International Journal of Psychosocial Rehabilitation, Vol. 24, Issue 08, 2020
ISSN: 1475-7192

The Measurement Comparison between Hadlock and Hadlock 4 Formulas in the Second and Third Trimesters Obstetric Ultrasound for Foetal Weight and Delivery Estimation

[1] Gando Sari, [2]Sriyatun, [3]Fellya Zumarnis, [4] Nursama Heru Apriantoro,
[1,2,3,41] Department of Radiodiagnostic and Radiotherapy Politeknik Kesehatan Kemenkes Jakarta II,

Abstract

This research aims to analyze the results of Hadlock and Hadlock 4 formulation measurement on pregnant women in the second and third semester obstetric ultrasound scan for foetal weight and delivery estimation. The design of this research is quantitative analytic. Data analysis was done by T-Test. This research was conducted from October to November 2019. The population of this research was taken from the entire number of Obgyn ultrasound examinations and 30 research samples. Based on the research, it can be concluded that an analysis of the estimated labor time with the Hadlock and Hadlock 4 obtained the results of *Tbirth-2 with an average labor time of 34.40 days while *Tbirth-4 is 40.87 days. There is a difference in the Sig. (2-tailed) value of 0,000 <0.05. From this result Ho was rejected and Ha was accepted which means there is a difference between the estimated delivery time based on the Hadlock and Hadlock 4 formulas. Estimated foetal weight with Hadlock and Hadlock 4 formula obtained **TFW-2 results with an average fetus weight of 2477.07 grams while **TFW-4 is 2416.80 grams with Sig value (2-tailed) of 0.000 <0.05 means that there are differences between estimated foetal weight based on Hadlock and Hadlock 4.

Index Terms— *Ultrasound, Hadlock, Hadlock 4, foetal weight, delivery*

INTRODUCTION

Ultrasound in the obstetric field began to develop since 1900. Ultrasound is a very important examination technique for pregnant women and can be done at any time during pregnancy, especially if there are clinical indications [1]. No doubt, this technique is a revolution of imagination and pathology in gynecology. The usefulness of information obtained in the form of estimated childbirth and foetal weight, location of the placenta, number of amnion fluid index (AFI) and induced safety, pregnancy ultrasound is a non-radiative, non-invasive and non-traumatic examination so it is safe for patients and the use of obstetric ultrasound routinely in all pregnancies is recommended by doctors [2]. The main purpose of ultrasound examination in the obstetric field is to determine gestational age more precisely, monitor foetal growth and detect early foetal abnormalities during the antenatal period. Therefore, for every obstetric ultrasoun

d examination regardless of the indications, foetal biometrics and anatomical structures must be examined carefully and systematically from the first to third trimester (early trimester to late trimester) [3]. Ultrasound examination of pregnant women is a fairly accurate examination in terms of detecting abnormalities during pregnancy.

There are several biometric measurements that can be used which are available from ultrasound devices, one of which according to Hadlock. Hadlock describes the measurements ranging from simple to complete measurements. The simple Had-lock formula measures 2 measurement parameters namely Biparietal diameter (BPD) and Abdominal

Circumference (AC), while Hadlock 4 uses 4 measurement parameters taken namely Biparietal diameter (BPD), Head Circumference (HC), Abdominal Circumference (AC) AC) and Femur Length (FL) [3]-[6]. This research will compare biometric measurements from Hadlock and Hadlock 4 formulas towards estimated time of delivery and foetal weight.

Received: 22 Oct 2019 | Revised: 13 Nov 2019 | Accepted: 15 Feb 2020

METHOD

A. Research Methods

This research is a quantitative analytic with a comparative method to determine the estimated delivery and foetal weight using the Hadlock and Hadlock4 formulas in obstetric patients trimester 2 and 3. Using GE LOGIQ V5 ultrasound with 52.91 inch height, 17.9 inch width, 43 kg weight, display 15 "LCD monitors and transducers used by the GE brand convex with a frequency range of 3.5 MHz to 5 MHz, Ultrasound gel, Sony brand printers and Sony UPP-110HG brand print papers with Type V (High Glossy) and 110 mm x 18 mm size. The population in this study were all pregnant women who underwent obstetric ultrasound scan at the Babelan I Health Center in Bekasi, West Java, Indonesia from October to November 2019, a sample of 30 people with criteria of second and third trimester pregnant women who do not have pathophysiological abnormalities such as preeclampsia, eclampsia, pregnancy twin, caesarean, hydramnios. Then the results of the data were analyzed statistically by the T test.

Table 1 The foetal measurement formulas based on the inventors

Formulas	**Biometry**			
Campbell	AC			
Hadlock	BPD	AC		
Hadlock 1	AC	FL		
Hadlock 2	BPD	AC	FL	
Hadlock 3	AC	FL	HC	
Hadlock 4	BPD	HC	AC	FL
Hansman	BPD	TTD		
Merz	BPD	AC		
Osaka	BPD	FTA	FL	
Shepard	BPD	AC		
Shinozuka 1	BPD	AC	FL	
Shinozuka 2	BPD	APTD	TTD	SL
Shinozuka 3	BPD	APTD	TTD	FL
Higgin Bottom	AC			
Thurnau	BPD	AC		
Warsof	BPD	AC		
Weimer 1	AC	HC		
Weimer 2	AC	FL	HC	
Woo	BPD	AC	FL	

RESULTS

Based on the research, from 30 samples of pregnant women there is a comparison between measurements using the Hadlock formula (BPD and AC) Hadlock 4 formula (BPD, AC, HC and FL) towards the estimated delivery and foetal weight.

Table 2. Sample Data Results

Age, LMP, BPD, AC, HC and FL in week; TFW2 and TFW4 in gram; Tbirth2 dan Tbirth4 in days from 30 samples from October 21st to November 5th 2019

No	**Age**	**LMP**	**BPD**	**AC**	**HC**	**FL**	**TFW2**	**TFW4**	**Tbirth 2**	**Tbirth 4**
1	26	31	33	30	33	34	1818	1858	58	51
2	22	34	35	33	34	35	2295	2320	38	36
3	30	24	24	22	24	26	700	757	110	108
4	23	34	36	33	32	36	2427	2411	34	41

Received: 22 Oct 2019 | Revised: 13 Nov 2019 | Accepted: 15 Feb 2020

5	30	39	40	38	38	39	3749	3583	3	10
6	35	39	40	38	36	38	3748	3439	17	11
7	24	36	36	35	33	36	2801	2714	29	37
8	33	32	32	31	30	33	1883	1871	56	59
9	19	32	32	31	31	32	1859	1847	56	60
10	32	36	36	36	34	36	2808	2815	28	33
11	37	32	33	32	31	32	1942	1866	53	60
12	22	39	39	39	37	39	3764	3825	4	13
13	30	33	33	34	30	34	2277	2311	43	51
14	24	31	31	30	29	31	1615	1592	60	68
15	35	34	35	36	33	33	2702	2684	31	43
16	38	37	37	37	34	38	3207	3333	17	26
17	26	36	35	37	32	37	2939	2992	25	33
18	44	38	39	37	34	38	3321	3389	14	23
19	34	33	34	31	30	30	2056	1732	50	64
20	34	33	34	32	30	33	2073	1943	49	57
21	34	34	35	33	33	35	2371	2345	40	43
22	26	40	40	40	35	40	4150	3930	16	12
23	42	37	37	37	37	37	3220	3206	18	23
24	24	36	37	35	33	35	2775	2538	29	41
25	31	40	38	41	33	41	4017	3958	3	13
26	21	36	36	36	34	37	2866	2850	26	32
27	35	34	34	34	31	34	2447	2332	38	49
28	31	36	36	35	33	36	2701	2622	29	37
29	31	34	34	34	32	35	2312	2373	42	47
30	32	32	36	32	32	31	2340	1994	40	54

Bivariate Analysis Results

Table 3. Analysis of the Relationship between Variables BPD, AC with Estimated delivery of the Hadlock formula

Variables	pValue	r
BPD	0,011	-0,458
AC	0,009	-0,472

Based on the Pearson corrrelation test in Table 3, the results are:
a. The relationship between BPD and the delivery estimation using Hadlock formula, with a moderate relationship pattern (r = -0.458) and pvalue = 0.011
b. The relationship between AC and delivery estimation using Hadlock formula is significant with a moderate relationship pattern (r = -0.472) and pvalue = 0.009

Table 4. Analysis of the Relationship Between Variables BPD, AC, HC and FL with Hadlock 4 Estimated delivery formula

Variables	pValue	r
BPD	0,019	-0,424
AC	0,009	-0,466
HC	0,034	-0,389
FL	0,041	-0,375

The obtained results of the Pearson correlation test in table 3 are:
a. The relationship between BPD and delivery estimation using Hadlock 4 formula is significant, with a moderate relationship pattern (r = -0.424) and pvalue = 0.019
b. The relationship between AC and delivery estimation using Hadlock 4 formula is significant with a moderate relationship pattern (r = 0.466) and pvalue = 0.009
c. The relationship between HC with estimated delivery using Hadlock 4 formula is significant, with a moderate relationship pattern (r = -0.389) and pvalue = 0.034
d. The relationship between FL and Childbirth Estimated Hadlock 4 formula is significant, with a moderate relationship pattern (r = -0.375) and pvalue = 0.041

Table 5. Analysis of the Relationship between BPD, AC, HC and FL Variables with the estimated foetal weight of the Hadlock formula

Variables	pValue	r
BPD	0,000	0,950
AC	0,000	0,972

Based on the results of the Pearson corrrelation test in table 4, the results are:
a. The relationship between BPD and Foetal Weight Estimation of Hadlock 4 formula shows that there is a significant or very strong relationship (r = 0.936) with a pvalue = 0,000.
b. The relationship between AC and Foetal Weight Estimation of the Hadlock 4 formula has a significant or very strong relationship (r = 0.971) with a pvalue = 0,000.
c.The relationship between HC and Foetal Weight Estimation of the Hadlock 4 formula has a significant or very strong relationship (r = 0.915) with a pvalue = 0,000.
d. The relationship between FL and Foetal Weight Estimation of the Hadlock 4 formula has a significant or very strong relationship (r = 0.947) with a pvalue = 0,000.

Table 6. Analysis of the Relationship between BPD, AC, HC and FL Variables with foetal weight estimation of Hadlock formula 4

Variables	pValue	r
BPD	0,000	0,936
AC	0,000	0,971
HC	0,000	0,915
FL	0,000	0,947

Based on the results of the Pearson corrrelation test in Table 6, the results are obtained:
a. The relationship between BPD and Fetal Weight Estimation of Hadlock 4 formula has a significant or very strong relationship (r = 0.936) with a pvalue = 0,000

b. Relationship between AC and Fetal Weight Estimation of Hadlock 4 formula there is a significant or very strong relationship (r = 0.971) with a pvalue = 0,000
c. Relationship between HC and Fetal Weight Estimation of Hadlock 4 formula there is a significant or very strong relationship (r = 0.915) with a pvalue = 0,000
d. The relationship between FL and Fetal Weight Estimation of Hadlock 4 formula shows that there is a significant or very strong relationship (r = 0.947) with a pvalue = 0,000

Table 7. Difference test between estimated time of delivery using the Hadlock formula and Hadlock 4 with an estimated foetal weight using the Hadlock and Hadlock 4 formula.

Variables	Mean	SD	pValue
Tbirth2	34,40 days	21,295 days	0,000
Tbirth4	40,87 days	21,038 days	
TFW2	2467,07 gram	887,301 gram	0,000
TFW4	2416,80 gram	867,939 gram	

Based on the Difference Test results in table 7, the results are:

Difference test results revealed that the estimated delivery based on the Hadlock formula was 34.40 days with a standard deviation of 21.295 days while the estimated delivery based on the Hadlock 4 formula was 40.87 days with a standard deviation of 21.038. Statistical Test Results (T Test) obtained p = 0,000 means that at alpha 5% there was a difference in estimated foetal weight between using the Hadlock and Hadlock 4 formulas.
Difference test results revealed foetal weight estimation based on the Hadlock formula of 2467.07 grams with a standard deviation of 887,301 grams while the estimated foetal weight based on the Hadlock 4 formula was 2416.80 grams with a standard deviation of 867,939 grams. Statistical Test Results (T Test) obtained p = 0,000 means that at 5% alpha there was a difference in estimated foetal weight between using the Hadlock and Hadlock 4 formulas.

DISCUSSIONS

Obstetric ultrasound in trimesters 2 and 3, performed with the Hadlock and Hadlock 4 formulas for the estimated delivery of 30 samples obtained range of values r = -0.375 s-d -0.472, this means there is a relationship with a moderate relationship pattern to the estimated delivery. Based on the T-test results, the average of estimated delivery using Hadlock formula was 34.40 days and with Hadlock 4 as much as 40.87 days, meaning that there was a difference in delivery time of 6 days between using the Hadlock and Hadlock formula 4. Results of 30 samples showed a minimum difference of 2 days of delivery and a maximum of 14 days of delivery estimation, this is in line with the opinion of Dr. Endjun JJ Sp.OG in his book "Basic Ultrasonography of Obstetrics and Gynecology. Jakarta: FK UI; that Plus Minus Estimated delivery of 7 to 14 days from the Last Mestruation Period (LMP)
The results of calculations from 30 samples using the Hadlock and Hadlock 4 formulas for the estimated foetal weight, obtained ranges of values r = 0.915 to 0.971 which means that there is a relationship with the pattern of a very strong relationship between the Hadlock and Hadlock 4 formulas for the estimated foetal weight. Based on the results of the T-test with 30 samples using Hadlock formula there is an average estimated foetal weight of 2467.07 grams and with Hadlock 4 of 2416.80 grams, there is a difference between the two of 19.362 grams, based on this several Obgyn doctors has followed the standards of the Indonesian Association of Obstetricians and Gynecologists (P0GI) who take measurements using the Hadlock fomula.

CONCLUSIONS

In obstetric gynecology ultrasound measurements using Hadlock formula, the duration is shorter because it only measures 2 parameters, while measurement with Hadlock 4 formula, the duration used is longer because it measures 4 parameters. The comparison of Hadlock and Hadlock 4 to the estimated delivery of Pearson correlation test results has a value of r> -0.375 which means that there is a relationship with a moderate relationship pattern to the estimated delivery.
The comparison between Hadlock and Hadlock 4 to the estimated foetal weight of the Pearson correlation test has a value of r> 0.915 meaning that there is a significant relationship with a pattern of a very strong relationship to the estimated foetal weight between using the Hadlock and Hadlock 4 formula.

REFERENCES

[1] P. E. . Palmer, *Manual of Diagnostic Ultrasound*. California: WHO, 2002.

[2] daniel Makes, M. Setiawan, and H. Sidharta, *Perkembangan Ultrasonologi 3*. Medan: Universitas Tarumanagara UPT Penerbitan, 1991.
[3] H. Sa'diah, G. Sari, J. Sudarmono, and Sarengat, "Evaluation Of Toraks USG Implementation With Indication Of Pleural Effusion Minimally In DR. H. A. Rotinsulu Hospital Bandung," *J. Teknol. dan Seni Kesehat.*, vol. 08, pp. 37–43, 2017.
[4] J. J. Endjun, *Ultrasonografi Dasar Obstetri dan Ginekologi*. Jakarta: FK UI, 2007.
[5] S. Fetuses, "Choice of Formula and Accuracy of Foetal Weight Estimation in," pp. 71–82, 2016.
[6] "Effect of foetal presentation on sonographic estimation of foetal weight according to different formulas," 2017.
[7] A. Aviram, Y. Yogev, E. Ashwal, L. Hiersch, and E. Hadar, "Prediction of large for gestational age by various sonographic foetal weight estimation formulas — which should we use ?," *J. Perinatol.*, no. February 2016, pp. 1–5, 2017.

Received: 22 Oct 2019 | Revised: 13 Nov 2019 | Accepted: 15 Feb 2020