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The Role of Maternal Hemoglobin Levels in the Incidence of Low Birth Weight Babies: An Insight from Community Medicine Perspective

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ABSTRACT

Aims: To analyze some aspects of the maternal and the newborn the in the incidence of low birth weight babies (LBWB).

Study design: simple retrospective with cross-sectional design approach

Place and Duration of Study: Retrospective data of LBWB obtained from newborn medical record (year 2017-2022) of The Sultan Thaha Saifuddin Tebo Regional Public Hospital, located in Jambi-Indonesia and analysis conducted in the Departemen Kedokteran Komunitas (Community Medicine), the Faculty of Medicine, Universitas Kristen Indonesia, Jakarta Indonesia, between September-November 2023.

Methodology: The inclusion criteria focus on all newborn with LBWB that have complete medical record data. The acquired data regarding (1) maternal age, gestational age at the time of giving birth, Hb level prior to delivery, (2) newborn: gender, survivability and birth weight. All respondents will be subjected to statistical analysis using the SPSS programme and Microsoft Excel 2016. The exhibited information consists of data distribution presented in the form of tables and utilising univariate analysis and regression testing.

Results: Analysis of 256 LBWB data (122 (47.65%) boys, 134 (52.34%) girls) revealed that in the maternal sidemean age 28.54 years old, mean gestational age 36.07 weeks at the time of giving birth and mean Hb level 10.8 gram/dL. In the newborn sideviability were 226 (88.33%) viable and mean overall birth weight 1990.2 g. Statistically using Pearson correlation, there is a very weak correlation firstly among mater Hb count with the neonates primary weight ($P = 0.00$, $r = 0.154$) and secondly between gestational age and the birth weight of newborn ($P = 0.00$, $r = 0.000$). From the community medicine perspective, Efforts to increase the Hb levels of pregnant women theoretically can be carried out more easily by encouraging and increasing the mother's and also their partners, familiess and society awareness of carrying out routine antenatal care, encouraging the role of health motivator/local health cadre and conducting Hb examination as simple screening.

Conclusion: Maternal low Hb count and gestational age correlate with birth weight of newborn. Further in depth and extensive study needed to explore specific factors contribute to the incidence of anemia in mother who gave birth neonates which have low birth weight (LBW) and their impact to pregnancy.

Keywords: , anemia, pregnancy, antenatal care, health promotion, specific protection

1. INTRODUCTION

Birthweight is the primary or first recorded weight of neonates obtained subsequent to birth, which should be measured as soon as possible. Newborn infant should be weighted as soon as possible after its birth and its weight must be documented, ideally weighed within the initial hours after birth [1], aforesaid consequential post-delivery weight deprivation has

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23 occurred especially in those with derangement in birth weight [2]. The term LBWB is
24 described as a birth weight of <2500g [3]. This condition of LBWB remains a key global
25 public health matters because its major contribution to neonatal complication and even death
26 in developing countries [1,3].

27 Epidemiologically, according to UNICEF report, it is estimated 14.7 per cent of all babies
28 born globally in the year 2020, suffered from low birthweight [4]. For e³²n 7 newborns
29 worldwide, 1 suffer from LBW. An elongated analysis of the report on 2017 Indonesian
30 Demographic and Health Survey (IDHS) revealed that 0.67 % of neonates were actually
31 suffer from LBW [6] and this percentage places Indonesia below the Philippines (13.8%) and
32 Myanmar (7.5%) but the same as Cambodia [6].

33 These unfortunate LBWB w²⁰e more distinctly possible to suffer from hazardous morbidity
34 that lead to mortality within their first month of life [7,8] and for those who sustained oneself
35 still face prevailing sequelae including a lofty risk of stunted growth [8], more inferior IQ in
36 adulthood³⁴ late-onset chronic health debilitating conditions such as overweight-obese [10]
37 and also increased risk of future type-2 diabetes with other chronic non communicable
38 illness during adult life [11].

39 Anemic pregnant women (Hb< 11 g/dL) are at eminent chance of possessing LBWB
40 compared with those normal, non-anemic pregnant women [12]. Anemia is actually a
41 common condition found among pregnant women ¹⁴. Other condition that can contribute
42 for the happening of LBWB is the condition of small for gestational age (SGA). It is
43 characterized by primary birth weight of <10th percentile for their actual gestational age [14].
44 SGA neonates are divided into 2 groups, namely (1) basically normal infants who are SGA
45 and (2) infants who are SGA because of growth retardation or restriction during pregnancy
46 that resulted in a birth weight lower than predicted superb birth weight [15]. Electronically,
47 there is SGA determination method made available for free. [16]

³¹
48 The aim of this study is to characterize LBWB and to determine the correlation between
49 maternal hemoglobin and gestational age with the birth weight. ²³

50 2. MATERIAL AND METHODS

51 This simple retrospective, cross-sectional study worked on analysis of LBWB primary data
52 with permission letter from the director of the hospital no 445/1970/RSUD/X/2023. Data
53 obtained from newborn medical record (year 2017-2022) of The Sultan Thaha Saifuddin
54 Tebo Regional Public Hospital, loca⁴d in Jambi-Indonesia and analysis conducted in the
55 Departemen Kedokteran Komunitas (Community Medicine), Faculty of Medicine, Universitas
56 Kristen Indonesia, Jakarta Indonesia, between September-November 2023. The inclusion
57 criteria focus on all newborn with LBWB that have complete medical record data. The
58 acquired data regarding (1) maternal: age, gestational age at the time of giving birth, Hb
59 level prior to delivery, (2) newborn: ³⁰gender, survivability and birth weight. All respondents will
60 be subjected to statistical analysis using the Statistic Product and Service Solution (SPSS)
61 programme, Microsoft Excel 2016 and Ms Powerpoint. The exhibited information consists of
62 data distribution presented in the form of tables and utilising univariate analysis and
63 regression testing.
64

65 3. RESULTS AND DISCUSSION

66 In this study, 256 data of newborn with LBWB were analyzed. The amount of LBWB annually
67 (2017-2022) were as follows: 20 (7.8%), 25 (9.8%), 35 (13.7%), 52 (20.3%), 36 (14.1%), and
68 88 (34.4%). Out of 256 data, 122 (47.65%) were boys and 134 (52.34%) were girls.
69 Statistical analysis revealed that in the maternal side, mean age 28.54 years old, mean
70 gestational age 36.07 weeks at the time of giving birth and mean Hb level 10.8 gram/dL. In

71 the newborn size, viability were 226 (88.33%) viable and mean overall birth weight 1990.26
 72 gram. Detailed data presented in table 1.

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Table 1. Distribution of LBWB born in The Sultan Thaha Saifuddin Tebo Regional Public Hospital, 2017-2022

Category	YEAR											
	2017		2018		2019		2020		2021		2022	
Mother's Age												
Range	n	%	n	%	n	%	n	%	n	%	n	%
16-20	1	5	4	16	5	14,3	8	15,3	3	8,33	10	11,3
21-25	4	20	4	16	9	25,7	12	23,1	7	19,4	21	23,8
26-30	6	30	7	28	10	28,6	16	30,7	13	36,1	24	27,2
31-35	2	10	5	20	6	17,1	7	13,4	6	16,7	19	21,5
36-40	7	35	4	16	5	14,3	5	9,6	7	19,4	13	14,7
41-45	0	0	1	4	0	0	3	5,7	0	0	1	1,1
46-49	0	0	0	0	0	0	1	1,9	0	0	0	0
Total	20	100	25	100	35	100	52	100	36	100	88	100
Baby Gender												
Male	7	35	12	48	17	48,6	31	59,6	14	38,9	41	46,5
Female	13	65	13	52	18	51,4	21	40,3	24	66,7	47	53,4
Total	20	100	25	100	35	100	52	100	36	100	88	100
Maternal Hb												
< 10 gr/dl	3	15	6	24	5	14,3	10	19,2	3	8,3	22	25
10-11 gr/dl	14	70	14	56	22	62,9	23	44,2	21	58,3	46	52,2
11,2- 12,5 gr/dl	2	10	4	16	3	8,5	14	26,9	11	30,6	15	17,1
> 12,6 gr/dl	1	5	1	4	5	14,4	5	9,6	1	2,7	5	5,6
Total	20	100	20	100	35	100	52	100	36	100	88	100
Infant Survival/Death												
Infant Survival	19	95	22	88	32	91,4	47	90,3	35	97,2	71	80,6
Death	1	5	3	12	3	8,57	5	9,6	1	2,7	17	19,3
Total	20	100	25	100	35	100	52	100	36	100	88	100
Birth Weight												
< 1000 gr	1	5	1	4	0	0	2	3,8	0	0	5	5,6
1100-1500 gr	4	20	3	12	7	20	4	7,6	1	2,78	8	9,1
1510-1700 gr	2	10	1	4	4	11,4	6	11,5	3	8,33	6	6,8
1710-1900 gr	3	15	6	24	4	11,4	3	5,7	3	8,33	11	12,5
1910-2100 gr	4	20	7	28	6	17,1	8	15,3	7	19,4	7	7,9
2110-2250 gr	4	20	2	8	8	22,9	11	21,1	5	13,9	15	17,1
2260-2500 gr	2	10	5	20	6	17,1	18	34,6	17	47,2	36	40,9
Total	20	100	25	100	35	100	52	100	36	100	88	100
Infant Birth Weight Categories												
ELBW	1	5	1	4	0	0	2	3,8	0	0	5	5,6
VLBW	4	20	3	12	7	20	4	7,6	1	2,7	8	9,1
LBW	15	75	21	84	28	80	46	88,4	35	97,2	75	85,2
Total	20	100	25	100	35	100	52	100	36	100	88	100
Small for Gestational Age												
SGA	16	80	18	72	30	85,7	37	72,5	31	86,1	70	80,4
Non SGA	4	20	7	28	5	14,3	14	27,5	5	13,9	17	19,6
Total	20	100	25	100	35	100	51	100	36	100	87	100

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77 If grouped based on the mother's age range into 16-20 year's old (yo), 21-25 yo, 26-30 yo,
78 31-35 yo, 36-40 yo, 41-45 yo and 46-49 yo then each group gets as many as 31 (12.1%), 57
79 (22.2%), 76 (29.6%), 45 (17.5%), 41 (16%), 5 (1.9%) and 1 (0.3%) respectively. The findings
80 from Adugna and Worku [17] from a specialized hospital in northwest Ethiopia revealed that
81 6% of mothers who gave birth to LBW were age under 20 years old and this is lower than
82 our findings (12.1%) while further analysis of 2017 Indonesian Demographic and Health
83 Survey (IDHS) conducted by Wulandari et al [17] found out that pregnant women <20 years
84 had the sharpest LBW percentage (8.9%). These findings indicate that marriage at a young
85 age has the risk of producing offspring with low birth weight. Azinar et al [16] found in their
86 study that women who got married at very young age (<20 years) actually had a greater risk
87 (1,728 times) to have LBWB compared to those who gave birth in age >20 years old.

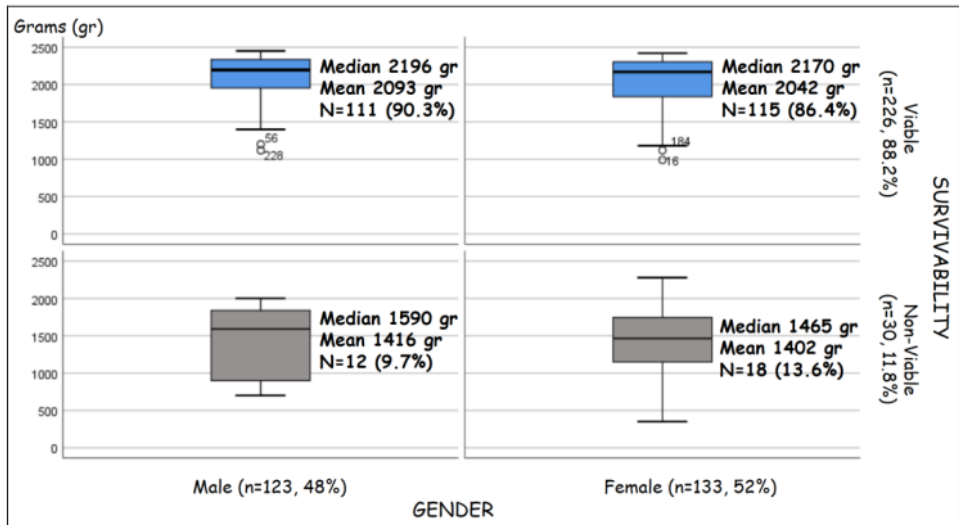
88 Sociological factors such as extreme impoverishment, rural type dwelling, socio-cultural
89 norms and social class in central Africa and southern part of Asia have all been connected
90 with premature onset of marriage [20]. Negative effect of premature marriage include: (1)
91 physical and psychological difficulties, e.g., extreme-risk pregnancy followed with risky
92 childbirth, diseases related to sexual relation, mental depression, and perhaps emotional
93 anguish; (2) sudden family issues such as conditional dissatisfaction due to marital milieu,
94 emotional shocking due to the burden of lots of responsibility, diminished of personal
95 independence in family life; (3) worsening social problems such as heavy smoking, risky
96 social behaviors, reduced of access to social and health services, social isolation, reduced
97 access to gain an appropriate job, and higher education opportunities; eventhough
98 perhaps there is also (4) positive exigency, e.g., accepting full intra-family support, improving
99 living milieu (compared to the pre-marriage condition), and opportunities for improvement,
100 progression with also empowerment [21,22].

101 Further breakdown of the data based on the maternal Hb level, showed us that in the range
102 <10 gr/dL, 10-11 gr/dL, >11-12.5 gr/dL and >12.5 gr/dL respectively were 49 (19.1%), 140
103 (54.6%), 49 (19.1%) and last but not least 18 (7%). Further statistical analysis to seek for
104 was there any significance of difference in birthweight based on maternal Hb level using
105 Wilcoxon signed rank test showed us there is a significant difference in birthweight based on
106 maternal Hb ($P=0.000$). Anemia in pregnant women possessed potential harm with
107 deteriorating consequences, both to the mother and the newborn [22,23]. A study conducted
108 by Nainggolan in Sumedang, west Java-Indonesia found 18.7% anemic pregnant women
109 [24]; while in our data, the prevalence of anemia among mother of LBWB was 189 individual
110 (73.8%). According to Kumari et al [25] The risk was rely on the anemia stratification and
111 classification, as the strongest relation was found in severe type of anemia with OR, 2.5 and
112 continued by moderate type anemia (OR, 1.11) and the last is the mild type anemia (OR,
113 0.57). The data suggest that the risk elevated along with the severity of anemia in pregnant
114 women.

115 In our opinion, among the existing independent variables, anemia may be one of the
116 condition that can be prevented or at least controlled. In India and many other countries,
117 anemia is varily seen in all age groups. A condition mainly caused by insufficient iron and or
118 folate in daily meal; where without realizing it, it is possible that daily food does not contain:
119 (1) enough vegetables or fiber (perhaps due to limited availability, financial problem and
120 even personal restriction); (2) restricted meat based food consumption; and (3)
121 unsatisfactory bioavailability of dietary iron from the routine daily diets. All of these three
122 actually must enrich plant-based diets that are presently encouraged among the community
123 as the feasible diets which heralded able to protect people from the risk of sendentary, non
124 communicable diseases, e.g., cardio-vascular diseases (CVD) and cancer [24-26]. This is
125 the main reason why it is necessary to strengthen the role of community medicine to reach
126 the vulnerable or even marginalized sub population [27]. A community-based intervention

127 designed for maintaining and even improving case detection and screening effort, referral
128 and up to follow-up commonly found anemia and other non-communicable illnesses
129 amongst pregnant and or postpartum women should be conducted massively through
130 community based antenatal care and health promotion [28-30].
131 Based on newborn survivability, 226 (88.2%) managed to survive until the babies was
132 discharged from the hospital. Unfortunately, 30 (11.8%) failed. To our opinion, sincere
133 compliment must be given to hospitals that are capable and strive to increase the
134 survivability of LBWB newborns ²⁶ statistical analysis to seek for difference between
135 survivability and birthweight using Independent-Samples Mann-Whitney U Test ($P=0.000$).
136 Further analysis based on the condition of SGA found out that out of 256 data LBWB, 204
137 classified as SGA (79.6%) and 52 (20.4%) not SGA. Statistical analysis using Pearson Chi
138 Square found out that $P=0.000$, means that there is a correlation between SGA and
139 survivability.
140 Regarding mortality of LBWB, study ⁸ conducted by Wondie et al [31] in Eithiopia found out
141 higher mortality rates, that reach 32.46% (95% CI 29.12% -35.8%) of LBW neonates in the
142 period of 1 week post partum. The condition ¹⁰ of LBWB surely increased the likelihood of
143 mortality in the time of infancy. Newborn with LBW had 200% bigger risk of experiencing
144 mortality during the first year of life compared to the normal children which born with
145 adequate birth weight ($\beta = 2.02$, 95% CI: 1.93, 2.12) [32]. Neonates with LBW are prone to
146 various type of comorbidities; this is due to the immaturity on histology, anatomical,
147 biochemical and physiological properties. Worldwide, 60 to 80% of newborn mortality was
148 caused by LBW [33]. Classic data presented by Carlidge and Stewart [34] showed that In
149 neonates with a birthweight ranging from 500 to 699 g, the one year survival rate was about
150 18%; compared ³ to 70% at birth weight 800 to 999 g, and increased significantly up to 97% at
151 1300 to 1499 g. The conceivability of survival among LBW ameliorated markedly with
152 surging postnatal age; for example, at 24-25 weeks of gestation it was 35% at birth, then
153 increased up ³ 50% at 12 hours post partum, elevated up to 66% at 1 week after delivery
154 and reached 78% at 4 weeks. Infant mortality was higher in males, but multiple pregnancy
155 actually had no effect. Birth weight is directly related to mortality that might have ²⁵ during
156 fetal, neonatal, and postnatal period; and future derangement of longstanding growth and
157 also development. LBW alone is the main contributing element to the neonatal mortality [35].
158 ¹
159 Low birth weight has been defined by WHO as weight at birth of < 2500 grams; and in our
160 study classified as follows: <1000gr, >1000-1500gr, >1500-1700gr, >1700-1900gr, >1900-
161 2100gr, >2100-2250gr and >2250-2500gr with the number of each group in sequence as
162 follows: 9 (3.5%), 27 (10.5%), 22 (8.5%), 30 (11.7%), 39 (15.2%), 4 ¹⁵ 17.5%) and 84
163 (32.8%). Further classification based on birth weight can be grouped into extremely low birth
164 weight (ELBW), very low birth weight (VLBW) and low birth weight (LBW) which the amount
165 in each group respectively: 9 (3.5%), 27 (10.5%) and 220 (85.9%). Statistical analysis to
166 seek for difference between gestational age (data not shown) with birthweight using
167 Wilcoxon signed rank test ($P= 0.000$). another statistical analysis conducted on difference
168 between maternal age and birthweight using Wilcoxon signed rank test ($P= 0.000$). Due to
169 the uniqueness of our data availability, it is difficult to compare with other study regarding the
170 incidence of LBWB, because most of them were come from hospital based data which
171 usually presented as a mix between the normal and abnormal birth weight. ²²
172 Globally according to WHO that cited by Cutland et al [36], it is roughly calculated about 15
173 to 20% of all birth ¹⁸ or estimated around 20+ million newborns annually, can be classified as
174 LBWB. Low- to middle-income countries (LMICs) reckon for a disproportionate load of
175 LBWB; >95 ¹ of the world's LBWB are come from LMICs [36]. The ultimate obstet ¹¹ is
176 finding and monitoring the incidence of LBW is that more than half of infants in the LMICs
177 are not weighed at or soon after birth, particularly in South Asia and sub-Saharan Africa,
178 which make ¹ it difficult for epidemiological studies to derive the real scope of the problem
179 [37]. Most population-based survey data often rely only on modeled estimates, with

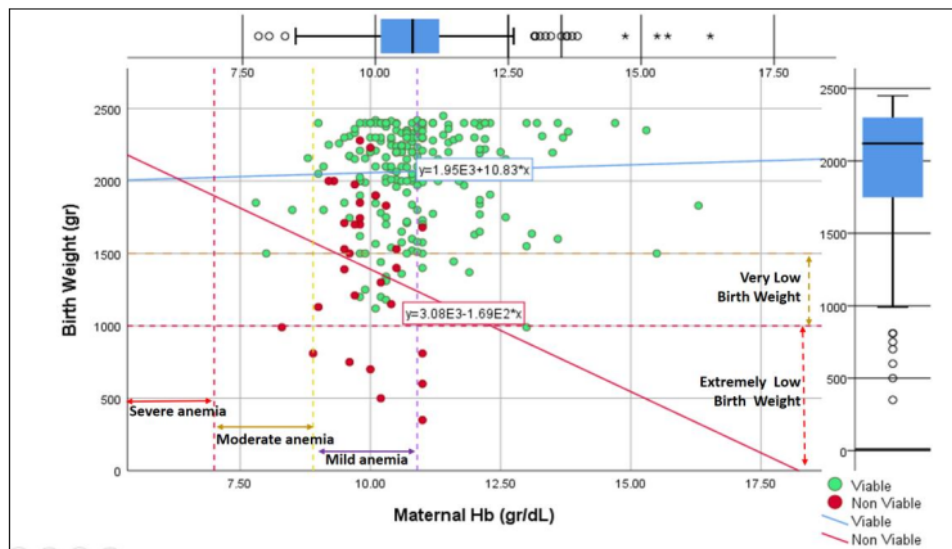
180 statistical methods to adjust for underreporting and misreporting of birth weight; because
 181 epidemiologically the report on this issue is rare and scarce [38].
 182 Once again, from the community medicine perspective, eventhough the scientific proof is
 183 insubstantial regarding the usefulness of home visiting care coordination in targeting poor
 184 birth result, especially for the LBWB, but the Community should be able to utilizes
 185 community health workers or cadres that suppose to actively screen and identify vulnerable
 186 women at risk of acquiring imperfect birth outcomes, followed by connect them to health and
 187 social services available in the community, and carefully follow-up each identified health or
 188 social issue to a measurable completion [39].
 189 Indonesia actually had established that kind of system nationally, called Posyandu whose
 190 main objective is community empowerment. It is a national programme rely on community
 191 based health service (*Upaya Kesehatan Berbasis Masyarakat/UKBM*) organized by the
 192 community member with full support from the local government, local health officers and
 193 community leaders. The activities in Posyandu are known as the five-table system,
 194 consisting of: (1) registration, (2) weighing, (3) charging the card to healthy (KMS), (4) health
 195 care, and (5) counseling. Posyandu is the leading role in giving the health and nutrition
 196 services with efforts to overcome the major health problems to women (specifically pregnant
 197 women) and also children [40].
 198 Furthermore, we conducted an in depth analysis regarding three data: birthweight,
 199 survivability (viable vs non-viable) and gender; data regarding mean, median and the
 200 number of each sub group also added; we presented it in box plot diagram (fig. 1).
 201



202
 203 **4** Fig 1. Box plot diagram regarding birth weight based on gender and survivability
 204
 205
 206

207 Data presented in fig. 1 showed us that in the Viable group on both sexes (male or female)
 208 have higher birth weight compared to the non viable group (2067 vs 1408gr). If studied
 209 more deeply based on gender, the male viable group have mean birth weight 2093gr which
 210 was slightly heavier compared to their counterpart the female newborn which viable have
 211 mean birth weight 2043gr. Survivability in both gender is almost the same (Male vs Female =
 212 90.3% Vs 86.4% viable) with mortality slightly higher in the female (9.7% vs 13.6%). The
 213 range of birth weight is slightly different between the male vs female newborn. The whisker
 214 line is more longer in the female group (compared to the male) and if compared more in-

215 depth, it appears that the non-viable female group has a longer whisker line than the viable
 216 ones. Means that, the birth weight range was much greater in the group of women who did
 217 not survive.
 218 Statistical analysis to seek for difference between gender based on birth weight using
 219 Pearson Chi-square test($P= 0.000$). Further statistical analysis for viability based on birth
 220 weight resulted $P=0.132$ which according to Pearson's R showed positive but weak
 221 correlation between viability and birth weight.
 222 Unlike our data regarding survivability based on gender, Abdallah [41] in Uganda found out
 223 that mortality was higher in male neonates (28.6% vs 13.1%), Ballot [42] in south Africa with
 224 male neonates mortality up to 42.7% and data from India reported by Aghai et al [43] that
 225 found out the rate of mortality among neonatal was clearly higher in male neonates
 226 (33.2/1,000 live births) compared to the female group (27.4/1,000, $p < 0.001$). According to
 227 Abdallah [41] the incidence of mortality among VLBW subsequent to hospital discharge is
 228 remain high. Discharge at weight less than 1200 gr clearly not recommended and may not
 229 be a safe procedure. Best effort to intercept sepsis and suspected cot death (or sudden
 230 infant death syndrome (SIDS)) should be clinically managed and directed appropriately prior
 231 to considering early discharge of these infants. All parents that bear children born LBW
 232 should be provided with appropriate education regarding specific baby handling, including
 233 baby hygiene and all of its utensils, in combination with appropriate medical and support
 234 services to minimize the lifelong backlashes of poor health condition at birth [44]. Once again,
 235 continuous health education must be conducted in order to improve routine and daily low-
 236 birthweight infant care practices [45]. This new age of information technology era suppose to
 237 be a blessing in disguise for effective health communication (in terms of modality of the
 238 media), as has been demonstrated many times during the Covid pandemic, which we
 239 believe can also be applied to health education issues for parents of low birth weight babies
 240 [46].
 241 Further more, we presented regression from data regarding maternal Hb with the newborn
 242 birth weight in fig. 2
 243
 244



245
 246
 247 Fig 2. Linear regression of maternal Hb and newborn birthweight. Viable LBWB newborns
 248 were marked with green circle, and non viable ones with red circle. For the viable group, the

249 trend has positive tendency (blue line) while for the non viable unfortunately has negative
250 tendency (red line).
251 Data presented in fig. 2 revealed that out of 226 viable newborn, 86 newborn (38%) had
252 mothers who were not anemic (mean Hb 12.0 gr/dL), 139 newborn had mother with mild
253 anemia (61.5%, mean Hb 10.2gr/dL) and only 1 newborn have mother with moderate
254 anemia (0.4%). While the non-viable group (n=30), 4 had mother with normal Hb level
255 (13.3%, with mean Hb 11gr/dL), 26 (86.7%) had mothers with mild anemia (mean Hb 9.7
256 gr/dL). In the viable group, higher maternal Hb level positively related with higher newborn
257 birth weight (blue color upward).
258 Most of the non viable newborn were born to mothers with normal or only mild to moderate
259 anemia; but the downward trend (red colour) suggested that the existence of other factors
260 that contribute to the failure to survive in these poor newborn. On contrary, more LBWB
261 babies are fortunate enough to still be able to survive, even though they are born to mothers
262 who suffer from mild to moderate anemia. Further study need to be conduct in order to find
263 the relevant factor that might contribute to survivability or mortality.
264 Maternal anemia always related to higher risk of disadvantageous events related to birth and
265 or health outcome [19, 7, 48]. In parts of Africa [49, 50], south Asia [48, 51], and many more
266 LMICs [52] actually had a higher maternal anemia prevalence than did other Asian and upper-
267 middle-income countries. Overall, in LMICs, 12% of low birth weight, 19% of preterm births,
268 and 18% of perinatal mortality were related to maternal anemia [47].
269 LBWB actually as an iceberg phenomenon, that has been linked to several contributing
270 factors, such as maternal [53], socio-demographic [54], physico-biologic [55] and behavioral
271 related maternal competency [56] as well as to the socio-economic welfare [57],
272 environmental [58], characteristics of specific households food insecurity situation [59] and
273 common neighborhoods poverty condition [60], and even up to government/state
274 expenditure [61] in combination with level of macro-economic conditions [62].

275
276

277 4. CONCLUSION

278

279 Anemic Maternal and gestational age correlate with birth weight of newborn. Further in depth
280 and extensive study need to explore specific factors contribute to the incidence of anemia
281 in mother who gave birth babies with low birth weight and their impact to pregnancy. Our
282 findings highlight the presence of maternal anemia in the distribution of LBWB. The
283 importance of maternal-parental specific health education through multi-model effort (direct
284 face to face health promotion or via social media) with improvement in socio-economic
285 environments in shaping LBWB, both in urban or rural settings. Implementing context-
286 sensitive interventions guided to improve women's education is highly recommended to
287 reduce the incidence of LBWB.

288
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291

292 We sincerely thanked the management of The Sultan Thaha Saifuddin Tebo Regional Public
293 Hospital, located in Jambi-Indonesia that provided us with very important raw data regarding
294 LBWB
295

296 **7**
297 **COMPETING INTERESTS**

298 "Authors have declared that no competing interests exist."
299

300 **AUTHORS' CONTRIBUTIONS**

301
302 "Author ED' designed the study, performed the statistical analysis, wrote the protocol, and
303 wrote the first draft of the manuscript. 'Author AS' and 'Author RF' managed the analyses of
304 the study using MS EXCEL, SPSS and MS Powerpoint and both also managed the literature
305 searches. All authors read and approved the final manuscript."
306

307 **CONSENT (WHERE EVER APPLICABLE)**

308
309 permission letter from the director of the hospital no 445/1970/RSUD/X/2023. No further
310 consent needed.

311
312
313 **ETHICAL APPROVAL (WHERE EVER APPLICABLE)**

314
315 Not needed
316
317

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