The Medical Journal of Tikrit University (2023) 29 (1): 127-138
DOI: http://doi.org/10.25130/mjotu.29.1.127-138

IRAQI Academic Scientific Journals

ISSN: 1813-1638

The Medical Journal of Tikrit University

Available online at:www.mjotu.com

MJTU

The Medical Journal of Tikrit University

Evaluating Maturity by Using Mid Upper Arm Circumference among Neonates at Salahadeen General Hospital

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***Keywords*:**

Maturity , Mid , Upper , Arm , Circumeference , Neonates.

ARTICLE INFO

Article history:

Received	04 Jan 2023
Accepted	26 Feb 2023
Available online	31 Jun 2023

Citation: Thamer J.; Omar M. Abd-almoula; Luay A.; Evaluating Maturity by Using Mid Upper Arm Circumference among Neonates at Salahadeen General Hospital. The Medical Journal of Tikrit University (2023) 29 (1): 131-142

DOI: http://dx.doi.org/10.25130/mjotu.29.1.9

ABSTRACT

Background: Anthropometry is the single most easily available, universally applicable, does not need expertise, economical, and non-invasive method of assessing body composition. It reflects both the health and nutrition of human body and predicts performance, health, and survival. Aim of the present study evaluating the efficacy of mid-arm circumference in assessing birth weight and maturity among new born

Methodology: A cross sectional study done in Salah Aldeen general hospital in the Tikrit city during the period from the (1st November 2021 to 1st April 2022). During the period of the study had a total of 200 neonates were selected randomly. Each newborn was examined and mid upper arm circumference was measured, birth weight was measured with a calibrated digital weighing scale to the nearest 10 g.

Results: Most of the preterm babies had mid upper arm circumference of ≤9.25 cm 47(90.4%) significantly higher than the full-term babies most of them had mid upper arm circumference of >9.25 cm 126(85.1%). The mid upper arm circumference is good parameter for diagnosing of prematurity with sensitivity of 90.4%, specificity (85%) and accuracy of the test was (87%). The PPV for diagnosing low prematurity was (68%) and the negative predictive value was (96.2%). Most of the Low birth weight babies had MUAC of ≤9.25 cm 53(93 %) while the Normal birth weight babies most of them had MUAC of >9.25 cm 127(88.8%) this relation was statistically significant.

Conclusions: Mid upper arm circumference could be used as a diagnostic tool to identify low birth weight and preterm newborns needing extra care when taken at birth and up to day 7 of life.

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Introduction:

Mothers and neonatal are disproportionately influenced by conflict [1,2]. Mutability due to conflict disrupts coverage of important Maternal, Neonatal, and Child Health (MNCH) services and undermines the health workforce's capability to respond to health prerequisites [3,4].

A convergence of factors, including health facilities' infrastructural damage, flight of the health workforce, interrupted access to essential information and social services, population displacement, and exposure to violence, drive the increase in maternal, newborn, and child deaths.

Poor antenatal care is detrimental to maternal health and affects fetal and neonatal health [5]. This can be apparent in anthropometric indicators such as a low mid-upper arm circumference (MUAC), which is considered a reliable predictor of pregnancy outcome. The advantage of MUAC for screening women at risk of poor pregnancy outcomes is reassuring both on theoretical grounds (it reveals maternal fat and/or lean tissue stores), because of the relationship between MUAC and weight [6,7, 10], and because it is independent of gestational age [8,9].

Birth weight is an essential factor in evaluating newborn health. Low birth weight has been clarified by the World Health Organization (WHO) as a weight at birth of fewer than 2500 grams (5.5 pounds). This practical cutoff for international comparison is based on epidemiological observations that infants weighing less than 2500 grams are approximately 20 times more likely to die than heavier babies [11].

Methodology

A cross-sectional study was done in Salah Aldeen general hospital in Tikrit city from (1 st November 2021 to 1st April 2022).

During the study, a total of 200 children were collected. The data of children between the age (of 0 weeks to 1weeks) was obtained using a

questionnaire shown in appendix 1. In addition, the neonatal care unit included records of inpatients and children brought in.

Inclusion criteria

All newborns aged (0-1 week) at Salahadeeen general hospital that their parents agreed to enroll in the study.

Most of the mothers aged 20-30 years , followed by 16-20 years , and > 30 years . Most of mothers had primary and secondary education followed by uneducated .

Exclusion criteria

• Newborns with congenital malformation of the left upper arm. (includings chromosomal disorders)

• Birth injury of the left upper arm. Either dute IUGR or multiple gestation.

Measurements

A neonatal mid-upper arm circumference (MUAC) assessment was performed for each newborn. Mid-arm circumference - measured by non-stretchable measuring tape to the nearest of 0.1 cm of left arm at the

midpoint between the tip of acromion process and olecranon process.

. Birth weight – babies were weighed naked on the electronic weighing scale

Measurements of weight were done 3times, and the mean used in the analysis

Gestational age calculation depends on the last menstrual period and on ultrasonic examination if we are not sure about

Gestational age and newborn maturity are measured depending on

1- The last menstrual period (LMP) + 280 days (40 weeks) for women with regular, 28-day menstrual cycles

2- depending on Ultrasonographic measurements of the fetus in the first trimester.

3- The New Ballard score (NBS) was used if the above two measures are not applicable. The NBS utilized 13 physical and neurological signs to evaluate maturity. Prematurity was

identified as gestational age AG <37 weeks.

The area below the receiver operating characteristic curve (AUC) for MUAC as predictor of the low birth weight was (95%) (95%CI 0.92 to 0.98) .

Results

Most of the sample was male gender 124(62%) in comparison to female 76(38%), most of the sample living in Urban area 137(68.5%) in comparison to rural area 63(31.5%). Most of the mothers aged 20-30 years 163(81.5%) followed by 16-20 years 22(11%), and > 30 years 15(7.5%). Most of mothers had primary and secondary education 101(50.5%) followed by uneducated 84(42%). Most of mothers from middle socioeconomic status followed by low socioeconomic status 72(36%), as shown in table 4.1.

Table 4.1: The general characteristics of the sample

General characteristics		Frequency	Percent
Gender	Male	124	62
	Female	76	38
Residence	Rural	63	31.5
	Urban	137	68.5
Age of mother	16-20 years	22	11
	20-30 years	163	81.5
	>30 years	15	7.5
Level of education	uneducated	84	42
	primary and secondary	101	50.5
	high educated	15	7.5
Socioeconomic status	Low	72	36
	Middle	113	56.5
	High	15	7.5
	Total	200	100

The mean gestational age of the neonate was (37.2±3.5), mean birth weight was (3.9±1.8), MUAC (9.5± 1.1), as shown in figure 4.1.

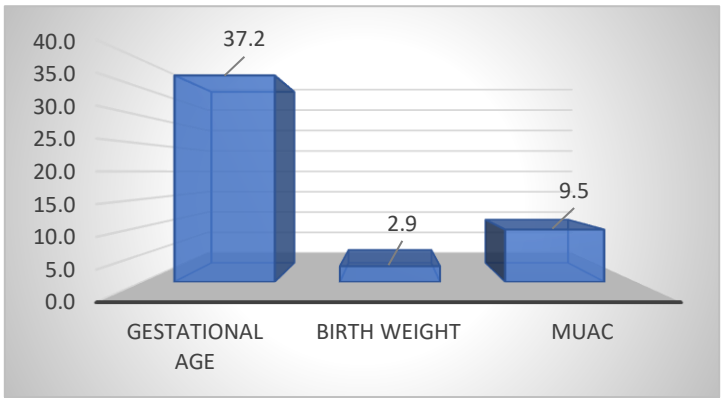


Figure 4.1. The mean gestational age, birth weight and MUAC

The mean gravidity was (3.02 ± 1.7), the mean parity was (2.57 ± 1.5), the mean abortion was (0.38 ± 0.7). the antenatal infection and complication were as following: skin rash and infection 18(9%), drug intake 33(16.5%), exposure to radiation 3(1.5%), gestational diabetes 24(12%), Uterine malformation3(1.5%), Preeclampsia18(9%), Smoking3(1.5%), history of polyhydramnios 6(3%), history of placental disorders6(3%), as shown in table 4.2.

Table 4.2: The Antenatal history of the mothers

Antenatal history		Frequency	Percent
gravida (mean±SD)		3.02 ± 1.7	
Para(mean±SD)		2.57 ± 1.5	
Abortion(mean±SD)		0.38 ± 0.7	
Skin rash and fever	Yes	18	9
	x	182	91
Drug intake	Yes	33	16.5
	x	167	83.5
Exposure to radiation	Yes	3	1.5
	x	197	98.5
Gestational diabetes	Yes	24	12
	x	176	88
Uterine malformation	Yes	3	1.5
	x	197	98.5
Preeclampsia	Yes	18	9
	x	182	91
Smoking	Yes	3	1.5
	x	197	98.5
history of polyhydramnios	Yes	6	3
	x	194	97
history of placental disorders	Yes	6	3
	x	194	97
Total		200	100

The natal history were as following:191(95.5%) delivered at hospital, 3(1.5%) at home , other place like midwife home or privet clinic was 6(3%), most of the casearian section was emergency 117(58.5), followed by elective 22(11%), vaginal delivery was 61(30.5%). history of previous prematurity found among 12(6%), as shown in table 4.3.

Table 4.3: The Natal history of the neonate mothers

natal history		Frequency	Percent
Place of delivery	Hospital	191	95.5
	Home	3	1.5
	Other	6	3
Type of delivery	elective	22	11
	Emergency	117	58.5
	vaginal delivery	61	30.5
NUD obstructed prolong	Yes	18	9
	No	182	91
history of previous prematurity	Yes	12	6
	No	188	94
Total		200	100

The Postnatal history were as following: immediate crying 161(80.5%), time of discharge from hospital (24-48)hr 96(48%), NICU admission 95(47.5%), Neonatal jaundice 42(21%), and Neonatal fit 18(9%), as shown in table 4.4.

Table 4.4. The Postnatal history of the neonate

Postnatal history		**Frequency**	**Percent**
immediate crying	**Yes**	161	80.5
	No	39	19.5
time of discharge from hospital (24-48)hr	**Yes**	96	48
	No	104	33.5
NICU admission	**Yes**	95	47.5
	No	105	52.5
Neonatal jaundice	**Yes**	42	21
	No	158	79

Postnatal history		Frequency	Percent
Neonatal fit	**Yes**	18	9
	No	182	91
Total		200	100

The area below the receiver operating characteristiccurve (AUC)for MUAC as predictor of the low birth weight was (95%) (95%CI 0.92 to 0.98),), as shown in the figure 4.2

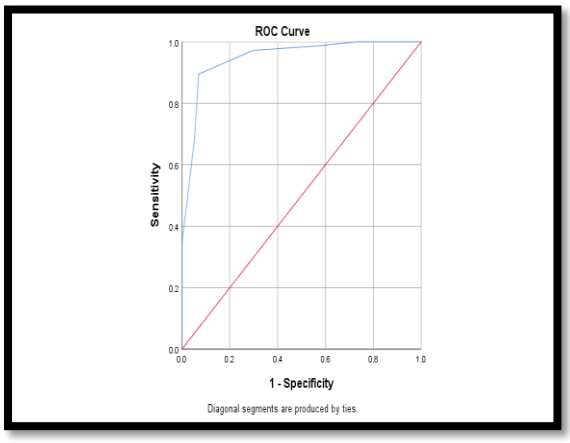


Figure 4.2. The Receiver operating characteristic curve for UMAC measures as diagnostic tools of low birth weight

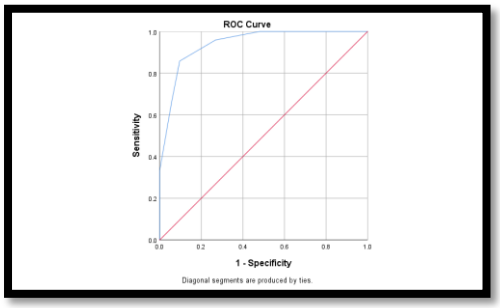
Most of the Low birth weight babies had MUAC of ≤9.25 cm 53(93 %) while the Normal birth weight babies most of them had MUAC of >9.25 cm 127(88.8%) this relation was statistically significant, as shown in table 4.5.

Table 4.5. The relation between MUAC and birth weight

		Birth Weight		
		Low birth weight	Normal birth weight	Total
MUAC	≤9.25 cm	53	16	69
		93.0%	11.2%	34.5%
	>9.25 cm	4	127	131
		7.0%	88.8%	65.5%
Total		57	143	200
		100.0%	100.0%	100.0%

X^2=120.67, df=1, P value<0.05 Significant

The area under the receiveroperating characteristic curve (AUC)for MUAC as predictor of the prematurity was (94%) (95%CI 0.91 to 0.98), as shown in the figure 4.3.



4.3. Receiver operating characteristic curve for UMAC measures as diagnostic tools of prematurity (<37 weeks)

Most of the preterm babies had MUAC of ≤9.25 cm 47(90.4%) while the full-term babies most of them had MUAC of>9.25 cm 126(85.1%) this relation was statisticallysignificant, as shown in table 4.6.

Table 4.6. The relation between MUAC and prematurity

		Gestational Age		
		preterm	full-term	Total
MUAC	≤9.25 cm	47	22	69
		90.4%	14.9%	34.5%
	>9.25 cm	5	126	131
		9.6%	85.1%	65.5%
Total		52	148	200
		100.0%	100.0%	100.0%

X^2=97.117, df=1, P value <0.05 Significant

The sensitivity of MUAC for detection of prematurity was 90.4%, and for low birth weight 93.0%. The specificity of MUAC for detection of prematurity was 85%, and for low birth weight 89%. The accuracy of MUAC for detection of prematurity was 87%, and for low birth weight 90%. The positive predictive value (PPV) of MUAC for detection of prematurity was 68%, and for low birth

weight 77%. The negative predictive value (NPV) of MUAC for detection of prematurity was 96.2%, and for low birth weight 96.9%.as shown in table 4.7.

Table 4.7:The Sensitivity, specificity, positive predictive values (PPV) and negative predictive values (NPV) for MUAC and prematurity and low birth weight.

Test	Sensitivity	specificity	False Positive	False negative	accuracy	PPV	NPV
Gestational age	90.4	85	15	9.6	87	68	96.2
Birth weight	93.0	89	11	7.0	90	77	96.9

Discussion

The mean birth weight was(3.9±1.8) in current study which goes with what found by Gupta VP et al 2018 found [12] The mean birthweight of the newborns was2.59kg.

The mean MUAC (9.5± 1.1),in current study, which goes withSeth B et al 2021[2] found that the mean MUAC at birth was 8.7(0.3) cm inmales and 8.8(0.2) cm infemales, respectively. Another study done by Tiruneh C. 2020 [14] found that the mean MUAC was 10.77 ±0.67.

The cut off point of MUAC in current study was 9.25 cm with The area under the receiveroperating characteristic curve (AUC) for MUAC as predictor of the low birth weight was (95%) (95%CI 0.92 to 0.98), as predictor of the prematurity was (94%) (95%CI 0.91 to 0.98), as predictor of the prematurity was (94%) (95%CI 0.91 to 0.98),in current study. This supporeted by previuos studies done by Gidi NW et al 2020[15] found that The area under the receiver operating characteristic curve (AUC)for MUAC as predictor of the low birth weight was (95%) (95%CI 0.92 to 0.98), giving cut off point 9.25.

But slightly higher than that of study from Vietnam done by Thi HN, et al 2015 which reported cut off 8.7[16]. And from Agrawal A et al 2020 [17] found that area under curve (AUC) for newborn MUAC is 0.974 which also signify statistically

significant association. Cut off value to predict low birth weight is 8.85.

The cut off in this study was lower than what reported by Gupta VP et al 2018 found [89] found with cut off between <11.26.

The difference in cut off points related to the difference in geographical and cultural areas, and in the methodology used by the studies.

The MUAC is good parameter for diagnosing of low birth weight with sensitivity of 93.0%, specificity (89%) and accuracy of the test was (90%). The PPV for diagnosing low birth weight was (77%) and the negative predictive value was (96.6%). This goes with Agrawal A et al 2020 [17] found the sensitivity (94.8%) , specificity (91.1%) with (OR 9.176 95%CI (7.273- 11.577). Newborn MUAC shown a linear correlation with birthweight. The Pearson Coefficient of correlation(r) was found to be 0.903.

Gidi NW et al 2020[15] 2020 found the sensitivity of MUAC for detecting low birth weight was 95%, specificity 70.6 %, and PPV 40% .

Thi HN et al 2015 [93] found that .Cut off <8.7 sensitivity was 92 specificity 85, PPV 80.

Seth B et al 2021[12] found that the sensitivity and NPV for detecting low birthweight were 100% at cut-off of 8.6cm in females and 8.7 cm in males, respectively(area under the curve: 0.92 (females) and0.96 (males)

The MUAC is good parameter for diagnosing of prematurity with sensitivity of 90.4%, specificity (85%) and accuracy of the test was (87%), and the PPV for diagnosing low prematurity was (68%). This goes with Gidi NW et al 2020[14] 2020 found the sensitivity of MUAC for detecting prematurity was 100%, specificity 46.6 %, and PPV 13.7% . Gupta VP et al 2018 found [12] found with cut off <11.26 the sensitivity was 74.1% , specificity was 24% PPV 95.7 and the maximum positive predictive value was noted for MAC (95.7%), which means that for newborn, the

possibility of preterm gestational age was 95.7%

Tiruneh C. 2020 [13]. found the highest correlation of gestational age with MUAC was observed on mid-upper arm circumference (r=0.406) followed by birth weight (r=0.334). found that the MUAC had good predictive value for gestational age and weight.

Conclusions

The MUAC is good parameter for diagnosing of prematurity with sensitivity of 90.4%, specificity (85%) and accuracy of the test was (87%).

Acknowledgment

In The Beginning My great thanks to **ALLAH** for his mercy and blesses.I would like also to thank **Dr. Mohammed Idres** , head of Head of Pediatric Medicine Department Collage of Medicine, Tikrit university . My grateful thanks to the department's staff, Tikrit University and salahaldin hospital for their helping and support. I would like to express my great admiration to **Dr. Ahmed Hashim** for his help and support. I would like to express sincere gratitude and grateful admiration to my supervisor **Dr. Hind Mutar Ibrahem**for his support, help, and encouragement through all research stage, for valuable advices and excellent profitional management, through experimental part and writing the current thesis, your efforts highly appreciated. My Gratefulness thanks especially to **Dr.jasim Breig**, support and encouragement

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