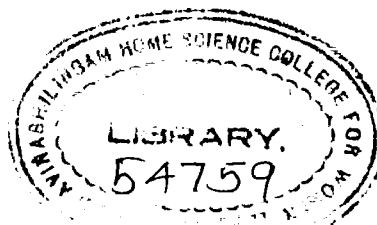


**ASSESSING THE VALIDITY OF THE NUTRITIONAL STATUS
INDEX FOR EXPECTANT MOTHERS**

**BY
BHAVANI .R.**

**A Thesis Submitted To The University Of Madras
In Partial Fulfilment Of The Requirement
For The Degree Of Master Of Science**

May - 1991



A C K N O W L E D G E M E N T

The investigator expresses her sincere gratitude to Dr. Mrs. Vijayalakshmi Purushothmen M.Sc(Madras) Ph.D (Madras) Assistant Professor of foods and nutrition for her unfailing help and suggestions throughout the investigation.

She also records her deep sense of gratitude to Dr.(Ent) Rajammal P.Devadas, M.A, M.Sc., Ph.D (Ohio State) D.Sc (Madras) Director of Sri Avinashilingam Home Science College for Women and Dr.(Ent) G.Kamalanathan M.Sc. (Cornell) Ph.D (Madras) Principal of Sri Avinashilingam Home Science College for the opportunity given by them. She expresses her thanks to Dr.(Ent) Usha Chandrasekar, M.Sc(Madras) Ph.D. (Purdue) for her suggestions .

The investigator records her deep sense of gratitude to the Authorities of Government hospital and G.Kuppuswamy-Naidu Hospital, Coimbatore. who kindly permitted to carry out this investigation in the hospitals and the investigator expresses her thanks to all the subjects who kindly co-operated

TABLE OF CONTENTS

CONTENTS

CHAPTER	PAGE NO
LIST OF TABLES	
LIST OF FIGURES	
LIST OF APPENDICES	
I INTRODUCTION	1
II REVIEW OF LITERATURE	9
A. Criteria for identification of high risk pregnancies	
B. Weight gain and height and the outcome of pregnancy	
C. Anaemia and the outcome of pregnancy	
D. Complications of pregnancy and the outcome of pregnancy	
E. Effect of socio-economic status of the mother and the outcome of pregnancy	
G. Other factors affecting the outcome of pregnancy	
III EXPERIMENTAL PROCEDURES	26
I. Selection of the problem	
II. Selection of area	
III. Selection of sample	
IV. Selection of methods	

V. Conducting the study

VI. Analysing and interpreting the data

IV RESULTS AND DISCUSSION

57

1. Risk levels based on prepregnancy weight of the expectant mothers
2. Risk levels based on weights of the expectant mothers at term of pregnancy
3. Risk levels based on weight gained by the expectant mothers
4. Risk levels based on the heights of the expectant mothers
5. Risk levels based on haemoglobin levels of the expectant mothers
6. Risk levels based on toxemia of pregnancy
7. Risk levels based on the nutritional status of the expectant mothers
8. Age and para of pregnancy related to the risk involved in pregnancy
9. History of previous pregnancy related to risk levels in the pregnancy
10. Risk levels based on the birth weight of previous children

V SUMMARY AND CONCLUSION

81

VI BIBLIOGRAPHY

96

VII APPENDICES

100

LIST OF TABLES

TABLE	PAGE NO
<p>I. PERCENTAGE OF EXPECTANT MOTHERS FALLING UNDER DIFFERENT RANGES OF WEIGHT BEFORE ONSET OF PREGNANCY IN THE TWO INCOME GROUPS</p>	<p>39</p>
<p>II. PERCENTAGE OF EXPECTANT MOTHERS FALLING UNDER DIFFERENT RANGES OF WEIGHT AT TERM OF PREGNANCY IN THE TWO INCOME GROUPS</p>	<p>44</p>
<p>III. PERCENTAGE OF MOTHERS HAVING DIFFERENT RANGES OF WEIGHT GAIN IN BOTH THE INCOME GROUPS</p>	<p>49</p>
<p>IV. PERCENTAGE OF EXPECTANT MOTHERS FALLING UNDER DIFFERENT RANGES OF HEIGHT IN BOTH THE INCOME GROUPS</p>	<p>51</p>
<p>V. PERCENTAGE OF EXPECTANT MOTHERS GROUPED UNDER DIFFERENT RANGES OF HAEMOGLOBIN LEVELS IN THE TWO INCOME GROUPS</p>	<p>55</p>
<p>VI. PERCENTAGE OF EXPECTANT MOTHERS SUFFERING FROM MILD OR SEVERE TOXEMIA IN THE TWO INCOME GROUPS</p>	<p>58</p>
<p>VII. PERCENTAGE OF EXPECTANT MOTHERS ENJOYING GOOD, MEDIUM OR POOR NUTRITION IN THE TWO INCOME GROUPS</p>	<p>61</p>
<p>VIII. PERCENTAGE OF EXPECTANT MOTHERS FALLING UNDER DIFFERENT AGE GROUPS AT PRIMIPARA IN LOW AND MIDDLE INCOME GROUP</p>	<p>64</p>
<p>IX. PERCENTAGE OF EXPECTANT MOTHERS CLASSIFIED ACCORDING TO NUMBER OF PREGNANCIES IN THE TWO INCOME GROUPS</p>	<p>67</p>

TABLES**PAGE NO**

X.	PERCENTAGE OF MOTHERS WHO HAD MISCARRIAGES, STILL BIRTHS AND NEONATAL MORTALITY IN THE TWO INCOME GROUPS	70
XI.	PERCENTAGE OF MOTHERS PRESENTING HISTORY OF PREVIOUS DELIVERY IN BOTH THE INCOME GROUPS	73
XII.	PERCENTAGE OF PREVIOUSLY BORN CHILDREN FALLING UNDER DIFFERENT WEIGHT RANGES	76
XIII.	EXPECTED AND OBSERVED RISK LEVELS IN BOTH THE INCOME GROUPS	79

LIST OF FIGURES

FIGURE

PAGE NO

- I THE VARIOUS RISK LEVELS EXPECTED WITH REFERENCE TO THE PREPREGNANT WEIGHT AND THE RISK LEVELS OBSERVED AMONG THE EXPECTANT MOTHERS OF LOW AND MIDDLE INCOME 40
- II THE VARIOUS RISK LEVELS EXPECTED WITH REFERENCE TO THE INDEX AND THE RISK LEVELS OBSERVED AMONG THE EXPECTANT MOTHERS OF LOW AND MIDDLE INCOME 90 a

LIST OF APPENDICES

APPENDIX		PAGE NO
I	ESTIMATION OF HAEMOGLOBIN BY CYANMETHAEMOGLOBIN METHOD	101
II	QUESTIONNAIRE TO ELICIT THE INFORMATION ABOUT THE NUTRITIONAL STATUS OF THE EXPECTANT MOTHERS	103
III	A. Prepregnant weight of the expectant mothers of the low income in Kg.	104
	B. Prepregnant weight of the expectant mothers of middle income in Kg.	107
IV	A. Weight of the expectant mothers of low income at term of pregnancy in Kg	109
	B. Weight of the expectant mothers of the middle income in kg	111
V	A. Height of the expectant mothers of the low income in cm.	112
	B. Height of the expectant mothers of the middle income in cm	116
VI.	A. Haemoglobin level of the expectant mothers of low income group in g/100 ml	117
	B. Haemoglobin level of the expectant mothers of middle income group in g/100 ml	120

VII STATISTICAL ANALYSIS

- A. Summary of statistical analysis of prepregnant weight, weight at term of pregnancy and height between low and middle income samples 121**
- B. Summary of the Chi-Square test for goodness of fit for various criteria 122**

I. INTRODUCTION

Pregnancy is a crucial period in a woman's life. The health of the expectant mother has a great bearing on the nutritional status of the offspring (NIN, 1979). Madhu Nath (1979) exhorts that since life for an infant starts before birth, during its perinatal stage, it becomes imperative that the attention is focussed on the health and nutrition of the mother right from pregnancy.

Health status of expectant and nursing mothers is often taken as an index of the health status of the community. Expectant mothers are one of the most vulnerable groups of the population according to National Institute of Nutrition (NIN, 1990). The factors affecting the outcome of the foetus may be chromosomal, genetic or environmental. The chromosomal and genetic factors have been well known. The environmental factors affecting the foetus have been of great curiosity according to Idnani (1979).

The nutritional status of the expectant mother is one of the important environmental factors which might be expected to influence maternal health and the course of

pregnancy. Research in the field of nutrition has indicated that there is a close association between maternal nutritional status on the one hand and the health of the expectant mothers and her off spring of the other as pointed out by Bhaskaran (1975).

The nutritional status of expectant mothers play a very important role in the outcome of pregnancy and the growth performance of the infants as rightly stated by Devadas (1975). Between conception and confinement every expectant mother faces many hazards and becomes vulnerable to nutritional stress. A major cause for the high mortality in our country is maternal malnutrition according to MIN (1966).

Pregnancy is a period of considerable physiological stress which calls for additional nutrients. It becomes essential that these groups of population be ensured with sound nutritional care. The high incidence of prematurity, low birth weight babies and consequent neonatal mortality are mostly attributable to maternal malnutrition as observed by Madhu Nath (1979).

Both for the growing foetus and the new born mammalian the supply of the nutrients has to come from the maternal organs. Ghosh (1976) has suggested the greater importance

of nutrition during pregnancy and the effects of deficiency. The health of the expectant mother has a great bearing on the nutritional status of her offspring. The food requirements of expectant mothers are more than those of a non-pregnant woman. The food she eats should be sufficient for maintenance of her health as well as for the growth of the foetus according to IIN (1978).

Effects of malnutrition during pregnancy of the offspring are quite striking. Bhaskara (1975) has shown that protein restriction during pregnancy increases foetal resorption. Maternal malnutrition is shown to result in a higher frequency of pregnancy wastage through abortions, miscarriages and still births. In addition faulty diet and poor nutrition of the mother can lead to premature termination of pregnancy. Incidence of prematurity seems to be several fold higher in women belonging to low socio-economic groups than in well-to-do mothers.

Madhu Nath et al. (1978) points out that anaemia is a factor known to influence birth weight. Anaemia though not fatal results in reduced work efficiency, lethargy, sluggishness often mistaken for laziness and increased susceptibility to infection, with low birth weight in the new

born. It results from the inability of the erythropoietic tissue to maintain normal haemoglobin concentration (Barton et al , (1973).

Nutrients such as iron, folic acid, vitamin B₁₂, protein and Vitamin C are necessary for blood formation. Lack of these nutrients gives rise to anaemia. Nutritional anaemia is one of the major health problems of India and is particularly serious among expectant mothers, as their requirements for essential nutrients are relatively high. All these considerations indicate that anaemia plays a major role in the high incidence of maternal deaths in the country (IIN, 1980).

After conception, restriction of calories for weight reduction is not desirable. However, an optimum weight before conception is most desirable for normal pregnancy and delivery. If the mother is underweight the chances of premature birth are increased (Antia, 1975). Grasse et al , (1972), suggests that the height of women appears to be an important factor in the course and outcome of pregnancy. Studies have shown that the incidence of still births and difficult labour was common among short women.

The incidence of low birth weight infants and closely related neonatal mortality rates appears to be affected by the socio-economic status of the mother (Krause et al., 1972). Idnani (1979) points out that certain factors in the mother, that is age, parity and socio-economic status affect the neonate directly or indirectly.

Occurance of pregnancy during adolescence presents both physical and psychological risks. Pregnancy after the adolescent years, that is when the girl is physically mature do not involve any special risk. But pregnancy in adolescent girls is known to be hazardous according to Bhaskaran (1975). He also points out that toxemia in expectant mothers which is characterised by high blood pressure, swelling of face and limbs and loss of proteins in urine is an important cause of maternal death and can adversely affect foetal growth and development.

The pregnancy complications and the mode of delivery also have important bearing on the condition of the foetus. A significant association between perinatal mortality and the above two factors have been found (Murali et al., 1975).

Pearson (1974) warns that any practicing obstetricians should have a scheme for the identification and management

of his high-risk pregnancy population. In many instances it may serve the patient best if she is referred to a perinatologist or a regional centre that is better prepared to manage all of the ramifications of a truly complicated pregnancy.

Having all these factors discussed above in mind, a nutritional status index was prepared by Vijalakshmi and Devadas (1990) which is under publication. The index contains 10 criteria through which the nutritional status and the risk levels of the expectant mothers could be judged and can guide a medical doctor or a nutritionist in forecasting the risk levels in pregnancy. The index consists of the following criteria.

1. a. Pre-pregnant weight of the mother
or
b. Weight at term of pregnancy
or
c. Weight gain during pregnancy.
2. Height of the expectant mother
3. Haemoglobin level
4. Presence of oedema, blood pressure and albuminuria
5. Nutritional status of the expectant mother
6. Age at primi para

7. Para of pregnancy
8. History of miscarriage, still birth and neonatal mortality
9. Type of previous delivery
10. Birth weight of previous children

This present study has been undertaken to assess the validity of the nutritional status index for expectant mothers that has been formulated. The investigator hopes that this study will throw some light on the identification of the high risk pregnancy population, so that those women can be given proper antenatal care to prevent any ill effect.

II REVIEW OF LITERATURE

The literature pertaining to the study of "Assessing the validity of nutritional status index for expectant mothers" is discussed under the following headings.

- A. Criteria for identification of high risk pregnancies
- B. Weight gain and height and the outcome of pregnancy
- C. Anemia and the outcome of pregnancy
- D. Complications of pregnancy and the outcome of pregnancy
- E. Nutritional status of the mother and the outcome of pregnancy
- F. Effect of socio-economic status on the outcome of pregnancy
- G. Other factors affecting the outcome of pregnancy

A. Criteria for identification of high risk pregnancies:

The mother with high risk pregnancy may be identified either on her initial visit or during her prenatal course. In the first instance the need for caution may be recognized on the basis of past history. A poor past obstetric performance that may have required a cesarean section for

delivery, those complicated by Rh sensitization are warning signals. The development of maternal complications during the prenatal course such as toxemia of pregnancy, gestational diabetes, Rh sensitization or abnormal uterine bleeding as well as recognition of possible fetal compromise developing a intrauterine growth failure, persistent. Malpresentation or multiple gestation also must place a patient in the high risk pregnancies according to Pearson(1974).

After conception, prenatal care is important for the health of the mother, for the optimum development of the foetus, as well as for preventing or minimizing the complication of pregnancy and labour and neonatal periods. Taking prenatal care as an example a committee appointed by World Health Organisation (1976) suggested that the following factors should be taken into account:

1. Health related characteristics of women of child bearing age
2. Health status
3. Biological factors - average age at first pregnancy, parity, spacing and total number of pregnancies
4. Prevalence of disease conditions specific to pregnancy
5. Health related activities in other sectors affecting the health of the pregnant women.

The reports of WHO (1972) points out that the various examinations and observations will permit the early detection of those expectant mothers (about 20 per cent) during whose pregnancy and delivery the foetus may be at high risk. The points considered are as follows:

1. Poor socio-economic background
2. Primiparity or multiparity (from the fourth pregnancy onward)
3. A history of antepartum haemorrhage, perinatal deaths or the birth of a child under 2500 g
4. Haemoglobin level less than 9.5 g/100ml
5. Diastolic blood pressure above 90mm Hg with or without proteinuria
6. Haemorrhages before the 28th week
7. Onset of labour outside the fullterm period

As a matter of priority, such expectant mothers should be kept under especially close surveillance.

From the data by the study done ^{by} Murali and Bali (1975) certain common characteristics of the mothers with perinatal deaths can be observed and using them, the following criteria can be formulated to identify the high-risk mothers.

1. Those mothers over 30 years at the time of primipara
2. Those with primiparity or grand multiparity

3. Those with history of previous foetus loss
4. Those belonging to low socio-economic status
5. Those with history of medical or obstetric complications in the current pregnancy.

B. Weight gain and height and the outcome of pregnancy:

Malathi (1975) states that normally a woman gains about 10-12 kg. of body weight during pregnancy, if her diet is nutritionally adequate. Of this 3-5 kg. is accounted for by the foetus, about 4 kg by the fat accumulated by her, and the rest by placental membranes and fluids incidental to pregnancy.

Mother's weight gain during pregnancy has been correlated positively with birth weight in most studies. Birth weight is related to mother's pregravid weight. The lighter the mother, the lower the birth weight (Ghosh et al.; 1972, Srikantha and Iyengar 1972 and Ruth 1976).

Kapur et al., (1971) reveal that among the 1,652 women they studied from different socio-economic groups the birth weight and length of nature babies correlated with weights and heights of their mothers.

In a study conducted by Keutzen et al., (1972) it was found that women under 150 cm height tended to lose infants

from premature birth and women under 54 kg had more still births before labour and perinatal deaths from placental inadequacy. Short, thin women had the highest overall incidence from all these causes and were the group at greatest risk. Height was a better indicator of perinatal mortality than body weight. Height indicated nutrition in childhood, body weight indicates recent nutrition and gain during pregnancy indicated nutrition during pregnancy (Cameron, 1976).

A study conducted by Prem (1979) showed that in the last six months of pregnancy weight gain observed was mainly fetal weight. A follow up of expectant mothers reveals that on an average, an Indian mother of low income group gain about 6.7 kg. during pregnancy when compared to about 10-12 kg in Western mothers (MIN 1971).

Some obstetricians have speculated that the common obstetric practice of routinely limiting caloric intake to restrict weight gain during pregnancy could be partially responsible for the number of low birth weight babies which contribute a disproportionate share to infant mortality (Pitkin, 1972). Shah and Shah (1969) in their

study on 261 antenatal mothers at Bombay could not find any relationship between birth weight of the infant and weight gain of mothers.

C. Anaemia and the outcome of pregnancy:

Nutritional anaemia is a major health problem in India particularly among expectant mothers. Haemoglobin estimation carried out in various parts of the country in pregnant women show that about 30 per cent of them are anaemic that is they have haemoglobin level below 10g/ 100ml Hb (1968). Gopalan and Vijaya Raghavan (1971) and Rajalakshmi (1975) have shown evidence that iron deficiency is largely responsible for this.

In one survey in India almost 100 per cent of expectant mothers were found to be iron deficient and approximately 50 per cent of these were also folate deficient (WHO, 1972). In a survey conducted among 4000 adult men and women Atkroyd (1970) found that anaemia was severe in expectant mothers and was due to iron deficiency in nearly 95 percentage of them.

Severe anaemia in expectant mothers increases maternal morbidity and mortality and involves a higher risk for the

foetus (WHO, 1975). Yucuffi et al. (1973) have suggested a correlation between maternal haemoglobin concentration and foetal birth weight.

Studies sponsored by WHO in 1963 in different parts of the world, the percentage of expectant mothers who had anaemia ranged from 21 per cent to 80 per cent and the percentage with iron deficiency was still higher.

MIM (1968) and Jopalan (1970) warn that maternal anaemia plays a major role in the high incidence of maternal deaths in the country. Maternal anaemia also affects the intra-uterine growth of the foetus. The role of maternal anaemia in perinatal mortality and premature birth is very significant according to Ghosh (1976). Rajalakshmi (1975) points out that about one in five of our expectant mothers suffer from severe degrees of anaemia.

In some parts of India an estimate of about 70 per cent has been made (Waisworth, 1970). Twenty five per cent of maternal deaths are attributable to anaemia. In severe cases congestive failure of the heart and death can occur. In complicated cases, toxemia of pregnancy may set in. Still births and severe growth retardation of the foetus also result in some cases (MIM, 1975).

Countries where malnutrition is of such greater importance folic acid may become the dominant factor in the production of anaemia during pregnancy as rightly pointed out by Chazaria (1973). Lee (1972) found that there was a relationship between the folate status of the mother and the size of the placenta.

Herbert (1970) and Denton (1976) bring out the fact that folic acid deficiency is a common cause of megaloblastic anaemia in various populations. There is an observation that administration of folate to expectant mothers can increase the birth weight of the infant, Bamalang *et al* (1970 and Iyengar 1972).

Klipstein (1967) and Chazaria (1973) suggest an association between folic acid deficiency and spontaneous abortion in early pregnancy and an increased risk of accidental haemorrhage, placental fetal abnormalities, toxemia, premature delivery and recurrent abortion. There is a clear relationship between the onset of folate deficiency in infants and low birth weight. Analysis of the lives of babies who died at birth by Hussain (1968) showed that very small babies have relatively low concentration of liver folate.

Copalan (1970) indicate that supplementation throughout the latter half of pregnancy with 30 mg of iron as a single tablet once in a day will prevent iron deficiency.

D. Complications of pregnancy and the outcome of pregnancy:

a. Pregnancy oedema:

It has been believed for a long time that oedema in pregnancy is pathological and that it is an early sign of impending toxemia. NIH (1979) reports have shown that oedema in pregnancy does not necessarily indicate impending toxemia.

b. Toxemia:

Combinations of symptoms including hypertension, oedema and albuminuria indicate toxemia. Pre-eclampsia is the appearance of hypertension, oedema of the face and hands and /or albuminuria. Eclampsia is the end result of pre-eclampsia (Robinson 1977). Toxemia continues to be an important complication of pregnancy and contributes considerably both to maternal and foetal morbidity according to reports from NIH (1979). Toxemia alone or in combination with other factors such as anaemia, infection and maternal malnutrition are known to interfere with normal placental function with the resultant retardation of intra-uterine growth of foetus.

The pregnancy complications and the mode of delivery have important bearing on the conditions of the foetus according to Murali and Bali (1975).

Chowdhury (1975) explains that there is a close relationship between the plasma protein levels and degree of toxemia. A similar situation was found in babies born of toxemic mothers. The degree of prematurity had a direct relationship to the severity of toxemia of pregnancy and concurrent diminution of plasma protein levels. The incidence of toxemia of pregnancy has been shown to be highest in the lowest socio-economic groups according to Roberts (1974).

About 10% of all women develop hypertension during pregnancy, having started the pregnancy with the normal blood pressure and although there is published evidence to show that the higher the diastolic pressure and the earlier the pregnancy, the worse the prognosis of the foetus, the critical marker for both fetal and maternal risk appears to be the appearance of proteinuria (Symonds, 1980).

2. Nutritional status of the mother and the outcome of pregnancy:

Health and happiness are the outcomes of good nutrition. Therefore good nutrition in pregnancy, infancy, childhood and throughout the life span is of paramount importance as

Rightly pointed out by Devadas (1970). Thomas (1974) asserts that child bearing imposes a great strain on the expectant mother and it is important that she be healthy to ensure the well-being of the growing baby in the womb. A properly balanced diet is all the more essential for these women. The growing baby in the womb depends entirely on the mother for obtaining all its nutrients. The foetus draws upon the maternal resources however scanty they may be (Mainthi 1975).

1978

It has been well established by Devadas et al, Iyengar (1972), Elboghadi (1971), Balasubramanian (1975), and Kusin (1973) that maternal nutritional status influences the course and outcome of pregnancy.

Iyengar (1972) warns that maternal malnutrition can not only induce a change in the pattern of foetal growth but can also influence the hormonal and placental environment. In a recent report Jourey and Fine (1972) reported that the maternal nutritional status has greater influence on the birth weights of infants than even the genetic factors.

During the famine in Holland in winter of 1944 to 1945, there was a downward shift of birth weight and it began to rise again immediately after famine ended, as reported

by Ghosh et al. (1972). Ghosh (1976) has suggested the importance of nutrition during pregnancy and during lactation and the effects of the deficiency during the former are believed to be present through the successive generation.

The high incidence of prematurity and the consequent high neonatal mortality in our country are mostly attributable to maternal malnutrition (IIN, ICMR 1972).

Various clinical studies have demonstrated both dietary and biochemical inadequacies in as many as 15 - 23 per cent of expectant mothers (Herbert, 1977). The great majority of expectant mothers in our poor communities live on diets which are clearly inadequate.

Shah Nagar and Dasgosh (1979) opine that prematurity is the leading factor associated with neonatal morbidity. To avoid this, diet of the mother and health of the mother has to be good throughout the pregnancy. Most of the world's women have grown up with less than optimum feeding and suffer food shortages during pregnancies throughout which they may do hard agricultural labour. Hytten (1974) indicates that such circumstances are undoubtedly associated with increased reproductive failure.

Malnourished foetus may after be left with some permanent defects including impairment of mental development (Lechtig et al.).

1976). There is a general association between low birth weight, high fetal and infant mortality and diets of poor nutritive value according to ICMR (1971). Bone density of the offspring is also affected by maternal malnutrition.

Roberts et al., (1974) studied animals such as the ^{and} rats, have shown that protein deprivation during pregnancy has an effect on the fetus. Of 68 sexually mature female rhesus monkeys evaluated, 43 became pregnant with a yield of 30 live births. Severe protein deficiency was found to increase still birth rate (Roberts et al., 1974). There is circumstantial evidence suggesting a causal relationship between malnutrition and such pregnancy states as toxemia, premature labour and abruptio placentae. There appears to be a critical period during phases of rapid growth during which malnutrition can produce irreversible effect (Maker et al., 1973).

Steward et al. (1971) by their experiments with dogs and rats demonstrated that mothers malnourished throughout the life, produced at full term small for date offspring which exhibited the most severe signs of malnutrition.

Data from the siege of Leningrad and from the induced famine in Holland suggest that if birth weight alone is considered severe, maternal undernutrition will result in significant fetal growth retardation (Preleden, 1970).

The study of pregnant women in their last trimester by Datta (1973) showed that there was usually a deficiency of total calories, proteins, minerals and vitamins. The intake of all the expectant mothers who participated in a study done by Vijayalakshmi *et al.*, (1975) was lower than the allowances made by ICMR (1975) with respect to calories and all the nutrients except ascorbic acid and thiamine in half of the cases.

Supplementation reduces the rate of pre-maturity, still births, low birth weight and neonatal death according to Wynn *et al.*, (1975). In the study conducted by Iyengar (1972) it was found that the birth weight of infants born to these mothers was higher than that of those born to unsupplemented mothers.

F. Effect of socio-economic status on the outcome of pregnancy:

The study conducted by Harish Chandra (1971) reveals that there is an inverse relation between the family income on

the one hand and the number of babies with birth weights above 2,500 g on the other. Mothers in the same ethnic group, but from a low socioeconomic level, generally deliver babies of lower birth weight which might average above 2.5 kg. (Cameron et al., 1976). NIN (1975) reports that the birth weight of infants belonging to the poor socio-economic group are generally lower than those of infants born to well-nourished mothers, also a greater proportion are small for date.

Average birth weight of infants born to mothers of the low income is 2,900 g as against 3200 g in the high income group. The incidence of prematurity is based on WHO standard is 30% respectively in those two income group (Iyengar, 1972). At the same parity the incidence of low birth weight increases as the economic condition worsens and the percentages of babies weighing more than 3000 g steadily falls (Harish Chandra, 1971).

A study carried out by Devadas et al. (1975) on expectant Mothers in the lower socio-economic status shows that the nutritional status of the expectant mothers has a direct role on the outcome of pregnancy. To some extent the perinatal mortality reveals the mother's reproductive efficiency which is influenced by her age, the number of previous pregnancies, her health

and physique, her education, all of which are affected by the socio-economic circumstances (Muralidhar Bai, 1975).

6. Other factors affecting the outcome of pregnancy

An important biological factor which is shown to be very much associated with perinatal mortality is the mother's obstetric history (Bai, 1975). Similar association has been reported by Butler and Cochara (1963). Certain factors in the mother that is age, parity, socio-economic status affect the neonate directly or indirectly (Idnani, 1979).

Accidents of labour, prolonged breast feeding and appearance of successive pregnancies makes the women continuously anaemic and under nourished (MIN, 1990). Studies by Akherji and Sethna (1970) and Beal (1971) have shown that parity may play an important role in the nutritional status of the new born. There are evidences in the studies carried out by Moidya et al. (1970) to prove that if there is a vast difference in the para of pregnancy it may affect the nutritional status of the new born.

In addition to inadequate consumption of food, lack of spacing between children, increasing number of pregnancies and early pregnancies contribute to poor maternal nutrition (Madhu Math, 1979).

44

So far as mode of delivery was concerned, elective caesarean section was the safest method for difficult breech in the study conducted by Balla et al. (1979) followed by vaginal route deliveries where instruments were not used. Mahiri (1964) and Chowdhury (1964) also reported lesser fetal loss by caesarean section in breech babies. Bhagwanani et al. (1973) and Rubin and Grimm (1963) have indicated the more liberal use of caesarean section in the breech. Although the outcome of breech babies by caesarean section has been good, there are limited indications selecting this method of delivery.

The maternal mortality rate in India has been as high as 252 per 100,000 live births in the last two decades. The incidence of maternal mortality is maximal after the third parity (Gopalan, 1973). An earlier study by Gopalan (1973) had suggested that 16-19 per cent of pregnancies among poor income groups resulted in miscarriages and abortions. The pregnancy wastage observed in the study was of the order 29 to 32 per cent. The still birth rate in India at present is 11.0 per 1000 live births. The incidence of anaemia as well as the nutritional deficiency signs were higher in women of later parities.

The effect of an improved nutritional standard was only perceptible in the primigravida from the middle income groups. In multigravida, increased growth potential outweighed the nutritional disadvantage of the low income groups (Chowdhury, 1974). In a study conducted by Harish Chandra (1971) it has been found that more number of poor mothers were noted at higher parities, the percentage of mothers giving birth to five or more babies was double in ^{low} socio-economic groups compared to that in rich mothers.

Clinically in international classification the term "low birth weight" is defined as below 2,500 g (Cameron and Hoflander, 1976). Among the important biological factors a significant association between prematurity and perinatal mortality has been established.

III EXPERIMENTAL PROCEDURE

The experimental procedure pertaining to the study of "Assessing the validity of the nutritional status index" is discussed under the following headings:

- I. Selection of the problem
- II. Selection of area
- III. Selection of sample
- IV. Selection of methods
- V. Conducting the study
- VI. Analysing and interpreting the data

I. Selection of the problem

It is possible through various examinations and observations to detect early, the risk involved in pregnancy and delivery. Those high-risk pregnancy population should be identified and should be given proper antenatal care. Hence an index to identify the risk levels among expectant mothers was formulated by Vijayalakshmi and Devadas (1950). Any newly formulated index has to be checked for its validity. This present study was undertaken to check the validity of the nutritional status index evolved by the above scientists, in predicting the high-risk pregnancies.

II. Selection of area:

The hospitals selected were the Government medical college hospital of Coimbatore and Lippuswamy Naidu Memorial Hospital, Papanaikannapuram. These hospitals were selected because of the fact that a large population of expectant mothers come there for their delivery and also the authorities of these hospitals were very cooperative.

III. Selection of samples:

The expectant mothers who were in the last trimester of pregnancy alone were taken into consideration due to the limited time available and also the application of the index required the observation only from the third trimester.

It is neither possible nor necessary to examine all members of the population; the basis of sampling is to select a random sample of sufficient size to give accurate, unbiased and representative results for the community as a whole (Jelliffe, 1966). So 400 samples were selected among whom 300 belonged to lower socio-economic levels and the other 100 belonged to middle-income group. Those whose per capita income was 0-100Rs/- month were considered to have low income and those whose income was 101-200 Rs/- month was considered to be in the middle income.

IV. Selection of Methods

The nutritional status index whose validity is to be checked is given below.

**INDEX FOR ASSESSING NUTRITIONAL STATUS OF MICROBIAL
MOTHERS**

Indicative levels and scores

Risk Factors	low risk	Scores	Medium risk	Scores	High risk	Scores
1. Prepregnant weight of the expectant mother in kg. or weight of the expectant mother in kg at term of pregnancy or Weight gain during pregnancy in kg	45 and above	10	40-45	5	Below 40	0
2. Height of the mother in cm.	150 and above	10	45-50	5	Below 45	0
3. Hb. level in g/100 ml. or Pallor of skin	10.5 and above	10	5-6.9	5	Below 5	0
4. Obvious clinical symptoms like Oedema, Blood pressure or Albuminuria	Healthy	10	140-150	5	Below 140	0
5. Nutritional status	Nil	10	9-10.4	5	Below 9	0
6. Mother's age at primipara	Good	10	pale	5	Severely pale	0
	20-29	10	Mild	5	Severe	0
	or 30-35	10	Medium	5	Poor	0
	or above 35	10	15-20	5	Below 15	0

 Indicative levels and scores

S. No.	Risk Factors	Low risk Scores	Medium risk Scores	High risk Scores	High risk Scores
7.	Para of pregnancy	2,3	1,4,5	5	above 5
8.	History of miscarriage, still birth or neonatal mortality	No such history	Tendency for miscarriage, bleeding and severe intra uterine pains	5	Miscarriage still birth or neonatal mortality
9.	Type of previous delivery	Normal	Prolonged labour or mild toxemia and the like	10	Complicated delivery with eclampsia or toxemia, cesarean, forceps or breech
10.	Birth weight of the previous children in kg.	Above 2.5	2-2.5	5	Below 2
Total Scores		100	30	30	0
High risk mothers		Scores below 40	Medium risk mothers 40-69	Low risk mothers 70-100	

For each criteria given in the index a separate method was followed.

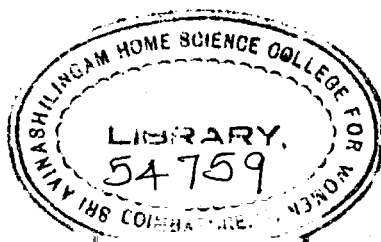
1. Weight:

Body weight of the expectant mothers was recorded with the help of a spring balance with an accuracy of a 250 g since transport of heavy lever type balance to different hospitals was difficult and lever balances which are portable were not available.

Jelliffe (1966) points out that spring balance is adequate to measure the weight, provided the balance is checked constantly against standard weights. Before weighing, the balance was checked for its accuracy with the help of standard weights. The weights of the expectant mothers were taken preferably in the morning after emptying the bowel and bladder and before meals. One week after delivery, the non pregnant weight of the mother was recorded, so that the investigator would obtain the non pregnant weight of the mother.

2. Height:

Standard height was measured using a fibre glass tape fixed to a wall. The mothers were made to stand erect on the flat floor, barefooted against the scale with the arms hanging at the sides in a natural manner.



A wooden scale was placed gently on the head, perpendicular to the wall and the height was measured from the scale correct to 0.1 cm. This measurement was taken to enable the investigator to correlate the height of the mother with the performance at delivery.

3. Haemoglobin level:

Anaemia occurs due to a series of nutrient deficiencies. In field situations, this can be best assessed by haemoglobin estimations associated with the estimation of the blood films and haematocrit estimation. Haemoglobin values are of great practical value in the assessment of the severity of anaemias in the expectant mothers (Jelliffe, 1966). For estimating the haemoglobin level of the expectant mothers cyanmethaemoglobin method (Varley, 1975) was followed, which is presented in Appendix II.

A field modification of this was done as suggested by National Institute of Nutrition (1971) in which 0.02 ml of fresh blood obtained by finger prick, without squeezing, was run on to a strip of Whatman filter paper (2 cm x 4 cm) and allowed to dry. Such specimens were transported in small individual envelopes and ultimately dissolved for 10 minutes in the Drapkin's solution and haemoglobin estimated.

4. Complications of pregnancy:

The presence or absence and the extent of oedema, blood pressure and albuminuria which were found out by the medical practitioners were recorded systematically for all the samples.

5. Nutritional Status:

A questionnaire for finding out the food intake of the samples was prepared which is given in Appendix II. Based on that questionnaire, the nutritional status of the samples were determined to be good, medium or poor. Meal pattern of the samples were also found out by using the questionnaire. The meal pattern of the samples for any three consecutive days were recorded.

6. Maternal age at birth:

Fetal and infant loss is high when maternal age was 17 years and below and also when the birth intervals were short according to Katherjee and Sethna (1970) and NIN(1974).

Privatsava et al. (1972) observed that mothers between 25 and 29 years delivered a higher percentage of babies weighing over 3000 g. So below 19 and above 35 years were

considered to be factors leading to high risk. The age group in which a low risk was expected was 20-29 years. A moderate risk was expected in the age group of 18-20 years and 30-35 years.

7. Para of Pregnancy:

Harish Chandra (1971) suggests that parity is one of the factors known to influence birth weight. Frequent and successive pregnancies make the women continuously anaemic and undernourished according to NIN(1980). The women who were in their second or third parity were expected to be at low risk. Women who were at their fourth parity, fifth parity and primiparity were expected to be at medium risk. Women at the fifth or above parity were considered to be at high risk.

9. History of miscarriage, still birth or neonatal mortality:

Murali (1975) points out another biological factor which is shown to be very much associated with perinatal mortality that is the mother's previous obstetric history. If the expectant mother did not have any miscarriages or still birth or neonatal mortality then she was considered to be at low risk. If she had any of these then she was expected to be at medium or high risk, depending upon the severity of the case.

9. Type of previous delivery:

Since the mode of previous delivery also affects the forth coming delivery, that was also taken into consideration. If the expectant mothers had a normal delivery then the forthcoming delivery was expected to be normal. If the expectant mother had prolonged labour or toxemia then the delivery expected was a medium risk one. If the expectant mother had needed a caesarian section or if she had had a breech delivery or forceps then the delivery was expected to be a high risk one.

10. Birth weight of previous children:

The criteria of Birth weight for prematurity indicating high risk, in India, has been considered to be 2000 g or less, by Ghosh (1970), Mittal and Sethar (1970) and Srivatsava et al. (1972). If the weight of the previous children was above 2500g then the expectant mothers were considered to be at low risk. This birth weight was recorded from the previous records, or from information received from the mother

IV Conducting the study:

Using the above methods, all the ten criteria were found out for each sample. These included the non-pregnant

weight, weight at term of pregnancy, height, haemoglobin level, complications of pregnancy, nutritional status, para of pregnancy, age at primipara, history of miscarriage of still birth or neonatal mortality, the type of previous delivery and the birth weight of previous children.

VI. Analysing and interpreting the data:

For all the samples each criteria was marked according to the scores given in the formulated nutritional status index- After marking if the sample had got 70-100 as her score then the delivery was expected to be a low risk one. If the sample had got a score of 40-69 then the delivery expected was ^a moderate risk delivery. If the sample had got a score below 40 then the delivery was expected to be a high risk one.

When the actual delivery was observed. If in a major or portion of the samples, the expected and the observed risk were the same, the criteria was proved to be valid. If in a major portion of the samples the expected risk and observed risk do not agree then the criteria was considered not to be valid.

Using these procedures the validity of the different criteria adopted in the index was assessed, and suitable modifications suggested.

IV RESULTS AND DISCUSSION

The results and discussion pertaining to this study on "Assessing the validity of the nutritional status index for expectant mothers" are presented under the following headings.

1. Risk levels based on prepregnancy weights of the expectant mothers
2. Risk levels based on weights of the expectant mothers at term of pregnancy
3. Risk levels based on weight gained by the expectant mothers
4. Risk levels based on the heights of the expectant mothers
5. Risk levels based on haemoglobin levels of the expectant mothers
6. Risk levels based on toxemia of pregnancy
7. Risk levels based on the nutritional status of the expectant mothers
8. Age and para of pregnancy related to the risk involved in pregnancy
9. History of previous pregnancy related to risk levels in the pregnancy
10. Risk levels based on the birth weight of previous children.

1. Risk levels based on prepregnancy weights of the expectant mothers

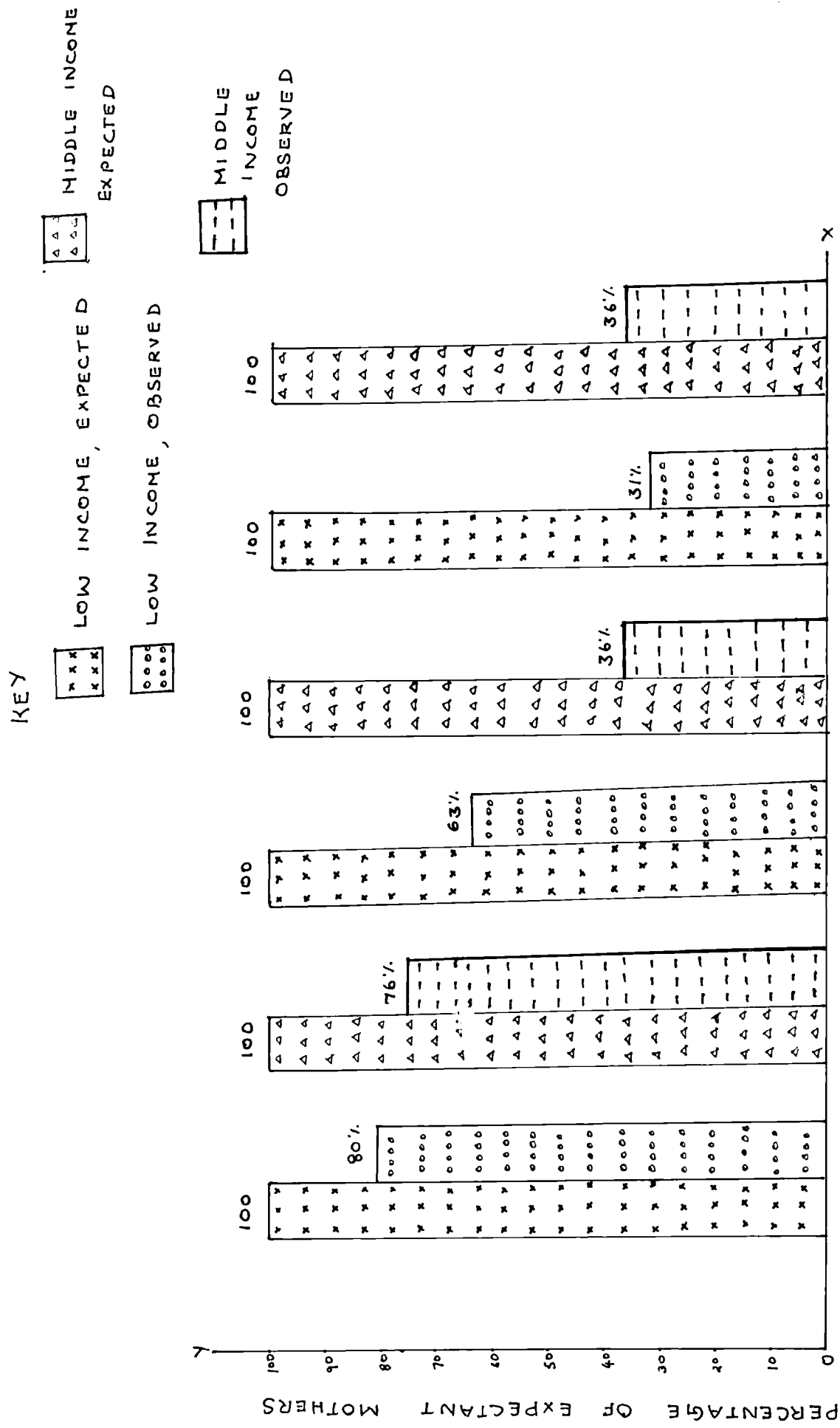
Table I presents the number and percentage of expectant mothers grouped into three categories, namely those who have a prepregnancy weight of 45 kg and above, those who have a weight between 40-45 kg, and those who registered a weight below 40kg. The individual data pertaining to this criteria for low and middle income groups are presented in Appendix III A and Appendix III B respectively. Figure I illustrates the percentage of expectant mothers who were expected to have various risk levels with reference to their prepregnant weight and the percentage of expectant mothers who were observed to have various risk levels.

TABLE I

PERCENTAGE OF DELIVERIES WITHIN RANGE OF WEIGHT BEFORE ONSET OF

PREGNANCY IN TWO INCOME GROUPS

Income	Delivery	45 kg and above				40 - 45 kg				Below 40 kg							
		High risk	Medium risk	Low risk	Total	High risk	Medium risk	Low risk	Total	High risk	Medium risk	Low risk	Total				
Low	Expected	129	100	0	0	0	0	0	105	100	0	0	0	0	0	67	100
	Observed	102	79.7	17	13.3	9	7.0	24	22.9	66	62.9	15	14.3	20	29.9	26	39.3
Middle	Expected	53	100	0	0	0	0	0	33	100	0	0	0	0	0	14	100
	Observed	60	75.5	7	9.4	8	15.0	12	36.3	42	36.3	9	27.3	5	35.7	4	28.6



THE VARIOUS RISK LEVELS EXPECTED WITH REFERENCE TO THE PREGNANT WEIGHT AND THE RISK LEVELS OBSERVED AMONG THE EXPECTANT MOTHERS OF LOW AND MIDDLE INCOME

FIGURE I

Out of the 300 mothers who participated in the present study, for assessing the validity of the nutritional status index, 129 mothers in the low income group had recorded a pre-pregnant weight of 45 kg and above and were expected to have a low risk according to the index. Actual observation of the delivery of these cases showed that out of these 129 mothers, 102 mothers had low risk working out to 79.7 per cent, 17 mothers (13.3 per cent) and 9 mothers (7 per cent) had medium and high risk respectively. This meant that almost 90 per cent of the cases turned out to prove the validity of the index with reference to the pre-pregnant weight of the mother. One hundred and five mothers were expected to have medium risk, as per the norms of the risk index, as their weight ranged from 40-45 kg and the actual delivery observed revealed that 66 per cent had moderate risk, 22.9 per cent had low risk and 14.3 per cent had high risk. In the same low income group 67 were expected to have high risk, as their weights were below 40 kg, and it was observed that 31.3 per cent of these mothers had high risk, 39.9 percent had medium risk and 29.9 percent had low risk.

On the whole 100 expectant mothers from the middle income group participated in the present study, out of these

100 mothers judged by their pre pregnant weight, 53 were expected to have low risk, but only 40, that is 75.5 per cent had low risk, 9.4 per cent had medium risk and 15 per cent had high risk. Thirty three mothers were expected to have medium risk, as their weights ranged from 40-45 kg and out of these, 36.3 per cent only had moderate risk, 36.3 per cent had low risk and 27.3 per cent had high risk. Fourteen mothers were expected to have high risk, while actual performance revealed only 35.7 per cent of the cases to be at high risk 25.6 per cent had medium risk and 35.7 per cent had low risk.

These results with reference to their pre-pregnant weight both among the mothers in the low income group and middle income group indicate that the index is reliable in 75.5-79.7 cases with reference low risk, 36.6-62.9 per cent of the cases in ^{the} medium risk and 31.3-35.7 cases in the high risk,

The mean pre-pregnant weights of the mothers of low income group and middle income group were found to be 45.5 kg and 46.4 kg respectively. The difference between the mean pre-pregnant weights of both groups was approved to be significant statistically using "t" test.

By observation it was concluded that some modifications can be made concerning this criteria, that is

prepregnant weight. The low risk level was changed from 45 kg and above to 40 kg and above, the medium risk range was changed from 40-45 kg to 35-40 kg, and the high risk was changed from below 40 kg to below 35 kg.

Applying this modification it was noticed that χ^2 test gave a value of 2.3 indicating that the criteria fit is good at 1% level of significance, when the low income group was considered. For the middle income group with this modification χ^2 test gave a value of 9.9 proving that the criteria's fit is good at 1% level of significance.

2. Risk levels based on weight of the expectant mothers at term of pregnancy

Table II brings out the number and percentage of expectant mothers falling under different ranges of weight at term of pregnancy in the two income groups. The individual data pertaining to this criteria for low and middle income are given in Appendix IV A and Appendix IV B respectively

TABLE II

PERCENTAGE OF EXPECTED ROAD KILLING UNDER DIFFERENT RANGES OF WEIGHT AS AREA OF CROSSLAND IN

IN THE TWO INCOME GROUPS

Income Delivery	50 kg and above				45-50 kg				Below 45 kg								
	N	%	N	%	N	%	N	%	N	%	N	%					
Low	Expected	152	100	0	0	0	0	100	100	0	0	0	0	0	0	48	100
Income Observed		110	72.4	28	19.4	14	9.2	22	22	62	62	16	16	14	29.1	19	37.5
Middle	Arrested	62	100	0	0	0	0	29	100	0	0	0	0	0	0	9	100
Income Observed		47	75.8	6	9.7	9	14.5	7	24.1	12	41.4	10	34.5	4	44.4	3	33.3

Table II reveals that out of the 300 expectant mothers in the low income group 152 were expected to have low risk, as per the norms of the index with reference to the weight at term of pregnancy. Actual performance at delivery revealed that 110 cases, working out to a percentage of 72.4 were at low risk, 18.4 per cent at medium risk and 9.2 per cent at high risk. One hundred mothers were expected to have medium risk according to the index, while 62% only had medium risk, 22 per cent had low risk and 16 per cent had high risk. Forty eight mothers were expected to have high risks pregnancy and only 33.3 per cent of them had actually high risk while 29.1 per cent and 37.5 per cent of them had low risk and medium risk respectively.

Among the 100 expectant mothers studied in the middle income group 62 were expected to have low risk during delivery while there were 75.8 per cent of cases who had not really low risk, 9.7 per cent of cases at medium risk and 14.5 who had high risk. Out of the 29 mothers who were expected to have medium risk based on their term weight of pregnancy in the range of 45-50 kg, only 41.4 per cent had medium risk, 24.1 per cent had low risk and 34.5 per cent had high risk. Out of the 9 mothers who were expected to have as high risk as their term weight of

pregnancy was lower than 45 kg, only 22.2 per cent had actual high risk, and 44.4 per cent had low risk, 33.3 per cent had medium risk.

These results with regard to the weight at term of pregnancy, in the low income and middle income reveal that the index is reliable in 72.4-75.9 per cent of the cases for low risk, 41.4-62.0 per cent of the cases for medium risk and 22.2-33.3 per cent of the cases for high risk.

The mean weight at term of pregnancy in the low and middle income were found to be 49.5 kg and 53.3 kg respectively. The difference between the two mean weights at term of pregnancy was proved to be statistically significant using "t" test.

Concerning this criteria of weight at term of pregnancy ^{the} following modifications were tried. The low risk range with reference to this criteria was changed from 50 kg and above to 45 kg and above. The medium risk range was changed from 45-50 kg to 40-45 kg and the high risk range was changed from below 45 kg to below 40 kg.

Applying this modification it was noticed that the χ^2 test gave a value of 9.9 for low as well ^{as} middle income groups proving that the fit of the criteria is good for both the income groups at 1% level of significance.

3. Risk levels based on weight gained by the expectant mothers:

Table III presents the per cent of the expectant mothers falling under different ranges of weight gain in both the income groups

TABLE III

PERCENTAGE OF MOTHERS HAVING DIFFERENT RANGES OF WEIGHT GAIN IN BOTH THE INCOME GROUP

Income Delivery	Above 7 kg				5 - 7 kg				Below 5 kg				
	N	%	N	%	N	%	N	%	N	%	N	%	
Low Income	Expected	50	100.0	0	0	0	0	0	0	0	0	0	0
	Observed	57	74	10	20	3	6	175	72.9	23	11.6	57	15.4
Middle Income	Expected	43	100	0	0	0	0	0	0	55	100	0	0
	Observed	30	69.8	6	13.9	7	16.3	34	61.8	8	14.6	11	20.4

Out of the 500 mothers observed in the low income group 50 mothers were expected to have low risk with reference to the weight gain at term of pregnancy. Among them only 74 per cent had actual low risk, 20 per cent had medium risk and 6 per cent had high risk. Out of the 240 mothers who were expected to have medium risk only 11.6 per cent were observed to have actual medium risk, 72.9 per cent of the mothers had low risk and 15.4 per cent were found to have high risk. Ten mothers were expected to have high risk since their weight gain was below 5 kg. Among them only 20 per cent had actual high risk, 70 per cent were found to have low risk and 10 per cent had medium risk.

Among the 100 mothers observed in the middle income group 43 were expected to have low risk since their weight gain was above 7 kg. Among them 69.3 per cent were found to have actual low risk, 13.95 per cent had medium risk and 16.25 per cent were found to have high risk. Fifty five mothers were expected to have medium risk pregnancy. The actual performance during delivery revealed that only 14.6 of them had actual medium risk, 61.3 per cent of them had low risk and 20 per cent were found to have high risk. Out of the five mothers who were expected to have high risk only one had actual high risk and the rest 4 were found to have low risk.

These findings observed in the expectant mothers of the low and middle income reveal that this criteria is reliable in 69.9-74.0 per cent of the cases for low risk, 11.6-14.6 per cent of the cases for medium risk and 20 per cent of the cases for high risk.

4. Risk levels based on Heights of the expectant mothers

Table IV presents the per centage of the expectant mothers falling under different ranges of heights in both the income groups. Appendix V A and V B gives the individual heights of the mothers of low and middle income respectively.

TABLE IV

PURCHASES OF SPECIALTY FOODS CALLING FOR DIFFERENT RANGES OF WEIGHT IN POUNDS AND INCOME GROUPS

	150 cm and above		140 - 150 cm		Below 140 cm	
Income Delivery	Low risk	Medium risk	High risk	Low risk	Medium risk	High risk
	N	%	N	%	N	%
Low						
Income Expected	191	100	0	0	0	0
Observed	93	54.1	56	30.9	27	14.9
Middle expected	73	100	0	0	0	0
Income Observed	43	65.8	13	17.8	12	16.4
High expected	73	100	21	100	0	0
Income Observed	43	65.8	6	29.5	9	38.0
Low	109	100	0	0	0	0
Income Expected	93	54.1	49	45.3	14	12.9
Observed	43	65.8	21	100	0	0
Middle expected	73	100	0	0	0	0
Income Observed	43	65.8	2	33.3	3	50
High expected	73	100	4	36.4	2	13.1
Income Observed	43	65.8	5	45	1	16.7

Out of the 300 expectant mothers in the low income group 191 were expected to have low risk, predicted using the index with reference to the height. The observed deliveries showed that 98 expectant mothers that is 54.1 per cent had low risk, 30.9 per cent had medium risk and 27 per cent had high risk respectively. According to the index 109 expectant mothers were expected to be at medium risk while actually only 49 per cent had medium risk, 41.7 per cent had low risk and 14 per cent had high risk. Eleven expectant mothers were expected to have high risk while actually only 45.5% of them had high risk, 2% had medium risk and 36.4 per cent of them had low risk.

Among the 100 expectant mothers taken for the present study from the middle income 73 were expected to be at low risk while 65.8 per cent of them had low risk delivery. The percentage of medium risk observed among them were 17.8 and 16.4 per cent of them had high risk.

Out of the 21 mothers who were expected to have medium risk with reference to their height which was in the range of 140-150 cm but only 29.5 per cent of the expected mothers had medium risk actually, 33.3 per cent of them had low risk and 3% of them were found to have high risk

Six expectant mothers whose heights were below 140 cm were categorised under high risk but among them only 16.7 per cent were observed to have a high risk delivery, 50 per cent had medium risk and 33.3 per cent low risk.

These results with reference to the height of the expectant mothers in the low and middle income show that the index is reliable in 54.1-65.9 per cent of the cases for low risk 29.5 - 45.3 per cent of the cases for medium risk and 16.7-4.5 per cent of the cases for high risk.

The mean heights of the expectant mothers of low and middle income was found to be 150.8 cm and 152.0 cm respectively. The difference between the mean heights of the low and middle income was statistically insignificant.

Some modifications were suggested with reference to the height criteria. The low risk range was changed from 150 cm and above to 145 cm and above. The medium risk range was changed from 140 -150 cm to 135-145 cm and the high risk range was changed from below 140 cm to below 135 cm.

By this modification it was noticed that with reference to height, χ^2 test gave a value of 7.3 for low income group and 9.3 for middle income group proving that the fit of this criteria is good at 1% level of significance for both the income groups

5. Risk levels based on Haemoglobin level of the expectant mothers

Table V indicates the per cent of the expectant mothers falling under different ranges of haemoglobin levels in both the income groups. The individual data pertaining to this criteria for low and middle income are given in Appendix VI A and VI B respectively.

TABLE V

PERCENTAGE OF HAPLOTYPE CARRIERS ABOVE AND BELOW DIFFERENT RANGES OF HEMOGLOBIN LEVELS IN NEW AND TREATING GROUPS

		10.5 g and above				9.10.4 g				Below 9 g			
		Low risk		Medium risk		High risk		Low risk		Medium risk		High risk	
		N	%	N	%	N	%	N	%	N	%	N	%
Income Delivery	Expected	30	100	0	0	0	0	0	0	0	0	0	0
	Observed	16	53.3	12	40	2	6.7	57	53.8	37	34.9	12	11.3
Middle Income	Expected	32	100	0	0	0	0	0	0	30	100	0	0
	Observed	19	59.3	7	21.9	6	19.8	17	56.7	6	20.0	7	23.3
Low Income	Expected	30	100	0	0	0	0	0	0	106	100	0	0
	Observed	16	53.3	12	40	2	6.7	57	53.8	37	34.9	12	11.3
Middle Income	Expected	32	100	0	0	0	0	0	0	30	100	0	0
	Observed	19	59.3	7	21.9	6	19.8	17	56.7	6	20.0	7	23.3
High Income	Expected	30	100	0	0	0	0	0	0	0	0	0	0
	Observed	16	53.3	12	40	2	6.7	57	53.8	37	34.9	12	11.3

Table V shows that out of the 300 expectant mothers studied, 30 were expected to be at low risk as per the index with reference to the haemoglobin levels. Actual performance at delivery revealed that 16 expectant mothers who contribute 53.3 per cent were at low risk, 40 per cent were at medium risk and 6.7 per cent were at high risk. Among the 300 expectant mothers 106 were expected to have medium risk as per their haemoglobin value which was in the range of 9-10.4g/100 ml. Among them only 34.9 per cent were medium risk during delivery, 53.8 per cent were low risk and 11.3 per cent of them were observed to have high risk. Among the expectant mothers studied 164 mothers were expected to have high risk pregnancy while only 19.9 per cent of them had high risk, 36.6 per cent had medium risk and 44.5% had low risk.

Among the 100 expectant mothers in the middle income group who were studied, 32 mothers were expected to have low risk according to the index while 59.3 per cent only had low risk, 21.9 per cent had medium risk, 19.3 per cent had high risk. Thirty mothers were expected to have medium risk pregnancy whereas only 20% of them were medium risk, 56.7 per cent were observed to have low risk and 23.3 per cent high risk.

Thirty eight mothers who had haemoglobin levels less than 9 g/100 ml were expected to have high risk pregnancy while only 19.4 per cent of them actually had high risk, 55.3 per cent of them had low risk and 26.3 per cent had medium risk.

These results with regard to the haemoglobin levels of the expectant mothers in the low income and the middle income show that the index is reliable in 53.3 - 59.3 per cent of the cases for low risk, 20 - 34.0 per cent of the cases for medium risk, 19.4 - 19.9 per cent of the cases for high risk.

The mean haemoglobin value of the expectant mothers of low income group was found to be 7.3 g/100 ml and the mean haemoglobin value of the expectant mothers of the middle income group was found to be 8.0 per g/100 ml.

6. Risk levels based on toxemia of pregnancy

Table VI reveals the per centage of the expectant mothers falling under three categories namely, those who have no toxemia, those who have mild toxemia and those who have severe toxemia.

TABLE VI

PERCENTAGE OF EXPONENTIAL DISTRIBUTION SUFFERING FROM MILD OR SEVERE TOXICITY IN THE TWO INCOME GROUPS

Income	Delivery	Mild					Severe						
		Low risk risk	Medium risk	High risk	Low risk	Medium risk	High risk	Low risk	Medium risk	High risk			
N	%	N	%	N	%	N	%	N	%	N	%	N	%
Low	Expected	228	100.0	0	0	0	0	0	0	0	0	0	0
Income	Observed	111	48.7	79	34.6	38	16.7	30	51.7	24	40.7	5	39.5
	Expected	68	100	0	0	0	0	0	0	27	100	0	0
Middle Income	Observed	38	55.9	17	25.0	13	19.1	19	66.7	5	15.5	4	14.9
	Expected	38	100	0	0	0	0	0	0	0	0	0	0

Among the 300 expectant mothers taken for the study 229 expectant mothers were expected to be at low risk during their delivery since they had no toxemia. But among them only 48.7 per cent had low risk actually, 34.6 per cent had medium risk and 16.7 per cent were observed to have high risk. Among the mothers observed 59 mothers were expected to have medium risk pregnancy. Actual performance during delivery revealed that only 40.7 per cent had medium risk, 51.7 per cent were low risk and five per cent had high risk. Among the thirteen expectant mothers who were expected to have high risk pregnancy only 30.8 per cent had high risk, 30.8 per cent were at medium risk and 39.5 per cent had low risk.

Among the 100 expectant mothers belonging to the middle income, 69 mothers were expected to have low risk pregnancy, while only 55.9 per cent were observed to be low risk, 23 per cent were medium risk and 19.1 per cent were high risk.

Among the mothers studied 27 were expected to be medium risk, while actual performance during delivery revealed only 19.5 per cent were medium risk, 66.7 per cent were low risk and 14.8 per cent of them were found to be high risk.

Five expectant mothers of middle income group were expected to have high risk pregnancy. While only 20 per cent were high risk, 60% were low risk and 20 per cent had medium risk.

This results from low and middle income group reveal that this criteria is reliable in 49.7-55.9 per cent of the cases for low risk, 19.5-40.7 per cent of the cases for medium risk, 20-30.9 per cent of the cases for high risk,

7. Risk levels based on nutritional status of the expectant mothers

Table VII presents the per cent of the expectant mothers grouped into three categories, namely those who have a good nutritional status, those who have a medium nutritional status and those who have a poor nutritional status.

TABLE VII

PERCENTAGE OF ESPICIANI IN THE FOLLOWING GOOD, MEDIUM OR POOR NUTRITION IN THE TWO INCOME GROUPS

	Good			Medium			Poor		
	N	%	N	%	N	%	N	%	
Income Delivery									
Low	47	100	0	0	122	100	0	0	
Expected	27	57.4	14	29.8	6	12.8	62	50.9	
Observed	46	100	0	0	43	100	0	0	
Middle	46	100	0	0	43	100	0	0	
Expected	30	65.2	11	23.9	5	10.8	26	60.5	
Observed	30	65.2	11	23.9	5	10.8	26	60.5	
High	14	100	0	0	14	100	0	0	
Expected	14	100	0	0	14	100	0	0	
Observed	14	100	0	0	14	100	0	0	
Low risk	47	100	0	0	122	100	0	0	
Expected	27	57.4	14	29.8	6	12.8	62	50.9	
Observed	46	100	0	0	43	100	0	0	
Middle risk	46	100	0	0	43	100	0	0	
Expected	30	65.2	11	23.9	5	10.8	26	60.5	
Observed	30	65.2	11	23.9	5	10.8	26	60.5	
High risk	14	100	0	0	14	100	0	0	
Expected	14	100	0	0	14	100	0	0	
Observed	14	100	0	0	14	100	0	0	
Low risk Medium risk High risk	47	100	0	0	122	100	0	0	
Expected	27	57.4	14	29.8	6	12.8	62	50.9	
Observed	46	100	0	0	43	100	0	0	
Middle risk Low risk Medium risk High risk	46	100	0	0	43	100	0	0	
Expected	30	65.2	11	23.9	5	10.8	26	60.5	
Observed	30	65.2	11	23.9	5	10.8	26	60.5	
Low risk Medium risk High risk	46	100	0	0	43	100	0	0	
Expected	30	65.2	11	23.9	5	10.8	26	60.5	
Observed	30	65.2	11	23.9	5	10.8	26	60.5	
Low risk Medium risk High risk	46	100	0	0	43	100	0	0	
Expected	30	65.2	11	23.9	5	10.8	26	60.5	
Observed	30	65.2	11	23.9	5	10.8	26	60.5	

Among the 300 expectant mothers studied 47 were expected to be low risk with reference to nutritional status as per given in the index. Among these mothers, the actual deliveries reveal that only 57.4 per cent had low risk, 29.8 per cent had medium risk and 12.8 per cent were found to have high risk. Out of the 122 mothers who were expected to have medium risk only 37.7 per cent had actual medium risk, 50.8 per cent had low risk and 11.5 per cent had high risk. Out of the 131 mothers whose deliveries were expected to be high risk, only 22.9 per cent had actual high risk pregnancy, 40.4 per cent had low risk and 36.6 per cent had medium risk.

Among the 100 mothers studied in middle income, 46 expectant mothers had a good nutritional status and were expected to be at low risk. But the actual delivery revealed that 65.2 per cent had low risk, 23.9 per cent were medium risk and 10.8 per cent were high risk.

Forty three mothers were expected to be medium risk with reference to nutritional status, but actual medium risk was observed only in 13.9 per cent of the expected cases. Low risk was observed in 50.5 per cent and high risk in 25.6 per cent of the cases.

Eleven mothers were expected to have high risk but while observing, it was found that only 9 per cent were high risk, 36.4 per cent at low risk and 54.5 per cent at medium risk. These results with regard to the nutritional status in the low income and the middle income reveal that the index is reliable in 57.4 - 65.2 per cent of the cases for low risk, 13.9-37.7 per cent of the cases for medium risk and 9-27.9 per cent of the cases for high risk.

3. Age and stage of pregnancy of the expectant mothers related to the risk levels involved in pregnancy

Table VIII presents the number and percentage of expectant mothers grouped in to three categories, namely those who were at the age of below 19 or above 35 years during primipara, those who were in the age group of 19-20 years or 30-35 years and those who were in the age group of 20-29 years

TABLE VIII

PERCENTAGE OF AIRBORNE BOMBERS FALLING INTO SEVERE DIFFERENT AGE GROUPS AT PHOENIX IN LOW AND HIGH RISK

INCOME GROUPS

		20 - 29 years		30-35 years		Below 30 or above 35	
		High risk	Medium risk	Low risk	High risk	Medium risk	High risk
		%	%	%	%	%	%
Low	Expected	191	100	0	0	0	0
	Observed	92	50.9	62	34.2	27	14.9
	Expected	65	100	0	0	0	0
	Observed	36	55.3	16	24.6	13	20

Out of the 300 mothers studied in the low income group 191 mothers were expected to have low risk pregnancy since they were at the age group of 20-29 years during primipara. But while observing the actual delivery only 50.8 per cent were found to have low risk, 34.2 per cent medium risk and 14.9 per cent were high risk. Among the 99 mothers who were expected to have medium risk. Only 35.3 per cent had actual medium risk, 43.9 per cent were low risk and 16.6 per cent were high risk. Thirty mothers were expected to have medium risk as per the norms of the risk index and the actual delivery observed revealed that only 13.3 per cent had high risk, 55.3 per cent had medium risk, and 33.3 per cent had low risk.

Out of the 100 expectant mothers observed in the middle income group 65 mothers were expected to have low risk pregnancy: Actual performance at delivery revealed that 36 cases, working out to a percentage of 55.3 per cent were low risk, 24.6 per cent had medium risk and 20 per cent had high risk. Twenty six mothers were expected to have medium risk according to the index whereas only 15.3 per cent of them had medium risk, 57.6 per cent had low risk and 26.6 per cent of the cases were found to have high risk. Nine mothers were expected to have high risk pregnancy while the actual delivery revealed that only 11.1 per cent of them had actual high risk, 22.2 per cent had medium risk and 66.6 per cent had low risk.

These results with low income and middle income reveal that the index is reliable in 50.8-55.5 per cent of the cases for low risk, 15.3 - 33.3 per cent of the cases for medium risk 11.1 - 13.3 per cent of the cases for high risk.

Table VIII reveals the per centage of expectant mothers classified according to the number of pregnancies in the two income groups.

SABLE IX

PER CENTAGE OF AIRPOLLUTE MEASURES CLASSIFIED ACCORDING TO NUMBER OF PRECIPITATIONS IN THE TWO INCOME GROUPS

	2, 3	1, 4, 5	Above 5															
Income Delivery	Low risk	Medium risk	High risk	Low risk	Medium risk	High risk	Low risk	Medium risk	High risk	Low risk	Medium risk	High risk	High risk					
	N	%	N	%	N	%	N	%	N	%	N	%	%					
Expected	150	100	0	0	0	0	0	0	137	100	0	0	0	13	100			
Income Observed	91	54.0	45	30.0	24	16.0	61	44.5	55	40	21	15.3	9	61.5	4	30.9	1	7.7
Middle Expected	39	100	0	0	0	0	0	0	60	100	0	0	0	0	0	0	2	100
Income Observed	29	73.7	7	19.4	3	7.9	27	45.0	17	29.3	16	26.6	0	0	1	0.9	1	50.0

Out of the 300 expectant mothers studied in the middle income 150 mothers were expected to have low risk with reference to the para of pregnancy according to the index. The observation of the actual delivery revealed that only 54 per cent of them had low risk, 30 per cent had medium risk and 16 per cent had high risk. Out of the 137 expectant mothers who were expected to have medium risk since they had first or fourth or fifth para only 40.1 per cent had actual medium risk, 44.5 per cent had low risk and 15.3 per cent were observed to have high risk. Thirteen mothers were categorized under high risk while only 7.7 per cent had high risk, 61.5 per cent had low risk and 30.8 per cent had medium risk,

Out of the hundred expectant mothers of middle income who were studied, 50 mothers were expected to have low risk. The actual performance during delivery revealed that 73.7 per cent had low risk, 18.4 per cent had medium risk and 7.9 per cent of the cases had high risk. Among the 60 mothers who were expected to have a medium risk pregnancy only 23.3 per cent had actual medium risk, 45 per cent had low risk and 26.6 per cent had high risk. Two mothers were expected to have a high risk pregnancy among whom one mother had actual high risk and the other one had medium risk.

These results in the low and middle income reveal that the index is reliable in 54-73.7 per cent of the cases for low risk, 44.5 - 45 per cent of the cases for medium risk 77.50 per cent of the cases for high risk,

10. History of previous pregnancy

Table IX indicates the percentage of expectant mothers grouped into three categories with reference to the history of previous pregnancy,

TABLE X

PERCENTAGE OF MOTHERS WHO HAD DISADVANTAGES STILL BORN AND MORTALITY RATE IN THE TWO INCOME GROUPS

Income	Low risk			Medium risk			High risk										
	N	%	High risk	N	%	High risk	N	%	High risk								
Expected	224	100	0	0	0	1	100	0	0	0	0	0	0	75	100		
Observed	115	51.3	75	23.4	34	15.7	1	100	0	0	0	30	40.0	32	42.6		
Middle Income	69	100	0	0	0	0	1	100	0	0	0	0	0	0	30	100	
Low Income	36	52.1	13	26	15	21.7	1	100	0	0	0	19	63.3	4	13.3	7	23.3
Σ																	

Out of the 300 expectant mothers observed, 224 mothers were expected to have low risk as per the index with reference to the mothers previous pregnancy. The actual delivery revealed that, only 51.3 per cent of the cases had low risk, 33.4 per cent had medium risk and 15.7 per cent had high risk. One mother was expected to have medium risk according to the index whereas/ whereas no one was found to have medium risk as well as high risk one person was observed to have low risk. Out of the 75 mothers who were expected to have high risk or pregnancy only 17.3 per cent were observed to have high risk, 42.6 per cent had medium risk and 40 per cent had low risk.

Among the 100 expectant mothers of the middle income observed, 69 mothers were expected to have low risk because they did not have any miscarriages or still births or neonatal mortality. But the actual delivery revealed that only out of them 52.1 per cent of the cases had low risk, 18 per cent had medium risk and 21.7 per cent had high risk. One person was expected to have medium risk whereas 20 one had medium risk. One person was observed to have low risk. Among the 30 mothers who were expected to have a high risk only 23.3 per cent had high risk, 63.3 per cent had low risk and 13.3 per cent had medium risk.

These results in the low and middle income group reveal that the index is reliable in 51.3 - 52.1 per cent of the cases for low risk, 0-1 per cent of the cases for medium risk 17.3 - 23.3 per cent of the cases for high risk.

11. Risk levels based on type of previous delivery of the expectant mother

Table XI presents the percentages of expectant mother grouped into three categories with reference to the type of previous delivery.

TABLE XI

PERCENTAGE OF MOTHERS PRESENTING HISTORY OF PREVIOUS DELIVERY IN BOTH THE INCOME GROUPS

		normal				Prolonged labour, toxemia				Caesarian, forceps of breech								
		Low risk		Medium risk		High risk		Low risk		Medium risk		High risk						
		N	%	N	%	N	%	N	%	N	%	N	%					
Expected	174	100	0	0	0	0	2	100	0	0	0	0	0	20	100			
Observed	94	54.0	61	35	19	10.9	1	50.0	1	50.0	0	0	5	25.0	1	5.0	14	70.0
Expected	44	100	0	0	0	0	0	0	0	0	0	0	0	0	0	6	100	
Observed	29	65.9	10	22.7	5	11.3	0	0	0	0	0	0	3	50.0	0	3	50.0	

Out of the 300 expectant mothers studied 174 mothers were expected to have low risk as per the norms of the index with reference to their previous delivery. But the percentage of cases observed to have low risk was found to be 54, 61 per cent of the had medium risk and 10.9 per cent had high risk. Out of the mothers who were expected to have medium risk only one had actual medium risk and the other one was found to have low risk and no one had high risk. Among the 20 mothers who were expected to have high risk, only 70 per cent had actual high risk, 25 per cent were observed to have low risk, and 5 per cent were found to have medium risk. Out of the 100 mothers who were studied in the middle income group 44 mothers were expected to have a low risk delivery with reference to their previous delivery. But the actual performance during delivery revealed that 65.9 per cent of them only had low risk 25.7 per cent had medium risk and 11.5 per cent were found to have high risk. No one in the middle income group was expected to have medium risk pregnancy according to the norms of the index and no mothers were found to have medium risk pregnancy. But of the 6 mothers who were expected to have high risk since they had a caesarian section or breach or forceps delivery, 50 per cent of them were observed to have actual high risk; 50 per cent of them had low risk and no mothers were found to have medium risk.

These results from the low and the middle income indicate that the index is reliable-in 54 - 69.9 per cent of cases for low risk, 50-100 per cent of cases for medium risk and 50.0 - 70.0 per cent of cases for high risk.

12. Birth weight of the previous children and outcome of pregnancy:

Table XII indicates the number and per centage of expectant mothers grouped into three categories namely, those who gave birth to infants weighing above 2.5 kg, those whose children's birth weights were 2-2.5 kg and whose birth weights were below 2kg.

Out of the 300 expectant mothers observed 121 mothers were expected to have a low risk pregnancy with reference to the birth weight of the previous children according to the index. The actual deliveries observed reveals that only 67.9 per cent of the expected cases had low risk, 21.5 per cent had medium risk and 10.7 per cent had high risk. Among the 69 expectant mothers who were expected to have medium risk 52.2 per cent had medium risk 24.6 per cent had low risk and 23.2 per cent had high risk. Out of the 6 expectant mothers who were expected to have high risk only 66.7 per cent had actual high risk, 16.7 per cent had low risk and 16.7 per cent had medium risk.

Among the 100 expectant mothers of middle income group 33 mothers were expected to have low risk. While observing the actual delivery it was noticed that 91.9 per cent of the expectant mothers had low risk, 19.2 per cent had medium risk and no one had high risk. Among the 16 mothers who were categorised under medium risk, 43.9 per cent had actual medium risk, 56.3 per cent had low risk and no one had high risk. No one was expected to fall under the category of high risk with reference to birth weight of previous children and no one was observed to have the same also.

These results obtained from the expectant mothers of low and middle income reveal that this criteria is reliable in 67.9 - 91.9 per cent of cases for low risk, 43-52.2 per cent of the cases for the medium risk and 100 per cent of cases for high risk.

To make this criteria more reliable the low risk range was changed from above 2.5 to 2.5 and above. By this modification it was noticed that χ^2 test gave a value of 4 for low income group and 3.1 for middle income group at 5% level of significance proving that the fit of the criteria is good for both the income group.

To summarize all the criteria together the total expected and observed low, medium and high risk deliveries were computed and the same are presented in table XIII

TABLE XIII

EXPECTED AND OBSERVED RISK LEVELS IN BOTH THE INCOME GROUP

Income	Delivery	Low risk		Medium risk		High risk	
		N	%	N	%	N	%
Low Income	Expected	164	54.7	120	40.0	16	5.3
	Observed	133	44.3	106	35.3	61	20
Middle Income	Expected	69	69	25	25	6	6
	Observed	62	62	19	19	20	20

Table XIII represents the total number and per cent of expectant mothers who were expected to fall under the three

categories of low, medium and high risk and the actual number and per centage of expectant mothers who were observed to fall under the three groups.

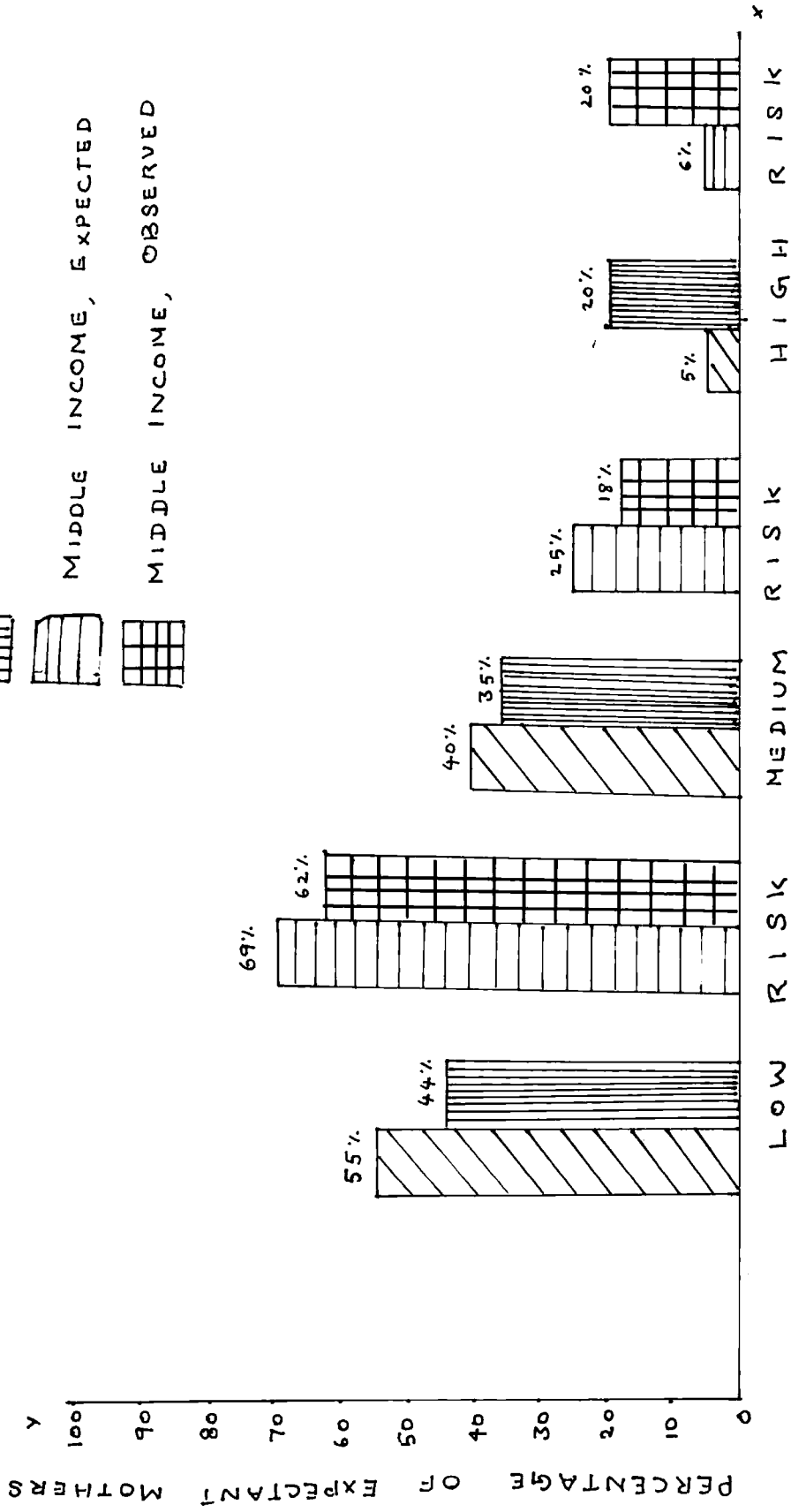
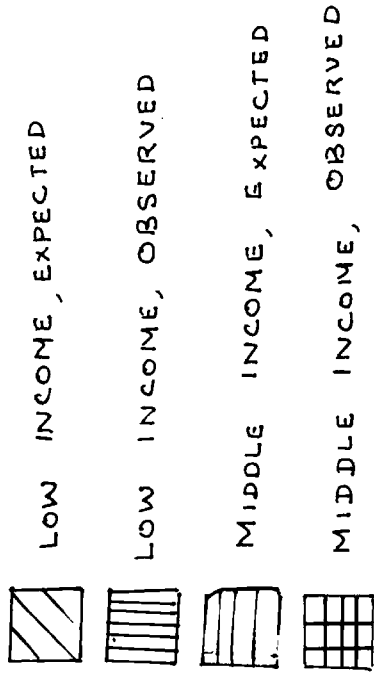
Out of the 500 mothers from the low income group 54.7 per cent of the mothers were expected to have low risk pregnancies, while the actual performance during delivery revealed 44.3 per cent of the mothers to be low risk. Forty per cent of the mothers were expected to have medium risk according to the index while 35.5 per cent were observed to have high risk. Among the 500 expectant mothers 5.3 per cent were expected to have high risk but 20 per cent were found to have high risk.

Among the 100 expectant mothers observed in the middle income group 69 per cent of them were expected to have low risk with reference to the index, whereas 62 per cent were found to have low risk, 23 per cent of the mothers were expected to have medium risk considering all the ten criteria and 19 per cent were observed to have actual medium risk. Six per cent were expected to have high risk among the middle income group but 20 per cent were found to have actual high risk.

These results indicate that the index on the whole is reliable in 91.8-39.9 per cent of the cases for low risk and 72.99.3 per cent of the cases for medium risk. There was a three to four fold increase in the case of high risk. Only 5.3 per cent were expected with reference to the index whereas 20 per cent had high risk in the low income. In the middle income group there ^{was} a three fold increase.

Figure II represents the percentage of expectant mothers falling in the different ranges of risk levels with reference to the index as a whole and the percentage of expectant mothers who were observed to have various risk levels.

KEY



THE VARIOUS RISK LEVELS EXPECTED WITH REFERENCE TO THE INDEX AND THE RISK LEVELS OBSERVED AMONG THE EXPECTANT MOTHERS OF LOW AND MIDDLE INCOME

FIGURE 11

V SUMMARY AND CONCLUSION

This study was undertaken to check the validity of the nutritional status index for expectant mothers which had been formulated. The index has 10 criteria and the validity of each criteria was checked separately and together. From the low income group 300 expectant mothers and from the middle income 100 expectant mothers were randomly selected for this study. For each sample all the criteria were applied and the validity checked. The findings of this study are as follows.

1. With reference to prepregnant weight both in the low and middle income group the criteria was found to be reliable in 75.3-79.9 per cent for low risk, 36.3-62.9 per cent for medium risk and 31.1-35.7% for high risk. The range of the weights for low, medium and high risk were reduced to make the criteria more reliable statistically.
2. While considering the term weight of pregnancy of the expectant mothers, the criteria was found to be reliable in 72.4-75 per cent of the cases for low risk, 41.4 - 62.0 per cent of the cases for medium risk and 22.2 - 31.3 per cent of cases for high risk.

The range of weight at term of pregnancy regarding the risk levels were reduced to make the criteria more reliable.

3. The criteria of weight gain during pregnancy was found to be reliable in 30-37 per cent of the cases for low risk, 11.6 - 51.9 per cent of the cases for medium risk and 20 per cent of the cases for high risk.
4. While the height of the expectant mothers were taken in to consideration, the criteria was found to be reliable in 54.1-65.8 per cent of the cases for low risk, 29.5- 45.3 per cent of the cases for medium risk and 16.7 - 45.5 per cent of the cases for high risk. In order to make this criteria more reliable the ranges for various risk levels were reduced.
5. When the next criteria haemoglobin was considered, the criteria was found to be reliable in 53.3-59.3 per cent of the cases for low risk 53.9-56.7 per cent of the cases for medium risk and 18.4-19.9 per cent of the cases for high risk.
6. Toxaemia, the next criteria was found to be reliable in 49.7-55.9 per cent of the cases for low risk, 19.8-40.5 per cent of the cases for medium risk and 20-30.8 per cent of the cases for high risk.

7. With reference to nutritional status Criteria it was found to be reliable in 57.4-65.2 per cent of the cases for low risk, 13.9-57.7 per cent of the cases for medium risk, 9.0-22.9 per cent of the cases for high risk.
8. While the age at primipara was taken into consideration, the criteria was reliable in 16-62 per cent of the cases for low risk, 15.3-33.3 per cent of the cases for medium risk and 11.1-13.3 per cent of the cases for high risk.
9. The next criteria, para of pregnancy was found to be reliable in 54.0-73.7 per cent of the cases for low risk, 23.3-40 per cent of the cases for medium risk and 7.7 - 50.0 per cent of the cases for high risk.
10. The criteria of history of miscarriages, still births or neonatal mortality was found to be reliable in 51.3-52.1 per cent of the cases for low risk, 100 per cent of the cases for medium risk and 17.3-23.3 per cent of the cases for high risk.
11. When the criteria of the type of previous delivery was considered, the criteria was found to be reliable in 54.0-65.9 per cent of the cases for low risks,

50-100 per cent of the cases for medium risk and 50-70 per cent of the cases for high risk.

12. The birth weight of the previous children was the next criteria considered. This criteria was found to be reliable in 67.3-81.8 per cent of the cases for low risk, 45.9-52.2 per cent of the cases for medium risk and 66.7-100 per cent of the cases for high risk. In order to make the criteria more reliable the range for low risk was reduced slightly.

The prepregnant weight, weight at term of pregnancy, height and haemoglobin level of the expectant mothers of the low income group was found to be less than that of expectant mothers of the middle income group.

Though there are variations when each criteria was considered separately, while observing the validity of the index as a whole, it was found that the index is reliable in 91.1-99.9 per cent of the cases for low risk, 72-93.3 per cent of the cases for medium risk. In the case of high risk there was a three fold to fourfold increase than the expected value.

It is obvious from these results and summary that the nutritional status index is reliable in a great number of cases and when applied can help as a guideline to give ^awarning

signal to deserving cases. This will enable nutrition workers and medical people to give adequate or extra care to the high risk mothers, so that maternal and neonatal mortality could be checked to some extent atleast.

BIBLIOGRAPHY

Mann, S.O.,
Barr, G.D.,
Hunemann, R.M.
1973

"Effects of nutritional
supplementation in pregnancy"
Journal of American Dietetic Association
Vol 72, No.2, p.144.

Antia, P.P.
1975

Clinical Dietetics and Nutrition
Oxford medical publications,
Delhi, pp.576-577.

Apte, S.V.,
Leela Iyengar.,
1971

"Effects of maternal iron
supplementation of placental iron"
American Journal of obstetrics
and Gynaecology, Vol.110, No.3,
pp.350-351

Aykroyd, M.R.,

Conquest of deficiency diseases
Achievements and prospects WHO
P. 94-95.

Balasubramanian, G.,
1975

"Special issue "Nutrition and
pregnancy. National Institute of
Nutrition, Vol.9, No.3, p.1

Baker, S.J.,
1973

Bulletin, WHO. pp-49.

Bassiani, H.,
Eddstein, L.,
Metc, J.,
1970

"Reduction of incidence of
prematurity by folic acid supple-
mentation in pregnancy", British
medical journal Vol 34.9.29

Beal, V.A.,
1971

"Nutritional studies during
pregnancy". Journal of American
Dietetic Association,
Vol.59, No.41, p. 921.

Beaton, G.H.,
Bengoe, J.M.,
1976

"Nutrition in preventive medicine.
The major deficiency syndromes
epidemiology and approaches to
control". WHO Geneva, monograph
series No.62, pp. 63-64

Bhalla, J.M.,
Bhalla, M.,
London, S.,
1979

"A study of babies delivered by
breech presentation". Indian
Journal of pediatrics, Vol.46,
p. 357

Bhargava, K.,
Vijaya Bhargava.,
Sudershan.,
Kumari.,
Shantha Madhavan.,
Shastri Chosh.,
1974

"Outcome of babies with severe
intra-uterine growth retardation",
The Indian Journal of Medical
Research, Vol. 62, No. 7, pp.367 -369

Bhawanani, S.G.,
Price.,
Laurence, K.,
Gius, M.,
1973

"Risks and prevention of cervical
cord injury in the management of
breech presentation with
hyperextension of the foetal head"
American Journal of obstetrics
and Gynaecology, Vol,115 p.1159.

Bhanjara, G.,
1975

"Effect of maternal malnutrition
on maternal health and the outcome
of pregnancy". Nutrition, Vol.9
No.3, pp.15-17.

Bhat Nagar, B.,
Kamesh, S.,
1973

"Prediction of perinatal outcome
by assessing foetal maturity"
Indian Journal of pediatrics,
Vol.55, No.368, p.279.

Cameron, A.,
Hofmader
1976

Protein-calorie Advisory
Group of the United Nations
system. Manual of feeding infants
and young children pp 1-4

Campbell, D.,
Maki, H.,
Pirani, S.,
1976

"The cause of the fall in
serum folate level in normal
pregnancy". Food and Nutrition
Notes and Reviews, Vol.33, No.3.

Chenaria, I.
1973

"Folate metabolism in pregnancy"
Nutrition, Vol.27, No.1, p.7

Chowdhury, M.R.,
1964

"Place of caesarean section in
breech presentation". Journal
of obstetrics and Gynaecology of
India,
Vol.14 p.94

Chowdhury, M.N.R.,
1975

"Role of protein deficiency in
toxemias of pregnancy". Journal
of American Dietetic Association,
Vol. 66, No.1, p.87

Courey, H.G.,
Kino, J.S.
1972

"Relationship of maternal
nutrition and weight gain to new
born infants". Obstetrics
Gynaecology vol 39, pp.460-465

Dawn
1973

"Prenatal dietary pattern in
Bengali women and its bearing of
anaemia in pregnancy". Journal of
American Dietetic Association,
Vol . 61, No.16, p.429

Devadas, R.P.
1970

"Social and cultural factors influencing malnutrition" Journal of Home Economics, Vol.32, p.164

Devadas, R.P.,
Vijayalakshmi, R.,
Vanitha, P.
1978

"Impact of nutrition on pregnancy, lactation and growth performance of extrauterine foetus". Indian Journal of Nutrition and Dietetics, Vol.15, No.2, pp. 31-36

Albaghdadi, S.,
Koursi, G.S.,
Karsouk, A.W.,
1971

"The effects of maternal nutrition on anthropometric measurements and other clinical findings in the off spring". Proceedings of the 6th symposium on nutrition and health in the near east p.29

Frieden, E.
1970

"Plasma Amino Acids in Maternal underweight" Nutrition Reviews Vol.28, No.3, p.23

Ghosh, S.,
Sudershan.,
Kumari.,
Bhargava, S.A.,
1972

"Growth and development of babies with severe intrauterine growth retardation". Proceedings of the Nutritional Society of India, No.11, pp.1-3

Ghosh, S.
1976

"The feeding and care of infants and young children, UNICEF, Year, New Delhi, p.36

Gopalan, C.
1962

"Effect of nutrition on pregnancy and lactation". World Health Organisation Bulletin, No.26.

Gopalan, G.
1970

"A report of the first fifty years of the National Research laboratory". Nutrition Reviews, Vol.29, No.1, pp. 5-6

Gopalan, G.
1973

"Nutrition, fertility and reproduction". Proceedings of the nutrition society of India, No.14, pp.49-55

Gopalan, G,
Vijaya Nageswara
1971

Nutrition atlas of India NIN. ICMR,
p - 60

Gopalan, G.
Balasubramanian, G.G.,
Rameswari, B.V.,
Visweswara Rao,
1971

Diet of pregnant women Diet status of India, NIN - ICMR, pp 60-61

Harish Chandras
1971

"Birth weights of infants of different economic groups in Hyderabad". Proceedings of the nutrition society of India, NIN, pp. 99-103

Herbert, V.
1970

"Introduction to symposium of folie acid deficiency". American Journal of clinical nutrition, Vol-23, 971.

Husain, F.G.,
Saias, H.F.
1980

American Journal of Obstetrics and Gynecology Vol.136, No.1, pp 10-2

Nyten, P. E.
1974

"Nutrition Journal in pregnancy".
The practitioner, Vol.212,
pp.459-464

Lba.,
Miswender, J.D.,
Woodwillie, M.
1974

"Relation of prenatal care
to birth weights major malformations
and new born deaths of
American Indians". Journal of
American Dietetic Association,
Vol.64, No.2, p.317

ICMR
1971

"Growth and physical development
of Indian infants and children.
ICMR Technical report Series
No.19, pp.1, 22

Idnani, M.,
Sharma.,
Saxena, S.
1979

"Effect of maternal factors on
the clinical features morbidity
and mortality of the newborn".
Indian Journal of pediatrics ,
Vol. 46, p.49

Indira Khali.,
Drena Ali
1975

"A clinico-epidemiological study
of perinatal mortality". The
Indian Journal of Medical
Research.

Iyengar, M.,
Srikantia, S.G.
1970

"Serum alkaline phosphatase in
pregnancy". American Journal of
clinical Nutrition, Vol. 29,
pp. 69-72

Iyengar, M.
1971

"Folic acid requirements of Indian pregnant women" American Journal of Obstetrics and Gynecology, Vol. 111 pp.13-1

Iyengar, M.
1972

"Influence of diet on the outcome of pregnancy". Proceedings of the Ninth international congress in Nutrition, pp.55.

Jelliffe
1966

"The assessment of the nutritional status of the community" world Health Organization monograph series No.55, pp.55, 97-99, 212.

Kapur, S.,
Hansen, K.C.,
Jesudian, G.
1971

"Height and weight of South Indian women of child bearing age and their effect of birth weight and length of the baby" Indian Journal of Medical Research Vol.59, No.9, pp.1490-1497.

Klipstein, F.A.
1967

"Intestinal diase conjugase activity in tropical sprue". American Journal of clinical Nutrition, Vol.25, p. 1004.

Krause,
Husscher
1972

Nutrition for pregnancy and lactation. Food Nutrition and diet therapy, published by W.B. Saunders' company, 5th edition, pp. 257-298

Kusin, A.J.,
 Adrie, M.,
 Voorhoeve, A.A.J.,
 Jansen.,
 Sheila.,
 Lakshmi.,
 Mannetje, W. t.
 1979

"A longitudinal study of pregnant women in relation to outcome of pregnancy in kenya". The Indian Journal of Nutrition and Dietetics, Vol.16, No.5, pp.195-204.

Knutzen, Y.E.,
 Davey, D.A.,
 1979

"The relationship between maternal height and weight at perinatal mortality" in Nutrition Abstracts and Reviews Vol.49 No.7, Abstract No.4960-5566

Lahiri, S.C.
 1964

"Hazards of breech presentation" Journal of Obstetrics and Gynecology India, Vol.14 p.94.

Lechtig, A.,
 Delgado, H.,
 Klein, R.E.,
 Habiet, J.P.,
 Behar, A.
 1976

"Maternal nutrition and foetal growth in developing countries" American Journal of Diseases Child, Vol 129, p.155

Nadhy Nath.,
 Geervani
 1978

"Diet and nutrition of pregnant and lactating women and infants of urban slums of Hyderabad". The Indian Journal of Nutrition and Dietetics, Vol.15, No.12 pp.422-429.

Maidha, R.M.,
 Gulati, P.V.,
 Chahilani, S.D.,
 1970

"Influence of socio-economic and environmental factor on birth weight" Indian Journal of Medical Research Vol.59, No.5, pp.651-659

Malathi, D.
 1985

"Dietary requirements of pregnant women special issue. Nutrition and pregnancy" MIN, Vol.9, No.3 p.2

Mukherjee, D.K.,
Sethna, S.J.
1970

"Birth weight and its relation
with certain maternal factors"
Indian Journal of Pediatrics,
Vol. 57, No. 272, pp. 462-468

Maayo, R. M.
1979

"Weight gain and the outcome
of pregnancy" in Nutrition
Abstracts and Reviews
Vol. 50, No. 7 Abstract #0-0309-
1295

NIN
1965

"Weight changes during pregnancy
and lactation". National
Institute of Nutrition, Annual
Report, pp 6-7

NIN
1966

National Institute of Nutrition
Annual Report, pp. 66

NIN
1969

"Report of the study group on
nutritional anemia Importance
of the problem" Nutritional
Society of India, pp. 1-2

NIN
1972

"Studies on the chemical
composition" of human brain"
National Institute of Nutrition,
Annual Report, p. 150

NIN
1975

"Studies on foetal growth and
development". National Institute
of Nutrition, Annual Report
pp. 119-120

NIN
1978

"Care of pregnant women"
National Institute of Nutrition.
Indian Council of Medical
Research, Hyderabad India. p.46

NIN
1979

National Institute of Nutrition
Annual report, pp 57-70

NIN
1980

"A mother- the care she needs"
National Institute of Nutrition
Indian Council of Medical
Research Hyderabad, India
p.25

Peerson, W.J.
1974

Journal of American Medical
Association pp. 1939-1940

Prem, K.
1979

"Pregnancy and lactation. Some
nutritional aspects". Indian
Journal of Medical Research.
Vol.69, pp 70-79

Pitkin M.R.
1977

"Pregnancy" Published by W.B,
Saunders Company, pp 3-13

Rajalakshmi, K.,
1975

"Effects of folic acid
supplement on birth weights".
American Journal of Obstetrics
and Gynaecology, Vol.123,
pp.332-336

Roberts, J.A.,
Hill, G.W.,
Riopelle, A.J.
1974

"Maternal protein deprivation and toxemia of pregnancy - studies in the rhesus monkey". American Journal of Obstetrics and Gynecology, Vol.119, No.1, P.14.

Robinson, A.G.
1975

"Nutrition during pregnancy and lactation" Normal and Therapeutic Nutrition, 14th Edition, Oxford and 13th publishing company New Delhi, p.91-102

Rubin, A.,
Orlans, J.
1965

Results in breech presentation American Journal of Obstetrics and Gynecology vol.96, p.1048.

Ruth, M.
1976

"Mothers diet during pregnancy and lactation". Food and Nutrition, Notes and reviews, Vol.53, No.4, pp.153-154

Shah and Shah.,
Edvani, P.A.,
1980

Indian Pediatrics Vol.6, p.651.

Srivatsava, R.,
Srivatsava, L.,
Gulathi, B.
1972

"Observation on low birth weight babies". Journal of Obstetrics and Gynecology, Vol.22, p-234

Steward
1971

"Maternal diet and brain development" Nutrition Journal of Dietetics Food catering and child Nutrition Vol. 25, No.3, p.147

Symonds, S.R.
1990

"Aetiology of pre-Eclampsia - a review" Journal of the Royal Society of Medicine and Academic Press, London, Vol.73 , No.12, p.971.

Thomas Zepf,
1974

"Diet survey of pregnant women
Nutrition in Punjab" Punjab Nutrition development project, pp.29-32

Zoo, T.
1972

Ph.D. thesis University of London

Vannotti, A.
1970

"Iron deficiency, Pathogenic clinical aspects, therapy", Published by Academic Press. pp.493-499.

Varley, H.
1975

"Fractional Biochemistry". published by Arnold Heinemann publishers, pp. 256-259

Venkatachalam, P.S.,
Shankar, K.,
Gopalan, C.
1960

Changes in body weight and body composition during pregnancy" Indian Journal of Medical Research, Vol.49, p.511

Vijayalakshmi, R.,
Mary Jacob,
Devadas, R.P.
1975

"Relationship between diet during pregnancy and nutritional status of the new born". The Indian Journal of Nutrition and Dietetics, V 1.12, No.9, pp. 233-236

Vijalakshmi.,
Devasas, R.P.
1930

A Ph.D. Thesis submitted
to Madras University.

Wadsworth, G.R.-
1980

"Anemias due to deficient
diets". Nutrition Journal
of Dietetics, Food catering.
Vol.24, No.4, p.225-228

WHO
1972

"The prevention of perinatal
morbidity and mortality".
Report on a seminar, World
Health Organisation, No.42
pp. 61-63

WHO
1975

"Control of nutritional
anemia with special reference
to iron deficiency". World
Health Organisation Technical
Report Series, p-6

WHO
1976

"New trends and approaches
in the delivery of maternal
and child care in health
services, care during pregnancy
and labour. World Health
Organisation Technical report
series, No. 600, pp. 49-51

Wynn, H.,
Wynn, A.
1975

"Nutrition counselling in the
prevention of low birth weight"
clinical obstetrics and
Gynaecology, Vol.16, No.1,
p.190

Yusuffi
1973

"Iron and folate and Vitamin B 12
nutrition in pregnancy. A
study of 1,000 women from
Southern India", World Health
Organisation Bulletin, Vol.48
pp.15.

APPENDICES



APPENDIX E

Estimation of haemoglobin by cyanmethaemoglobin method.

The haemoglobin is treated with a reagent containing potassium ferricyanide, potassium cyanide and potassium dihydrogen phosphate. The ferricyanide forms methaemoglobin which is converted to cyanmethaemoglobin by the cyanide.

Reagents.

1. Drapkin's diluent solution
Sodium bicarbonate - 1 gm
Potassium cyanide - 0.05 gm
Potassium ferricyanide - 0.20 gm
Distilled water - 1 litre

This solution is preserved in dark brown bottle and preferably under cold storage. Its preparation and handling should be done with great care. This solution should not be used after it forms a precipitation at the bottom of the storage bottle.

Procedure:

1. Exactly 5 ml of drapkin's diluent solution is measured in to a dry test tube from a burette (or) a pipette with suction bulb.

2. Exactly 0.02 ml of blood is transferred from a standard haemoglobin pipette into a diluent solution.

Usual care in filling and cleaning of loaded haemoglobin pipette must be observed.

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

4. The blood and the diluent are thoroughly mixed by rotating the tube.

5. Ten minutes time is allowed for the formation of the cyanmethaemoglobin.

6. 5 ml of diluent solution is used as blank

7. The readings are taken in a photo electric colorimeter at 540 μ g.

Calibration procedure.

1. Total blood iron is determined by wong's method. This determination would give absolute amount of haemoglobin.

2. Exactly 0.02 ml of this known blood sample is measured into 5.0, 7.5, 10.0, 12.5 and 15.0 ml of diluent solution. These are now equivalent to blood samples containing respectively 100, 67, 50, 40.

of that original solution -

3. The intensity of the colour is read using green filter 540 against diluent as blank set at zero optical density
4. On a graph paper a standard graph is drawn using these haemoglobin concentration and corresponding density values.

APPENDIX II

QUESTIONNAIRE TO ELICIT THE INFORMATION ABOUT THE NUTRITIONAL
STATUS OF THE EXPECTANT MOTHERS

Foods	Included or Not	Frequency of inclusion

Non Vegetarian		
Green Leafy Vegetables		
Fruits		
Milk		
Pulses		
Cereals		
Vegetables		
Roots and Tubers		

APPENDIX III A

PREPREGNANT WEIGHT OF THE EXPECTANT MOTHERS OF LOW INCOME IN kg.

1.	38	24.	50	47.	49	70.	46	93.	46
2.	41.5	25.	52	48.	46	71.	45.5	94.	32.5
3.	39	26.)	44	49.	51	72.	47	95.	44
4.	45	27.	57.5	50.	46	73.	44.5	96.	46
5.	47	28.	40	51.	47	74.	47	97.	44.5
6.	49	29.	45	52.	39	75.	47	98.	39.5
7.	48.5	30.	94.2	53.	41	76.	57.5	99.	44
8.	39	31.	44	54.	37.5	77.	41	100.	40 -
9.	37.5	32.	49	55.	45	78.	37	101.	46
10.	41	33.	47.5	56.	49	79.	43	102.	45
11.	53.5	34.	41.5	57.	38	80.	38-	103.	35
12.	45	35.	39	58.	36.5	81.	35	104.	44
13.	43.5	36.	44	59.	51	82.	45.5	105.	44.5
14.	44	37.	39	60.	49.95	83.	39.5	106.	42
15.	34	38.	3	61.	42	84.	45	107.	46
16.	39	39.	40	62.	50	85.	43	108.	40
17.	46.5	40.	46	63.	47	86.	38	109.	47
18.	43	41	49.5	64.	45	87.	43	110.	43-
19.	41.5	42.	49	65.	37.5	88.	51.5	111.	51
20.	46	43.	46	66.	39	89.	43	112.	50
21.	41	44.	45	67.	40	90.	49.5	113.	40
22.	39	45.	40	68.	48.5	91.	54	114.	64
23.	42	46.	43.5	69.	42.5	92.	49	115.	35

116.	46	141.	40	166.	40	191.	39
117.	43	142.	45	167.	44.5	192.	59.5
118.	42	143.	52	168.	33.5	193.	39
119.	41	144.	45	169.	40	194.	39
120.	44 - x	145.	28	170.	45.5	195.	42
121.	45.5	146.	46	171.	40	196.	45
122.	49.5	147.	37	172.	44	197.	37
123.	43.5	148.	34.5	173.	37.5	198.	33.5
124.	43	149.	20.5	174.	40	199.	32
125.	41.5	150.	57	175.	41	200.	43
126.	39.5	151.	41.5	176.	39	201.	39
127.	50	152.	43	177.	49.5	202.	45
128.	39	153.	46	178.	36	203.	42
129.	45	154.	37.5	179.	51	204.	39.5
130.	50 -	155.	42	180.	35	205.	39
131.	40	156.	53	181.	46	206.	47
132.	55	157.	48	182.	48	207.	40
133.	47	158.	43	183.	32.5	208.	33
134.	45	159.	40	184.	41.5	209.	39
135.	60	160.	44.5	185.	40	210.	39
136.	44	161.	42.5	186.	43	211.	43.5
137.	45	162.	35	187.	44	212.	34
138.	44.5	163.	42.5	188.	45	213.	34
139.	46	164.	42.5	189.	48.5	214.	40
140.	47 -	165.	35	190.	45	215.	41

216.	39	239.	38	262.	41	295.	42
217.	41	240.	54	263.	31	296.	53
218.	44.5	241.	49	264.	42	297.	43
219.	42	242.	49	265.	32	298.	47
220.	34	243.	46	266.	31	299.	44
221.	43	244.	47	267.	39	290.	48
222.	41	245.	46	268.	36	291.	39
223.	43	246.	49	269.	41	292.	49
224.	43	247.	43	270.	46	293.	44
225.	31	248.	42	271.	42	294.	47
226.	35.5	249.	45	272.	59	295.	44
227.	45	2500	41	273.	30	296.	49
228.	33	251.	43	274.	46	297.	47
229.	41	252.	45	275.	46	298.	44
230.	45.5	253.	45	276.	49	299.	52
231.	42	254.	52	277.	36	300.	54
232.	32	255.	43	278.	46		
233.	53.5	256.	50	279.	49		
234.	50.5	257.	52	280.	45		
235.	47	258.	39	281.	42		
236.	35	259.	37	282.	56		
237.	45	260.	43	283.	43		
238.	44	261.	49	284.	44		

APPENDIX III B

PRE PROGRAMM BIRTH OF THE EXPLOITABLE MOVERS OF MIDDLE INCOME IN Kg.

1.	51	26.	50	51.	44	76.	50.5
2.	44	27.	45	52.	43	77.	34.5
3.	54	28.	45	53.	40	78.	41
4.	39	29.	58	54.	40	79.	36.5
5.	51	30.	50.5	55.	46.	80.	30
6.	54	31.	41.5	56.	39	81.	40
7.	50	32.	40.5	57.	45.5	82.	42
8.	51	33.	46	58.	33	83.	48.5
9.	44	34.	45	59.	46.5	84.	46
10.	39.	35.	33	66.	49.5	95.	99.5
11.	39.	36.	46.	61.	51.5	96.	44.5
12.	34	37.	48	62.	47	97.	58
13.	39	38.	46	63.	50	98.	48
14.	49	39.	56	64.	50	99.	41.5
15.	49	40.	42	65.	46	90.	49.5
16.	50.5	41.	54	66.	43.5	91.	53
17.	52	42.	49	67.	56.5	92.	43
18.	44.5	43.	42	68.	42	93.	42
19.	57.5	44.	53	69.	55	94.	39
20.	39	45.	45	70.	49	95.	43
21.	49.5	46.	42	71.	54.5	96.	54
22.	50.5	48	33	72.	41	97.	51
23.	55	49.	41.5	73.	49.5	98.	50
24.	44.5	49.	46	74.	59	99.	35
25.	44.5	50.	43.5	75.	43	100.	52

APPENDIX IV A

WEIGHT OF THE EXPECTANT MOTHERS OF LOW INCOME AT TERM OF PREGNANCY IN G.

1.	44	24.	57.5	47.	56	70.	52.5	93.	52.
2.	43	25.	59.5	48.	53.5	71.	53	94.	39
3.	44	26.	50.5	49.	58	72.	54	95.	49.5
4.	51	27.	63.5	50.	52	73.	51.5	96.	51
5.	51	28.	46	51.	53.5	74.	51	97.	50
6.	54	29	51	52.	45	75.	54.5	99.	44
7.	55	30.	47	53.	47.5	76.	66	99.	45.5
8.	45	31.	50.5	54.	44.5	77.	49	100.	46.5
9.	44	32.	55.5	55.	52	78.	42	101.	50.5
10.	47.5	33.	59.5	56.	54	79.	50.5	102.	50.5
11.	60	34.	49	57.	44.5	80.	44.5	103.	49.5
12.	50	35.	44	58.	41.5	81.	41.5	104.	50.5
13.	50	36.	50	59.	59	82.	53.5	105.	51
14.	50.5	37.	45.5	60.	56.5	83.	49	106.	47
15.	39.5	38.	50	61.	49	84.	50.5	107.	51.5
16.	45	39.	46.5	62.	56	85.	49.5	108.	45.5
17.	53.5	40.	51	63.	52	86.	44	109.	52
18.	50.5	41.	55	64.	52	87.	49.5	110.	49.5
19.	48	42.	55	65.	44	88.	57	111.	57
20.	52.5	43.	53	66.	46	89.	49	112.	55.5
21.	48	44.	51	67.	47	90.	55.5	113.	46
22.	42	45.	46	68.	54	91.	59	114.	69.5
23.	49	46.	50	69.	47.5	92.	54	115.	40

116.	51	142.	50.5	169.	39	194.	45	
117.	49	143.	5	59	169.	46	195.	49
118.	47	144.	50.5	170.	52.5	196.	51.5	
119.	46	145.	31	171.	49.	197.	45	
120.	50	146.	50	172.	49	198.	39	
121.	51	147.	44	173.	44	199.	37.5	
122.	56	148.	40	174.	46	200.	49	
123.	57	149.	45.5	175.	47.5	201.	44	
124.	49	150.	63	176.	43.5	202.	51	
125.	48	151.	49	177.	55	203.	47.5	
126.	45	152.	49.5	178.	42	204.	45	
127.	57	153.	52	179.	57	205.	45	
128.	45.5	154.	45	180.	40	206.	53	
129.	51.5	155.	48	181.	52	207.	45.5	
130.	46.5	156.	59	182.	54	208.	39	
131.	46	157.	52	183.	39	209.	44.5	
132.	61	158.	49.5	184.	47	210.	45	
133.	53	159.	45	185.	46.5	211.	50	
134.	51.5	160.	51	186.	49	212.	40	
135.	69	161.	48	187.	50	213.	40	
136.	49.5	162.	40	188.	52	214.	46	
137.	50.5	163.	46.5	189.	54	215.	47	
138.	50	164.	48	190.	50	216.	43	
139.	52	165.	41.5	191.	46	217.	46.5	
140.	52	166.	46	192.	64	218.	50	
141.	45	167.	50.5	193.	45	219.	49	

220.	40.5	243.	51.5	266.	49	289.	50
221.	49	244.	53	267.	44	290.	49
222.	45	245.	51.5	268.	41.5	291.	43
223.	49	246.	55	269.	47	292.	53.5
224.	49	247.	53.5	270.	51	293.	49.5
225.	37	248.	49	271.	49	294.	52.7
226.	42	249.	50	272.	64	295.	49.5
227.	53	250.	55.5	273.	53.5	296.	55.5
228.	39	251.	49.5	274.	52	297.	53
229.	47	252.	51	275.	52	298.	50.5
230.	52	253.	49.5	276.	54.5	299.	57
231.	48	254.	53	287.	42.5	300-	60
232.	40	255.	50	279.	52		
233.	60.5	256.	56	279.	54		
234.	56	257.	53.5	280.	51		
235.	53	258.	44	281.	49		
236.	40.5	259.	42	282.	62		
237.	51	260.	53.5	283.	49.5		
238.	51	261.	55.5	284.	50		
239.	44	262.	46.5	285.	49		
240.	59	263.	47.5	286.	60		
241.	55	264.	47	287.	50		
242.	54	265.	49.5	288.	32.5		

APPENDIX IV B

WEIGHT OF THE SEVERAL ELEMENTS OF THE MIDDLE INCOME IN 1950

1.	56	26.	56.5	51.	41	76.	57.5
2.	49	27.	49.5	52.	47	77.	42
3.	61	28.	50.5	53.	45.5	78.	49.5
4.	45	29.	65	54.	47.5	79.	43
5.	58	30.	58	55.	52	80.	46.5
6.	50	31.	48	56.	46	81.	46.5
7.	58	32.	49.5	57.	49.5	82.	48
8.	57.5	33.	53.5	58.	39	83.	54.5
9.	49.5	34.	53	59.	52.5	84.	53
10.	46	35.	44.5	60.	53	85.	66
11.	44.5	36.	53	61.	55	86.	52
12.	40	37.	56	62.	53	87.	62.5
13.	44.5	38.	53.5	63.	56.5	88.	54.5
14.	53.5	39.	63	64.	57	89.	46.5
15.	56	40.	83	65.	52	90.	53
16.	57	41.	61	66.	51	91.	59
17.	59	42.	56	67.	63.5	92.	50
18.	50	43.	48	68.	48	93.	48.5
19.	64.5	44.	59.5	69.	60.5	94.	45.5
20.	45	45.	59	70.	57	95.	48
21.	56.5	46.	48	71.	61.5	96.	60
22.	58	47.	48	72.	47	97.	57.5
23.	61.5	48.	48	73.	56.5	98.	86.5
24.	52	49.	53.5	74.	65.5	99.	41.5
25.	51.5	50.	50.5	75.	50	100.	59.5

APPENDIX V A

HEIGHT OF THE APPROXIMATE POINTS OF THE LOW INCOME LI CR.

1.	141	21.	146	41.	153	61.	153
2.	160	22.	143	42.	157	62.	163
3.	142	23.	154	43.	149	63.	160
4.	152	24.	155	44.	155	64.	150
5.	152	25.	159	45.	150	65.	155
6.	145	26.	156	46.	142	66.	150
7.	166	27.	161	47.	147	67.	150
8.	149	28.	153	48.	151	68.	159
9.	143	29.	157	49.	153	69.	155
10.	153	30.	154	50.	149	70.	148
11.	145	31.	144	51.	152	71.	157
12.	150	32.	152	52.	144	72.	156
13.	145	33.	146	53.	147	73.	156
14.	147	34.	143	54.	143	74.	160
15.	149	35.	146	55.	140	75.	145
16.	156	36.	143	56.	149	76.	153
17.	146	37.	143	57.	149	77.	149
18.	143	38.	155	58.	138	78.	143
19.	145	39.	144	59.	157	79.	150
20.	150	40.	139	60.	156	80.	142

91.	151	104.	151	127.	152	150.	156
92.	141	105.	151	128.	157	151.	150
93.	141	106.	152	129.	155	152.	151
94.	149	107.	155	130.	159	153.	155
95.	152	108.	146	131.	155	153.	141
96.	153	109.	152	132.	146	155.	149
97.	155	110.	149	133.	157	156.	150
98.	160	111.	147	134.	155	157.	147
99.	150	112.	165	135.	153	158.	155
90.	162	113.	151	136.	152	159.	151
91.	153	114.	159	137.	152	160.	153
92.	157	115.	159	138.	157	161.	160
93.	155	116.	141	139.	142	162.	135
94.	142	117.	155	140.	161	163.	152
95.	149	118.	141	141.	150	164.	149
96.	152	119.	159	142.	150	165.	145
97.	150	120.	152	143.	156	166.	152
98.	147	121.	151	144.	160	167.	150
99.	153	122.	153	145.	123	168.	149
100.	147	123.	152	146.	155	169.	151
101.	151	124.	149	147.	149	170.	146
102.	143	125.	147	148.	148	171.	146
103.	137	126.	150	149.	147	172.	160

173.	145	198.	147	223.	149	248.	148
174.	153	199.	158	224.	152	249.	143
175.	142	200.	151	225.	151	250.	151
176.	146	201.	151	226.	141	251.	160
177.	151	202.	156	227.	156	252.	152
178.	147	203.	147	228.	145	253.	161
179.	155	204.	147	229.	154	254.	164
180.	151	205.	148	230.	150	255.	154
181.	150	206.	154	231.	154	256.	159
182.	158	207.	151	232.	152	257.	156
183.	145	208.	147	233.	155	258.	145
184.	154	209.	158	234.	148	259.	139
185.	147	210.	148	235.	153	260.	155
186.	145	211.	154	236.	141	261.	153
187.	150	212.	144	237.	152	262.	150
188.	152	213.	143	238.	149	263.	154
189.	160	214.	158	239.	155	264.	155
190.	154	215.	158	240.	151	265.	146
191.	143	216.	147	241.	148	266.	154
192.	152	217.	152	242.	147	267.	149
193.	143	218.	155	243.	151	268.	141
194.	140	219.	151	244.	158	269.	155
195.	155	220.	139	245.	158	270.	152
196.	151	221.	159	246.	162	271.	155
197.	154	222.	143	247.	146	272.	155

273.	155	299.	154
274.	152	300.	145
275.	153		
276.	156		
277.	139		
278.	153		
279.	155		
280.	154		
281.	151		
282.	155		
283.	155		
284.	156		
285.	150		
286.	155		
287.	148		
288.	153		
289.	151		
290.	148		
291.	132		
292.	157		
293.	149		
294.	149		
295.	148		
296.	160		
297.	159		
298.	146		
299.	154		
300.	145		

APPENDIX V B

HEIGHTS OF THE HIGHEST MOthers OF THE MIDDLE INCOME IN Co.

1.	151	26.	159	51.	147	76.	160
2.	154	27.	155	52.	146	77.	149
3.	150	28.	150	53.	142	78.	150
4.	156	29.	156	54.	149	79.	146
5.	152	30.	150	55.	150	80.	153
6.	157	31.	149	56.	143	81.	160
7.	153	32.	156	57.	150	82.	153
8.	153	33.	152	58.	153	83.	154
9.	153	34.	149	59.	166	84.	153
10.	152	35.	144	60.	156	85.	164
11.	149	36.	153	61.	150	86.	160
12.	150	37.	145	62.	143	87.	154
13.	144	38.	151	63.	157	88.	149
14.	152	39.	154	64.	152	89.	143
15.	152	40.	147	65.	151	90.	154
16.	161	41.	152	66.	154	91.	161
17.	150	42.	149	67.	155	92.	149
18.	155	43.	153	68.	151	93.	153
19.	152	44.	152	69.	163	94.	145
20.	143	45.	149	70.	145	95.	146
21.	152	46.	156	71.	162	96.	160
22.	155	47.	147	72.	153	97.	151
23.	146	48.	160	73.	159	98.	159
24.	153	49.	151	74.	164.	99.	145
25.	153	50.	150	75.	165	100.	152

APPENDIX VI A

**EMPLOYMENT LEVEL OF THE AVERAGE MEMBER OF LOW INCOME GROUP
IN 1989 \$1.**

2.	9.6	24.	9.8	47.	6.6	70.	6.6	93.	7.9
2.	9.1	25.	6	48.	7.2	71.	8.9	94.	7.2
3.	9.4	26.	9.6	49.	9.1	72.	4.8	95.	4.8
4.	7.9	27.	9.9	50.	7.9	73.	7.4	96.	7.2
5.	7.9	28.	6	51.	7.9	74.	7.9	97.	9.6
6.	6	29.	6.6	52.	7.2	75.	6.5	98.	6
7.	7.9	30.	9.4	53.	7.2	76.	7.2	99.	6
8.	7.2	31.	7.9	54.	7.2 72	77.	7.2	100.	6.6
9.	6	32.	7.7	55.	7.2	78.	6.6	101.	7.2
10.	7.9	33.	7.2	56.	6	79.	6.6	102.	9.4
11.	4.3	34.	7.9	57.	10.8	80.	7.9	103.	9.4
12.	9.9	35.	7.2	58.	7.2	81.	6	104.	7.2
13.	6	36.	7.4	59.	6.6	82.	6	105.	7.9
14.	4.9	37.	7.2	60.	6.6	83.	7.2	106.	9.4
15.	6	38.	6.6	61.	6	84.	7.9	107.	7.2
16.	9.6	39.	7.2	62.	7.2	85.	7.2	108.	7.2
17.	10.6	40.	7.2	63.	6	86.	6	109.	7.2
18.	9.4	41.	9.6	64.	7.2	87.	7.9	110.	7.2
19.	9.4	42.	7.9	65.	6.6	88.	11.5	111.	7.9
20.	7.2	43.	6	66.	7.2	89.	7.2	112.	6.6
21.	8.4	44.	7.9	67.	6.6	90.	7.2	113.	7.9
22.	6	45.	9	68.	6	91.	7.6	114.	9.4
23.	9.8	46.	7.2	69.	6	92.	10.3	115.	9.4

116.	6.6	133.	7.9	160.	7.2	192.	7.9
117.	9.4	139.	9.1	161.	7.9	193.	7.2
118.	9.4	140.	6.6	162.	6	194.	7.2
119.	6.6	141.	9.5	163.	7.2	195.	7.2
120.	9.1	142.	6.6	164.	4.5	196.	7.9
121.	6.6	143.	6.6	165.	4.5	197.	7.2
122.	7.4	144.	6	166.	6.6	198.	7.9
123.	4.9	145.	6.9	167.	7.9	199.	7.2
124.	7.2	146.	6	168.	6.6	190.	9.4
125.	6	147.	8.9	169.	7.2	191.	9.4
126.	7.2	148.	7.9	170.	7.9	192.	7.4
127.	5.4	149.	7.2	171.	7.2	193.	9.6
128.	7.2	150.	6	172.	7.9	194.	9.6
129.	6	151.	7.9	173.	6	195.	7.9
130.	7.9	152.	4.5	174.	7.2	196.	6
131.	6.6	153.	6.6	175.	6	197.	7.9
132.	7.2	154.	9.4	176.	7.2	198.	6
133.	9.4	155.	7.2	177.	7.2	199.	4.9
134.	6	156.	6.6	178.	7.2	200.	7.2
135.	9.1	157.	7.9	179.	7.9	201.	7.2
136.	9.1	158.	7.9	180.	3.4	202.	7.2
137.	7.9	159.	4.9	181.	6.5	203.	6

204.	7.9	229.	9.3	254.	7.2	279.	6
205.	7.9	230.	7.4	255.	5.4	280.	7.9
206.	3.5	231.	9.4	256.	7.2	281.	7.9
207.	4.9	232.	7.2	257.	7.2	282.	6
208.	6.6	233.	7.9	258.	8.9	283.	9.4
209.	7.2	234.	6.6	259.	7.2	284.	7.9
210.	6.6	235.	7.2	260.	7.2	285.	4.9
211.	7.9	236.	7.2	261.	7.9	286.	6.6
212.	5.5	237.	7.9	262.	8.6	287.	7.2
213.	7.9	238.	9.4	263.	9.4	288.	6
214.	7.2	239.	9	264.	9	289.	7.2
215.	9.9	240.	7.9	265.	5.4	290.	7.9
216.	6.6	241.	9.4	266.	7.2	291.	7.2
217.	6.3	242.	9.4	267.	7.9	292.	7.2
218.	6.6	243.	7.9	268.	7.2	293.	7.9
219.	6	244.	9	279.	7.9	294.	7.2
220.	7.6	245.	10.2	270.	6.6	295.	7.2
221.	5.7	246.	7.2	271.	7.9	296.	6
222.	9.1	247.	7.2	272.	7.2	297.	4.9
223.	7.5	248.	7.2	273.	6.6	298.	6.6
224.	50.9	249.	9.4	274.	7.2	299.	7.9
225.	6	250.	9.6	275.	6.6	300.	4.9
226.	6	251.	7.9	286.	6.6		
227.	9.1	252.	9.6	277.	7.9		
228.	9.1	253.	7.9	278.	7.9		

APPENDIX VI B

TRANSGLUTIN LEVEL OF 100 MICROGRAMS OF MIDDLE INCOMEGROUP IN 0 / 100 ml.

1.	7.9	26.	6.4	51.	9.4	76.	9.6
2.	7.9	27.	4.5	52.	6	77.	9.4
3.	7.2	28.	7.2	53.	6.6	78.	7.9
4.	7.2	29.	7.2	54.	4.9	79.	9.4
5.	7.4	30.	9.6	55.	6.6	80.	9.4
6.	7.6	31.	9.6	56.	5.6	81.	10.9
7.	9.6	32.	7.9	57.	7.9	82.	7.2
8.	6	33.	9.1	58.	9.4	83.	6.6
9.	7.9	34.	9.9	59.	7.2	84.	10.6
10.	9.4	35.	9.4	60.	9.4	85.	9.4
11.	7.2	36.	6	61.	9.6	86.	7.2
12.	7.9	37.	10.3	62.	9	87.	7.2
13.	6.6	38.	9.4	63.	9.6	88.	6
14.	6.7	39.	4.9	64.	9.9	89.	7.9
15.	7.2	40.	9.6	65.	7.9	90.	9.1
16.	9.4	41.	9.6	66.	9.9	91.	5.4
17.	9.4	42.	6.6	67.	11.9	92.	7.2
18.	10.3	43.	7.2	68.	9.4	93.	7.9
19.	10.3	44.	6	69.	9	94.	5.4
20.	7.9	45.	7.4	70.	9.4	95.	9.6
21.	9.4	46.	9.4	71.	9.3	96.	9.3
22.	9.6	47.	7.2	72.	9.6	97.	11.6
23.	7.2	48.	5.4	73.	9.3	98.	7.9
24.	7.9	49.	9.6	74.	9.3	99.	6.6
25.	7.2	50.	7.2	75.	9.4	100.	9.3

APPENDIX VII A

STATISTICAL ANALYSIS

SUMMARY OF STATISTICAL ANALYSIS OF PREPREGNANT WEIGHT, WEIGHT AT TERM OF PREGNANCY, AND HEIGHT BETWEEN LOW AND MIDDLE INCOME SAMPLES

S.No.	Criteria	Income	't' Value
1.	Prepregnant weight	Low income Vs Middle income	4.474 * *
2.	WEIGHT AT TERM OF pregnancy	Low income Vs Middle income	5.321 * *
3.	Height	Low income Vs Middle income	1.915 N.S

* * - Significant at 1% level

N.S- Not significant at 1% level

APPENDIX VII B

SUMMARY OF THE CHI-SQUARE TEST FOR GOODNESS OF FIT FOR VARIOUS CRITERIA

S.No.	Criteria	Income	Chi-square value
1	Pregnant weight	a. Low income	2.398 * *
		b. Middle income	9.976 * *
2.	Weight at term of pregnancy	a. Low income	9.95 * *
		b. Middle income	9.99 * *
3.	Height	a. Low income	7.25 * *
		b. Middle income	9.55 * *
4.	Birth weight of previous children	a. Low income	3.99 * * *
		b. Middle income	3.10 * * *

* * - Fit of the criteria is good at 1% level

* * * - Fit of the criteria is good at 5% level.