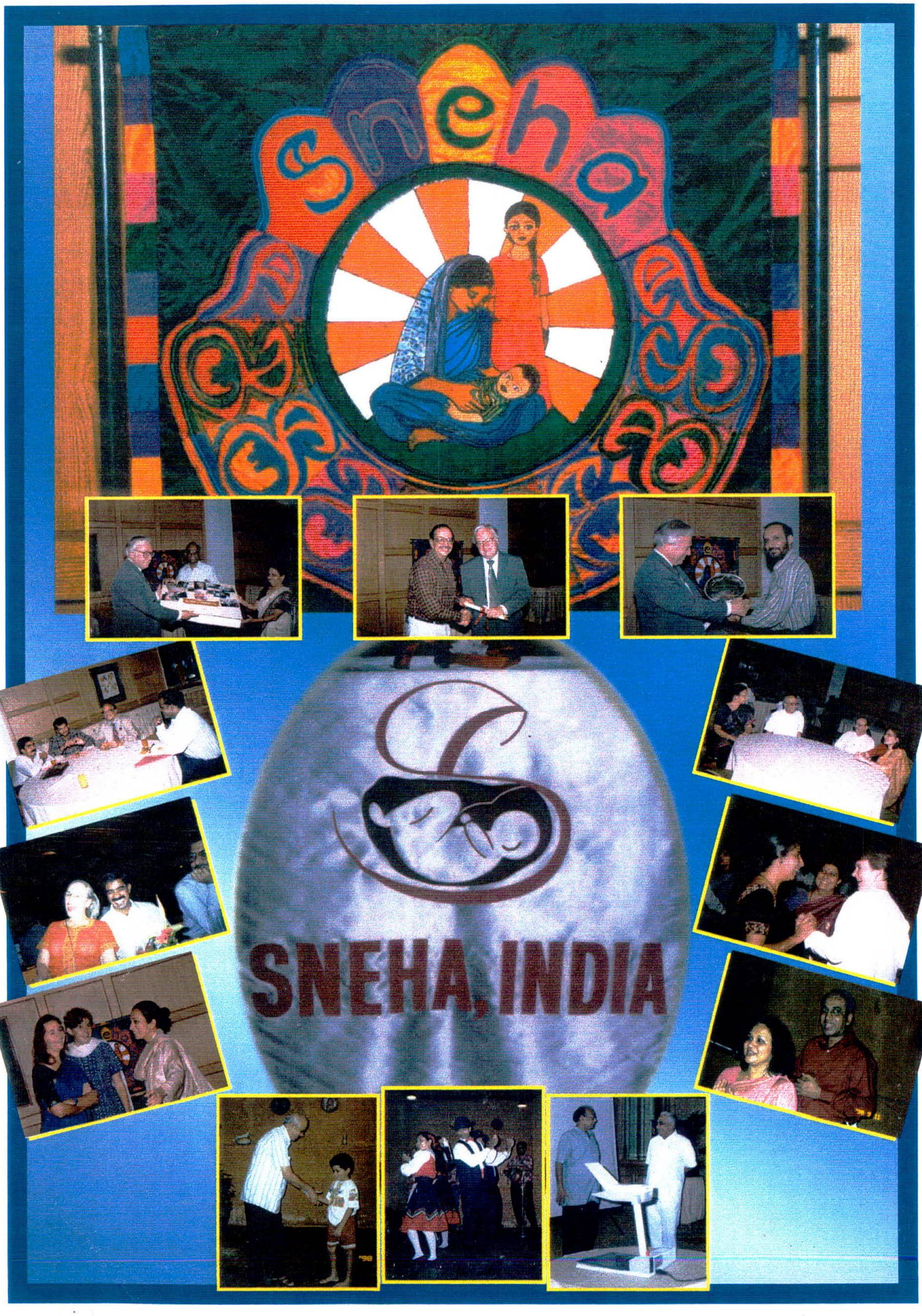
sneha
SNEHA, INDIA

THE FIFTH ANNUAL INDIAN WORKHOP ON THE FETAL ORIGINS OF ADULT DISEASE

Goa, India
September 10th-13th 1998

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PROGRAMME

THURSDAY 10th SEPTEMBER

17.30-19.00 ***SNEHA AGM*** (Members only)
Chairman: Dr Anand Pandit

19.00-20.00 ***CELEBRATIONS ON THE BIRTH OF SNEHA***
Compered by Dr Ramesh Potdar

FRIDAY 11th SEPTEMBER

Scientific Session 1 — **INTRA-UTERINE GROWTH**

Chairman: Dr Armida Fernandes

08.45-09.05	Opening words and introductions	*Dr Ramesh Potdar*
09.05-09.35	Where we are in 1998	*Dr Caroline Fall*
09.35-10.05	The 'Thrifty Phenotype' Defined	*Dr CS Yajnik and Dr Kurus Coyaji*
10.05-10.25	The GLV Story	*Dr Shobha Rao*
10.25-10.45	*COFFEE*	
10.45-11.30	***Guest speaker: Dr Vijay Joshi*** ***Placental pathology in IUGR***	
11.30-11.50	Intra-uterine growth of rural Indian babies - fetal ultrasound	*Dr Manoj Chinchwadkar*
11.50-12.10	Intra-uterine growth of rural Indian babies - size at birth	*Dr Vaman Khadilkar*
12.10-12.30	The Mysore Two-Generation Study	*Dr SR Veena and Dr K Kumaran*
12.30-13.00	Low birthweight in South Asia	*Dr HPS Sachdev*
12.50-14.00	*LUNCH*	

FRIDAY 11th SEPTEMBER

Scientific session 2 — **CARDIOVASCULAR DISEASE AND RISK FACTORS**

Chairman: Dr J Richard

14.00-14.30	Metabolic and cardiovascular correlates of low birthweight in children	*Dr Ashish Bavdekar*
15.00-15.20	Coronary risk factors - what does the man in the street know?	*Dr Usha Shrivastava*

15.20-15.40	Neonatal autopsy studies	*Dr Sudha Sane*
15.40-16.10	*TEA*	
16.10-16.50	The Helsinki Study – a vision of India in the future?	*Dr David Barker*
16.50-17.35	***Guest speaker: Dr Vasant Athavale***	
	Effects of intra-uterine growth on adult health – an Ayurvedic view	

SATURDAY 12th SEPTEMBER

Scientific session 3 — **FOCUS ON WOMEN AND MOTHERS**

Chairman: Dr P Raghupathy

09.00-09.25	Birthweight and age at menarche	*Dr J Richard*
09.25-09.45	Recurrence of low birthweight in successive pregnancies	*Dr B Antonisamy*
09.45-10.05	Low birthweight in Bengali mothers	*Dr Debabrata Chatterjee*
10.05-10.20	Trace elements and fetal growth	*Dr Armida Fernandes*
10.20-10.35	Maternal and placental determinants of fetal growth	*Dr Jayshree Mondkar*
10.35-10.55	Cord blood data from the Pune urban study	*Dr CS Yajnik*
10.55-11.30	*COFFEE and PHOTO SESSION*	
11.30-11.50	***Guest speaker: Dr Lakshmi Lingam***	
	Women, education and health	
11.50-12.10	Cultural influences on the nutrition of girls and women	*Ginny Chorghade*
12.10-12.30	Mothers and babies in Beijing	*Dr David Barker*
12.30	*LUNCH*	

SUNDAY 13th SEPTEMBER

Scientific session 4 — **FINALE: MOTHERS, BABIES AND ADULT DISEASE**

THREE KEY INDIAN STUDIES IN GESTATION

Chairman: Dr CS Yajnik

09.00-09.20	The Mysore Parthenon Study	*Dr Jacqui Hill*
09.20-09.40	Cardiac development in utero	*Dr Arun Kinare*
09.40-10.00	Finlindia - the Delhi/Vellore studies	*Dr Caroline Fall*
10.00-10.20	*COFFEE*	
10.20-10.30	The Mumbai Office – New environment and how can it help you?	*Sabita Saldanha*
10.30-11.00	**Open Discussion: 'Where should our research go from here?'**	*Dr Ramesh Potdar*

ABSTRACTS

1. INTRAUTERINE GROWTH OF RURAL INDIAN BABIES " THE THRIFTY PHENOTYPE" DEFINED

CS Yajnik

Reduced fetal growth (reflected in small size at birth) is associated with an increased risk of adult coronary heart disease (CHD) and type 2 diabetes. This has important implications for India, where 30% of babies have low birth weight and rates of CHD and diabetes are rising. To develop interventions to improve fetal growth, a better understanding of its relationship to maternal nutrition is required.

Methods Detailed anthropometry was carried out before and during pregnancy in a population sample (n=633) of Indian women, and their newborn babies.

Results The mean weight, height and body mass index of the mothers were 42 kg, 1.52m, and 18kg/m^2. Full term birth weight was 2.7kg. Compared with UK babies, the Indian babies were small in all dimensions; the deficit was greatest for non-fat soft tissue (mid-upper-arm 83% and abdomen 85%), while subcutaneous fat (skinfold thickness 93%), head (94%) and length growth (95%) were relatively spared. Maternal head circumference predicted all birth measurements. Maternal height and pre-pregnant fat mass predicted neonatal length and skinfold thickness respectively, but the fattest babies were born to short fat mothers. Non-fat weight gain during pregnancy was a significant predictor of birth size.

Conclusions The thin babies born to small Indian mothers have a substantial soft tissue deficit. Of the soft tissues, in utero adaptations favour deposition of fat. Optimal fetal growth requires that mothers be well-nourished throughout infancy, childhood and puberty, reflected in good head and height growth. Mothers in nutritional transition (short but fat) produce short fat babies. The propensity of Indian babies to lay down fat at the cost of muscle may underlie adult insulin, resistance, diabetes and CHD.

2. THE GLV STORY

Shobha Rao

Earlier studies from India and other developing countries have shown that dietary intakes of rural women are low and that they do not increase substantially during pregnancy. However, in view of the recent hypothesis by Barker and his group about the 'foetal origins of adult diseases' it has become essential to understand the maternal-fetal nutritional relationships. The Pune study had accordingly collected dietary intake data through 24-hr recall as well as FFQ. The placental weight showed an almost independent effect on all neonatal anthropometry. Therefore, factors associated with placental weight were examined and indicated two important food groups viz. green leafy vegetables and dairy products. The detailed analysis for GLV consumption scores from FFQ data was therefore attempted. Higher frequency of consumption of GLV at 28th wk was associated with higher weight gain between 18th & 28th wk, higher placental weight, higher red cell folate at Visit II, higher birth weight and also higher skinfold thicknesses of the baby. However, this effect was only seen among thinnest women (lower tertile of birthweight distribution). Therefore, multiple regression analysis was undertaken to control all other factors such as pre-pregnant weight, gestation, sex, parity, calorie intake at visit II and activity score at visit II. The analysis showed that effect of GLV consumption on birth weight remained significant ($P<.01$) even after controlling for these factors. It was interesting to observe that impact of GLV consumption was also seen on neonatal skinfolds after adjusting for above factors. Thus it seemed that increased consumption of GLV especially among thin mothers was associated with not only increase in birth weight but also with higher skinfolds at birth. Thus fetuses born to undernourished mothers had tendency for fat deposition. The factors associated with actual GLV consumption are being investigated.

3. PLACENTAL PATHOLOGY IN INTRAUTERINE GROWTH RETARDATION (IUGR)

Vijay Joshi

Introduction IUGR is usually defined in terms of body weight which is less than 10th percentile for the gestational age. It is of two types: 1) Symmetrical and 2) Asymmetrical. It appears that in the articles and chapter on placental pathology of IUGR, the authors mostly concentrate on the placental pathology in the more common type of asymmetrical IUGR which occurs in the third trimester of pregnancy and is characterized by normal body length and head size and lack of association with congenital anomalies (1). IUGR can be associated with three types of factors: A) Maternal, B) Fetal and C) Placental. In some cases, association with any of these factors cannot be demonstrated The maternal factors include: Cigarette smoking, drug abuse, chronic debilitating disease, malnutrition, chronic infection (for example, malaria), and pregnancy related disorders (for example,

pre-eclampsia). Small size and hypovascularity of the placenta, and increased vascular resistance etc. have been described in many of these conditions. It should be noted that small size of placenta in IUGR is a reflection of growth disturbance affecting the conceptus as a whole. Placenta can be looked upon as extracorporeal organ. Therefore small placenta and small fetus are the result of the same pathologic process and the former is not the cause of the latter. However, in some cases of IUGR, the placentas may be relatively large. The combination of IUGR and large placenta may have an accentuated affect on the degree of hypertension developing subsequently in adulthood (1A). An enigmatic maternal vascular lesion resembling acute atherosis occurring in the absence of maternal hypertension or pre-eclampsia has been described in rare cases of IUGR (1B). The fetal factors mainly include intrauterine fetal infections (for example, CMV, Syphilis, toxoplasmosis, etc.) and multiple congenital anomalies. The placenta shows evidence of infection (villitis) in the former. In congenital anomalies associated with chromosomal syndromes (for example, trisomy 13,18 or 21), the placenta tends to be small with a high incidence of single umbilical artery. The villi may show delayed maturation, hypovasularity and migrating trophoblast cells within the stroma of villi (2). The primary placental lesions associated with IUGR will be discussed in some detail in this presentation.

Primary placental lesions in IUGR These are related to abnormalities of: A) Membrane insertion, B) Cord insertion and C) Placental parenchyma.

Membrane insertion These are described as placental extrachorialis (circummarginate and circumvallate placenta) in which the membranes are inserted a short distance from the edge of the chorionic plate. The circumvallate placenta is associated with IUGR. It is possible that this type of placenta is inefficient in transfer of nutrients and gas to and from the fetus (2,3).

Umbilical cord These include velamentous and marginal insertion of the cord, and single umbilical artery. Compression of the cord resulting in placental hypoperfusion can occur when it is inserted abnormally. Single umbilical artery may cause increased resistance to blood flow from fetus to placenta and thus may result indirectly in chronic fetal hypoxia and IUGR.

Placental parenchyma These include circulatory disorders (extensive infarcts, perivillous fibrin deposition, maternal flow infarct and twin transfusion syndrome), tumors (e.g. large chorangioma or teratoma) and villitis (infectious and of unknown etiology).

Extensive placental infarction is seen in association with severe pre-eclampsia or severe hypertension, but it can rarely occur without a demonstrable associated factor. Placenta has a large reserve capacity and involvement of as much as 30% of otherwise normal placenta by infarction (or other lesions) may not cause placental insufficiency. The etiology of extensive perivillous fibrin deposition, maternal flow infarct, (which is characterized by perivillous fibrin deposition at maternal surface) is not known. These lesions interfere with placental perfusion, thus resulting in IUGR. In twin transfusion syndrome, there are vascular anastamoses between the two placental territories in a monochorionic twin placenta. The anastamoses are direct (vessel to vessel of the fetal surface) or through shared lobules, that is, placental artery supplies a placental lobule in its own territory but the blood from that lobule is drained into the placental vein of the other placental territory. The latter are of greater importance in twin transfusion. Large chorangiomas can result in hypoperfusion of the placental parenchyma as a result of shunting of blood through the lesion.

Infectious villitis can be seen in syphilis, toxoplasmosis and CMV infection and in other viral and bacterial infections (for example, listeriosis). The spread to the placenta is by hematogenous route. In all these instances, the fetus is also infected via transplacental transmission resulting in IUGR (although hydrops fetalis may also be seen).

Recently emphasized placental abnormalities The placental lesions associated with maternal and fetal factors and the primary placental lesions associated with IUGR described above are well known and established. The more recently emphasized and interesting placental abnormalities in IUGR include: 1) Inadequate placentation, 2) Abnormalities of placental villous structure, 3) Villitis of unknown etiology (VUE), 4) Confined placental mosaicism (CPM), 5) Placental and umbilical cord vascular changes and 6) Apoptosis in the placental trophoblast. These lesions are briefly described below.

Inadequate placentation is characterized by inadequate conversion of endometrial and myometrial spiral arteries into markedly dilated uteroplacental blood vessels due to defective trophoblastic invasion. The etiology of this defect is not known but maternal immunologic factors have been implicated (3). Abnormalities of terminal villi

demonstrated by morphometry, and light and scanning and transmission electron microscopy include small diameter with reduced villous surface, reduced cytotrophoblastic nuclei, increased stroma, reduced number of capillary loops, increased syncytiotrophoblastic apoptosis and thickened basement membrane (4-6). In villitis of unknown etiology (VUE), the most characteristic finding is infiltration of villi by lymphomononuclear cells. VUE can be recurrent. The inflammatory cells in VUE are maternal T lymphocytes (2,3,7,8). This finding suggests that VUE may be related to immunologic factors; viral infection has also been suggested as an etiologic factor. Confirmed placental mosaicism (CPM) is characterized by discrepancy between fetal and placental karyotypes (2,9). The placental chromosomal abnormality involves Trisomy 2,3,8,9,or 16 which is seen in the trophoblast or villous stroma or both. It has been suggested that CPM may interfere with placental function and fetal growth. In CPM, the placenta does not show any morphologic changes on routine pathologic examination (2).

Doppler studies of the umbilical arterial flow in IUGR have shown that there may be absence or actual reversal of flow at the end of diastole. Morphometric and semiquantitative histologic assessment of villi and umbilical cord has shown the following abnormalities: A) Medial hyperplasia and luminal narrowing of blood vessels of the stem villi, hemorrhagic endovasculitis, hypovascularity of villi and B) Reduced Wharton's jelly, reduced venous lumen and hypoplasia of arteries in the umbilical cord (10,11). Apoptosis represents programmed cell death or cell suicide (distinct from necrosis) occurring normally in various normal tissues (particularly during embryonic development) and tumors. The process is of great importance during the development of organs. It is characterized by condensation and fragmentation of nuclei due to endonuclease activity. Apoptotic nuclei can be identified by light and electron microscopy. More specific recognition is made by TUNEL (Terminal deoxynucleotidyl transferase-mediated deoxyuridine triphosphate - dUTP - nick end labelling). The "nick end " refers to DNA 3' - hydroxy groups generated as a result of endonuclease activity. Apoptosis occurs normally in the placenta. It has been shown that placental apoptosis is increased in IUGR (0.14% in normal controls versus 0.24% apoptotic cells in placentas in pregnancies with IUGR; $p<0.01$) (5). The authors concluded that increased apoptosis due to unknown mechanism may play a role in the pathogenesis of IUGR.

References:

1. Brar,HS et al: Sem Perinatal 1988;12:2
1A. Barker, DJP et al: Brit Med J 1990; 301:259.
1B. DeWolf , F et al: Brit J Obstet Gynecol 1980; 87:678
2. Joshi VV: Handbook of Placental pathology, 1994, Igaku Shein Medical Publishers, New York.
3. Fox, H: Pathology of the Placenta, 1997, W.B. Saunders Co., 2nd Edition, W.B.Saunders Co., Philadelphia.
4. Macara, L et al: Placenta 1996; 17:37.
5. Smith, SC et al: Am J Obstet Gynecol 1997; 177:1395.
6. Robinson, JS, Owens, J: In the Human Placenta, CWG, Sargent IL, Starkey PM (Editors), 1993, Blackwell Scientific Publications, London, pp 558-578.
7. Redline RW et al: Am J Pathol 1993; 143:473.
8. Labarre, CA et al: Am J Obstet Gynecol 1990; 162:515.
9. Kalousek, D: Pediatric Pathol,1990; 10:69.
10. Salafia, CM et al: Obstet Gynecol 1997; 90:830
11. Bruch, JF et al: Hum Pathol 1997; 28:1139.

4. MID-PREGNANCY PLACENTAL DIAMETER, EASILY MEASURED ON ULTRASOUND,PREDICTS BIRTHWEIGHT AND PLACENTAL WEIGHT AT BIRTH

Manoj Chinchwadkar

Introduction Correlations between mid - pregnancy placental volume (MPPV) and birth weight and placental weight at birth have been shown ($r=0.22,0.25$ respectively; $p<0.001$). Interestingly a number of placentae were found to be longer than 12.5cm and MPPV could not be measured. This initiated our interest in measuring the dimensional aspects of the placental morphology contributing to the placental volume.

Subjects and methods 700 women underwent ultrasound examined between 15-21 weeks of gestation for placental volume recording. In 137 women, two placental diameters and the maximum placental thickness (MPPT) were also measured at the same time. Of these 114 women delivered live babies between 37-42 weeks of gestation and were selected for analysis.

Results Longitudinal and transverse placental diameters correlated more strongly with the MPPV ($r=0.64,0.60$; $p<0.0001$) than the thickness (MPPT; $r=0.34$;$p<0.0001$) Assuming the round shape of placenta, two diameters were averaged to calculate mid-pregnancy placental diameter (MPPD). From 15 to 21 weeks, MPPT did not change significantly; where as MPPD showed a significant correlation with gestation ($r=0.37$, $p<0.0001$). The

mean MPPT was 2.3 cm (SD 0.6, range 0.8-4.2 cm). After adjusting for gestation the mean MPPD was 10.1cm (SD1.3, range 6.0 -13.0 cm). MPPD showed a significant correlation with the birth weight and placental weight at birth (r=0.31 for both, p=0.002) while MPPT was not related. Thus, there was gradual increase in the birth weight with increasing centiles of placental diameter. Women with MPPD below the 10th centile (Mean=7.7cm, SD 0.7) had babies weighing 2492 g (SD 231). Women with MPPD above 90th centile (Mean 12.3 cm, SD 0.4) had babies weighing 2866 g (SD 203).

Comments Measuring placental diameter between 15-21 weeks of gestation is extremely easy to perform during an ultrasound examination. If the results are proved in a study involving larger numbers, mid-pregnancy placental diameter (MPPD) would prove valuable in suspecting low birthweight early in gestation and indicate a close monitoring of fetal biometric growth by subsequent serial ultrasound examinations.

5. GROWTH ANALYSIS OF RURAL MAHARASHTRA FULL TERM BABIES

Vaman Khadilkar

Background Reduced fetal growth is associated with an increased risk of adult type 2 diabetes and coronary artery disease. The international definition of growth retardation is below 2500 grams full term. The average birth weight is lower in Indian babies and hence it is inappropriate to use the same definition for our population. A single cut off point for babies born at different gestation between 37 to 40 weeks is also not logical.

Aims and objectives

1. Define sex specific centile charts for rural Maharashtra babies from 37 to 40 weeks gestational age for various growth parameters.
2. Compare centiles of rural Maharashtra babies with international centiles.
3. Identify and sub-classify the IUGR population and examine catch-up growth based on international centiles.
4. Examine correlation between Ponderal index and SD scores.

Methods Seven hundred and seventy one babies were measured at the time of delivery for various growth parameters and every six months thereafter. First delivery took place in Nov 94 and last in Aug 96. Statistical analysis was performed using SPSSPC+ package.

Results Gestation-specific birth centiles were lower as compared to the international centiles for both sexes, weight being the lowest. The average weight gain each week from 37 to 40 weeks for boys and girls was 87.5 g. There was no correlation between Ponderal index and SD scores for birth weight. When only Ponderal index was used to diagnose IUGR, 83 individuals were recognized as having IUGR whereas only 12 individuals were truly below - 2SD for birth weight on our own centiles. All 12 babies with birth weight SD scores below -2 caught up at the end of one year in all three parameters studied.

Conclusions

1. Centiles for birth weight in Rural Maharashtra when compared with international centiles were substantially lower, length and head circumference being relatively spared.
2. It is inappropriate to use a single birth weight cut off value for full term babies (from 37 to 40 weeks gestation) to define IUGR.
3. Ponderal index has limitations and is insensitive in diagnosing symmetrically retarded babies and when used as a stand alone criteria gives a high false positive result.
4. We would like to study catch up growth based on international growth centiles.

6. RELATION OF FETAL GROWTH TO CORONARY HEART DISEASE AND ITS RISK FACTORS IN SOUTH INDIAN ADULTS: AN INTERGENERATIONAL STUDY

SR Veena, K Kumaran, C Fall

Introduction and background Coronary heart disease (CHD) and its risk factors are common in India and the rates are rising. CHD is also associated with the metabolic profile called "Insulin Resistance Syndrome" which is common in India. The first Mysore study was conducted to study the relation between fetal growth and CHD and its risk factors in South Indian adults aged 40-60 years. 517 men and women born in the Holdsworth Memorial Hospital (HMH) between 1934 and 1953 and whose birth records included weight, length and head circumference at birth participated. CHD was associated with low birth weight, smaller head circumference and shorter length at birth. People whose mothers had been lighter during pregnancy also had higher rates of CHD. The study also found high rates of NIDDM in those adults who were short and had a high ponderal index at birth and whose mothers had large pelvic diameters and had been heavier during pregnancy. We concluded that these associations with maternal size reflected maternal adiposity and proposed that low birth weight women who become obese are insulin resistant, develop hyperglycaemia in pregnancy and give birth to fat babies who develop impaired insulin secretion and diabetes in adult life. Evidence from Pune and Southampton found that

a woman's own fetal growth influences the fetal growth of her offspring. We therefore decided to study glucose/insulin metabolism, lipid profiles and blood pressure in young adults aged 20-40 years old who were born in HMH and whose mothers' birth records were also available.

Methods The HMH has preserved obstetric records from 1934 up to the present and it is possible to trace families where 2 or more generations were born in the hospital and are still living in and around Mysore. In order to find sufficient subjects for the second generation, the house to house survey of Mysore city has been extended to cover an 8 sq. mile area surrounding the hospital. The birth records have been computerised up to 1977. The team has traced 207 men and women aged 20 years and above who are suitable for the study and whose mothers' birth records are also available. In most cases their mothers have taken part in the first Mysore study thus enabling us to include maternal glucose/insulin metabolism in the analysis. The proposed cohort for the study is 250 men and women between the ages of 20 and 40 years. The subjects are invited to the hospital after an overnight fast for 12 hours and the following investigations are carried out:

1) Fasting blood samples, as well as 30 minute and 120 minute blood samples (after 75 grams oral glucose) to study plasma glucose/insulin metabolism.
2) Blood samples for fasting serum lipid concentrations.
3) Detailed anthropometric measurements.
4) Recording of blood pressure using an automated recorder (DINAMAP)
5) ECG
6) Information on diet, physical activity, occupation, smoking, alcohol intake and socio-economic status, obtained by questionnaire.

Results The study started in December 1997 and data collection is expected to conclude in early 1999. 117 subjects have taken part so far. Analysis will be carried out in the later part of 1999, and will determine how mother's size at birth, body mass index during pregnancy and offspring's size at birth are related to CHD and NIDDM in these young adults.

7. ENDOCRINE, METABOLIC AND CARDIOVASCULAR CORRELATES OF LOW BIRTH WEIGHT IN INDIAN CHILDREN

A Bavdekar, S Bapat, S Bhave, A Pandit, V Nagarkar, C Yajnik, S Kellingray, C Fall.

Methods A study carried out at our hospital 4 years ago in 4 year old children revealed that plasma glucose and insulin concentrations 30 min after an oral glucose load were higher in children of low birth weight and fell with increasing birth weight. These children have now been restudied at 8 years to determine if (i) features of syndrome X are related to birth weight (ii) raised plasma glucose, insulin and IGF-I concentrations found in low birth weight at 4 years track and persists at 8 years and (iii) children of lower birth weight have increased urinary excretion of adrenal steroid metabolites and (in girls) polycystic ovaries. Our sampling frame comprised of (i) children who had taken part in the earlier study and are now 8 years old (n=190) and (ii) additional children selected from the labour wards during the same time frame as the earlier children (n=287). Children and their parents were admitted overnight and the following studies were carried out the next day: (a) blood pressure (BP) of children and parents (b) plasma glucose and insulin of children and parents (c) fasting serum lipids (d) measures of central fatness (e) ultrasonography of abdomen in children and (f) 24 hr. urinary collection for steroids.

Results The children ranged in age from 8.05 to 8.88 years (mean 8.47, SD 0.11) 256 boys and 226 girls were studied. Boys had a higher mean birth weight and greater head circumference than girls at 8 years, while girls had fatter skinfold thickness. No sex differences were seen in other parameters (like body weight, height and waist hip ratio serum lipids and blood pressures). Blood pressures measured during sleep were consistently lower than when the child was awake ($p< 0.001$). Girls had higher insulin, pro-insulin and split proinsulin than boys.
403 fathers and 461 mothers were also assessed. 98 fathers (24.4%) and 61 mothers (13%) and 8 children (1.7%) had an abnormal glucose tolerance test (impaired glucose tolerance or diabetes mellitus).
After adjustment for current weight, age and sex, lower birth weight was associated with increased systolic BP ($p=0.008$), plasma fasting insulin, pro-insulin and 32-33 split pro-insulin ($p=0.07$, 0.1 and 0.02), plasma glucose and insulin concentrations 30 min. post glucose ($p=0.06$ and 0.02) and fasting serum triglycerides and cholesterol concentrations ($p=0.1$ and 0.002). Low birth weight was also associated with increased insulin resistance as calculate RIR-HOMA, but not with calculated indices of beta cells secretion/function. Lower birth weight was also associated with an increased tendency to deposit fat centrally as measured by the ratio of subscapular to triceps skinfold ($p=0.003$). All insulin resistance variables were strongly related to current weight. There was an interaction between birthweight and current weight, such that the highest levels of the insulin resistance variables were seen in children who were with a low birth weight but attained weight at 8 years.

Conclusion Although current weight was more strongly correlated with insulin resistance variable than size at

birth, our findings suggest that reduced intrauterine growth has a lasting effect on the development of insulin resistance in later life.

8. KNOWLEDGE REGARDING CORONARY RISK FACTORS AND CORRELATION WITH RISK FACTOR DISTRIBUTION IN AN INDIAN URBAN COMMUNITY

Usha Shrivastava, KS Reddy, LM Nath

Methods Public health strategies for control of cardiovascular disease epidemic require the ascertainment of the community's knowledge regarding modifiable risk factors. A cross- sectional survey of adults in the age group of 35-64 years was conducted with random cluster sampling of the urban blocks on the basis of the census records. The study estimated the present level of knowledge related to lifestyle related risk factors of coronary heart disease and correlated this with the risk factor distribution of modifiable risk factors in this community. It was conducted on 1064 adults (males 543, females 521).

Results Stress was perceived as the foremost risk factor for coronary heart disease (68.9%), followed by diet (59.2%), and overweight (57.0%). Only 54.3% of them could recognise smoking as a risk factor for coronary heart disease. It was observed that 71.7% of the respondents were not aware that diabetes was a risk factor for coronary heart disease. The coronary risk score was computed based on the presence of various risk factors like hypercholesterolaemia, level of HDL-cholesterol, history of smoking, and hypertension and diabetes in relation to age and sex. The Spearman's rank correlation coefficient between risk factor knowledge and coronary risk score was 0.06.

Conclusion The knowledge of risk factors of coronary heart disease is inadequate in urban population of Delhi and there is a poor correlation between risk factor knowledge and coronary risk score. There is thus a need for population education regarding the modifiability of coronary risk factors.

9. PERINATAL AUTOPSY STUDY

Sudha Y Sane, Asha Shenoy, Rekha Udani and Sabita Saldanha.

Intrauterine growth retardation has been associated with 'Hypertension and Coronary heart disease' in later life. Fetal growth retardation may alter circulation and ventricular dynamics. Growth of heart occurs by hyperplasia in fetal life and hypertrophy after birth. Wall thickness of heart and vessels is a function of mural tension. Various parameters of growth retardation may show relation with cardiac measurements.

Methods We did prospective study of perinatal autopsies on cases beyond 37weeks gestation and dying within 7 days of birth. Cases of major malformations and hydrops were excluded. Various body parameters and organ weights were recorded.

Weight of heart and thickness of right and left ventricles of heart was measured.

Microscopic measurements were performed with the help of image analyser:

1. Number of nuclei per square millimeter in myocardium of left ventricle and
2. Average thickness of myocardial fibers.

The data is analyzed to find if there is any relation of body parameters to cardiac measurements and compare data of normal birth weight babies with cases of growth retardation.

10. EFFECTS OF INTRAUTERINE UNDERNUTRITION ON HEALTH IN LATER LIFE (AYURVEDIC APPROACH)

VB Athavale.

Low birth weight babies i.e. intrauterine growth retardation is caused by-

1) Genetic constitutional factors and
2) Intrauterine environmental factors – Most important of which is nutrition received by fetus through placental blood vessels. Ayurveda has studied the causes of intrauterine growth retardation and clinical manifestations and treatment in these babies.

Ayurveda has also studied the effects of genes and constitution on intrauterine as well as postnatal growth and development, and its effects on various tissues, organs and mind and the diseases to which the individual is prone in childhood as well as in adult life. The undernourished low birth weight babies are thin and lean and are included in babies with vataja constitution. Most of these babies continue to be vataka constitution throughout their life. The purpose of this seminar is to study – 1) How undernutrition in fetus and infants determines the constitution and diseases in later life. 2) How improving the nutrition of and health of girls, young women, pregnant and lactating mothers will improve the health of their children throughout their lives.

In this presentation, I have divided the Ayurvedic approach to the subject in 3 parts –

1) Fetal i.e. Intrauterine malnutrition.

2) Constitution – Vataja constitution and its relation to adult diseases.
3) Planning for better progeny with balanced, physical and pyschological constitution.

Foetal malnutrition

In Ayurveda, three conditions of foetal malnutrition are described depending on the degree of failure of growth.

1) Upavishtaka – Where the foetus does not grow further. The foetal movements are less in frequency and intensity.
2) Upashushkaka or Nagodara – Where the foetus loses weight and foetal movements become further weak and occur less frequently.
3) Leena garbha – Where the foetus remains thin and lean and does not show signs of foetal movements.

The manifestations in mother, the causative factors, pathogenesis and treatment is described. Depending on the dominant dosha, each of these conditions is divided into vataja, pittaja and kaphaja types. Their manifestations and treatment are described.

Constitution

The constitution is basically genetic and is modified to a certain extent by environmental factors. The various factors which determine constitution are derived from –

1. Pitruja – Father
2. Matruja – Mother
3. Atmaja – Soul principle i.e. subtle body or linga deha
4. Satvaja – Mind
5. Rasaja i.e. Nutrition
6. Satmyaja - Ability to adapt to environmental factors.

Basic physical and biological atoms and molecules of Ayurveda

Space, Air, Energy, Water and Earth constitute the basic physical elements of the entire inanimate universe. Vata, pitta and kapha are the basic biological elements which constitute the bodies of all living creatures including plants and animals. Vata molecules are derived from combination of space and air elements. Pitta molecules are derived from combination of energy and water elements. Kapha molecules are derived from combination of water and earth elements. All the three biological elements have certain properties e.g. vata is dry, pitta is hot and kapha is heavy. Since these elements are the constituents of the entire body as well as mind, their qualities are reflected in the physical and mental characteristics of an individual. Vata is dry, light, mobile, expansile, quick, cold, rough and clear. The dry quality of vata in the body manifests in the form of a dry, slim and small body. The hair, nails, teeth and eyes appear dry. The voice is weak, low, cracked and dry. Because of dryness, the vata individual does not get sleep and remains awake. Because of light nature of vata, the diet, movements and activities of the person are light and quick. The mobile nature of vata results in unsteadiness and excessive movements of joints, eyebrows, chin, lips, tongue, neck, shoulders and limbs.

The expansile nature of vata becomes manifest in prominent blood vessels and fascia in persons with vata constitution. Because of quickness of vata, persons are quick to start their jobs but get tired, upset or emotionally disturbed quickly. They grasp quickly, but forget as easily. The cold nature of vata gives rise to cold body, intolerance to cold, stiffness of body or tremors or shivering. The roughness of vata result in rough hair, nails, teeth, face and limbs. The clear quality of vata manifests in the form of well differentiated parts of the body and cracking of joints during movements. The natural desires and cravings are for food and environment having opposite qualities. Because of the combination the above mentioned qualities such persons are usually weak, beget few children and have a short life span. Due to their physical weakness and wavering nature, they usually do not earn enough money and are considered unfortunate. The diseases to which the individuals with vata constitution are prone: higher functions: wavering mind, fear, greed, insomnia; CNS: hemiplegia, tremors, giddiness; heart: sluggishness of heart (Hrunmoha), tachycardia (Hruddrava); skin: cracking of lips, nails, alopecia; gastro-intestinal tract: constipation and fissures; reproductive system: amenorrhoea, oligospermia, cancer of prostrate, few children, low birth weight babies; growth and development: emaciation, early ageing, short life span. The various factors aggravating vata constitution and their prevention and treatment is given.

11. THE RELATIONSHIP BETWEEN BIRTH WEIGHT AND AGE AT MENARCHE

J Richard

The children born during 1969 to 1973 have been followed and their physical and mental measurements were recorded at various points of time. For the girls the age at menarche was noted down at the appropriate time. The birth weight of these girls were correlated with the age at menarche and the preliminary findings are presented.

The mean age at menarche was 14.3 and the standard deviation was 1.2. The correlation coefficient was 0.204, very small but significant with p=0.017.

12. RECURRENCE OF LOW BIRTHWEIGHT IN SUCCESSIVE PREGNANCIES

B Antonisamy and J Richard

Methods Using a population based prospective survey carried out in representative segments of rural and urban areas of Vellore district during 1969-73, we examined the recurrence of low birthweight (LBW) in two successive pregnancies and explored the genetic, obstetric and socio-economic risk factors for recurrence. Among the 475 women who had successive pregnancies with birthweight recorded, we observed the proportion in each of the four groups of women based on LBW (<2500g) such as normal to normal, normal to low, low to low, and low to normal and how these groups differ according to their maternal characteristics.

Results The recurrence of LBW in successive pregnancies was 9.5 percent and 5.3 percent in rural and urban women respectively. The percentage of LBW in either of two successive pregnancies was 29.5 in rural and 18.0 in urban. Based on subgroup analysis, the risk of LBW in successive pregnancies was high in mothers of rural background, teenage mothers, mothers of short gestation, illiterate fathers, and low maternal height and weight.

Conclusion The persistence of these risk factors emphasises the need for specific target interventions to achieve further improvements in infant health.

13. STUDY OF LOW BIRTH WEIGHT BABY IN BENGALI MOTHERS OF CALCUTTA

Debabrata Chatterjee and Mousumi Bhattacharya

Methods A survey on low birth weight (LBW) Babies has been carried out on the basis of clinical diagnosis. The baseline data has been collected from two hospitals in Calcutta a) general hospital and b) maternity hospital.

a) It is a teaching and general hospital. The patients usually undergo prenatal diagnosis and investigation for pregnancy followed by regular Antenatal medical checkup for various aspects, delivery and also immediate postnatal care. The delivery rate per year in the maternity ward is around 6000, having different income, mostly higher and middle income group.
b) The second one is a maternity hospital with yearly delivery around 2500. Normally the prenatal care starts from 2nd trimester followed up to delivery and subsequently postnatal care up to 7 days. Here the patients are middle and low income group. Entirely routine breast feeding is practiced.

To consider the LBW of the newborn babies the survey has been initially carried out for about 1500 cases (from a total birth of 8500 during one year). 300 cases have been recorded in detail giving emphasis on low to very low birth weight (2.0 kg to 800 g). History for mothers age, parity, marital status, socio-economic conditions are analyzed and the blood group parameter of mother/child combination for Rh D and ABO factors are also observed. The occurrence of 'O' group was found to be frequent among the very low birth weight group (up to 2 kg).

100 individual cases were selected for detailed study. The mother and the father were interviewed in detail for the factors like socio-economic status, parental age, previous sibling blood group, parity, mother's education etc. The heterozygous status of ABO and Rh were specially considered. The detailed physical examination including the birth weight of the baby, height, morbidity pattern, anthropometric measurement, ponderal Index, feeding pattern and the nutrition of the baby was observed by neonatologists.

Results LBW baby mortality in the general hospital is 13.5% but in the maternity hospital it is less than 2%. Following are the mean anthropometric measurement in the general hospital: mid-arm circumference 8.16 cm; chest circumference 27.65 cm and abdominal circumference 26.05 cm. The results show a positive relation on the occurrence of LBW baby with 'O' blood group (30%). Incidence of 'O' group for mother is (22%) and both mother and child is 20%.

14. TRACE ELEMENTS IN MATERNAL BLOOD - THEIR CORRELATION WITH CORD BLOOD LEVELS & NEONATAL ANTHROPOMETRY

Armida Fernandez and Jayashree Mondkar

Objectives

1. To determine the levels of Zinc, Copper, Iron, Lead and Cadmium, in maternal and fetal blood.
2. To correlate levels of these trace elements with fetal growth.

Design Prospective, pilot case-control study.

Setting Hospital based level III.

Subjects 85 mothers and their neonates having no medical or obstetric illness and no congenital anomalies.

Methods 85 mother -infant pairs were included in the study and divided into 3 groups.

Group I - 26 full term neonates

Group II - 29 preterm neonates
Group III - 30 full term low birth weight neonates

Results and conclusions

1. Maternal levels of the trace elements had a positive relation with cord blood levels of full term, preterm, and low birth weight babies.
2. Levels of Zn, Cu, Fe, in maternal and cord blood were significantly lower in preterm and low birth weight babies as compared to full term neonates with birth weight more than 2.5 kg.
3. Neonatal anthropometry showed a positive correlation with maternal Zn, Cu, and Fe, levels - Higher levels were associated with higher birth weights.

There was no correlation of the maternal Pb, and Cd levels with the neonatal anthropometry. There was no significant difference in the maternal and cord blood Pb and Cd levels in the 3 groups.

15. WOMEN, EDUCATION AND HEALTH

Lakshmi Lingam

Education and health are engraved in the Directive Principles of the Constitution of India. An educated and healthy population is considered a great human resource to any nation. The concern and focus on education and health are evident in the several Five-Year Plan documents and the various national policies that have been drafted at different points of time since India's independence.

Education and Policy Documents The Universal Declaration of Human Rights (1948) is the first international treaty, which recognises the right to education. The Declaration postulates that education shall be free at least in the elementary and fundamental stages. One of the Directive Principles of State Policy of the Indian Constitution enjoins that 'The State shall endeavour to provide within a period of ten years from the commencement of this Constitution, for free and compulsory education for all children until they complete the age of fourteen years' (The Constitution of India, Art.45). This corresponds closely to Article 28 of the Universal Declaration of Rights. The Five-Year Plan documents set the achievement of universal availability and equality of opportunity for education as a basic means of promoting the general welfare.

The National Policy on Education (NPE) 1986, states the need for "an unqualified priority to universalisation of elementary education (...) universal enrolment (...) and universal retention of children in school up to 14 years of age" (Govt. of India, 1989). The NPE called for an investment of 6% of national income or GDP in education during the Eighth Five-Year Plan. The NPE is a landmark in the field of women's education and empowerment. The section on 'Education for Women's Equality' considers empowerment of women as a critical precondition for their participation in the education process and other development activities. On the basis of the policy statement a series of women's empowerment programmes, popularly known as 'Mahila Samakhya', have been initiated in different states of India. The programme is attaining a lot of significance in the lives of rural women. The United Nations Convention on the Rights of the Child, which clearly states that signatories "recognise the right of the child to education, and with a view to achieving this right progressively and on the basis of equal opportunity, they shall, in particular make primary education compulsory and free to all" (Article 28), has been ratified by India. Apart from basic education being a human right it also has economic rationality. Investment in education is seen as vital instrument to achieve the country economic advancement.

Economic Aspects of Basic Education Education is the point of convergence in social policies and economic approaches. Prior to the discovery of Human Capital Theory by Shultz in 1961, the concentration was on physical capital, namely, machinery, equipment or buildings. It is observed that education contributes to the acquisition of skills, attitudes and so on, which contributes to individual productivity. There is empirical evidence, which shows that education, especially primary education, is a valuable unique investment that serves various facets of development. First, it enhances the human capabilities to enjoy life, inculcating better habits and approaches to life, thereby enhancing the quality of life. Second, it enhances productivity of the labour force in the labour market, and thereby increases earnings. Third, education contributes to better health, reduction in age at marriage, increased acceptance of contraception, reduction in family size and participation of women in the labour force. Lastly, it improves not only efficiency of the system through increased productivity, personal and social development, but it is also found to be an effective instrument of reduction of poverty, upward social and occupational mobility and improvement of equity in the system (Tilak, 1996). Thus universal elementary education is enshrined in the Constitution of India and in several declarations of the UNESCO and United Nations Organisations.

Women's Education Formal education of women in India began a hundred years ago. Despite the early start, the improvement in general literacy was slow till the time of independence. The ratio of female literacy to male literacy in India between pre-independence period and the post-independence period has increased considerably, however the significant difference between male literacy and female literacy persists.

The decennial census enumeration carried out by the Office of the Register General and Census Commissioner, defines literacy as the ability to read and write with understanding in any language. A person who can read but cannot write is not defined as literate. Children below the age of five are considered illiterate. According to the Censuses, the progress of literacy in the total population is as follows: 24.90% in 1951, 34.46% in 1961, and 52.21% in 1991. The situation with respect to female literacy is even more disappointing. The progress has been as follows: 7.83% in 1951, 12.96% in 1961, 18.69% in 1971, 24.82% in 1981, and 32.89% in 1991. It may be noted that literacy among females in 1991 (32.89%) is a little less than literacy among males in 1961 (34.46%), implying a lag of 30 years (Dandekar, 1996). Differentials also prevail in literacy rates in rural and urban areas, with the rural population having lower rates than the urban population. Literacy rates for urban females are higher than those for rural males (Karkal, 1991). There has been substantial increase in enrolment at all levels including for girls and Scheduled Castes (SCs) and Scheduled Tribes (STs). Drop out rates, though declining, are significantly large. Gender disparities are very conspicuous among SCs and STs as well, though this is attributed more to poverty and access factors than to discrimination.

The all India literacy data masks the large variations across states, rural-urban regions, communities and gender that exist. According to 1991 Census, the lowest female literacy rate in the country is 20% in Rajasthan and the lowest male literacy rate was 52% in Bihar. In every state the percentage literate is higher for males than for females and higher percentage of males have completed each level of schooling than females. The literacy gap between males and females is particularly large in Rajasthan, Uttar Pradesh and Bihar where the male literacy rate is more than twice the female literacy rate.

Girl Child's Education Women and girls globally constitute the largest single category of persons denied full and equal opportunities for education. The UNESCO's 1995 World Education Report reopens the debate on discrimination against women and girls. The report notes that: "women today represent two-thirds of the world's illiterate adults, while girls account for a similar proportion of the world's out-of-school population" (DPEP, 1996: 34).

The education of the girl child had attained specific focus during the year 1992, which was declared the 'Year of the Girl Child'. Considerable evidence had accumulated by this time in terms of low enrolment in schools and high drop out rate after primary level, high work participation rates of girl children and the low age at marriage prevalent in many parts of India. The education of girl children in general and SCs and STs in particular is an issue of concern. The education of girls is of low priority for families that generally place a relatively better emphasis on the education of the boys. Girls and women do not gain equal access to a range of resources and services within the household. Moreover, the non-availability of schools in close proximity, irregular teacher attendance in many schools, uninteresting and alienating school curriculum, teaching methods and materials compound the problems. This is especially so in rural areas. There is a strong negative correlation between school attendance rate and percentage of households having no literate members, indicating the inter-generation effect of education. In case of rural females, the percentage of villages having primary school as well as all-weather roads have positive effect on attendance (Unisa, 1995). Dearth of women teachers, quality of teaching, class room climate and physical facilities in the school have been seen to have close relationship to girl child education (Anandalakshmy, 1994).

The NFHS (1992-93) reports that: In the country as a whole, only 68% of children age 6-14 are attending school. The gap between girls and boys in school attendance is more pronounced in rural than in urban areas, especially at age 11-14 where only 48% of rural girls as opposed to 73% of rural boys are in school. In spite of the substantial educational advances that have been made over time, 41% of school-age girls in India are still not attending school. Urban females experience a 7% decline in attendance and rural females, whose level of education is much lower to begin with, experience a 13% decline in attendance from age 6-10 to age 11-14. Educational attainment of women has been uneven corresponding to the class distinctions of the Indian society. Hence, women from the middle and upper classes acquire education, though largely stereotyped, as opposed to women from the lower classes where poverty coupled with the low valuation of the benefits of education, deter girls

from going to school. The school enrolment, retention and achievement are also closely linked to economic development, household incomes and poverty. Further to this are cultural practices like early age at marriage.

Social Structure and Women's Health The health of a population is dependent on the social, economic, cultural, political and environmental factors prevailing in that country. Health as an outcome is contingent on factors that operate at three levels: the political, the societal and the household. Patriarchal values and cultural perspectives intersect al all levels, which have implications to women. At the political level, the policies and programmes of the State pertaining to wide range of issues, for example agriculture, industry, employment, health, forests, and so on, impact household income and access to vital requirements to live in dignity. At the societal level the caste, class, religious and ethnic differences determine the location of the household in the social structure. At the household level, the total household income determines the purchasing power of health goods and services. The physical location of the household in a social environment determines the access to housing space, clean drinking water, air, sanitation, drainage, accessibility and availability of health services and so on. The health culture at the community and household level influence and shape health beliefs and practices. At the intra-household level, studies have observed that an unequal access to goods and services exist on the basis of age, gender and kinship status. Woman's health within the household is typically dependent on her age, marital status and position in the household, and the status of women in society in general.

Patriarchal values manifest at each of these levels. At the political level, the values pertaining to the normative roles that women play in society, as wives and mothers, determine the designing and implementation programmes. Thus, women's fertility is targeted through the Family Planning Programmes; and women as mothers are the target clientele for a range of child health programmes. Paradoxically, while women are the guardians of household health through their domestic roles, there is least empirical evidence to indicate women's decision making power in health matters. The societal and cultural desire for sons as opposed to daughters; the low value attached to women's non-monetised work inside and outside the house; and so on, impact women's self.

Health Status The World Health Organisation (WHO) has defined health as "a state of physical, mental and complete well being and not the absence of disease or infirmity" (1958). The health status of a population is assessed through demographic indicators such as mortality rates, life expectancy, morbidity (disease incidence and prevalence) rates and so on, which essentially point to the absence of health. The death rate in India is 10, which is equivalent to the rates attained by any developed country. However, a close examination of the death rates indicate that infant mortality rate (IMR), and deaths of women in the reproductive ages, a large percentage of which is due to maternal causes (maternal mortality rate, MMR), continue to exist. The morbidity load that women carry, specifically those concerning reproductive health are attaining a lot of attention at present. Women are considered to be more vulnerable to contracting sexually transmitted diseases and specifically HIV/AIDS through the heterosexual modes of transmission, where they lack the power to negotiate for safe sex either as wives, sexual partners or as sex workers. Women's status related issues have a larger role to play in health outcomes than the mere presence of health care services.

Education and Health Linkages The positive outcomes of attaining education are considered to be many. The particular association between education and its linkages to several health outcomes has come to light during the last few decades. Research with macro data in examining this linkage covers areas such as fertility behaviour, i.e., the preference to have small or big families; contraceptive use; child survival, i.e. infant mortality rates, performance of immunisation, knowledge and use of Oral Rehydration Therapy (ORS), knowledge of AIDS/ STD. The knowledge pertaining to infections, diseases, the requisite individual and household practices, and health seeking behaviour are areas that are examined at micro settings to understand the education and health linkages.

Education and Fertility Behaviour Fertility behaviour understood in simple terms as the preference to have big or small families is observed to be influenced by the level of education, specifically attained by women. The examination of fertility behaviour is done with the help of demographic indicators such as crude birth rates (CBR), general fertility rates (GFR), and total fertility rate (TFR). The states of Kerala and Tamil Nadu have attained low birth rates and total fertility rates (TFR) and this is attributed to the female literacy levels of these states which are 86.17% and 51.33% in 1991, respectively. Table 1 provides the details of fertility by background characteristics. The association of education to TFR and mean number of children may be observed. Given this information it might be simplistically assumed that the preference for large families is due to the mere lack of

education or superstitions. It needs to be understood that apart from fertility behaviour being culturally rooted, it also has a host of economic dimensions. The following may be noted: (a) children contribute to the labour inputs in agriculture and artisan families; (b) amongst poor families, children contribute to the family survival from early ages; they are an asset rather than a liability; (c) in the absence of any old age pensions, children are seen as a security during the period of old age or disability. It is also observed that high infant mortality rate (IMR) creates the conditions of high fertility. Families have more children as a mechanism to ensure the survival of at least a few children. Women's health and child health are inter-linked issues. Hence, improvements in child survival and the contingent declines in IMR induce the declines in TFR, which in turn improves women's reproductive health. Similarly, improvements in women's health status which has an inter-generational affect contributes significantly to the declines in the IMR.

Education and Child Survival A review of the World Fertility Survey data of 115 countries conducted among child bearing women in several countries had identified the positive correlation of maternal education to declines in child mortality (Caldwell, 1979). This observation has been reiterated by the recent National Family Health Survey (1992-93), presented in Table 1. The Indian data on the relationship of IMR by mother's education is presented in Table 2.

Male infant mortality is high compared to female infant mortality at an aggregate level. However, the detailed data (not presented here), indicates that males have a higher risk of dying in the first month of life, whereas females have this risk between the first and fifth birthday. This reversal is thought to reflect the relative nutritional and medical neglect of girls after the cessation of breast feeding. Children of both very young and old mothers are at higher risk of dying, mortality rates are relatively high for first births and high order births, and child spacing patterns have a powerful effect on the survival chances of children. As the length of birth spacing decreases the risk of infant dying is higher. Infant mortality declines sharply with increasing education of mothers. Infant mortality is higher in rural areas than in urban areas. Scheduled Castes have higher levels of infant mortality than Scheduled Tribes, who in turn have higher levels than non-SC/ST women. Hindus have higher infant and child mortality than all other religious groups.

Table. 1: Fertility by background characteristics

Background characteristic	Total fertility rate*	Mean no. of children ever born to women age 40-49
Residence		
Urban	2.70	4.16
Rural	3.67	5.13
Caste/Tribe		
Scheduled-Caste	3.92	5.40
Scheduled-Tribe	3.55	4.81
Other	3.30	4.76
Education		
Illiterate	4.03	5.26
Literate(<middle)	3.01	4.50
Middle School Complete	2.49	3.71
High School Complete	2.15	2.80
Total	3.39	4.84

*Rate for women age 15-49 years; Source: NFHS, India, 1992-93, p.97.

Table 2: Child mortality by educational level of mother, 1981

	BY AGE 2	BY AGE 5
Illiterate	138	170
Literate below middle	96	107
Middle-below metric	63	71
Metric below graduate	43	48
Graduate+	28	32

Source: Registrar General, Census 1981, Occasional Paper No.2, 1989, cited in Ghosh S (1995): Integrated Health of the Girl Child.

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Issues such as pre-natal, ante-natal and post-natal care at maternity, deliveries in an institutional set up, seeking trained attendance at birth, the knowledge of vaccinations, immunisations, are all considered to be positively associated to female education. However, the exact processes that connect women's education to positive health outcomes, has been a subject of conceptual modelling. The primacy given to education and behavioural variables in research, to the neglect of economic variables that intersect with social variables, has been an area of contention.

A recent micro study that had examined the complex linkages between gender inequality, poverty and reproductive behaviour, observed a powerful relationship of per capita income as an explanatory variable for fertility as opposed to literacy indicators (ISST, 1996). Another study that critically examined the Tamil Nadu's recent demographic experience of declines in TFR, with disaggregated district level data, indicated the falsity in broad based generalisations of greater female autonomy of women in South India (ostensibly female friendly kinship structures) as a factor that contributes to the decline in fertility. Vast intra-regional variations exist which baffle these generalisations according to the author. Therefore, while high fertility rates resulting from lack of autonomy is understandable and plausible, low fertility rates need not necessarily imply presence of autonomy for women (Swaminathan, 1998). Jeffery and Basu's (1996) recent publication had grappled with women's autonomy, girl's schooling and fertility reduction in South Asia.

Conclusion The present paper has broadly outlined women's education, understood as literacy and schooling, in India. The macro-level data clearly indicate the steady increase in women's education. Nevertheless, the gender gap in access to education at all levels; the rural-urban and caste differences in enrolment, retention and achievement in education, are issues of concern. The paper also highlights the close association of education and health variables observed with macro-data. However, health outcomes are examined only in terms of child survival, reduction in fertility, contraceptive use or acceptance of small family norm. The pathways at a micro-level to these demographic outcomes are still fuzzy. On the other hand, existing evidence conclusively indicates the reduction in periods of exclusive breast feeding and reduction in the post partum period of amenorrhoea among educated women. Research studies have still not directed their attention to examining the relationship of women's education and women's proneness to Caesarean Section, menopausal problems, hysterectomy and mental health problems. This is not to say that women's education is undesirable. On the contrary, it has to be considered as a goal/ end in itself, rather than a means/ instrument to achieve other goals.

References

1. Anandalakshmy, S. (1994): The Girl Child and the Family. An Action Research Study. Dept. of Women and Child Development, HRD Ministry, Govt. of India, New Delhi.
2. Caldwell, J. C. (1979): Education as a Factor in Mortality Decline: An Examination of Nigeria Data. Population Studies, 33, 395.
3. Dandekar, V. M. (1996): The Indian Economy 1947-92. Vol II, Population, Poverty and Employment, Sage Publications, New Delhi.
4. DPEP (1996): Equal Opportunities for Women- An Impossible Dream? DPEP Calling, May, p.34-36.
5. ISST (1996): Poverty, Gender Inequality, Reproductive Choice: Some from a Household Survey. Occasional Paper 1-5, ISST, New Delhi.
6. Jeffery, Roger & Basu, A.M. (1996): Girl's Schooling, Women's Autonomy and Fertility Change in South Asia. Sage Publications, New Delhi.
7. Karkal, M. (1991): Progress in Literacy in India: A Statistical Analysis. Indian Journal of Social Work, Vol.LII, No.2, p.229-243.
8. Swaminathan, P. (1998): Work and Reproductive Health: A Hobson's Choice for Indian Women?
9. Tilak, J.B.G. (1996): How Free is 'Free' Primary Education in India? Economic and Political Weekly, Vol.XXXI, No.5, p.275-282, No.6, p.355-366.
10. Unisa, S (1995): Demographic Profile of the Girl Child in India. Social Change, Vol.25, Nos.2-3, p.30-37.

16. SOCIO CULTURAL FACTORS WHICH INFLUENCE NUTRITIONAL STATUS OF WOMEN AND YOUNG GIRLS IN RURAL MAHARASHTRA, INDIA

Ginny P Chorghade

Background Women in Rural India are thin and short and give birth to small babies. The Pune Maternal Nutrition Study (PMNS) conducted in Rural Maharashtra suggests that maternal height and pre-pregnant weight are strong determinants to fetal growth. Interventions to improve fetal growth should aim at improving

the nutritional status of young women. In order to develop an intervention, need arises to understand the social and cultural factors which directly or indirectly influence nutritional status. This study aims to look in-depth at these social and cultural behaviours that influence nutritional status of women in Pabal village, near Pune.

Methods The study started in January 1998, and will use both quantitative and qualitative methods. Sample households containing at least one brother-sister pair in the age range 4-8 years were selected from the PMNS database. Anthropometric measurements (height, weight, MUAC and triceps and subscapular skinfolds) of the sibling pair, parents and grand parents were used to determine nutritional status. Socio-economic information for every household was also collected. Comparison of BMI SD-scores and skinfold thickness data will be used to select households for further interviews Focus group discussions held in the village and its hamlets gave insight into the norms and beliefs on nutrition and health in the community. Data collection for the anthropometry phase and focus group discussions is complete and results will be presented at the conference.

17. FETAL GROWTH IN RELATION TO MATERNAL GLUCOSE TOLERANCE AND BODY COMPOSITION - THE MYSORE, PARTHENON PROJECT

Jacqui Hill

Introduction The Parthenon project follows closely from the first Mysore project, in which it was found that higher maternal weight was associated with increased rates of NIDDM in the adult offspring and that those babies who developed NIDDM as adults were short and fat, with a higher ponderal index at birth. It was hypothesised that low birth weight women who become obese as adults, are insulin resistant, develop relative hyperglycaemia in pregnancy and give birth to heavy, fat babies which are hyperinsulinaemic and go on to become diabetic as adults. This project was designed to test the hypothesis by determining how maternal glucose, insulin, pro-insulin and 32-33 split pro-insulin concentrations relate to: 1. the mother's own size at birth; 2. the mothers adult body composition; 3. the size and proportions of her baby at birth; 4. the baby's cord blood insulin concentration.

Methods Women are being recruited from the ante-natal clinics at HMH and asked to attend our clinic between 28 and 32 weeks gestation. At this clinic we administer a questionnaire, carry out a series of anthropometric measurements and perform a 100g (3 hour) oral glucose tolerance test. When these women deliver, we collect cord blood for insulin and glucose measurements, weigh and measure the placenta and carry out anthropometric measurements on the babies.

Discussion The project began in May 1997 and will end when all the women recruited have delivered their babies (end December 1998). We will present the data and conclusions drawn from it by this time next year. Sample size is less than originally projected and we will discuss some of the reasons for this. We will also present comparative data relating to the mothers who were themselves born in HMH, and comparing the Mysore mothers and babies to those in Pune and Southampton.

18. FETAL CARDIAC MEASUREMENTS AND ESTIMATION OF PLACENTAL RESISTANCE

Arun Kinare

Background Small babies are more prone to cardiovascular diseases and diabetes in adult-hood. Indian babies are amongst the smallest in the world. Maternal Nutrition and Placental Volume as the predictors of neonatal outcome were studied in the earlier project (PMNS). In the proposed study, Prof.Kent Thornburg's hypothesis for the link between reduced intrauterine growth and adult cardiovascular disease will be studied using measurements of different fetal cardiac structures and the placental circulation. These will be Ultrasound and Doppler-based measurements.

Methods In the pilot study we plan to evaluate 10 controls and 15 growth retarded fetuses (including asymmetric as well as symmetric). The detailed protocol will be presented. In short, three examinations will be carried out at 20,28, and 36 (+/-2) weeks of gestation.

MATERNAL DATA, which includes weight, height and blood pressure will be recorded at the first visit. FETAL DATA including BIOMETRY, the AMNIOTIC FLUID INDEX, CARDIAC MEASUREMENTS and UMBILICAL HEMODYNAMICS will be studied at all three visits.

19. 'FINLINDIA' - THE DELHI AND VELLORE STUDIES

Caroline Fall

Last year, Dr Richard from Vellore, and Dr Usha Shrivastava from Delhi presented a detailed outline of these proposed studies. They have now been granted funding by the British Heart Foundation, and fieldwork will go ahead this year. Rather than repeat the details again, it was decided that I, as a 'common factor' to both studies would present a brief view of their importance and context.

Background The studies are based on 1969-73 birth cohorts for whom similar data were collected in both Delhi and Vellore: maternal weight and height, accurate gestational age, detailed anthropometry of the babies at birth, and measurements of their growth during infancy and childhood. These cohorts are analogous to those in Helsinki, Finland. Importantly, in the Indian context, they represent both urban and rural communities.

Methods The 'babies', now young adults, will be traced and a range of CHD risk factors measured. These will be analysed in relation to their mother's height and body mass, their size at birth and childhood growth, as well as their current body composition and lifestyle. The studies will concentrate on the features of the Insulin Resistance Syndrome, known to be a hallmark of Indian CHD patients.

Delhi The initial cohort, started by Dr Shanti Ghosh and Dr Santosh Bhargava, resulted from following up women in a geographically-defined area of Delhi (Lajpat Nagar). There were 8,030 singleton live births. In a pilot tracing exercise carried out by Dr Bhargava in 1994, 1,794 members of the cohort, now aged 25-29 years, were found to be still living in or around Delhi. Data will be collected from these young men and women on demographic and lifestyle factors relevant to CHD including socio-economic status, tobacco consumption, dietary fat intakes and physical activity. Anthropometric measurements will be made, including measurements of body fat distribution, and CHD risk factors: blood pressure, glucose/insulin concentrations, serum lipid concentrations and plasma clotting factors will be measured. Clinical testing and laboratory investigations will be carried out at the All India Institute of Medical Sciences, New Delhi, under the direction of Dr KS Reddy.

Vellore The initial cohort was started by Dr Richard as part of a longitudinal study in maternal and child health. The study area included 26 rural villages of the KV Kuppam Panchayat Union, and 3 districts of varying socio-economic character in Vellore town. There were 3,831 singleton live births. In a pilot tracing exercise in 1995-6, 50% of rural and 28% of urban subjects were still living within the study area. It is estimated that 1,580 will be traceable to form the sample for the study. The protocol in Vellore will be similar to that in Delhi, and fieldwork will be under the direction of Dr Richard, Dr Raghupathy and Dr Leni Mathew. The rural part of the study will use the infrastructure of RUHSA (the Rural Unit for Health and Social Affairs) centrally located in the village area. The urban part of the study, and all laboratory investigations will be carried out at CMC Hospital in Vellore.

Discussion These studies will produce data of great public health importance. India is undergoing a transition in which the nutritional status of the adult population has improved, but fetal growth remains poor. The Finland study has shown that the small baby is more vulnerable to the adverse effects of even mild obesity in childhood and adult life, and to maternal obesity in pregnancy. It is hoped that, in addition to discovering if these same processes apply in India, the Delhi and Vellore studies will help to define optimal body weights for pre-pregnant Indian women in relation to their height, and optimal body mass index in Indian boys and girls, in relation to their size at birth.

SUMMARY OF PROCEEDINGS

FRIDAY 11th SEPTEMBER
INTRA-UTERINE GROWTH

Dr Caroline Fall – Where we are in 1998

News headlines for 1997-8: The official launch of SNEHA, India (Society for the Natal Effects of Disease in Adults) is the main headline of the year. Credit goes to Dr Potdar for completing the official registration procedures. Sabita Saldanha designed the SNEHA logo, showing an Indian mother, nurturing her child, first in utero and then in her lap, with the curve of her sari sheltering the baby. Other headlines this year:

- Unicef covered the findings of the Pune Maternal Nutrition Study in its prestigious publication 'The State of the World's Children 1998'
- The British Heart Foundation decided to fund the studies in Delhi and Vellore (see abstract 19).
- A collaboration was born between Dr Arun Kinare (KEM, Pune) and Dr Kent Thornburg (Portland, Oregon, USA) to study fetal cardiac development.
- The Wellcome Trust launched two funding initiatives; a) to promote research into non-communicable diseases in developing countries, and b) a series of Indian research fellowships.
- The Medical Research Council (UK) has selected Southampton University as for one of its new MRC Centres, to study physiological mechanisms underlying fetal programming.
- Last but not least: Professor David Barker was awarded Fellowship of the Royal Society.

On the scientific side: Evidence linking small size at birth to adult CHD continues to grow. While the early UK studies were based on relatively low follow-up rates, new studies from Finland[1] and Sweden[2], with excellent birth data (including gestational age) and over 90% trace rates, show similar findings. They have sufficient data on socio-economic and lifestyle factors to conclude that associations between low birthweight and adult disease are unlikely to result from confounding factors in later life. The main areas of 'hot' debate on the fetal origins hypothesis are now:

- *The interaction of childhood growth with low birthweight* Low birthweight effects are strongest in adults who become obese. The Pune 8-year-old study (see abstract 7) showed similar effects with increased body fat in *childhood*. This has public health implications: should interventions to control obesity be targeted to people of low birthweight, and start in childhood?
- *Maternal effects* The Mysore and Finland studies suggest that obesity in *mothers* exacerbates the risk of NIDDM and CHD in the next generation. Ranjan Yajnik's data (abstract 1) shows how the nutritional history of the mother predicts the body composition of the baby at birth, and may programme insulin resistance.
- *Genes v environment* While environmental effects on fetal growth are well established, the genetics of fetal growth is in its infancy. In the last year, studies have shown effects on fetal growth of a) naturally occurring polymorphisms of the insulin gene[3], and b) mutations of the glucokinase gene[4]. In addition, more genes are being identified which predict variation in CHD risk. In Hertfordshire there were additive effects of poor early growth and Apolipoprotein E genotype on adult LDL-cholesterol concentrations[5]. New studies starting this year in Hertfordshire will study gene/early growth interactions on CHD and risk factors.
- How *important* is the low birthweight effect? Calculations published this year show that if overall birthweight increased by 300 g, CHD prevalence would be reduced by only 5-7%[6]. Such calculations are misleading, since birthweight and birthlength are at best only crude proxy measures of fetal experience. We need better endocrine and biochemical markers of programming.
- *Mechanisms* (The perennial question) The most exciting progress is in the field of steroid metabolism. Animal studies show that environmental exposures early life imprint the hypothalamo-pituitary-adrenal axis (HPAA), resulting in permanent modification of the neuroendocrine response to stress. Early evidence of similar effects in humans is now emerging, with the demonstration of high fasting cortisol concentrations[7] and a prolonged response to ACTH in men of low birthweight.

Dr Ranjan Yajnik and Dr Kurus Coyaji – The 'Thrifty Phenotype' defined (Abstract 1, page 6)

The Pune Maternal Nutrition Study (PMNS) has produced a wealth of data on the relationships between maternal size, body composition and diet, and fetal growth, in a large population sample of women measured from before pregnancy. Size at birth was related to various 'components' of the mother's body composition, including her head size, height and fat mass. Ranjan proposed that each of these reflected a different period in the mother's

nutritional history: head circumference her nutrition in fetal life and infancy, height her nutrition in childhood and adolescence, and fat mass her current energy balance. The mother's head circumference was related to all measurements of the baby (except the placenta), while her height was related only to the baby's length, and her fat mass to the baby's skinfold thicknesses. This suggests important effects of a woman's nutrition at every stage of her life.

Compared with babies born in Southampton (Pune measurement/Southampton measurement), the Pune babies were small in all dimensions. Head circumference, length and skinfold thicknesses were, however, relatively 'spared', compared with mid-arm circumference (a measure of muscle), and abdominal circumference (a measure of liver size). The result was a thin baby with a 'fat-sparing, muscle-depleted, abdomen-depleted' phenotype. While fat may have benefits for survival in the immediate post-natal period, this phenotype, if it persists into adult life could cause centrally obesity and insulin resistance. Ranjan described similar phenotypic characteristics (preserved head and length and increased abdominal fat) in pups born to a colony of undernourished rats in Pune. The greatest mother-baby 'transfer' of subscapular fat was in short fat mothers, who were also centrally obese, and had high glucose, insulin and triglyceride concentrations. The worst scenario was possibly therefore the mother who was stunted in early life and becomes fat as an adult.

Finally Ranjan described his recent work on the inflammatory cytokines interleukin-6 (IL-6) and tumour necrosis factor (TNF-α). These are produced by adipose tissue, and may contribute to the aetiology of heart disease. Concentrations were low in the rural population (values similar to Londoners), but raised in urban (middle-class) Pune, and even more so in urban slum dwellers in Pune.

Discussion: Dr HPS Sachdev made the helpful comment that SD scores would be preferable to simple ratios in comparing the Pune and Southampton babies.

Shobha Rao – The GLV story (Abstract 2, page 6)

Shobha presented fascinating data from the PMNS on pregnancy outcome in relation to the mother's intake of green leafy vegetables (GLV's). Food intakes were measured by 24-hour recall and food frequency questionnaire (FFQ). Of all the food groups measured, GLV's and dairy products (mainly milk) showed direct relationships to pregnancy outcome. Mothers with higher intakes of GLV's had lower rates of premature delivery and of low birthweight. Their babies were larger in all birth measurements. Although mothers with higher GLV intakes were themselves heavier and fatter, and gained more weight during pregnancy, these relationships to neonatal size were independent of maternal size. All the effects were strongest in lighter mothers. Shobha raised the point that we do not yet know the long-term effects of differences in neonatal size associated with different maternal GLV intakes.

Of great interest if this story is to move forward is knowing what distinguishes the mothers who were eating GLV's regularly from those who hardly ever ate them. Shobha has carried out a survey specifically to answer this question. Main reasons for eating GLV's were a) personal liking and b) availability of land and water. Some people said they rarely ate GLV's because of their reduction in volume on cooking and therefore 'poor value'.

Dr Vijay Joshi – Placental pathology in IUGR (Abstract 3, page 6)

Dr Joshi presented a comprehensive review of the function, structure and pathology of the placenta, which provides nourishment, oxygen and protection to the fetus, as well as being an important endocrine organ. He provided a full manuscript of his presentation (see abstract 3). Population- and gestation-specific charts are essential to determine 'normal' placental weight, and PGI Chandigarh has constructed charts for India. Placental weight measurement is influenced by the presence of maternal and fetal blood, and by fixation methods. Large placentas (currently defined as >750g at term or 100g above normal at other gestational ages) occur in hydrops, diabetes, and infection. Dr Joshi emphasised the need for further research, including systematic placental examination in cases of IUGR, immunological investigations, correlation between pathology and outcome, and follow-up to examine long-term effects.

Dr Manoj Chinchwadkar – Intra-uterine growth of rural Indian babies: fetal ultrasound (Abstract 4, page 9)

Manoj presented ultrasound data from the PMNS. Scans in mid- and late-gestation showed that fetal head growth was similar to western standards until 26 weeks, but abdominal circumference was markedly reduced from as early as 22 weeks. Femoral length on the other hand kept up with western standards throughout gestation.

Low mid-pregnancy placental volume (MPPV) was associated with low birthweight, and a reduction in all birth measurements. Examination of the possible maternal determinants of placental volume was, however, rather disappointing: of all the mother's measurements, only her weight predicted MPPV. MPPV predicted birthweight independently of maternal weight. MPPV was unrelated to maternal blood pressure, or any of the blood parameters measured, including haemoglobin, serum ferritin, red cell folate and plasma glucose and Vitamin C concentrations.

Manoj described the fascinating phenomenon of 'non-fitting' placentas; many extended further over the uterine surface than in Southampton and did not fit within the view of the ultrasound probe. This was striking in view of the smaller overall MPPV and the use of a longer probe than in Southampton. He suggested that this placental extension was a mechanism to increase materno-fetal exchange. Indeed, it was associated with larger fetal size. He also described 2 new measurements: mid-pregnancy placental diameter (MPPD), the average of two perpendicular diameters, and mid-pregnancy placental thickness (MPPT). MPPV correlated strongly with MPPD ($r=0.6$), but less strongly with MPPT ($r=0.3$). MPPD also correlated with measurements of the baby at birth (birthweight $r=0.3$, placental weight 0.3), and predicted low birthweight at least as strongly as MPPV. In contrast, MPPT was not correlated with neonatal size. 68% of mothers with MPPD <9cm had babies weighing <2500g at birth. MPPD can be measured using standard ultrasound equipment, and Manoj put this forward as a useful clinical measurement, in contrast to MPPV, which is time-consuming and requires a special probe.

Dr Vaman Khadilakar – Intra-uterine growth of rural Indian babies: size at birth (Abstract 5, page 9)

Vaman grappled with the controversial issue of growth standards. Is it appropriate to use standards derived in other populations, and to use universal definitions of IUGR and symmetry/asymmetry? Using data from the PMNS, he compared rural Indian babies with UK (Castlemead) growth standards at birth, 6 months and one year, using SD scores. 13% of PMNS babies had IUGR, defined as < 2 standard deviations for birthweight for gestation. Head circumference and length were relatively spared, the latter most marked in boys. Ponderal index was not a sensitive indicator of IUGR.

At 6 months 70% of IUGR babies had 'caught up' reaching or exceeding –2SD's for weight. At one year, however, most had dropped back again to some extent. This occurred in babies with both symmetrical and asymmetrical IUGR (distinguished using on ponderal index), although asymmetrical tended to maintain catch-up slightly better than symmetrical. The length/height-sparing effect persists at 6 months and one year.

Vaman concluded that this rural Maharashtrian population has low rates of IUGR compared with all-India figures. What, however, is the best measure of IUGR in this population? Head and length growth are spared in Indian babies, and this persists postnatally. Catch-up growth is good at 6 months, but tends to regress in late infancy.

Dr SR Veena and Dr K Kumaran – An inter-generational study of coronary heart disease (Abstract 6, page 10)

Dr Veena described the study currently taking place in Holdsworth Memorial Hospital, Mysore, of 'second generation' adults born in HMH, *whose mothers were also born there.* The findings of the first Mysore study led to the hypothesis that low birthweight women, especially if they are obese, develop insulin resistance and impaired glucose tolerance in pregnancy. It was proposed that this causes hyperinsulinaemia and 'macrosomia' in the fetus, who then develops deficient insulin secretion in adult life. The inter-generational study (and the Parthenon Study: abstract 17) aim to test this hypothesis. Cardiovascular risk factors will be examined in relation to current body size, size at birth, maternal glucose/insulin metabolism, maternal weight and height in pregnancy, and maternal birthweight. . If the hypothesis is correct, the highest rates of NIDDM will be in subjects born to shorter fatter mothers who had a low birthweight. The study started in December 1997, and will conclude in July 1999. Results will be available for the next workshop.

Dr HPS Sachdev – Low birthweight in South-East Asia[8]

Implications of low birthweight, and the scale of the problem Low birthweight is associated with increased perinatal morbidity and mortality, poor growth in childhood, and increased adult morbidity. Of the two main causes of low birthweight: prematurity and IUGR, the latter is dominant in developing countries. WHO has defined low birthweight as a birthweight.<2500g; using this criterion, half of the global burden of LBW is in South Asia, the prevalence being highest (50%) in Bangladesh, and 30% in India. Within India prevalence ranges from 10% to 56% according to region, socio-economic status and rural or urban location. Reliable data collected by the National Neonatology Forum from 15 centres (1995) reports an overall LBW prevalence of 33% in India, one third (12% overall) due to prematurity[9]. A significant proportion of LBW in India is thus due to prematurity; there is evidence that gestation at birth is 'shifted to the left' in India, with average gestation being 39-40 weeks as opposed to the 40-41 weeks seen in the west. This is most marked in lower socio-economic communities.

Secular trends Although others have reported no changes in mean birthweight in India between the 1960's and 1980's, Dr Sachdev pointed out that this conclusion may be unreliable, since it was based on comparisons of data from disparate settings. He has attempted to make a more valid analysis, using data from the same areas at different time points. Based on 8 studies covering rural and urban populations, and community and hospital births, he found a small, 50-100g, increase in birthweight over 30 years, and a small increase in gestational age at birth. Despite these apparently small changes, percentages of low birthweight babies, have fallen by 8-12%. Data from Europe and the USA show a similarly small (50-100g) increase in birthweight over the same period.

Interventions to improve birthweight Kramer, in his 1997 meta-analysis of the causes of low birthweight divided the determinants of birthweight into 'established/not established', 'important/not important', and 'modifiable/ not modifiable'[10]. For example he identified adolescent pregnancy as an important modifiable cause of low birthweight. Trials of dietary supplementation in pregnancy have been disappointing, with, at best, only modest increases in birthweight. The role of micronutrient supplementation is at present unclear. Earlier studies showing benefits from folate supplementation have not been replicated. Supplementation trials have encountered difficulty getting supplements to the target population. ICDS data from a recent pregnancy supplementation trial showed that only 25% of eligible women received the intended supplements, and only 10% actually consumed them. In pregnancy, dietary restriction, *in order to produce a small baby*, is still routinely practised. Dr Sachdev proposed that improvements in birthweight will need multiple measures, aimed to tackle all modifiable factors within a given community. In India, such measures may include:

- Delayed marriage and child-bearing
- Improvements in the nutrition of women and mothers
- Access to education and ante-natal care
- Adequate rest during pregnancy
- Prevention of tobacco-smoking and chewing
- Better sanitation and living conditions
- Malaria prophylaxis.

FRIDAY 11th SEPTEMBER
CARDIOVASCULAR DISEASE AND RISK FACTORS

Dr Ashish Bavdekar and Dr Manoj Chinchwadkar – Endocrine, metabolic and cardiovascular correlates of low birthweight in Indian children (Abstract 7, page 11)

The Pune 4-year old childrens' study showed that children of lower birthweight had higher glucose and insulin concentrations 30 minutes after oral glucose[11], thought to represent early evidence of insulin resistance. The children have now been re-studied at 8 years with a larger study sample especially at the extremes of birthweight. In addition to repeating the risk factors measured at 4 years, urine was collected for estimation of adrenal steroid hormones, and left ventricular mass, renal and pancreatic dimensions, and (in girls) ovarian volume, were measured by ultrasound.

After adjusting for current body weight, children of lower birthweight had higher waking (but not sleeping) systolic blood pressures, fasting and 30-minute insulin concentrations, calculated insulin resistance, subscapular/ triceps ratios, and total- and LDL-cholesterol concentrations. The highest values were in children who had a low birthweight, but were heavy at 8 years. Thus, although risk factors were more strongly related to current weight

that birthweight, the study provides support for the hypothesis that reduced intra-uterine growth has lasting endocrine and metabolic effects, and that these changes are detectable in childhood. Urinary adrenal steroids were strongly related to 8-year body size, but not to birthweight.

The high prevalence of abnormal glucose tolerance in the parents (25% of fathers (mean age 40 years) and 12 % of mothers (mean age 33 years) had either NIDDM or IGT) highlighted India's diabetes problem.

Manoj presented preliminary ultrasound data. Mean left ventricular mass was strongly related to current body size, especially surface area, but not to birthweight. It was not correlated with blood pressure. Pancreatic cross-sectional area correlated with 30-minute insulin, but not fasting or 120-minute concentrations. It was unrelated to birthweight.

Dr Usha Shrivastava – Knowledge regarding coronary risk factors in an Indian urban community (Abstract 8, page 11)

Since the details of the newly-commenced study of coronary risk factors in young Delhi adults have been presented at earlier workshops, Usha presented data from another study, of public knowledge regarding heart disease and its risk factors. The subjects, men and women aged 35-64, living in Delhi, were selected to derive a varied sample in terms of socio-economic status. People's beliefs were recorded using a questionnaire and focus group discussions. An ECG was recorded, and a number of CHD risk factors were measured, including anthropometry, blood pressure and serum cholesterol concentrations.

Levels of knowledge were highest in middle and upper class groups, but poor overall. Only 40% of diabetics (and 18% of non-diabetics) were aware that diabetes was a risk factor for CHD. Stress was considered the foremost risk factor (identified by 69% of subjects), and was thought to affect men more than women because of responsibility outside the home. 59% of subjects said dietary factors were important, but only fried foods were identified as risky, and ghee was seen as beneficial. Obesity was recognised as a risk factor by 57% of subjects, and smoking by 54%, although the latter was considered a risk factor for lung disease more than for CHD. Alcohol was considered very harmful in a general sense; 'it burns the body'. There was little awareness that lack of physical exercise, and high intakes of salt, influenced CHD. Usha concluded that public understanding of lifestyle risk factors for CHD is inadequate, even in this urban setting. Strategies to control cardiovascular disease should include education programmes informing the population about modifiable risk factors.

Dr Sudha Sane – Perinatal autopsy study (Abstract 9, page 12)

Dr Sane has shown great persistence in continuing this study against all odds, including major equipment failure. Her aim is to measure organ size and tissue-specific histological characteristics in newborns born at full term but dying within 7 days of birth, in Mumbai's KEM Hospital. The study will test the hypothesis that asymmetrical IUGR, in which the brain-sparing reflex is likely to have operated in utero, is associated with changes in the size and structure of the heart, blood vessels and abdominal organs. Specifically, she expects an increase in cardiac left ventricular thickness relative to right ventricular thickness and in the number of nuclei in cardiac myocytes, reduction in the size of the liver, pancreas and kidneys, reduced numbers of renal nephrons and pancreatic islet cells, and reduced elastin in the descending aorta and coronary arteries. So far 39 cases have been studied.

Cardiac weight rose with increasing birthweight. There was no relationship, however, between birthweight and LV mass, LV or RV thickness, or their ratio. The number of nuclei per square millimetre in cardiac myocytes was significantly increased in babies who had a low birthweight and ponderal index at birth. Liver and adrenal gland weights were higher in babies with a higher birthweight and ponderal index. We await with interest data from more cases, and her examination of vascular structure when the image analyser is sorted out.

Dr David Barker – The Helsinki study: a vision of India in the future?

David's main theme was the nutritional transition, now taking place in many developing countries. A similar transition in 19th century Europe was followed by the 20th century 'epidemic' of coronary heart disease and diabetes.

He started by presenting findings of the Dutch Hunger Winter Study. The Dutch Famine of 1944 started and ended abruptly. For 7 months the previously well-nourished population was reduced to a mean calorie intake of 500-600 kcal/day. Birthweights fell, although perhaps surprisingly little. The follow-up study has shown poorer

glucose tolerance in men and women who were exposed to famine in utero, especially those whose mothers were thin, who themselves had a low ponderal index at birth, and who were exposed to famine in mid-late gestation[12]. This 'experiment of history' shows that diabetes can be caused by intra-uterine under-nutrition. The epidemiology of NIDDM makes it clear, however, that the disease does not result entirely from being an undernourished baby born to a thin undernourished mother. The prevalence of the disease is rising in association with increased affluence and urbanisation.

Finland, which since 1950 has progressed from being a very poor country, is a good place to study the effects of transition. It has excellent records of birth measurements and childhood growth. The first Finland study showed that low ponderal index at birth predicted increased adult mortality from CHD[1]. We now know that though thin at birth, men who died from CHD had a higher than average body mass index throughout their childhood. In other words men who were thin at birth and relatively fat as children had the highest mortality. The development of body fat in children is still poorly understood, but there is some evidence that it is programmed. Rolland-Cachera has shown that BMI at 2 years and 8 years is unrelated to dietary intakes at those times, but dietary intakes at 2 years predict BMI at 8 years.

Possible explanations for the Finland findings:

- Because of the tendency for BMI to 'track', high BMI in childhood may simply be a marker for high BMI as an adult (the adult BMI of the Finland cohort is not recorded).
- People who were thin at birth may have a low muscle mass. A high BMI in later life may therefore reflect relatively more body fat.
- An unbalanced journey, from fetal undernutrition to post-natal over-nutrition. In rats, dietary restriction of the mother during pregnancy followed by over-nutrition post-natally, reduces life-span.
- High childhood BMI may reflect programmed endocrine changes, in the insulin or GH/IGF axes.

These will be explored in future studies in Finland.

The other major finding of the Finland study was that men whose *mothers* had a high BMI also had increased CHD mortality. The effect was seen only in *short* mothers, suggesting that the phenomenon is related to early-life stunting of the mother. This is also supported by the finding that thin babies born to short fat mothers had small placentas. In conclusion, the Finland data show that it is bad for an individual to start life as a thin baby and become a fat child, and bad for the next generation for a thin baby girl to become a short fat mother. This, David suggested, surely carried some strong public health messages for India.

Discussion: Dr Sachdev suggested that transition will bring these problems and that they are probably unavoidable. Dr Barker replied that strategies to increase height growth and muscle mass, and avoid fat deposition, may be possible. Dr Sachdev replied that at the moment we do not know how to change people's height, or muscle and fat mass. Dr Joshi pointed out the large benefits in terms of general health and energy of the nutritional transition. Dr Barker accepted this, but emphasised the major death toll from CHD among Indian migrants to the west. Dr Armida Fernandes pointed out that fat is a necessity and that babies need fat to survive in the perinatal period.

Dr Vasant Athavale – An Ayurvedic approach to IUGR and its impact on health in later life (Abstract 10, page 12)

We were very grateful to Dr Athavale for coming to the meeting, and for taking a great deal of trouble to orientate himself to the 'fetal programming hypothesis'. His lecture was fascinating, and explored concepts entirely new to many in the audience. The word 'Ayurveda' is derived from 'ayesh' meaning 'life' and 'veda' meaning 'knowledge'. It concerns the science and philosophy of life, and teaches the way to lead a long, healthy and useful life. It recognises that life is an interaction with a changing environment, and requires constant adaptation. At the basis of ayurvedic teaching is the concept of each individual's 'constitution', determined by genetic and environmental factors:

- Pitruja and mitruja: The father's and mother's seed, ie genes.
- Atmaja: The soul principle or *linga deha* resulting from our many previous lives.
- Satvaja: The mind.
- Rasaja: Nutrition and diet. Certain foods are intrinsically thought of as good, for example fresh fruits. Diet has a broader meaning than just food; everything we see is 'diet' for our eyes, and everything we hear is 'diet' for our ears.

- Satmyaja: Adaptation to various environmental factors. The aim is to evolve with each successive life, towards a state in which, like Buddha or Krishna, one is without tension.

Space, air, energy, water and earth are the 5 basic physical elements of the universe, and as VATA (space and air), PITTA (energy and water) and KAPHA (water and earth) make up the bodies and constitutions of living creatures. The typical VATA constitution is characterised by a small body, physical weakness, a low voice, a tendency to restlessness and inability to focus. People with this constitution age early and have a short lifespan. As women they tend to have low birthweight babies. The PITTA constitution is associated with an angry, fiery temperament, and a quick intelligence. People with a KAPHA constitution are large, sluggish (phlegmatic), slow to understand but retentive, calm, lazy and live a long life. All 3 constitutions have bad as well as good elements, and a healthy constitution is a balanced one combining the good qualities from all three: 'He will enjoy the burning heat of summer as well as the biting cold of winter'.

Intra-uterine growth retardation is caused by genetic and environmental factors, the most important environmental factor being nutrition. Ayurveda describes 3 types of fetal malnutrition:

- Upavishtaka: 'Sitting fetus', not making progress, ie has stopped growing and moving.
- Upashushkaka: 'Shrinking fetus', actually losing weight. Also known as Nagodara (serpent-like abdomen), ie the abdomen does not bulge in the normal way.
- Leena Gharba: Thin and lean fetus.

Manifestations described in the mother include a failure of abdominal girth to increase, reduced fetal movements and vaginal bleeding. The causes include maternal factors such as insufficient or unsuitable diet (including fasting, which is not recommended for pregnant women), suppression of natural urges (coughing, sneezing or urination), over-exertion, and low maternal age (less than 16 years). They also include constitutional factors in the fetus, especially over-expression of VATA characteristics. This problem becomes localised to the placenta, affecting placental blood flow. Treatments recommended include certain foods (eggs, milk, chicken, peacock, rice, carrot, radish, bilwa shoots), ghee impregnated with medications, application of oils to the abdomen, and avoidance of aetiological factors.

Ayurveda prescribes a monthly regime for pregnant women, known as *Masanumasa*. This includes particular dietary items and medications, specific for the woman's constitution and stage of pregnancy, and aimed at promoting fetal growth. It also recommends the ideal environment in pregnancy, with 'good' sensory inputs such as music and fragrance, and the ideal code of conduct for the mother. Ayurveda says that the mother and father should not be related to each other within 7 generations. It also recommends dietary changes in the pre- and periconceptual time, to promote the health of the fetus.

Returning to the programming hypothesis, Dr Athavale said that Ayurveda sees life as a continuous process from birth to death. There is no concept of a 'crucial' or 'critical' period when the individual can be permanently programmed. Rather, the opportunity for adaptation and improvement exists throughout life.

SATURDAY 12th SEPTEMBER
FOCUS ON WOMEN AND MOTHERS

Dr J Richard - Birthweight and age at menarche (Abstract 11, page 13)

Like Dr Shrivastava, Dr Richard decided not to present details of the Vellore arm of the British Heart Foundation Study again this year. He analysed age at menarche in a sub-set of the same cohort of children, born in rural and urban areas of Vellore during 1969-1973. 278 girls were studied. Their mean birthweight was 2747g. The mean age at menarche was 14.4 years (SD 1.2; range 11-19 years). There was a correlation between age at menarche and birthweight ($r=-0.136$, $p=0.023$) such that girls with a higher birthweight attained menarche earlier. Although statistically significant, this correlation was not impressively strong when displayed using a scatterplot. These findings differ from those of two studies in the west: a study of one of the UK national cohorts, which showed earlier menarche in girls of lower birthweight[13], and Proos' study of low birthweight Indian children adopted in Sweden[14]. Further analysis is planned, taking into account childhood weight and height, which also influence menarche.

Dr B Antonisamy – Recurrence of low birthweight in successive pregnancies (Abstract 12, page 14)
Dr Antonisamy examined maternal, genetic, obstetric, and socio-economic factors associated with recurrence of low birthweight in two successive pregnancies, within the 1969-73 Vellore cohort. 475 mothers had two pregnancies within the cohort, with birthweight available for both babies. Dr Antonisamy divided them into 4 groups, depending on low (<2.5 kg) or normal birthweight:

Group	1st pregnancy	2nd Pregnancy	Frequency (%)
A	Normal birthweight	Normal birthweight	69
B	Low birthweight	Normal birthweight	11
C	Low birthweight	Low birthweight	7.5
D	Normal birthweight	Low birthweight	12.5

Recurrence of low birthweight occurred more frequently in rural (9.5%) pregnancies, than in urban pregnancies (5.3%). Risk of recurrent low birthweight was raised in teenage mothers (RR 4.1), mothers of low body weight (<40 kg: RR 2.9) and short stature (<145 cm: RR 3.5), and pregnancies where the father was uneducated (RR 2.6).

Dr Debabrata Chatterjee – Low birthweight babies in Bengali mothers (Abstract 13, page 14)
Dr Chatterjee presented data from a survey of 100 low birthweight babies born during a one year period (June 1997 to May 1998) in 2 Calcutta hospitals. Criteria for selection were birthweight <2.5 kg (irrespective of gestation), a healthy mother, baby examined within one hour of birth, and no major congenital abnormality. The babies were measured in detail, and data were collected on blood group, parental income and socio-economic status, maternal age, education and age at menarche, and contraceptive methods.

There was no consanguinity. Mean age at menarche of the mother was 13 years, and earlier menarche was associated with lower birthweight. An unexpected finding was that babies of blood group O, and babies whose mother and/or father were of blood group O had lower birthweights.

Discussion: This study would have been more informative if a control group of 'normal' weight babies had been included, and if LBW due to prematurity and IUGR were examined separately. The finding for blood group was interesting – there may be data in Pune and Mysore in which this could be examined.

Dr Armida Fernandes – Trace elements in maternal and cord blood (Abstract 14, p 15)
Relatively little is known about the relationship between trace elements and fetal growth, although higher maternal zinc (Zn), copper (Cu) and iron (Fe) have been associated with larger size at birth, while lead (Pb) and cadmium (Cd) have been associated with reduced fetal growth. Armida examined Zn, Cu, Fe, Pb and Cd in maternal and fetal (cord) blood samples, and correlated these with size at birth. 85 mother-baby pairs delivered in LTMG (Sion) Hospital were studied. Cases of maternal diabetes, renal failure, heart disease and tuberculosis were excluded. Studied cases were divided into 3 groups according to birthweight and gestation: a) normal full-term (birthweight ≥2.5 kg, gestation ≥37 weeks), b) preterm, and c) full-term low birthweight.

For all five trace elements, cord blood levels correlated positively with maternal blood levels. Iron concentrations were significantly higher in the baby than the mother. Birthweight correlated positively with cord blood levels and maternal levels of Zn, Cu and Fe, but was unrelated to Pb and Cd (see table).

	A Normal full-term (n=29)	B Preterm (n=26)	C Full-term, low birthweight (n=30)
Birthweight (kg)	2.7	1.7	2.1
Maternal weight (kg)	47.5	45.4	44.5
Blood zinc (μg/dl)			
Mother	840	660	675
Baby	439	204	313
Blood copper (μg/dl)			
Mother	226	116	125
Baby	61	42	47
Blood iron (μg/dl)			
Mother	47	37	38
Baby	58	45	51

Dr Jayshree Mondkar – Maternal and placental determinants of fetal growth

Jayshree presented findings of the study she and Dr Vasundara Kanbur carried out, of pregnant women living in Dharavi, Mumbai, and delivering in LTMG (Sion) Hospital. The main aims were to correlate maternal anthropometry and placental histology to fetal growth (measured by ultrasound and neonatal anthropometry). Inclusion criteria at booking were: a certain LMP date, gestation less than 16 weeks, singleton pregnancy, and no known major maternal disease. Maternal anthropometry, and fetal anthropometry on ultrasound, were measured at 16, 20, 28, 32 and 36 weeks gestation.

The study was hampered by difficulty getting the women back for follow-up; many mothers decided to deliver elsewhere. Of 116 women recruited, 51 were followed through to delivery. The womens' characteristics at booking were as follows: age 21 years, weight 44.7 kg, height 151.4 cm, body mass index 23.1 kg/m^2, triceps skinfold thickness 4.8 mm and subscapular skinfold 11.4 mm. Mean birthweight, birth length, head circumference and placental weight were 2.61 kg, 49.1 cm, 33.7 cm and 463 g respectively. *(Editorial note: Anthropometric measurements were made using the same techniques as for the rural women in the Pune maternal Nutrition Study. The Mumbai maternal values are similar to those recorded for Pune rural women at a similar stage of pregnancy. The babies were also of similar weight in Pune (2.67 kg), while length and head measurements were slightly smaller (47.8 and 33.1 cm). Mean placental weight was smaller in Pune (mean 360 g), but the Pune placentas were trimmed of cord and membranes before weighing.)*

There were positive correlations between maternal weight gain in pregnancy, and the baby's weight, mid-upper arm circumference and skinfold thicknesses at birth. There was a high correlation (r=0.6) between placental weight and birthweight. 33% of placentas showed gross pathology. On histology, lower birthweight was associated with larger terminal villous diameter. The fetal ultrasound data are still to be analysed.

Dr CS Yajnik – Cord blood data from the Pune urban study

Ranjan presented data from the KEM Hospital 'urban' study (January-May 1998) which was designed to collect data on urban mothers and babies comparable to that for the rural (PMNS) community. Anthropometry of mothers and babies delivered at the KEM Hospital was measured within 24 hours post-delivery. The study differed from the PMNS in that it was not community-based, and maternal anthropometry was measured for the first time post-delivery.

Of 471 babies born in KEMH during the study period, maternal anthropometry was obtained for 353, and neonatal anthropometry for 290. At delivery, blood was taken from mothers and babies (cord blood) for measurement of haemoglobin, plasma glucose, and serum lipids, albumin and total protein. Blood was obtained from 206 mother/baby pairs. Other data collected included a 'migration' history for the mother, ie. location (rural/urban) at birth, during childhood and currently, and ultrasound measurements of neonatal subcutaneous fat thickness.

Urban mothers were heavier, taller and fatter than rural mothers (Table). The babies were heavier, and slightly fatter, though the differences are small. Placental weight was heavier in the urban sample, though Ranjan queried whether this was a true difference, or due to the fact that the rural placentas were weighed after a longer interval post-delivery.

MOTHERS	PUNE URBAN (n=353)	PMNS RURAL
Weight (kg)	53.7	51.6
Height (cm)	153.1	152.0
BMI (kg/m²)	22.8	22.3
Head circumference (cm)	53.5	52.3
Triceps (mm)	14.0	11.0
Subscapular (mm)	20.0	14.7
Biceps (mm)	7.3	6.7
Supra-iliac (mm)	17.1	11.8
Fat mass (kg)	16.3	12.2
Muscle mass (kg)	15.8	15.3
BABIES	**PUNE URBAN (n=290)**	**PUNE RURAL**
Birthweight (kg)	2.788	2.665
Birthlength (cm)	47.8	47.8
Ponderal index (kg/m³)	2.57	2.44
Head circumference (cm)	33.3	33.1
Triceps (mm)	4.4	4.2
Subscapular (mm)	4.2	4.2
Mid-upper-arm (cm)	9.8	9.7
Abdomen (cm)	28.8	28.6
Placenta (g)	420	360

A high proportion of mothers had pregnancy-induced hypertension (PIH, 32%), perhaps reflecting referral of high-risk cases to the KEM. Their babies were small and thin. Babies born to diabetic mothers were large in all dimensions, including length (Table).

KEM Urban Study

	PIH (n=94)	DM (n=10)
Birthweight (kg)	2.301	2.970
Length (cm)	47.3	51.4
Ponderal index (kg/m³)	25.2	25.4
Head circumference (cm)	32.7	34.0
Triceps (mm)	4.1	5.4
Subscapular (mm)	3.9	5.3
MUAC (cm)	9.4	10.5
Abdomen (cm)	27.9	30.6
Placenta (g)	382	500

Maternal triglycerides and cholesterol concentrations were (as in the PMNS) positively correlated with birthweight, and cholesterol and HDL-cholesterol concentrations with the baby's skinfold measurements. Cord blood triglyceride concentrations were *inversely* correlated with neonatal skinfold thicknesses. Maternal and cord blood glucose (but not lipid) concentrations were highly correlated. Unlike glucose there is no direct cross-placental transfer of triglycerides, which have to be converted first to fatty acids. There was striking maternal hyperglycaemia at the time of delivery; more than 50% of the mothers had a plasma glucose of >140 mg/dl, even when not on IV fluids, and this was most marked in premature deliveries. Is this a 'stress' response? There were no relationships between maternal glucose at this time, and either maternal or neonatal anthropometry.

Dr Lakshmi Lingam – Women, education and health (Abstract 15, page 15)

Laksmi gave us a comprehensive referenced manuscript relating to the education and health of Indian women (see abstract 15). Here I will summarise information which did not appear in this manuscript, and especially that relating to *'fetal'* matters. Lakshmi told us that as the only social scientist in the meeting she felt like a 'fish out of water', but that she also felt that the strange current in which she found herself, was a friendly one. We greatly appreciate the fact that she was willing to take the plunge!

Data from many countries show that infant mortality rates are inversely correlated with the level of education of women. The National Family Health Survey (1992) confirmed that this phenomenon holds true in India. Recent international policies for development enshrine the idea that empowering women to make choices will lead to healthier, smaller and better nourished families, and better preservation of the environment. This is borne out by data from India. Lakshmi outlined how the emphasis of government policies relating to the health of the population has changed since Independence. Recent policies incorporate a 'bottom-up' programme, in other words, an emphasis on training local village-level workers, like ANM's. Now, also, the 'girl child' has come into focus, with the realisation that though naturally and biologically stronger than the male, culturally many forces conspire throughout childhood to weaken her. Lakshmi criticised the over-narrow continuing emphasis, in terms of policy for womens' health, on reproductive health issues.

Scientific proof that certain measures lead to better health are not enough on their own. To get people to change, it is important to know how they think. For example 'fatness' is so strongly associated in the public psyche with prosperity that it is difficult to persuade people that it can possibly be unhealthy. While a middle-class educated mother appreciates the importance of nourishing her fetus, and makes sure she 'eats for two', many poorer women still try to eat less, to make the baby as small a possible in order to ensure an easier delivery.

Mrs Ginny Chorghade – Socio-cultural influences on the nutrition of girls and women in rural Maharashtra (Abstract 16, page 20)

Ginny described her study, which is taking place in Pabal, one of the PMNS villages. She is using community- and household-level techniques to investigate why young women are so poorly nourished in this community.

Focus group discussions identified factors that determine food intake and workload. Men are the ones who hold the 'purse-strings' for buying food, although women invariably prepare it. Men also tend to eat first in the household, and often do not know how much food their wives are getting. Although it was acknowledged that girls get a slightly lower priority than boys when they fall sick, there was not a marked difference, and no evidence that girls are neglected in this sense. Criteria for selection of a bride are that she is able to work hard, and not be taller or better educated than her husband. On marriage, women said their food intakes changed little, but workload increased enormously. This was especially the case within the increasingly common nuclear families. Despite their heavy workload, there is a general expectation to produce a child within the first year after marriage. In pregnancy, almost all are advised by the older women in the family to eat less and work hard. Most women fast, as often as 2 days per week, and for a variety of reasons, including the welfare of the husband and ensuring birth of a male child. One of Ginny's most interesting findings so far is that 'bride price' has largely been replaced by dowry in this community in recent years, and that social changes within the villages are encouraging the dowry system. In the past girls expected to marry into farming families. Now, with the beginnings of rural industrialisation and greater mobility, there are other alternatives, and, if their families can muster sufficient dowry, girls have the chance to marry factory workers or government employees in nearby towns. Thus a good dowry is seen as a way of getting your daughter out of a life of hard physical labour as a farmer's wife.

Ginny's study is now progressing to the stage of detailed questionnaire-based assessment within selected households.

Dr David Barker – Mothers and babies in Beijing

Picking up on earlier discussion, David expressed the opinion that epidemiological transition in India does not inevitably mean an epidemic of CHD. He cited France as an example of a country which has largely escaped the disease despite a rapid transition to affluence over the last 200 years. History clearly shows the environmental factors which impair fetal growth and lead to CHD; the areas of Britain which had low birthweights in the past, and have high CHD rates now, were characterised by:

- poor agricultural land
- urban industrial development which led to employment of women in appalling working conditions
- unsanitary living conditions
- poorly paid heavy physical labour (eg coal-mining) where shortage of food meant that it all had to go to the men, to allow them to work

Moving on to the main subject of his talk, David described the Beijing study of cardiovascular risk factors in men and women born in the Peking Union Medical College Hospital during 1948-54. This was one of the few hospitals to survive relatively unscathed from the Cultural Revolution. Data recorded included maternal weight and height in early and late pregnancy, and the weight, length and head circumference of the babies at birth. In addition to placental weight, detailed line drawings of the *appearance* of the placenta were recorded – although it was not clear how to use these diagrams in the analysis. 795 people were traced, 86% of whom took part in the study.

The mothers had a mean height of 156 cm (*PMNS 152 cm; Southampton 163 cm*), and a mean early pregnancy weight of 51 kg (*PMNS 44 kg; Southampton 65 kg*). The Chinese babies had a small mean head circumference (31.9 cm; *PMNS 33.1 cm; Southampton 35.2 cm*) and length (49.4 cm; *PMNS 47.8; Southampton 50.2*) at birth, but were relatively heavy (birthweight 3.1 kg; *PMNS 2.7 kg; Southampton 3.4 kg*) and fat (ponderal index 25.6 kg/m^3; *PMNS 24.1; Southampton 27.1*). David speculated that these characteristics reflect down-regulation of intra-uterine growth at an early stage of gestation in Chinese babies. As in western populations, lower birthweight and thinness at birth (low ponderal index) were associated with higher adult blood pressure, impaired glucose tolerance and insulin resistance. There were no associations between size at birth and adult concentrations of LDL-cholesterol or fibrinogen. The pattern of growth of Chinese babies, with 'symmetrical' growth retardation, may prevent sacrifice of liver growth.

Maternal body mass index (measured during pregnancy) predicted adult glucose tolerance in the offspring. Men and women born to thinner mothers were more likely to be diabetic. However, there was also evidence of a U-shaped relationship, such that the offspring of very fat mothers also had raised 120-minute glucose concentrations. There may be an 'ideal' body mass index in terms of future glucose tolerance in the offspring. Maternal weight gain in pregnancy did not predict adult cardiovascular risk factors.

SUNDAY 13th SEPTEMBER
THREE KEY STUDIES IN GESTATION

Dr Jacqui Hill – The Mysore Parthenon Study (Abstract 17, page 21)

Jacqui described her ongoing study into the relationship between maternal glucose tolerance and fetal growth. She is carrying out OGTT's at 28 weeks gestation, in women booking antenatally at HMH, Mysore. Blood samples will be analysed for insulin and glucose to study glucose tolerance, and insulin resistance and secretion. The main research questions Jacqui will be asking are:

- Do lower birthweight, shorter, fatter mothers develop higher blood sugars during pregnancy?
- Is relative maternal hyperglycaemia within the normal range associated with changes in the baby's phenotype and cord blood insulin concentrations at birth?

Data collected so far show that the Mysore urban mothers are markedly fatter, but only slightly taller, than the Pune rural mothers, and that the babies are larger in all dimensions. Data collection will be complete in December 1998, and the results will be ready for the next meeting. In the longer term, the babies will be followed up (by Dr Krishnaveni) to examine the relationship of maternal glucose and insulin metabolism in pregnancy to the development of the child's glucose and insulin metabolism.

	MYSORE (Parthenon) n=534	PUNE (PMNS) n=633	SOUTHAMPTON (Wellbeing) n=519
Mothers			
Weight (kg)	56.5 (9.0)	47.3 (5.2)	73.3 (11.7)
Height (m)	1.55 (0.06)	1.52 (0.05)	1.64 (0.06)
Triceps (mm)*	17.2 (12.3, 24.5)	9.2 (7.1, 11.4)	19.5 (15.4, 24.7)
Subscapular (mm)*	24.4 (18.0, 34.1)	12.9 (10.1, 15.9)	17.7 (13.3, 25.1)
SS/TR	1.42 (1.2, 1.7)	1.4 (0.4)	1.0 (0.8, 0.9)
Babies			
Birthweight (kg)	2.898 (0.43)	2.633 (0.35)	3.448 (0.46)
Length (cm)	48.8 (0.06)	47.8 (2.0)	49.9 (2.0)
Head circ (cm)	33.9 (1.3)	33.1 (1.2)	35.0 (1.2)
Triceps (mm)*	4.2 (3.7, 4.8)	4.1 (3.6, 4.6)	not measured
Subscapular (mm)*	4.4 (3.9, 4.9)	4.1 (3.6, 4.6)	not measured
Abdomen (cm)	29.9 (2.0)	28.6 (1.9)	33.4 (1.6)
MUAC (cm)	10.4 (0.9)	9.7 (0.9)	11.6 (0.9)
Placenta (kg)	0.41 (0.36, 0.47)	0.36 (0.08)	0.57 (0.13)

Mean and SD given; *for logged variables, mean and interquartile range

Dr Arun Kinare – Cardiac development in utero (Abstract 18, page 21)
Arun described his proposed study into the relationship of fetal cardiac morphology to placental resistance. It will test the hypothesis set out at last year's meeting by Dr Kent Thornburg, that in IUGR placental resistance leads to increased right ventricular overload, which permanently alters the structure of the heart. Arun and Manoj Chinchwadkar visited Kent's unit earlier in 1998, to become familiar with ultrasound measurement of the fetal heart. They now plan to do a pilot study, of 5 normal and 15 growth-retarded fetuses at 20 weeks gestation. Measurements of fetal somatic growth (BPD, abdominal circumference, femur length), amniotic fluid index, cardiac dimensions, and flow indices in umbilical and other vessels, will be made 20, 28 and 36 weeks, using B-mode, M-mode and Doppler ultrasound techniques. Middle cerebral artery flow will not be measured as it is very influenced by treatment. Echocardiography will also be carried out in the neonatal period. The fetal measurements take about one hour per visit, and can be difficult due to the small size of the fetal heart and vessels, variable fetal position, and the need to make measurements at precise angles. Studies in Singapore have shown greater difficulty in making fetal ultrasound measurements in mothers of Indian origin because of greater deposits of abdominal fat.

Caroline Fall – 'Finlindia' – the Delhi and Vellore studies (Abstract 19, page 22)
The Delhi and Vellore groups did not want another detailed presentation of these studies this year. However, since funding for the studies has now arrived, and in the light of new knowledge since last year, their special role deserves to stay fresh in everyone's mind. The Finland data have been referred to on several occasions during this meeting: they have enabled study of *maternal* effects, and effects of *childhood growth patterns,* on adult disease. The Delhi and Vellore data will allow similar analyses – hence the invention of this word 'Finlindia'.

In terms of maternal effects: data from Finland, Beijing and Mysore suggest that both extreme thinness and extreme fatness in the mother can have adverse effects on the offspring. We hope the Delhi and Vellore studies will give us information on the 'ideal' range of BMI for height, for women before pregnancy. In terms of childhood growth: the Finland and Pune (8-year-old study) data suggest that high body fat in childhood is associated with increased CHD risk. We hope that the Delhi and Vellore studies will help determine 'ideal' patterns of childhood growth, and shed light on a) parental influences on these patterns of growth, and b) their endocrine correlates.

Sabita Saldanha – The Mumbai office and how it can help you

Sabita informed everyone of the new Mumbai office address (see page 38), and reminded us of the facilities it offers, including Medline searches, the SNEHA newsletter, and help with transfer of information, equipment, and samples between India and Southampton. She described future plans to set up a Powerpoint slides service. Suggestions put forward for other useful services the office could offer included the development of a SNEHA website (see overleaf), and a list of contact addresses (including e-mail addresses) for all members.

Dr Potdar – Final words

It's always a shame to precis Dr Potdar's words, but these were the main points:

- If Sneha's members want the organisation to have a future as an agent for change this will depend on all the groups developing a sense of 'fellowship' with each other and being able to work together in an orchestrated way.
- A SERVICE or INTERVENTIONAL element should start to be introduced into our research investigations, at least in a small way or in subsets. In this we would benefit from the help of social scientists.
- Sneha should do more to increase its profile by getting sessions and workshops within specialist meetings and conferences.
- Sneha should look for sources of funding within India, and think about developing LOCAL strategies for this.

References

1. Forsen T *et al.* Mother's weight in pregnancy and coronary heart disease in a cohort of Finnish men: follow up study. *BMJ* 1997;**315**:837-40.
2. Leon DA *et al.* Reduced fetal growth rate and increased risk of death from ischaemic heart disease: cohort study of 15,000 Swedish men and women born 1915-29. *BMJ* 1998;**317**:241-5.
3. Dunger D *et al.* Association of the *INS* VNTR with size at birth. *Nature Genetics* 1998;**19**:98-100.
4. Hattersley A *et al.* Mutations in the glucokinase gene of the fetus result in reduced birthweight. *Nature Genetics* 1998;**19**:268-70.
5. Henry JA *et al.* The effects of genotype and infant weight on adult plasma levels of fibrinogen, factor VII, and LDL-cholesterol are additive. *J Med Genet* 1997;**34**:553-8.
6. Joseph KS *et al.* Should we intervene to improve fetal growth? In: A Life Course Approach to Chronic Disease Epidemiology. Eds.Kuh D, Ben-Schlomo Y. Oxford University Press, Oxford, 1997.
7. Phillips DIW *et al.* Elevated plasma cortisol concentrations: a link between low birthweight and the insulin resistance syndrome? *J Clin Endocrinol Metab* 1998;**83**:757-60.
8. Sachdev HPS. Low birthweight in South Asia. In: Malnutrition in South Asia: A Regional Profile. Ed. Gillespie SR. Rosa Publication No.5, Unicef, Regional Office for South Asia, Kathmandu, Nepal, 1997; pp23-50.
9. National Neonatology Forum. Neonatal morbidity and mortality – report of the National Neonatal/Perinatal database. *Indian Pediatrics* 1997;**34**.
10. Kramer MS. Determinants of low birthweight: methodological assessment and meta-analysis. *Bull WHO* 1987;**65**:663-737.
11. Yajnik CS *et al.* Fetal growth and glucose and insulin metabolism in four year old Indian children. *Diabetic Med* **12**:330-336, 1995.
12. Ravelli ACJ *et al.* Glucose tolerance in adults after prenatal exposure to famine. *Lancet* 1998;**351**:173-77.
13. Cooper C *et al.* Childhood growth and age at menarche. *Br J O G* **103**:814-817, 1996.
14. Proos LA. Growth and development of Indian children adopted in Sweden. *Acta Universitalis Upsaliensis*, Upsala University, 1992.

Summary compiled by Caroline Fall, with help from Sabita Saldanha, K Kumaran, Jacqui Hill, and Ginny Chorghade.

NEXT MEETING

THE 1999 WORKSHOP WILL BE HOSTED BY THE VELLORE GROUP, AND WILL TAKE PLACE OCTOBER 8th – 10th,
Venue: Mahabalipuram

SABITA SALDANHA'S DEPARTURE

AS MANY OF YOU KNOW, SABITA IS GETTING MARRIED IN MAY 1999, AND WILL BE LEAVING US TO LIVE IN THE USA. WE WOULD LIKE TO SAY THANK YOU FOR ALL YOU HAVE DONE FOR MRC AND SNEHA. YOU HAVE BEEN A GREAT COLLEAGUE. WE WISH YOU ALL THE VERY BEST FOR YOUR WEDDING AND IN YOUR NEW LIFE. PLEASE KEEP IN TOUCH.

ALIFIYA MOTIWALA WILL TAKE OVER FROM SABITA ON APRIL 9TH 1999.

WEBSITE

THIS IS NOW IN PREPARATION. WOULD ALL MEMBERS PLEASE SEND A PHOTOGRAPH AND 200-WORD SUMMARY OF THEMSELVES TO THE MUMBAI OFFICE. THIS SHOULD INCLUDE QUALIFICATIONS, CLINICAL EXPERTISE, AND RESEARCH INTERESTS, PLUS THE REFERENCE OF YOUR SINGLE MOST IMPORTANT RECENT PUBLICATION.

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