



18 AUG 1993]

LOW BIRTHWEIGHT BABIES : A CASE-CONTROL STUDY OF  
MATERNAL RISK FACTORS IN A BANGKOK MATERNITY HOSPITAL

DIGBIJAYA SHAMSHER J.B.RANA.

อธิปัตถนาการ

๑๓๓

" นึกพหุภวาทนาการ น.ป.๑๓๓ "

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF  
THE REQUIREMENTS FOR THE DEGREE OF  
MASTER OF SCIENCE  
(MEDICAL EPIDEMIOLOGY)

IN

FACULTY OF GRADUATE STUDIES

MAHIDOL UNIVERSITY

1993

Copyright by Mahidol University

23308

Thesis

entitled

LOW BIRTHWEIGHT BABIES : A CASE-CONTROL STUDY OF  
MATERNAL RISK FACTORS IN A BANGKOK MATERNITY HOSPITAL



*Digbijaya S. Rana*

.....  
Digbijaya S. Rana,  
Candidate.

*Pratap Singhavanon*

.....  
Pratap Singhavanon,  
M.B.; B.S., D.T.M. & H.,  
Dr. P.H.,  
Assistant Professor,  
Major advisor.

*Cherdlarp Vasuvat*

.....  
Cherdlarp Vasuvat, M.D.,  
D.T.M. & H. D.A.P. & E.,  
M.P.H. & T.M.,  
Associate Professor,  
Co-advisor.

*Somkiat Khoarmornpatana*

.....  
Somkiat Khoarmornpatana,  
M.D.,  
Clinical Lecturer,  
Co-advisor.

*Monthree Chulasamaya*

.....  
Monthree Chulasamaya, M.D.,  
Ph.D.,  
Dean,  
Faculty of Graduate Studies,  
Mahidol University.

*Cherdlarp Vasuvat*

.....  
Cherdlarp Vasuvat, M.D.,  
D.T.M. & H., D.A.P. & E.,  
M.P.H. & T.M.,  
Chairman,  
Master of Science Program in  
Medical Epidemiology.

Thesis

entitled

LOW BIRTHWEIGHT BABIES : A CASE-CONTROL STUDY OF  
MATERNAL RISK FACTORS IN A BANGKOK MATERNITY HOSPITAL

was submitted to the Faculty of Graduate Studies, Mahidol University for  
the degree of Master of Science (Medical Epidemiology)

on

21 May B.E. 2536 (1993)

*Digbijaya S. Rana*  
.....

Digbijaya.S.Rana,  
Candidate.

*Pratap Singhavanon*  
.....

Pratap Singhavanon, M.B.;B.S.,  
D.T.M. & H., Dr.P.H.,  
Assistant Professor,  
Chairman.

*Somkiat Khooarmornpatana*  
.....

Somkiat Khooarmornpatana, M.D.,  
Clinical Lecturer,  
Member.

*Cherdlarp Vasuvat*  
.....

Cherdlarp Vasuvat, M.D., D.T.M.& H.  
D.A.P. & E., M.P.H. & T.M.  
Associate Professor,  
Member.

*Sunthorn Horpaopan*, MD FAAP  
.....

Sunthorn Horpaopan, M.D.,F.A.A.P.,  
Neonatologist,  
External Examiner.

*Monthree Chulasamaya*  
.....

Monthree Chulasamaya, M.D.,  
Ph.D.,  
Dean,  
Faculty of Graduate Studies,  
Mahidol University.

*Somjit Supannatas*  
.....

Somjit Supannatas, M.Ed.,  
M.P.H., Dr.P.H.,  
Dean,  
Faculty of Public Health,  
Mahidol University.

## Acknowledgement

I express my thanks to my major advisor Dr. Pratap Singhasivanon and my co-advisor Dr. Somkiat Khoarmornpatana for their invaluable advise in this thesis. I am also grateful to the staff of Rajavithi Hospital for their co-operation in the collection of the data.

My sincere thanks to the Departments of Epidemiology, Tropical Medicine and Biostatistics for their enthusiasm and guidance during the course. My special thanks to Dr. Somchai Supanvanich and Dr. Cherdlarp Vasuvat for the warm rapport and patience with which they taught us all.

I thank Dr. Kulaiya Narksawat for co-ordinating my study during the year and Mr. Phongsak Nuamnakron and Miss Villai Kludprom for their various help which I had solicited during the year. I also thank H.M.G. of Nepal for the opportunity and the WHO for their financial assistance in the completion of my course.

I must mention two teachers par excellence, Dr. Pratap Singhasivanon and Dr. Jayantoon Patumanond who had been a constant source of inspiration during my study.

Finally, I thank all my friends for their constant help, my wife for her companionship and the people of Thailand for their genuine friendship and various help which was extended to me during my stay in Thailand.

Dr. Digbijaya. S. Rana

## BIOGRAPHY

NAME DIGBIJAYA SHAMSHER J.B.RANA

DATE OF BIRTH 5th. JULY, 1952

PLACE OF BIRTH KATHMANDU, NEPAL

### INSTITUTIONS ATTENDED

All India Institute of Medical Sciences,

M.B.;B.S., 1982.

Mahidol University,

M.Sc.(Medical Epidemiology), 1993.

### POSITION HELD AND OFFICE ADDRESS

Medical Officer,

Ministry of Health,

Kathmandu,

Nepal.

### AWARDS RECEIVED

'Seva Padak'



participants were randomly selected and the study used data derived from interviews with the post-partum mothers, using standard, structured questionnaires and hospital records. The results were analyzed using descriptive statistics in terms of numbers and percentages to compare the trend in the cases and the controls. Analytic study to see the effect of associations between the various maternal risk factors and low birthweight was done using OR, 95%CI and p-values. All risk exposures showing significant risk for low birthweight were finally adjusted for their potential confounding factors using software programme Mult-LR.

Crude analytic study showed six of the seventeen risk factors studied to be significantly associated with low birthweight. They were:

-mothers <18yrs. old when compared to mothers aged between 18-35 yrs. were 2.1 times more at risk of delivering a LBW.(OR = 2.1, 95%CI of OR = 1.03,4.29, p-val. = 0.0403).

-mothers weighing <45kgs. before pregnancy were 2.09 times more at risk of delivering a LBW when compared to mothers weighing >55kgs before pregnancy. (OR = 2.09, 95%CI of OR = 1.01 4.37, p-val. = 0.0460).

-mothers whose frequency of antenatal-care visit was <4 were 1.71 times more at risk of delivering a LBW than mothers whose frequency of ANC visit was  $\geq 4$ . (OR = 1.71, 95% of OR = 1.05,2.79 p-val. = 0.0313). Whereas mothers with no ANC visit were 2.99 times more at risk of delivering a LBW as compared to mothers who had  $\geq 4$  ANC visits (OR = 2.99, 95% of OR = 1.42,6.34, p-val. =

0.0026).

-mothers with a past history of having delivered a LBW were 2.07 times more at risk of again delivering a LBW as compared to mothers with no such history. (OR = 3.27, 95% of OR = 1.32,8.09, p-val. = 0.0063).

-expectant mothers who were in contact with cigarette smokers for >12hrs./day were 3.17 times more at risk of delivering a LBW as compared to expectant mothers who were in contact for <3hrs./day (OR = 3.17, 95% of OR = 1.27,11.1, p-val. = 0.0128).

-babies who were born with gestational age <37wks were 15.9 times more at risk of being of low birthweight than those babies who were born at term. (OR = 15.9, 95% of OR = 8.43,30.8, p-val.= <0.0001.

After simultaneously adjusting for their potential confounders, of the six significant factors in the crude analysis only two were significant:

-gestational age (OR = 15.85, 95% of OR = 8.6,29.1, p-val. = <0.001).

-past h/o LBW (OR = 3.69, 95% of OR = 1.59,8.56, p-val. = 0.0022).

In conclusion, mothers' past history of having delivered a low birthweight and her gestational age are risk factors for delivering a low birthweight baby independent of her age, pre-pregnancy weight, frequency of her ANC visits and duration of her smoking or in contact with cigarette smokers.

The findings of this study is limited to Rajavithi Hospital and cannot be generalized to all of Thailand. Anyway, this study can be used as a rough guide to future studies on the topic in Thailand.



## TABLE OF CONTENTS

	PAGE
ABSTRACT.....	i
TABLE OF CONTENTS.....	iii
LIST OF TABLES.....	v
CHAPTER	
I INTRODUCTION.....	1
II LITERATURE REVIEWS.....	5
CONCEPTUAL FRAMEWORK.....	17
III OBJECTIVES OF THE STUDY.....	18
-General objective.....	18
-Specific objectives.....	18
-Significance of the research.....	19
-Hypothesis.....	19
-Definition of the terms.....	22
-Study design.....	24
-Place of study.....	24
-Study population.....	24
-Criteria for selection of cases and controls....	24
-Exclusion criteria for cases and controls.....	25
-Sample size.....	26
-Data collection.....	27
-Data preparation.....	28
-Plan of analysis.....	28
-Descriptive statistics.....	28
-Bivariate analysis.....	29

## -TABLE OF CONTENTS (CONT.)-

	-Multivariate analysis.....	29
	-Limitation of the research.....	30
	-Ethical consideration.....	30
IV	RESULTS OF THE STUDY.....	31
	-Descriptive characteristics of the sample.....	31
	-Crude statistical analysis.....	47
	-Multivariate analysis.....	51
V	DISCUSSION .....	60
VI	RECOMMENDATIONS.....	82
	REFERENCES.....	86
APPENDIX		
A	Questionnaires.....	90
B	Abbreviations.....	96

## LIST OF TABLES

TABLES	PAGE
1	Birthweight and neonatal mortality..... 2
2	Mean birthweights and low birthweight prevalence by country..... 3
3	Distribution of average birthweight and percentage of low birthweight in Thailand..... 5
4	Comparison of genetic and constitutional characteristics between LBW cases and controls in Rajavithi hospital, Bangkok 1993..... 32
5	Comparison of demographic and psycho-social characteristics between LBW cases and controls in Rajavithi hospital, Bangkok 1993..... 35
6	Comparison of obstetric characteristics between LBW cases and controls in Rajavithi hospital, Bangkok 1993..... 39
7	Comparison of nutritional characteristics between LBW cases and controls in Rajavithi hospital, Bangkok 1993..... 40
8	Comparison of maternal morbidity during pregnancy between LBW cases and controls in Rajavithi hospital, Bangkok 1993..... 41

## -LIST OF TABLES (CONT.)-

9	Comparison of toxic exposures during pregnancy between LBW cases and controls in Rajavithi hospital, Bangkok 1993.....	44
10	Comparison of Antenatal-care between LBW cases and controls in Rajavithi hospital, Bangkok 1993.....	46
11	Comparison of genetic and constitutional factors between LBW cases and controls.....	47
12	Comparison of demographic and psychosocial factors between LBW cases and controls.....	47
13	Comparison of obstetric factors between LBW cases and controls.....	48
14	Comparison of nutritional factor between LBW cases and controls.....	49
15	Comparison of Maternal morbidity factors between LBW cases and controls.....	49
16	Comparison of toxic exposures during pregnancy between LBW cases and controls.....	50
17	Comparison of Antenatal-care during pregnancy between LBW cases and controls.....	50
4.3.7.	Predictors of LBW outcome including gestational age.....	56
4.3.8.	Prediction probability of LBW outcome.....	58

## CHAPTER I

### INTRODUCTION

Low birthweight (<2500 gms.) is a prime public health problem, especially in the developing countries. This condition is associated with poor physical and intellectual child-development, increases in perinatal and infant mortality, neurological and other disabling sequelae and economic loss to the family and the nation. Low-birth-weight also indicates the socio-economic and health status of the communities into which they are born.

An estimated 21 million L.B.W. babies are born yearly, 19 million in developing countries<sup>(1)</sup>. The risk of mortality of LBW babies is up to 20 times higher than that of other babies in the neonatal period as shown in Table 1.

The incidence of low birthweight in Thailand, as reported by the Ministry of Public Health is 9.3%. In the 7th. five-year Health Development Plan (1992-1996) it is hoped to bring this rate down to 7% by 1996, thus hoping to decrease the present infant mortality rate of 35 per 1000 live-births to 23 per 1000 live births.

TABLE 1. BIRTH WEIGHT AND NEONATAL MORTALITY

Birth Weight	Mortality Rate
3501 - 4000	0.3
3001 - 3500	0.5
2501 - 3000	0.6
2001 - 2500	3.0
1501 - 2000	14.0
1001 - 1500	44.0
501 - 1000	90.0
<500	100.0

Source: Neonatal Mortality Birth Wt. of University of Colorado Medical Center 1950-1968.

The etiology and epidemiology of LBW have been vastly investigated over the last few decades. As a result, it is now acknowledged that many factors can influence the gestational length and rate of intrauterine growth, showing the cause of L.B.W to be multifactorial. Due to the failure to distinguish between IUGR and prematurity there is considerable confusion and controversy about the factors that have independent effects on L.B.W. as well as the quantitative importance of those effects. The important reason for the discrepant findings has been the failure to distinguish associated factors from true causal determinants.

Many factors may individually insignificantly influence birthweights. To demonstrate such small effects

are statistically significant requires large sample sizes and the control of all potential confounders. Unfortunately reliable sources of data on large sample sizes, such as birth certificates and hospital records often lack key clinical information, e.g. height and pre-pregnancy weight of the mothers, gestational weight gain, smoking and drinking habits. Most clinical studies done in hospitals are often satisfactory for measuring potentially important variables, but the sample sizes are usually too small to detect small effects, and may also be unrepresentative.

TABLE 2. MEAN BIRTH WEIGHTS AND LOW BIRTH WEIGHT (LBW) PREVALENCE BY COUNTRY

COUNTRY	MEAN BIRTHWEIGHT (gms.)	LBW%
<b>NORTH AMERICA</b>		
Canada	3327	6.0
USA	3299	6.9
<b>EUROPE</b>		
France	3240 - 3335	5.6
Federal Republic of Germany	3356	5.5
Hungary	3144 - 3162	11.8
Italy	3445	4.2
Norway	3500	3.8
Sweden	3490	4.0
United Kingdom	3310	7.0

( Table 2. continued )

COUNTRY	MEAN BIRTHWEIGHT (GMS.)	LBW%
<b>LATIN AMERICA</b>		
Brazil	3170 - 3298	9.0
Chile	3340	9.0
Colombia	2912 - 3115	10.0
Guatemala	3050	17.9
Mexico	3019 - 3025	11.7
<b>AFRICA</b>		
Egypt	3200 - 3240	7.0
Kenya	3143	12.8
Nigeria	2880 - 3117	18.0
Tunisia	3210 - 3376	7.3
Zaire	3163	15.9
<b>ASIA</b>		
China	3215 - 3285	6.0
India	2493 - 3285	30.0
Indonesia	2760 - 3027	14.0
Iran	3012 - 3250	14.0
Iraq	3540	6.1
Japan	3200 - 3208	5.2
Malaysia	3027 - 3065	10.6
Pakistan	2770	27.0
Thailand	3014	9.3

Source: Bulletin of the World Health Organization, 65 (5) 633-737 (1987).

## CHAPTER II

## LITERATURE REVIEW

Like in other developing countries, in Thailand low-birth-weight is a paramount maternal and child health problem. The Health Planning Division, Ministry of Public Health, Thailand (1992) has stated the proportion of low-birth-weight in Thailand to be 9.3% as of 1989. This has substantially come down since 1982, the figures of which are shown region-wise in Table 3.

Table 3. Distribution of average birth weight and the percentage of low-birth-weight in Thailand.

Region	Av. birth weight (gms.)	% of LBW
Northern	2933	12.9
North - Eastern	2980	10.4
Central (excluding Bangkok)	3042	9.4
Eastern	3039	9.0
Western	3050	9.9
Southern	3044	9.9

In Thailand a multicenter unmatched case-control study to provide a research method for investigating factors that may prevent LBW newborns by Termsri Chumnijarakij et al.<sup>(2)</sup> in 1986-1987 have concluded the following results:

- Women who weigh <45 kgs. had a 7.15 times greater risk of delivering a LBW over women weighing 45-54.9 Kgs. This difference was statistically significant at the 95% confidence level.
- Mothers <150 cms. have 1.41 times the risk of mothers between 150-159.9 cms. for delivering a LBW. This too was statistically significant at the 95% confidence level.
- Mothers of parity 1 or parity  $\geq 4$  have 1.72 times the risk of delivering a LBW than mothers of parity two, and 1.33 times the risk of mothers with parity 3. Statistically significant at the 95% confidence level.
- It was found that mother's age between 35-39yrs. have 1.32 times the risk of LBW than mother's age between 19-34yrs. This RR was statistically significant and increased with maternal age. If the mother's age is >40yrs. then the risk of LBW is 3.62 times that of mother's age between 19-34yrs.
- For mother's level of education it showed that lower-educated mothers have higher risk to deliver

LBW babies. As compared to mothers who had  $\geq 12$  yrs. of schooling, those with no schooling, 4 yrs. of schooling, and 9 yrs. of schooling had relative risks of 1.67, 1.33, 1.39 respectively; all being significant at 95% confidence level.

- Low family-incomes of  $< \$40/\text{month}$  and  $\$40-\$200$  per month had relative risks of 1.75 and 1.35 as compared to those earning  $> \$200$ . Both RR being significant at 95% confidence level.
- Mothers who were working as either laborer or in agriculture had a RR of 1.36 and 1.5 respectively of giving birth to LBW as compared to mothers working in offices. These RR were significant at 95% confidence level.
- If the inter-pregnancy interval was  $< 6$  months the relative risk of giving birth to LBW baby was 1.47 as compared to those of interval  $> 25$  months and this RR was significant at 95% confidence level.
- Mothers with no antenatal-care visits or with  $< 4$  antenatal-care visits had RR of giving birth to LBW babies 2.26 and 1.59 times as compared to those mothers who had  $> 4$  antenatal-care visits; these RR were significant at 95% confidence level.

The gravity of the problem of LBW has now been universally recognized and L.B.W. has been designated by WHO as an indicator for monitoring progress towards 'health for all by the year 2000 A.D.'

It is generally known that low birthweight can be caused by many factors. Between 1970-1984 a total of 921 relevant publications in English and French were identified, of which 895 were successfully located and reviewed by M.S. Kramer<sup>(3)</sup>. Factors with well-established causal impacts on intrauterine growth include infant sex, racial/ethnic origin maternal height, pre-pregnancy weight, paternal weight and height, maternal birth weight, parity, history of prior low-birthweight infants, gestational weight gain and calorie intake, general morbidity and episodic illness, malaria, cigarette smoking, alcohol consumption and tobacco chewing. In developing countries, the major determinants of IUGR are black or Indian racial origin, poor gestational nutrition, low pre-pregnancy weight, short maternal stature, and malaria. In developed countries, the most important single factor by far, is cigarette smoking, followed by poor gestational nutrition and low pre-pregnancy weight. Future research should focus on factors of potential quantitative importance for which data are either unavailable or inconclusive. In developing countries the most important of these for intrauterine growth

are calorie expenditure (maternal work), antenatal-care, and certain vitamins and trace elements.

Birthweight is the single most important factor that affects neonatal mortality, in addition to being a significant determinant of post-neonatal infant mortality and of infant and childhood morbidity.

Low birthweight is defined by WHO as a birth weight less than 2500 grams, since below this value birth-weight-specific infant mortality begins to rise rapidly.

Birth weight is governed by two major processes: duration of gestation and intrauterine growth rate. Low birthweight is thus caused by either a short gestation period or retarded intrauterine growth (or a combination of both). The best available global estimates of mean birth weight and the prevalence of LBW were produced by WHO in 1979 and updated to 1982. Of the 127 million infants born in the world in 1983, 20 million (16%) were estimated to weigh less than 2500 gms. and over 90% of these infants were born in developing countries.

C.R.S. Dougherty and A.D. Jones made an analysis of the variations in birth weight of term babies associated with

the socioeconomic, physical and medical factors recorded at a London hospital<sup>(4)</sup>. The results showed that the sex of the baby, parity, maternal smoking during pregnancy, maternal height, weight, marital status, and race, and gestation were all important and significant factors. This was a case-control study of 1115 obstetric patients who had given birth at London Hospital. They had excluded from the study, cases in which the duration of gestation was less than 37 weeks or the birth weight was less than 2500 gms., delivery was by section, multiple births and mothers <18 yrs. The results of multivariate regression analysis showed that female babies weighed 118 gms. less than males which was significant at 0.1% level. Babies born to multiparous mothers weighed 104 gms. more than those born to primiparous mothers. This too was shown to be significant at 0.1% level. Maternal age was not an important factor. Maternal height was divided into lower quartile (157 cms. or less) and upper quartile (169 cms. or more), and the remainder was taken as the reference category. The analysis showed that the babies born to mothers in the upper quartile were 81 gms. heavy, and those born to mothers in the lower quartile were 132 gms. light after all other factors were controlled. Height treated as a continuous variable, had a coefficient of 11.3 gms. increase in birth weight per centimeter, significant at the 0.1% level. Likewise it was also found that the heavier the mother at

booking, the heavier the baby. Again the sample was divided into lower quartile (54 kilos or less) and upper quartile (68 kilos or more) and the remainder was taken as the reference category. When maternal weight was treated as a continuous variable it had a coefficient of 4.8 gms. increase in birth weight per kilogram of maternal weight, significant at the 0.1% level. The fully specified regression indicated that moderate smokers (<15 cig./day) had babies 107 gms. lighter than those of nonsmokers. Heavy smokers (16 or more cig./day) had 158 gms. light. These were significant at 1% levels. In this study the non-caucasian estimate in the fully specified regression, 122 gms. light as compared to the reference group the caucasian, was very highly significant at 0.1%.

A retrospective study was conducted by Sansnee Jirojwong and Michael Skolnik in two hospitals in Southern Thailand<sup>(5)</sup> from April to Dec. 1987. The socio-economic, biological, and obstetric characteristics of 602 cases and 705 controls were compared based on standardized interviews with postpartum women. In this study, the case group comprised all women who delivered infants with a birth weight between 500-2499 gms. and the controls were randomly and systematically selected and consisted of every seventh woman who delivered an infant with a birth weight between 2500-4000 gms. During the study period there were 5791 deliveries and the proportion of

infants with low birth-weight of less than 2500 gms. was 12.2%. It was found that LBW deliveries occur more commonly in women who are poorly educated, are not government employees, are in a family with a monthly income of less than 3000 baht, and who are engaged in housework. The odds ratio of giving birth to LBW newborns as compared to mothers of +10 grade education were for mothers lower than Grade 4, 2.42 with 95%CI of 1.49,3.96 and for mothers with Grade 4-7 level of education the OR was 1.39, with 95%CI of 1.06,1.81. When various occupations are taken as risk factors to L.B.W and comparing them to 'Govt. Officer' (taken as 1) it was found that traders/ employee/ peasant had the OR 2.18, with 95%CI of 1.15,4.18. Taking monthly family-income of 6000 Bahts or more as 1, this study has shown that those families earning <3000 Bahts had the OR 1.18 (95%CI = 1.31,2.51) and those earning 3000- 5999 Bahts had the OR 1.32 (95%CI = 0.95,1.84). In this study, too as in so many literatures, there was an association between cigarette smoking and Low-Birth-Weight. Here the OR was 1.92 (95%CI = 1.32,3.02) as compared to non-smoking mothers. Maternal ht. of <150 cms. was significantly associated with L.B.W. babies as compared to mothers whose height was >150 cms. The OR was 1.85 and 95% CI was 1.45, 2.38. and  $p < 0.0001$ .

Joel C Kleinman and Jennifer H. Madans<sup>(6)</sup> studied

the effects of maternal smoking, physical stature, and educational attainment on the incidence of low-birth-weight. Their study was based on the data from 1980 National Natality Survey, which was a retrospective survey based on a random sample of 9941 live birth certificates for births to residents of U.S.A. during 1980. In addition to the information on the birth certificates, information on smoking, height, weight, prenatal health practices, prenatal care, previous pregnancies and on socio-demographic characteristics were obtained by mailed questionnaires or telephone interviews when the questionnaires were not returned from mothers who were married at the time of the delivery. The data obtained were then analyzed using multiple logistic regression to control for the effects of infant's sex, live birth order, and maternal age. It was found that women with less than 12 yrs. education had a low birthweight odds ratio of 2.38 and women with 12 yrs. had a low birthweight odds ratio of 1.24 relative to women with 13 or more years of education. After further controlling for height, weight and smoking these odds ratios were reduced to 1.59 and 1.1 respectively. Controlling for smoking, however, had a more substantial effect - the odds ratios were reduced to 1.16 (95%CI = 1.15,2.27) and 1.11 (95%CI = 0.9,1.38). Thus differences in smoking accounted for over half the excess risk of low-birth-weight in each education group. Evidently the number of cigarettes smoked

per day had a strong effect on LBW with the odds ratio multiplied by 1.26 for every 5 additional cigarettes smoked per day (95%CI = 0.19,1.33). Thus, the odds ratio of having a low birth-weight infant for women who smoked 21 or more cigarettes per day compared to those who did not smoke was 3.16 (95%CI = 2.36,4.33).

Silva de Sanjose and Eve Roman<sup>(7)</sup> studied the effects of maternal age, gravidity, marital status, previous perinatal deaths, and parental social class on babies born low-birth-weight in Scotland. Their study used data on discharge summaries from all maternity hospitals in Scotland. Their analysis involved information on 2,59,462 singleton babies born during 1981-1984.

Their findings are tabulated below:

	LBW RR (95% C.I.)
<b>MOTHER'S AGE (YEARS)</b>	
<20	1.2 (1.1 , 1.2)*
20-29	1.0
30-34	1.1 (1.0 , 1.1)*
>34	1.2 (1.1 , 1.4)*
<b>GRAVIDITY</b>	
0	1.3 (1.2 , 1.3)*
1	1.0
2	1.1 (1.0 , 1.1)*
3+	1.3 (1.2 , 1.3)*
<b>PREVIOUS PERINATAL DEATH</b>	
none	1.0
1+	2.2 (1.9 , 2.4)*
<b>MARITAL STATUS</b>	
married	1.0
single	1.3 (1.2 , 1.4)*
previously married	1.5 (1.3 , 1.6)*
<b>MOTHER'S SOCIAL GROUP</b>	
non-manual	1.0
manual	1.2 (1.2 , 1.3)
housewives	1.1 (1.1 , 1.2)
other	1.3 (1.2 , 1.4)
<b>FATHER'S SOCIAL GROUP</b>	
non-manual	1.0
manual	1.5 (1.4 , 1.5)
other	1.7 (1.6 , 1.8)

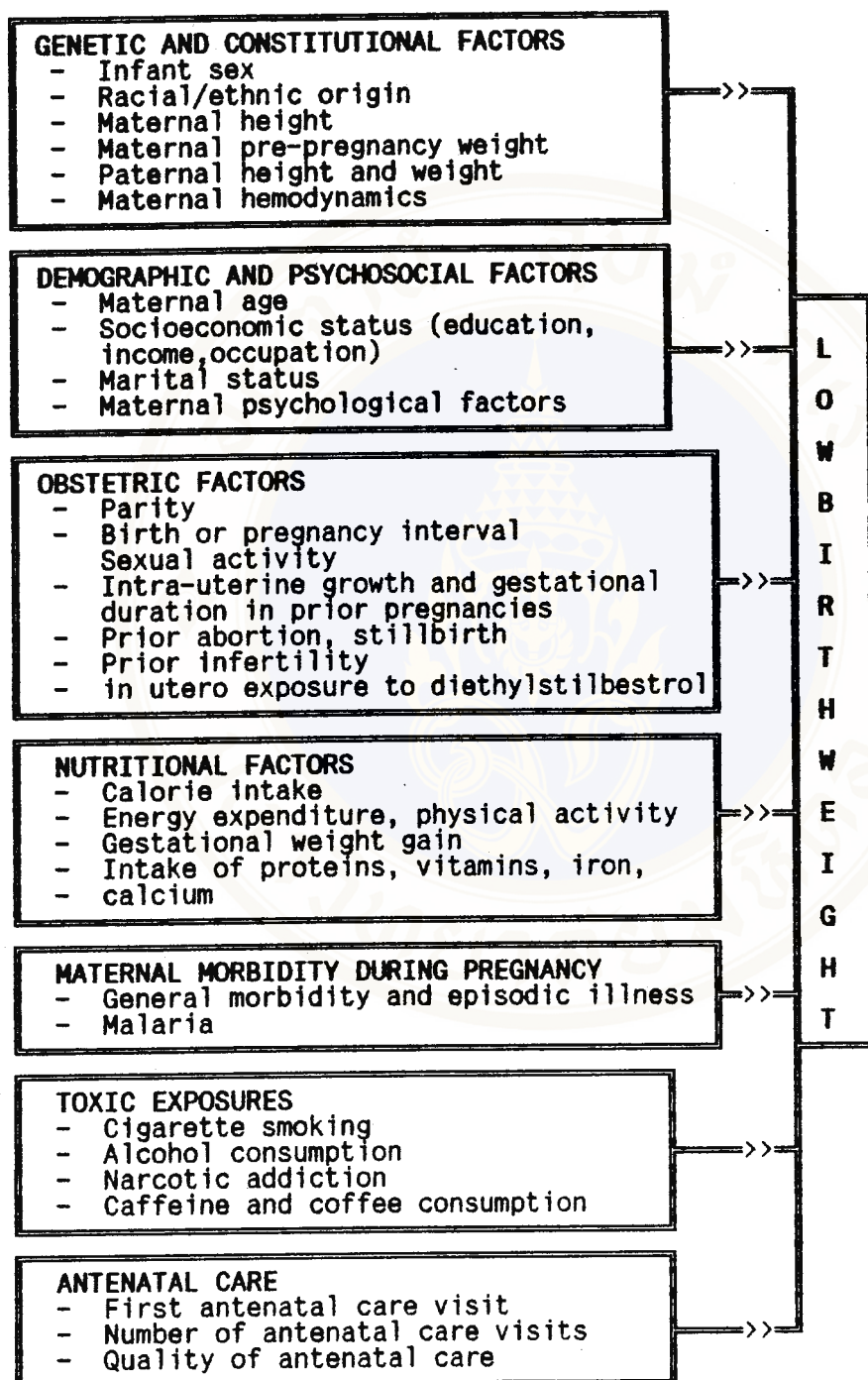
\* significant ( $P < 0.05$ )

In this study previous perinatal death was found to be the strongest predictor for low birthweight, single mothers were at high risk of having small for gestational age baby and women aged less than 20 yrs., those >34 yrs., nulligravidae, and those of parity of 3 or more were also at increased risk

of adverse pregnancy outcome. Mothers and fathers in manual social classes and those who could not be assigned a social class on the basis of their occupation were also at an increased risk. The babies of parents who were in manual occupations were twice as likely as those of parents in non-manual occupations. Mother's social class was a risk factor for adverse pregnancy outcome independent of maternal age, parity, and adverse reproductive history, and also independent of father's social class.

Brody DJ and Bracken MB in their study<sup>(8)</sup> have reported that those conceiving within 1-4 months of a prior live birth were at increased risk of delivering a low birth weight newborn (RR = 5.70, 95%CI = 0.83, 39.75), as were those conceiving 5-8 months later (RR = 3.25, 95%CI = 1.02, 10.34), when compared with women conceiving 9 or more months later. Adjustment was made for maternal age, ethnicity, preterm delivery or low birthweight of prior newborn, and cigarette smoking in pregnancy.

### Conceptual Framework



## CHAPTER III

## OBJECTIVES OF THE STUDY

3.1 General objective

To study the association between the maternal risk factors and the occurrence of low birthweight babies in Rajavithi Hospital.

3.2 Specific objectives

3.2.1. To measure the prevalence of low birthweight babies among the live-birth babies in Rajavithi Hospital, Bangkok.

3.2.2. To collect data on maternal characteristics associated with low-birth-weight in Rajavithi hospital.

3.2.3. To identify and measure the effect of associations between various maternal risk factors and low-birth-weight after adjusting for the potential confounding factors.

3.2.4. To identify whether certain risk factors associated with LBWs are being modified by other risk factors.

### 3.3 Significance of the research

- 3.3.1. This study is attempted to determine the precise risk of various maternal factors for L.B.W. among Thai women in Bangkok.
- 3.3.2. The results can be utilized in a programme of prevention and control measures to reduce the incidence of L.B.W. among Thai women.
- 3.3.3. Performance of this research will tremendously assist the researcher to gain epidemiological research skill.

### 3.4 Hypothesis

There is an association between low-birth-weight and the following factors:

- 3.4.1. Genetic and constitutional factors:
- Infant sex. Female infants are at a higher risk of being of low birthweight than male infants.
  - Maternal height. Mothers of short stature have a higher risk for delivering low birth-weight infants than taller mothers.
  - Maternal pre-pregnancy weight. Mothers who are underweight are at a higher risk of

delivering a low birthweight infant than heavier mothers.

3.4.2. Demographic and psychosocial factors:

- Maternal age. Mothers <18yrs. and those >35yrs. are at a higher risk of delivering a LBW than mothers aged between 18-35 yrs.
- Socio-economic status (education, occupation, income). Mothers of a low socio-economic status are at a greater risk for delivering a LBW than mothers of a higher socio-economic status.
- Marital status. Unmarried mothers are at a higher risk for delivering a LBW than those who are married.

3.4.3. Obstetric factors:

- Parity. Primiparae and grand-multiparae are at a greater risk of delivering a LBW than multiparae.
- Birth-interval. Mothers with shorter inter-pregnancy interval is at a higher risk of delivering a LBW than mothers with a longer inter-pregnancy interval.
- Prior stillbirth, neonatal death or LBW babies. Mothers with a past history of such factors is at a higher risk of delivering a

LBW than mothers with no such history.

3.4.4. Nutritional factors:

- Iron and anaemia. Mothers of low haematocrit levels are at a higher risk to deliver a LBW than those mothers with normal haematocrit.

3.4.5. Maternal morbidity during pregnancy:

- General morbidity and episodic illness. Mothers suffering from illnesses during their pregnancy is at a higher risk of delivering a LBW than those mothers who did not suffer any illnesses during their pregnancy.

3.4.6. Toxic exposures:

- Cigarette smoking. Mothers who smoke during their pregnancy, or are in contact with cigarette smokers during their pregnancy are at a higher risk of delivering a LBW than those mothers who did not smoke and were not in contact with cigarette smokers during their pregnancy.
- Alcohol consumption. Mothers who consume alcohol during their pregnancy is at a higher risk of delivering a LBW than those mothers who abstains from alcohol during their pregnancy.

- Coffee consumption. Mothers who consume coffee during their pregnancy is at a higher risk of delivering a LBW than those mothers who did not take any coffee during their pregnancy.

3.4.7. Antenatal-care:

- Mothers with no or insufficient( $<4$ ) antenatal care is at a higher risk of delivering a LBW than mothers with sufficient( $\geq 4$ ) antenatal-care.

3.5 Definition of the terms

- 3.5.1. Low-birthweight pertains to any infant with a birthweight  $<2500$  gms.
- 3.5.2. Anaemia exist in women during pregnancy if Haematocrit is  $<30\%$ .
- 3.5.3. Live birth means fetus of complete duration of pregnancy that show evidence of life such as presence of heart beat and pulsation of umbilical cord.
- 3.5.4. Still-birth is birth after 28 wks. of pregnancy in which the baby does not breathe or show any other signs of life after being completely expelled from the mother.

- 3.5.5. Antenatal-care refers to complete health supervision of the pregnant women in order to maintain, protect and promote the health and well being of the mother, the fetus and the new-born infant.
- 3.5.6. Maternal height is the height of the mothers in cms. taken barefoot.
- 3.5.7. Parity is the status of a women as regards the fact of having borne viable children. The number of full-term children previously borne by a woman excluding miscarriages or abortions in early pregnancy, but including stillbirths.
- 3.5.8. Birth-interval. Interval between termination of one completed pregnancy and the termination of the next.
- 3.5.9. Maternal weight is her weight in kilograms before she conceived the present child.
- 3.5.10. Maternal illness is defined as the mothers' incapability of performing her routine work due to ill-health more than 24 hours.
- 3.5.11. Gestational length is calculated from the first day of the last menstrual period upto date of delivery.
- 3.5.12. Unmarried mothers are those mothers who do not possess an official marriage certificate.

### 3.6 Material and methods

#### 3.6.1 Study Design.

Hospital-based unmatched case-control study.

#### 3.6.2. Place of study.

Rajavithi Hospital, Bangkok. This hospital is situated in the heart of Bangkok, catering to about 1500 delivery cases per month.

#### 3.6.3. Study Population.

All LBW cases and controls identified in Rajavithi Hospital.

#### 3.6.4. Criteria for selection of cases and controls.

**Case:** Cases were mothers who had delivered a single new-born weighing <2500 gms. between Jan.20, 1993 to March 31, 1993. A total of 144 cases were interviewed by structured questionnaires.

**Control:** Controls were mothers who had delivered a single new-born weighing 2600-3500 gms. between Jan.20, 1993 to March 31, 1993 in the same hospital. They too, were interviewed by the same set of questionnaires. These controls were selected from the same ward, giving birth on the same day and immediately

following the cases i.e. after the delivery of the case, two subsequent normal deliveries were taken as controls. Two controls were selected for each case.

### 3.7 Exclusion criteria for both cases and controls

- 3.7.1. Those suffering from chronic illnesses e.g. Diabetes, Tuberculosis, Psychiatric disorders, HIV infection, malignancies etc.
- 3.7.2. Those delivering multiple babies.
- 3.7.3. Stillbirths.
- 3.7.4. Mothers who had not delivered through the vaginal canal. This meant caesarian cases were excluded from the study.

3.8. Sample size      Formula used ( Schlesselman )

$$n = \frac{[Z_{\alpha}\sqrt{2pq} + Z_{\beta}\sqrt{p_1q_1 + p_0q_0}]^2}{(p_1 - p_0)^2}$$

where,

- n = required sample size.
- $p_0$  = Proportion of the exposed among the control  
= 0.15
- R = Relative risk corresponding to the smallest  
increase or decrease in risk of interest = 2
- $Z_{\alpha}$  = Significance level at 0.05 = 1.64
- $1 - Z_{\beta}$  = Power of the study = 0.80
- $p_1$  =  $p_0R / \{1 + p_0(R - 1)\}$   
=  $0.15 \times 2 / (1 + 0.15(2 - 1)) = 0.26$
- p =  $(p_1 + p_0) / 2 = 0.26 + 0.15 / 2 = 0.21$
- q =  $1 - 0.21 = 0.79$

$$n = \frac{(1.64\sqrt{2 \times 0.21 \times 0.79} + 0.84\sqrt{0.26 \times 0.74 + 0.15 \times 0.85})^2}{(0.26 - 0.15)^2}$$

$$= 2.0155 / 0.0121 = 167$$

Therefore no. of cases = 170

no. of controls = 340.

Total = 510.

### 3.9. Data collection

- 3.9.1. Data were collected during the study period 20/1/1993 to 31/3/1993.
- 3.9.2. Relevant data were collected from the mothers of 'cases' and 'controls' by the help of structured questionnaires and hospital records.
- 3.9.3. Paramedical staffs were hired as interviewers. To obtain reliable information from the interviews the following steps were taken:
- the interviewer explained to the study subjects the purpose of the interview and verbal consents were taken.
  - privacy was strictly enforced during the interviews and interruption was avoided as far as possible.
  - The interviewers stressed to the study subjects confidentiality of the information to be derived.
  - the interviewer adopted a respectful and a warm approach to the respondents.

### 3.10. Data preparation

Data were coded, edited and entered into a microcomputer using dbaseIII plus®.

### 3.11. Plan of analysis

The independent variables were categorized as either continuous, ordinal or nominal and were analyzed using appropriate statistical tests. To facilitate the computation statistical software such as EPIINFO VERSION 5, EPISTAT, HARVARD GRAPHICS and MULTI-LR were used.

### 3.12. Descriptive statistics

Only one dependent variable and one independent variable were analyzed at a time. Maternal height, maternal pre-pregnancy weight, sex of infant, maternal age, socio-economic status, parity, pregnancy interval, iron and anaemia, cigarette smoking, alcohol and coffee consumption, number of antenatal-care, past history of still-born and LBW, sickness and malaria during pregnancy, gestational age, haematocrit level and type of delivery were considered as dependent variables.

### 3.13. Bivariate analysis

One dependent variable and one independent variable were analyzed at a time and hypothesis testing was done. The dependent variable was the presence or absence of LBW. while maternal age, sex, height, parity etc. were considered as independent variables. Crude OR with its 95%CI and p-value of Chi-square or Fisher's test were found.

### 3.14. Multivariate analysis

Logistic Regression analysis was done to simultaneously control for confounders, to assess possible interaction between different variables and to know which variables were predictive of LBW. The equation is as follows:

$$\text{LOG (ODDS OF HAVING LBW)} = B_0 + B_1X_1 + B_2X_2 + \dots + B_kX_k$$

$B_0$  = baseline regression coefficient.

$B_1, B_2, B_k,$  = regression coefficient of each corresponding regressor variable

$X_1, X_2, X_k,$  = set of values for regressor variables

$k$  = number of regressor variables.

To assess interaction, a cross-product term  $B_3 \times X_1 \times X_2$  was added to the equation. The antilog of each coefficient was taken to get adjusted odds ratios. Log-likelihood ratio test was done to determine which variable was to be included in the model that was most appropriate in predicting low birthweight.

### 3.17. Limitation of the research

- 3.17.1. Since this study depended on the information obtained from the subjects, recall and information biases could not be excluded from the study.
- 3.17.2. As the data were collected from only Rajavithi hospital, the final analysis cannot be generalized to all Thai women.
- 3.17.3. As more than one interviewer was involved in the study we cannot rule out inter-interviewer and intra-interviewer biases.

### 3.18. Ethical consideration

Complete anonymity of the cases and the controls was made. If need arose verbal consents were taken from the subjects. This study did not involve any procedure that harmed the subjects physically or emotionally.

## CHAPTER IV

## RESULTS OF THE STUDY

During the study period from Jan 20, 1993 to March 31, 1993 a total of 144 cases of low-birth-weight and 288 cases of normal birth-weight babies' mothers were interviewed by standard, structured questionnaires in Rajavithi Hospital. During this period there was a total of 2626 deliveries in this hospital. Thus, the prevalence rate of LBW at birth per live birth in Rajavithi Hospital for the said period:

$$= 144/2626 \times 100 = 5.48\%$$

#### 4.1. Descriptive analysis

##### 4.1.1 Genetic and constitutional characteristics

###### 4.1.1.1 Sex of Infant.

Female infants predominated among the cases comprising of 51.4%. In the control-group males were predominant- 53.1% (Table 4). The birth weight in the cases ranged from 1050-2480 kgs., the mean of which was 2116.32 kgs. with a standard deviation of 340.52 kgs. In the control group the birthweight ranged from 2600-3500 kgs. with a mean of

3029.24 kgs. and a standard deviation of 261.34 kgs.

#### 4.1.1.2. Pre-pregnancy weight of the mother.

34.7% of the cases and 27.1% of the controls were <45 kgs. before conception. 54.9% of the cases and 55.9% of the controls were between 45-55 kgs. and only 10.4% of the cases and 17% of the controls were >55 kgs. (Table 4)

#### 4.1.1.3. Height of the mothers.

59.0% of the cases and 68.4% of the controls were in the height group of '150-160 cms.' The percentages in the other groups '<150 cms.' and '>160 cms.' were 29.2% and 10.4% in the cases and 21.2% and 10.1% in the controls.

(Table 4)

Table.4 Comparison of genetic and constitutional characteristics between LBW cases and controls in Rajavithi hospital, Bangkok 1993.

Variable	Case		Control	
	No.	%	No.	%
Infant sex:				
M	70	48.6	153	53.1
F	74	51.4	135	46.9
Pre-preg.wt.of mother:				
<45 kgs.	50	34.7	78	27.1
45-54.9 kgs	79	54.9	161	55.9
≥55 kgs.	15	10.4	49	17.0

-continued Table 4-

Table.4 Comparison of genetic and constitutional characteristics between LBW cases and controls in Rajavithi hospital, Bangkok 1993.

Variable	Case		Control	
	No.	%	No.	%
Ht. of mother:				
<150 cms.	42	29.2	61	21.2
150-159.9 cms.	85	59.0	197	68.4
≥160 cms.	15	10.4	29	10.1
No records	2	1.4	1	0.3

#### 4.1.2 Demographic and psycho-social characteristics

##### 4.1.2.1 Maternal age.

In this study maternal age ranged from 15-41.83 yrs. with a mean age of 24.5 yrs. with a standard deviation of ±5.44 years.

The highest proportion of both the cases and the controls were in the age group '18-35 years'. Among the cases and the controls 81.3% and 89.9% belonged to this age group respectively. (Table 5)

#### 4.1.2.2 Marital status of the mothers.

Among the cases 33.3% were married and 66.0% unmarried but living to-gether. The other groups (Divorced, Separated, Widows, Others) were negligible.

Similarly in the controls 41.7% were married and 55.9% were unmarried and the remaining groups accounting for only 2.3% (Table 5)

#### 4.1.2.3 Maternal education.

The majority of the cases were in '4-9 yrs. schooling' and '>9 yrs. schooling' groups accounting for 66.0% and 22.2% respectively.

In the controls too, most were in '4-9 yrs. schooling' and '>9 yrs. schooling' groups comprising 61.1% and 22.2% respectively. (Table 5)

#### 4.1.2.4 Maternal occupation.

Most of the cases and the controls belonged to the group 'housewife/unemployed'. 47.2% of the cases and 50.7% of the controls belonged to this group. The other

large group - 'private employee' comprised of 31.3% of the total cases and 36.1% of the total controls. (Table 5)

#### 4.1.2.5 Family-income.

The percentage distribution of the cases according to the family income were: <2000 bahts/mth., 7.6%; 2000-4000 bahts/mth., 36.1%; 4001-7000 bahts/mth., 35.4% and >7000 bahts/mth., 20.8%. The corresponding figures for the controls were 9.7%, 29.9%, 30.2% and 29.5% respectively. (Table 5)

Table.5 Comparison of demographic and psycho-social characteristics between LBW cases and controls in Rajavithi hospital, Bangkok 1993.

Variable	Case		Control	
	No.	%	No.	%
Maternal age (yrs.):				
<18 yrs.	19	13.2	20	6.9
18-35 yrs.	117	81.3	259	89.9
>35-40 yrs.	7	4.9	9	3.1
Marital status:				
Married	48	33.3	120	41.7
unmarried	95	66.0	161	55.9
Divorced/separated/ Widows/others	1	0.7	7	2.3
Education:				
No formal education	4	2.8	7	2.4
<4 yrs. education	6	4.2	18	6.3
4-9 yrs. education	95	66.0	176	61.1
>9-12 yrs. education	32	22.2	64	22.2
>12 yrs education	7	4.9	23	8.0

-continued Table 5-

Table.5 Comparison of demographic and psycho-social characteristics between LBW cases and controls in Rajavithi hospital, Bangkok 1993.

Variable	Case		Control	
	No.	%	No.	%
Income:				
<2000 Bahts	11	7.6	28	9.7
2000-4000 "	52	36.1	86	29.9
4001-7000 "	51	35.4	87	30.2
>7000 "	30	20.8	85	29.5
No answer	0	0	1	0.3
Occupation:				
Govt. employee	3	2.1	2	0.7
Private "	45	31.3	104	36.1
Family business	7	4.9	11	3.8
Servant	1	0.7	0	0
Housewife/unempl.	68	47.2	146	50.7
Student	3	2.1	1	0.3
Others	17	11.8	24	8.3

#### 4.1.3 Obstetric characteristics

##### 4.1.3.1 Parity.

For the majority of both the cases and the controls the present pregnancy was their first. 68.1% of the cases and 58.3% of the controls belonged to this group. In the other groups of parity '1', '2-3', and '4 or more', 18.1%, 13.2%, and 0% of the cases were present respectively whereas in the control group 25.3%, 14.6%, and 1.4% were

respectively present. (Table 6)

#### 4.1.3.2 Pregnancy interval.

The majority of both the cases and the controls had pregnancy interval of >24 months. 20.1% of the cases and 32.3% of the controls were in this group. In the other categories of <12 months and 12-24 months there were only 4.9% and 4.2% of the cases and 3.1% and 5.2% of the controls respectively. For 70.8% of the cases and 59.4% of the controls the present pregnancy was their first. (Table 6)

#### 4.1.3.3 Past h/o still-born or neonatal deaths.

93.7% of the cases and 96.9% of the controls had no h/o still-born or neonatal deaths. Only 6.3% of the cases had such a history as compared with 3.1% of the controls. (Table 6)

#### 4.1.3.4 Past h/o Low-birth-weight babies.

Only 10.4% of the cases and 3.5% of the controls had a past history of LBW babies. The majority of both the cases and the controls had no such history. (Table 6)

#### 4.1.3.5 Complications during labour.

Only 11.1% of the cases and 8.0% of the controls had any complications during labour. (Table 6)

#### 4.1.3.6 Gestational age.

48.6% were of term delivery in the cases and 87.5% in the controls. 49.3% were pre-term and 1.4% were post-term in the cases and the corresponding figures for the controls were 5.6% and 6.6%. (Table 6)

#### 4.1.3.7 Type of delivery.

91% of the cases had normal deliveries and 91.3% of the controls had normal deliveries. Only 9% of the cases and 8.7% of the controls had an assisted delivery. (Table 6)

#### 4.1.3.8 Type of assistance.

The percentages of the cases belonging to the three groups 'forceps', 'vacuum', and 'breech', were 4.2%, 2.1% and 2.8%. In the controls the corresponding figures were 2.1%, 5.9%, and 1%. (Table 6).

Table.6 Comparison of obstetric characteristics between LBW cases and controls in Rajavithi hospital, Bangkok 1993.

Variable	Case		Control	
	No.	%	No.	%
<b>Parity:</b>				
0	98	68.1	168	58.3
1	26	18.1	73	25.3
2-3	1	13.2	42	14.6
≥4	0	0	4	0.3
No answer	1	0.7	1	0.3
<b>Last birth-interval:</b>				
<12 months	7	4.9	9	3.1
12-24 "	6	4.2	15	5.2
>24 "	29	20.1	93	32.3
First preg.	102	70.8	171	59.4
<b>H/O stillborn/neonatal deaths:</b>				
Yes	9	6.3	9	3.1
No	135	93.7	279	96.9
<b>H/O LBW:</b>				
Yes	15	10.4	10	3.5
No	126	87.5	275	95.5
Don't know	3	2.1	3	1.0
<b>Complications during labour:</b>				
Yes	16	11.1	23	8.0
No	128	88.9	256	92.0
<b>Gestational age:</b>				
Term (37-42 wks)	70	48.6	252	87.5
Pre-term (<37 wks)	71	49.3	16	5.6
Post-term (>42 wks)	2	1.4	19	6.6
No records	39	27.1	49	17.0
<b>Delivery type:</b>				
Normal	131	91.0	262	91.0
Assisted	13	9.0	26	9.0
<b>Type of assistance:</b>				
Forceps	6	4.2	6	2.1
Vacuum	3	2.1	17	5.9
Breech	4	2.8	3	1.0
No assistance	131	91.0	262	91.0

#### 4.1.4 Nutritional characteristics

##### 4.1.4.1 Haematocrit level in the mothers.

The haematocrit level was <30% in 3.5% of the cases and 1.4% of the controls. (Table 7)

Table.7 Comparison of nutritional characteristics between LBW cases and controls in Rajavithi hospital, Bangkok 1993.

Variable	Case		Control	
	No.	%	No.	%
Haematocrit level:				
≤30%	5	3.5	4	1.4
> 30%	100	69.4	235	81.6
No records	39	27.1	49	17.0

#### 4.1.5 Maternal morbidity during pregnancy

##### 4.1.5.1 Sickness during pregnancy.

16% of both the cases and the controls were sick during pregnancy. (Table 8)

Table.8 Comparison of maternal morbidity during pregnancy between LBW cases and controls in Rajavithi hospital, Bangkok 1993.

Variable	Case		Control	
	No.	%	No.	%
Sickness during pregnancy:				
Yes	23	16.0	46	16.0
No	121	84.0	242	84.0

#### 4.1.6 Toxic exposure characteristics

##### 4.1.6.1 Smoking during pregnancy.

Very few women were seen to smoke during their pregnancies. In the cases only 6.9% were found to smoke and in the controls 4.9%. (Table 9)

##### 4.1.6.2 Number of cigarettes smoked during pregnancy.

Only 0.7% of the cases smoked  $\geq 5$  cigarettes a day as compared to 1.0% of the controls. Those smoking  $< 5$  cigarettes a day comprised 6.3% of the cases and 2.8% of the controls. (Table 9)

#### 4.1.6.3 Contact with cig. smokers during pregnancy.

62.5% of the cases and 54.4% of the controls were in contact with cigarette smokers during their pregnancy period (Table 9)

#### 4.1.6.4 Duration of contact with cigarette smokers during pregnancy.

Out of the five groups of '<3 hrs.', '3-6 hrs.', '>6-12 hrs.', '>12 hrs.' and 'no contact', 38.2% of the cases belonged to the first group, 9.7% belonged to the second group, and 6.3% and 8.3% belonged to the third and the fourth groups respectively. For the control group the corresponding figures were 41.3%, 9.7%, 7.3%, and 2.4%. (Table 9)

#### 4.1.6.5 Alcohol consumption during pregnancy.

In this only 7.6% of the cases and 4.2% of the controls consumed alcohol during pregnancy. (Table 9)

#### 4.1.6.6 Types of alcohol consumed during the pregnancy.

Only 4.2% of the cases and 1.4% of the controls consumed whisky and 3.5% of the cases and 2.8% of the controls consumed beer. (Table 9)

#### 4.1.6.7 Amount of alcohol consumed during pregnancy.

The amount of alcohol consumed during pregnancy were 1.4% consumed >200ml./week in the case group and correspondingly 0.7% similarly consumed in the control group. 5.6% of the controls consumed <200ml/week and 3.5% of the cases consumed <200ml/week. (Table 9)

#### 4.1.6.8 Coffee consumption during pregnancy.

Only 13.2% of the cases and 12.2% of the controls were found to have taken coffee during their pregnancy. (Table 9)

#### 4.1.6.9 Quantity of coffee consumed during pregnancy.

The quantity of coffee consumed during pregnancy were 13.2% in those who consumed <2 cups/day in the cases

and 11.1% in the controls. Only 0.7% of the controls consumed >2 cups/day and none in the cases. (Table 9)

Table.9 Comparison of toxic exposures during pregnancy between LBW cases and controls in Rajavithi hospital, Bangkok 1993.

Variable	Case No. %	Control No. %
Smoking during preg.:		
Yes	10 6.9	14 4.9
No	134 93.1	274 95.1
No. of cig. smoked:		
<5/day	9 6.3	8 2.8
≥5/day	1 0.7	3 1.0
Non-smoker	134 93.1	277 96.2
Contact with cig. smokers during preg.:		
Yes	90 62.5	171 54.4
No	54 37.5	115 39.9
No answer	0 0	2 0.7
Duration of contact:		
<3 hrs./day	55 38.2	119 41.3
3-6 hrs./day	14 9.7	28 9.7
>6-12 hrs./day	9 6.3	21 7.3
>12 hrs./day	12 8.3	7 2.4
No contact	54 37.5	113 39.2
Alcohol consumption during pregnancy:		
Yes	11 7.6	12 4.2
No	133 92.4	275 95.5
No answer	0 0	1 0.3
Alcohol frequency:		
<200 ml./wk.	8 5.6	10 3.5
≥200 ml.	2 1.4	2 0.7
Not taken	134 93.1	276 95.8

-continued Table 9-

Table.9 Comparison of toxic exposures during pregnancy between LBW cases and controls in Rajavithi hospital, Bangkok 1993.

Variable	Case		Control	
	No.	%	No.	%
Alcohol type:				
Whisky	6	4.2	4	1.4
Beer	5	3.5	8	2.8
No alcohol	133	92.4	276	95.8
Coffee during preg.:				
Yes	19	13.2	35	12.2
No	125	86.8	253	87.8
Amt.of coffee taken:				
<2 cups/day	19	13.2	32	11.1
≥2 cups/day	0	0	2	0.7
No coffee	125	86.8	254	88.2

#### 4.1.7 Antenatal-care characteristics

##### 4.1.7.1 Frequency of Antenatal-care.

The frequency of antenatal care in the three groups: no-visits, <4 visits, 4 or more visits, were for the cases 13.9%, 29.9%, and 56.0% respectively and for the controls 59.0%, 22.2% and 71.5% respectively.(Table 10)

## 4.1.10. First ANC visit.

Most of the cases and the controls had their first ANC visit during their second trimester of pregnancy. 27.8% of the cases had an ANC check-up during their first trimester, 41.7% during their second trimester and 18.1% in their last trimester. The corresponding figures for the control group were 26.0%, 45.8% and 21.5%. (Table 10)

Table.10 Comparison of Antenatal-care between LBW cases and controls in Rajavithi hospital, Bangkok 1993.

Variable	Case		Control	
	No.	%	No.	%
Antenatal-care:				
None	20	13.9	17	5.9
<4 visits	43	29.9	64	22.2
≥4 visits	81	56.3	206	71.5
No answer	0	0	1	0.3
First ANC visit:				
1-3 months	40	27.8	75	26.0
>3-6 "	60	41.7	132	45.8
>6-9 "	26	18.1	62	21.5
No ANC	18	12.5	19	6.6

## 4.2 Crude statistical analysis

Table 11. Comparison of genetic and constitutional factors between LBW cases and controls

Variables	Case	Control	OR(95%CI)	p-val
Sex of inf.:				
Male	70	153	1.0	
Female	74	135	1.20 (0.79,1.82)	0.4336
Pre-preg.wt.(kgs.):				
>55	15	49	1.0	
45-55	79	161	1.60 (0.81,3.19)	0.1914
<45	50	78	2.09 (1.01,4.37)	*0.0460
Height of mother:				
>160cms.	15	29	1.0	
150-160cms.	85	197	0.83 (0.41,1.73)	0.7244
<150cms.	42	61	1.33 (0.60,2.97)	0.5638

\* Significant at  $\alpha = 0.05$

Table 12. Comparison of demographic and psychosocial factors between LBW cases and controls

Variables	Case	Control	OR(95%CI)	p-val
Age-group:				
18-35 yrs.	117	259	1.0	
>35 yrs.	8	9	1.97 (0.67,5.73)	0.2651
<18 yrs.	19	20	2.10 (1.03,4.29)	*0.0403
Marital status:				
married	48	120	1.0	
unmarried	95	161	1.48 (0.95,2.30)	0.0865
Education:				
>12 yrs.	7	23	1.0	
<4 yrs.	10	25	1.31 (0.38,4.66)	0.8446
4 - 9 yrs.	95	176	1.77 (0.70,5.03)	0.2784
>9-12 yrs.	32	64	1.64 (0.59,4.73)	0.4191
Mother'occupation:				
Housewife	68	146	1.0	
Priv./govt	48	106	0.97 (0.61,1.56)	0.9921

-continued Table 12-

Table 12. Comparison of demographic and psychosocial factors between LBW cases and controls

Variables	Case	Control	OR(95%CI)	p-val
Stud./serv./ fam.busi.	11	12	1.97 (0.76,5.07)	0.1872
Others	17	24	1.52 (0.73,3.18)	0.3055
Income(Bahts/month):				
>7000	30	85	1.0	
4001-7000	51	87	1.66 (0.93,2.96)	0.0872
2000-4000	52	86	1.71 (0.96,3.05)	0.0676
<2000	11	28	1.11 (0.46,2.69)	0.9609

\* Significant at  $\alpha = 0.05$ 

Table 13. Comparison of obstetric factors between LBW cases and controls

Variables	Case	Control	OR(95%CI)	p-val
Prev.delivery:				
1	26	73	1.0	
0	98	168	1.64 (0.95,2.83)	0.0762
≥2	19	46	1.16 (0.54,2.46)	0.8120
Preg.intval:				
>24 months	29	93	1.0	
12-24 months	6	15	1.28 (0.37,3.91)	0.8431
<12 months	7	9	2.49 (0.75,8.18)	0.1589
H/o stillborn or neonatal death:				
No	134	278	1.0	
Yes	9	9	2.07 (0.74,5.85)	0.1988
H/o LBW:				
No	134	274	1.0	
Yes	15	10	3.27 (1.32,8.09)	*0.0063
Complications during labour:				
No	128	256	1.0	
Yes	16	23	1.39 (0.67,2.86)	0.4303

-continued Table 13-

Table 13. Comparison of obstetric factors between LBW cases and controls

Variables	Case	Control	OR(95%CI)	p-val
Gestational age:				
Term	70	252	1.0	
Pre-term	71	16	15.9 (8.43,30.8)	*<0.0001
Post-term	2	19	0.38 (0.04,1.64)	0.1436
Delivery type:				
Normal	131	262	1.0	
Assisted	13	26	1.0 (0.47,2.11)	0.8586

\* Significant at  $\alpha = 0.05$ 

Table 14. Comparison of nutritional factor between LBW cases and controls

Variables	Case	Control	OR(95%CI)	p-val
Hematocrit:				
≥30%	100	235	1.0	
<30%	5	4	2.94 (0.62,15.0)	0.1020

Table 15. Comparison of Maternal morbidity factors between LBW cases and controls

Variables	Case	Control	OR(95%CI)	p-val
Sickness during pregnancy:				
No	121	242	1.0	
Yes	23	46	1.0 (0.56,1.78)	0.8892

Table 16. Comparison of toxic exposures during pregnancy between LBW cases and controls

Variables	Case	Control	OR(95%CI)	p-val
<b>Smoking:</b>				
No	134	274	1.0	
Yes	10	14	1.46 (0.58,3.61)	0.5039
<b>Contact with smokers:</b>				
No	54	115	1.0	
Yes	90	171	1.12 (0.73,1.73)	0.6611
<b>Duration of contact:</b>				
<3 hrs./day	55	119	1.0	
3-6 " "	14	28	1.08 (0.50,2.34)	0.9754
>6-12 " "	9	21	0.93 (0.37,2.30)	0.9700
>12 " "	12	7	3.17 (1.27,11.1)	*0.0128
<b>Alcohol during pregnancy:</b>				
No	133	275	1.0	
Yes	11	12	1.9 (0.76,4.74)	0.2008
<b>Coffee consumption:</b>				
No	125	252	1.0	
Yes	11	35	1.09 (0.58,2.07)	0.8875

\* Significant at  $\alpha = 0.05$

Table 17. Comparison of Antenatal-care during pregnancy between LBW cases and controls

Variables	Case	Control	OR(95%CI)	p-val
<b>ANC visit</b>				
$\geq 4$	81	206	1.0	
0	20	17	2.99 (1.42,6.34)	*0.0026
<4	43	64	1.71 (1.05,2.79)	*0.0313
<b>First ANC visit:</b>				
1-3 months	40	75	1.0	
>3-6 "	60	132	0.85 (0.51,1.43)	0.6076
>6-9 "	26	62	0.79 (0.41,1.49)	0.5233

\* Significant at  $\alpha = 0.05$

### 4.3. Multivariate analysis

The results of the bivariate analysis showed the current study to have six factors statistically significant ( $p = <0.05$ ). These factors were : maternal age of  $<18$  yrs., pre-pregnancy weight of the mothers of  $<45$  kgs., frequency of antenatal-care of 0 and  $<4$  visits, past history of delivering a low-birth-weight in the mothers, duration of contact with cigarette smokers of  $>12$  hrs. during pregnancy and gestational age of  $<37$  wks. These factors explain only the risk independently for each variable but do not explain any further association with Low-birth-weight. Thus, the best available method "Logistic Regression" was used in the multivariate analysis to explore the relationship between these factors and the LBW.

To assess the degree of confounding all potential confounders were added at a time to the models and the crude and the adjusted odds ratios were compared. Only those factors showing significance in the bivariate analysis were adjusted for their potential confounders. (Tables 4.3.1-4.3.6.)

Table 4.3.1

Variables	Coefficients	OR (95% of OR)	p-val.
Age-group <18yrs.	0.7434	2.1 (1.08,4.08)	0.028 *
+ alcohol	0.7395	2.1 (1.07,4.07)	0.029 *
+ ht.mother	0.7604	2.1 (1.07,4.08)	0.030 *
+ ANC visit	0.6321	1.9 (0.95,3.71)	0.068
+ smoking	0.6239	1.9 (0.94,3.69)	0.073
+ ges.age	0.6360	1.8 (0.89,3.99)	0.096
+ parity	0.6273	1.9 (0.88,3.95)	0.100

\* statistically significant at  $\alpha = 0.05$

In the above table it is seen that alcohol consumption and mothers' height are not confounders for mothers' age group of <18yrs. However, by the addition of factors 'ANC', 'smoking', 'gestational age' and parity the significant association of age group of <18 yrs. to LBW became insignificant. After adjusting for the mentioned six variables we see that the crude OR overestimates the adjusted OR by 10%.

Table 4.3.2

Variables	Coefficients	OR (95% of OR)	p-val
Wt.of mother <45kgs.	0.7391	2.1 (1.062,4.128)	0.0328*
+ ht. mother	0.6530	1.9 (0.950,3.886)	0.0692
+ agegrp	0.6188	1.8 (0.911,3.782)	0.0883
+ smoking	0.6056	1.8 (0.897,3.742)	0.0964
+ ges.age	0.2050	1.2 (0.551,2.735)	0.6161

\* statistically significant at  $\alpha = 0.05$

In the above table it is seen that height, age group and smoking status of mothers have slight confounding effect on mothers weight of <45kgs., but the effect was enough to change the significant association of weight of the mother with LBW to insignificant levels. Here gestational age is a true confounder as the OR is drastically changed when it is included in the model. In this model after adjusting the mentioned four variables we see that the crude OR overestimates the adjusted OR by 75%.

Table 4.3.3

Variables	Coefficients	OR (95% of OR)	p-val.
Freq.ANC <4 visits.	0.5357	1.7 (1.00,2.70)	0.0237*
0 visit.	1.0959	2.9 (1.50,6.00)	0.0020*
+ wt.mother	0.5838	1.8 (1.10,2.90)	0.0148*
	1.1004	3.0 (1.50,6.00)	0.0021*
+ income	0.6003	1.8 (1.10,2.90)	0.0147*
	1.1532	3.2 (1.50,6.50)	0.0022*
+ parity	0.6130	1.8 (1.10,3.00)	0.0147*
	1.1516	3.1 (1.50,6.60)	0.0024*
+ age.grp.	0.6014	1.8 (1.10,3.00)	0.0181*
	1.1318	3.1 (1.50,6.50)	0.0030*
+ ges.age	0.2984	1.3 (0.75,2.40)	0.3168
	0.7961	2.2 (0.91,5.30)	0.0782

\* statistically significant at  $\alpha = 0.05$

In the above table only gestational age is having a confounding effect on the frequency of ANC visits("0 visit" and "<4 visits"). By its addition to the model a significant association of both "<4 ANC visits" and "0 visit" to LBW becomes insignificant. By adjusting the mentioned five

variables we see that the crude OR for ANC <4 visits is overestimating the adjusted OR by 30% whereas the crude OR for ANC 0 visit is overestimating by 31%.

Table 4.3.4.

Variables	Coefficients	OR (95% of OR)	p-val.
h/o LBW	1.1860	3.3 (1.43,7.48)	0.0050*
+ wt.mother	1.1716	3.2 (1.39,7.44)	0.0060*
+ ht.mother	1.2139	3.4 (1.45,7.80)	0.0046*
+ smoker	1.2202	3.9 (1.46,7.85)	0.0044*
+ alcohol	1.2100	3.4 (1.45,7.85)	0.0045*
+ ges.age	1.4307	4.2 (1.70,10.2)	0.0018*

\* statistically significant at  $\alpha = 0.05$

In this model gestational age is seen to have some modifying effect on h/o LBW with LBW. After simultaneously controlling for all the potential confounders the association of h/o LBW to LBW is still significant. In this model after adjusting the mentioned five factors we see that the crude OR is underestimating the adjusted OR by 22%.

Table 4.3.5.

Variables	Coefficients	OR (95% of OR)	p-val.
Duration of contact with smokers <12hrs.	1.3108	3.7 (1.38,9.96)	0.0091*
+ income	1.4076	4.1 (1.40,11.2)	0.0063*
+ gesage	1.1594	3.2 (1.01,10.4)	0.0476*

\* statistically significant at  $\alpha = 0.05$

Here income and gestational age have very little confounding effect on the duration of contact with cigarette smokers for >12hrs. and even after controlling for them the p-value still shows significance. Here the crude OR is overestimating the adjusted OR by 15% after adjusting for income and gestational age.

Table 4.3.6.

Variables	Coefficients	OR (95% of OR)	p-val.
Gestational age			
pre-term	2.0160	7.5 (4.63, 12.16)	<0.0001*
+ duration	2.1962	9.0 (4.76, 16.98)	<0.0001*
+ ANC	2.1121	8.3 (4.34, 15.71)	<0.0001*
+ age grp.	2.1120	8.3 (4.37, 15.94)	<0.0001*
+ wt.mother	2.1147	8.3 (4.34, 15.89)	<0.0001*

\* statistically significant at  $\alpha = 0.05$

In the above model all the risk factors are having a modifying effect on gestational age of pre-term. After adjusting the mentioned four factors we see that the crude OR is underestimating the adjusted OR by 10%.

The mentioned six factors were recategorized to dichotomous variables before fitting into the logistic model:

- $X_1$  = maternal age group - yrs. (0 =  $\geq 18$ , 1 =  $< 18$ )  
 $X_2$  = maternal prepreg.weight - kgs. (0 =  $\geq 45$ , 1 =  $< 45$ )  
 $X_3$  = frequency of ANC - visits (0 =  $\geq 4$ , 1 =  $< 4, 0$ )  
 $X_4$  = history of low-birth-weight (0 = no, 1 = yes)  
 $X_5$  = contact with cig.smokers - hrs. (0 =  $< 12$ , 1 =  $\geq 12$ )  
 $X_6$  = gestational age (0=term, 1=preterm/postterm)

Using the software programme Mult-LR the coefficient of these factors and the Z-test to derive the lower and upper limits of the coefficients, the odds ratios and the 95% confidence intervals were found. Table 4.3.7.

Table 4.3.7.

Model 1 : Predictors of LBW outcome : MLR  
Dependent variable: Status (0 = control, 1 = case)

Variables	Coefficients	p-val.	OR (95% of OR)
1) Mat.age-yrs. (0 = $\geq 18$ , 1 = $< 18$ )	0.6609	0.1037	1.93 (0.874, 4.293)
2) Prepreg.wt.-kgs. (0 = $\geq 45$ , 1 = $< 45$ )	0.3960	0.1320	1.48 (0.888, 2.488)
3) Freq. ANC-visits	0.3800	0.1398	1.46 (0.883, 2.422)
4) History of LBW	1.3082	0.0022	3.69 * (1.598, 8.563)
5) Duration contact with smokers. (0= $\leq 12$ hrs, 1= $> 12$ hrs.)	0.3931	0.1116	1.48 (0.913, 2.405)
6) Gestational age (0=term, 1=pre-term)	2.7634	$< 0.001$	15.85 * (8.626, 29.136)
Constant	1.9275	-8.1667	
Likelihood ratio statistic, df6 = 128.7100			

\* Statistically significant at  $\alpha = 0.05$

It is seen that the variables that were significant in bivariate analysis, after simultaneously analyzing in the Mult-LR, only two variables turned out to be significant factors to LBW : past history of LBW and gestational age of  $< 37$ wks.

The mentioned factors excluding gestational age (as gestational age can be calculated only at delivery) can be used in Rajavithi Hospital to predict the outcome of LBW newborns from pregnant women by physical examination and interviews regarding the said factors. The observed results are compared with Table 2 to see the probability value which can state the risk of the mother to deliver a low birth-weight newborns.

Excluding gestational age, we have another model :

Model 2. Predictors of LBW outcome : MLR  
Dependent variable Status (0 = control, 1 = case)

Variable	Coefficient	OR (95% of OR)	p-val.
1) Maternal age-yrs. (0= $\geq$ 18, 1= $<$ 18)	0.7031	2.02 (1.021, 3.996)	0.0433*
2) Prepreg.wt.-kgs. (0= $\geq$ 45, 1= $<$ 45)	0.3560	1.42 (0.192, 2.235)	0.1195
3) Frequency ANC (0= $\geq$ 4, 1=0, $<$ 4)	0.6915	1.99 (1.299, 3.070)	0.0016*
4) History of LBW	1.1904	3.28 (1.538, 7.031)	0.0021*
5) Contact with smokers-Hrs. (0= $\leq$ 12hrs, 1= $>$ 12hrs)	0.2684	1.30 (0.861, 1.987)	0.2085
Constant	-1.3330		
Likelihood ratio statistic, df5 = 26.9059			

\* Statistically significant at  $\alpha = 0.05$

For calculating a probability of LBW, the equation will be:

$$P = 1/1+\exp^{-(B_0+B_1X_1+B_2X_2+B_3X_3+B_4X_4+B_5X_5+B_6X_6)}$$

where,  $B_0$  = constant value in Table 1

$B_1$ - $B_6$ = coefficient value of each variable

$X_1$ - $X_6$ = value of characteristics

The result from the above equation resulted in a probability of LBW of 0.8672 or 86.72% (Table 2.) in a pregnant women who had visited Rajavithi Hospital with all the five mentioned factors. The various probabilities with different combinations of the said factors are given below.

Table 4.3.8.: Prediction probability of LBW outcome (MLR analysis)

Probability	X1 M.agegrp <18yrs.	X2 M.weight <45kgs.	X3 Freq.ANC 0-4visit	X4 H/o LBW Yes	X5 contact smoker >12hrs.
0.8672	X	X	X	X	X
0.8333	X	X	X	X	
0.8206	X		X	X	X
0.7658	X	X		X	X
0.7639		X	X	X	X
0.7143	X	X		X	
0.7122		X	X	X	
0.6963	X			X	X
0.6939			X	X	X
0.6365	X			X	

0.6341			X	X	
0.6031	X	X	X		
0.5531		X		X	
0.5316				X	X
0.5154	X		X		
0.4644				X	
0.4291		X	X		
0.4106	X				X
0.4078			X		X
0.3476	X	X			
0.3475	X				
0.3449			X		
0.3299		X			X
0.2735		X			
0.2564					X

The given table, hopefully, will predict the outcome of LBW in pregnant women who come for antenatal check-up in Rajavithi Hospital.

## CHAPTER V

## DISCUSSION

## 5.1.1 Maternal age.

Pregnancy outcomes, including birth weight and gestational age are generally less favorable among adolescents and women over 35 years of age. Women <18 years are still growing and may consume fewer calories and other nutrients. Because their pregnancies are often unwanted or unplanned, they are often late in seeking antenatal care. Increased cigarette smoking, alcohol consumption and drug use among teenagers may also put them at risk. Thus, younger maternal age should be an important risk factor for LBW. Older women may not be at increased risk because of their age alone, but age >35 years may augment the impact of other risk factors. In the current study it is found that mothers aged <18 years have 2.1 times the risk of LBW than mothers aged 18-35 years (OR = 2.1, 95%CI = 1.03,4.29, p-value = 0.0403), which is consistent with other studies done in Thailand. Termsri Chumnijarajik, in a multicentre study has found a significant relative risk of 1.8 in those <18yrs as compared to those 19-34yrs., 95%CI of RR = 1.5, 2.15. Similarly, in a study conducted in Srisangwon General Hospital in 1985-1986 by

Jarueyporn Suparp, the risk of those aged <19yrs. as compared to those aged 20-34 yrs. was 1.14, which was however insignificant. This insignificance may be due to a year increase in the cut-point in the exposure group from 18 to 19 yrs. In the current study, in women >35 years the OR was 1.97, which was insignificant. In Termsri's study this group had a significant RR of 1.32. In this study, after simultaneously adjusting for the confounding effects of alcohol consumption, height, frequency of ANC visits, smoking, parity and gestational age, the risk of LBW in mothers <18yrs. was 1.8 times as compared to mothers aged 18-35yrs old. (OR = 1.9, 95%CI = 0.886,3.959, p-value = 0.1005). In Termsri's study this adjusted risk was significant, RR = 1.44, 95%CI = 1.23,1.69 (this may be due to the fact that gestational age was not adjusted for its confounding effect).

#### 5.1.2. Infant Sex.

Sex of the foetus can influence birth weight. According to the WHO report of the meeting on etiology, prevention and social implications of LBW in Geneva in 1975 - the male foetus grows more rapidly than the female foetus throughout pregnancy, with a mean difference of 50 gms. at 32 weeks and 150 gms. at term. In this study in the control group the mean difference between the weight of the male and

the female babies at term was 65 gms. The mean difference between the cases and the controls in infant weight-by-sex was 912.92 gms. at birth. (Table 4.1.3.). In the cases the mean age was 2116.32 kgs. and in the controls it was 3029.24 kgs.

Since infant sex is not associated with any of the other factors being assessed, its relationship to gestational duration and intrauterine growth should be unconfounded. Furthermore, sex assignment should not be a subject of measurement error or bias. No methodological standards are therefore required to study the effect of infant sex beyond an adequate description of the study sample. In my study the combined Male:Female ratio was 1.06:1.0. In this study a female baby was 1.2 times more at risk of being a low-birth-weight than the male baby. This was however insignificant (OR = 1.2, 95%CI = 0.79,1.82, p-value = 0.4336). In all the studies it is seen that female babies are lighter at birth.

#### 5.1.3. Marital status:

Marital status is closely linked with socio-economic status. It indirectly reflects whether the mothers are in active work or not. Any effect on intrauterine growth or gestational duration might operate in the mother through a psychological mechanism e.g. stress, independently of her

socio-economic status. In the current study it was found that unmarried women were 1.48 times more at risk of delivering a low-birth-weight than married women. (OR = 1.48 95%CI = 0.95,2.30, p-value = 0.0865). In Termsri's study the RR of those unmarried to those married was 1.42, which was significant at 95%CI. The other groups in this category- 'divorced', 'separated', 'widows' and 'others' were very few to have any analytical significance, hence they were discarded during analysis.

#### 5.1.4. Education:

Education can influence the rate of LBW, both directly and indirectly. Mothers of low or no education may lack adequate knowledge of health-care during or before child-bearing. While indirectly affecting the rate of LBW their low level of education keeps them jobless or out of good jobs, resulting in low income and, in turn, insufficient food during pregnancy. In this study, groups 1 and 2 were collapsed to form a single group (due to inadequate number in group 1 - those with no formal education) and the final analysis resulted in women with <4 yrs. of schooling being 1.31 times more at risk of delivering a LBW infant than women with >12 yrs. of schooling. (OR = 1.31, 95%CI = 0.38, 4.66, p-value = 0.8446) Similarly the '4-9 yrs. of schooling' and '>9 yrs. of

schooling' groups were 1.77 and 1.64 times more at risk than those with >12 yrs. of schooling. Their respective analytic values being OR:1.77, 1.64; 95%CI:0.70, 5.07, 0.59,4.73; p-values:0.2784,0.4191. In Termsri's study those with <4yrs. education were 1.33 times at risk as compared to those with >12 yrs. education and in those with 4-9 yrs. of education the risk was 1.39. These were significant at 95%CI. Though the ORs in these two studies were quite similar, the current study has shown the risk to be insignificant due to the inadequacy in its sample size as is evidenced by its wide confidence interval.

#### 5.1.5. Occupation:

Biologically, LBW arises from insufficient food for the pregnant mothers who spend so much energy in occupations. Socially, mothers who do manual labour or work requiring much effort have insufficient time or knowledge for behaviors that would secure a healthy infant. In my study although there were seven categories of maternal occupations, 78.5% of the cases and 86.8% of the controls formed only two large groups- 'housewife/unemployed' and 'private employees'. Groups 'students', 'family business' and 'servant' were collapsed to form a single group and in the analysis of the final four groups it was found that 'government/private employees' were

0.97 times at risk of delivering a LBW as compared to the 'housewives/unemployed' group showing no difference in risk to LBW between these two occupations. (OR = 0.97, 95%CI = 0.61,1.56, p-value =0.9921) Similarly, those in the 'students/servants/family business' group were 1.97 times at risk of delivering a LBW as compared to the 'unemployed/housewives' group (OR = 1.97, 95%CI = 0.76,5.07, p-value = 0.1872). Likewise the group 'others' were 1.52 times at risk (OR = 1.52, 95%CI = 0.73, 3.18, p-value = 0.3055). Comparisons with other studies could not be made regarding this variable due to the difference in categories.

#### 5.1.6. Pre-pregnancy weight of the mothers:

Maternal pre-pregnancy weight is influenced by both the genetic and environmental factors, and genes that control adiposity or lean body mass could, theoretically, be expressed in the baby. Maternal weight prior to conception reflects nutritional stores potentially available to the growing fetus. Since heavier women are generally taller, isolation of the effect of maternal pre-pregnancy weight requires control for the confounding effect of maternal height. Since teenagers recently past their menarche are likely to be thinner than older, physiologically more mature women, age should also be controlled. Nicotine is a well-known appetite suppressant,

and, all else being equal, women who smoke may be lighter than those who do not. Since cigarette smoking might also affect the outcome of pregnancy it too needs to be controlled in the analysis.

In the current study the majority of both the cases and the controls were in the age group '45-55 kgs.' 54.9% and 55.9% in the case and the control groups respectively. Due to inadequacy, group of '>65 kgs.' was collapsed with group '55-65 kgs.' forming a single '>55 kgs.' group. Then, after analysis it was seen that women who weighed <45 kgs. were 2.09 times more at risk than those weighing >55 kgs. This magnitude of association was significant at 95%CI (OR = 2.09, 95%CI = 1.01,4.37, p-value = 0.0460). Whereas those weighing 45-55 kgs. were only 1.6 times at risk when compared to those weighing >55 kgs (OR = 1.60, 95%CI = 0.81,3.19, p-value = 0.1916). In Termsri's study, analysis after recategorising his data has shown the OR in those weighing <45kgs. to be 7.15 and those weighing 45-55kgs. the OR was 2.79, both being significant at 95%CI. This difference in risk in the two studies, though uni-directional may be due to the variance in the two study populations.

To find the independent effect of pre-pregnancy weight of the mothers their height, age, smoking status and

gestational age were simultaneously controlled resulting in the adjusted OR of 1.2 showing gestational age to be the main confounder (OR = 1.2, 95%CI = 0.551,2.735, p-value = 0.6161). In the study done by Termsri his adjusted OR = 3.9 which was significant. He has however not adjusted gestational age which is an important confounder in this study.

#### 5.1.7. Income:

Low-income families are indicated of having a significant risk of delivering a LBW. The reason can be traced back to low-education, insufficient health-care knowledge and hard physical work. In this study, those earning <1000 Bahts/month were combined with those earning '1000-2000 Bahts' due to lack of both the cases and the controls in the former group, to form a single group '<2000 Bahts/month'. After analysis it was found that mothers with monthly income of <2000 Bahts were 1.11 times more at risk of delivering LBW than those earning >7000 Bahts/month (OR = 1.11, 95%CI = 0.46,2.69, p-value = 0.9609). Similarly, those earning 2000-4000 Bahts/month were 1.71 times at risk (OR = 1.71, 95%CI = 0.96,3.05, p-value = 0.0676) and those earning 4001-7000 Bahts monthly were 1.66 times more at risk when compared to those earning >7000 Bahts/month (OR = 1.66,95%CI =0.93,2.96, p-value = 0.0872). In Termsri's study the RR of those earning <\$40

and \$40-\$200 as compared to those earning >\$200 were 1.75 and 1.35, both being significant at 95%CI.

#### 5.1.8. Antenatal-care visits:

Antenatal-care could have a beneficial impact on birth weight either by diagnosis and timely treatment of pregnancy complications (e.g. toxæmia, diabetes, antepartum haemorrhage) or by eliminating or reducing modifiable risk factors. The risk-factors that seem most amenable to such an impact include calorie intake, cigarette smoking, alcohol consumption, and malaria prophylaxis and treatment. In this study at Rajavithi Hospital, women without any antenatal-care were at a significant risk of 2.99 times more of delivering a LBW than those who had 4 or more antenatal-care visits (OR = 2.99, 95%CI = 1.42, 6.34, p-value = 0.0026). The corresponding risk in Termsri's study was 2.26, significant at 95%CI. In those who had <4 visits the risk was 1.71 times; this too, being significant (OR = 1.71, 95%CI = 1.05, 2.79, p-value = 0.0313). In Termsri's study this risk was 1.59 and was significant.

After simultaneously adjusting for weight, income, parity, age group and gestational age of the mothers the frequency of ANC visit of both 0 visit and <4 became

insignificant, the OR being reduced from 2.9 to 2.2 in the former (OR = 2.2, 95%CI = 0.91,5.30, p-value = 0.0782) and from 1.7 to 1.2 in the latter (OR = 1.2, 95%CI = 0.75,2.40, p-value = 0.3168).

#### 5.1.9. First antenatal-care visit:

The stage in pregnancy at which a woman is first seen for antenatal-care is of great importance, because, the effects of many pregnancy complications and risk factors if attended to early in gestation, could then be substantially mitigated. Women who begin antenatal-care at a late stage in their pregnancy and those who never begin are likely to differ in prognostically important ways from those who seek early antenatal-care: they are more likely to be young, primiparous, poor, members of racial/ethnic minority, or undernourished, and may be more likely to smoke or drink. To isolate the effect of antenatal-care should, therefore control for these confounding factors. In the current study however, women having their first ANC check-up in the third trimester were 0.79 times at risk of delivering a LBW infant as compared to those mothers who had their first ANC check-up in the first trimester (OR = 0.79, 95%CI = 0.41,1.49). First ANC visit in the second trimester too, was found to be beneficial regarding LBW as compared to first trimester visit (OR = 0.85, 95%CI =

0.51,1.43, p-value = 0.6076). In Termsri's study, analysis after recategorization of his data has shown the risk of 1.1 times of delivering a LBW when women first have an ANC check-up in both the second and the third trimester as compared to the first.

#### 5.1.10. Parity:

There is general agreement that pregnancy outcomes are more favorable for multiparae than primiparae; grand-multiparity however, is often believed to constitute a risk. In particular, primiparae tend to be younger than multiparae. Young adolescents are likely to differ from older women in their height, pre-pregnancy weight, cigarette and alcohol consumption, and the use of antenatal-care. The control of age is therefore essential. Grand-multiparity may also be associated with socio-economic status, cigarette smoking and alcohol consumption. Therefore, control is also required for these factors. In addition, as mothers of high parity are likely to have shorter intervals since their previous pregnancy, birth-interval should also be controlled. In this study, group '>4' was collapsed with group '2-3' (due to lack of cases in the former) to form a single group of '>2'. After analysis it was found that for those who were primiparae the risk of LBW was 1.64 times as compared to those who had had a

single delivery previously (OR = 1.64 95%CI = 0.95,2.83, p-value = 0.0762). And for those who had 2 or more previous deliveries the risk of delivering a LBW infant was 1.16 times as compared to singleton mothers (OR = 1.16, 95%CI = 0.54,2.46, p-value= 0.8120). Due to the groups '>4' being collapsed with '2-3' this variable could not be compared with other studies. Due to recategorization of the data in this study it could not be compared to other studies.

#### 5.1.11. Pregnancy interval:

A short interval since the previous birth might lead to poor pregnancy outcome. Nutritional depletion is the most obvious mechanism for such an effect, but inadequate physiological (e.g. hormonal) recovery of the mother could also be the reason. In the current study, due to inadequate cases the pregnancy interval of '<6 months' was combined with '6-12 months' to form a group of '<12 months' and it was found that those with pregnancy interval of less than 12 months had a risk of 2.49 times of giving birth to a LBW as compared to those with an interval of more than 24 months (OR = 2.49, 95%CI = 0.75,8.18, p-value = 0.1589). In Termsri's study after recategorising his data, the corresponding risk was 1.24. Pregnancy interval of 12-24 months had a risk of 1.28 times (OR = 1.28, 95%CI =0.37,3.19, p-value = 0.8431) whereas

in Termsri's study it showed 0.86.

#### 5.1.12. History of stillborn or neonatal deaths:

It is likely that previous stillbirths and neonatal deaths represent severely premature or growth-retarded fetuses, any effect of these prior infant deaths is probably due to the mothers' inherent tendency for LBW. In my study it was found that mothers with a past history of having delivered a still-born or those with a history of neonatal death had a risk of 2.07 times of delivering a LBW infant as compared to those mothers who had no such history (OR = 2.07, 95%CI = 0.74,5.85, p-value = 0.1988). In Suparp's study this risk was 1.22 and was statistically insignificant at 95%CI. due to a larger sample size.

#### 5.1.13. History of prior Low-Birth-Weight babies:

Some women appear to have a tendency to repetitive LBW. Whether this represents merely the persistence of other risk factors or an inherent tendency is unclear e.g. if smoking leads to LBW and a women smokes in each of two consecutive pregnancies, she will be at increased risk for LBW infant in both pregnancies. The other risk factors like smoking, height, pre-pregnancy weight, alcohol should be controlled otherwise a fallacious conclusion of an inherent

tendency for LBW will result. In this study women with a prior h/o of LBW infants had a significant risk of 3.27 times of again giving birth to a LBW as compared to women with no such past history (OR = 3.27, 95%CI = 1.34, 8.09, p-value = 0.0063).

After simultaneously controlling for weight, height, smoking status and alcohol consumption there was minimal change in the adjusted odds ratio. However when gestational age was added to the model the OR increased from 3.3 to 4.2 showing gestational age to have some modifying effect on history of LBW.

#### 5.1.14. Smoking during pregnancy:

Maternal smoking could result in LBW through several mechanisms. The most likely mediators are carbon-monoxide and nicotine. Carbon-monoxide interferes with the oxygen delivery to the foetus by displacing oxygen from haemoglobin so that less oxygen is released to the fetal tissues resulting in poor growth. Nicotine is not only an appetite suppressant, but also increases the maternal catecholamines and consequent uterine vasoconstriction.

Tobacco smoke also contains cyanide compounds, and a cyanide mediated interference with fetal oxidative metabolism also occurs. In this study, smoking mothers were 1.46 times more at risk of delivering a LBW infant than non-smoking mothers. (OR = 1.46, 95%CI = 0.58, 3.61, p-value = 0.5039) whereas in Termsri's study analysis after recategorization the risk was 1.5 times as compared to non-smokers. (OR = 1.5, 95%CI = 1.18 2.03, p-value = 0.001).

The number of cigarettes smoked per day is also important for the adverse outcome of pregnancy. In this study as the number of smokers were very small the various categories of smokers could not be aptly analyzed due to inadequate sample size.

#### 5.1.15. Contact with cigarette smokers during pregnancy:

For reasons already given, contact with cigarette smokers during pregnancy too, will have an adverse effect on pregnancy outcome. In the current study it was seen that pregnant women in contact with smokers were 1.12 times at risk of delivering a LBW infant as compared to women without such exposure (OR = 1.12, 95%CI = 0.73,1.73, p-value = 0.6611)

The duration of contact is also important, and on analysis it was found that those women who were in contact with cigarette smokers for >12 hrs./day there was a significant risk of 3.17 times of delivering a LBW baby as compared to women who were in contact for <3 hrs. (OR = 3.12 95%CI = 1.27,11.12, p-value = 0.0128). For those who were in contact for '3-6 hrs.' the risk was 1.08 times (OR= 1.08, 95%CI = 0.50,2.34, p-value = 0.9754), and for those who were in contact for '>6-12 hrs' the risk was 0.93 (OR = 0.93, 95% CI = 0.37,2.30, p-value = 0.9700).

Controlling income and gestational age simultaneously there was a slight fall in the odds ratio in those who were in contact for >12hrs. from 3.7 to 3.2, the change still being within the level of significance.

#### 5.1.16. Alcohol consumption during pregnancy:

Maternal alcohol consumption during pregnancy might adversely affect intrauterine growth. In experimental animals the fetal growth inhibiting effect of alcohol has been amply demonstrated when high doses are administered and the mechanism may involve fetal hypoxia. In this study the risk of LBW was 1.9 times in mothers who took alcohol during their pregnancy as compared to mothers who abstained from alcohol

(OR = 1.9, 95%CI = 0.76,4.74, p-value = 0.2008). In Termsri's study there was no risk.(OR = 1, 95%CI = 0.78,1.26 p-value = 0.99).

The type and quantity of alcohol consumed could not be properly analyzed regards to its relation to LBW due to the inadequacy of the sample size.

#### 5.1.17. Sickness during pregnancy:

Common episodic illnesses such as upper resp. tract infections, vomiting, diarrhoea etc. could affect intrauterine growth by:

- resulting in decreased caloric intake, which when prolonged could result in the reduction in the energy available to the fetus, and in women who have inadequate nutritional reserves, impair fetal growth.

- the metabolic cost of maintaining febrile temperatures or of mounting appropriate host defenses may reduce the energy available to the fetus, even with a constant dietary caloric intake.

- the infection or symptom may lead to a diminished uterine blood flow, or even spread to the placenta or amniotic fluid and interfere with intrauterine growth.

In this study however, there was no relationship between LBW and sickness during pregnancy (the OR of those sick to those not being sick being 1).

#### 5.1.19. Coffee consumption during pregnancy:

Caffeine is a potent inhibitor of phosphodiesterase, an enzyme responsible for the metabolic breakdown of cyclic AMP. The resulting increased levels of cyclic AMP could either interfere with cell division or lead to uterine vasoconstriction resulting in LBW. The major dietary source of caffeine is coffee, but lesser amounts are also contained in tea, cola beverages and chocolates. Because coffee and other foods may contain potentially harmful chemical agents other than caffeine, it should be emphasized that a significant association between coffee consumption and LBW does not necessarily implicate caffeine as the etiologic agent. Coffee drinking is highly co-related with cigarette smoking and alcohol consumption, therefore these factors have to be controlled to find the independent effect of coffee.

In the current study coffee drinkers during pregnancy were 1.09 times more at risk of delivering LBW than those who abstained from it (OR = 1.09, 95%CI = 0.58, 2.07, p-value = 0.8875). Termsri has shown a significant risk of

1.78, 95%CI = 1.55,2.04. Due to inadequate sample size the quantity of coffee taken during pregnancy could not be analyzed.

#### 5.1.20. Height of the mothers.

Any contribution of maternal height to gestational growth must have a genetic basis. Because of assortive mating i.e. the tendency of men and women of similar relative stature and weight to marry, paternal height (and weight) are important confounding variables that require control. In the current study mothers <150 cms. were 1.33 times more at risk to deliver a LBW than mothers who were >160 cms (OR = 1.33, 95%CI = 0.60,2.97, p-value = 0.5638). In Termsri's study this risk was 2.1 (OR = 2.1, 95%CI = 1.69,2.62, p-value = <0.0001). Mothers whose heights were 150-160 cms. were 0.83 times at risk as compared to mothers over 160 cms. (OR =0.83 95%CI = 0.41, 1.73, p-value = 0.7244). On the contrary, in Termsri's study mothers of this group were at significant risk of 1.49 times as compared to those >160cms.(OR = 1.49, 95%CI = 1.22, 1.83, p-value = <0.0001).

#### 5.1.21. Complications during labour.

In the current study it was found that the risk of LBW was 1.39 times more in complicated vaginal deliveries than in normal deliveries (OR = 1.39, 95%CI = 0.67,2.86, p-value = 0.4303). In Termsri's study the complications were specific and his study indicates that those expectant women bleeding per vagina were at 3.3 times more at risk than those not bleeding, those having spontaneous abortion were 1.1 more at risk than those who do not, premature rupture of the membrane carried a risk of 3.18 times of delivering a LBW than those with no such ruptures.

#### 5.1.22. Gestational age.

Biologically pre-term babies tend to be of low birthweights whereas post-term babies tend to be heavier. However, the mortality and morbidity of both are higher than those born at term. In this study it was found that the risk of delivering a LBW is 15.98 times more in the pre-term deliveries as compared to the term deliveries. (OR = 15.98, 95%CI = 8.43,30.85, p-value = <0.0001). The risk of LBW in the post-term deliveries was 0.38 as compared to term deliveries (OR = 0.38, 95%CI = 0.04,1.64, p-value = 0.1436). In all the studies preterm has shown a significant risk of

LBW. Pre-term babies generally being of low birthweight is so obvious that any study contradicting this is due to flaws either in its design or analysis. So, this factor need not be compared to any other study to see its consistency.

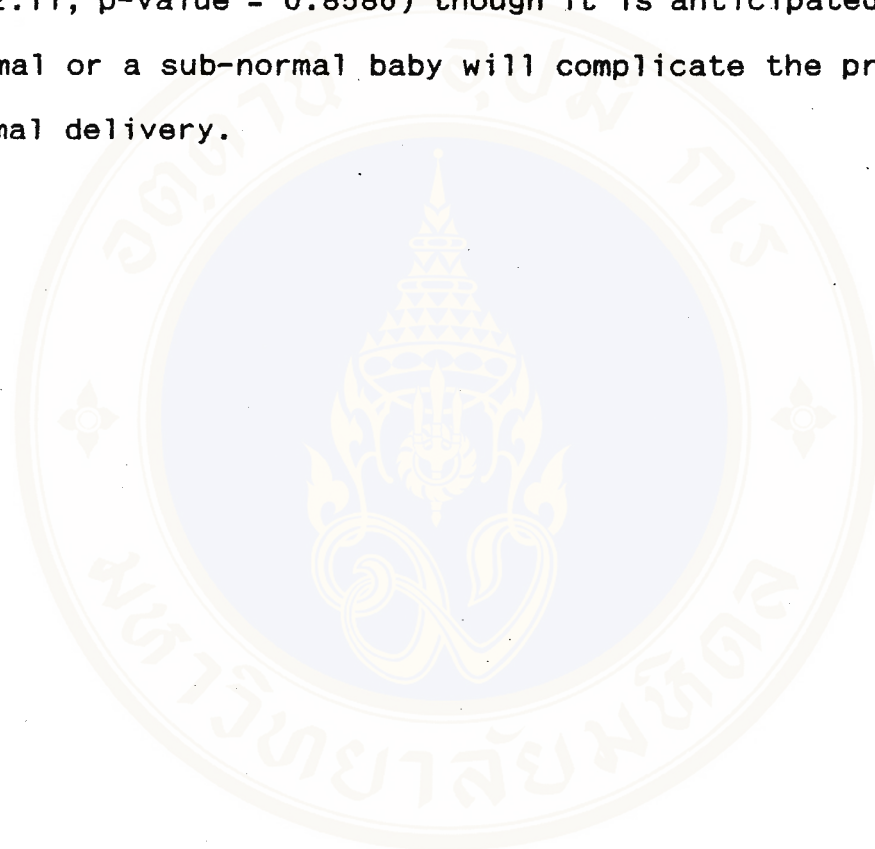
#### 5.1.23. Haematocrit level.

Despite increased maternal erythropoiesis during pregnancy, haemoglobin concentration falls progressively until about the 32nd week of gestation, due to the even greater increase in the plasma volume. Anaemia if severe, could impair oxygen delivery to the fetus and thus interfere with the normal intra-uterine growth or pregnancy duration.

In the current study only 3.5% of the cases and 1.4% of the controls had haematocrit levels of <30%. When this was analyzed the risk of LBW was 2.94 times in those with haematocrit <30% as compared to those with 30% or more (OR = 2.94, 95%CI = 0.62,15.07, p-value = 0.1024). In Termsri's study this risk is shown to be 1.56, significant at 95%CI.(OR = 1.56, 95%CI = 1.14,2.14)

#### 5.1.24. Type of delivery.

In this study there was no relation between LBW and whether the delivery was assisted or normal (OR=1, 95%CI = 0.47,2.11, p-value = 0.8586) though it is anticipated that an abnormal or a sub-normal baby will complicate the process of a normal delivery.



## CHAPTER VI

## RECOMMENDATIONS

Public health interventions should be specific for the population concerned and aimed at quantitatively important modifiable determinants of LBW. The importance of the factors is determined by its individual effect magnitude and prevalence. However, in developing countries we should also consider issues like cost-effectiveness, cultural acceptability, and political feasibility before planning any intervention programme.

In developing countries like Thailand, the interventions likely to have the largest short-term impact on LBW include caloric supplementation before and during pregnancy and in maternal smoking. In this study, contact with cigarette smokers is seen to be potentially of more public health importance than smoking itself. Not only the expectant mothers, but the expectant fathers too, should be counselled on this matter. However, stringent anti-smoking campaigns have already been initiated globally and this should have a benevolent impact on LBW.

In this study maternal height and weight were

statistically insignificant in the crude analysis, but it was a risk factor to LBW, no doubt. Hence, the importance of general improvements in nutrition, living conditions, water supply and sanitation not only to increase maternal height and weight but also to reduce both communicable and non-communicable diseases during pregnancy cannot be ignored.

In consistent with other studies, in this study young maternal age is seen to be a significant risk factor even after its potential confounders were adjusted. For effective public-health intervention a more widespread use of contraceptive methods and selective abortion in young adolescents should have an indirect effect on LBW by delaying pregnancy until they are more optimal to bear children. In societies where contraceptive methods and abortions are banned, and where women marry at a tender age, the cultural obstacles to these interventions may be considerable.

Antenatal-care has been a consistently significant factor for LBW in many studies, and this study was no exception. In most developing countries where health-care facilities are free or inexpensive, a wider participation in ANC from expectant mothers should be encouraged through the mass-media. Though the general awareness to the importance of antenatal-care has shown a positive trend in recent years, a

yet, wider participation can be expected if the accessibility to the ANC clinics is easier and the quality of such clinics more congenial.

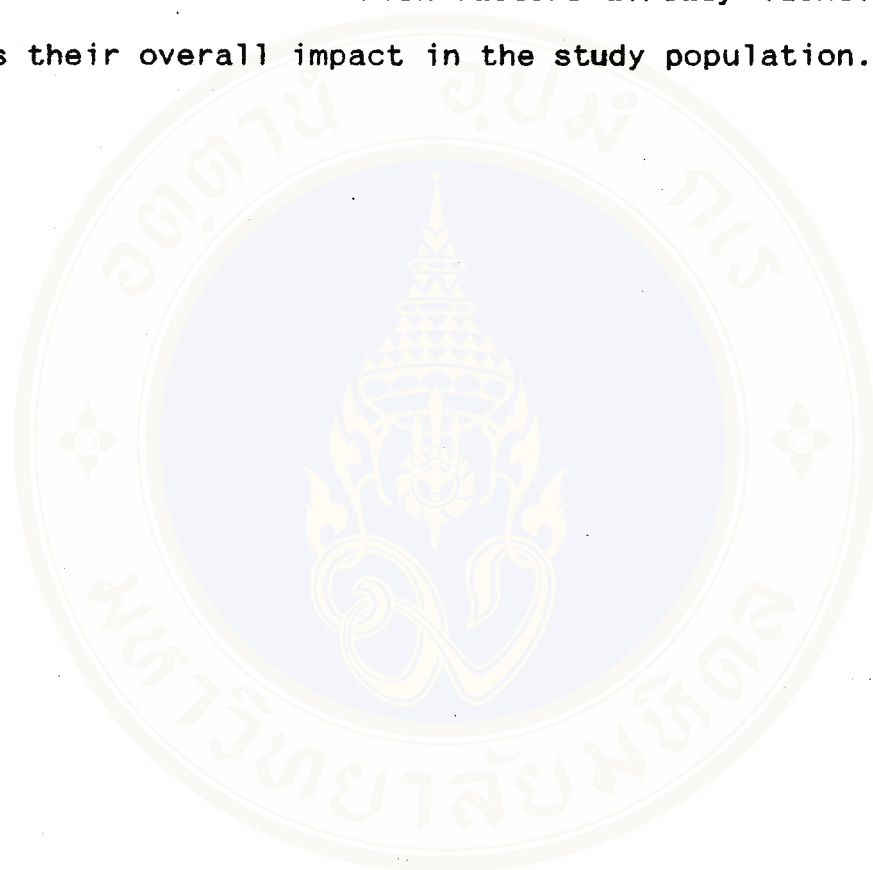
In the past studies, heavy work during pregnancy have shown to be a risk factor for LBW. Though so, in our society it is far from certain that the family will forego the extra income which the mother brings to the family. However, common civil amenities like nearby public water supplies, could be beneficial in areas where expectant mothers are often obliged to carry water over large distances.

Better maternal education is the cornerstone for healthier babies. Besides improving the socioeconomic status of the family, it may also improve nutrition and reduce cigarette smoking during pregnancy. The overall benevolent impact on birthweights due to maternal education is immeasurable.

Further reduction in LBW rates will depend on the ability to clarify the role of currently suspected, and identify those yet undiscovered, determinants of LBW.

Finally, so much work has been done on low birth weights in the past that now, rarely we hypothesize the

existence of a new factor. Therefore, over the last decade, the money and manpower spent on various studies on LBW have been disproportional to the additional knowledge gained on the topic. Far more useful would have been population surveys of the prevalence of those risk factors already identified, to assess their overall impact in the study population.



## CHAPTER VII

## REFERENCES

- 1) Jarueyporn Suparp. Maternal Risk Factors and Low-Birth-Weight in Thailand.
- 2) Chumnijarakij T. Maternal risk factors for low birth weight newborns in Thailand. Department of Preventive and Social Medicine, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand.
- 3) M. S. Kramer. Reviews Analysis. Determinants of low birth weight : methodological assessment and meta-analysis. Bulletin of The World Health Organization, 65 (5) : 663-737 (1987).
- 4) C. R. S. Dougherty and A. D. Jones. The determinants of birth weight. Am. J. Obstet. Gynecol. September 15, 1982.
- 5) Sansee Jirojwong and Michael Skolnik. Types of Antenatal care and other related factors associated with Low Birth weight in Southern Thailand. Asia-Pacific Journal of Public Health 1990-vol. 4.
- 6) Kleinman JC ; Madans JH. The effects of maternal smoking, physical stature, and educational attainment on the incidence of low birth weight. Am-J-Epidemiology; 1985 Jun; 121 (6); P 843-55.

- 7) Silvia de Sanjose, Eve Roman. Low birthweight, preterm, and small for gestational age babies in Scotland. *Journal of Epidemiology and Community Health* 1991; 45: 207-210.
- 8) Brody DJ; Braken MB. Short interpregnancy interval: a risk factor for Low birth weight. *Am-J-Perinatol*; 1987.
- 9) Elenice M. Ferraz et al. Interpregnancy Interval and Low Birth Weight: Findings from a Case-Control Study. *American Journal of Epidemiology* 1988.
- 10) Abner H. Levkoff et al. Maternal Risk Factors in Infants with Very Low Birth Weight. *American Journal. Dis.-Child.*
- 11) Herbert C. Miller, MD. A Model for studying the Pathogenesis and Incidence of Low Birth Weight Infants. *Am. J Dis-Child-Vol. 137, April 1983.*
- 12) Dr. Terence Perera. Perinatal Mortality And Morbidity including Low Birth Weight. A South East Asia Region Profile. SEARO Regional Health Papers No. 3.
- 13) Starfield B. et al. Race, family income and low birth weight. *Am-J-Epidemiology*; 1991 Nov. 15; 134 (10); P 1167-74.
- 14) Vianna NJ. Incidence of Low Birth Weight among Love Canal residents. *Science*; 1985 Dec 7; 226 (4679), P 1217-9.

- 15) Low birth weight, drink, smoking and diet (editorial)  
Public Health; 1983 Nov; 97 (6); P 307-308.
- 16) Schuler D; Klinger A. Causes of low birth weight in Hungary. Acta-Paediatr-Hung; 1984; 25 (1-2);  
P 173-85.
- 17) Newton RW; Hunt LP. Psychosocial stress in pregnancy and its relation to low birth weight. British Medical Journal-(Clin-Res-Ed); 1984 Apr. 21; 288 (6435);  
P 1191-4.
- 18) Tyagi NK. Low birth weight babies in relation to nutritional status in primipara. Indian-Pediatr;  
1985 Jul; 22 (7) P 507-14.
- 19) Benicio MH et al. Multivariate analysis of risk factors for low birth weight in live births in the municipality of Sao Paulo, SP (Brazil).  
Rev-Saude-Publica; 1985 Aug; 19 (4) P 311-20.
- 20) Behrman RE. Preventing low birth weight: a pediatric perspective J-Pediatr; 1985 Dec; 107 (6); P 842-54.
- 21) Macquart-Moulin G et al. Antenatal surveillance and risks of prematurity and fetal growth retardation.  
J-Gynecol-Obstet-Biol-Reprod-(Paris); 1992; 21 (1);  
P 9-18.
- 22) Michielutte R et al. A comparison of risk assessment models for term and preterm low birthweight. Prev-Med;  
1992 Jan; 21 (1); P 98-109.

- 23) Dechering WH; Perera RS. A secondary analysis of determinants of Low birth weight. *Ceylon-Med-J*; 1991 Jun; 36 (2); P 52-62.
- 24) Simoson RJ, Armand Smith NG. Maternal smoking and low birthweight: implications for antenatal care. *J-Epidemiol-Community-Health*; 1986 Sept; 40 (3); P 223-7.
- 25) Martin TR, Braken MB. Association of low birth weight with passive smoke exposure in pregnancy. *Am-J-Epidemiol*; 1986 Oct; 124 (4); P 633-42.
- 26) Shino PH et al. Birth weight among women of different ethnic groups. *JAMA*; 1986 Jan 3; 255 (1); P 48-52.

case control I.D.NO   
(เลขที่แบบสอบถาม)

แบบสอบถามสำหรับการวิจัยในวิทยานิพนธ์  
"Maternal Risk Factors to Low Birth Weight Baby"

loc. Dr. Digbijaya S. Rana

## QUESTIONNAIRE

(สำหรับมารดา)

1. Name of Mother .....

(ชื่อมารดา)

2. Age: อายุมารดา

1. &lt;18 years

2. 18-35 years

3. &gt;35-40 years

4. &gt;40 years

Date of birth วันเกิดมารดา .....

3. Delivery date:.....

(วันเดือนปีที่คลอด)

4. Sex of infant:

ทารกเพศ 1) M ชาย

2) F หญิง

5. Birth weight.....

(น้ำหนักแรกเกิด)

## 6. Marital status:

(สถานภาพสมรสของแม่)

- 1) Married (แต่งงาน)
- 2) Unmarried, living together (ไม่ได้แต่งงาน, อยู่ด้วยกัน)
- 3) Divorced (หย่า)
- 4) Separated (แยกกันอยู่)
- 5) Widow (หม้าย)
- 6) Others (specify) อื่น ๆ .....

## 7. Education: (ระดับการศึกษาของแม่)

- 1) No formal education (ไม่ได้เรียนหนังสือ)
- 2) < 4 years of schooling (ต่ำกว่า ป.4 ปี)
- 3) 4-9 years of schooling (ป.4-ป.7)
- 4) >9-12 years of schooling (มศ.1-มศ.5)
- 5) >12 years of schooling (ระดับอุดมศึกษา)

## 8. Occupation of the mother: (อาชีพมารดา)

- 1) A Government employee (ข้าราชการ)
- 2) A Private employee (ลูกจ้างเอกชน)
- 3) Family business (ทำธุรกิจในครอบครัว)
- 4) Servant (คนใช้)
- 5) Housewife/unemployed (แม่บ้าน/ไม่ได้ทำงาน)
- 6) Student (นักศึกษา)
- 7) Others (specify) อื่น ๆ ระบุ .....

## 9. Weight of the mother before the present pregnancy:

(น้ำหนักแม่ก่อนตั้งครรภ์)

- 1) < 45 Kgs.
- 2) 45-54.9 Kgs.
- 3) 55-64.9 Kgs.
- 4) > 65 Kgs.

10. Family Income per month: (รายได้ครอบครัวต่อเดือน)

- 1) <1000 Bahts/month
- 2) 1000-2000 Bahts/month
- 3) 2001-4000 Bahts/month
- 4) 4001-7000 Bahts/month
- 5) > 7000 Bahts/month

11. Frequency of antenatal care: (จำนวนครั้งของการมาฝากครรภ์)

- 1) None (If no go to Q.No.13)  
ไม่เคย (ข้ามไปข้อ 13)
- 2) < 4 visits เคยแต่น้อยกว่า 4 ครั้ง
- 3) > 4 visits เคยตั้งแต่ 4 ครั้งขึ้นไป

12. First antenatal visit: (ได้รับการตรวจครรภ์ครั้งแรกเมื่อ)

- 1) 1-3 month gestational age
- 2) >3-6 months gestational age
- 3) >6-9 months gestational age

13. Number of previous deliveries (excluding this one)

จำนวนการคลอด

- 1) 0 (If 0 skip next Question)
- 2) 1
- 3) 2 - 3
- 4) > 4

14. How long was your last pregnancy interval?

ตั้งครรภ์ครั้งหนึ่งห่างจากครั้งหลังสุดกี่เดือน

- 1) < 6 months
- 2) 6-12 months
- 3) >12 - 24 months
- 4) >24 months

15. Any history of still-born or neonatal deaths (< 7 days)

ท่านเคยมีประวัติทารกตายในครรภ์หรือคลอดแล้วเสียชีวิตหรือไม่

- 1) Yes เคย
- 2) No ไม่เคย

## 16. Any history of previous Low Birth Weight Babies:

ท่านเคยคลอดบุตรที่มีน้ำหนักต่ำกว่าปกติหรือไม่

- 1) Yes เคย
- 2) No ไม่เคย
- 3) Don't know ไม่ทราบ

## 17. Do you smoke? ท่านสูบบุหรี่หรือเปล่า

- 1) Yes สูบ
- 2) No (If no go to Q. no. 19)  
ไม่สูบ (ข้ามไปข้อ 19)

## 18. If yes, how many cigarettes/day did you smoke during pregnancy:

ถ้าสูบ, สูบวันละกี่มวนในขณะตั้งครรภ์

- 1) < 5 cigarettes/day น้อยกว่า 5 มวนต่อวัน
- 2) 5-10 cigarettes/day 5-10 มวนต่อวัน
- 3) >10-15 cigarettes/day >10-15 มวนต่อวัน
- 4) > 15 cigarettes/day มากกว่า 15 มวนต่อวัน

## 19. Are you in contact with cigarette smokers at home and/at office

ขณะตั้งครรภ์, ท่านได้ใกล้ชิดกับคนที่สูบบุหรี่หรือเปล่า

- 1) Yes เคย
- 2) No (If no go to Q.No. 21)  
ไม่เคย (ข้ามไปข้อ 21)

## 20. If yes about how many hours/day are you in contact with them?

ถ้าเคย, คิดว่าใกล้ชิดกับคนสูบบุหรี่กี่ชั่วโมงต่อวัน

- 1) < 3 hours น้อยกว่า 3 ชม.
- 2) 3-6 hours 3 - 6 ชม.
- 3) >6-12 hours >6-12 ชม.
- 4) >12 hours มากกว่า 12 ชม.

## 21. Did you take alcohol during this pregnancy:

- 1) Yes ดื่ม
- 2) No (If no go to Q.no. 24)  
ไม่ดื่ม (ข้ามไปข้อ 24)

22. If yes, what kind of alcoholic beverages did you take?

ถ้าดื่ม, คุณดื่มเหล้าชนิดใด

- 1) Whisky เหล้า
- 2) beer เบียร์
- 3) wine coolor ไวน์คูลเลอร์
- 4) other specify อื่น ๆ ระบุ.....

23. If yes, how often did you take:

ถ้าดื่ม, ดื่มบ่อยแค่ไหน

- 1) About 100 ml./week 0.5 แก้ว/สัปดาห์
- 2) About 101-200 ml./week 0.5-1 แก้ว/สัปดาห์
- 3) >200 ml./week มากกว่า 1 แก้ว/สัปดาห์

24. Have you ever been sick during this pregnancy?

ในระหว่างตั้งครรภ์ท่านเคยป่วยไหม

- 1) Yes ป่วย
- 2) No ไม่ป่วย

If yes please specify ถ้าป่วยระบุโรค.....

25. Did you suffer from malaria during this pregnancy:

ระหว่างตั้งครรภ์ลูกคนนี้ท่านป่วยเป็นมาลาเรียหรือเปล่า

- 1) Yes ป่วย
- 2) No ไม่ป่วย

26. Did you take coffee during this pregnancy?

ท่านดื่มกาแฟเป็นประจำในระหว่างตั้งครรภ์บุตรคนนี้หรือเปล่า

- 1) Yes ดื่ม
- 2) No (If no skip Q no.27)  
ไม่ดื่ม (ผ่านข้อ 27 ไป)

27. If yes, how much did you take? ถ้าดื่ม, บ่อยแค่ไหน

- 1) 1-2 cups/day
- 2) >2-5 cups/day
- 3) > 5 cups/day

**QUESTIONNAIRE TO BE FILLED FROM THE HOSPITAL RECORDS**

ส่วนนี้ได้จากบัตรโรงพยาบาล

1) Height of the mother: ความสูงของมารดา

- 1) Below 150 cms. น้อยกว่า 150 ซม.  
 2) 150-159.9 cms. 150-159.9 ซม.  
 3) > 160 Cms. มากกว่า 160 ซม.

2. Maternal complications during labour:

เคยเกิดโรคแทรกซ้อนในระหว่างคลอดหรือไม่

- 1) No ไม่มี  
 2) Yes (Specify) มี ระบุ.....  
 .....

3. Gestational age (estimated from the last menstrual period)

อายุครรภ์มารดา (นับจากการมีประจำเดือนครั้งสุดท้าย)

- 1) Term (37-42 weeks)  
 2) Preterm (<37 weeks)  
 3) Postterm (> 42 weeks)

4. Blood test: ผลเลือด

- 1) Haematocrit 30% or less  
 2) Haematocrit > 30%  
 3) No record

5. Type of delivery: ชนิดของการคลอด

- 1) Normal (If normal skip Q.no 6)  
 คลอดปกติ (ไม่ต้องตอบข้อ 6)  
 2) Assisted  
 คลอดโดยใช้เครื่องมือช่วย

6. If assisted, what type of assistance?

ถ้าใช้เครื่องมือช่วย, ใช้วิธีใด

- 1) forceps  
 2) vacuum  
 3) breech

## List of abbreviations

cig.	cigarette
LBW	Low birthweight
yrs.	years
mths.	months
wks.	weeks
HIV	Human immunodeficiency virus
IUGR	Intra-uterine growth retardation
ses	socio-economic status
preg.	pregnancy
ht.	height
unempl.	unemployed
ml.	milliliters
ANC	Antenatal-care
inf.	infection
cms.	centimeters
Priv.	private
fam.	family
busi.	business
prev.	previous
intval.	interval
ges.	gestational
kgs.	kilograms
Freq.	frequency



grp.	group
hrs.	hours
gesage	gestational age
prepreg.	pre-pregnancy
MLR	multiple logistic regression
df	degree of freedom
exp.	exponential
obstet.	obstretic
Gynaecol.	Gynaecology
Dis.	disease
Pediatr.	Pediatric
Epidemiol.	Epidemiology
CI	confidence interval
RR	Relative risk
OR	odds ratio
stud.	student
serv.	servant
h/o	history of
govt.	government
priv.	private
amt.	amount