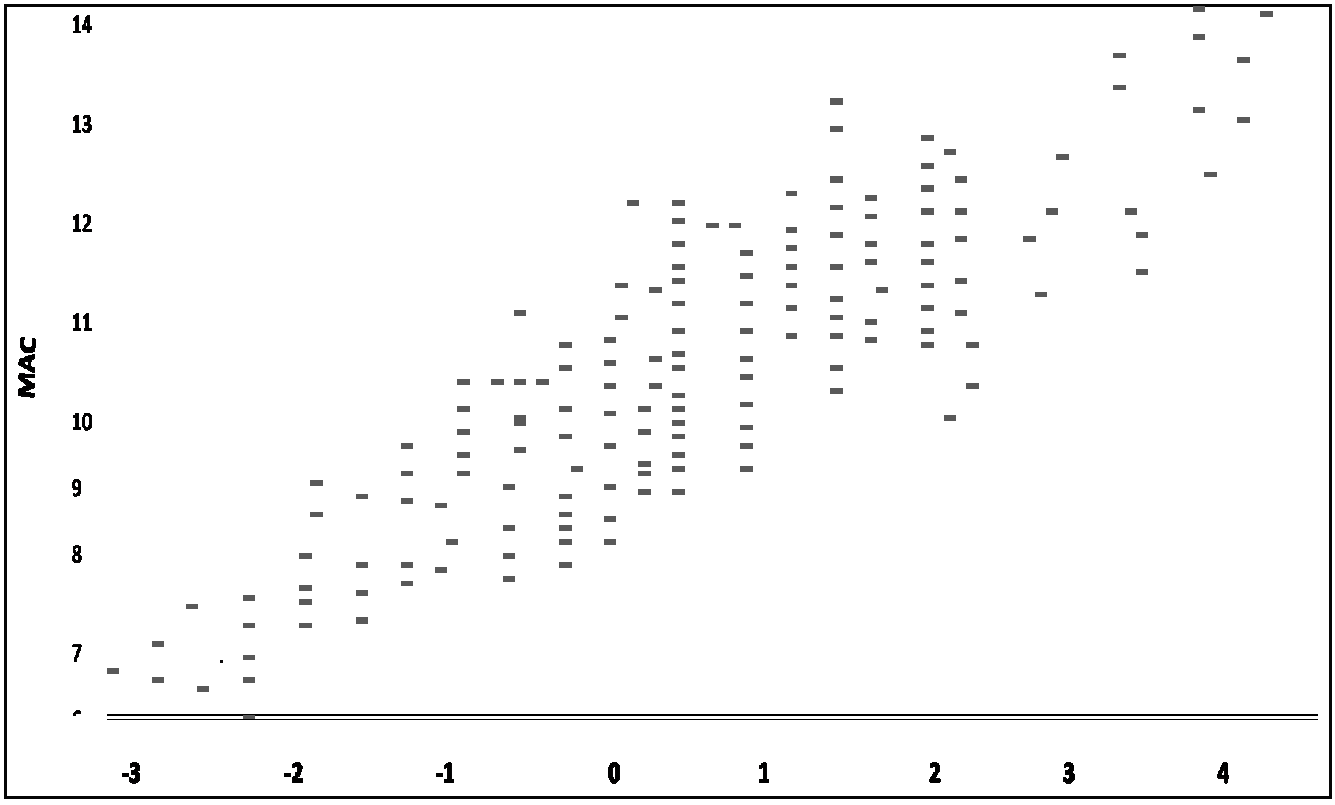


Regression Standardized Residual

The histogram confirm that the variable mid arm circumference follows a normal distribution.

Scatterplot

Dependent Variable: MAC



Regression Standardized Predicated Value

The Scatterplot shows that the variable mid arm circumference and the birth weight are highly correlated.

DISCUSSION

The results of the study clearly establishes the usefulness of mid arm circumference as an indicator of low birth weight. According to the World Health Organization, the cut off point for defining the low birth weight is 2500 grams. But a birth weight of 2000 grams is considered as a more appropriate criteria for defining low birth weight among Indian population.

The incidence of low birth weight babies <=2500 grams, in this is study is 36%. It is within the national incidence of low birth weight babies (30-40%). The mean birth weight of this study population is 2711 grams. The mean mid arm circumference of this study population is 9.8 cm.The mean foot length of this study population is 8.4 cm.Various studies conducted all over the world to know the correlation between birth weight,mid arm circumference and foot length gives various mid arm circumferences,foot length as a cut off point. At any cut of f level, some false positive, as well as some false negative bound to occur. The studies are tabulated below:

Study table

Author	Year	Place	Population	Results
BhargawaRamiji Mohan et al	1985	Rural Delhi	520	8.7 cm of MAC for BW <2500 gm
JN Sharma BS Sharma et al	1986	Jaipur	1000	8.6cm of Mac<2500 gm of BW, 7.4 of MAC for <2000 gm
Singh et al	1988	Rural Haryana	446	MAC of 9 cm for BW of 2500 gm, 8.5cm for BW of 2000 gm
Huque AH Hussain AM	1991	Bangladesh	-	8.6cm of MAC for VW <2500 gm
Mohan et al	1991	Urban Hyderabad	2925	8.6cm MAC for BW 2500 gm, 7.4 cm of Mac for BW of 2000 gm
Kulkarni AP Sathe PV	1993	Aurangabad	-	9 cm of MAC for BW <2500 gm
Raymond	1994	Ethiopia	-	9 cm MAC for BW

				<2500 gm
Kapoor SK Kumara G Anand K	1996	Ballabgarh Rural North India	733	8.5 cm of MAC for BW <2500 gm
Mohanty C Das BK	1997	Varanasi	385	8.5 cm MAC for BW <2500 gm
Ahamed Kareem et al	2000	Assam	1667	9 cm MAC for BW <2500 gm
GC Samal et al	2000	Orissa	1580	8.3 cm MAC for BW <2500 gm
SL Sood GL Saiprasad CG Wilson	2002	Pune	1272	8.6 cm MAC for BW <2000 gm
CS Yajnik et al	2003	Pune, UK	631 in India 331 in UK	MAC highly correlated with BW
Bhai IA et al	2003	Jaipur	199	9.94 cm MAC for BW<2500 gm

In this study, various mid arm circumference values form 8 cm to 11 cm evaluated to predict birth weight of <20000 & 2500 gm.

In this study the best cut off limit of mid arm circumference is <=10 cm for identification of babies weighing <=2500 gm and 9 cm for <2000 gm. The mid arm circumference value obtained by this study, coincides with the earlier study results.

Bhai (MAC 9.94 cm for <=2500gm)

SL Slood (MAC 8.6 cm for <2000 gm)

Ahamed Kareem (MAC 9 cm for <2500 gm)

Raymond (MAC 9 cm for <2500 gm)

Kulkarni (MAC 9 cm for <2500 gm)

Singh (MAC 9 cm for <2500 gm)

However, the sensitivity, specificity, positive and negative predictive values are different.

In this study the best cut off limit of mid arm circumference is <=10 cm for identification of babies weighing 2500 gm and less. However, at this limit, there is a possibility of missing above 7% of low birth weight babies, as the sensitivity is 93%.

The specificity for this mid arm circumference is 49%, which means 51% of the referred has low birth weight requiring re-screening.

If the mid arm circumference value is <=9 cm, specificity increased to 95%, which means, only 5% of the referred population needs re-screening, but, sensitivity of this value reduced to 41%, which means 59% of the low birth weight babies <2500 mg may be missed. Since the condition being screened is a life threatening one, it may not be desirable to miss as many low birth weight babies.

If the mid arm circumference value is <=11cm, sensitivity increased to 100%, which means no low birth weight babies <2500 gm missed by this cut off. But, specificity for this value is only 8%, which means 92% of the referred babies needs re-screening. Referral of those babies will put a greater load on the referral centres.

So, the best mid arm circumference cut off value for <=2500 gmweighing baby is <=10cm with a sensitivity of 93% and with a specificity of 49% and the positive predictive value of 5%, negative predictive value of 93%.

In this study the best cut off limit of mid arm circumference is <=9 cm for identification of babies weighing 2000 gm and less. However, at this limit there is a possibility of missing above 5% of low birth weight babies, as the

sensitivity is 95%. The specificity for this mid arm circumference is 87%, which means 13% of the referred, has low birth weight requiring re-screening.

If the mid arm circumference value is <=8 cm, specificity increased to 99%, which means, only 1 % of the referred population needs re-screening, but sensitivity of this value reduced to 19% which means 81% of the low birth weight babies <2000 gm may be missed. Since the condition being screened is a life threatening one, it may not be desirable to miss as many low birth weight babies.

If the mid arm circumference value is <=10 cm, sensitivity increased to 100%, which means no low birth weight babies <2000 gm missed by this cut off. But, specificity for this value is only 36%, which means 64% of the referred babies needs re-scanning. Referral of those babies will put a greater load on the referral centres.

So, the best mid arm circumference cut off value for a baby weighing <=2000 gm is <=9 cm with a sensitivity of 95% & with a specificity of 87% and the positive predictive value of 37%, negative predictive value of 99%.

In this study, various foot length values from 7 cm to 9 cm evaluated to predict birth weight of <20000 & 2500 gm.

In this study the best cut off limit of foot length is <=8 cm for identification of babies weighing <=2500 gm and<=7 cm for <2000 gm. The foot length value obtained by this study, coincides with the earlier study results.

Iranian journal of foot length(FL <7cm- <1.5 kg)

(FL <8cm-< 2.5 kg)

James DK et al(6)-1979 in Manchester.

Hirne et al(9),Pune- India.

Mullany et al(10)-2007,Nepal.

Taiwan(11)in 2009(FL <7.2cm-<1.5 kg)

(FL<7.9cm-<2.5 kg)

However, the sensitivity, specificity, positive and negative predictive values are different.

In this study the best cut off limit of foot length is <=8 cm for identification of babies weighing 2500 gm and less. However, at this limit, there is a possibility of missing above 67% of low birth weight babies, as the sensitivity is 33%.

The specificity for this foot length is 99%, which means 1% of the referred has low birth weight requiring re-screening.

If the value is <=7 cm, specificity increased to 100%, which means 0% of the referred population needs re-screening, but, sensitivity of this value reduced to 2%, which means 98% of the low birth weight babies <2500 mg may be missed. Since the condition being screened is a life threatening one, it may not be desirable to miss as many low birth weight babies.

So, the best foot length cut off value for <=2500 gm weighing baby is <=8cm with a sensitivity of 33% and with a specificity of 99% and the positive predictive value of 97%, negative predictive value of 73%.

In this study the best cut off limit of foot length is <=7 cm for identification of babies weighing 2000 gm and less. However, at this limit there is a possibility of missing above 45% of low birth weight babies, as the sensitivity is 55%. The specificity for this foot length is 100%, which means 0% of the referred, has low birth weight requiring re-screening.

If the foot length is <=8 cm, specificity decreased to 97%, which means, only 3 % of the referred population needs re-screening, but sensitivity of this value reduced to 4% which means 96% of the low birth weight babies <2000 gm may be missed. Since the condition being screened is a life threatening one, it may not be desirable to miss as many low birth weight babies.

So, the best foot length cut off value for a baby weighing <=2000 gm is <=7 cm with a sensitivity of 55% & with a specificity of 100% and the positive predictive value of 100%, negative predictive value of 83%.

Usefulness of the study:

Devising a tape with 3 colour zones for field use:

a. From the finding of the study, a tape with 3 coloured zones can be devised, to identify <2000 gm with the following measurements:

Red (at risk): <= 9cm

Yellow (border line): 9-10 cm

Green (normal): >10 cm

b. From the finding of the study, a tape with 3 coloured zones can be devised, to identify <2500 gm with the following measurements:

Red (at risk): <= 10cm

Yellow (border line): 10-11 cm

Green (normal): >11 cm

The birth attendants and any community volunteers, in rural areas can be easily trained about the use of this tape. So, they also take part for the identification of low birth weight babies(shared care programme). So that they can identify the

babiesfalling in the Yellow zone managed in the homes under the supervision of health care workers. The babies falling in Red zone – immediately referred to higher centers for further management. Even the mothers can be given this tape during the antenatal visits. So that they can also identify at risk babies and come to Primary Health Centers for further advice.

Deriving the formula:

To calculate the birth weight from the given mid arm circumference calculated by using the following formula.

Birth weight = -1390.391+(418.442 X MAC)

To calculate the mid arm circumference for the given birth weight, the following formula can be used:

MAC -= 5.808 + 0.001473 X BW)

The accuracy of the above formula is 61%, it is affected by other variable which is not included in this study.

The effect of birth weight, maternal age of the mother over the mid arm circumference is studied by multiple regression model.

The significance value for age of the mother is more than 0.05. So mid arm circumference is not influenced by maternal age in this study.

Mid arm circumference affected by birth weight (P<0.000) and not affected by age of the mother (P<0.210).

Birth weight influenced by age of the mother (P<0.045) a and mid arm circumference of the baby not influenced by age (P<0.495) of the mother.

SUMMARY OF

THE STUDY

The present study is an attempt, in evaluating the utility of mid arm circumference to detect the low birth weight in neonatal period, the influence of age of the mother over their babies mid arm circumference. To measure the foot length and analyse its correlation with the birth weight, and to compare mid arm circumference and foot length with respect to their influence over birth weight. The study was conducted at the Post Natal Wards of the Raja Mirasudar Hospital, attached to Thanjavur Medical College Hospitals, Thanjavur. By random sampling with prescribed inclusive criteria, total of 300 babies within 24 hours of life, were screened over a period of 10 months. The incidence of low birth weight in this study is 36% with mean birth weight of 2711 gmand mean mid arm circumference of 9.8 cm. Mid arm circumference, highly correlated with weight (P<0.001). A mid arm circumference of <10 cm, predicts a birth weight of <=2500gm, with a sensitivity of 93% and specificity of 49% Mid arm circumference of <=9 cm, predicts a birth weight of <=2000 gm, with a sensitivity of 95% and specificity of 87%.

In this study,foot length highly correlated with birth weight(P<0.001).A foot length of <8 cm, predicts a birth weight of <=2500gm, with a sensitivity of 33% and specificity of 99% .Foot length of <=7 cm, predicts a birth weight of <=2000 gm, with a sensitivity of 55% and specificity of 100%.Regression

values were analysed and formula for detecting birth weight for the given mid arm circumference was derived. Multiple regression show mid arm circumference affected by birth weight (P<0.000) and not affected by age of the mother (P<0.210). ANOVA correlating birth weight with age of the mother had high significance (P<0.045),ANOVA correlating mid arm circumference with age of the mother had no significance (P<0.495).

CONCLUSION OF

THE STUDY

Mid arm circumference is a reliable indicator for low birth weight. A positive correlation existed between mid arm circumference and birth weight ($P<0.001$).

A cut off value of 10 cm of mid arm circumference for identification of low birth weight babies weighting <=2500 gm, and 9 cm of mid arm circumference for identification of low birth weight babies <=2000 gm, with optimum sensitivity and specificity.

A cut off value of 8 cm of foot length for identification of low birth weight babies weighting <=2500 gm, and 7 cm of foot length for identification of low birth weight babies <=2000 gm, with optimum sensitivity and specificity.

Mid arm circumference affected by birth weight ($P<0.000$) and not affected by age of the mother.

Birth weight affected by age of the mother ($P<0.045$).

The formulae were derived for detecting the birth weight and mid arm circumference, for a given mid arm circumference and birth weight respectively with an accuracy of 61%.

Tri coloured tape, developed for detecting low birth weight babies, at field.

On comparing mid arm circumference and foot length in determining birth weight of babies,both of them are found to have their influence over birth weight.In this study,mid arm circumference has got more sensitivity in determining the weight of low birth weight babies when compared to foot length.

Measurement of newborn mid arm circumference and foot length for home births in resource poor settings has the potential to be used by birth attendants, community volunteers or parents as a screening tool to identify low birth weight or premature newborns in order that they can receive targeted interventions for improved survival.

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PROFORMA

NAME:

SI.NO:

AGE:

SEX:

ADDRESS:

DATE OF BIRTH:

TIME OF BIRTH:

HOURS OF LIFE:

SOCIO ECONOMIC STATUS :

BIRTH WEIGHT:

GESTATIONAL AGE ASSESSMENT:

PRE-TERM :

TERM :

POST TERM:

GENERAL EXAMINATION:

EXAMINATION OF EXTREMITIES:

1.LIMB ANOMALIES:PRESENT/ABSENT

2.ANY EVIDENCE OF FRACTURE OF EXTREMITIES:PRESENT/ABSENT

MID ARM CIRCUMFERENCE:

FOOT LENGTH:

CONSENT FORM

I _____ hereby give consent to participate in the study conducted by **Dr.B.MATHIANA,** Post graduate in the Department of Paediatrics, Thanjavur Medical College & Hospital, Thanjavur – 613004 and to use my personal clinical data and result of investigation for the purpose of analysis and to study the nature of disease. I also give consent for further investigations

Place :

Date :

Signature of participant

MASTER CHART

MASTER CHART

NAME	IP.NO	HOL	SEX	GESTATION AGE	B.WT(KG)	MAC(CM)	FL(CM)	AGE OF MOTHER
B/O VENNILA	373234	4 hrs	MCH	38 weeks	2.75	8.8cm	8cm	30 yrs
B/O PICHAIYAMMAL	373266	3 hrs	FCH	39 wks+1 day	2.5	10cm	7.9	30yrs
B/O MOHANA	373262	3 hrs	FCH	40 wks	3	9.8cm	8.5	24
B/O KAMALA	373400	2 hrs	FCH	38wks+6days	3.25	9.8	8.5	24
B/O KAVITHA	373385	3 hrs	FCH	37wks+2 days	3.25	9.8	8.5	24
B/O KALAIMATHI	373246	2 hrs	MCH	28wks+6days	1.2	7.6	6.9	21
B/O SATHYA	373247	10 hrs	FCH	39wks	2.75	8.2	8.1	22
B/O VIDHYA	373411	9hrs	FCH	39wks+2days	2.6	9.4	8.3	23
B/O DHIVYA	373415	9 hrs	MCH	38wks+3days	2.75	8.8	8.3	23
B/O KOWSALYA	373359	11 hrs	FCH	39wks	3	10.1	8.4	30
B/O GENMA RAGINI	373409	8 hrs	FCH	36wks	1.95	8.2	7.8	30
B/O ELAVARASI	373390	7hrs	FCH	37wks+2 days	1.8	9.1	8	27
B/O SHYAMALA	373419	6 hrs	FCH	39wks+2days	2.5	9.8	8	36
B/O JABAMALAI RANI	373274	11hrs	FCH	39wks+4days	2.75	9.2	8.3	24
B/O MAHALAKSHMI	372321	6 hrs	FCH	40wks	3	9.7	9	24
B/O ARTHI DEVI	363006	6hrs	FCH	38wks	2.2	7.9	7.3	24
B/O MUTHULAKSHMI	373083	7hrs	FCH	39+4days	3	9.8	8.7	22
B/O UMA MAHESHWARI	372287	6hrs	MCH	40+3days	3	9.4	8.6	23
B/O DEVIKA	372624	5hrs	MCH	41wks	3	9.4	8.6	23
B/O MALATHI	373049	5hrs	MCH	42wks	3.1	9.6	8.5	24
B/O BHUVANA DEVI	373083	3hrs	MCH	38wks+1day	2.8	9.5	8.7	20
B/O HELLEN CARMEL	372617	3hrs	FCH	32wks	1.5	7.8	7.1	22
B/O SHILPA KAVINILA	372655	2hrs	FCH	37wks+2 days	2.7	9.7	8.1	32
B/O JEEVITHA	373325	3hrs	MCH	36wks+5days	2.75	9.3	8.2	21
B/O GOMATHY	373317	2hrs	FCH	40wks	2.75	10	8.7	23
B/O RAMYA	372551	2hrs	FCH	39wks	3	10.1	8.4	25
B/O ESWARI	373182	8hrs	FCH	38+2days	3.2	9.9	8.4	29
B/O NASREEN JEBAIR	373287	6hrs	MCH	40wks	3	9.2	8.7	25
B/O LATHA	373131	5hrs	MCH	40wks	3	9.2	8.3	25
B/O PRIYADHARSINI	373284	8hrs	MCH	36wks	1.7	7.8	7.1	22
B/O MEGHALA	373295	3hrs	MCH	38+5days	3	9.7	8.9	26
B/O MADHAVI	373264	6hrs	MCH	40wks	3.75	10	9	27
B/O SASIKALA	372281	2hrs	MCH	37wks+2 days	2	9.2	8.2	23
B/O SUMAIYA BEGUM	372289	11hrs	MCH	39	2.6	9.6	8.3	27
B/O KANAGA	371758	10hrs	MCH	36wks	2.4	9.1	8.1	20
B/O VIJAYALAKSHMI	373280	9hrs	FCH	37wks	1.8	8	7.2	22
B/O MUTHULAKSHMI	373305	12hrs	FCH	34wks	1.8	8	7.4	35

B/O SUNDARI	373259	10hrs	MCH	36wks	2.9	9.6	9	26
B/O SARASWATI	373312	12hrs	FCH	35wks	2.6	9.7	8.2	24
B/O DHIVYA	372663	8hrs	MCH	40wks	2.5	9.3	8	21
B/O SOWNDHARYA	372386	6hrs	FCH	40wks	2.75	9.2	8.7	26
B/O MARIYA ANGEL	373247	3hrs	MCH	39wks+3days	3	9.8	9	24
B/O LAKSHMI	373271	2hrs	MCH	39	2.4	9.1	8.1	20
B/O BHUVANESHWARI	373032	1hr	MCH	40wks	2.75	9.2	8.7	20
B/O SHANTHI	373191	2hrs	MCH	38	3	9.2	8.6	27
B/O BAGYAM	373289	4hrs	FCH	31wks	1.25	7.7	7	22
B/O SUGANTHY	371596	8hrs	MCH	40wks	2.8	9.6	8.9	23
B/O NALINI	373282	11hrs	MCH	38wks	2.7	9.7	8.3	23
B/O SHENBAGAM	373273	7hrs	FCH	39	2.9	9.6	8.9	20
B/O PRAVEENA	372957	8hrs	FCH	36wks	2.4	9.1	8.1	26
B/O KAVITHA	373140	13hrs	FCH	38wks	3.2	9.8	8.6	20
B/O LAKSHMI	373255	14hrs	FCH	39wks	1.9	8	7.4	28
B/O CHINNA ROJA	373189	12hrs	MCH	38wks	3.4	10	8.6	24
B/O RANJITHA	372942	9hrs	MCH	37wks+4 days	3	9.4	8.3	31
B/O SIVARANJANI	373227	10hrs	MCH	38wks	2.2	9.1	8	27
B/O PAVITHRA	373265	7hrs	MCH	38wks	2.6	9.4	8.4	21
B/O NANDHINI	373046	6hrs	MCH	41wks	2.75	9.6	8.2	32
B/O RADHA	373160	6hrs	FCH	38wks+4days	2.5	10.5	8.1	24
B/O VELLIMALAR	372798	5hrs	FCH	41wks+2days	3.1	10.2	8.5	26
B/O UMA	373218	7hrs	FCH	38wks	2.2	9.2	8.1	21
B/O DHIVYA BHARATHY	373026	4hrs	FCH	37wks+2 days	3.1	9.7	8.5	25
B/O KOWSALYA	372495	4hrs	FCH	40wks	2.75	8.8	8.3	25
B/O VELLAIYAMMAL	373237	6hrs	MCH	35wks	2.4	9.4	8.1	25
B/O ANITHA	372626	9hrs	MCH	37wks	3.2	9.7	8.6	21
B/O VEMBARASI	372729	8hrs	FCH	39wks	3.75	10	9	22
B/O PODHUM PONNU	373092	6hrs	MCH	35wks	1.9	8	7.2	29
B/O KANCHANA	372264	6hrs	MCH	40wks	3	9.8	8.2	25
B/O RAMAJEYAM	372371	5hrs	FCH	40wks	2.3	9.2	8.3	30
B/O REKHA	372054	4hrs	MCH	38wks	3.2	10	9.1	28
B/O GAYATHRI	372958	3hrs	MCH	37wks	3.4	9.8	8.8	22
B/O PRIYA	373034	10hrs	FCH	35wks	2.1	9	8	22
B/O NADHIYA	373141	9hrs	MCH	36wks	2.4	9	8	28
B/O SUDHA	373113	10hrs	MCH	37wks	1.75	9.1	8.2	30
B/O ADAIKALA MARY	371242	8hrs	FCH	37wks	2.5	10.4	8.2	24
B/O RENUGA	372683	8hrs	MCH	40w+3days	2.5	8.7	8.1	27
B/O RADHA	372091	12hrs	FCH	40wks	2.7	9.8	8.7	26

B/O NITHYA	373146	9hrs	FCH	37wks	2.4	9.3	8.1	25
B/O LAKSHMI	373045	11hrs	MCH	39wks	3	9.8	8.6	26
B/O JAYALALITHA	373077	4hrs	MCH	36wks	1.9	9	8.3	24
B/O KEERTHIGA	373076	3hrs	MCH	34wks	1.8	9.2	8.2	30
B/O NADHIYA	372752	2hrs	FCH	32wks	1.9	8.9	8	24
B/O ARUL MARY	373180	6hrs	MCH	40wks	3	9.8	8.8	25
B/O JAYASHREE	373106	5hrs	MCH	40wks	3	9.7	8.7	27
B/O CHITHRA	373111	5hrs	FCH	39wks	1.8	8.8	8	29
B/O MARIYAMMAL	373080	4hrs	FCH	35wks	1.8	8	7.2	21
B/O SAGUNTHALA	372145	2hrs	MCH	34wks	1.9	8	7.2	27
B/O SUDHA	372689	1hr	FCH	37wks	2	9.2	8	28
B/O SUGANYA	372797	12hrs	FCH	39wks	2.6	9.6	8.3	27
B/O DURGADEVI	373074	10hrs	FCH	39wks	3	9.8	8.7	20
B/O YOGANAYAKI	372986	11hrs	MCH	40wks	3	9.9	8.9	22
B/O RADHIKA	371901	9hrs	FCH	39wks	2.7	9.7	8.8	35
B/O MARIYAMMAL	371830	8hrs	MCH	38wks	2.9	9.7	8.4	27
B/O SATHYA	372346	10hrs	MCH	39wks	3.75	10.1	8.7	24
B/O SUDHA	372961	8hrs	MCH	40wks	2.5	10.5	8.3	21
B/O SUDHA	372556	6hrs	MCH	36wks	2.4	9.4	8.4	22
B/O SHARMILA	373086	7hrs	MCH	38wks	2.5	10.3	8.3	26
B/O KALAIVANI	373101	3hrs	FCH	39wks+3days	2.2	9.4	8.2	24
B/O INDRA PRIYADARSHINI	372750	2hrs	FCH	39wks+2days	3.8	10.2	8.9	20
B/O KAVITHA	372699	1hr	FCH	40wks	2.6	7.9	7.4	26
B/O KAVITHA	372953	3hrs	MCH	36wks	2.3	9.1	8.2	24
B/O PAPPU	372819	8hrs	MCH	40wks	2.8	9.8	8.4	28
B/O TAMILARASI	373016	10hrs	FCH	38wks	2.7	9.6	8.9	24
B/O REVATHY	373059	6hrs	FCH	39wks	3.2	9.8	8.7	25
B/O ANBARASI	372969	7hrs	FCH	38wks	2	9	8.1	26
B/O MUTHUKUMARI	372515	4hrs	MCH	37wks	1.8	9.6	8.2	28
B/O BHAVANI	372460	12hrs	MCH	37wks	2.8	9	8.6	28
B/O PALANIYAYI	370809	6hrs	FCH	38wks+2days	2.75	9.7	8.8	31
B/O CHANDRA RAJAKUMARI	362702	8hrs	MCH	38wks	1.8	8.8	8.1	28
B/O MAHALAKSHMI	372681	6hrs	FCH	40wks	3.1	9.9	8.6	37
B/O KANMANI	372155	8HRS	FCH	40WKS	3	9.8	8.7	21
B/O SARANYA	370227	6HRS	FCH	39WKS	3	9.9	8.4	24
B/O RANJANA	373085	8HRS	MCH	40WKS	2.6	9.5	8.3	28
B/O THENMOZHI	372932	10HRS	MCH	38WKS	1.8	8.7	8	21
B/O SARANYA	373057	12HRS	FCH	39WKS	2.4	9.2	8.2	26
B/O BAIRAVI	372748	8HRS	FCH	40WKS	2.6	9.6	8.2	21

B/O PUNITHAVATHI	372426	2HRS	MCH	40WKS	2.7	10	8.8	26
B/O SATHYA	372953	6HRS	FCH	40WKS	2.5	10.1	8.6	28
B/O SUBATHRA	372938	4 hrs	MCH	40WKS	3.5	10.3	8.8	22
B/O SUNDARI	373038	6HRS	MCH	40WKS	3.2	10.1	8.7	28
B/O SUDANDIRA DEVI	372963	8HRS	FCH	38WKS	3.3	10.4	8.9	25
B/O SUGANYA	372818	6 HRS	MCH	39WKS	2.7	10	8.7	26
B/O SUGANYA	372761	5 HRS	FCH	39WKS	2.5	10.2	8.3	22
B/O NITHYA	372413	6HRS	MCH	39WKS	2.5	10.1	8.4	25
B/O SANGEETHA	372604	12 HRS	FCH	39WKS	2.75	10.1	8.9	29
B/O MADHAVI	372640	13HRS	FCH	39WKS	1.9	9.2	8.2	31
B/O KASTHURI	371467	12HRS	FCH	39WKS	3.2	10.2	8.8	22
B/O KRITHIGA	372920	13HRS	FCH	38WKS	2.5	10	8.2	35
B/O KRITHIKA	372786	10HRS	MCH	38WKS	3	10	8.6	32
B/O RAMYA	372802	2HRS	MCH	38WKS	2.25	9.7	8.1	25
B/O UMA MAHESHWARI	372725	12 HRS	FCH	38 weeks	2.8	10	8.9	21
B/O BUVANESHWARI	372813	1 HR	MCH	38 weeks	2.75	10.2	8.8	26
B/O JENIFER	372941	10 hrs	FCH	38 weeks	2	8.9	7.9	21
B/O SIVARANJANI	372946	11hrs	FCH	38 weeks	2.9	10	8.8	21
B/O GUNASEKARI	372578	3 hrs	FCH	40 wks	2.9	9.9	8.8	28
B/O PONMANI	371528	18 HRS	FCH	39 WEEKS	3.5	10.4	8.8	21
B/O KAVITHA	372782	20 HRS	MCH	38 weeks	2.3	8.8	7.7	20
B/O LAKSHMI	372734	12 HRS	MCH	38 weeks	2.8	9.9	8.7	24
B/O JAYANTHI	372785	11 hrs	FCH	39 WEEKS	3	10.1	8.9	28
B/O INDHRA	372202	20 HRS	MCH	38 weeks	2.6	9.9	8.7	19
B/O RESHMA	371129	12 HRS	MCH	38 weeks	2.9	10	8.6	21
B/O JAYANTHI	372738	11 hrs	FCH	40 WEEKS	3.2	10.2	9	25
B/O REKHA	372796	3 hrs	MCH	37 WEEKS	2.3	8.9	8.2	24
B/O KEERTHANA	372766	10 hrs	MCH	39 WEEKS	2.75	10.1	8.8	21
B/O KAVITHA	372816	8 hrs	MCH	38 weeks	3	10	8.8	35
B/O TAMIL SELVI	372661	14 HRS	FCH	39 WEEKS	2.6	9.9	8.5	30
B/O MARIAMMAL	372736	3 hrs	MCH	38 weeks	3.25	10.3	8.9	23
B/O RADHIKA	372767	4 hrs	MCH	40 WEEKS	2.5	10	8.7	27
B/O JEYADEVI	372774	11 hrs	FCH	40 WEEKS	3.4	10.4	9	20
B/O SUGANYA	372041	2 hrs	FCH	38 weeks	2.25	9.6	8.6	22
B/O MARIAMMAL	372731	13 HRS	MCH	37 WEEKS	2.4	10.2	8.1	36
B/O CHANDRA	372277	10 HRS	MCH	39 WEEKS	2.8	10	8.7	33
B/O POOPATHI	372795		FCH	38 WEEKS	1.9	8	7.3	28
B/O BUVANESHWARI	372577		FCH	36 WEEKS	2.64	10	8.8	22
B/O USHADEVI	372657		MCH	36 WEEKS	3	10.1	8.8	23
B/O AKILA	372723		MCH	36 WEEKS	1.8	8.5	8.1	24

B/O KARTHIGA	372606		FCH	36 WEEKS	1.85	8.9	7.8	24
B/O ZYLA	372717		MCH	36 WEEKS	3	10	8.8	27
B/O KALAISELVI	372684		MCH	36 WEEKS	2.5	10.2	8.8	27
B/O ANBARASI	372600		MCH	36 WEEKS	2.9	10.1	9	24
B/O SASIKALA	372728		MCH	38 weeks	3.8	10.8	9.1	28
B/O MAHADEVI	372616		MCH	40 WEEKS	3.6	10.5	9.2	25
B/O MANJULA	372620		FCH	37 WEEKS	3.8	10.7	9	26
B/O KALAIMATHI	371949		FCH	38 weeks	2.7	9.5	8.6	24
B/O KAVITHA	372754		FCH	41 WEEKS	1.9	8.4	8.1	20
B/O NIVETHA	372722		FCH	39 WEEKS	3.5	10.4	9.3	20
B/O MAHADEVI	372756		FCH	38 weeks	3	11.2	9	20
B/O KAVITHA	372702		MCH	34WEEKS	1.8	8	7.5	28
B/O SUDHA	372706		FCH	39 WEEKS	3.2	11.4	8.8	28
B/O UDAYANANDINI	372700		FCH	38 weeks	3.2	11.2	9.1	26
B/O AMBIGA	372609		MCH	37 WEEKS	1.9	9.1	8.3	24
B/O JAYAPRADHA	372713		MCH	38 weeks	2.5	8.9	8	21
B/O SITA	372483		MCH	36 WEEKS	3.6	11.6	8.6	23
B/O SARANYA	372579		FCH	38 weeks	2.25	8.6	8.2	22
B/O JENOVA	372144		FCH	36 WEEKS	2.8	8.9	8	29
B/O SASIKALA	371777		FCH	38 weeks	3.5	11.4	9.1	27
B/O KRISHNAVENI	372685		FCH	40 WEEKS	2.9	11.1	9	27
B/O SARANYA	372636		FCH	37 WEEKS	3.2	11.4	8.9	24
B/O AMALORBA RITA	372678		FCH	39 WEEKS	2.4	10.5	8.2	24
B/O MUTHULAKSHMI	371936		FCH	38 weeks	2.6	8.7	8.1	24
B/O INDHRA	372498		MCH	39 WEEKS	2.7	11.1	9	34
B/O PREMA	372135		FCH	38 weeks	3.5	11.5	9.1	28
B/O LATHA	371521		FCH	37 WEEKS	2.8	9.7	8.6	21
B/O REHANA	372602		MCH	40 WEEKS	2.8	11.2	8.8	22
B/O MEENA	372469		MCH	38 weeks	3.1	11.5	8.6	21
B/O DAMAYANDI	372667		FCH	38 weeks	2.7	9.8	8.7	24
B/O USHA	372257		FCH	37 WEEKS	2.8	9.7	8.6	26
B/O UMA	372638		FCH	38 weeks	3	9.9	8.7	27
B/O SARITHA	372613		FCH	38 weeks	2.9	9.7	8.8	27
B/O AMALA	372662		FCH	38 weeks	3	9.8	8.8	23
B/O VALLI	372071		FCH	39 WEEKS	2.6	8.8	8.5	26
B/O PRABA	372267		MCH	38 weeks	3	9.8	8.7	21
B/O PRIYANKA	372650		MCH	38 weeks	3.3	9.9	8.9	24
B/O KALAIVANI	372142		FCH	38 weeks	3.2	10.5	8.8	23
B/O RAJESWARI	372083		FCH	38 weeks	2.7	9.6	8.4	23
B/O EZHILARASI	371159		FCH	38 weeks	3	9.8	8.8	30
B/O VANITHA	372554		FCH	38 weeks	2.9	9.7	8.7	34

B/O ARULMOZHI	371996		MCH	38 weeks	2.4	10.5	8.2	24
B/O MUTHULAKSHMI	371940		FCH	34 WEEKS	2.4	8.6	8.1	28
B/O RASHMI	372473		MCH	36 WEEKS	2.2	8.2	7.9	28
B/O REKHA	372562		FCH	34 WEEKS	2.3	8.5	8	20
B/O BANUPRIYA	372336		MCH	40 WEEKS	3	9.8	8.6	22
B/O JAYANTI	372490		MCH	36 WEEKS	2.3	8.2	8.2	27
B/O MAHITHA	372615		MCH	38 weeks	3.7	11.6	8.8	35
B/O VELLAIYAMMAL	372552		FCH	34 WEEKS	2.4	10.3	8.2	26
B/O SUGANYA	372472		MCH	34WEEKS	1.8	8.1	7.8	27
B/O GOWTHAMI	372619		FCH	36 WEEKS	2.2	10.1	8.7	21
B/O GAYATHRI	372120		MCH	40 weeks	2.75	8.9	8.4	19
B/O SARANYA	372555		FCH	38 weeks	2.6	9.3	8.4	23
B/O RADHIKA	372471		MCH	35 weeks	1.7	8	7.4	21
B/O AAROKYA VINOTHA	372573		FCH	40 WEEKS	3.5	11.5	8.9	25
B/O DEVI	372543		MCH	36WEEKS	1.9	8.1	7.7	22
B/O PRIYA	372564		FCH	35WEEKS	1.9	8.1	7.8	26
B/O SUMITHRA	371875		FCH	37WEEKS	2.7	8.8	8.2	34
B/O ANNAKILI	371874		FCH	39WEEKS	3	11.2	8.7	28
B/O RAJESHWARI	377279		FCH	35WEEKS	2.4	8.7	7.9	24
B/O RAMASUGUNA	372544		MCH	35WEEKS	2.3	8.6	7.9	24
B/O RADHA	372357		FCH	37WEEKS	1.7	8	7.4	26
B/O AMALA	372342		MCH	40WEEKS	3	11.2	8.9	23
B/O PARAMESHWARI	372435		MCH	40WEEKS	2.7	9.4	8.7	23
B/O PARAMESHWARI	372390		MCH	40WEEKS	3.25	11.5	8.8	24
B/O NITHYA	372391		MCH	34WEEKS	1.8	9	7.9	23
B/O LAVANYA	372428		MCH	38WEEKS	2.6	9.4	8.8	28
B/O SASIKALA	371309		FCH	34WEEKS	2	8.2	7.6	23
B/O THENMOZHI	372531		MCH	38WEEKS	1.9	9.2	7.9	25
B/O FATHIMA BEEVI	372403		MCH	39WEEKS	3.3	11.4	8.8	30
B/O DIVYA	372399		FCH	40WEEKS	2.6	9.3	8.4	22
B/O THENMOZHI	372363		MCH	36WEEKS	1.8	9.1	7.9	20
B/O DHANALAKSHMI	372534		FCH	40WEEKS	2	8.3	8	25
B/O REVATHY	371795		MCH	37WEEKS	3.3	9.9	8.9	26
B/O MAHALAKSHMI	372542		FCH	40WEEKS	2.7	9.7	8.6	27
B/O SUMATHI	372547		MCH	40WEEKS	3	9.8	8.7	34
B/O SUGANTHI	372540		MCH	40WEEKS	2.7	9.7	8.6	24
B/O MAHESWARI	372387		MCH	40WEEKS	2.9	9.7	8.8	28
B/O PUSHPAMALATHI	372508		FCH	35WEEKS	1.9	9.2	7.6	25
B/O MAHESWARI	372488		FCH	40 WEEKS	3.5	9.9	8.7	28
B/O GOMATI	372463		MCH	40 WEEKS	2.75	9.7	8.4	30

B/O SALPA	372336		MCH	38 weeks	3.1	9.8	8.7	20
B/O RAJINIKANTH	372516		MCH	37 WEEKS	2.5	10.7	8.4	33
B/O REKHA	372514		FCH	39 WEEKS	2.7	9.6	8.5	27
B/O VASUGI	372486		MCH	38 weeks	2.8	9.6	8.6	28
B/O RAGINI	372469		FCH	37 WEEKS	3	10.4	8.8	26
B/O VENNILA	372464		MCH	36 WEEKS	2.85	9.7	8.6	32
B/O MANVIZHI	372502		FCH	37 WEEKS	2.6	9.6	8.4	26
B/O RAJESWARI	371294		FCH	40 WEEKS	2.5	8.6	8.3	27
B/O RANI	372401		MCH	39 WEEKS	2.9	10.2	8.6	30
B/O NIRMALA	372190		FCH	36 WEEKS	2.3	8.4	8.1	24
B/O ILAVARASI	372411		MCH	38 weeks	2.7	10.3	8.6	27
B/O ROJA	372394		FCH	38 weeks	3.3	10.6	8.9	29
B/O SANGEETHA	372478		MCH	33 WEEKS	2.6	9.5	8.5	23
B/O GEETHA	372392		FCH	35 WEEKS	3	10.3	8.7	37
B/O ANANDHI	372434		MCH	37 WEEKS	3.2	10.4	8.6	23
B/O POONGODI	371800		FCH	38 weeks	3	10.3	8.5	27
B/O BAAN BASWARI	371134		FCH	37 WEEKS	2.8	10.3	8.4	25
B/O JAMUNA RANI	372420		FCH	41 WEEKS	2.7	9.6	8.2	27
B/O ANBUSELVI	372403		MCH	37 WEEKS	2.7	9.5	8.3	28
B/O VIYAKULA KALAIYARASI	372458		MCH	39 WEEKS	2.8	10.2	8.5	20
B/O KRISHNAVENI	372410		MCH	37 WEEKS	2.5	8.8	8.3	24
B/O SANGARI	372430		MCH	41 WEEKS	3.4	10.5	8.8	26
B/O SRIDEVI	369420		MCH	34 WEEKS	3	10.6	8.7	38
B/O SATHYA BARATHI	371798		FCH	37 WEEKS	3.3	10.5	8.9	22
B/O MAHALAKSHMI	372361		FCH	39 WEEKS	2.9	10.4	8.3	21
B/O BOOPATHY	372334		MCH	40 WEEKS	2.4	10.3	8.2	26
B/O JAQULIN PRIYA	372132		MCH	39 WEEKS	1.8	9.1	7.9	23
B/O SARITA	372368		FCH	39 WEEKS	2.5	8.7	8	29
B/O SELVARANI	372384		MCH	38WEEKS	1.8	9	7.8	20
B/O SRIDEVI	372340		FCH	41WEEKS	2.4	9.1	8.2	22
B/O THILAGAVATHI	372374		FCH	38WEEKS	2.9	10.3	8.6	25
B/O RAJAMANI	372372		MCH	40WEEKS	3	9.8	8.7	30
B/O RENUGA	372350		MCH	39WEEKS	3.25	10.6	8.9	21
B/O THENMOZHI	372331		FCH	40WEEKS	2.6	9.3	8.3	22
B/O MANGAYARKARASI	372391		MCH	40WEEKS	2.61	9.5	8.4	26
B/O ANBARASI	372388		MCH	40WEEKS	2.8	10.3	8.8	26
B/O PUSHPAVALLI	372437		MCH	41WEEKS	1.8	9.1	7.8	24
B/O PALANITHA	372359		FCH	36WEEKS	1.9	9.2	7.9	24
B/O MUTHULAKSHMI	372270		MCH	40WEEKS	2.72	10.4	8.6	30

B/O MEGALA	372367		MCH	40WEEKS	3.11	9.8	8.9	22
B/O KAYALVIZHI	372295		MCH	40WEEKS	2.64	10.2	8.4	22
B/O MALATHI	371928		FCH	34WEEKS	1.9	9	8.1	28
B/O KANAGA	372199		MCH	40WEEKS	2.6	9.4	8.2	25
B/O SUGANTHI	371935		MCH	40 WEEKS	2.75	10.4	8.5	27
B/O MALAR	371637		MCH	39 WEEKS	1.9	9.2	8	22
B/O SHARMILA	372254		MCH	39 WEEKS	2.25	8.8	8.1	28
B/O UDHAYA	372269		MCH	39 WEEKS	2.4	10.6	8.2	23
B/O SARANYA	372353		MCH	38 weeks	2.6	9.3	8.5	23
B/O ANBUKARASI	371954		MCH	36 WEEKS	1.9	9.1	7.9	34
B/O NANDHINI	371952		FCH	35WEEKS	1.8	9	7.8	20
B/O RAJESHWARI	372191		FCH	37 WEEKS	1.9	9.2	8	27
B/O VASANTHI	372262		MCH	39 WEEKS	2.8	10.1	8.4	27
B/O SURYA	371992		MCH	40 WEEKS	3.2	10.6	8.8	24
B/O ANBUKARASI	371446		MCH	38 weeks	2.6	10.2	8.6	25
B/O DEVI	371796		FCH	38 weeks	3.2	10.6	8.9	28
B/O MALATHY	371654		FCH	38 weeks	2.6	10.1	8.5	29
B/O REVATHY	372265		FCH	39WEEKS	3	10.5	8.7	26
B/O JHANSIRANI	371794		MCH	38 weeks	2.6	10.1	8.6	24
B/O SASIKALA	371960		FCH	38 weeks	2.9	10.2	8.8	24
B/O SIVARANJANI	372207		MCH	40 WEEKS	3.2	10.6	8.7	23
B/O RAMASELVI	371750		FCH	40 WEEKS	2.6	9.4	8.5	29
B/O NANDHINI	371662		MCH	37 WEEKS	3.2	10.7	8.8	23
B/O CHITRAVALLI	372188		MCH	34WEEKS	1.8	9.1	8	30
B/O RADHA	372111		FCH	39 WEEKS	2.6	9.5	8.1	27