Assessment of Intrauterine Growth in Risk Categories

BY

S. Kala

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I INTRODUCTION

World Health Organisation estimates that about half a million women die each year because of conditions related to pregnancy and child birth. Almost 99 per cent of these deaths take place in developing countries. India shares a staggering maternal death of 125,000 annually (Dawn, 1989).

Forty three percent of female deaths in the age group of 15-24 years is due to causes associated with pregnancy and child birth (Chhabra et al, 1987). Indian mortality rate is therefore nearly 50 times higher than that of a developed country. However since poor rural women have on an average five to six live births compared with one or two in Western countries, the actual risk of women dying in India of maternity related cause is 150 - 300 times greater (Chatterjee, 1984). No country sees more mothers die each year from readily avoidable complications of pregnancy as India does (Carriere, 1990).

The economic status of the women plays an important role in maternal deaths by affecting their nutrition. In the poor socio-economic groups the nutritional status of women in the reproductive period is far from satisfactory (Venkatesh, 1988). Majority of the women belonging to the low socio economic groups have chronically low energy intakes. Pregnancy

in these women adds to the additional stress due to increased requirement of energy for the growing foetus (Raman, 1987).

Inadequate nutritional intake including calories and other nutrients result in insufficient weight gain (Aronson, 1990). Women belonging to the low socio-economic group gain only around, three to five kilograms body weight during pregnancy as against 12 Kgs in developed countries. (Srikantia, 1975). Women who weigh 38 Kg or less during early pregnancy and 42 Kg or less during the last month of pregnancy fall into the high risk category (Gopalan, 1987). The pre-pregnancy weight and the weight gain during pregnancy are associated with pregnancy outcome. (Francis, 1990). The incidence of low birth weight infant is more in the case of women who are underweight at the time of conception and those who fail to gain adequate weight (Narayanan, 1990).

Surveys indicate a high incidence of malnutrition among pregnant women of the poor socio-economic group (Hillard, 1990). A severely malnourished woman has higher rate of miscarriages and still births (Ravindran, 1988). Prematurity is also of greater incidence in maternal malnutrition (Neumann, 1982).

Repeated pregnancies followed by prolonged lactation is a source of drain on the already depleted maternal tissues affecting the weight of infants in successive pregnancies (Natu and Patnaik, 1988).

Therefore frequent pregnancies and too short intervals between pregnancies cause danger to the health of the mother as well as the child. A gap of about three years between births helps to make child bearing safe (Ritchie, 1983).

Maternal age influences pregnancy outcome. Pregnancies in teenage girls and in women over 35 years of age are dangerous as women at the extremes of reproductive age face higher risk of complications than women in their twenties (Rinehart, 1988). Preterm labour is more common among the late (31 - 35 years) and early (below 20 years) reproductive age groups (Achari, et al, 1986). Studies have shown that perinatal, neonatal and infant mortality rates are significantly higher in infants born to adolescents under 16 years of age (Krishna, 1987). Along with age, parity also affects the foetal growth. In India high parity, pregnancy at the extremes of reproductive life and short intervals between pregnancies account in part for high maternal mortality, low birth weight babies, increased risk during pregnancy and foetal wastage (Kady et al, 1989).

A majority of women of the low income group continue to do unskilled heavy manual work throughout pregnancy in order to earn wages and buy food (Ramachandran, 1989). The strenuous work of the pregnant mother in the last trimester is associated with increased energy output and therefore, lack of nutrition to the foetus (Bijon Chakra borty, 1989).

Haemorrhage is common in these women andthey have high incidence of low birth weight babies (Yadav, 1983).

It has been recognised that anaemia is a major nutritional problem during pregnancy. According to World Health Organisation, India has probably the highest prevalence of nutritional anaemia in women. Hemoglobin surveys carried out in different parts of India indicate that 15 to 20 per cent of women are anaemic at the onset of pregnancy which rises to 60 to 70 per cent before child birth (WHO, 1986). Anaemic women have less reserve to withstand the stress of haemorrhage at delivery. Severe anaemia in pregnancy therefore is one of the major causes of maternal death and low birth weight and IUGR (Shah, 1983).

Hypertensive disorders account for about one sixth of all maternal deaths and are significant factors in perinatal mortality (Laros, 1987). Toxemia is a disorder of pregnancy characterised by high blood pressure, water logging of tissues, proteinuria and occasionally convulsions. It occurs in five to ten per cent of the pregnant women usually during the last trimester (Zanden, 1989). In severe pregnancy induced hypertension the foetus suffers due to placental insufficiency and hypoxia which cause growth retardation posing a significant threat to the foetus (Nutrition News, 1987).

Maternal diabetes is another major risk factor in pregnancy. Diabetes whether overt or gestational gravely jeopardises the new born by making it susceptible to a number of metabolic and other complications (Sudarshan et al, 1987).

Seventyfive per cent of the Indian population lives in rural areas. However, the elaborate health network, the primary health centres, hospitals and the referral centres have infact overlooked the rural realities specially the needs of pregnant women (Shatrugna, 1990). On an average only less than ten per cent of pregnant women in rural areas are reached through the health centres and in the backward states of India, the proportion is even less (Gopalan, 1987). Considering the needs of this group, the health facilities are inadequate to provide effective health coverage (Tamil Nadu Corporation For Development of Women, 1986). Thus when pregnant women at risk donot have adequate diet and access to proper care in the antenatal period or at delivery high maternal mortality is inevitable (Gopalan, 1985).

Timely referral and effective care of the referred patients would therefore contribute tremendously in improving the health status of the mother and child (Das et al, 1987). Hence development of skills and facilities for monitoring adequate foetal growth is the need of the day (Rinehart, 1988).

Simple paramaters for timely identification of intra uterine growth retardation need to be used for wide application in urban as well as rural communities. Longitudinal studies have indicated that serial measurements of fundal height, abdominal girth and gain in weight are helpful in the detection of intra uterinegrowth retardation (ICMR, 1981).

Reports from NIN recommend that these parameters can be considered as simple reliable indices to monitor intrauterine growth and the trained birth attendants can be taught to use these simple indices in the prediction of high risk complications in pregnant women. Therefore action in the community is an important part of the larger strategy to prevent maternal deaths.

Hence this study was undertaken with the objectives of

1. Locating pregnant women who have conditions that complicate the normal pregnancy process.
2. Relating the pregnancy outcome with previous and/ or current obstetric complications.
3. Correlating the different parameter values to the birth weight of the new born.

Review of Literature

II REVIEW OF LITERATURE

The review of Literature for the study on "Assessment of intrauterine growth in risk categories" are presented under the following headings.

A. Significance of maternal nutrition

B. Risk factors in pregnancy

C. Intrauterine growth monitoring

D. Need for screening pregnant women

A. Significance of maternal nutrition

Maternal nutrition is an important factor influencing the outcome of pregnancy. Nutritional requirements are increased in pregnancy in order to provide for proper foetal growth and development and at the same time to preserve maternal homeostasis (Narayanan, 1990).

An adequate diet during pregnancy results in fewer complications of pregnancy and a less difficult labour thus avoiding wastage. Energy requirement during pregnancy is elevated because of the increased basal metabolic rate, the additional energy required for the growth of the maternal tissues and foetoplacental unit (Aronson, 1990). The total energy cost has been worked out to be 75,000 Kcals. An adequate diet for a pregnant woman to stay healthy should provide 40 Kcal/kg body weight per day (Isaac, 1988). In other words, 150 Kcals per day during the first part of

pregnancy and 300 Kcals/day during the latter half will be required as additional energy allowances (Antia, 1989).

The need for protein can not be over emphasized during pregnancy. The amino acids derived from the dietary protein are essential for the expansion of maternal plasma, the growth of uterus and breasts and for the synthesis of foetal proteins (Gupta, 1991). About 925 g of protein is deposited in the foetus and maternal tissues during pregnancy and hence an additional allowance of 30 g protein per day should be included during pregnancy (Robinson et al., 1986).

Protein deficiency in the first trimester results in decreased number of nerve cells in the brain. A similar deficiency in later pregnancy would result in a diminution of cellular size in the brain. Correction of such protein depletion will increase the size of the nerve cells but not their number (Narayanan, 1990).

Around 25 mg of calcium is required daily for the foetus during the third month and thereafter the demand gradually increases to 300 mg daily in the ninth month (King and Weininger, 1990). The full term foetus has about 28 g of calcium. Maternal calcium is utilised almost fully by the foetus for its skeletal calcification. The extra needs of the mother for calcium is best met by increasing the intake of milk by half-a-litre per day (Lewis, 1986).

The demand for iron goes up during pregnancy to meet with the increased maternal red cell formation and for the requirement of foetoplacental unit. The total amount of iron needed during pregnancy is approximately 1000 mg (Kumar and Kumar, 1988).

The daily requirement for iron and folate is six times greater for a woman in the last trimester of pregnancy than for a non pregnant woman. There is also an increased requirement for Vitamin B_2 in pregnancy partly due to foetal drain and partly due to increased metabolic demands in pregnancy (Dunn, 1983).

Iodine is another nutrient specially needed during pregnancy. This is required for the proper functioning of the thyroid gland, as its increased activity demands for an additional iodine supply (William and Caliendo, 1984).

Sodium intake should not be restricted below 2000 mg. per day (Grills and Bosscher, 1981).

Best reproductive performance is associated with a weight gain of approximately 10-12 kg and the nutritional sufficiency can be assessed by satisfactory weight gain (Narayanan, 1990). Therefore maintenance of an optimum nutritional status of expectant mothers is of utmost importance.

B. Risk factors in pregnancy

High risk pregnancy is characterised by one or more of maternal conditions that impose considerable hazard to the survival of the mother and the foetus or new born (Korones, 1981). Several maternal risk factors adversely affect the health and longivity of the child (Roy et al, 1982).

Age less than 18 years and more than 35 is considered as risk. Infants born to mothers above 35 years of age are at risk followed by infants born to mothers below 20 years of age (Bhattacharya et al, 1980). Rates of complications such as hypertension, diabetes mellitus, abruptio placentae and placenta previa are greater in women older than 35 years. More over, these complications affect perinatal mortality adversely. Increasing maternal age is associated with increased incidence of still birth, neonatal death and overall perinatal mortality (Cunningham and Leveno, 1990). Perinatal, neonatal and infant mortality rates are also significantly higher in infants born to adolescent girls under 16 years (NIN, 1980).

In India chronic under nutrition and imbalances in intakes are major issues which adversely affect pregnancy outcome (Devi, 1980). Diets of pregnant women belonging to the low socio-economic groups are sub-optimum in quality as well as quantity (Gopalan, 1989). Such diets grossly lack in protective and body building foods. Pregnancy therefore adds

additional stress in these women due to increased need of the growing foetus (Raman, 1987).

Weight gain of such mothers is much lower than that found in the developed countries and low pregnancy weight has been correlated with decrease in birth weight (Brown et al, 1981). Therefore maternal weight gain is a better indicator of foetal growth. There is a close relationship between the birth weight of the infants and nutritional status of the mothers. Poor intrauterine growth and low birth weight are common among infants born to women from low income group (Morrison, 1989).

Various studies conducted in different parts of India indicate that the incidence of low birth weight among women belonging to the poor socio-economic class ranges from 20-30 per cent and half of all perinatal and one third of all infant deaths are due to low birth weight (Viedma, 1989).

Women with more than four pregnancies are at risk as high parity increases a woman's risk in pregnancy. High parity women face greater risks of antepartum and post partum - hemorrhage, anaemia and at times chronic conditions such as uterine prolapse (Berbowitz et al, 1990). Frequency of anaemia increases with parity, especially if pregnancies succeed one another at short intervals (Fleming, 1987).

Anaemia is a major health problem. Recent World Health Organisation Statistics indicate a worldwide prevalence of about 30 per cent with even higher figures in developing countries. The most common causes of anaemia are lack of bio-available dietary iron, menorrhagia, worm infestations and chronic infections. Malnutrition is another contributing factor of anaemia in women during the child bearing age (Joshi et al, 1989).

Pregnant women are considered anaemic when the hemoglobin level falls below 11 g /dl and Anaemia is associated with decreased work and mental performance and impaired resistance to infection (Nutrition Today, 1990).

Between 15 to 20 per cent of maternal deaths may be associated with anaemia which greatly increases the danger of hemorrhage (Sai, 1986). Severe anaemia is associated with increased perinatal mortality and low birth weight (Shah,1983).

Hypertensive disorders of pregnancy are termed as toxemia, preeclampsia and hypertension gestosis. Hypertensive disorders of pregnancy can be categorised into three groups such as hypertension alone, hypertension with proteinuria with or without oedema which is otherwise called as preeclamptic toxemia and eclamptic toxemia with convulsions (Kapoor et al, 1989).

Toxemia is characterised by swelling of the face, feet and hands, abnormal increase in blood pressure and presence of protein in the urine. In severe pregnancy induced hypertension hypoxia of severe degree is seen due to poor placental function. The best treatment is prevention through good health as toxemia is often associated with poor health (Ravindran, 1988).

Hypertensive disorders account for about one sixth of all maternal and perinatal deaths (Laros, 1987). Preeclampsia of early on set is associated with high pregnancy wastage (Desai et al, 1988). It is the third common cause of maternal deaths in India (De, 1988). Survey of medical literature reveals that the incidence of eclampsia and maternal mortality rate continues to be high without any significant change during the last three decades (Ghosh and Das, 1987).

Pregnancy and obesity are two contributing factors to the development of maturity on set diabetes (Aronson, 1990). A woman with diabetes needs to have her blood sugar controlled both before and during pregnancy so as to minimize the risk of birth defects or other pregnancy related problems (Hillard, 1990).

Infections of the mother also can affect the growth of the foetus. Direct transmission across the placenta is a well recognised phenomenon. Data from various studies show that the prevalence of infective morbidity is high in rural pregnant women as compared to urban expectant mothers. Infections during pregnancy affects the weight gain, course, outcome of pregnancy and birth weight of infant (Strang et al, 1984).

Results of various studies indicate that preterm delivery is a repetitive obstetric problem and women who have delivered premature babies in the past have an increased risk of prematurity in succeeding pregnancy (Creasy and Liggins, 1979). Prematurity is one of the most important causes of perinatal mortality and morbidity in India (Parkar et al, 1987).

Preterm labour is more common among late (31-35 years) and early (below 20 years) reproductive age groups. Also it is more common in poor socio-economic class of expectant mothers (Achari et al, 1986).

Consumption of alcohol during pregnancy causes damage to the foetus. Drinking alcohol is connected with the risk of miscarriage, low birth weight and at times with morphological abnormalities (Day et al, 1989).

Thus mothers with high risk factors should be detected early, treated effectively and special care given in the antenatal period.

C. Intrauterine growth monitoring

Growth monitoring is an operational strategy to enable one to visualise growth or lack of it and to obtain specific, relevant and practical guidance to ensure continued regular growth (Central Health Education Bureau, 1988). The objective of growth monitoring is to prevent growth retardation through timely and early detection of growth faltering (Gopalan, 1987). Community health workers can monitor the progress of pregnancy by using simple indices.

Risks in pregnancy can be identified by weight gain during pregnancy, fundal height and abdominal girth and also by monitoring the hemoglobin level (Murthy and Makhija, 1988). Weight gain in the middle of pregnancy is crucial in the determination of foetal growth. If weight gain is less than one kg than the previous visit, the woman enters into high risk category (Raman, 1990). The fundal height and abdominal girth are useful indicators to assess IUGR. Fundal height less than 32 cm at 36 weeks of gestation is taken as a risk factor. Abdominal girth is used along with fundal height in the detection of intrauterine growth retardation (ICMR, 1981).

Mothers having abdominal girth of less than 90 cm at 36 weeks is taken as at risk (Natu and Patnaik, 1988).

Maternal hemoglobin is a good indicator of nutritional status of pregnant women. One hemoglobin value estimated at 20 weeks is sufficient to detect severe grades of anaemia which is associated with low birth weight (Ramachandran, 1989). Intensive intranatal monitoring would help early identification of compromised foetus (Sheriar and Mataliya, 1987).

D. Need for screening pregnant women

Though India has launched a number of schemes to improve the health care delivery system, the indices of health like infant mortality rate, neonatal mortality and proportion of low birth weight infants still continue to be very high (Murthy and Makhija, 1988).

Perinatal mortality rate is a reliable index of the health status of mothers and the quality of antenatal, natal, and neonatal care they receive (Aras et al 1990). Toxemia during pregnancy is one of the leading causes of maternal, foetal and early neonatal deaths accounting for 10 to 15 percent of perinatal deaths (Kalra, 1989). Early detection of pregnancy induced hypertension will therefore prevent the development of eclampsia and thus reduce maternal and perinantal mortality to a great extent (Nanda et al, 1989).

Anaemia in pregnancy is another major cause of maternal mortality and low birth weight which in its severe form aggravates a number of complications in the pregnant women during labour and delivery (Shah, 1983).

Available data suggests that it is not possible to identify this group clinically. Hence the first task of the health care delivery system is to ensure that all pregnant mothers are screened at a comparitively early stage of pregnancy in order to identify this group (Ramachandran, 1989).

World Health Organisation has evolved a system of 'risk approach' for maternal and child health care. The aim of this 'risk approach' system is to identify the woman who are 'at risk' early as possible so that appropriate intervention can be given to the identified group (Gopalan, 1989). Timely identification of this group and their transfer to the suitable referral centre will pay high dividents interms of reduction in morbidity and mortality (Junghare et al, 1988).

Risk scoring system is a valuable clinical technique used for the identification of these woman 'at risk' (Jain et al, 1988). Since majority of the deliveries in India are conducted by dias or trained birth attendants, they should be trained to identify this group in the community. For this purpose it is desirable to develop simple scoring system to be used effectively

by any community health worker (Daftary, 1988). Thus to reduce the high rate of foetal wastages interventions at the community level are essential (Datta and Das, 1990).

Methodology

III METHODOLOGY

The methodology for the study on 'Assessment of intrauterine growth in risk categories' involved the following steps.

A. Selection of the area

B. Selection of the sample

C. Selection of the tool

D. Conduct of the study and

E. Analysis of data

A. Selection of the area

Seethalakshmi Maternity Hospital from the city of Coimbatore was selected for the study as adequate sample could be obtained and the authorities expressed willingness in extending co-operation for collecting the required data.

B. Selection of the sample

The sample was selected on the basis of the expectant mothers regularity in attendance for antenatal care and their decision to have their delivery in this hospital. One hundred women belonging to the low socio-economic group and who were in their third trimester of pregnancy were selected for the study. As the growth of the foetus is rapid during the third trimester, assessing the intrauterine growth with simple parameters is possible and reliable.

Since the weight deficit and poor weight gain are common features of pregnant women at risk, only these women who showed poor weight gain were chosen for the study. Moreover, weight gain during pregnancy is a key indicator of pregnancy outcome (Nadig, 1988).

C. Selection of the tool

A detailed interview schedule was prepared in three parts (Appendix A), inorder to elicit information on socio-economic back ground, nutritional and health status of the expectant mothers. As the information secured through interview technique is more accurate compared to data secured through other techniques and the doubts of the respondants could be clarified, this method was used to gather information from the study group (Wilkinson and Bhandarkar, 1984).

A risk scoring system developed by Datta and Das (1990) was adopted to categorise these women into low scores of(0-2), moderate(3-5) and high risk 6 and above groups (Appendix B). Risk scoring is a formalised method of recognising, documenting and cumulating antenatal and intranatal factors to identify high risk pregnancy and predict complications for the mother, foetus and infant (Ambiye et al, 1990). This method is simple and effective in detecting risk factors. A total score of six and above was taken as the cut off point for the high risk category

and between three and five for moderate risk and zero to two for low risk category. Anthropometric parameters such as weight gain (kg), abdominalgirth (cm) and fundal height (cm) were selected for assessing the intrauterine growth.

D. Conduct of the study

The study group were interviewed and information with regard to their age, parity para of pregnancy and economic back ground were collected with the use of the first section of the interview schedule. Information regarding their nutritional status was obtained through 48 hours recall survey. Data on the frequency of consumption of food items, special food consumed during pregnancy, food cravings and aversions, omission of foods due to beliefs and overt pica were also obtained.

Weighment survey was conducted for ten per cent of the sample for a period of three consecutive days. From the measurements of cooked food items, raw equivalents were obtained. Computed and used for further calculation of nutrient intake.

Information from the third part of the schedule included medical and obstetric histories. Details of past obstetric histories such as abortions, still birth, premature deliveries, caesarian and other complications of deliveries were also obtained. Indirect causes of poor pregnancy outcome such as anaemia, poor maternal weight gain, toxemia, diabetes, heart disease, antepartum haemorrhage and infections were elicited

from the study group.

At the beginning of every month weights of the mothers were taken using a spring balance from the seventh month to term. Abdominal girth measurement was taken at the level of the upper border of umblicus using a plastic measuring tape. For accurate fundal height measurements, the distance from the symphysis pubis to the top of the uterus was measured. Serial measurements of these were obtained from seventh month of pregnancy to term.

With the help of the medical personnel, blood samples were drawn from the study group and estimations of haemoglobin, albumin and serum total proteins were done. The analytical procedures are appended (Appendix C). Birth weights of the new borns were also recorded.

E. Analysis of data

The data was analysed to assess the nutritional status, pre-existing obstetric complications and maternal risk factors of the 'low', 'moderate' and 'high risk' categories. Test of significance was used to assess whether anthropometric profile and the blood protein picture of the three categories differed from each other significantly. Simple correlation test was applied to assess the relationship of the parameter values to the new borns weight.

Results and Discussion

IV RESULTS AND DISCUSSION

The findings of the study on "Assessment of intrauterine growth in risk categories" are presented under the following headings:

A. Findings of the survey

1. The income and occupational status of the selected sample
2. The nutritional status of 'low' moderate' and 'high'risk categories
3. History of obstetric complications in the three risk categories
4. Maternal risk factors in the three risk categories

B. Anthropometry, Haemoglobin and serum total protein picture of the three risk categories

1. Anthropometric profile of the expectant mothers
2. Haemoglobin and serum total protein picture of the expectant mothers
3. Correlation of the different parameter values to the new born's birth weight

1. The income and occupational status of the selected sample

Out of the 100 pregnant women, only 12 had taken up employment outside their homes for daily wages. The rest were home makers. The mean monthly income of the "low risk", 'moderate risk' and 'high risk' groups were Rs. 627, Rs.438 and Rs.288 respectively. Obviously all of them were subsisting on very limited income and resources.

2. The nutritional status of 'low', 'moderate' and 'high' risk categories

Aspects included were food consumption pattern through recall survey method, frequency of consumption of body building and protective foods, mean food intake by weighment survey, mean nutrient intake, special foods consumed during pregnancy, food cravings and aversions during pregnancy, food fads, habits of betal chewing and craving for non-food items.

a. Food consumption pattern through recall survey

The food consumption pattern of the 'low', 'moderate' and 'high risk' categories collected through the 48 hours recall survey is shown in Table I.

TABLE I

FOOD CONSUMPTION PATTERN THROUGH RECALL SURVEY

Food stuff	Low risk (n=20)	Moderate risk (n=40)	High risk (n=40)
	Percentage		
Cereals alone	-	12	30
Cereals and pulses	9	14	44
Cereals, pulses and vegetables	9	70	20
Cereals, pulses, vegetables, fruits and milk/milk products	82	4	6
Total	100	100	100

Three-fourths of the 'high risk' category and one-fourth of the moderate risk category included cereals alone or cereals and pulses in their diet. Surprisingly 70 per cent of the 'moderate risk' category included vegetables. Eighty two per cent of the 'low risk' category consumed fruits and milk/milk products. Dietary surveys conducted in various parts of India have consistently revealedthat the diets of low income groups are predominantly cereal based. It is to be understood that the quantity of protective foods consumed, is significantly low (Figure 1).

b. Frequency of consumption of body building and protective foods:

Pulses, green leafy vegetables and milk/milk products were consumed daily by the 'low risk' category, while 'moderate' and 'high' risk categories consumed them thrice weekly and twice weekly respectively. Fleshy foods were consumed once a week by the 'low' and 'moderate' risk categories and only occasionally by the 'high risk' categories.

c. Mean food intake of the selected sample:

The mean food intake of the three categories of the sample are presented in Table II.

FOOD CONSUMPTION PATTERN THROUGH RECALL SURVEY

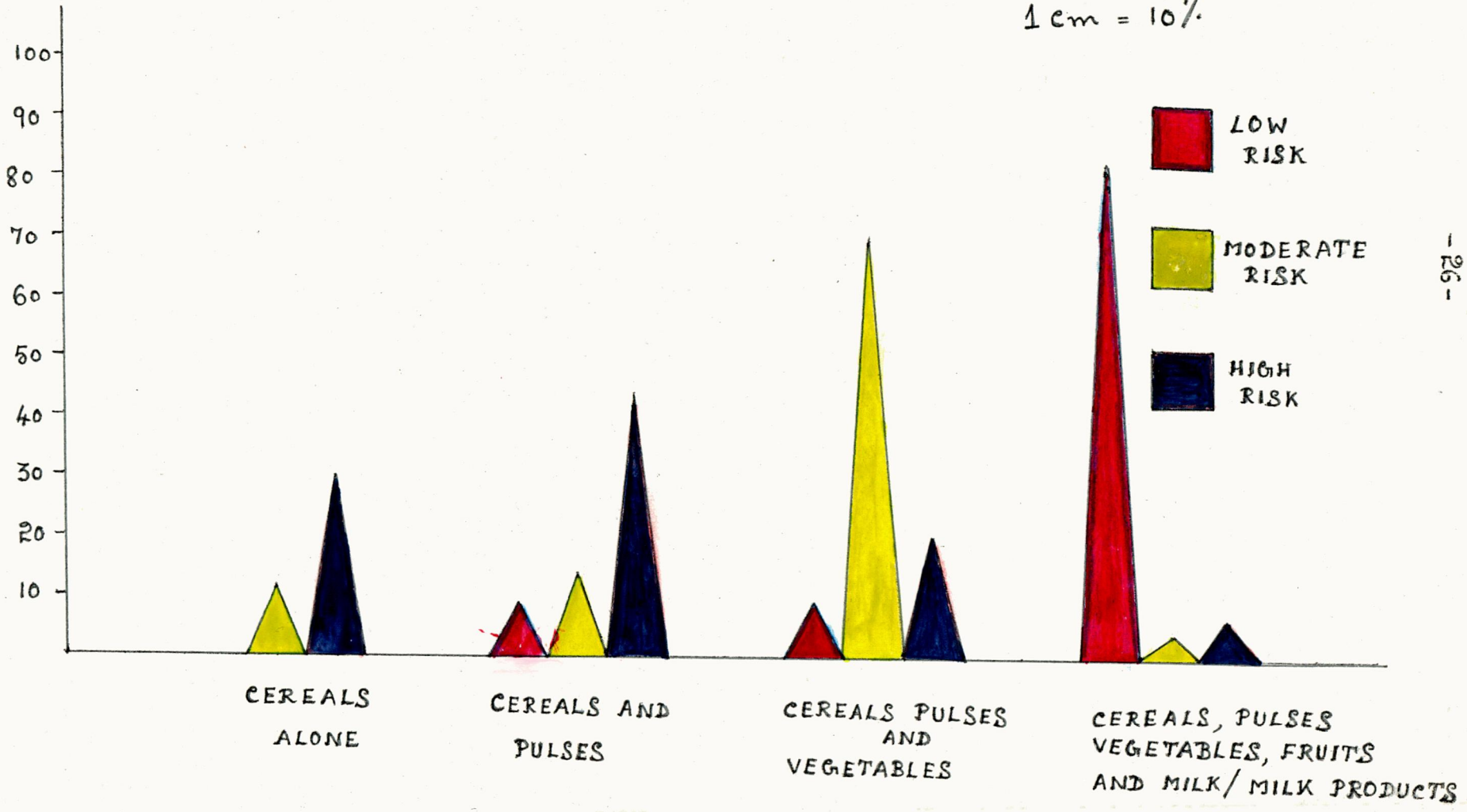

FIGURE 1

TABLE II

MEAN FOOD INTAKE

MODERATE WORK

Foodstuff in g	RDA ICMR 1984	LOW RISK (n=20)	Percent deficit or surplus	Moderate risk (n=40)	Percent deficit or surplus	High risk (n=40)	Percent deficit or surplus
Cereals	475	425	-10.53	350	-26.32	290	-38.9
Pulses	60	55	- 8.33	42	-30	38	-36.6
Green leafy vegetables	100	75	-25	62	-13	45	-55
Other vegetables	40	40	0	35	-12.5	35	-12.5
Roots and tubers	100	100	0	75	-25	50	-50
Fruits	30	110	+266	80	+166	50	+66.6
Milk	325	250	-23.08	140	-56.9	100	-69.2
Fats and oils	30	20	-33.33	15	-50	10	-66.6
Sugar and jaggery	30	30	0	30	0	25	-16.6

There is a great variation in the mean food intake of the pregnant women in the three risk categories. When compared to the recommended food allowances of ICMR (1984), the consumption of cereals, pulses, green leafy vegetables, milk as well as fats and oils were deficient for all the three risk categories, the deficiency increasing directly in relation to the degree of risk observed in the pregnant women.

d. Mean nutrient intake:

The mean nutrient intake of the three risk categories as revealed by the weighment survey are illustrated in Table III in comparison to the recommended dietary allowances of ICMR (1989).

TABLE III

MEAN NUTRIENT INTAKE

MODERATE WORK

Nutrients	RDA ICMR 1989	Low risk (n·20)	Percent deficit or surplus	Moderate risk (n·40)	Percent deficit or surplus	High risk (n=40)	Percent deficit or surplus
Energy; Kcal	2100	2426	+15.524	1874	-10.8	1520	-27.62
Protein; g	65	57.72	-11.1	45.6	-29.85	35.62	-45.2
Calcium; mg	1000	1270.2	+27.02	991.8	-0.82	740.14	-25.99
Iron; mg	38	10.59	-72.13	8.88	-76.68	6.76	-82.2
B-Carotene; µg	2400	4711.4	+96.31	3723.6	+55.15	3664.1	+52.7
Thiamine; mg	1.4	1.61	+15	1.34	-4.29	0.99	-29.3
Riboflavin; mg	1.7	1.603	-5.71	0.74	-56.5	0.54	-68.24
Niacin; mg	18	29.8	+65.66	16	-10.11	13.63	-84.28
Vitamin C; mg	40	204.6	+411.5	133.9	+234.8	85.9	+114.8

The mean intake of protein and riboflavin were deficient for all the three risk categories when compared to ICMR (1989) recommended dietary allowances. The mean intake of calcium, iron, thiamine and niacin were deficient for the "moderate" and "high" risk categories.

e. Special foods consumed during pregnancy:

Special foods such as milk, egg and greens were consumed by 45 per cent, 25 percent and five per cent of the 'low', 'moderate' and 'high' risk categories respectively. About 70 per cent of the pregnant women took barley kanji regardless of the risk category. Poor purchasing capacity along with ignorance are the main causes of poor food consumption during pregnancy.

f. Food cravings and aversions:

Craving for fleshy items was reported by 32 per cent, 27 per cent and 36 per cent of the 'low', 'moderate' and 'high' risk groups respectively. Cravings for sour items were also reported by 62 per cent, 48 per cent and 59 per cent of the women from the 'low', 'moderate' and 'high' risk categories.

g. Food fads:

Ninety five per cent of the women avoided papaya and 40 per cent avoided pineapple for fear of heat and abortion.

h. Habit of betal chewing:

About 60 per cent of the pregnant women were in the habit of betal chewing regardless of the risk categories.

i. Craving for non-food items:

Thirty two per cent of the 'high' risk category, 24 per cent of the 'moderate' risk category and 31 per cent of the 'low' risk categories reported cravings for non-food items such as ash, charcoal, mud and chalkpiece.

3. History of obstetric complications in the three risk categories

Information on the obstetric complications of the sample are depicted in Table IV.

TABLE IV

HISTORY OF OBSTETRIC COMPLICATIONS IN THE THREE 'RISK' CATEGORIES

Obstetric profile	High risk (n=40)	Moderate risk (n=40)	Low risk (n=20)
	Percentage		
Still birth, abortion, premature delivery and caesarian	55	10	Nil
Still birth	5	-	-
Abortion	15	2	-
Premature delivery	15	-	-
Foetal abnormalities	10	-	-

All the obstetric complications were present in the 'high risk' group. Still birth, abortion, premature delivery and caesarian were reported by more than half of the 'high risk' group. However they were minimum in the 'moderate risk' group, and absent in the 'low risk' group. This is in line with the findings of numerous studies that obstetric complications are often present among the 'high risk' categories (Figure 2).

4. Maternal risk factors in the three risk categories

The maternal risk factors observed in the three risk categories are reported in Table V.

HISTORY OF OBSTETRIC COMPLICATIONS IN HIGH RISK CATEGORY

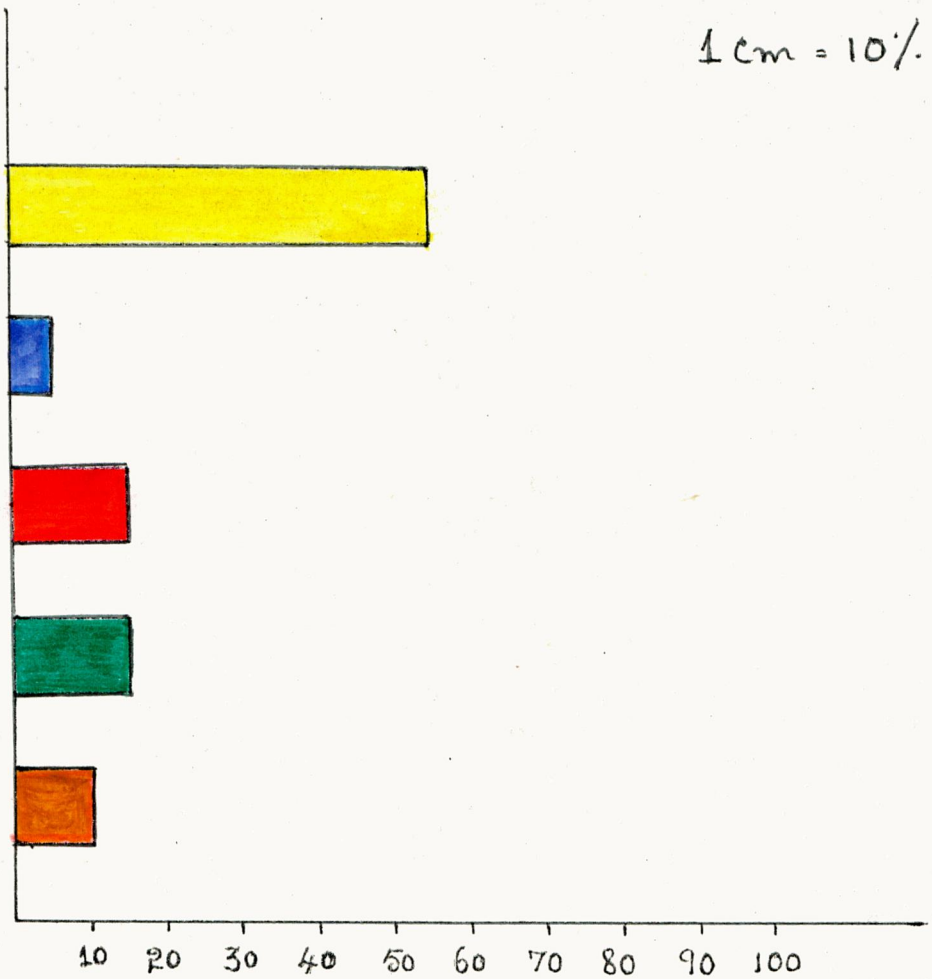

FIGURE 2

55% STILL BIRTH, ABORTION, PREMATURE DELIVERY AND CAESARIAN

5% STILL BIRTH

15% PREMATURE DELIVERY

15% ABORTION

10% FETAL ABNORMALITIES

TABLE V

MATERNAL RISK FACTORS IN THE THREE RISK CATEGORIES

Risk factors	Low risk (n=20)	Moderate risk (n=40)	High risk (n=40)
	Percentage		
Anaemia	40	70	30
Anaemia and Toxemia	-	20	40
Antepartum haemorrhage	-	-	1
Anemia, toxemia combined with odema and hypertension	-	10	30

Ninety per cent of the 'moderate' and 'high' risk groups suffered from anaemia as well as anaemia and toxemia. Anaemia and toxemia combined with odema and hypertension were also found in 10 per cent of the 'moderate' and 30 per cent of the 'high' risk groups. Thus vast difference is noted in the prevalence of the risk factors in the three categories, which increase with increase in risk category.

B. Anthropometry, haemoglobin and serum total protein picture of the three risk categories

1. Anthropometric profile of the expectant mothers

Details of weight gain, abdominal girth, fundal height and birth weight of the three risk categories are depicted in Table VI.

TABLE VI

MEAN ANTHROPOMETRIC PROFILE OF THE THREE RISK CATEGORIES

Parameter		Low risk n=20 A	Moderate risk n=40 B	High risk n=40 C	Comparison between	't' value
Weight gain (kg)	Mean	4.26	3.83	3.29	A Vs B	1.60 NS
	S.D.	±0.98	±0.97	±1.18	B Vs C	2.28 *
					C Vs A	2.98 **
Abdominal girth (Cm)	Mean	5.58	3.64	3.74	A Vs B	6.00 **
	S.D.	±0.67	±1.36	±1.24	B Vs C	0.34 NS
					C Vs A	6.19 **
Fundal height (cm)	Mean	4.93	4.05	3.99	A Vs B	2.22 *
	S.D.	±1.39	±1.47	±1.41	B Vs C	0.19 NS
					C Vs A	2.44 *
Birth weight (kg)	Mean	2.77	2.69	2.67	A Vs B	1.05 NS
	S.D.	±0.18	±0.31	±0.22	B Vs C	0.31 NS
					C Vs A	1.70 NS

NS Not significant

* Significant at five per cent level

** Significant at one per cent level

The anthropometric values of the three risk categories reveal that in general the 'moderate' risk group is better than the 'high' risk group and the 'low' risk group is better than the 'moderate' risk group. The statistical appraisal reveals that the values of the 'low' risk group are significantly different from the other two groups especially in weight gain, abdominal girth and fundal height (Figure 3).

2. Haemoglobin and serum total protein picture of the expectant mothers

The haemoglobin, total serum protein, serum albumin and serum globulin of the expectant mothers in relation to the risk category are shown in Table VII.

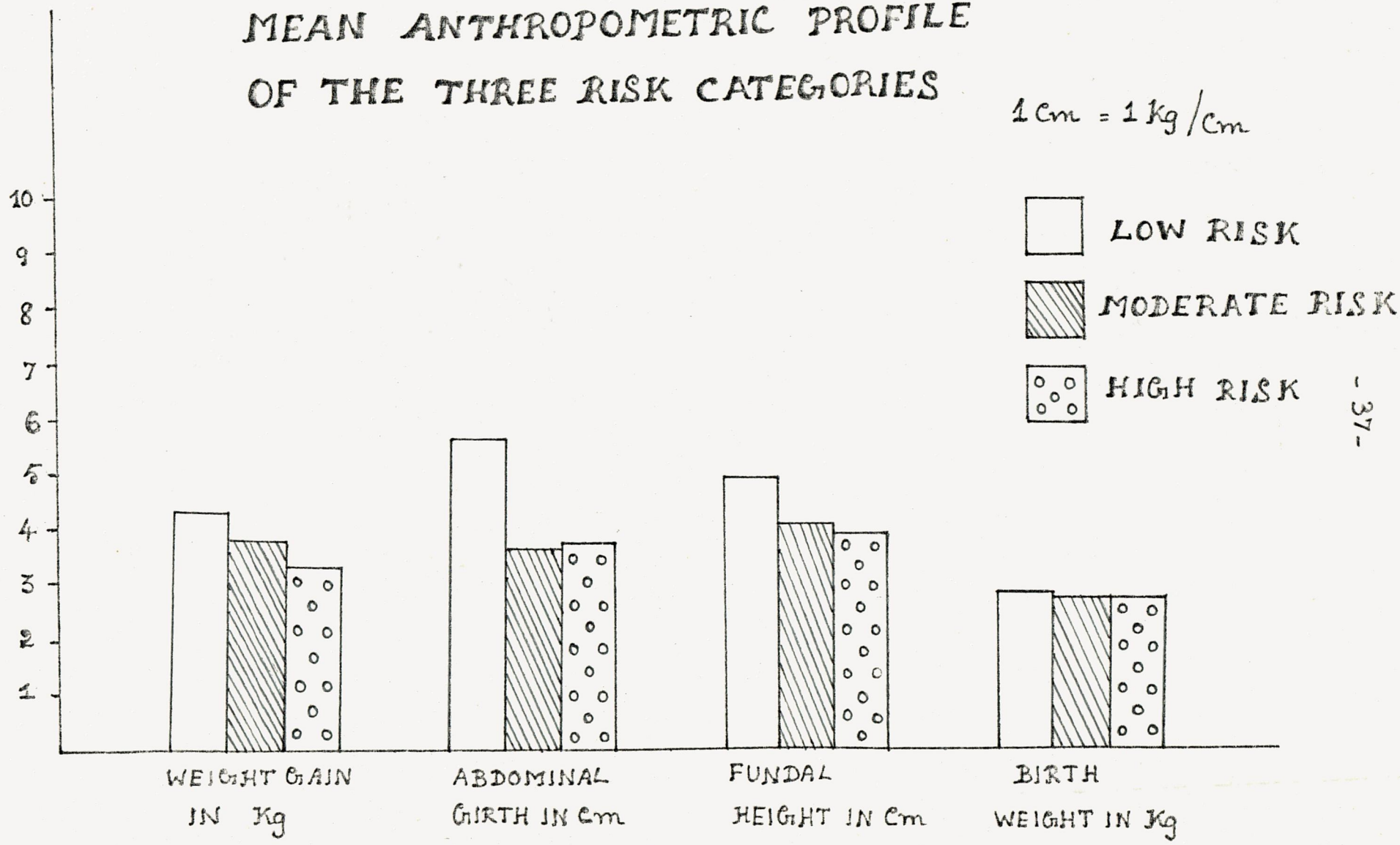
MEAN ANTHROPOMETRIC PROFILE
OF THE THREE RISK CATEGORIES
1 Cm = 1 Kg / Cm
LOW RISK
MODERATE RISK
HIGH RISK
10
9
8
7
6
5
4
3
2
1
WEIGHT GAIN IN Kg
ABDOMINAL GIRTH IN Cm
FUNDAL HEIGHT IN Cm
BIRTH WEIGHT IN Kg

FIGURE 3

TABLE VII

MEAN HAEMOGLOBIN AND SERUM TOTAL PROTEIN PICTURE OF THE EXPECTANT MOTHERS

Parameters		Low risk n=20 A	Moderate n=40 B	High risk n=40 C	Comparison between	't' value
Haemoglobin g%	Mean	10.44	8.81	7.06	A Vs B	11.38 **
	S.D.	±0.36	±0.59	±0.70	B Vs C	12.04 **
					C Vs A	20.12 **
Serum total protein g%	Mean	6.58	6.15	4.93	A Vs B	5.71 **
	S.D.	±0.29	±0.26	±0.48	B Vs C	14.32 **
					C Vs A	14.22 **
Serum albumin g%	Mean	3.85	3.74	2.79	A Vs B	0.69 NS
	S.D.	±0.44	±0.66	±0.58	B Vs C	6.78 **
					C Vs A	7.24 **
Serum globulin g%	Mean	2.73	2.44	2.07	A Vs B	1.65 NS
		±0.45	±0.70	±0.41	B Vs C	2.87 **
					C Vs A	5.65 **

NS Not significant

** Significant at one per cent level

In all the parameters the 'moderate' risk group was better than the 'high' risk group and the 'low' risk group was better than the 'moderate' risk group. The differences mostly are highly significant. The haemoglobin values of all the three 'risk' categories are below the accepted value of 11.0 g per cent as recommended by WHO (Figure 4).

3. Correlation of the different parameter values to the newborn's birth weight

The correlation of the different parameter values to the newborn's birth weight for the total sample is illustrated in Table VIII.

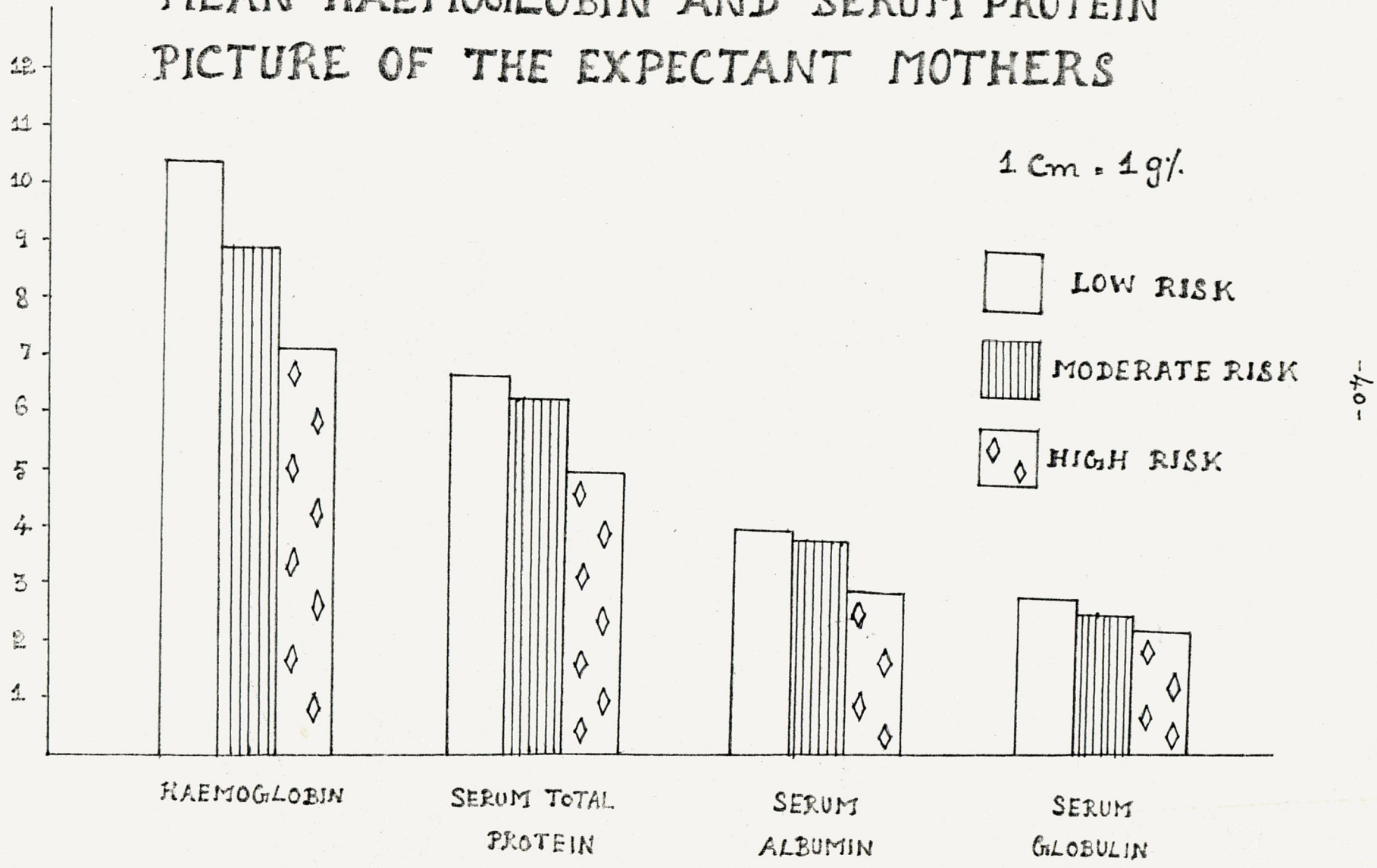
MEAN HAEMOGLOBIN AND SERUM PROTEIN PICTURE OF THE EXPECTANT MOTHERS
1 Cm. = 1 g%.
LOW RISK
MODERATE RISK
HIGH RISK
12
11
10
9
8
7
6
5
4
3
2
1
HAEMOGLOBIN
SERUM TOTAL PROTEIN
SERUM ALBUMIN
SERUM GLOBULIN

FIGURE 4

TABLE VIII

CORRELATION OF THE DIFFERENT PARAMETER VALUES TO THE NEW BORN'S BIRTH WEIGHT

Parameters	Mean	Comparison	Correlation
Weight gain, kg (X_1)	3.71 ± 0.40	BW Vs X_1	0.2708
Abdominal girth, cm (X2)	4.32 ± 1.09	BW Vs X2	0.9736
Fundal height, cm (X3)	4.32 ± 0.52	BW Vs X3	0.9922
Haemoglobin, g% (X4)	8.77 ± 1.68	BW Vs X4	0.9365
Serum Total protein, g% (X5)	5.89 ± 0.85	BW Vs X5	0.8176
Serum albumin, g% (X6)	3.46 ± 0.58	BW Vs X6	0.7221
Serum globulin, g% (X7)	2.41 ± 0.32	BW Vs X7	0.9166

BW 2.7 kg

The 'r' values clearly show that the various parameter values of the expectant mothers had a positive correlation with the birth weight of the newborn. This clearly indicates that by improving the parameter values, the birth weight of the newborn could be improved. Birth weight is a clear-cut yardstick to assess the maternal health status.

Summary and Conclusion

V SUMMARY AND CONCLUSION

Anaemia in pregnancy is the major cause of maternal mortality and low birth weight. As suggested by WHO, early identification of women at risk and their transfer to suitable referral centres would pay rich dividents in terms of reduction in morbidity and mortality. For this purpose, simple scoring system is essential to be used effectively by any community health worker.

Therefore the study was undertaken with the objective of assessing the intrauterine growth in risk categories using commonly available parameters.

One hundred women belonging to the low socio-economic group who were in the third trimester of pregnancy were selected from Seethalakshmi Maternity Hospital of Coimbatore City. Women who showed poor weight gain were interviewed and information on nutritional status, pre-existing obstetric complications and maternal risk factors were obtained. Using the risk scoring system developed by Datta and Das (1990), the women were categorised as 'low', 'moderate' and 'high' risk groups. The anthropometric profile and the serum total protein picture were done for the different categories. Correlation computation was also done between the parameter values and birth weight of the newborn.

The key findings of the study are as follows:

1. The mean monthly income of 'low', 'moderate' and 'high' risk groups were Rs.627, Rs.438 and Rs.288 respectively.

2. Three fourths of the 'high' risk category and one fourth of the 'moderate' risk category included only cereals or cereals and pulses in their diet.

3. Pulses, green leafy vegetables and milk/milk products were consumed thrice a week and twice a week by the 'moderate' and 'high' risk categories respectively.

4. When compared to the recommended food allowances of ICMR (1984), the consumption of cereals, pulses, green leafy vegetables, milk as well as fats and oils are deficient in the diets of all the three risk categories.

5. The mean intake of protein and riboflavin are deficient for all the three categories when compared to ICMR (1989) recommended dietary allowances. The mean intake of calcium, iron, thiamine, and niacin were deficient for the 'moderate' and 'high' risk categories.

6. Special foods such as milk, egg and greens were consumed by 45 per cent, 25 per cent and five per cent of the 'low', 'moderate' and 'high' risk categories respectively.

7. Thirty two per cent of the 'high' risk category, 24 per cent of the 'moderate' risk category and 31 per cent of the 'low' risk category reported cravings for non-food items such as ash, charcoal, mud and chalk piece.

8. Obstetric complications such as still birth, abortion, premature delivery and caesarien were reported by 55 per cent of the 'high' risk group. However they were minimum in the 'moderate' risk group and absent in the 'low' risk group.

9. Ninety per cent of the 'moderate' and 'high' risk groups suffered from anaemia as well as anaemia and toxemia. Anaemia and toxemia combined with oedema and hypertension were found in 10 per cent of the 'moderate' and 30 per cent of the 'high' risk groups.

10. In anthropometric measurements, haemoglobin and serum total protein picture the moderate risk group was better than 'high' risk group and the 'low' risk group was better than the 'moderate' risk group. The differences were significant in weight gain, abdominal girth, fundal height, haemoglobin and serum total protein picture.

11. The various parameter values of the expectant mothers had a positive correlation with the birth weight of the newborn.

RECOMMENDATIONS

1. Identification of the high risk pregnant women and establishment of guidelines for timely transfer of mothers to referral centres for better care need to be initiated by the government and followed up for safe motherhood.

2. Health personnel need to be trained to use simple parameters for identifying 'high' risk pregnancies. Monitoring systems and record-keeping systems must be established for periodic evaluation of the programme.

3. Supporting systems of consultations, laboratory services, educational facilities and transportations need to be developed.

Bibliography

BIBLIOGRAPHY

Achari, K, Roy, P., and Mukhopadhyay, R. 1986. Factors associated with preterm spontaneous birth. The J. of obstet and gynaec of India, Vol. XXXVI, No.1, PP. 54 - 55.

Ambiye, V.R., Allahabadia, G., Shanbhag, A.M., Vaidya, P.R., 1990. Detection of high risk pregnancy A simple scoring system. The J of obstet and gynaec of India, Vol.40, No.2, PP. 176 - 180.

Antia, F.P., 1989. Pregnancy and lactation. clinical dietetics and nutrition, 3rd Edn Oxford University Press, New York. PP. 383 - 384.

Aras, R.Y., Pai, N.P., Purandare, A., 1990. Perinatal mortality - A retrospective hospital study, The J. of obstet and gynaec of India, Vol.40, No.3, PP. 365 - 368.

Aronson, V., 1990. Pretest on pregnancy and lactation nutrition. The dietetic technician, Effective nutrition counseling, 2nd Edn, Van noetrand reinhold, New York, PP. 136 - 341.

Berbowitz, G.S., Skovron, M.L., Lapinski, R.H., and Berkowitz, R.L., 1990. Delayed child bearing and the outcome of pregnancy. N. Engl. J. Med, Vol.322, No.10, PP. 659 - 663.

Bhattacharya, B.N., Srivastava, V.K. and Lamba, IMA, 1980. A study of some important biological factors influencing infant mortality under Indian conditions. IMA - J. Fam Welfare, Vol.2 PP. 34 - 41.

Bijon Chakraborty., 1989. Intra uterine growth retardation, J. of the Indian Medical Association, Vol.87, No6, PP. 129 - 130.

Brown, J.E., Jacobson, H.M., Askul, L.H. and Piech, M, 1981. Influence of pregnancy weight gain on size of infants born to under weight women. Obstet gynaec., Vol.57, No.13.

Carriere, R.C., 1990. Who dies when and from what - and why isn't more being done about that? Mother and child care, Health action, PP. 5 - 13.

Central Health Education Bureau, 1988. Reducing incidence of low birth weight babies in India, Swasth hind, Vol.XXXII, No.8, P. 212.

Chhabra, R., Raleigh, V. and Jindal. A., 1987. Early marriage, high fertility and poor health, Future (development perspectives of children) UNICEF 2:21 PP 35 - 38.

Chatterjee, M., 1984 Women's access to health care : crucial for children, future (development perspectives on children 10)UNICEF PP. 21 - 26.

Creasy and Liggins. 1979. G.C: 13th recent advances in obstet and gynaec, churchill Livingston, Edinberg, London and New York P. 403.

Cunningham, F.G., Leveno, K.J., 1990 Maternal age and outcome of pregnancy. The N.Engl. J. Med. Vol. 323, No.6, PP. 413 - 415.

Datta, S., and Das, K.S., 1990 Identification of high risk mothers by a scoring system and its correlation with perinatal outcome. J.obstet and gynaec of India, Vol. 40, No.2., PP. 181 - 190.

Das, S.K., Sethi, C.M., and Batra, A., 1987. Identification of high risk pregnancy by a simple risk scoring system. J. obstet gynaec India, Vol. XXXVII, No.5., PP. 639 - 642.

Daftary, S.N., 1988. The 31st all India obetetric and gynaecological congress. J obstet and gynaec of India, Vol,XXXVIII, No.1, P.1

Day, N., Jasperse, D., Richardson, G., Robces, N., and Moorthy, U.S., 1989. Prenatal exposure to alcohol. Effects of infants growth and morphologic characteristics, pediatrics, Vol.84, No.3, PP. 536 - 554.

Dawn, C., 1989. Health Education safe motherhood, J.obstet gynec India, Vol.XXXIX, No.4, PP. 443 - 444.

DE, K.C., 1988. Caesarean section in eclampsia The J of obstet and gynaec of India, Vol.XXXVIII, No.3, PP. 311.

Devi, P.K., 1980 Maternal nutrition and foetal growth. Proc. Nutr. Soc. India, No.26, Fourth Gopalan Oration, PP. 20 - 23.

Desai, P.D., Chandrasekhar, G., Udwani, H., Hazra, M.N., 1988. Pre-eclampsia of early onset, J of obstet and gynaec of India, Vol. XXXVIII, No.5, PP. 548 - 553.

Dunn, M.D., 1983. Fundamentals of nutrition CBI Publishing comp. Inc., Boston, PP. 267 - 270.

Fleming, A.F., 1987. Maternal Anaemia in northern nigeria, causes and solutions, world health forum, Vol.8, No.3, PP. 339 - 343.

Francis, C.M., 1990. From the editor's Desk. Health action, Vol. 1, No.7, PP.1.

Ghosh, N.K., and Das.B., 1987. Maternal mortality following eclampsia: A critical analysis of 683 cases in two teaching hospitals in northern India. The J. of obstet and gyneco of India, Vol. XXXVIII, No.3, PP. 256 - 260.

Gopalan, C., 1985. Maternal Health, fertility, control and child nutrition. NFI, Bulletin PP. 286 - 294.

Gopalan, C., 1987 — Nutrition problems and programmes in South - East Asia. WHO Regional office for South - East Asia, New Delhi,

Gopalan, C., 1987 — Growth monitoring - some - basic issues. Nutrition Foundation of India, Bulletin, PP. 257 - 266.

Gopalan, C., 1989 — Nutrition, Health and National Development. A compilation of six lectures. Nutrition Foundation of India Special Publication series - 4.

Gopalan, C., 1989 — Habitual diets in India and their adequacy, Nutritive value of Indian Foods, NIN, ICMR.

Grills, N.J., and Bosscher, M.V., 1981. — Pregnancy normal and high risk, manual of nutrition and diet therapy, Macmillan publishing Co., Inc., New york, PP. 309 - 311.

Gupta, I., 1991. — Misconceptions regarding child birth, women's era, pregnancy and motherhood special, PP. 51 - 53.

Hillard, P.A., 1990. — High risk pregnancy health action PP. 29 - 30.

ICMR, 1981 — Use of measurements of abdominal girth the fundal height for the detection of intrauterine growth retardation studies in pregnancy, Nutrition and reproduction, NIN, Ann. Rep., P. 93.

ICMR, 1984 — Recommended Dietary Intabes for Indians, ICMR offset press, New Delhi. PP. 58 - 59.

ICMR, 1989 — Nutritive value of Indian foods, NIN, Hyderabad, P. 47 - 67.

Isaac, P., 1988 — A happy pregnancy, Health action, Vol.1, No.7, PP. 9 - 12.

Jain, R., Mishra, P., Khatan, A, and Singhal, S., 1988 — High risks of repetitive preterm births. J. obstet gynec India Vol. XXXVIII, No. 4, PP. 403 - 405.

Joshi, J.V., Donde, U.M., Maitra, A., and Gokral, J.S., 1989 — Assessment of anaemia and iron deficiency by haemoglobin and plasma ferritin aesay in rural antenatal cases using finger prick samples. J. obstet gynec India, Vol.XXXIX, No.4, P. 454.

Junghare. P., Somwanshi, P.R., Purwar, M.B., and Tayade, K.W., 1988 — Simple scoring of maternal factors influencing perinatal morbidity and mortality, J. obstet and gynaec of India, Vol, XXXVIII, No.3, P. 266.

Kady, A.A., Salch, S., Fortney, S.J. and Bayounic, H., 1989 — Obstetric deaths in menoufia governorate, B.J. obstet, gynec, vol. 96, P. 1.

Kalra, 1989 — J. of obstet and gynaec of India.

Kapoor, M., Gupta, J., Ratna., Kumar, A., Singh, S.P., 1989 — Serum immunoglobulin in pregnancy complicated with leaking anaemia and toxemia, Indian medical gazette, Vol. CXXIII, No.3, PP. 86 - 88.

King, J.C., Weininger, J., 1990 — Pregnancy and lactation, present knowledge in nutrition 6th Edn, International life sciences Institute, Nutrition Foundation, P.316.

Korones, B., 1981 — High risk newborn infants C.V.Mosby Co., 3rd Edn, P. 32.

Krishna, N.J., 1987 — Child health problems and high risk pregnancy, Two years of universal immunization programme in India, P. 4.

Kumar, N., and Kumar, S., 1988 — Anaemia in women, swasth hind Vol. XXXII, No.7, P. 182.

Laros, R.K. 1987 — Hypertensive disorders during pregnancy, obstet and gynaec, 8th Edn, The C.V.Mosby Company, P.364.

Lewis, C.M., 1986 — Nutrition and the maternity cycle, Nutrition and Nutritional Therapy in Nursing, Appleton century crafts/ Norwalk, PP. 153 - 173.

Morrison, J., Najman, J.M., Williams, G.M., Keeping, J.D., and Anderson, M.J., 1989 — Socio economic status of pregnancy outcomes, B.J.obstet, gynec, Vol. 96, PP. 298 - 307.

Murthy, G.V.S., and Malhija, K., 1988 — The effect of antenatal care on birth weight, The J. of obstet and gynaec of India, Vol.XXXVIII, No.6, PP. 643 - 646.

Nanda, S., Sharma, B., and Gulati, P.K., 1989 — Perinatal mortality in eclampsia, J of obstet and gynaec of India, Vol. XXXIX, No.6, P. 792.

Nadig, M., 1988 — Health action, Health accessories for all publication, Vol.1, No.7, PP. 5 - 10.

Natu, M., and Patnaik, B., 1988 — Small for date babies - A risk approach, The J obstet and gynaec of India, Vol.XXXVII, No.2, PP. 123 - 124.

Narayanan, R., 1990 — Maternal nutrition and fetal outcome, Health action, special Issue, P. 21.

Neumann, C.G., 1982 — Maternal nutrition and neonatal immunocompetence, Advances in international maternal and child health, Vol-2, Oxford University Press, New York, Toronto, PP. 16 - 20.

NIN, 1980 — Care of pregnant women Nutrition, ICMR, Hyderabad, P. 16.

Nutrition News, 1987 — Glucose metabolism in undernourished pregnant women, Vol.8, No.2, National Institute of Nutrition Hyderabad, P. 52.

Nutrition Today, 1990 — Zinc supplements improve pregnancy outcomes in teenagers, Vol.25, No.2, published by williams and wilkins, P. 4.

Parkar, S.K., Bilaney, J.A., and Krishna, U.R., 1987 — Risk factors in prematurity. The J of obstet and gynaec of India,, Vol.XXXVII, No.2, PP. 237 - 241.

Raman, L., 1987 — Glucose metabolism in undernourished pregnant women, vol.8, No.2, National Institute of Nutrition, Hyderabad, P.52.

Ravindran, S., 1988 — South Asia, among the worst for women now, health action, Vol.1 No.7, PP. 49 - 50.

Ramachandran, 1989 — The effect of antenatal and neonatal services on pregnancy outcome and health of the mother and the child, J.Fmly, Wel., Vol.XXXV, No.5, PP. 34 - 46.

Raman, L.,
1990

Health and nutritional problems of adolescent girl, NIN, Hyderabad, PP. 13 - 14.

Ritchie, J.A.S.,
1983

Pregnancy and lactation, Nutrition and Families, Macmillan Press Ltd, P. 86.

Rinehart,
1988

Mother's lives matter: Maternal health in the community, Issues in world health, series L.7, PP. 1 - 4.

Roy, A.K.,
Halder, A., and
Das, K.K.,
1982

A study of the birth weight in relation to parity in slums of calcutta, Applied Nutrition, J Ind. Diet. Assoc, Vol. 10, PP. 28 - 33.

Robinson, C.H.,
Lawler, M.R.,
Chenoweth, W.L. and
Garwick, A.E.,
1986

Physiologic and biochemical changes in pregnancy, normal and Therapeutic Nutrition, 17th Edn, Macmillan Pub. Company, New York, PP. 266 - 276.

Sai, F.T.,
1986

Family planning and maternal health care a common goal, World Health Forum, WHO, Vol.17, No.4, PP. 315 - 324.

Shah, K.P., 1983 — Appropriate technology and perinatal care: the kasa experience. The short Text book of pediatrics, 4th Edn., Jaypee brothers Medical publishers, New Delhi, P. 10.

Sheriar, N., and Mataliya, M., 1987 — Challenges in the prevention of fresh still birth. J obstet gynec India, Vol. XXXVII, No.5, PP. 667 - 671.

Shatrugna, V., 1990 — Fairer sex - how fair? National Institute of Nutrition, ICMR, Hyderabad, P. 3.

SriKantia, S.G., 1975 — Pregnancy and nutrition, Swasth hind, Vol. No.9, PP. 90 - 93.

Strang, A., Lachman, Pitsoe, S.B., Marszalek, A., and Hughphilpott, R., 1984 — Malaria in pregnancy with fatal complications, B.J. Obstet, gynec, Vol. 91, No.4, PP. 399 - 403.

Sudarshan, K., Jain, S., Jain, R.K., Kanodia, K., Sethi, G. and Misra, S.L., 1987 — Study of morbidity and mortality pattern in infants born to diabetic mothers. J obstet gynec India, Vol. XXXVII, No.4, PP. 481 - 484.

Tamil Nadu Corporation for Development of Women 1986. Health and family welfare women in Tamil Nadu a profile, 1st Edn, PP. 79 - 85.

Varley, 1988. Practical Clinical Biochemistry, 4th Edn, CBS Publishers, Delhi.

Venkatesh, S., 1988. Safe motherhood - Maternal care save lives. Swasth hind, Vol. XXXII, No.7, PP. 179 - 181.

Viedma, C., 1989. 'Maternal and child health', Swasth hind, Vol. XXXVII, No.3, and 4, PP. 73 - 74.

WHO, 1986. Maternal mortality: helping women off the round to death, WHO chronicle, Vol. 40, No.5, PP. 175 - 183.

Williams, E.R., and Caliendo, M.A., 1984. Pregnancy and lactation, Nutrition, principles, Issues and Applications, Mccrraw, Hill Book Company, New York, PP. 398 - 407.

Wilkinson, J.S., and Bhandarkar, 1984 — Methodology and techniques of Social research, Himalaya publishing House, Bombay.

Yadav.K., 1983 — Normal new born baby. A Text-book of Neonatal Surgery, Vikas publishing house Pvt. Ltd, PP. 21 - 24.

Zanden, J.W.V., 1989 — Prenatal environmental influences, Human development, 4th Edn, P. 103.

Appendix

APPENDIX A

SRI AVINASHILINGAM INSTITUTE FOR HOMESCIENCE AND HIGHER EDUCATION FOR WOMEN COIMBATORE - 641043.

SCHEDULE TO COLLECT INFORMATION ON ASSESSMENT OF INTRAUTERINE GROWTH IN RISK CATEGORIES

1. Name :
2. Age/Date of birth :
3. Weight (Kg.) : Height(cm) :
4. Menstrual History :
   Last menstrual period :
   Month :
   Date :
5. Gravida, para :
6. Are you employed? : Yes ( ) No ( )

Nature of work	Type of work	Description of work	Hours of work put in/day
Full time	Light		
Part time	Moderate		
Seasonal	Heavy		
(if seasonal frequency/ month)			

PART - A

FAMILY SOCIO-ECONOMIC BACK GROUND

No.	Name	Age	Sex	Relationship to the respondent	Educational status	Occupation	Income/month

Income through other sources :

Investment :

Rent :

Agriculture :

Poultry :

Dairy :

Anyother :

Total Income/month :

PART B

NUTRITIONAL HISTORY

1. Give details of meals taken during the past two days:

   Vegetarian :

   Non-vegetarian :

Day	Breakfast	Lunch	Tea	Dinner	Snacks taken in-between meals and the dinner timing

2. Are you consuming the following foods regularly?

Foods	Daily	Frequency/week Thrice	Twice	Once	Fort nightly	Not at all	Quantity/ day
Meat/Fish							
Egg							
Dhal							
Milk							
Curd							
Greens							
Fruits							
Papaya							
Plantain							
Guava							
Date							
Orange							
Jack fruit							
Grape							

Note: Milk : Tumbler
others : Katori

3. Do you drink coffee/tea?

Yes ( ) No ( )

If yes, indicate the quantity and frequency/day

Item	Frequency	Total quantity consumed
Coffee		
Tea		
Others		

4. Do you take any special food during pregnancy?

Yes ( ) No ( )

If yes,

Special foods taken	Frequency				Reasons
	Daily	Weekly	Monthly	Rarely	

5. Do you crave for any foods?

Yes ( ) No ( )

If yes, indicate the foods and the frequency of consumption

Foods	Frequency of consumption/day/week
1. Non-vegetarian	
Chicken	
Meat	
Fish	
2. Sweets	
3. Sour items and fruits	
Raw tamarind	
Mango	
Elandavada	
4. Nuts	
5. Any other	

6. Do you have any of the following habits?

Yes ( ) No ( )

Habit	Before pregnancy	After pregnancy	Frequency/ day	Quantity/ day	Reasons
Betal Chewing					
Tobacco Chewing					
Snuff					

7. Do you have a craving to consume the following items?

Yes ( ) No ( )

If yes,

Items	Frequency of consumption / day
Mud	
Coal	
Ash	
Chalk	
Any other	

8. Do you avoid any food during pregnancy due to fads?

Yes ( ) No ( )

Items avoided	Reasons

9. Do you avoid any food due to aversion?

Yes ( ) No ( )

If yes,

Foods avoided	Reasons

10. Does your husband have the habit of smoking?

Yes ( ) No ( )

If yes,

Items smoked	Frequency/day	Rarely	Quantity
Cigarette			
Surutoo			
Beedi			
Kanja			

P A R T - C

MEDICAL HISTORY

1. Previous obstetric history

   1. Abortions

      Yes ( ) No ( )

      Number

   2. Still births

      Yes ( ) No ( )

      Number

   If yes,

Details	1st baby	2nd baby	3rd baby	4th baby	5th baby
Sex of babies					
Weight of babies					
Gestation period					

3. Term delivery ( ) or Pre-mature delivery ( )
4. Previous foetal abnormalities if any?

   Yes ( ) No ( )

If yes, specify:

5. Rhesus factor incompatability:

Yes ( ) No ( )

6. Caesarian

Yes ( ) No ( )

If yes, indicate the reason

a. Big baby ( )

b. No pain ( )

c. Narrow pelvic canal ( )

d. Abnormal position ( )

e. No movement ( )

7. Did you have any other complication during delivery?

Yes ( ) No ( )

If yes, indicate the complication.

a. Breech ( )

b. Footling ( )

c. Transverse ( )

d. Umblical cord around the neck ( )

II Family History

Are you married to your close relatives?

Yes ( ) No ( )

If yes, indicate the relationship.

III High Risk Ractors

1. Do you have (or) did you have any of the following complications during pregnancy?

Complication	1st baby	2nd baby	3rd baby	4th baby	5th baby
a. Anaemia					
b. Poor weight gain during pregnancy					
c. Toxemia					
d. Ante-partum haemorrhage					
e. Diabetes					
f. Hypertension					
g. Asthma					
h. Heart disease					
i. Radiation exposure					
j. Chronic renal disease					
k. Infections					
(I) German measles					
(II) Jaundice					
(III) Viral fever/ high tempara-ture					
(IV) Malaria					
(V) Any other					

2. Have you taken any drug during pregnancy?

Yes ( ) No ( )

If yes, specify the drug

Drug	Reason	Quantity	Frequency / day

PART - D

PARAMETERS

Measurements	6th month	7th month	8th month	9th month	10th month
Weight gain (kg)					
Height of the uterus (cm)					
Abdominal girth (cm)					

APPENDIX B

RISK SCORING SYSTEM

Reproductive history		Associated diseases		Present pregnancy	
Factor	score	Factor	Score	Factor	Score
1. Age: 16	= 1	Diabetes Mellitus	= 3	Bleeding 20 wks	= 1
16-35	= 0			20 wks	= 3
35	= 2	Cardiac disease	= 3		
2. Parity: 0	= 2	Ch. Renal diseases	= 2	Anaemia 10 gm%	= 1
1-4	= 0			Hypertension	= 2
5+	= 2	Previous gyn. surgery	= 1	Oedema	= 3
3. Past Obstetric history		Infective hepatitis	= 1	Albuminuria	= 3
Abortion/ Infertility	= 1	Pulmonary tuberculosis	= 2	Multiple pregnancy	= 3
PPH/Manual removal	= 1	Undernutrition	= 2	Breech	= 3
Baby 4 kgs (4000 gms)	= 1	Other diseases according to severity	= 1-3	RH-Isoimmunisation	= 3
Baby 5½ lbs (2500 gms)	= 1				
PET/Hypertension	= 1				
Previous caesarean Sec.	= 2				
Stillbirth/ Neonatal death	= 3				
Prolonged labour/ difficult labour	= 1				

Source: Datta, S. and Das, S.K., All India Institute of Hygiene and Public Health, Calcutta.

APPENDIX C

ESTIMATION OF HAEMOGLOBIN BY CYANMETHEMOGLOBIN METHOD (Varley, 1988)

Principle

The haemoglobin is treated with a reagent containing potassium ferric cyanide and potassium di-hydrogen phosphate. The ferriccyanide forms methemoglobin which is converted to cyanmet haemoglobin by the cyanide.

Reagents

Sodium bicarbonate	..	1 g
Potassium cyanide	..	0.05 g
Potassium ferricyanide	..	0.2 g
Distilledwater	..	1 litre

The solution was preservedin dark bottle and preferably under cold storage. It's preparation and handling should be done with great care. This solution should not be used after it forms a precipitate at the bottom of the storage bottle.

Procedure

1. Exactly 5.0 ml of Drapkin's dilutent solution was measured into a dry test tube from a burette (or) a pipette with suction bulb.

2. Exactly 0.02 ml of blood was transferred from a standard haemoglobin pipette into a dilutent solution. Usual care in filling and cleaning of haemoglobin pipette was observed.

3. The pipette was rinsed three times with the diluent solution without allowing the formation of air bubbles in the solution.

4. The blood and dilutent were thoroughly mixed by rotating the tube.

5. 10 minutes time was allowed for the formation of cyonmet haemoglobin.

6. 5 ml of dilutent solution was used as blank.

7. Exactly 0.02 ml of known blood sample was measured and treated as above. This was used as the standard.

8. The readings were taken in a calorimeter at 540 m.

Calculation

$$\frac{\text{Optical density of test}}{\text{Optical density of standard}} \times \text{Concentration} \times \frac{0.25}{\text{standard}}$$

ESTIMATION OF SERUM TOTAL PROTEIN (BIURET METHOD)

Principle

The colorimetric method for protein estimations makes use of the biuret reaction. Substances which contain two CON H_2 groups join together directly or through a single carbon or nitrogen atom give a purple colour which being different with different proteins. The reaction takes its name from the complex formed biuret.

Reagents

Stock reagent

Dissolve 45 g of Rochellet salt (sodium potassium tartarate) in about 400 ml of 0.2.N NaOH and add 15 gm of copper sulphate. Stirring continuously until the solution is complete. Add 5 gm of potassium iodide and make it up to a litre with 0.2 N NaOH.

Working reagent

Dilute 200 ml of stock reagent to litre with 0.2 N NaOH.

Standard protein

400 mg of BSA in 100 ml of saline

1 ml = 4 mg.

Procedure

4 ml. of water and 0.2 ml of serum is taken to which add 4.0 ml of reagent mix and keep it for 10 minutes read at 540 nm

setting the blank to zero blank - 4 ml. water and 4 ml.reagent.

Calculation

$$= T \times 4$$

$$= \frac{T}{S} \times 4 \times \frac{100}{0.2 \times 1000} = 100 \text{ g \%}$$

$$= \frac{T}{S} \times 2 \text{ gm \%}$$

ESTIMATION OF ALBUMIN

Principle

The proteins are able to bind with dye. This binding capacity is used for determination of albumin.

Reagents

1. 17.3 ml of M. Sodium citrate (294 gm/litre is M.Solution)
2. 32.7 ml of M.citric acid and (210 gm/litre is M.Solution)

6 ml of 0.01 bromocresol green dye (9.8 ml of 0.1 N NaOH is added to 0.698 gm of bromocresel green dye and diluted to 100 ml with distilled water). Prepare the buffer by mixing citrate and sodium citrate and adjusting the PH to 3.8 and then add the dye and again adjust the PH to 3.8.

Standard

20 mg of BSA in 1.0 ml of saline.

Test

0.02 ml of serum is added to 4 ml of dye and read at 6.20 mm (crma) using dye as blank.

Calculation

1 ml std. = 20 mg

$$\frac{T/S \times 20 \times 100}{0.02 \times 1000} = 100 \text{ g\%}$$

0.01 ml Std. = 1 gm %

The globulin concentration was calculated by

globulin concentration = Total protein - Albumin

APPENDIX D

STATISTICAL ANALYSIS

'T' TEST

Weight gain

Comparison between three risk groups

Example	Mean S.D
Low n_1 = 20	4.25 ± 0.98
Moderate n_2 = 40	3.83 ± 0.95
High n_3 = 40	3.28 ± 1.1918

1. Low risk vs moderate risk

$n_1 = 20$

$n_2 = 40$

$\overline{XI} = 4.25$

$\overline{X2} = 3.83$

$$t = \frac{\overline{X_1} - \overline{X_2}}{S} \times \sqrt{\frac{n_1 \times n_2}{n_1 + n_2}}$$

$$t = \frac{4.25 - 3.83}{S} \times \sqrt{\frac{20 \times 40}{20 + 40}}$$

$$= \frac{0.412}{S} \times \sqrt{\frac{800}{60}}$$

$$= \frac{0.42}{S} \times \sqrt{13.33}$$

$$= \frac{0.46}{S} \times 3.65$$

$$S = \sqrt{\frac{(n_1 - 1)\, S_1^2 + (n_2 - 1)\, S_2^2}{n_1 + n_2 - 2}}$$

$$S = \sqrt{\frac{(20-1) \times (0.98)^2 + (40-1) \times (0.95)^2}{20 + 40 - 2}}$$

$$= \sqrt{\frac{19 \times 0.9604 + 39 \times 0.9025}{60 - 2}}$$

$$= \sqrt{\frac{18.2476 + 35.1975}{58}}$$

$$= \sqrt{0.9214}$$

$$S = 0.9599$$

APPENDIX E

RAW SCORES

LOW RISK

S.No.	Weight gain (km) X1	Abdominal girth (cm) X2	Fundal height (cm) x3	Haemoglobin (g%) x4	Serum Total Protein (g%) X5	Serum Albumin (g%) X6	Serum globulin (g%) X7	Birth weight (kg) X8
1.	4.5	5.5	4.5	11	6.8	4.0	2.8	3.0
2.	7.0	6.0	4.5	10.4	6.2	4.0	2.2	3.0
3.	5.0	6.5	5.5	10.5	6.6	4.0	2.6	2.75
4.	6.0	5.5	4.0	10	5.95	3.25	2.7	2.5
5.	3.0	5.0	6.0	10.3	6.6	4.0	2.6	2.75
6.	3.0	5.0	4.0	10.1	6.4	3.7	2.7	2.65
7.	3.5	6.5	6.0	10.6	6.4	4.0	2.4	3.0
8.	4.0	5.0	4.0	10.5	6.8	3.2	3.6	2.75
9.	4.5	6.0	7.0	11	6.5	3.5	3.0	3.0
10.	4.1	5.0	3.0	10	6.8	4.0	2.8	2.75

S.No.	X1	X2	X3	X4	X5	X6	X7	X8
11.	4.0	6.5	4.0	10.2	6.7	4.3	2.4	2.8
12.	3.5	5.0	3.5	9.8	6.2	3.8	2.4	2.9
13.	3.5	5.0	2.0	10.3	7.0	4.5	2.5	3.0
14.	3.5	6.5	5.5	9.8	6.8	3.13	3.5	2.8
15.	3.0	6.5	6.0	11.0	7.0	4.8	2.2	2.75
16.	4.5	5.0	6.0	9.6	6.8	3.7	3.1	2.75
17.	4.5	6.0	4.5	10.2	6.8	3.1	3.7	2.5
18.	4.5	5.5	4.5	9.7	6.4	4.2	2.2	2.6
19.	5.0	5.0	7.0	11.3	6.7	3.9	2.8	2.4
20.	4.5	4.5	7.0	10.7	6.2	3.8	2.4	2.75

MODERATE RISK

S.No.	X1	X2	X3	X4	X5	X6	X7	X8
1.	5.0	6.5	6.0	8.5	6.5	5.8	0.7	2.4
2.	4.5	4.0	6.0	8.5	6.25	3.1	3.18	2.5
3.	3.5	5.0	4.0	9.1	6.2	3.9	2.3	2.75
4.	5.0	4.5	4.0	8.6	6.2	3.9	2.3	3.0
5.	4.5	4.0	5.0	9.4	6.1	3.2	2.9	2.5
6.	2.5	2.5	1.5	9.6	6.0	4.0	2.0	2.6
7.	2.5	2.0	2.0	8.7	6.2	3.3	2.9	2.75
8.	3.5	1.5	3.0	10.0	6.4	3.5	2.9	2.6
9.	2.5	4.0	2.5	8.7	6.2	3.8	2.4	2.8
10.	1.5	4.5	6.0	8.8	6.2	3.5	2.7	2.4

S.No.	X1	X2	X3	X4	X5	X6	X7	X8
11.	3.5	2.5	2.0	8.4	5.18	4.2	1.6	2.9
12.	4.5	1.5	4.0	8.0	6.2	5.0	1.2	2.5
13.	3.5	3.5	3.5	8.2	5.8	3.5	2.3	2.6
14.	3.0	5.0	7.0	8.3	5.9	3.9	2.0	2.25
15.	4.0	3.0	3.0	8.4	5.8	4.2	1.6	3.0
16.	4.0	6.0	5.0	8.1	5.9	3.5	2.6	2.5
17.	3.5	4.0	3.5	8.0	6.4	3.7	2.7	2.6
18.	4.0	2.0	5.0	8.7	6.4	3.1	3.3	2.5
19.	2.5	5.0	5.0	8.1	6.4	2.3	4.2	2.5
20.	3.5	3.0	4.0	8.0	6.5	3.2	3.0	2.5
21.	2.5	2.0	4.0	8.3	6.2	4.0	2.2	3.25
22.	6.0	4.5	4.0	8.8	6.2	3.7	2.7	3.00
23.	5.0	5.0	4.0	8.4	6.4	4.0	2.4	3.25
24.	4.5	4.0	2.5	8.5	6.4	3.4	3.0	3.75
25.	6.0	4.0	5.0	8.6	6.4	3.8	2.4	2.5

S.No.	X1	X2	X3	X4	X5	X6	X7	X8
26.	3.5	3.5	3.5	8.2	6.2	4.2	2.2	2.6
27.	4.5	4.5	6.0	8.9	6.4	3.8	2.4	2.25
28.	4.5	1.5	4.0	9.1	6.2	5.0	1.2	2.75
29.	3.5	1.5	3.0	9.4	6.2	3.2	3.0	2.5
30.	4.0	3.0	2.0	9.8	6.2	3.1	3.3	2.5
31.	4.0	3.0	7.0	9.4	6.4	3.7	2.7	2.75
32.	4.0	5.0	5.0	8.3	6.4	3.5	2.9	2.5
33.	4.0	6.0	4.0	9.8	6.4	4.2	1.6	2.75
34.	4.5	3.0	1.5	8.5	5.8	3.9	2.0	2.6
35.	2.5	2.5	5.0	9.6	5.9	3.5	2.3	3.25
36.	4.5	5.0	3.5	9.1	5.8	5.0	1.2	2.6
37.	3.5	5.0	5.0	9.4	6.2	3.8	2.4	2.6
38.	2.5	5.0	2.0	9.8	6.2	3.5	2.7	3.0
39.	4.0	3.0	6.0	9.6	6.2	2.3	3.5	2.4
40.	4.5	4.5	3.0	8.7	5.8	3.3	2.9	2.75

HIGH RISK

S.No.	X1	X2	X3	X4	X5	X6	X7	X8
1.	3.5	3.5	6.5	7.3	4.5	2.3	2.2	3.0
2.	1.5	2.5	1.5	7.4	5.2	3.1	2.1	2.75
3.	2.0	4.0	4.5	7.25	5.0	3.1	1.9	2.75
4.	3.5	4.5	4.5	7.21	5.3	4.0	1.3	2.85
5.	2.0	2.5	3.0	7.3	5.1	3.2	1.9	2.4
6.	2.5	2.5	3.5	7.3	4.90	3.0	1.9	3.0
7.	3.0	3.0	4.0	7.4	5.0	2.5	2.5	2.75
8.	3.0	4.0	4.0	7.0	5.4	2.1	3.3	2.75
9.	3.0	5.0	3.0	6.78	4.5	2.3	2.2	2.5
10.	2.5	2.0	3.5	6.19	5.2	3.8	1.45	2.5
11.	5.5	4.5	6.0	7.1	5.1	3.0	2.1	3.0
12.	2.0	2.5	5.0	7.5	3.8	1.9	1.9	2.75
13.	2.0	5.0	3.0	7.5	4.7	2.5	2.2	2.75
14.	5.5	6.5	5.0	7.0	5.2	3.1	2.1	2.4

S.No.	X1	X2	X3	X4	X5	X6	X7	X8
15.	5.5	5.5	6.5	7.5	4.7	2.5	2.2	3.0
16.	3.5	2.0	1.5	7.0	4.8	2.5	2.3	2.4
17.	4.5	4.5	3.0	6.3	5.0	3.2	1.8	2.4
18.	3.5	5.0	3.0	7.21	4.5	2.2	2.3	2.6
19.	4.5	2.5	4.5	7.3	4.7	2.5	2.2	2.75
20.	2.0	3.0	3.5	7.3	4.5	2.3	2.2	2.5
21.	3.0	5.0	3.0	7.1	5.3	4.0	1.3	2.75
22.	2.5	2.5	3.5	7.3	5.1	3.2	1.9	3.0
23.	2.0	2.5	3.0	7.5	4.90	3.0	1.9	2.4
24.	3.0	4.0	4.0	7.31	5.40	2.1	3.3	3.0
25.	2.5	2.0	2.5	7.5	4.5	2.3	2.2	2.5
26.	3.0	3.0	5.0	6.75	4.7	2.5	2.3	2.5
27.	1.5	2.5	1.5	7.5	5.4	4.0	1.4	2.5
28.	3.5	3.5	6.5	7.0	5.2	3.1	2.1	2.75
29.	5.5	5.5	6.5	7.5	4.7	2.5	2.2	2.75

S.No.	X1	X2	X3	X4	X5	X6	X7	X8
30.	5.5	4.5	6.0	7.4	4.5	2.3	2.2	2.4
31.	2.5	3.0	3.5	6.5	4.5	2.3	2.2	3.0
32.	3.5	4.5	4.5	6.75	5.2	3.8	1.45	2.5
33.	2.0	2.5	5.0	7.5	4.7	2.5	2.3	2.25
34.	4.5	6.5	5.0	6.9	5.0	3.2	1.8	2.5
35.	3.5	2.0	1.5	7.2	3.8	1.9	1.9	2.6
36.	4.5	4.5	3.0	7.0	5.2	3.1	2.1	2.75
37.	3.5	5.0	3.0	6.5	4.8	2.5	2.3	3.0
38.	4.5	2.5	4.5	6.7	4.5	2.3	2.2	2.75
39.	3.0	4.0	4.0	7.3	5.2	3.1	2.1	2.75
40.	3.0	3.0	5.0	7.5	4.90	3.0	1.9	2.5