

Relation between Maternal' Anthropometric Measurements and Their Newborns

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Background: birth size is considered an important indicator in maternal, fetal, and neonatal health. Hence, anthropometric measurements at birth are important predictors of the growth pattern, health, and psychosocial development of infants.

The study aimed to assess the relation between maternal ' anthropometric measurements and their newborns at Obstetrics and Gynecology ward at Sohag University hospital and EL-Fayoum University Hospital.

Design: A cross-sectional and observational design was carried out in the study.

Sample: - included 432 newborns and their mothers were recruited into this study.

Tools: A structured questionnaire sheet and anthropometric measurements tool were utilized for collecting the data. **Results:** mothers' age ranged from 18 - 35 years, and that women were mostly between 23 < 27 years, it was observed that (52.5%) of studied newborns were male. There was a significant relation was observed between anthropometric measurements of mothers and their newborns ($p = 0.000 < 0.05$).

Conclusion: There was an association between anthropometric measurements of mothers and their newborns.

Recommendations: Anthropometric measurements should be applied in routine care to help mothers to minimize missed opportunities for them that may benefit in interventions to improve pregnancy outcomes.

Keywords: mothers, newborns, anthropometrics measurements

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I. Introduction

Fetus growth is occurred as a result of interaction of multifactor which including genetic, complication during pregnancy, emotional and physiological stress, social cultural, demographic, inappropriate maternal nutrition, maternal anemia, smoking, and the intrauterine environment that affected the growth of the fetus and health of the neonates (Tabrizi and Saraswathi, 2012).

These factors have adverse effects on the mother, through interfering with placental growth and transport of nutrients to the fetus, because mothers who have not suffered from illness or nutritional deprivation in their childhood and who enter pregnancy with good health maintaining will have healthy infants than mothers who do not have and as the mother provides the fetus with the whole of the physical and biological environment during gestation (Zelege et al., 2012).

Maternal anthropometry is considered an important tool in evaluation of pregnancy status and prediction of neonate birth weight. As when infant birth weight has been increasing that mean an obstetric hazard and a health problem and birth weight involves a risk of obesity in later life. In contrast, a low body mass index is of mother is considered one of strongest predictors of adverse pregnancy outcomes such as preterm birth and fetal growth retardation (Assefa, 2012).

Gestational age also is an important factor of growth, development for the newborn. Growth of fetus is associated with maternal, placental, and genetic factors because morbidity and mortality in newborns are directly associated with gestational age and anthropometric measurements as length, birth weight, head, arm, and chest circumferences in addition to period of gestation are expected to provide the building system of the desired index (Oluwafemi, et al., 2013).

There are a high percentage of mothers with low weight, height, and mid-upper arm circumference (MUAC). And more than 20 million of infants are born with LBW where seventy-two percent of LBW infants in developing countries are born in Asia and 22% in Africa (Jacinta et al., 2011).

The anthropometric measurements in newborns is suggested a variation in the ability of different anthropometric indices that help in identifying newborns with abnormal growth during pregnancy (Ezenwa, et al., 2016). Hence, it is necessary to present a combination of at least two indicators is currently recommended for all the anthropometric indices that used to categorize newborns (Sifianou, 2010).

The important role of the nurse and health care providers is to know the evidence about the state of maternal and neonates health in order to plan counseling and behavioral interventions for pregnant women which help in promoting health (Benjumea, 2007).

Hence, the current study was carried out to assess the relation between maternal ' anthropometric measurements and their newborns at Obstetrics and Gynecology ward at Sohag University hospital and EL-Fayoum University Hospital.

Significance of the study

Birth weight is considered an important determinant that may has an effect on newborn's future growth and development³ because growth have significant association with high risk of neonatal morbidity and mortality as any chronic diseases in life.

Aim of the study

The aim of this study is to assess the relation between maternal ' anthropometric measurements and their newborns at Obstetrics and Gynecology ward at Sohag University hospital and EL-Fayoum University Hospital.

Research question:

1. Is there is a relationship between anthropometrics measurements of mothers and their newborns?

Subjects and methods:

Research design:-

A cross-sectional and observational design was carried out in this study.

Setting

This study was conducted at Obstetrics and Gynecology ward at Sohag University Hospital and EL-Fayoum University Hospital in Egypt.

Subjects:

- A convenient sample of 432 children and their mothers was recruited from the previously mentioned setting; they were recruited within a period of 6 months (from September to March 2019). The inclusion criteria were newborns and their mothers did not have congenital malformation or any abnormalities at birth and both sexes (male and female). Mothers who are available at the time of the study at selected hospital and who are willing to participate in the study and both educated and non-educated mothers

Tools and techniques of data collection:-

It was developed by the researcher after reviewing related literatures. There were two tools used in the present study as the following:

Tool (1):- A structured questionnaire sheet: It was composed of two parts:

Part (1): it includes socio- demographic characteristics of mothers; it was contain 6 items related to age, educational level, occupation, type of delivery, parity and residence.

Part (2): it includes socio-demographic characteristics of newborns; it was contain 3 items related to sex, birth order, and gestational weeks.

Tool (2):- anthropometric measurement tool: it was composed of two parts:

Part (1): it includes anthropometric measurement of mothers which used to record weight, height and arm circumference.

Part (2): it includes the anthropometric measurement of newborns which used to record weight, height, arm, head circumference.

Tool validity: Content validity of the tools was determined through an extensive review of literature about to relation between mothers ' anthropometric measurements and their newborns at Obstetrics and Gynecology ward at Sohag University hospital and EL-Fayoum University Hospital. The content of the data collection tools was submitted to a panel of five experts in the Obstetric and Gynecology nursing field and pediatric nursing with more than ten years of experience in the field. Modifications of the tools was done according to the panel

judgment on clarity of sentences, appropriateness of the content, sequence of items, and accuracy of scoring and recording of the items.

Tool Reliability

The tools reliability was estimated through using the Pearson correlation coefficient test to compare between variables. The Pearson correlation coefficient for the variables ranged between ($P. < 0.5$) and ($P. < 0.001$), which indicated a highly significant positive correlation between variables of the subjects. The findings from the validity and reliability suggested that, the tools of the study could be used as valid and reliable data collection tools for the current study.

Methods of data collection:

Permission: - An official permit was taken from Sohag University Hospital administrators and the manager of the postnatal wards. Permission also was obtained from the head nurse of the Obstetrics and Gynecology ward at Sohag University hospital and EL-Fayoum University Hospital in Egypt to gain her cooperation. A clear explanation was given about the nature, importance and expected outcomes of the study to administrators.

Ethical consideration: - All mothers were informed about the aim of the study, its benefits, and data collection tools in order to obtain their acceptance and cooperation. The researcher informed them that the participation in the study is voluntary; they have the right to withdraw from the study at any time, without giving any reason and that their responses would be held confidentially.

Review of current and past local and international literature related to the research task was made so as to be oriented with relevant research articles and magazines. It was done at the Obstetrics and Gynecology ward at Sohag University hospital and EL-Fayoum University Hospital in Egypt. Hence this review was helpful in developing the data collection tools used.

Pilot study: It was carried out on 10 % of the mothers and their newborns, for the purpose of modification and clarification and estimation of the time needed for data collection. The designed tool was tested on women. To fill in the sheets unclear items were clarified, unnecessary items were omitted and new items were added. Those who shared in the pilot study will be excluded from the study sample.

Study period: Data was collected from September to March 2019 after obtaining the permission from the authorities.

Field work:

- The researcher first introduced herself to the mothers and then explained the aim of the study at the beginning of the interview, so the mothers were reassured that all gathered information will be confidential.
- The title and objectives of the study were illustrated as well as the main data items to be covered and the study was carried out after gaining the necessary permission from the administrator of selected ward. Each mother was interviewed individually.
- The interview for mother was conducted in three days through the week. The purpose of the interview was to fill out the questionnaire sheet.
- The purpose and nature of study was explained to the mothers of newborns and the study was obtained. Tools were utilized to collect the desired data. Confidentiality of obtained information was assured.
- The average time spent for each mother for completion of each interview was around 40-50 minutes.
- The researchers visited the selected ward three times to collect the data from 9.00 a.m. to 14.00 p.m.
- Researchers faced the mothers and asked them the questions in Arabic and recorded their answers in the structured questionnaire sheet.
- Anthropometric measurements were taken at postnatal ward within 24 hours of age.
- Routine examination was done for newborn and birth weight, length, arm and head circumference were measured by using measuring tape.
- Newborns' weight was measured by using an electronic weighing scale.
- Anthropometric measurements of newborns were measured by taken their thigh circumferences which taken between the juncture of right thigh and buttock, mid-upper arm circumferences (MUAC) at mid-point between tip of right shoulder and tip of right elbow and head circumferences (HC) at maximum transverse circumference within 24 hours of birth that were measured in centimeter.

- Birth weight of newborns was measured in kilogram using digital baby weighing scale. Normal birth weight was defined as birth weight between 2.5 kg and 4.0 kg. Socio-demographic characteristics of mothers and their newborns were collected by interviewing (to mothers) and reviewing their hospital records.
- Maternal height was measured in centimeter, at standing position, she was also asked to stand straight with her back to the height rule and to look straight. The head piece of the stadiometer was lowered so that the hair was pressed flat in measuring her height and maternal weight was assessed by using electronic weight scale.
- Assessment of gestational age was calculated through last menstrual period (LMP) by Naegele's formula by adding of 9 months and 7 days to the first day of LMP

Statistical analysis:

The data obtained were reviewed, prepared for computer entry, coded and scored, then analyzed and tabulated. Data entry and analysis were done using SPSS (statistical software package) version 17.0. Data were expressed as means, SD and percentage distribution. And have using Manwhitiny test to determine significance for numeric variable, Chi Square to determine significance for non-parametric variable. Using paired T test for comparison between pre, post program evaluation and using person's correlation for numeric variable. N.s $P > 0.05$ no significant, * $P < 0.05$ significant, ** $P < 0.001$ moderate significance and *** $p < 0.000$ highly significance.

Results:

Table (1) shows socio-demographic characteristics of the studied mothers. It was observed that mothers' age ranged from 18 - 35 years, and that mothers were mostly (57.0%) between 23 < 27 years. Concerning educational level, it was noted that high percentage of mothers (31.0%) was in secondary education. Regarding type of delivery, majority (75.0%) of them had vaginal delivery, and the parity of the (80.0%) mothers ranged from 2 to 4

Figure (1) shows the percentage distribution of studied women according to their residence, it was clear that, approximately two thirds of them were from urban and (35.0%) from rural. Concerning the percentage distribution of studied women according to their occupation, **figure (2)** pointed out that majority of mothers (85.0%) were housewives.

Table (2) shows percentage distribution of studied newborns according to their socio - demographic characteristics, it was found that more than half (52.5%) were male, number of the second birth was 195 (45%), and the gestational age was ranged between 33 and 36 among most of them 324 (75%)

As shown in **table (3)** about percentage distribution of studied mothers according to their anthropometric measurements. This table illustrated that, most of them 311 (72%) their weight ranged between 76 < 90 (cm). Regarding height 393(91%) was ≥ 1.60 , and mid arm circumference of the mothers was ranged between 25-30(cm) in (55%).

Table (4): shows percentage distribution of studied newborns according to their anthropometric measurements. It was clear that, newborns were mostly 376 (87.0%) between 3 < 3.5(kg), (73.0%) of them were appropriate weight for gestational age, and their mid arm circumference / Occipito - frontal circumference ratio was > 0.27 in (85.0%) and < 0.27 in (15.0%)

Table (5): shows relation between anthropometric measurements of mothers and their newborns' gestational age. It was found that, there was a statistical significant difference between anthropometric measurements of mothers as regard weight, height, mid arm circumference and their newborns' gestational age ($P = 0.001$, $p = 0.000$) respectively.

Table (6): shows relation between anthropometric measurements of mothers and their newborns' birth weight, it was observed that, a highly statistical significant differences were found between anthropometric measurements of mothers as regard weight, height, mid arm circumference and their newborns' birth weight ($P = 0.000$, $p = 0.001$, $p = 0.000$) respectively.

Concerning relation between anthropometric measurements of mothers and their newborn's weight-for-GA, **table (7)** displayed that, a statistical significant differences were found between anthropometric measurements of mothers as regard weight, height, mid arm circumference and their newborns' weight-for-GA ($P = 0,002$, $p = 0.000 = p = 0,000$) respectively.

Table (8): shows relation between anthropometric measurements of mothers and their newborns MAC/OFC ratio. It was clear that, a highly statistical significant differences were observed between anthropometric

measurements of mothers as regard weight, height, mid arm circumference and their newborns' MAC/OFC ratio (P= 0.000, p= 0.003, p= 0.002) respectively.

Table (1): Percentage distribution of studied mothers according to their socio -demographic characteristics

Socio - demographic characteristics	No.	%
1-Mothers ' age in years		
Range 18 - 35 years		
- 18 < 22	56	13.0
- 23 < 27	246	57.0
- 28 < 32	100	23.0
- 33 < 37	30	7.0
2- Mothers ' education		
- Illiterate	21	5.0
-Read and write	108	25.0
-Primary education	83	19.0
-Secondary education	134	31.0
-University education	86	20.0
3-Type of delivery:		
- Vaginal delivery	324	75.0
- Cesarean delivery	108	25.0
4-Parity:		
- 1	65	15.0
- 2< 4	346	80.0
- ≤ 5	21	5.0

Figure (1): Percentage distribution of studied mothers according to their residence

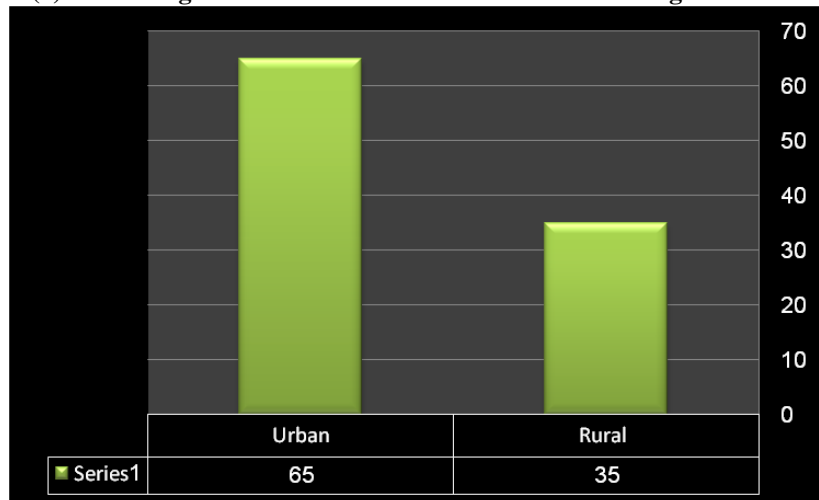


Figure (2): Percentage distribution of studied mothers according to their occupation

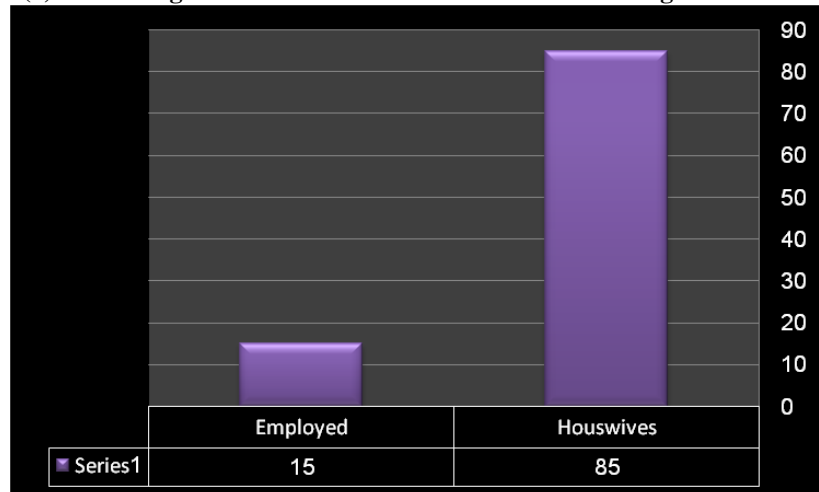


Table (2): Percentage distribution of studied newborns according to their socio - demographic characteristics

Socio - demographic characteristics	No	%
Sex		
- Male	227	52.5
- Female	205	47.5
Birth order		
- First birth	86	20.0
- Second birth	195	45.0
- Third birth	151	35.0
Gestational age		
- 28 < 32	35	8.0
- 33 < 36	324	75.0
- 37 < 42	73	17/0

Table (3): Percentage distribution of studied mothers according to their anthropometric measurements

anthropometric measurements	No.	%
1-Weight		
- 60 < 75	100	23.0
- 76 < 90	311	72.0
- 91- 115	21	5.0
2- Height		
- < 1.60	39	9.0
- ≥ 1.60	393	91.0
3- Mid arm circumference		
- < 24	43	10.0
- 25 - 30	238	55.0
- > 30	151	35.0

Table (4): Percentage distribution of studied newborns according to their anthropometric measurements

Anthropometric measurements	No.	%
1-Birth weight		
- 2 < 2.5	35	8.0
- 3 < 3.5	376	87.0
- 4 - 4.5	21	5.0
2- Weight for gestational age		
- SGA	74	17.0
- AGA	315	73.0
- LGA	43	10.0
3- Mid arm circumference / Occipito - frontal circumference ratio		
- < 0.27	65	15.0
- > 0.27	367	85.0

Table (5): relation between anthropometric measurements of mothers and their newborns' gestational age

Anthropometric measurements	Newborns' gestational age			p-value pp-value
	28 < 32	33 < 36	37 < 42	
1-Weight				
- 60 < 75	3.0	15.0	5.0	0.001 1000100001
- 76 < 90	12.0	50.0	10.0	
- 91- 115	1.0	3.0	1.0	
2- Height				
- < 1.60	1.0	6.0	3.0	0.001
- ≥ 1.60	23	61.0	7.0	
3- Mid arm circumference				
- < 24	3.0	5.0	2.0	0.000
- 25 - 30	15.0	35.0	5.0	
- > 30	5.0	25.0	5.0	

Table (6): relation between anthropometric measurements of mothers and their newborns' birth weight

Anthropometric measurements	Newborns' birth weight			p-value
	2 < 2.5	3 < 3.5	4 - 4.5	
1-Weight				
- 60 < 75	2.0	17.0	1.0	0.000 0
- 76 < 90	5.0	60.0	3.0	
- 91- 115	1.0	10.0	1.0	
2- Height				

Anthropometric measurements	Newborns' birth weight			p-value
	2 < 2.5	3 < 3.5	4 - 4.5	
- < 1.60	3.0	5.0	1.0	0.001
- ≥ 1.60	29.0	51.0	11.0	
3- Mid arm circumference				
- < 24	13.0	20.0	10.0	0.000
- 25 - 30	15.0	35.0	5.0	
- > 30	10.0	15.0	10.0	

Table (7): relation between anthropometric measurements of mothers and their newborn's weight-for-GA

Anthropometric measurements	Newborn's weight-for-GA			p-value
	SGA	AGA	LGA	
1-Weight				
- 60 < 75	1.0	4.0	2.0	0.002
- 76 < 90	13.0	52.0	7.0	
- 91- 115	2.0	6.0	2.0	
2- Height				
- < 1.60	2.0	6.0	1.0	0.000
- ≥ 1.60	9.0	71.0	11.0	
3- Mid arm circumference				
- < 24	3.0	6.0	1.0	0.000
- 25 - 30	8.0	35.0	12.0	
- > 30	5.0	25.0	5.0	

Table (8): relation between anthropometric measurements of mothers and their newborns MAC/OFC ratio

anthropometric measurements	Newborns ' MAC/OFC ratio		p-value
	< 0.27	> 0.27	
1-Weight			
- 60 < 75	1.0	23.0	0.000
- 76 < 90	11.0	52.0	
- 91- 115	3.0	10.0	
2- Height			
- < 1.60	5.0	27.0	0.003
- ≥ 1.60	10.0	58.0	
3- Mid arm circumference			
- < 24	3.0	10.0	0.002
- 25 - 30	8.0	45.0	
- > 30	4.0	30.0	

II. Discussion

Maternal anthropometric measurements, such as height, weight, and arm circumference (BMI), are considered important indicators of maternal nutritional status because nutrition during pregnancy and lactation influences the nutritional status of the infant. That means low in maternal nutritional status lead to insufficient amount of nutrients provided to the fetus and to the newborn / infant in breast milk and therefore insufficient infant nutrient intake (Griffiths et al., 2017).

Placenta provides all the metabolic demands to the fetal growth and uterine and umbilical blood flow rates. Therefore, factors that influence placental vascular development is have an impact on fetal growth and development, and thus on neonatal morbidity and mortality (Redmer et al., 2014).

The present study revealed that mothers ' age ranged from 18 - 35 years, and they were mostly between 23 < 27 years, approximately two thirds of them were from urban and about one third of mothers was in secondary education, these results were nearly and supported by (Onubogu et al., 2017) who found in his study about " The Influence of Maternal Anthropometric Characteristics on the Birth Size of Term Singleton South-East Nigerian Newborn Infants " that the mean age of mothers was 26 ± 5 years.

The current study revealed that more than half were male. These results were in accordance with the results conducted by (Onubogu et al., 2017) who found the same.

The current study revealed that, a statistical significant difference between anthropometric measurements of mothers as regard weight, height, mid arm circumference and their newborns' gestational age, this result was similar with the study conducted by (Jananthan et al., 2009) who studied " Maternal anthropometry as a predictor of birth weight " and found that a correlation between maternal characteristics such as age, body weight, height and mid arm circumference, gestational age.

This result also was in agreement with the study conducted by (Eltahir and Gerd, 2007) who studied "The effect of maternal anthropometric characteristics and social factors on gestational age and birth weight in

Sudanese newborn infants "and mentioned that maternal anthropometric measurements was positively correlated with infant weight-for-age.

The current study reflected that, there was a relation between anthropometric measurements of mothers and their newborns' birth weight. This result was in congruence with (Muula et al., 2011) who found the same relation. And Bisai, (2011) reported that maternal MAC had reflected the current nutritional status of the mothers and there was an impact of these parameters on newborns' birth weight. Also (Nahar et al., 2007) found that maternal anthropometric measurements had a significant positive relation with neonatal birth.

Similarly, Sen et al., (2010) mentioned significant positive correlation between maternal weight and birth weight.

The current study displays that, a highly statistical significant difference was found between anthropometric measurements of mothers and their newborn's weight-for-GA. This result was supported by (Jananthan et al., 2010) who studied "Maternal Anthropometry as a Predictor of Birth Weight" and found that a significant relation was found between maternal weight and weight-for-GA. This is explained by that he fetus is dependent completely on his mother on supplying of nutrients required for growth. Because low availability of nutrients from poorly nourished mothers would lead to poor intrauterine growth.

On the other hands, this study was not similar with Chalachew et al., (2018) who studied "Maternal Anthropometric Measurements Do Not Have Effect on Birth Weight of Term, Single, and Live Births in Addis Ababa City, Ethiopia" and found that maternal anthropometric measurements have no effect on birth weight.

Similarly, Elshibly and Schmalisch, (2008) who studied "The effect of maternal anthropometric characteristics and social factors on gestational age and birth weight in Sudanese newborn infants" and reported that Sudanese women 'height had a statistically significant effect on determining the risk of LBW.

Also, Onubogu et al., (2017) reported that maternal anthropometric measurements are a very important tool in identifying the mothers that they are at risk of having newborn infants who experienced abnormal intrauterine growth. Therefore, it's recommended to apply routine care to enable these mothers benefit from interventions targeted at improving pregnancy outcomes.

This result also was in agreement with the study conducted by (Eltahir and Gerd, 2007) who studied "The effect of maternal anthropometric characteristics and social factors on gestational age and birth weight in Sudanese newborn infants "and mentioned that maternal education was significantly associated with birth weight. And birth order and maternal height were found to be the most important maternal parameters which influence birth weight. Also, Emmanuel, (2014) found that maternal weight and BMI are considered good predictors of birth weight

III. Conclusion

Anthropometric measurements is very important tool in identifying that mothers will having risk newborn infants with subnormal or excessive intrauterine growth, which may associated with higher risk of perinatal morbidity and the mother anthropometric measurements have been known to influence the condition of the infant at birth.. There was an association between anthropometric measurements of mothers and their newborns.

IV. Recommendations

- Anthropometric measurements should be applied in routine care to help mothers to minimize missed opportunities for them that may benefit in interventions to improve pregnancy outcomes.
- Emphasizing on health education regard knowledge and modify dietary habits and quality of food consumed.
- Encourage a better nutrition especially in adolescent mothers, that resulting in lower rates of LBW and hence lead to great reduction in infant morbidity and mortality.
- Encourage measuring of maternal anthropometric measurements which can be applied to primary health care level and identification the effect of those anthropometric measurements on birth weight to determine the level of care and the priorities for the referral to the centers where neonatal care is available.
- Use maternal measurements as screening test in the poor resource setting.
- Encourage health care workers for detection of the mothers who are at risk of delivering big or low birth weight babies that can affect neonatal care.

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