The Factors Influencing Newborn Birth Weight

Bülent Demir[1], Faruk Demir[2]

[1]Ergani State Hospital, Diyarbakır
[2]Diyarbakır Children Hospital, Diyarbakır

Abstract

Objective: To assess the socioeconomic, anthropometric, medical and nutritional factors that may influence newborn birth weight by a questionnaire.

Methods: This study was performed by face to face talking in 500 full term pregnant women by using a form including 50 questions.

Results: The mean birth weights of the male and female newborns were 2923.66 gr. and 2922.10 gr, respectively. The difference in mean birth weights of males and females was 156 g. although statistically significant value was not obtained. There was positive correlation between mother's body weight and height measures and newborn birth weights. There were no statistically significant relationship between mean newborn birth weights and maternal age, maternal body weight and height, educational and occupational status of the family, smoking habit in pregnancy, number of birth, mineral and vitamin support during pregnancy, frequency of prenatal care, weight gain in pregnancy, localization of inhabitance and nourishment of mothers in pregnancy.

Conclusion: It may be concluded that the investigation and correction of the factors that may lead to low birth weight would reduce the perinatal morbidity and mortality.

Keywords: Pregnancy, birth weight, sociodemographic factors.

Doğum ağırlığını etkileyen faktörler

Amaç: Yeni doğan doğum ağırlığını etkileyebilecek sosyoekonomik, antropometrik, medikal ve beslenme faktörlerinin soru cevap yöntemi ile araştırılması.

Yöntem: Çalışma son adet tarihine göre term olan 500 gebe araştırma kapsamında değerlendirildi ve bir ön çalışma ile oluşturulan 50 soruyu içeren soru formu her gebe ile yüz yüze konuşma yöntemi ile dolduruldu.

Bulgular: Kız bebeklerin doğum ağırlıkları ortalaması 2922.10 gram ve erkek bebeklerin doğum ağırlıkları ortalaması 2923.66 gram olarak bulundu. Kız ve erkek bebeklerin doğum ağırlıkları arasında 156 gram fark bulundu, ancak bu fark istatistiksel olarak anlamlı değildi. Annenin ağırlığı ve boyu arttıkça bebek doğum ağırlığı da artmaktaydı. Sonuçlara göre bebeğin doğum ağırlığı ile; annenin yaşı, vücut ağırlığı, boyu, öğrenim durumu, mesleği, ailenin sosyoekonomik statüsü, annenin gebelikte içtiği sigara sayısı, doğum sayısı, gebelikte aldığı mineral ve vitamin desteği, almış olduğu prenatal bakım sayısı, gebelikte alınan kilo, yerleşim yeri ve annenin gebelik sırasındaki beslenmesi arasında istatistiksel anlamlı ilişki saptanmadı.

Sonuç: Yeni doğanın düşük doğum ağırlığında doğmasına yol açacak faktörlerin bilinmesi ve bunların düzeltilmesine yönelik yapılacak çalışmaların perinatal morbidite ve mortaliteyi azaltabileceği kanısına varıldı.

Anahtar Sözcükler: Gebelik, doğum ağırlığı, sosyodemografik faktörler.

Correspondence: Uz. Dr. Bülent Demir, Saray Mahallesi Çifte Pınar Cad. Sönmez Apartmanı No:1 21950 Ergani/Diyarbakır
e-mail: drbd@mynet.com

Introduction

Deaths of newborns in the world occur mostly due to infections during the delivery (sepsis, neonatal tetanus) or in a short time after delivery (pneumonia, diarrhea). One third of all newborn deaths occur within one month after the delivery, a quarter of them occur in the first week after delivery. One third of newborns die due to asphyxia and birth trauma. Low birth weight is also has an important position in perinatal death reasons.[1] One of the important factors influencing perinatal morbidity and mortality is birth weight of baby. Being born of baby in ideal weight will reduce perinatal risk.[2] There is a high death risk in fetus or newborn which has low weight or risk of having problem physically and intellectually is high if it lives.[3]

Low birth weight is among the most important factors which affects living possibility of baby. Death rate in these groups of baby is higher than other babies 20 times. There is a direct proportion between weight and chance of living.[3-6] Clinical problems of newborns is related closely with birth weights and gestational ages. It can be guessed that a 1000 g baby may have many problems and they have to be taken care in intensive care unit and that a 2000 g baby may have hyperbilirubinemia, respiratory distress, nutrition problems and on the other hand that a 4000 g newborn is within risky group for birth trauma and may be a baby of diabetic mother.[7] It was found by studies that matures who had birth weight <2500 g had frequently hypertension, type II diabetes mellitus, insulin resistance, frequent cardiovascular disorders and less nephron.[8]

Researches also found variables influencing birth weight as socioeconomic, physical, medical, ethnic, antropometric factors and they examined relations between birth weight and one or more of these parameters. But close relationship between these factors prevent to put forward a single factor in determining birth weight.

In this study, we searched precautions for carrying to the upmost level of newborn weight and factor influencing newborn weight.

Methods

Study population was chosen by sampling method from among pregnants who just delivered. 500 pregnants who applied in various months and delivered were included into the study group. A form including 50 questions were filled by face to face discussion with each pregnant in a pre-study.

All of pregnants who were included to study group were term gestations as to their definite last menstrual period. Anthropometric measurements such as ages, weights and heights of mother and father were taken directly. For determining socioeconomic status groups in our study; profession and the education of individual who earns the actual income in the family designated by European Society for Opinion and Marketing Research (ESOMAR) were taken as a base.

Marital status was determined as three groups as civil marriage, not civil marriage; only civil marriage and only not civil marriage; common law marriage. Settlement locations of families were classified as city, district, shanty towns and village. Smoking habit of the mother was classified as to daily cigarette number. Information about whether the mother took ferrum-vitamin preparations or not, weights of mothers before gestation and weight increases of mothers during gestation, gestation , miscarriage and stillbirth numbers and also about the profession, educational status and medical control number that mother took during the gestation were collected.

High tensioned and preeclamptic pregnants were not included into the study group due to the fact that high tension and preeclampsia were major factors causing low birth weight. Term pregnants having no diabetes and no problem during the gestational period and who had normal spontaneous vaginal delivery were included into the study.

Newborns were recorded to study form by determining their sexuality, weight and height.

Parameters influencing birth weight were interpreted statistically by SYSTAT Version 5 method. ANOVA (Analysis of Variance) was used for statistical determining parameters which had more than

two groups and Bartlett's Homogeneity test was used for homogeneity of groups' variances. T-test was used for statistical determining parameters which had more than two groups.

Results

224 (44.8%) of cases were male and 276 (55.2%) of them were female. Average birth weight of male babies was 2923.66 gr and average birth weight of female babies was 2922.10 gr. There was statistically no significant difference between two groups ($p>0.05$).

Familes were separated into four groups as to their settlement locations. 170 (34%) of families were from city center, 134 (26.8%) of them were from districts, 99 (20.8%) of them were from shanty towns and 97 (19.4%) of them were from villages. Birth weights of babies of families who came from cities and districts were higher than birth weights of babies of families who came from shanty towns and villages and this difference was statistically significant ($p<0.001$).

Mothers were separated into three groups as to their ages. 202 (40.4%) of them were under 19, 180 (36%) of them were between 20 and 34 and 118 (23.6%) of them were ≥35. Baby birth weight increased as maternal age increased and the increase was statistically significant ($p<0.001$). But this increase was not observed among advanced maternal ages (over 35) ($p>0.05$).

Mothers were separated into five groups as to their weights. 72 (14.4%) of mothers were ≤59 kg, 170 (34%) of them were 70-79 kg, 66 (13.2%) of them were 80-89 kg and 92 (18.4%) of them were ≥90 kg. Baby birth weight increased as mother's weight increased and this increase was statistically significant ($p<0.001$).

Mothers were separated into three groups as to height groups. 28 (5.6%) of mothers were ≤159 cm, 271 (54.2%) of them were between 160 and 169 cm and 201 (40.2%) of them were ≥170 cm. Baby birth weight increased as mother heights increased and this increase was statistically significant ($p<0.001$).

Mothers were separated into six groups as to their educational status.102 (20.4%) of mothers were not literate, 58 (11.6) were uneducated literate, 97 (19.4%) of them graduated from primary school, 81 (16.2%) of them graduated from secondary school, 69 (13.8%) of them graduated from high school and 93 (18.6%) of them graduated from higher education. Baby birth weight increased as educational status of mothers increased and this increase was statistically significant ($p<0.001$).

Families were separated into six SEL groups as to their socioeconomic levels as groups A, B, C1, C2, D and E. 98 (19.6%) of them were in group A, 73 (14.6%) of them were in group B, 66 (13.2%) of them were in group C1, 40 (8%) of them were in group C2, 83 (16.6%) of them were in group D and 140 (28%) of them were in group E. Baby birth weight increased as socioeconomic levels of families increased and this increase was statistically significant ($p<0.001$).

Mothers were separated into four groups as to their professions. 162 (32.4%) of mothers were housewives, 117 (23.4%) of them were office workers-officials, 72 (14.4%) of them were self-employed and 149 (29.8%) of them were employees-workers. Baby birth weights of mothers who were physically working in hard jobs were quite low and this lowness was statistically significant ($p<0.001$).

Mothers were separated into three groups as to cigarettes daily smoked during gestation. 292 (58.4%) of mothers were not smoking, 194 (38.8%) of them were smoking 1-10 cigarettes daily and 14 (2.8%) of them were smoking ≥11 cigarettes. Baby birth weights of smoking mothers were lower than those who did not and this lowness was statistically significant ($p<0.001$).

Mothers were separated into six groups as to their delivery number. 142 (28.4%) of them delivered once, 95 (19%) of them delivered twice, 120 (24%) of them delivered three times, 39 (7.8%) of them delivered four times, 75 (15%) of them delivered five times and 29 (5.8%) of them delivered ≥6 times. Baby birth weight increased as deliver numbers increased (until 5 deliveries) and this increase was statistically significant ($p<0.001$). But baby birth weights of women who delivered 5 times and over were low.

Mothers were separated into four groups as to prenatal care number they took. 102 (20.4%) of

them never took prenatal care, 199 (39.8%) of them took 1-3 times, 129 (25.8%) of them took 4-9 times and 70 (14%) of them took ten times or more. Baby birth weight increased as prenatal care numbers increased in parallel and this increase was statistically significant (p<0.001).

Families were separated into three groups as to their marital status. 268 (53.6%) of them were those having civil marriage + not having civil marriage, 132 (26.4%) of them were those having just civil marriage and 100 (20%) of them were those having common law marriage. Birth weights of babies were changing as to the marital status of families. Baby birth weights of mothers within first group were higher than other two groups but this difference was statistically not significant (p>0.05).

Mothes were separated into two groups as to taking ferrum-vitamin preparation during gestation. 195 (39%) mothers were taking it and 305 (61%) mothers were not taking it. Baby birth weights of women who were taking ferrum-vitamin preparation during gestation were statistically and significantly higher then those who were not taking it (p<0.001).

Mothers were separated into two groups as to gained weight amount. 245 (49%) of mothers gained 5-10 kg weight and 255 (51%) of mothers gained 11-15 kg weight. Baby birth weights of second group were statistically and averagely different when compared with first group (p<0.05).

Discussion

Turkey is among the countries having high baby birth and death rates, and also protein energy malnutrition is frequently observed.[9-13]

Average birth weight within different races changes as to average mature height. Generally, birth weights of newborns in short Far East and East Asia societies are lower than other countries. A significant relation between mother's height and baby's birth weight is reported. Average birth weight values in our country seem similar with Western Europe and the USA standards.[14]

Birth weights of female babies are reported averagely 118-121 gram lighter than male babies.[15] We found that birth weights of female babies were born 156 gram lighter in our stuffy, it was statistically not significant (p>0.05).Birth weights of male babies are 150-200 gram heavier than females. This difference is explained by the effect of paternal Y chromosome or testosterone hormone secreted from male testes in the second half of the gestation.[14]

Generally, studies related with the relation between gestational age and birth weight are retrospectively performed. It was shown that all factors such as mother height, weights gained during gestation, genetic and socioeconomic factors, nutrition before and during gestation affected fetal growth.[10,12,16] Newborn weight has an important role in perinatal deaths and next periods of life. The subject of newborn weight is studied in terms of especially maternal nutrition by discussing in various aspects.[12,17]

Average baby birth weight was found as 2922.88 gram in our study. Statistically a significant relation was found between maternal weight and baby birth weight (p<0.001). Neyzi et al classified mothers as low, normal and high weighted as to their weights before relative birth in order to study the relationship between birth weight and maternal nutrition; they found the average of birth weight as 3252 gram and the average of mothers' weights as 58.8 kg; they determine a significant relation between both weights.[18] In a study in which previous studies were reviewed, it was observed that maternal weight has an important effect on baby birth weight. Lowness of maternal weight in developing countries causes tending to left in birth weight distribution and low weighed baby births in high prevalence.[19] Margarita et al found in their study performed in Portugal for examining the relation between maternal weight and newborn birth weight that there was a significant relationship between maternal weight and newborn birth weight.[20]

Birth weight displays differences as to the various societies. The role of intrauterine living conditions that mother prepared for baby was evaluated by Thomson and the effect of diets with different calories on birth weight was stated.[21] Average birth weight of babies of less fed mothers was found as 2327 gram and average birth weight of babies of well fed mothers was found as 3665 gram. Higgins showed a positive relationship between baby birth

weight, gaining weight of mother, protein and energy intake of mother.[21] Ozalp et al showed the effect of mother's weight on baby birth weight in their study performed in Ankara.[11,12]

We found a positive relation between weight gaining of mother and birth weight of baby in our study ($p<0.001$). The positive relationship between weight increase and birth weight explains the increase in blood volume and positive effects of body changes related to gestation, a definite recovery was found between maternal weight and weight gaining and birth weight.[22] UNICEF suggests to take nutrition support for weight gaining less than 1.5 kg/month in the last six month of gestation. Type of weight gaining is important; if early weight gaining is low birth weight appears (SGA) and if late weight gaining is low, preterm birth incidence appears. Weight gaining is very important for adolescence pregnants who are also growing. While ideal weight gaining is normally 9-14 kg in pregnants, it is accepted as 18 kg for adolescence pregnants.[2]

Delivering heavier babies of those who take additional nutrition and who use vitamin and ferrum preparation in gestation can be explained in various ways. Birth weights of babies of mothers who took ferrum-vitamin support were higher than those who did not take in our study and it was statistically significant ($p<0.001$). Even though weight gaining of mother is accepted as a criterion for enough nutrition in various studies, they emphasized this criterion as balanced nutrition with basic food stocks. Effects of various nutrition types on gestation are determined as lack of calorie and plasma volume expansion of mother. Again probable mitogenic effect of bad nutrition is emphasized before conception in literature. It is clear that taking additional food in a balanced way decreases morbidity of birth weight and it is effective in many way.[23]

Maternal age has a specific effect on baby birth weight ($p<0.001$). Ertogan et al found average maternal age as 24.2 and average baby birth weight as 3305 gram and they found a significant relation between maternal age and baby birth weight when they examined them by regression analysis ($p<0.05$).[17] While Dougherty and Jones stated that mothers between 18-20 age group deliver 89 gram lighter babies and women aged as 36 and over deliver 124 gram and heavier baby;[15] Viegos reports that the effect of age on birth weight is variable younger and older mothers deliver lighter babies than middle aged women group and that optimal age is 28. The effect of age on birth weight is -50 gram on age twenty, +10 gram on age 30, -110 gram on age 40.[24] It is also reported in literature that maternal age and baby birth weight has a positive correlation.[15,24,25] Our findings are parallel these four studies.

A significant relationship was found between mothers' heights and baby birth weights ($p<0.001$). Similarly, mothers' heights and baby birth weights were related with each other in the study performed by Ozalp et al in Ankara and in the study performed by Aygun et al in Istanbul.[11,12,16]

As socioeconomic structure of a region gets worse, low weighed baby births and perinatal morbidity increases.[26] We statistically found that baby birth weight decreases when socioeconomic status gets worse ($p<0.001$). Gould and Roy showed us in their study performed on 127558 deliveries that possibility of low weighed baby birth clearly increases as income level of white and black races decreases. Socioeconomic disadvantages do not cause directly low birth weight but it shows an indirect effect by ruining to utilize from health services, by preventing enough nutrition and by causing stress.[27]

Birth weights of those applied from cities and districts were higher than those applied from shanty towns or villages and they were statistically significant ($p<0.001$). This difference may be explained by socioeconomic advantages. Our results are similar with literature information.[5,6,28,29]

Educational status of mother is one of the important factors affecting newborn weight. Newborn weights of mothers who graduated from high school or from higher education were found high and statistically significant ($p<0.001$). Information in the literature is similar.[5,6,28]

We found in our study that profession of mother is effective on birth weight. Baby birth weights of mothers who were physically working in hard jobs were the lowest (p<0.001). Dougherty and Jones found in their study which was evaluating this parameter in the literature that women having a professional job delivered heavier weighed baby (+12 gr), qualified workers (-60 gr) and workers (-69 gr) delivered lighter weighed baby when housewives were taken as reference.[15]

Positive relationship between parity and birth weight is also found in studies performed on other countries. Birth weight increases as parity increases (we found it statistically significant; p<0.001) and this can only be explained by adaptation of mother's organism to gestation. But when delivery number excesses five, baby birth weight displays a decrease.

It has been known since 1970 that baby birth weight decreases if mother smokes.[30,32] 38.8 of mothers who participated to our study smoked maximum 10 piece/day and 2.8% of them smoked minimum 10 piece/day. Baby birth weights of those who did not smoke were more than those smoking and the difference was statistically significant (p<0.001). The literature also reports averagely 170 gram lowness in babies of mothers who smoke regularly.[33] Similarly, pregnants who were exposed to the smoke of cigarette at least for two hours in their homes and pregnants who did not expose to any smoke were compared in the study and it was observed that possibility of low weighed birth increased in smoking group.[34]

Weight averages of babies of mothers who got prenatal care by contacting health centers during gestation were compared with babies of mothers who did not get any prenatal care during gestation and the difference was statistically significant (p<0.001).

Marital status which is thought as a factor that may affect mother's psychological adaptation to baby did not affect birth weight (p>0.05). It is showed by many studies that birth weights of babies born as a result of illegitimate affairs and unwanted pregnancies will be low.[15,31]

Consequently; low weighed births affected by many risk factors constitute the most important of risky newborn group of neonatology. Thus, knowing risk factors affecting low weighed births and taking related protective precautions would open new prospects to us in order to keep babies alive by the cooperation of obstetricians and neonatologysts.

References

1. Atıcı A, Özgünen FT. Çukurova Üniversitesi Perinatal Tanı, Tedavi, Araştırma ve Uygulama Merkezi (PERİTAM), lll. Perinatoloji Kursu. Kurs Kitabı, Kasım 1996; s 1-12.
2. Kadanalı S, Önvural A, Erten O. Doğum kilosunu etkileyen faktörler. *Perinataloji Dergisi* 1994; 2:89-93.
3. Ashford JR, Fryer JG, Karlberg P, Priolisi A, Harding RA. Measures of maturity indices in perinatal mortality. *Monogr Paediatr* 1977; 9: 121-64.
4. Syrovatka A, Vondracek J. Relationship of birth weight and infant mortality in regions of Bohemia. *Cesk Pediatr* 1969; 24: 130-7.
5. Wallace HM. Factors associated with perinatal mortality and morbidity. *Clin Obstet Gynecol.* 1970; 13: 13-43.
6. WHO: Report of a WHO expert commitee:The prevention of perinatal mortality and morbidity. *WHO Tech Rep Ser* 1970; 457: 1-60,
7. Onat T: Yenidoğan ve Hastalıkları. Çocuk Sağlığı ve Hastalıkları. Cilt 1 Eksen yayınları, İstanbul 1996; 245-246.
8. Vasarhelyi B, Dobos M, Reusz GS, Szabo A, Tulassay T. Normal kidney function and elevated natriuresis in young men born with low birth weight. *Pediatr Nephrol* 2000; 15: 96-100.
9. Ganguly M, Elwood JH, Mac Kenzie G. Factors associated with "low" and "high" birth weight. *Am J Epidemiol* 1972; 96: 161-7.
10. Neyzi O. Protein enerji malnütrisyonu. Süt çocukluğu döneminin beslenme sorunları. Şişli günleri. İstanbul: Nurettin Uycan Matb. 1978; 69-93.
11. Özalp İ, Ciliv G, Erdem G, Durmuş Z, Doğramacı İ. Small for dates babies in 1018 consecutive births in a general matemity hospital in Ankara. *Bulletin of the international Pediatric Association* 1980; 3: 9-22.
12. Özalp İ, Ciliv G, Erdem G, Metcoff J, Costiloe P, Doğramacı İ. An equation for computing expected birth measurements (including birth weight) for the Turkish population (based on pregnancy characteristic). *Turk J Pediatr* 1981; 23: 5-13.
13. Tanner JM, Israelson WJ. Parent-child correlations for body measurements of children between the ages on month and seven years. *Ann Hum Genet* 1963; 26: 245-59.
14. Neyzi O, Ertuğrul (Yüksel) T: Yenidoğan ve Hastalıkları. Çocuk Sağlığı ve Hastalıları. Cilt 1, Acar Matbaacılık, İstanbul 1993; 174-250.
15. Dougherty GNS, Jones AD. Determinants of birth weight. *Am J Obstet Gynecol* 1982; 144: 190-200.

16. H. Aygün AD, Genca E, Bingöl M. Doğum ağırlığını etkileyen faktörler üzerine bir araştırma. *Türkiye Klinikleri Pediatri* 1994; 3: 114-7.
17. Ertogan F, Berki R, Abal G, Öcal G, Doğru Ü. Anne yaşı ve doğum sayısının doğum boyu ve ağırlığı ile ilişkisinin araştırılması. XV Türk Pediatri Kong Tebliğler Kitabı, Sermet Mat 1977; 2: 349-54.
18. Neyzi O, Günöz H, Çelenk A, Bundak R. Birth weight in Turkish infants. *Hum Biol* 1986; 58: 367-78.
19. Ounsted M, Scott A. Associations between maternal weight, height, weight for height, weight gain and birth weight. ln:Dobbing J, ed. Maternal nutrition in pregnancy: eating for two. London. *Academic Press*, 1981; 113-30.
20. Tavares M, Rodrigues T, Cardoso F, Barros H, Leite LP: Independent effect of maternal birth weight on infant birth weight. *J Perinat Med* 1996; 24; 391-6.
21. Higgins A. A preliminary report of a nutrition study on public patients. Report of a workshop on nutritional suplementation and the outcome of pregnancy. National Academy of Science National Research Council, Washington DC. 1972, ed. Jacobsan HN, 1974.
22. Wöller BO, Medhin MG, Lindmark G: Maternal weight, weight gain and birthweight at term in the rural tanzanian village of ilula. *Br J Obstet Gynecol* 1989; 96: 158-166.
23. Aaronson L, Macnee GL: The relationship between weight gain and nutrition in pregnancy. *Nursing Research* 1989; 38: 4-223.
24. Viegos OA, Ratnom SS, Cole TJ. Ethnic and other factors affecting birthweight in Singapore, Int. *J Gynecol Obstet* 1989; 29: 289-95.
25. Hytten FE, Leitch I: The Physiology of Human Pregnancy, 2d ed. *Oxford, Blackwell Scientific Publ* 1971: 599-617.
26. Sporloch CW, Hirds NVV, Skaggs JW, et al: Infant death rates among the poor and nonpoor in Kentucky, 1982 to 1983, *Pediatrics* 1987; 80: 262-8.
27. Gould JB, Le Koy S: Socıoeconomıc status and low birth weight: A racial comparison, *Pediatrics* 1988; 82: 896-9.
28. Newman, NM. Perinatal mortality: a social or obstetric problem. *Aust Fam Physician* 1977; 6: 224: 217-9.
29. Oral ST:I-Köysel bölgede süt çocuklarının boy, ağırlık, baş çevresi ortalamaları ve büyüme hızı. II- Gecekondu bölgesinde doğan çocukların bazı ölçüleri ve düşük ağırlıklı çocukların görülme sıklığı. *H. Ü. Çocuk Sağlığı ve Hastalıkları Dergisi*, 1973; 16, 2, 100-20, 157-68.
30. Butler NR, Goldstein H, Ross EM: Cigarette smoking in pregnancy: İts ınfluence on birth weight and perinatal mortality. *Br Med J* 1972; 127-8.
31. Davies DP, Gray OP, Elwood DC, Aberhathy M: Cigarette smoking in pregnancy: Associations vvith maternal weight and fetal growth. *Lancet* 1976; 385-7.
32. Joseph FF, Frank EJ, Lundin J: Smoking and pregnancy. *Lancet* 1964; 173-5.
33. Miller HC, Hassanein K: Maternal smoking and fetal growth retardation. *Arch Path* 1971; 79: 284-8.
34. Mc Ganity WJ, Cannon RO, Bridgeforth EB, Martin MP et al: The vanderbit cooperative study of matarnal and infant nutrition. V. Description and outcome of obstetric sample. VI. Relationship of obstetric performance to nutrition. *Am J Obs and Gyn* 1954; 67: 491-501.