# REASONING ABOUT CAUSALITY AND TREATMENT OF CHILDHOOD NUTRITIONAL DEFICIENCIES IN RURAL INDIA: ROLE OF INDIGENOUS KNOWLEDGE AND PRACTICES

BY

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### A THESIS SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

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### ABSTRACT

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This study examines the relative influence of traditional and biomedical theories of health and disease on the reasoning about childhood nutritional problems by mothers in rural South India. Mothers with different levels of schooling, traditional practitioners, and medical experts were interviewed. Their explanations of nutritional problems were verbally recorded and analysed using methods of cognitive analyses.

Nutritional concepts and their interpretations given in the mothers' explanations matched that of the traditional theory of Siddha medicine, prevalent in South India. With an increase in formal education, there was an increase in the use of concepts derived from modern biomedical theory. However, the mothers exhibited little understanding of the underlying mechanisms involved. Implications of these findings for designing nutrition and health education are discussed, in relation to knowledge reorganization to replace harmful concepts and relations with beneficial ones.

#### RESUME

Cette étude examine l'influence relative des théories traditionnelles et biomédicales de santé et de maladie sur le raisonnement que font les mères au sujet de problèmes nutritionnels dans les régions rurales de l'Inde du Sud. Des mères avec différents niveaux d'instruction, des praticiens traditionnels, et des experts médicaux ont été interviewés. Leurs explications des problèmes nutritionnels ont été verbalement enregistrées et analysées à l'aide de méthodes d'analyses cognitives.

Des concepts nutritionnels et leurs interprétations données dans les explications des mères ont correspondu à ceux de la théorie traditionnelle de la médecine Siddha, qui prédomine dans l'Inde du Sud. Avec une augmentation de l'éducation formelle, il y avait une augmentation dans l'usage des concepts découlant de la théorie biomédicale moderne. Cependant, les mères ont fait montre de peu de compréhension des mécanismes sous-jacents impliqués. Les implications de ces conclusions dans la préparation d'un projet de nutrition et d'éducation de santé sont discutées, relativement à la réorganisation de la connaissance pour remplacer des concepts et relations nocifs par d'autres qui soient bénéfiques.

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#### CHAPTER 1

#### INTRODUCTION

According to the latest United Nations International Childrens' Emergency Fund policy review (UNICEF, 1990-1), malnutrition is stated as one of the most significant global problems of the day. Protein energy malnutrition, nutritional anemia, vitamin A deficiency and iodine deficiency disorders (IDD) are the most serious nutrition problems. About 150 million children under the age of five years are underweight, and more than 20 million suffer from severe malnutrition. Some 40 million children suffer from vitamin A deficiency and some of these children go blind and eventually die. About 2,50,000 children go blind or partially blind and survive. Around half the children under five years suffer from nutritional anemia (UNICEF, 1990-2). Two of the important goals of UNICEF for the 1990s constitute (a) the reduction of both moderate and severe protein energy malnutrition in children under five years of age by one half of the 1990 levels, and (b) the virtual elimination of vitamin A deficiency and its consequences, including blindness.

It has been argued that the nutrition programmes in the past have been monofocal technical interventions, sometimes reflecting the disciplinary background and priorities of the "intervener" more than the real needs of the community (UNICEF, 1990-1). Thus instead of adopting and trying to implement 'pre-packaged' technical interventions, it has been recommended that the most appropriate actions should emerge from the assessment and analysis of specific contexts.



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An important element of this new strategy is a conceptual framework for the analysis of the causes of malnutrition in a specific context. In this framework, as shown in Figure 1, inadequate dietary intake and disease are the most significant immediate causes of malnutrition and in most cases malnutrition is viewed as the combined result of these two factors. The underlying causes which could be many and usually interrelated have been grouped into three main clusters. These include insufficient basic health services and an unhealthy environment, insufficient household food security, and inadequate maternal and child care, and these have to be identified in a particular context. The potential resources in the community, together with the economic, political and ideological structure constitute the basic or the structural causes. The ideological factors include aspects of the society such as religion, culture, tradition and beliefs. The conceptual model also recognizes the importance of formal and informal institutions which play an important role as the interface between underlying and basic causes, as they provide basic services or promote improved practices regarding food production and child care.

Identifying a mother's knowledge about child care, an important component of maternal and child care in a community, and the influence of the traditional ideologies which are often imbedded in the accepted local culture, therefore form important components of the conceptual framework outlined above. Likewise, attempts at assessing the existing knowledge on child care practices in different cultures, have been made in several studies in the past. Studies have been conducted on peoples' common sense knowledge about cause, treatment and prevention of diseases due to nutritional deficiencies based on local belief systems. Attempts have also

been made to characterize the many prevailing beliefs, customs and cultural factors influencing child feeding. Moreover, in many communities a codified medical system exists and traditional practitioners provide health advice and early medical care. Studies have shown the coexistence of ideas and treatment regimens from both the traditional and more modern western medical traditions, for a variety of ailments in various communities.

However, although most of these studies provide a detailed descriptive knowledge of the prevailing belief structures and practices, they do not provide any prescriptive answers. This is partly due to the lack of precise methods available for the analysis of data. More recently, the theories and methods developed within the domain of cognitive science have been shown to be powerful tools for in depth analysis of peoples' knowledge and behaviours. Cognitive science is a discipline where an attempt is made to borrow methods and theories from a number of domains such as psychology, computer science, linguistics, philosophy, anthropology and sociology.

In the rural and suburban parts of India, systems of traditional medicine are still practiced quite widely. In South India, the Siddha medical system flourishes and Ayurvedic medicine prevails throughout India. Both these systems of traditional Indian medicine are based on the eternal wisdom of the *rishis* or the sages of India, who supposedly received these sciences from the Divine beings through religious introspection and meditation. A fundamental relationship between the compositions of drugs, man and universe forms the basis for both Siddha and Ayurveda. In rural South India, Siddha medicine also goes by more familiar names such as "granny medicine" or "folk medicine".

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The present study attempts to look at the mothers' reasoning about causality and treatment of childhood nutritional deficiencies in rural South India using some of the methods developed within the domain of cognitive psychology. The aim is to identify nutritional concepts and to examine the mothers' reasoning strategies about childhood nutritional disorders. The relative influence of traditional, indigenous Indian medicine and modern western medicine on the mothers' knowledge and practices about childhood nutrition are examined.

Formal education plays a significant role in the promotion of improved child care practices. Recent research on learning and instruction has demonstrated the importance of prior knowledge in the acquisition of new information. Naive, socially acquired theories have been found to persist despite formal instruction. Preliminary studies were undertaken by the author (Sivaramakrishnan & Patel, 1990a; Sivaramakrishnan & Patel, 1990b; Patel & Sivaramakrishnan, 1990; Patel & Sivaramakrishnan, in press) in a sample of East Indian mothers born and educated in India, and living in Canada for the last 5 to 20 years. These studies, using some aspects of the methods developed in cognitive psychology, examined the role of traditional Indian medicine on the mothers' explanations about childhood nutritional deficiencies. The results from the study showed that even among the group of immigrant population of East Indian origin, the explanations about childhood nutrition and the problems therein, were based on traditional theory (Ayurvedic theory). The use of traditional concepts prevailed even in mothers with college or university degrees. There was an increased use of biomedical concepts by these mothers, but the interpretation of the concepts were based on traditional theory.

Although we know a great deal about the correlational relationship between schooling and nutritional status, very little is known about how newly acquired knowledge from formal instruction is integrated into prior nutritional knowledge acquired from social experience. In the present study, mothers with varying levels of formal education were selected to investigate the effects of nutrition information obtained from formal schooling on their pre-existing knowledge and practices. The results on how knowledge with respect to childhood nutritional problems is organized for use by mothers in Madurai, will help identify the strengths and weakness of the existing knowledge structure. Such information would facilitate the planning of more culturally appropriate and effective nutrition education programs aiming at alternate knowledge organizations, with implications for child nutrition and health.

Chapter II of this manuscript outlines a critical review of the literature related to reasoning and the structure of knowledge used for reasoning in everyday situations. This is compared to scientific reasoning. The review is further extended to include literature that deals with the various perspectives on the process of knowledge acquisition in both informal and formal settings. The relevance of the issues of reasoning and knowledge acquisition to education in nutrition are discussed.

Chapter III provides a profile of the study population followed by a discussion of the methodology used for quantitative and qualitative analyses of the data. This chapter also describes the biomedical and traditional reference models for the childhood nutritional problems in question, which have been used for the interpretation of the results.

The results of the study are presented in Chapter IV, followed by a discussion of the results. The concepts generated by the mothers in their reasoning about the childhood nutritional deficiencies have been identified and compared with the concepts and their interpretations within the two reference models. The influence of formal education on the mothers' reasoning about the presented nutritional problems are addressed.

Discussion of the results is followed by the conclusions drawn from the results. An outline of the specific positive and negative influences of the traditional belief structures on child nutrition and health is also presented. The implications of the findings for improved education in the domain of nutrition are discussed.

### CHAPTER II

#### **REVIEW OF LITERATURE**

### Reasoning

Reasoning is, loosely, the working through of problems so that one can explain either why something happened or what will happen (Hunt, 1989). Recent research, particularly in the area of informal cognition has focussed on thinking and reasoning in everyday contexts. It is being increasingly recognized that reasoning in everyday life is a practical activity and may, therefore, not be of the same nature as reasoning in scientific and academic settings. Studies have attempted to compare and contrast thinking and reasoning in the two situations.

### Everyday reasoning vs scientific reasoning:

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Studies on scientific understanding and conceptual change have focussed on the metaphor of the lay adult or the child as an intuitive scientist, which has gained wide acceptance in the last decade. The scientist explores the environment, constructs mental models to understand it, and also revises those models based on new evidence generated. Likewise, lay people endeavour to make sense of their environments by processing information, constructing mental models of it, and evaluating the models they generate. Thus, both the child or the lay adult and the scientist gain an understanding of the world through construction and revision of models or paradigms that replace each other, whenever there is a need to coordinate new evidence with pre-existing theory. The development of both scientific

and lay understanding thus involves a progression of partially correct theories within individual conceptual domains.

However, in recent studies questions have been raised on whether the processes by which theory and evidence are co-ordinated, and theories are constructed and revised are similar in lay adults/children and scientists. For example, Kuhn (1989) claims that the processes of scientific thinking, and the co-ordination of theory and evidence is fundamentally different in a lay person and a scientist. According to her, the scientist is able to consciously articulate a theory that he or she accepts, knows what evidence does and could support it and what evidence does or would contradict it. He or she is able to justify why the coordination of available theories and evidences has led him or her to accept that theory and reject others purporting to account for the same phenomena. This requires certain rules of inference and methods of hypotheses testing such as the ability to encode and represent the evidence separately from a representation of the theory, the ability to think about the theory rather than with it, and the ability to temporarily bracket the theory and evidence. Kuhn suggests limitations in the differentiation and hence coordination of theory and evidence by children and lay adults. She argues that the abilities for hypotheses testing described earlier, which are refined in the scientist are largely lacking in the general population.

Her findings on reasoning by lay individuals showed that when theory and evidence were compatible, there was a melding of the two into a single representation of the "way things are", and there was no concept of evidence as standing apart from theory. However, when theory and evidence were discrepant, both lay adults and children used a variety of devices to bring them into alignment. Either the theory or the evidence was

adjusted by ignoring it or by attending to it in a selective and distorting manner. Performance of college subjects was better but even they showed the same phenomenon as soon as more complex problems were introduced. Schooling and experience may more directly foster these skills by affording practice in bracketing one's own experience or beliefs in order to infer a conclusion that follows from information given. However, the fact that both adults and college students were able to reason at no more advanced level than children, indicates that sufficient exercise may often, not be available.

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Perkins and Simmons (1988) also believe that, in contrast to everyday experience, the sciences and the technical domains require a commitment to extra-ordinarily high standards of logical consistency in the co-ordination of theory and evidence. Vosniadou and Brewer (1987) advice us to exercise caution in the interpretation of the analogy between the child/lay adult and scientist because there are important differences between the two. Theory change in the case of the scientist requires the discovery of an internally consistent new paradigm, but this is not the case for the child or the lay adult. Children and lay adults do not have to independently discover a new paradigm, but have only to integrate current scientific views with theories derived from his/her experience. Misconceptions may arise in their attempt to integrate conflicting pieces of evidence.

Thus, what is regarded as logical reasoning in academic settings may not fit problem solving in everyday situations. Everyday cognitive activity has been defined as activity that is of a very practical and opportunistic nature and is adjusted to meet the demands of the situation (Rogoff, 1984). Instead of employing formal approaches to solving problems considering all possible alternatives, people use a practical and efficient solution to daily

problems. Interaction with other people and socially provided tools and practices play a significant role in reaching appropriate solutions to problems in everyday contexts.

Analyses of arithmetic practice in everyday situations by Lave (1988) and Saxe (1990) further exemplify the relations between everyday cultural practices and cognition. Both Lave's observations on daily activities in grocery shopping, cooking, dieting, and money management in adults and Saxe's research on the mathematical practices involved in Brazilian child candy sellers, show that everyday reasoning skills are acquired primarily through social interactions and cultural influences rather than through formal education.

Irrespective of the afore-mentioned differences between scientific and everyday reasoning, fundamental to reasoning in both the situations is the individual's knowledge structure or cognitive structure.

### Structure of knowledge used in reasoning:

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Cognitive refers "to the mind, having the power to know, recognize, and conceive, concerning personally acquired knowledge", so cognitive structure concerns individuals "ideas, meanings, concepts and cognition". Structure refers to the form, the arrangement of elements or parts of anything, the manner or organization. The emphasis is not on the elements, but on the way those elements are bound together (Pines, 1985). Cognitive structure is therefore defined as the knowledge someone possesses and the manner in which it is arranged (White, 1985).

For many years cognitive structures have been described using standard psychometric procedures. These approaches have used a model of knowledge based on associations and stimulus-response relationships. They have focussed on quantitative rather than qualitative aspects of knowledge, that is, on the amount of knowledge rather than the extent of knowledge. The methodology used for assessing knowledge has concentrated on statistical factors and a particular format of multiple choice questions.

The psychometric procedures (such as concept classification and categorisation tasks, and word association tasks), which represent major advancements made in the fields of psychology and education during the past century, proved to be very effective for many situations. However, the assumption generally made was that knowledge exists as subject matter disciplines rather than as psychological entities (Shuell, 1985). As more complex relationships characteristic of cognitive structure were developed, it was realized that the traditional psychometric procedures were unable to capture the complexities therein. As a result, newer more appropriate procedures for representing knowledge and describing cognitive structures were developed. However, associations and associative data clearly exist and any comprehensive model of cognitive structure must be able to explain such data along with the more complex relationships described by the newer approaches (Shuell, 1985).

### Knowledge representation and cognitive structure:

The concept of knowledge representation plays a central role in nearly all aspects of cognition although there are still tremendous debates concerning the precise nature of the representation. A representation is

something that stands for something else. In other words, it is a kind of model of the thing it represents. There is a representing world and a represented world. The representing world must somehow mirror some aspects of the represented world. Therefore, theories of representation have the brain states as the represented world and the theoretical structures as the representing world (Rumelhart and Norman, 1985).

The representation systems most popular today fall into three basic families:

1) The propositionally based systems, in which knowledge is assumed to be represented as a set of discrete symbols or propositions, so that concepts in the world are represented by formal statements.

2) Analogical representation systems, in which correspondence between the represented world and the representing world is as direct as possible, for example, maps that are analogical representations of some geographical features of the world or pictures in which three dimensional space is represented by marks on a two dimensional medium.

3) Procedural representation systems, in which knowledge is assumed to be represented in terms of an active process or procedure.

Most of the representational systems that have been developed and evaluated to date have, however, used semantic networks that are primarily propositional. The concept of a proposition, borrowed from logic and linguistics is central to this analysis. A proposition is the smallest unit of knowledge that can stand as a separate assertion, that is, the smallest unit about which it makes sense to make the judgement true or false

(Anderson,1990). Semantic networks were first introduced around 1966 by Ross Quillian as a representation for the concepts underlying English words and since then they have become a very popular language for representing knowledge. They build upon the node-relation-node triplet. The basic notion is that knowledge can be represented by a kind of directed, labelled graph structure in which the basic structural element is a set of nodes interrelated by relations. Nodes represent concepts in memory and a relation (which is labelled and directed) is an association among sets of nodes. The meaning of a concept (represented by a node) is given by the pattern of relationships among which it participates. Two methods of propositional analyses have been proposed by experts in the literature (Kintsch, 1974; Frederiksen, 1975).

However there are features of our knowledge that cannot be represented simply by the network structures defined by propositions. Working with large semantic nets proved to be cumbersome, and people soon began to detect structures within such sets. It was seen that certain sets of propositions cohere together in larger order units or higher level structures called schemas (Anderson, 1990). They have been given other names such as frame and script.

The nodes and relations of semantic networks do not allow one to structure knowledge into higher order representational units. Schemas, however, form holistic units which allow for the encoding of more complex inter relationships among the lower level units. They represent our knowledge about how features tend to go together to define episodes. Roughly schemas are like models of the outside world. They encode the cooccurrence relations among propositions, spatial information, and the order

of events. van Dijk and Kintsch (1983) describe schema as a label with slots that stand in some prearranged relation to each other. Each slot accepts information of a given type. Information here may mean concepts, propositions or even other schemata. Information regarding how propositions are related can be used to generate a schema or frame. The most direct way is to use the linking propositions as links and the remaining propositions as nodes. The structure is then made coherent by imposing some kind of compelling "natural" structure upon the propositions from outside (Patel and Groen, 1986). Such a relational structure with labelled links and possibly empty nodes also corresponds closely to the notion of a macrostructure as proposed by Groen & Patel (in press) and Kintsch (1983).

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A number of data collecting techniques have been used to obtain information on such cognitive structures. The most subtle, fine grained techniques use interviews in one form or another, which provide great insights into how people store and recall knowledge and use it in thinking. There is heavy emphasis on the use of protocol analysis as a basis for inferences about underlying cognitive processes or structures involved in intellectual activities. A protocol, in a context of psychological terminology refers to an exact transcript of the verbal response of a subject. Two chief protocol methods commonly used, have been the talking aloud technique and the clinical interview technique. Newell and Simon have made extensive use of the talking aloud method, in which the subject is instructed to say everything that comes into his or her head, while solving a problem. Aside from the initial instruction to talk aloud, the researcher seldom intervenes beyond presenting the relevant tasks. The verbal clinical interview method as originally used by Piaget, involves flexible questioning

contingent on previous response of individuals on a totally verbal level and the protocol simply preserves the verbal interaction. In the revised clinical interview, concrete objects are used to illustrate the problem to be solved and data obtained include both verbalizations and aspects of non-verbal behaviour. Methods of diagnostic explanation have been used to obtain information on knowledge structures, in the area of medicine.

### Use of the explanation paradigm to describe knowledge:

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Patel and Groen (1986) in their study on medical reasoning were unable to use a problem solving paradigm since the "thinking aloud" techniques invariably yielded extremely sparse protocols. One explanation for this is that the pressures inherent in medical practice make the reasoning process highly automated (Groen and Patel, in press). As a result, protocols generated during problem solving do not yield much information. Patel and Groen (1986), therefore used an explanation task, rather than a problem solving task, to obtain adequate protocols. The subjects were requested to explain the pathophysiology, or causal pattern, underlying a clinical case. In another study by Patel, Eisemon and Arocha (1988), mothers in Kenya were interviewed using a series of clinical probes to study their understanding and explanation of the causality, recognition and treatment of childhood diarrheal diseases. The mothers' protocols were analyzed to generate structural networks consisting of nodes (concepts) and labeled links (relations). The three relations in the semantic network were labelled causal, conditional and proximal (a causal relation referred to an event, act or process which caused a change in state; a conditional relation indicated the presence of one event or process contingent on the presence of another event; a proximal relation denoted the co-occurrence of two events spatially

or temporally. Reference models ("folk model" and "textbook model") were used to interpret the data generated by the subjects.

Although the information from the protocols has been used to elicit the complex problem solving process and also the underlying cognitive processes and data base, modern psychology has been dubious about the verbalizations produced by subjects and even more dubious has been the response to experimenter probes or retrospective answers about prior behaviour. However, now with verbatim transcripts of the recorded tapes, verbal data also represents hard data and not soft data. Data are hard when there is inter-subjective agreement, that they correspond to the facts of the observed behaviour, whereas in the case of soft data different interpreters making different inferences will each arrive at an interpretation that is favourable to his theoretical orientation (Ericsson and Simon, 1984). The process of protocol analysis begins with tape recording which contains all of the auditory events. Selection is then required to produce the written transcript. After the temporal information, repetitions and stress have bein used to segment and parse the verbal stream, most of this information is usually eliminated from the transcript and this process of transcription is referred to as the pre-processing step. The protocols are then segmented into individual statements (assertions or propositions). This information is then used to generate a semantic network representation.

Recent research in cognitive science and education, using such methodology, has focussed on the conceptual models that lie behind peoples' reasoning in various domains. Methods such as the generation and exploration of semantic networks, details about which are described in the

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chapter on methodology have been used by several researchers to obtain information on peoples' knowledge structures.

An issue of concern in recent years, particularly to research in everyday cognition and cross-cultural research has been the acquisition of knowledge informally through cultural (contextual) influence.

### Cultural (contextual) influence on knowledge:

It is being increasingly recognized that human knowledge is influenced considerably by the external aspects of a functioning cognitive system. These external aspects include the influences of the intellectual and physical environments. The intellectual environment, that concerns the cultural knowledge and beliefs which have been passed on from generation to generation by society interacts with the physical environment, that includes the facts and events of the real world. Concept formation depends on the mental sets of individuals which are a function of this interaction between the two environments. For example, the linguistic metaphors rooted in the history and culture of the Sotho people (in Southern Africa) influenced at least to some extent their conception of heat (Hevrson, 1985). For the subjects living in the hot, arid areas in the interior of Southern Africa, "hot" is bad and the heat metaphor is used for situations in life that involve negative feelings, death, and sickness.

Recent research contrasts the use of knowledge acquired through formal education with knowledge acquired informally through a cultural medium. There is now extensive literature which indicates that sciencenaive individuals have an understanding of the natural world which is based on their interpretation of everyday experience. This naive knowledge

is usually quite different from the knowledge imparted to them through formal education.

Such naive knowledge, beliefs or conceptions have been referred to in several different ways by different authors. For example, West et al (1985) differentiate private knowledge from public understanding. According to them science exists as public knowledge in text books, and in scientific papers. When individuals read (or are told) this public knowledge, they interpret and internalize it in their own way depending on their prior knowledge and experience. Public knowledge, according to them exists because there is a substantial overlap between the private understanding of different individuals. Pines and West (1986) distinguish between two sources of individual knowledge : 1) the knowledge that is acquired spontaneously through interaction with the environment and 2) the knowledge that is acquired in a formal fashion through schooling. The former is referred to by them as "gut knowledge", "naive knowledge" or "spontaneous knowledge". This informal knowledge, according to them, constitutes the belief system about the world and how it works. It is acquired in a rather haphazard fashion over considerable time, and is influenced by culture. The latter is called "formal knowledge" or "scientific knowledge" and it is someone else's interpretation of the world. The acquisition of formal knowledge, according to them is influenced by spontaneous knowledge.

While a number of researchers appear comfortable using these terms interchangeably, the majority exhibit a distinct preference for some rather than others. They have been referred to as naive theories (McCloskey, 1983), naive beliefs, intuitive ideas, common sense beliefs (Champagne et al, 1985),

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preconceptions (Clement, 1983), misconceptions, alternate framework and children's science (Gilbert, 1985).

There is extensive literature that establishes the existence of such naive or intuitive beliefs in various domains. For example, Vosniadou's studies (1989) in astronomy have shown that children construct ontological beliefs of the world based on their everyday experience under the constraints of their global theories. Meaningful and internally consistent conceptual structures are generated from these ontological beliefs. Several studies demonstrate the existence of "naive physics" knowledge in students (Nersessian & Resnick, 1989; McCloskey, 1983; Clement, 1983; Champagne et al, 1985; Wiser & Carey, 1983; diSessa, 1988 ) which is strikingly inconsistent with the fundamental principles of classical physics. Although there are now a number of domains which have received considerable attention, there have been relatively fewer studies in biological areas than in the physical sciences (Driver, 1989).

Most of the studies, moreover, have focussed on concept acquisition, particularly, in domains of science in children and students. Not many studies have been done in adults and on concepts needed for functioning in everyday life. Although science is only a refinement of everyday thinking, there are some major differences between everyday concepts and scientific concepts (Reif, 1987). Scientific and mathematical concepts are used to pursue the scientific goal of achieving optimal predictive and explanatory power, and so they have to be specified with minimum ambiguity, maximum precision and highest generality. Everyday concepts, on the other hand are used with the implicit goal of ensuring satisfactory human functioning in daily life, a goal which can be achieved by concepts which may

be somewhat ambiguous and vague, occasionally inconsistent and limited in scope (Reif, 1987).

Few studies have shown the existence of alternative concepts related to issues of health and nutrition in various cultures. For example, Launer et al (1989) in their study on the concepts about infant health, growth and weaning in nutritional scientists and in mothers from Indonesia, found that although both share common concern for the well-being of the child, their definition of key concepts differed. The nutritional scientists' conceptual model was related to the biomedical model of health, whereas the mothers' conceptual framework was related to the Madurese model of health. Studies by Patel et al (1988) on the reasoning about cause and treatment of childhood diarrhea by Maasai schooled and unschooled mothers in Kenya showed that the unschooled mothers' conceptual structures related to knowledge and beliefs shared by the community whereas the schooled mothers had a quasibiomedical model. Study on the explanation of childhood nutritional deficiencies by East Indian mothers (Sivaramakrishnan and Patel, 1990a) showed the presence of a non-mechanistic traditional (Ayurvedic) level of explanation in the unschooled mothers, which gradually became more mechanistic with age. With increase in formal education, besides the traditional knowledge which became more mechanistic, there was also evidence for the emergence of naive biomedical explanation.

Researchers also disagree over whether there is an underlying structure that generates these intuitive explanations. Research on technical expertise (Chi, Feltovich and Glaser, 1981) has shown that novices' knowledge of a domain is spotty, consisting of isolated a unitions and superficial understanding of central terms and concepts. As competence is

achieved, these elements of knowledge become increasingly interconnected (structured). Research in medical diagnosis (Patel & Groen, 1986) has shown that the explanations of expert physicians are far more coherent than those of medical students. Thus while some think that the intuitive knowledge is loosely connected and fragmented (diSessa,1988) and does not have the systematism of a scientific theory, others advocate the view that there is an underlying structure that generates such intuitive explanations which are therefore coherent and systematic like any other scientific theory. The importance of theories in cognitive development and their role in conceptual coherence have been explicated by many researchers (Murphy, 1985).

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Vosniodou (1989) states that children start their knowledge acquisition process with a global theory consisting of a set of core concepts and a notion of causality which forms the basis of their ontology and epistemology and they synthesize these discrete beliefs into large, internally coherent conceptual units. Champagne, Gunstone and Klopfer (1985) comment on the parallel between students' pre-instructional beliefs and aspects of Aristotelian physics. Nerssesian & Resnick (1989) have been able to construct an intuitive belief structure with its associated conceptual structure which parallels the medieval beliefs. McCloskey (1983) has drawn attention to the similarities between pupils naive physics and the "medieval impetus theory". Clement (1983) relates the naive physics to the conceptual model discussed by Galileo.

Such findings which indicate that the untutored ideas appear similar in certain respects to certain historically influential systems of scientific thought, result in their being considered in some sense prior, either

developmentally or historically, to the conceptual schemes of contemporary science (Hills, 1989). Other researchers are inclined to regard the views of the uninitiated as having scientific purport, as such views are developed using some notion of scientific method. Hills (1989), is of the view that the untutored views or alternative framework originates in "common sense theories". Common sense, according to Hills, can be viewed as a system of shared beliefs or concepts which provide the basis for day-to-day activities within a culture and common sense theories seem to play an important role in structuring experience in the practical affairs of life.

An open question has also been whether these naive conceptions are being used consistently in different contexts. While some studies provide quite strong support for this view (Vosniadou & Brewer, 1989; Carey, 1985; McCloskey, 1983) others are not so definite. For example, Clough & Driver's investigations (1986) in areas of physical and biological sciences has shown that although in some cases there are very clearly identified single alternative conceptions, in other cases the situation is more complex. Responses varied across question contexts, both at population and individual level.

Another important focus of research on the use of knowledge in reasoning and problem solving has been concerning the methods used for problem solving in a domain. An issue of increasing concern has been the directionality of the reasoning used by experts and novices.

### Directionality of reasoning:

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An expert has been defined as an individual with a specialized knowledge of the domain. A novice, on the other hand is defined as either

a lay person with only common sense or everyday knowledge of a domain, or a beginner with prerequisite knowledge assumed by the domain (Groen and Patel, in press).

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A major finding emerging from this research has been the difference in the methods used by experts and novices in their use of knowledge during problem solving. A distinction is frequently made between forward and backward reasoning. Forward reasoning or inductive reasoning refers to an oriented path that leads from a fact to a hypothesis, whereas backward reasoning or deductive reasoning is where the problem solver works backward from a hypothesis regarding the unknown back to the given information.

Studies contrasting expert and novice problem solving in domains such as physics have shown that experts appear to use forward driven reasoning (Larkin et al, 1980; Simon & Simon, 1978). Research in medical diagnosis (Patel and Groen, 1986; Patel, Groen & Arocha, 1990) has shown that expert physicians used an inductive process of pure forward reasoning (from data to diagnosis) as opposed to a deductive process of backward reasoning (from diagnosis to data) to explain problems for which they give accurate diagnosis. With incomplete diagnosis, a mixture of forward and backward reasoning were used. Forward reasoning was thus strongly related to diagnostic accuracy, since none of the subjects with an inaccurate or incomplete diagnosis used this directionality of reasoning. Similarly, when the experts giving a correct diagnosis were confronted with "loose-ends" or information not accountable in terms of the major hypothesis in their explanation, they resorted to backward reasoning (Patel, Groen & Arocha, 1990).
Studies on the explanation of nutritional concepts by mothers of East Indian origin, now living in Canada, (Sivaramakrishnan & Patel, 1990b) have shown that both the "expert" older mothers who practiced traditional nutrition, and the "expert" nutritional consultants, with university degrees in nutrition used similar strategy of forward reasoning in diagnosing the problem. The difference was in the use of knowledge base; the former used a socialized form of Ayurveda and the latter used biomedical knowledge.

The expert in any domain possesses knowledge that the novice does not. Forward reasoning is, therefore, being used whenever there is adequate domain knowledge and it seems to be characteristic of experience (Hunt, 1989). The subject, obviously views his or her existing knowledge base as adequate and therefore, misconceptions will be long lasting and difficult to eradicate . Backward reasoning on the other hand is the preferred method of reasoning when there is not enough domain knowledge and misconceptions in this case may only be the means to an end (Groen & Patel, in press). The presence of backward reasoning therefore implies that the subject is trying to learn something new. For example, the use of this reasoning strategy by experts to "tie up" the loose ends in a clinical case suggests that some form of learning may be taking place (Patel, Groen & Arocha, 1990).

Another issue of increasing concern for research in cognitive science and education has been the nature of knowledge acquisition. Besides studies on intuitive knowledge, research has also focussed on the impact of instruction on peoples' knowledge and reasoning in various domains. Studies have also examined the role of prior knowledge on the acquisition and utilization of new knowledge.

### Knowledge acquisition and utilization

Instruction is defined as anything that is done in order to help someone else acquire a new capability (Resnick, 1983). Thus any act, whether formal or informal, that intentionally arranges the world so that somebody will learn something more easily will qualify as instruction. The acquisition of knowledge in both such formal and informal settings has been of considerable interest to researchers since several years.

There is a long history of empirical research on knowledge acquisition and learning dating back to 1800, but in recent years there has been a change in the way people think about learning in general.

### Earlier perspectives on knowledge acquisition:

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Older learning theories, in the 1960's and 70's considered learning to be a passive, receptive and reproductive process. They were based on a general theory of acquisition and although they provided a coherent theory of instruction that included methods of specifying the capabilities to be taught, there were no references to the thought processes behind them (Resnick, 1983). For example, learning according to the associationist theories of Thorndike involved the acquisition of bonds, and instruction aimed at the development of correct bonds and the weakening of incorrect ones. The Skinnerian view of learning was like that of other radical behaviourists, who denied that a science of mental life was possible as mental events were not open to public observation. They focussed on the capabilities to be taught entirely in terms of observable performances.

These earlier theories were judged as inadequate by cognitive psychologists who were interested in promoting reasoning and understanding. It was increasingly recognized that simple forms of learning such as simple tasks involving memorization more than comprehension could not adequately handle the more complex forms of learning such as concept learning and problem solving encountered in real life situations. This led to the more cognitive theories such as those of the Gestalt psychologists who viewed learning as the acquisition of structural knowledge rather than as an unordered collection of bonds and behaviours specified without any reference to the underlying thought processes. Piaget's theories were concerned with development and acquisition of capabilities which, according to him are the structural basis of thinking. The key elements in his theory were interaction and equilibration. Broadly, the interactionist position referred to the fact that the biological endowment interacts with the environment so that a child growing up in its appropriate socio-ecological niche will develop in certain directions. Equilibration referred to the complementary processes of assimilation and accommodation by which the child constructs more complex and powerful schemes that are used to interpret the stimuli encountered in the environment.

However, most of these early c. unitive theories focussed almost exclusively on issues of cognitive performance while ignoring the issue of how these performances were acquired (Resnick, 1983). Work towards the cognitive theories of acquisition are relatively more recent. A transition has gradually occurred from a strictly behaviouristic view of learning to one involving more cognitive activities alongside the so called cognitive

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revolution in psychology (Shuell, 1985) This has resulted in an approach to the study of knowledge acquisition from a cognitive perspective.

# Cognitive perspectives on knowledge acquisition:

The influence of cognitive psychology has resulted in several changes in the peoples' conceptualization of the knowledge acquisition process. An outline of this cognitive perspective on knowledge acquisition contrasted with earlier views of the associationist and behaviourist theories is presented below:

## Learning as the acquisition of knowledge structures:

The cognitive conceptions of learning focus on the acquisition of knowledge and knowledge structures rather than on behaviour per se (Greeno, 1980). The emphasis is no longer strictly on behaviour but on the mental processes and knowledge structures that can be inferred from behavioural indices and that are responsible for various types of human behaviour (Shuell, 1986). Behaviour is viewed as the result of learning rather than that which itself is learned.

A major factor responsible for this transition has been the result of studies on the organization of human knowledge. The earlier view of knowledge was one that consisted primarily of isolated facts, so that instruction involved the provision of more and more facts with little, if any, need to consider how these facts are related to each other or to prior knowledge. In recent years it has been realized that knowledge consists of complex networks of information and skills. Knowledge acquisition, thus, concerns the acquisition of such complex knowledge structures.

Both conceptions agree that both environmental factors and factors internal to the learner contribute to learning, however, the behavioural approach focuses on changing the environment in order to influence learning, for example, by providing reinforcement when the appropriate response is made, whereas the cognitive approach focuses on changing the learner, for example, by encouraging the person to use appropriate learning strategies.

Furthermore, in psychological literature, in the present time, a distinction is frequently made between procedural knowledge (sometimes referred to as algorithmic knowledge) and propositional knowledge (also referred to as declarative knowledge or semantic knowledge) (Shuell, 1985). Declarative knowledge refers to the systematic and organised body of knowledge that we have about something (knowing what). Procedural knowledge, on the other hand, is our knowledge about procedures necessary to perform some task (Anderson, 1990). Acquisition of one type of knowledge, declarative, for example, does not mean that the learner will also be able to apply that information in a procedural manner. Researchers interested in skill acquisition (Anderson, 1987) therefore view learning as the acquisition of procedural skills.

### Learning as an active process:

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The traditional behaviouristic view of learning has considered learning as a passive, receptive and reproductive process, characterized as "learning from the outside in". Whereas the cognitive conceptions of learning emphasize that learning is an active, constructive and goal oriented process characterized as "learning from the inside out" (Shuell, 1987). The

focus is on the important role of mental constructions and interpretations by the learner (Resnick, 1983).

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This central theme has been considered even within the Piagetian cognitive developmental theory wherein the processes of assimilation and accommodation involve the construction of new schemes. The constructivists view of learning suggested by Pines and West (1986) involves a learner constructing his or her own private understanding of conceptually structured public knowledge. They refer to this internalized knowledge as framework, belief system, cognitive structure or conceptualizations.

The cognitive conceptions of learning (cognitive learning) are, thus, concerned with more complex forms of learning, characterized as "meaningful learning", where one learns for understanding. Although many investigators limit cognitive learning to the acquisition of information that is structured or organized, Shuell (1987) is of the view that even simpler forms of learning such as rote memorization also involves the use of higher order thought processes (for example, mnemonics) and should therefore be included in the definition of cognitive learning.

# Learning as a cumulative process dependant on prior knowledge:

Cognitive conceptions of learning also place considerable importance on the role of prior knowledge in the acquisition of new knowledge. Acquisition is viewed as the building of appropriate links between knowledge already held and new knowledge. This is, however not a small task, since prior knowledge can interfere with new knowledge. It is important to think not only about the cumulation and linking of knowledge

structures but also about what kind of confrontation between old conceptions and new conceptions may be needed for the new to take hold (Resnick, 1983).

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According to Pines and West (1986) the interaction between new knowledge and existing relevant knowledge is the most important ingredient in the process of meaningful learning. They use a vine metaphor to describe the interaction of formal and informal (spontaneous) knowledge. The spontaneous knowledge which originates within the learner and is therefore a more internally experientially based belief system, is represented by an upward growing vine (to highlight that it is part of the organic growth of the learner) and formal knowledge imposed by authority is seen as a downward vine (suggesting its imposition on the learner by the authorities above). They describe four alternatives when the vines meet 1) the congruent situation in which the two vines don't clash and the formal knowledge merely reinforces the student's existing conceptions about the world integrating them into a larger whole. 2) zero spontaneous situation in which little spontaneous knowledge exists to interact with formal knowledge. The upward vine does not therefore exist but the downward vine is complex, elaborate, extensive and well structured. 3) uninstructive situation in which there is no formal knowledge being presented and the spontaneous knowledge is extensive 4) the conflict situation in which the upward growing spontaneous knowledge conflicts with the downward growing formal knowledge. The beliefs are those which are validated each day by experience and have served very well in the past in making sense of the world, and so are not given up easily.

Pines and West describe three alternatives that can occur when the vines clash. A first possibility is that the formal knowledge is considered as

irrelevant, inappropriate and useless and is therefore ignored. A second possibility is that the learner continues to hold his or her misconception while wrongly learning the formal content. New knowledge will therefore be compartmentalized and the two vines will never meet. Mature learning or meaningful learning, according to them involves the questioning of reality and the transfer from one set of beliefs which have been established over a long period to another set which is completely incongruent with the old one.

### Learning as a process of conceptual change:

This perspective on the way the conceptions change with formal education has received most attention from science educators who consider learning as a process of conceptual change (Strike and Posner, 1985). Learning according to them does not involve simply an expansion of some body of interconnected facts and concepts, but it involves a change in the form of one's knowledge. This view emphasizes on the transformation of conceptions in the process of learning, unlike the empiricists' view of learning as simply additive. The term accommodation has been used to refer to large scale conceptual changes and the word assimilation to those kinds of learning where a major conceptual change is not required (Strike and Posner, 1985).

Recent research in cognitive science has focussed on the manner in which the naive conceptions based on global theories are differentiated and restructured on exposure to domain specific theories that occurs with formal instruction. Cognitive acquisition is viewed as a process of knowledge restructuring (Resnick, 1983). Restructuring has been conceptualized in a

number of ways. According to Piaget, developmental change (growth of child's logical capabilities) results in global restructurings known as stages which constrains the child's ability to acquire knowledge in all domains and this has been referred to as global restructuring. Recent emphasis is more on domain specific restructuring which occurs due to increase in knowledge of a domain brought about by experience and/or by instruction. Research on the development of expertise in various domains and studies comparing novices and experts have given further support to this view of restructuring.

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The process of knowledge acquisition has been characterised in terms of two types of domain specific restructuring, a weak restructuring and a strong/radical restructuring. Two successive conceptual systems are considered to be structurally different in the weaker sense if the later one represents different relations among concepts than the earlier one does, and if the pattern of these relations motivates superordinate concepts in the later system that are not represented in the earlier one (Carey, 1986). Researchers investigating the novice/expert shift (Chi et al, 1981) have postulated a weak form of restructuring. Two successive conceptual systems are considered to be structurally different in the stronger sense if the transition between the two involves conceptual change (Carey, 1986), that is, changes in domain of phenomena to be accounted for by the theory, changes in explanatory mechanisms, and changes in individual concepts. This is a change in theory similar to what is seen in the history of science.

Many researchers have postulated that learning involves restructuring in the strong sense. They have tried to show similarities between the intuitive beliefs and the medieval beliefs (diSessa,1988; McCloskey, 1983; Clement, 1983) and have tried to develop an intuitive belief

structure similar to the medieval theory (Nersessian & Resnick, 1989). The radical restructuring view is also evident in the work by Carey (1986) on children's conceptions of biological phenomena. She argues that the acquisition of biological knowledge in children during the years four to ten involves a restructuring of the child's knowledge of animals and living things atleast of the weaker sort and very likely of the stronger sort, that must be seen as full fledged theory change, involving conceptual reorganization. According to her the restructuring can be thought of as the emergence of a new theory (of intuitive biology) from its parent theory (intuitive theory of animal behaviour).

Vosniadou and Brewer (1987) in their study on knowledge acquisition in astronomy in children have seen a change from a geocentric schema in which the earth is conceptualized as flat and motionless to a heliocentric schema in which the earth is conceptualized as spherical and rotating, and this according to them meets all the criteria for radical restructuring. According to them, however, the notions of weak and strong restructuring need not be exclusive. They claim that the process of knowledge acquisition can be characterized by both.

The distinction between weak and strong restructuring can be viewed as analogues to the distinction between theory change and change in paradigms in the history of science (Kuhn, 1970). According to Kuhn, normal science involves the articulation of existing paradigms which may result in theory change Only when attempts at articulation fail repeatedly, does the need for a true paradigm shift arise in an attempt to resolve anomalies between the existing theory and observations. The development of knowledge in the child or the lay adult can be seen in similar terms as a

process of enriching and elaborating existing theories that gives rise to theory change and only when they are faced with major anomalies which the existing conceptual structure cannot account for, a new paradigm is required giving rise to radical restructuring (Vosniadou & Brewer, 1987).

This distinction between weak and strong restructuring of learners' conceptions is also reflected in the terms "conceptual development" and "conceptual change" (West and Pines, 1985) and "accretion" and "restructuring" (Rumelhart and Norman, 1978). West and Pines (1985) have identified three different kinds of learning, conceptual development, conceptual resolution and conceptual exchange. Conceptual development according to them, is the process of learning where the major learning is the development of the downward growing vine, which represents formal knowledge in their vine metaphor described earlier. The learner makes sense of formal knowledge which has little, if any, reference to what the learner already knows by integrating and differentiating the formal knowledge within cognitive structure and a gradual merging of the two vines occurs during their mutual expansion. Conceptual resolution is necessary when the two vines clash and there cannot be an integration and differentiation of spontaneous and formal knowledge. If the conflict is major it may necessitate conceptual exchange or the acceptance of a new framework while abandoning what was previously held to be true.

Rumelhart and Norman (1978) describe three ways in which existing schemata can be modified by new experience, namely, accretion, tuning and restructuring. Accretion, according to them refers to the encoding of new information in terms of existing schemata. New information is added on to knowledge already in memory without any changes being made in the way

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that knowledge is organized. It involves the acquisition of factual information, referred to by some as memorization. There are no structural changes in the information processing system itself. The learning of lists, dates, and telephone numbers are examples of learning through accretion. This type of learning has been referred to as schema instantiation (Resnick, 1983) and is similar to the Piagetian concept of assimilation. This kind of learning probably occurs most frequently. Tuning or schema evolution involves the slow modification and refinement of a schema and this occurs as a result of using it in different situations. It involves more than a simple addition to the data base. Pre-existing schemata undergo continual tuning or minor modifications to bring them more in congruence with the functional demands. Tuning is a substantially more significant kind of learning. Restructuring or schema creation is a yet more significant (and difficult) process. It occurs when new structures are devised for interpreting new information and imposing a new organization on that already stored. Restructuring may occur without any formal addition of new information, the only thing that occurs is a reorganization of existing knowledge.

Researchers have also been interested in the factors capable of bringing about this kind of a conceptual change (strong restructuring or accommodation) in learners. For example, Pines and West (1986) suggest three phases for the process of conceptual exchange, namely, awareness, disequilibrium and reformation. Awareness involves discussions highlighting the existence and nature of competing points of view. Disequilibrium involves the introduction of anomalies that challenge existing beliefs, and reformation involves the presentation of formal concepts that resolve the anomalies so that the learner who is so

uncomfortable with the anomalies will accept the formal theories as his own.

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> Strike and Posner (1985) outline four conditions necessary for a conceptual change. First, there must be dissatisfaction with the existing conception. One major source of dissatisfaction is anomaly, that is, when one simply cannot make sense of something. When one is faced with an anomaly, the most likely responses are rejection of the observational theory, a lack of concern for the experimental findings, assimilation of the new information into existing conceptions and a compartmentation of knowledge to prevent new information from conflicting with others. Dissatisfaction with existing conceptions and accommodation can occur only if it is understood as to why the experimental findings represent an anomaly, need for accommodation is recognized and if attempts to assimilate do not seem to work. Second, a new conception must be minimally understood. Third, a new conception must appear plausible, that is, the new conception must be consistent with prior theories and experiences and seem capable of solving problems and fourth, a new conception should suggest the plausibility of a fruitful research program. Novel practical applications must be suggested by the new conception. Accommodation, they claim, is a gradual process and occurs if and only if the status of the alternative conception is greater than that of the existing conception. It involves something more than understanding of the conception. It also involves a degree of acceptance of the conception.

> Vosniadou and Brewer(1987) suggest two mechanisms which can bring about radical restructuring of knowledge. First, Socratic dialogues which are used chiefly to facilitate the awareness of inconsistencies in an

individual's existing schema. This is a necessary step for those types of changes that require that old beliefs be abandoned and replaced with fundamentally different conceptual structure. They suggest that the recognition of anomalies which has been the major motivating force for radical conceptual shifts and paradigm changes in the history of science, can be used to induce schema restructuring and drive knowledge acquisition. But it should be followed by proposing alternate frameworks, creating conceptual conflict, and leading the learner into constructing conceptually consistent theories of the domains.

The use of analogies and metaphors from other domains is another mechanism for radical restructuring as suggested by Vosniadou and Brewer. Analogies and metaphors from other domains may be more effective in bringing about restructuring of existing knowledge, than relating new knowledge to an existing schema from the same domain. However analogies have to be used with caution for they can sometimes result in inappropriate extensions of an analogy to generate false information (Champagne et al, 1985).

### <u>Learning as the development of higher level processes (metacognition):</u>

Research on learning as a process of theory change akin to scientific theories described above strongly supports the metaphor of the lay adult or the child as an intuitive scientist However, in recent years studies [Kuhn (1989); Vosniodou & Brewer (1987)], described earlier in this review of literature, have compared the cognitive processes in lay adults/children and scientists. There is increasing recognition of the changes in cognitive functioning that occur during learning The cognitive conceptions of

learning acknowledge the role of such higher level cognitive processes termed as "metacognition" and attempts are made to foster the development of metacognitive activities involved in cognition.

Studies on scientific and technical expertise have shown that experts develop skills for monitoring performance, checking and assessing progress, judging difficulty, apportioning time, and predicting outcomes (Chi et al, 1981). Thus an important dimension of learning is also the development of such control performances.

### Learning as the development of situation specific competencies:

In recent years a further perspective on learning is provided by some researchers who argue for a theory of 'situated cognition'. Learning and cognition, according to these researchers are both fundamentally situated [Brown, Collins and Duguid (1989); Resnick (1987)]. They argue that learning involves not so much a change in conception, but in learning to distinguish the contexts when particular conceptions are appropriate (Driver, 1989). Knowledge, they say, is situated in activity and that it is used and made sense of within specific contexts and cultures (Brown et al, 1989). As an alternative to conventional methods of teaching and learning, they therefore propose cognitive apprenticeship, which emphasises learning in context (Brown et al, 1989).

Research on all the above mentioned issues of learning within the cognitive perspective have resulted in several implications for instruction.

### Implications for instruction:

The cognitive learning theories have resulted in a constructivist theory of instruction, which recognizes the central and complicated role of prior knowledge. It aims to place the learner in a situation where the constructions that they naturally make as they try to make sense of their world are correct as well as sensible (Resnick, 1983). It is being realized that instruction should be build around existing knowledge. However, as pointed out by Vosniodou and Brewer (1987), the emphasis to be placed on prior knowledge will vary depending on whether the purpose of education is to promote weak restructuring or strong restructuring. Relating the new information to prior knowledge is important for the operation of weak Instruction should be built around existing schema. restructuring. However, if learning is viewed as strong restructuring, then the emphasis to be placed on prior knowledge will be different. It may be preferable to select only those aspects of the existing knowledge structure which is compatible with the new theory for instruction purposes, or to present the new theory alone, ignoring what they already know.

Traditional conceptions and theories of learning have been for the most part, content free. Learning has been considered to be occurring in basically the same way, or following the same principles in all situations. In recent years, however, it is realized that learning may be much more domain specific rather than domain independent (Glaser, 1984). Attempts have been made to provide education and thinking skills in specific domains of knowledge, although questions have been raised whether such skills taught in the context of a specific domain will be transferred to other domains (Block, 1985; Sternberg, 1985).

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Most of the research on cognitive learning has occurred within the areas of artificial intelligence, where the goal has been to develop computer programs based on current knowledge of the characteristics of competent performance (Glaser, 1989). Instructional programs have been developed based on each of the learning objectives discussed earlier (Glaser, 1990). For example, tutoring programs for programming in LISP, generating geometry proofs and solving algebraic equations has been developed by a group led by John Anderson for the acquisition of procedural skills. The program reciprocal teaching, has been designed to foster the development of selfregulatory control skills. The program GUIDON, provides structured knowledge for problem solving in medicine and the program QUEST for teaching troubleshooting of electric circuits leads the learner through a progression from simple to advanced mental models.

The rest of this review discusses the relevance of all the above issues of reasoning and knowledge acquisition to the nutrition domain and the implications drawn therefrom, for education in nutrition.

# Reasoning and knowledge acquisition in nutrition

Reasoning in nutritional issues is of fundamental importance for satisfactory functioning in daily life. Two issues of chief concern for research on reasoning and knowledge acquisition in nutrition are 1) what is the intuitive knowledge with respect to nutrition and nutritional problems among lay individuals from different cultures? and 2) what is the impact of formal and informal instruction on this lay understanding?

#### Intuitive knowledge in nutrition:

In recent years, research results have accumulated at a sufficiently rapid rate on the understanding of nutritional issues by lay people in different cultures. While some researchers have focussed on issues of food classificatory systems and factors governing the choice and restrictions of specific foods, in different cultural set ups, others have focussed more on issues pertaining to the beliefs about disease etiologies and treatment.

Studies in the past have revealed that foods may be classified in different ways in different cultures. For example, (Helman, 1984) describes five types of food classificatory systems which have been identified in various cultures. They are as follows:

<u>Food vs non-food</u>: Some foods are considered as non-foods and are never eaten in certain communities on cultural grounds. For example, dog meat in Europian communities.

Sacred vs Profane foods: The former refers to those foodstuffs, the use of which is validated by religious beliefs. This category would include the staple food which has a deep historical and often religious significance, and is the main source of energy and nutrients and has, therefore been referred to as the cultural "superfood" (Jelliffe & Jelliffe, 1989). Profane foods, on the other hand are those foods which are expressly forbidden by religion. For example, pork in Muslim communities. In India the orthodox Hindus will not kill or eat any animal, particularly the cow. Both eggs and fish are infrequently eaten. Milk and its products, may be eaten, since they do not involve taking the animal's life.

<u>Social foods</u>, are those that are consumed in the presence of other people. For example, the contents of a religious feast. Jelliffe & Jelliffe (1989) refer to them as special occasion foods, which are usually animal products such as meat, fish or milk dishes.

Food appropriate and inappropriate for different groups: Cultural factors impose restrictions on the consumption of certain foods, while advocating the use of others. For example, in parts of West Africa, eggs are considered inappropriate for young children (Jelliffe & Jelliffe, 1989). In Papua New Guinea, although there are few food taboos which apply to young children, there is some sexual differentiation in the consequences of breaking the few food taboos which do apply to children. For example, if a child eats a strong, long cooking banana (*dewer banak*), which is taboo, it is believed that girls will become sick, and boys will be unsuccessful hunters. The late introduction of supplementary feeding (at the time of eruption of the deciduous teeth) is another feature of this culture (Thomason, Jenkins and Heywood, 1986).

Apte (1977) in his study on the socio-cultural aspects of food avoidance in a low income population group in Tamilnadu, South India, has shown that numerous beliefs restrain the nutrient intakes among children, pregnant and lactating women. The causes of many diseases are traced back to specific food items which are then avoided.

<u>Binary (hot/cold) food classification</u>: Binary food classificatory systems, including notions of 'hot' and 'cold' (sometimes including intermediate categories such as 'cool' or 'neutral') have been identified in many cultural groups in the Islamic world, India, Latin America and China. In many cases

this view of health and illness represents a survival of the traditional humoral theory of disease. Some researchers feel that there is no consensus among the people and cultures, on which foods are 'heaty' or 'cooling' (Apte, 1977; Helman, 1984).

Pool (1987), however, has extended the classification to include diseases and has shown that by proceeding from the classification of diseases, and not from classification of foods, it is possible to demonstrate certain underlying classificatory principles. His study in Gujarat, India, has shown that hot/cold systems are used as an explanatory model to explain diseases. Cold diseases are usually situated deep in the body with no signs on the outer surface and characterized by freezing, congestion and solidification, for example, constipation and coughs. Hot diseases are usually manifested on the surface of the body (skin) or as an excretion (blood, diarrhea ). The ascription of hot and cold qualities to foods appears to be derived from the diseases, which are caused by excesses of these attributed qualities.

Wandel, Gunawardena, Oshaug and Wandel (1984) in their study on the heating and cooling foods in a southern Sri Lankan community have shown that, although the hot-cold system is not an important factor in the day-to-day choice of food for healthy adults, during critical times of life such as early childhood, pregnancy, after confinement and in periods of disease, the hot - cold systems exert a considerable influence on peoples' behaviour. Among the Malay in Indonesia and among the Kanara of South India, pregnant women avoid or restrict certain foods and medicines believed to be "hot". Hot substances are thought to cause the womb to become uncomfortably hot and to induce abortions (Abou-Zahr, 1990).

Besides the dual categories of hot and cold, other categories of food such as gaseous, strengthening, blood producing and disease free foods have been recognized as significant factors determining what to eat and avoid in many communities (Apte, 1977; Rizvi, 1986).

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<u>Food as medicine</u>: In certain societies special diets may be seen as a form of medicine for certain illnesses. Eating of bitter tasting foods prevents diseases and cleanses the blood according to people in Bangladesh (Rizvi, 1986). In other societies, substances such as vitamins may be viewed as items of food.

Research has also focussed on lay peoples' understanding about the cause and treatment of nutritional problems. Ethnomedicine is a relatively new discipline in anthropology and it is defined as the study of those beliefs and practices related to disease which are the products of indigenous cultural development and are not explicitly derived from the conceptual framework of modern medicine (Nations, 1989).

McKay (1980) reports that in Ulu Trengganu, West Malaysia, an eye condition which corresponds closely to xeropthalmia, is simply attributable to *chaching* (worms). Small, thin worms (*chaching hallus or kerawit*) are said to cause roughening of the skin, irritation and drying of the eyes and night blindness. A white scale (*sisek*) develops in the eye as the condition advances and eventually the eye may become cloudy (*kelabu*) and vision may be lost completely. Such a condition is said to be made worse and may even be precipitated by giving common green or yellow vegetables or fruits that are cooling or sour tasting. The rational seems to be that these foods irritate the disease causing worm to greater activity and may cause its ascend from the gut, thus affecting the eye.

Patel et al (1988) in their study on the causal reasoning and treatment of diarrheal diseases by mothers in Kenya, have shown the existence of traditional knowledge and beliefs about diarrheal disease, which is different from the western knowledge of the disease. The traditional knowledge of diarrhea concerned the attributes of people, whereas the western knowledge of the disease concerned the attributes of entities such as bacteria, viruses or dirt.

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In Nigeria, protein energy malnutrition was locally recognized as the disease "kosoko", meaning no hoe (hoe in the Yoruba culture symbolizes both life and death), or as the disease "orinla", meaning big head. It was thought to be the caused by the child having the supernatural power to die and be reborn, and as a preventive measure mothers made sacrifices to the spirits and made charms in the form of rings, leather armlets, wristlets and necklaces (Ojofeitimi, 1982).

In Brazil, many cases of malnutrition in children were interpreted as folk illness "doenca de Crianca", an illness which mothers do not actively seek to cure. A child with this sickness was meant to die, and it was generally believed that even if they attempted to treat such a child, he/she would never be alright (Hughes, 1984). In Nepal, a child's undernourished condition was never viewed by the villagers as a nutritional problem that could be improved by dietary changes. Overriding any medical explanation for undernutrition was the explanation of supernatural influences (Graves, 1984).

Rao (1986) in her study in Karnataka, India reports a condition known as *muttu dosha* in the local language, which was recognized as the most

common disease in children 1 to 6 years old. This disease with clinical features similar to those of kwashiorkar or marasmus, was believed to be caused by the shadow of a menstruating woman falling on the abdomen of the pregnant woman, and contaminating the unborn child. Research in nutritional anthropology (Jerome et al, 1980) reveals several instances throughout the world, wherein non-dietary etiologies are applied to diseases that we recognize as nutritional deficiencies.

Also in many communities a codified traditional medical system coexists with modern medicine and influences peoples' thinking about the cause and treatment of diseases. Koo (1987) reports on the co-existence of ideas and treatment regimens from both western and Chinese medical traditions for a variety of common ailments including anemia, among Hong Kong Chinese. A typically Chinese remedy of tonic foods and wines was recommended for the treatment of anemia by 50% of the respondents.

Nichter (1985) in his study on the cultural interpretations of a set of childrens' illnesses often associated with states of malnutrition, in South Kanara district, Karnataka state, India, reports on lay illness categories ( for example, agra, chappe roga and tamare roga), which focus on notions of etiology as well as on symptoms. A wide range of causal factors were associated with the illnesses namely food, overheat, bad blood, pitta & kapha (humoral substances identified by traditional Indian medicine), ancestors, spirits and deities, heredity, contagion and sin, karma, stars and planets. While states of malnutrition were linked to inappropriate diet, lay concepts of appropriate diet were markedly different from that of biomedicine. Traditional Indian medicine (Ayurvedic) and folk dietetics were both a

primary source of promotive health care and a major source of primary health care for states of malnutrition.

A study on the explanation of childhood nutritional deficiencies by East Indian mothers living in Canada (Sivaramakrishnan & Patel, 1990a) has shown that concepts of traditional Ayurvedic medicine influenced the mothers' thinking about childhood nutrition and nutritional problems. Traditional concepts persisted even in mothers with higher education. A study by Bhopal (1986a) showed that traditional humoral concepts and belief systems prevailed among Asian residents of Britain who originated from the Indian subcontinent . *Bhye bhaddi*, a Punjabi term describing an Asian concept of illness caused by dietary imbalance was seen to persist among these Asians (Bhopal, 1986b).

Research has also focussed on aspects of knowledge acquisition in nutrition, and literature reveals studies on the effect of formal education on nutritional knowledge and practices.

### Knowledge acquisition in nutrition:

There is extensive literature which indicates that maternal education is positively related to child health whether measured by nutritional status or by infant and child mortality (Cochrane, 1980). However, the effect of education on nutritional knowledge is still not clearly documented.

Study by Goyal and Bulter (1989) on the knowledge, attitudes and practices related to nutrition of rural homemakers in Ludhiana district, India, has shown that nutrition knowledge and practices were related to the educational level at 2 percent and 1 percent levels respectively. Devadas

(1979) in her study on the impact of a nutrition and child care education program on the nutrition knowledge and dietary practices of mothers, has shown that the nutrition knowledge scores of the participating mothers were significantly higher than the scores of mothers who did not attend the education program. Nutrition education also resulted in a positive impact on the knowledge, behaviour and health status of students in classes 3 to 5 (Devadas, 1986). Studies such as these, which have demonstrated an increase in nutrition knowledge with education have generally used more quantitative assessment methods such as the use of nutrition knowledge test scores to assess the nutrition knowledge.

More recently, researchers in cognitive science, suggest methods for studying the way knowledge is organised. Methods characterizing the mental models or the internal network representations of knowledge have been used to characterize knowledge in various domains. Studies in nutrition, which use such methods suggest that formal education may not have effects on nutrition knowledge to the desired extent.

Leeds (1989) has used a cognitive method to study the students' understanding of the process of energy metabolism. Models of the students' mental representations were generated using the nodes (major concepts) and links (ideas connecting major concepts). The results of the study, showed that subjects identified more nodes than links suggesting that they were able to identify relevant concepts, but have trouble linking them.

Studies on mothers' reasoning about diarrheal diseases in Kenya (Patel et al, 1988), has shown that schooled knowledge about diarrheal diseases was not well integrated into pre-existing traditional knowledge. Mothers with

schooling had a quasi-biomedical model of the disease, which was fragmented into a series of facts that had little or no connection between them. Studies on the comprehension of the printed instructions for oral rehydration therapy (ORT) by mothers in rural Kenya (Eisemon, Patel and Sena, 1987), showed that even mothers with formal education experienced difficulty in understanding the original printed instructions.

Thus, although school instruction seemed to influence beliefs about the causation and treatment of childrens' illnesses, it may not produce the understanding that is presumed in the use of modern medicine or in the adoption of nutritional and other practices associated with better health (Eisemon, 1988). Most nutrition programs that have been in operation in recent years have not been able to successfully reach the planned objectives. Failure in understanding the peoples' existing health beliefs, attitudes and practices has resulted in many programs being irrelevant or too expensive to continue (Ritchie, 1986).

Nutrition education or a health intervention program can be most easily accepted only when it fits into a group's cultural pattern, or does not run contrary to it (Jelliffe & Jelliffe, 1981). For example, much time and energy is being wasted with little effect by health workers and nutritionists trying to teach housewifes in the developing world about western oriented food classifications, whereas most families throughout the developing world usually consider the staple crop as "food" and the rest as flavourings. For them the choice of food from various food groups has no meaning (Ritchie, 1986). In African hospitals, one of the factors found to be hindering the success of nutrition education programmes was a lack of interest and understanding by the mothers (Kariuki, 1986). Short stature, apathy, slow

achievement of developmental markers, such as walking and talking are much more common in communities with extensive malnutrition, hence the characteristics of deficit become normative in such communities, and influences the behavioural response to a growth monitoring program (Pelto, 1987). The classification of foods as having a hot or cold effect on the body influences the advice that can be given in infant feeding in many communities (Jelliffe &Jelliffe, 1981).

Cultural factors play an important role in peoples' compliance with prescribed treatment regimes. For example, in India, women from the lower socio-economic group seldom take tablets with any regularity, yet, will readily accept injections. In Sierra Leone, the Mende choose white colored or bitter medicines for the treatment of fevers. In south Kanara, pregnant women perceive tablets as inappropriate forms of medication because hard pills are considered difficult to digest and are thought to share the same body space as the fetus (Abou-Zahr, 1990).

The understanding of peoples' concepts of disease causation and treatment is important not only for patient compliance with therapy, but also particularly important for the success with prophylaxis. For example, a pregnant woman's feelings, beliefs and understanding of her own body and her perception of her own state of health as a critical factor, influences whether or not she takes the iron supplement (Abou-Zahr, 1990).

Similarly, marketing strategies have also been found to affect compliance. For example, in India, the health staff distributing iron medications, promoted the tablets as "good for health" and as a tonic to "produce a big baby". This marketing strategy negatively affected women's

decisions to take iron tablets because big babies are associated with difficult deliveries (Abou-Zahr, 1990).

Also as pointed out by Nichter (1985), health education efforts must address folk illness categories and clearly recognized illnesses (e.g. *tamare* in Karnataka, India ) and not culturally distant disease categories like marasmus or kwashiorkar. *Tamare* is a lay illness category strongly associated with marasmic kwashiorkor with pronounced vitamin A deficiency.

In the light of such evidences on the existence of definite intuitive knowledge in nutrition and the relative inadequacies with respect to the process of knowledge acquisition in nutrition, several implications for improving the effectiveness and efficiency of educational strategies in nutrition, can be drawn from the cognitive learning theories, discussed in the earlier section of this review.

### Implications of cognitive learning theories for education in nutrition:

The utility of methods developed in cognitive psychology for studying peoples' knowledge in the nutrition and health domain have been documented in studies by Leed (1989), Sivaramakrishnan & Patel (1990a & b), and Patel et al (1988). Features of the cognitive learning theories can also be used to improve the nature and success of nutrition education.

The importance of providing new information in the context of prior knowledge, an important feature of the cognitive theories of learning and instruction, is of fundamental importance to education in nutrition. Although investigations into the role of attitudes and beliefs in determining dietary behaviours, has been going on, not many attempts have been made

to use the information for planning the nutrition education. Few studies attempting this, have documented the efficiency of nutrition messages that have been delivered in the context of prior knowledge and daily experience. For example, the study by Eisemon et al (1987) has shown that comprehension of the printed instruction for ORT by mothers in Kenya, can be improved with simple changes in the printed text that reinforce appropriate prior knowledge.

Research on knowledge acquisition distinguishes between a weak restructuring of knowledge (also reflected in terms such as conceptual development) and a strong restructuring of knowledge (also reflected in terms such as conceptual change), described in the earlier sections of this review. Factors capable of bringing about a conceptual change or a strong restructuring of knowledge in learners, involving a major theory change, such as the change from Aristotelian physics to Newtonian physics, have been outlined.

However, an important feature that differentiates prior "naive" knowledge in nutrition from "naive" knowledge in other scientific and technical domains such as physics and biology, is the fact that not all prior nutrition knowledge needs to be replaced by new information. Although most taboos, cultural beliefs and practices are heavily detrimental to nutritional well being, several examples of culturally determined behaviours that have nutritionally beneficial consequences can be identified (Wilson, 1985). For example, the traditional cultural food system of the Nuxalk (a native Indian group in Canada) has been recognized as having important nutritional potential (Kuhnlein and Moody, 1989). Kimati (1986) stresses

upon the need to "rethink" nutrition education and to learn from the rural mothers who are not always 'ignorant' in feeding their children.

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As Hills (1989) points out it seems wrong or atleast premature to maintain that the lay conception is defective or inadequate and therefore it should be repaired or replaced simply because it parts compliance with the current scientific view. Both the theories should be rightly compared and judged as if they were competing for the same ground within the domain of science. We should identify anomalies, collect counter examples and draw attention to phenomena not explained by traditional theory. The sole purpose of the exercise should be to bring out the virtues of the scientific framework while retaining the integrity of the traditional view.

This study examines the role of knowledge and practices of traditional Indian medicine on the reasoning about childhood nutritional problems by mothers in rural India. Methods developed in the domain of cognitive psychology (described in the next chapter) have been used to obtain information on the mothers' reasoning about PEM (both chronic, and acute, characterized by marasmus and kwashiorkar), vitamin A deficiency and anemia. The influence of formal education on the mothers' reasoning is also examined. Attempts to identify specific positive and negative aspects of the traditional belief structure have been made, which will facilitate the planning of more successful and culturally sensitive nutrition education programs.

### CHAPTER III

### METHODOLOGY

### **Profile of study population**

The study population was drawn from a cross section of rural areas with a high incidence of childhood malnutrition in Madurai district. The areas were identified after consultation with the pediatricians at the Government Rajaji Hospital in Madurai. Madurai is one of the 15 districts in Tamil Nadu, which is one of the Southern states (provinces) in India. All of these rural areas, located at a distance of 40 to 80 Km. from Madurai town, are accessible to the town by public transportation.

The majority of the men and women in these villages are engaged in subsistence level farming of rice, vegetables and animal stock (goats, cows, pigs and hen). Most of the houses are made of mud with thatched roof (refer to pictures in Appendix I). Tamil is the locally spoken language. For the people in these villages, a day typically begins at 4.30 to 5.00 a.m. The men and women work in the fields until about 2.00 to 3.00 p.m., and the evenings are spent at home with families and neighbours. While the parents are at work, the younger children are taken care of by the oldest of the children or by the elders in the family. There are government run public schools in all of these villages. In families with elders, the entire family lives under the same roof. Decisions regarding child feeding and care are taken largely by the women, especially by the elderly women in the families.

All the villages had access to western medicine, locally called "English medicine". Doctors attached to government nutrition and health programs

frequently visit these villages. The villagers had access to clinics located in nearby town areas and also to the Government Rajaji Hospital in Madurai town. Trained traditional practitioners (Siddha/Ayurvedic physicians) and untrained traditional practitioners (mid-wives) were available both within the rural areas and in the neighbouring town areas, including Madurai town.

All of these villages had access to atleast one of the several government nutrition programs, described below:

Integrated Child Development Services Scheme (ICDS): (Tandon, 1983; Gopalan, 1987; CARE India, 1985)

ICDS is the most extensive national programme in India, and is related to overall child development with a major nutrition component. It provides a package of services to children upto six years old, pregnant women and lactating mothers. All services are delivered at a central point in each village (anganwadi) by a local village woman (anganwadi worker) specially trained for this programme. The programme at the centre includes immunization, nutrition supplementation, nutrition therapy for severely malnourished children, health check-ups, antinatal services, postnatal care, treatment of minor illnesses, preschool education, informal education of women, and health and nutrition education. Guidance for the health and nutrition programme is provided by the medical officer of the primary health centres and by faculty members of medical colleges, who serve as technical consultants.

In Madurai, there are four ICDS projects, each covering a population of one hundred thousand people (one lakh). Each project includes a total of 90 to 100 *anganwadi* centres. For each project there is one medical officer, one child development project officer (CDPO), four auxillary nurse mid-wives (ANM) and

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four supervisors, who share the responsibilities of the project. Each anganwadi centre is managed by one anganwadi worker (AWW) and two helpers.

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Supplementary feeding for children between 6 months to 2 years of age at the centres is in the form of a nutritious *laddu* (a sweet ball) of the following composition per *laddu*:

Wheat -	42 grams
<i>Bengal gram</i> (a lentil) -	10.5 grams
Jaggery (brown sugar) -	17.5 grams

Pregnant and lactating mothers (upto 6 months of lactation) are given the same *laddu*, in the form of weekly rations. Children from 2 years to 5 years are provided the noon meal at the centre. The composition of the meal provided for each child includes:

Rice -	80 grams
Lentil -	10 grams
Vegetables, greens & dried peas	
Spices	

The meal is prepared at the centre and the fuel cost for preparation per child is 3 paise.

**Tamil Nadu Chief Minister's Noon Meal Programme (CMNMP)** (Gopalan, 1987; Devadas, 1987; Devaraj, 1988).

This is the most extensive supplementary feeding programme throughout the State of Tamil Nadu, using the Government's own internal resources. The unique feature of the programme is the feeding of a<sup>1</sup> needy children 2 to 14 years of age in poor communities, so as to provide 1/3 of the nutritional

requirements. Children 2 to 10 years of age belonging to the poor communities get one good meal in the day, on all the 365 days of the year, while those between 10 and 14 years of age get meals on 200 days of the year when the schools are open. The underfives (2 to 5 years) get their meals through the child welfare centres (*Balwadi*) managed by a Child Welfare Organizer (CWO) (a preschool teacher) and 2 assistants (Balsevikas). These are all women selected from the community in which the centre is located. Children between 5 and 9 years get their meals at the primary schools and those between 10 and 14 years at the high schools, under the charge of a Noon Meal Organizer. Each centre is self contained with respect to facilities for cooking and storage of foods.

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The composition of the daily noon meal provided to the children of different ages is as follows:

Children under five years of age - Rice (80 grams); lentils (10 grams); oil (1 gram ) and vegetables.

Children from 5 years to 12 years of age (grade 1 to grade 8) -

Rice (100 grams); lentils (15 grams); oil (1gram) & vegetables.

Children from 13 years to 14 years of age (grade 9 & grade 10) -

Rice (120 grams); lentils (15 grams); oil (1gram) & vegetables. Tamil Nadu Integrated Nutrition Project (TINP): (Devadas & Easwaran, 1989; Devadas & Easwaran, 1986).

This project, sponsored by the Government of Tamil Nadu and aided by the World Bank for mass nutrition rehabilitation of high risk groups of the population namely children between 6 months to 6 years, pregnant women and lactating mothers, is being implemented in 6 districts of Tamil Nadu, including Madurai district. The services at TINP include growth monitoring of children 6 to 36 months of age, short term (90 days) supplementary feeding for malnourished children until they graduate (achieve the desired weight gain), and involvement of the mothers completely in the maintenance of the health cards, thus promoting nutrition education and communication.

The services of TINP are delivered at community nutrition centres (CNC) by a community nutrition worker (CNW) and a helper. They work in coordination with the health worker attached to the primary health centres (PHC) in the rural areas. The basic composition of the ration used for supplementary feeding, providing 380 calories and 13 grams of protein per kilogram of the ration is as follows:

Ragi ( a type of cereal) -	200 grams.
Peanut -	150 grams
Roasted bengal gram (lentil) -	200 grams
Sesame -	50 grams
Wheat -	200 grams
Jaggery (brown sugar) -	250 grams

Severely malnourished children (Grades 3 & 4 of malnutrition) less than 2 years of age are given 80 grams of the ration in the form of two balls (ladoos) and

severely malnourished children more than or equal to two years of age are given 160 grams of the ration in the form of 4 balls (*ladoos*). Normal children and children with first and second grade malnutrition, are given 40 grams of the ration if they are below 2 years of age, and 80 grams of the ration if they are more than or equal to 2 years of age. Women from the seventh month of pregnancy and lactating mothers upto the fourth month of lactation are given 80 grams of the ration per head per day.

# Nutrition problems addressed

The nutritional problems addressed in this study were the three most serious problems among children under 5 years of age (UNICEF, 1990-1), namely, protein energy malnutrition (PEM) (both chronic, characterized by height weight retardation; and acute, characterized by marasmus and kwashiorkar), vitamin A deficiency and anemia. Details on the nature, etiology and treatment of these deficiency states are provided in the section on the biomedical model, presented later in this chapter. The study focussed on the knowledge and belief systems about these diseases and their treatment in mothers with varying levels of formal education.

# **Procedure**

### Data collection

The subjects for the study were mothers of children enroled at the nutrition health centres (CNC managed by TINP and *anganwadi* centres managed by ICDS) in the selected rural areas. Random samples of these mothers were used as subjects for the study. The mothers were interviewed
individually in their homes located in the vicinity of the centre. Data was collected on the following aspects:

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(a) Background information on the mothers' age, education, number of children, ages of children and occupation.

(b) Reasoning about childhood nutritional deficiencies: The mothers were shown pictures of Indian children showing symptoms of the nutritional deficiencies (Appendix II) and the symptoms were also verbally explained to facilitate understanding of the problem. The child with marasmus showed symptoms of extreme wasting of subcutaneous fat and muscle. The child with kwashiorkar showed symptoms of apathy, generalized edema, enlarged abdomen, skin changes (dry, flaky and peeling skin) and thin, dry hair on the head. For vitamin A deficiency, the mothers were shown enlarged pictures of the eye showing changes in the conjunctiva (dry, dull, wrinkled with greyish patches) and cornea (dry, dull and opaque). The mothers were also verbally told that the child may have difficulty in seeing in dim light. No pictures were used for chronic PEM and anemia, but the symptoms were verbally explained. The mothers were then asked to explain a) how and why does she think the conditions arise and b) how would she treat them. The mothers were probed to obtain detailed information on their reasoning about the cause and treatment of the said conditions. All interviews were conducted in the local language, Tamil, and were audiotaped.

(c) The heights and weights of children under five years of age of the subjects of the study were recorded. An infant weighing scale was used for recording the weight of very small children, a portable bathroom weighing scale for older children and a tape measure was used to record the heights.

Similar information on the causality and treatment of the nutritional deficiencies was obtained from registered traditional practitioners (Siddha and Ayurveda physicians) and untrained traditional practitioners (midwifes) in the selected rural areas, to obtain a traditional reference model for the nutritional problems in question. Medical officers attached to the nutrition programs were interviewed in order to obtain a reference biomedical model.

Detailed information on the nutrition activities at the health centres, including information on the contents of the nutrition education material were collected from the program offices at Madurai. The science texts used in the government aided primary and secondary schools were examined for the nature of the nutrition material provided therein.

#### Transcription and translation of the audiotaped interviews

All the audiotaped interviews were transcribed using a Phillips transcriber. The transcribed interviews were then translated into English and the translations were subsequently checked for their accuracy by translating parts of the text back into the Tamil language.

#### Data Analysis:

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For <u>quantitative analysis</u> of the results, the responses were categorized and the frequency of occurrences of the various responses in the mothers with varying levels of formal education were calculated as percentages. The <u>qualitative analysis</u> of the subjects' explanation protocols, in order to look at the knowledge organization was done using methods developed within the domain of cognitive psychology (Patel and Groen, 1986). In summary, this involved the use of techniques of discourse analysis for analyzing complex verbal data

generated by the subjects (van Dijk & Kintsch, 1983). Methods of propositional analysis (Kintsch, 1974) were used to generate a structural representation of the subjects' explanations. Propositions and the relations among propositions were represented as semantic network structures (van Dijk & Kintsch, 1983). A proposition is defined as a semantic unit in the form of a triplet, where two concepts are joined together by a labelled relation or link. For example, in a sentence "body heat causes kanai", two concepts "body heat" and "kanai", are linked by a causal relation. The sentence "if kanai is seen, give kanai oil", is represented as two concepts, "kanai" and "kanai oil", and the relation between the two concepts is an "if-then" relation and is called a condition.

In representing the propositions in a semantic network structure, the types of links between propositions used have specific implications (Patel & Groen, 1986; Patel et al, 1988). The links labelled CAU: (cause) are strongest, since the statement of the relation is both explicit and precise. Links labelled COND: (conditional) are relatively strong, but not as strong as cause, since conditional-relations (if-then implications) could arise from a number of actual relations subsumed under conditional, such as, is-caused-by, and is-evidence-for. What is claimed by use of a conditional link is neither explicit or precise. Other links, such as "is a part of" or "is associated with" are much weaker because they are vaguer and make only general claims about the associations between propositions, with little implication for underlying mechanisms.

A semantic network was generated from each subject's explanation protocol. Concepts generated in the subjects' responses were compared with the concepts in the traditional and biomedical models for the nutritional problems in question, described below, for their similarity in node-link structures and the interpretation of these structures within each of the two theoretical frameworks.

The reference model for the biomedical explanation was developed from the protocols of the medical officers and pediatricians attached to the nutrition programs and with the help of text books on nutrition. The reference model for the traditional interpretation was developed from the interview data of the trained (Siddha/Ayurveda physicians) and untrained (midwifes) traditional practitioners and also using the traditional medical texts.

The semantic networks were examined for the nature of the reasoning processes. Forward reasoning, which represents an oriented path from a fact to a hypothesis was identified whenever a mother reasoned from the presented symptoms to a hypothesis about the prevailing condition. Backward reasoning, which represents an oriented path from a hypothesis to a fact was identified whenever a mother generated a hypothesis about a prevailing condition and the symptoms were predicted from the hypothesis. The network structures were also examined for coherence in reasoning. The extent of connection between the nodes in the network, was used to judge coherence. A semantic network is coherent to the extent that the nodes are connected. A conceptual structure with unconnected facts lacks coherence (Patel, Groen, Norman, 1991).

The influence of formal education on the mothers' reasoning about the presented childhood nutritional problems was examined by comparing the responses of mothers with varying levels of formal education.

<u>Statistical analysis</u> was carried out using the statistical package SPSSX version 4.1. A multivariate analysis of variance test was performed with level of formal education in the mothers (no schooling, primary schooling and secondary schooling) as the independent variable. Subjects were assigned a score of one for each specific biomedical and traditional concept identified in

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their protocols. The total biomedical score and the total traditional score for each mother was then calculated. These formed the two dependent variables in the analysis.

## **Reference models**

A brief outline of the reference models based on t.aditional and biomedical concepts is presented below. More detailed interpretations for individual concepts are provided along with the results in chapter IV.

Traditional model (Subramaniam & Madhavan, 1983; Lad, V, 1985)

There are two ancient systems of medicine in India, the Siddha which flourishes in the South (including Tamil Nadu) and the Ayurveda which prevails in the whole of India. Literature in Ayurveda is in Sanskrit and Siddha literature is in Tamil. The origin of both these ancient systems of medicine is attributed to Divine beings, who supposedly passed on the knowledge to the sages or the wise men of India.

Both these systems of traditional medicine are still practiced in India, particularly in the suburban and rural parts. The Siddha medical system also goes by more familiar names such as folk medicine, granny's medicine or herbal medicine. Both Ayurveda and Siddha are based on a fundamental relationship between the composition of drugs, man and the universe. The human being is viewed as a miniature imitation of the universe and whatever properties are contained in the universe are also found in the human body. According to Indian philosophy, the universe consists of 5 gross elements (*bhutas*) namely earth (*prithvi*), water (*ap*), fire (*agni or tejas*), wind (*vayu*) and ether (*akasa*) and the same factors constitute the basic elements of the human body. Drugs are also made up of the same five *mahabhutas*.

According to the traditional theory, the universal element of wind appears in the body as a humor called wind(*vayu or vata*), fire appears as bile(*pitta*) and water as phlegm (*kapha*). All bodily structures and functions are controlled by these 3 humors. Diseases, whether major or minor are caused because of disequilibrium in one or more of the three *doshas*, namely *vata* (*vatam*), *pitha* (*pitham*) and *kapha* (*kapham*) that exist in the human system. Based on this theory, the problems of various systems are also classified as *vatha* diseases, *pitha* diseases and *kapha* diseases.For example, most common problems associated with the digestive system are considered as *pitha* diseases, most of the respiratory disorders are *kapha* in nature (Rao & Veluchamy, 1983).

The concept of the identity between the macrocosm (universe) and the microcosm (body) equating the five elements both in the universe and in the body, guides the Siddha/Ayurvedic physician in his/her choice of the appropriate treatment for each case. For example, if the *dosha vata* is weak in the body giving rise to typical symptoms, drugs that are preponderate in the characteristics of *vata* are selected and administered to normalise the *dosha* in the body. Similarly, when *vata* is preponderant in the body, drugs that possess opposite characteristic properties (those of *pritvi* or solid elements) are selected and given (Narayanaswami, 1983).

The speciality of Siddha system is in its non differentiation of food and medicines. Most of the dietary items in a typical Indian diet, such as vegetables, fruits, roots and greens are used as medicines. Literature references give details of specific indications of the use of herbs, namely roots, stem and leaves which

are easily accessible in rural areas, economical and also received well by human systems. The drugs of the Siddha system of medicine also include metals and minerals.

Pediatrics in Siddha medicine describes diseases according to age, starting from early infancy to late childhood. The treatment with specific herbs varies with each disease and most mothers are quite conversant with these herbal preparations.

In the early infancy, that is, upto 3 months, only leafy extracts are administered, depending on the condition, internally to the baby by applying the medicine to the mother's breast, facilitating the baby to suckle the medicine along with the milk. Pasty medicine applied over the anterior fontanel of the baby to produce quick relief by cutaneous absorption and medicinal herbs for bath are recommended.

In late infancy, upto one year, the infant is considered as being exposed to the influence of birds and humans who cast their powerful eyes inflicting diseases. Treatment for this kind of disease (*e.g. thodam*) is mainly tantric and such tantric practices are still common in rural and in some urban parts of India.

From the first year of life, due to exposure to external pollution and contact, the child develops diseases with various signs and symptoms. Treatment comprises mostly oil based vegetable preparations consisting of mainly barks, roots, leaves and also ingredients of mineral and animal origin. Infusion, pastes, pills and oil preparations are used mainly to improve digestion, regulate the bowel, control the fevers and to stabilize the vitiated *doshas*. Selective combinations for each disease are made to produce the desired result.

Biomedical model (Shils & Young, 1988; Robinson et al, 1986)

The biomedical view of disease, on the other hand, is interpreted in terms of pathophysiology. It focuses on disease rather than on illness. The nutritional deficiencies are explained scientifically with respect to the underlying biochemical and physiological abnormalities. Spiritualism has no role in this theory.

According to the biomedical model, protein energy malnutrition (PEM), the most important nutritional disease in developing countries because of its high prevalence and its relationship with child mortality rates, can affect all groups but it is more frequent among infants and preschool children. Primary PEM, as shown in Figure 2, results from insufficient food intake or from the ingestion of foods with proteins of poor nutritional quality. These inadequate intakes are almost always linked to poverty (causing low food availability and unsanitary living conditions), ignorance (leading to poor child rearing practices, insufficient breast feeding combined with inadequate weaning practices, misconceptions about use of certain foods, inadequate feeding during illnesses and improper distribution of food within family members), and infectious diseases ( causing reduced food intake due to anorexia and increased metabolic losses). Maternal malnutrition prior to and/or during pregnancy is likely to produce an underweight newborn which when compounded after birth by insufficient food for catch up growth results in PEM. Intestinal parasites have little or no effect unless the infection is extensive or causes acute diarrhea. Unsanitary living conditions lead to frequent infections with deleterious nutritional consequences. The main clinical features of mild and moderate PEM



FIGURE 2: Biomedical Model For Cause And Treatment Of Chronic Mild PEM





FIGURE 3: Biomedical Model For Cause And Treatment Of Kwashiorkar And Marasmus



is weight loss. When PEM is chronic, children show growth retardation in terms of weight and height.

Dietary energy and protein deficiencies usually occur together, but sometimes one predominates and, if severe enough, may lead to the clinical syndrome of Kwashiorkar (predominant protein deficiency) or Marasmus (mainly energy deficiency), as shown in Figure 3. Marasmic kwashiorkar is a combination of chronic energy deficiency and chronic or acute protein deficit. However this is a too simplistic concept and some investigators have proposed that marasmus is a better adapted syndrome in which visceral proteins are preserved more efficiently. In marasmus a decrease in energy intake is quickly followed by a decrease in energy expenditure (less physical activity) and when this cannot compensate for the insufficient intake, body fat is mobilized with a decrease in adiposity and weight loss. As the energy deficit becomes more severe, subcutaneous fat is markedly reduced, and protein catabolism leads to muscular wasting. The generalized muscular wasting and absence of subcutaneous fat gives the patient a "skin and bone appearance". The hair is sparse, thin and dry. The skin is dry, thin and wrinkled. Abdominal distension may be present. The predominant feature of kwashiorkar is edema in the feet and legs but extending to the perineum, upper extremities and face in severe cases. The body tries to adapt to the protein deficit (by decreasing nitrogen excretion and increasing nitrogen recycling), but when the adaptive mechanisms fail, the concentration of serum proteins, and especially albumin decreases. The ensuing reduction in intravascular oncotic pressure and outflow of water into the extravascular space contribute to the development of edema. Skin may be dry, peeling, and hyperpigmented. Hair is dry, brittle and without its normal sheen. The patient is apathetic and has an expression of sadness and misery.

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Hepatomegaly (enlarged liver) caused by severe fatty infiltration (due to increased synthesis from excess carbohydrate, impaired breakdown and transport by liver) is usually present. Because of the protein deficiency, a decrease in gastric, pancreatic and bile production is observed which impair the absorptive functions. The abdomen is frequently protruding because of distended stomach.

Treatment of the less severe forms of PEM (as seen in Figure 2) involve improvement of child feeding practices and supplementary feeding. Severe forms of PEM (as seen in Figure 3) may necessitate hospitalization for the correction of fluid and electrolyte disturbances; infections; complications such as impai<sup>-</sup> ed cardiac functions, severe anemia, hypothermia, hypoglycemia, or severe vitamin A deficiency; and rapid and safe replacement of nutrient deficits. This should be followed by nutrition rehabilitation during which the child must be made to eat adequate amounts of protein, energy and other nutrients, and he/she should be treated for persistent diarrhea and intestinal parasites.

Vitamin A deficiency is a practical nutritional problem among preschool children. The two major causes of vitamin A deficiency in the child are 1) an inadequate intake of vitamin A in the diet or 2) a reduced absorption of the vitamin, either due to a low fat intake (efficient absorption of vitamin A is dependent on the presence of fat in the diet) or due to some underlying malabsorptive disorder. The eye is primarily involved. The symptoms primarily involve a history of night blindness (locally termed as *malaikan*) due to reduced sensitivity of the dark adaptation response (less rhodopsin is formed) in the retina of the eyes. A sequence of abnormalities of increasing severity occur in the conjunctiva and the cornea of the eye because of loss of integrity of the epithelium. Dryness (xerosis) of conjunctiva occurs followed by the appearance

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of Bitot spot's (locally termed as *pu viyundiruku*), a heaping up of desquamated, keratinized epithelial cells. Corneal involvement proceeds to xerosis and severe irreversible changes occur in the cornea, which ultimately perforates with loss of the aqueous humor (keratomalacia), frequently resulting in blindness. Vitamin A deficiency also produces skin changes, but these symptoms are not unique indicators of vitamin A deficiency as other nutritional deficiencies also produce similar skin disorders. Treatment involves the administration of therapeutic or curative doses of the vitamin, correction of the dietary deficiency by increasing intake of vitamin A and carotene rich foods and treatment of any other underlying malabsorptive disorder.

Anemia (locally called *rathasokai*) in the child may occur due to an excessive loss of blood because of hemorrhage or parasites such as hookworm. It may also occur because of an improper production of blood cells due to certain nutritional deficiency. Treatment involves the dietary and therapeutic supplementation with iron along with any other deficient nutrient. Treatment also involves the medical correction of any other underlying cause.

#### CHAPTER IV

#### **RESULTS AND DISCUSSION**

This chapter presents the results of the study followed by a discussion of the results on the mothers' reasoning about the cause and treatment of each of the presented childhood nutritional problems.

The total sample of subjects for the study consisted of 87 mothers, 21 elders (grandmothers) in the community, 5 trained traditional practitioners, 5 untrained midwifes and 5 medical officers and/or pediatricians attached to the nutrition program. The mothers were categorized into three groups, those with no schooling (26), those with primary schooling (29) and those with secondary schooling (32), based on the extent of formal education. Primary schooling in India represents five years of formal education, and secondary schooling represents 10 years of formal education. None of the mothers in the study had more than 10 years of schooling.

The elders in the study were all over 50 years old, and none of them had any formal education. The mothers' age (besides that of elders) ranged from 18 years to 41 years, with an average of 26 years (S.D.=5.1). The total number of children in each family ranged from 1 to 6 (Mean=2.7, S.D.=1.2).

The health cards with four grades of malnutrition (Appendix III) used for growth monitoring at the nutrition centres, were used to determine the nutritional status of the children under five, whose weight and height were recorded. Seventy percent of the children showed mild to moderate malnutrition (Grade I and II). Table 1 shows the nutritional status of children of mothers, with varying levels of formal education. A greater

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# TABLE 1

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# Number and percentage of normal and malnourished children of mothers with varying levels of formal education.

Nutritional status *	Number and percentages				
	Mothers with no schooling	Mothers with primary schooling	Mothers with secondary schooling		
	N(%)	N(%)	N(%)		
Normal children	2(8)	8(24)	10(28)		
Children with mild and moderate malnutrition (Grades I &II)	18(75)	22(67)	25(69)		
Children with severe malnutrition (Grades III & IV)	4(17)	3(9)	1(3)		

\* Nutritional status assessed using growth charts used at the nutrition centres (Appendix III)

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percentage of normal children belonged to mothers with primary and secondary schooling, whereas a greater percentage of children with severe malnutrition belonged to mothers with no formal education. Maternal education thus had a positive effect on the child's nutritional status. Other researchers (Cochrane, 1980) have reported a similar positive relationship between maternal education and child health.

Quantitative results on the frequency of the responses to various categories of causality and treatment of chronic PEM, kwashiorkar, marasmus, vitamin A deficiency and anemia, given by mothers with varying levels of formal education and by the elders in the community are presented below. The quantitative analysis is followed by detailed qualitative semantic analysis of the causal explanation protocols of individual mothers.

Concepts generated in the mothers' protocols were identified and compared with concepts and their interpretations within the traditional and biomedical theories. The influence of formal education on the mothers' reasoning about childhood nutrition and nutritional problems was examined. Specific positive and negative aspects of the traditional belief structure with respect to child nutrition and health were characterized.

## **Reasoning about chronic PEM**

Chronic PEM in a child is caused by an insufficient food intake due to factors such as poverty, ignorance, unsanitary living conditions leading to infections, and inadequate feeding during illnesses. Dietary deficiency of energy and protein results in symptoms of height and weight retardation in the child as described in the biomedical model for the condition in chapter III.

The mothers' reasoning about the cause and treatment of chronic PEM in the child, however, revealed the presence of other concepts, in addition to that of insufficient/improper food, as seen in Table 2. The left hand side of the table lists the various categories of causality identified in the mothers' responses to the questions related to the cause and treatment of heightweight retardation in the child. The right hand side of the table gives the number and frequency of occurrence of the responses in mothers with varying levels of formal education and in the elders from the community. Sixty nine percent of the mothers with no schooling, 83% of the mothers with primary schooling, 84% of the mothers with secondary schooling and 38% of the elders in the study considered height-weight retardation in the child to be the result of an insufficient and/or improper food intake by the child. The condition was identified as the result of therai, caused by physical contact with a type of toad, locally called as therai, by 12% of the mothers with no schooling and by 14% of the mothers with primary schooling. This concept, however, did not feature in the reasoning about chronic PEM given by mothers with secondary schooling and by the elders in the community. Twenty nine percent of the elders interviewed, however, linked the condition to a state of kanai caused by excessive heat in the body.

A description of each of these factors is presented below. Treatment in all cases paralleled the subjects' understanding of the underlying causal mechanism.

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# TABLE 2

Number and percentage of responses to the causes of chronic PEM in the child given by mothers with varying levels of formal education and by elders in the study.

Causes *	Percentages				
	Mothers with no schooling	Mothers with primary schooling	Mothers with secondary schooling	Elders	
	N(%)	N(%)	N(%)	N(%)	
Less &/or improper food	18(69)	24(83)	27(84)	8(38)	
Therai	3(12)	4(14)	0(0)	0(0)	
kanai	0(0)	0(0)	0(0)	6(29)	

\* All factors noted by atleast 10% of the subjects have been included in the table.

#### Less and/or improper food

Less and/or improper food was considered as the number one causative factor for height and weight retardation in the child by a majority of the mothers in the study as seen in Table 2, with the percentage of mothers responding increasing with an increase in the level of their formal education. For treatment of the condition, the mothers emphasized the importance of providing the right food for optimum growth in children. There was considerable consistency of opinion regarding what is an appropriate diet for the child.

#### <u>Concept of appropriate diet for the child:</u>

Breast feeding was widely practiced by the mothers in this community. Several mothers, however, also mentioned the use of commercial infant milk formulas (such as 'Amul'), baby foods (such as 'Cerelac') and health foods (such as 'Horlicks' and 'Bournvita').

The typical meal pattern for the older children in these communities consisted of *idli* and coffee in the morning. *Idli* is a traditional preparation made of rice, which is the staple food in these areas, and lentils. The mixture is fermented, ground and steamed. The combination of cereal and pulse in its composition and the method of cooking used, makes it an ideal weaning food for children. The afternoon meal consisted of the food provided in the nutrition centres, discussed in chapter III. At night, the children were fed on rice with oil or *ghee* and lentils along with a traditional preparation called *Koyambu*, which is prepared with vegetables and lentils and occasionally meat and fish. The use of milk, fruits, eggs, biscuits, bread (locally called *roti*), meat and fish were recommended, if affordable.

Three major concepts of thokam, mandham & perali (considered together because of their close association) and karpan, governed the choice of foods considered as suitable for consumption by the small child. Foods known to cause these three conditions were strictly avoided in the child's diet. Table 3 presents the number and percentage of mothers with different levels of formal education who revealed the presence of these concepts. Thirty five percent of the mothers with no schooling, 31% of the mothers with primary schooling and 22% of the mothers with secondary schooling avoided foods that cause thokam in the child. Thirty one percent of the mothers with no schooling, 52% of the mothers with primary schooling and 47% of the mothers with secondary schooling avoided mandham producing foods and 31% of the mothers with no schooling, 38% of the mothers with primary schooling and 28% of the mothers with secondary schooling avoided *perali* producing foods in the child's diet. Foods associated with karpan were avoided in the child's diet by 4% of the mothers with no schooling, 10% of the mothers with primary schooling and by 16% of the mothers with secondary schooling. Traditional concepts such as thokam, mandham, perali and karpan, that govern the selection of foods given to the child in this community, therefore persist even in mothers exposed to several years of formal education.

A description of these traditional concepts as they feature in the mothers' protocols and their interpretation within the traditional theory is presented below:

# TABLE 3

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Frequency of occurrence of traditional concepts related to child feeding in explanations by mothers with varying levels of formal education.

Concepts *	Number and Percentages				
	Mothers with no schooling	Mothers with primary schooling	Mothers with secondary schooling		
	N(%)	N(%)	N(%)		
Tho <b>kam</b>	9(35)	9(31)	7(22)		
Mandham	8(31)	15(52)	15(47)		
Perali	8(31)	11(38)	9(28)		
Karpan	1(4)	3(10)	5(16)		

\* All factors noted by atleast 10% of the subjects have been included in the table.

## The concept of "thokam":

Thokam is described by the mothers in this study as a condition caused by certain types of food such as meat pieces, and fruits and vegetables with skin such as grapes, egg plant and jackfruit, and also by non-food items such as paper and hair. Such substances are considered to be getting stuck in the kodal (intestine) resulting in abdominal distension, vomiting, diarrhea and the feeling of faintness in the child, so affected. For example, Figure 4 gives the protocol of a mother (# 28) with primary schooling in response to the question of cause and treatment of kwashiorkar in the child. She associates the enlarged abdomen seen in kwashiorkar with thokam, caused by some article eaten by the child, which is stuck in the intestine and results in diarrhea. Oral rehydration therapy (ORT) mixture (referred to, by her as sugar/salt mixture), according to her, is not effective for diarrhea caused by thokam. For treatment, she suggests taking the child to local folk healers who either remove it by blowing through a tube inserted into the mouth of the child or by rubbing and tapping on the belly and enchanting mantras (sacred words). Similar treatment strategies were apparent in the protocols of 18 other mothers in the study, including 6 mothers with secondary schooling.

This concept of *thokam*, as it appears in the mothers' protocols has a strong resemblance to the concept of *empacho* in Mexican villages. In medical terms *empacho* or impaction means that the gut is stopped up or obstructed. But, according to the local folk in Mexico, any illness causing stomach ache or diarrhea may be called *empacho*. It is said to occur because a ball of hair or something else blocks a part of the gut, due to the influence of

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# TABLE 4.

# A typology of relations used in the semantic networks

- **CAU:** Attributed Causality
- **COND:** Directional Conditionality
- **EQUID:** Equivalent in value of a specifiable property
- **IDENT:** Identity

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- **TEM: ORD:** Temporal sequence of events
- **CAT:** Object belonging to a Category
- **RSLT:** Result of a specified action
- **PRT:** Part/whole relation
- **NEG** Having a negative truth value

**R.** Shows the mother a picture of a child showing the symptoms of kwashiorkar S. This is "thokam";

R. Why do you think it happens?

S. It happens if the child has had something and it gets stuck We have to take the child to folk healers who tap on his belly ("thatividuva") and it will go in If stomach is swollen and the child has diarrhea, then it is thokam They say some mantram and tap on the stomach. Some people remove it by blowing ("oodividuva") with a rod We do all this in velachari (a nearby rural area). For some simple diarrhea, mixture of sugar and salt works Thokam does not become alright with that.



FIGURE 4: Explanation Protocol And The Semantic Representation Of The Protocol Of A Mother (#28) With Primary Schooling For The Concept Of *Thokam* 

witches or evil spirits (Werner, 1990). The treatment involves magical cures or cupping, and folk healers pretend to take a ball of hair or thorns out of the gut by sucking on the belly. However, no reference to such practices could be located in the Siddha literature or in the explanations of the traditional practitioners in this study.

The folk treatment in many cases was followed by the administration lemon (citrus of substances such as aurantifolia) and 'omam'(Trachyspermum ammi). The digestive and antiemetic properties of these substances have been documented in Siddha medical literature (Rao & Veluchamy, 1983). For example, lemon, is a well known digestant, antiinflammatory agent due to its high vitamin C content, a good liver tone and also an antiemetic agent; 'omam', is also a good antiemetic and liver tone agent. Such traditional practices would therefore relieve the sick child with symptoms of diarrhea and vomiting. However, the treatment by some folk healers is followed by the administration of certain herbs causing diarrhea, in an attempt to remove the material stuck in the intestines, as evident in the following excerpt from the protocol of a mother (#23) with no schooling:

S: The child must have eaten something and will have diarrhea. Remove thokam in Kochadai (the place where the folk healers are located). They blow it out or tap on the belly and remove it. They give some medicine. The child will have diarrhea and the material stuck will come out in stools.

Such malpractices were also evident in the protocols of mothers with schooling. For example, given below is an excerpt from the protocol of a

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mother (#77) with secondary schooling for the treatment of *thokam* in the child:

S. If something is stuck (bone or snacks) then we go to Velachari (place nearby). There is an old lady who gives a leaf juice, enchants a God's name and applies something on the stomach of the child. After coming home the child will have diarrhea. Then we give black coffee and sangellai juice (a herbal remedy).

Such treatment strategies may cause further dehydration in the child who is already affected by diarrhea. Feeding of black coffee to the child is another practice, frequently seen in this community.

#### Concept of mantham and perali:

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Perali was identified by the mothers in this study as a condition in the child characterized by green diarrhea. Consumption of certain articles of food such as mango, jackfruit, guava and coconut was considered to be the causative factor for mandham followed by perali in the child. Such items were also therefore avoided from the child's diet. For example, mango was avoided in the child's diet by 54% of mothers with no schooling, by 79% of the mothers with primary schooling and by 75% of the mothers with secondary schooling. Similarly 35% mothers with no schooling, 41% mothers with primary schooling and 53% mothers with secondary schooling avoided jackfruit from the child's diet.

Mandham in Siddha literature includes febrile gastrointestinal and other illnesses affecting infants and children under three. It is attributed to impaired digestive power. The word itself means retardation with respect

to the digestive energy. Figure 5 gives the excerpts from the protocol of a trained Siddha physician, which provides detailed mechanistic explanations for the factors causing mandham and perali in the child. According to the physician mandham is caused by the child breast fed by a mother who has not had nourishing food or mother having uterine disorder. The milk forms lumps and curdles, and the child has diarrhea which is now called mandham. Perali is green diarrhea caused due to mandham. To cure the condition the child is given traditional oils called mandha ennai, perali ennai or kanai ennai so that the curdled milk inside the stomach comes out. This is further facilitated by the administration of oil every week along with herbs to facilitate digestion. Further, the mothers are given a traditional preparation called kayamarundu, which is prepared from several herbs, so that the milk becomes good and the womb is cleaned. To counteract the heat generated by this traditional preparation, the child is given an oramarundu prepared from a mixture of seven herbs which are cooling and have astringent properties.

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adder.

The concepts of *mandham* and *perali*, as they feature in the mothers' protocols has a strong bearing on these concepts as seen in this traditional model. Consumption of foods such as mango and jackfruit by the lactating mother or the breast fed child was believed to be the cause of *mandham* followed by *perali* in the child by all the mothers exhibiting these concepts. An example of the mothers' reasoning is evident in Figure 6, which gives excerpts from the protocol of a mother (#40) with primary schooling. According to her, the consumption of mango, guava and jackfruit by the child causes *mandham* and *perali*. For treatment, the mother recommends

R. Shows a picture of a child suffering from marasmus. S. This is a type of 'kanai'. Child gets it while inside the mothers womb. If the mother does not eat nourishing food, or if she has some uterine disorder, child is born like this. When the child has milk, it forms a lump (katti) and the child has diarrhea. This is called 'mandham', the stage before kanai in children below 3yrs. of age. In 3-7yr. olds, it becomes kanai, which is called 'primary complex, in modern terminology. "Perali' is green diarhea due to mandham. To cure mandham in Siddha vaidyam (medicine), to the new born give various oils such as "mandha ennai', 'kanai ennai', and "perali ennai". By giving this all the curdled milk in the stomach comes out in motions. After that every week they give oil (different types each day). All the curled milk and milk lumps formed while inside the uterus comes out. Body gets strength, body heat is reduced and all the illnesses which come after 6 months of age are prevented. For the lactating mother the mid-wives give a herbal medicine called ' kayamarundu'. This gives body heat (because of lack of menstruation in the motiler for 10 months, the body becomes very cool) and the mothers milk becomes good. The child then remains healthy. The mothers then give the child a herbal medicine called 'oramarundu' which is cooling, and has astringent properties. This is given because the mothers during lactation eat 'kayamarundu' which is hot.

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FIGURE 5a: Explanation protocol of a Siddha physician explaining the concepts of mandham and perali in the child.



FIGURE 5b: Scmantic representation of the explanation protocol of a Siddha physician explaining the concepts of mandham and perali in the child

R. Are there any foods to be avoided in the child's diet? S. Mango, guava and jackfruit cause mandham and perali Perali is green diarthea due to indigestion For this, some people who don't know that it is perali go to remove thokam. Others give sugar and salt water (ORT powder) which we get at the nutrition centre. Salt/sugar water works for some children For perali give herbs (sangellai, podudhalai, omam etc.) We get all this here We also get an oil called perali ennai in Mathur (next village) The mother should not eat brinjal (eggplant), some lentils, fish, meat and dried fish Otherwise the child will have problems



FIGURE 6: Explanation Protocol And The Semantic Representation Of The Protocol Of A Mother (#40) With Primary Schooling Showing The Concept Of Mandham & Perali the observation of dietary restrictions by the lactating mother and the use of traditional herbs such as *poduthalai*, omam and sangellai.

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Poduthalai leaves (Lippia nodiflora) and omam (Trachyspermum ammi), mentioned by her, are both recommended for the treatment of diarrhea in children. According to Siddha medical texts Poduthalai has an astringent action, antibacterial and anti-amoebic properties (Rao & Veluchamy, 1983). Salt and sugar water, the well known ORT preparation recommended for diarrhea in children, according to her, works only for some children. She also recommends the use of a traditional preparation called *perali oil*, which is locally available. This traditional preparation is made by folk healers by boiling several roots and leaves and then extracting the oil from it, as seen in the following excerpt from the protocol of a local mid-wife.

S: We make this oil from a lot of leaves, roots, medicines etc.. We buy all this from the local market. We boil all this, filter and keep the oil ready.

#### The concept of Karpan:

Foods such as egg plant and certain varieties of lentils were avoided from the child's diet by the mothers in this study, as they were considered to result in a skin condition identified by them as *karpan*. According to Siddha literature, *karpan* is a condition that occurs in children usually between 1 to 3 years of age, manifesting cutaneous changes according to variety (Krishnamurthy, 1983). According to Siddha physicians interviewed, it is a condition caused by the consumption of rotten food and is usually an allergic reaction. The practice, as evident in the mothers' protocols, of avoiding certain articles of food likely to cause an allergic reaction (*karpan*) only in

some children, altogether from the diet of all children, may then be considered undesirable

#### Therai

Twelve percent of the mothers with no schooling and 14% with primary schooling considered height-weight retardation in the child to be the result of *therai*. *Therai*, was also identified as the number one causative factor for marasmus in the child, as described in the section on marasmus

Therai was described as a condition that occurs at birth if the therai, which is a kind of toad, falls on the pregnant mother, or if the pregnant mother consumes food with which the *therai* had been in physical contact. For example, a coconut with a soft interior was considered as *therai* coconut. Physical contact with the therai was said to induce a softening of the coconut's interior and the creation of a distinct odour and taste. Drinking of its water by the pregnant mother was said to result in therai in the child. The therai child was said to be just skin and bone with the stomach and head being big and the hands and legs being thin (a condition very similar to marasmus). The condition was said to occur because the *thera*, when it falls on the pregnant mother sucks all the rasam (nutrients) from the foetus and therefore the child is born very thin, like the *therai*. Marasmus, characterized by extreme wasting, was therefore identified as therai by a surprisingly large number of mothers in the study, as described in the section on marasmus. Treatment, according to the mothers, involved the tying of a live therai enclosed in a leather bag on the neck or waist of the child. As the therai dies, the juice was said to be entering the child's body, who therefore gets back the nourishment which was earlier lost. Such explanations were

given by almost all the mothers who associated the condition with *therai* in the child. Detailed mechanisms of causation and treatment were provided by older mothers (elders) in the study. Younger mothers did not provide such mechanisms. Examples of such explanations are evident in Figures 7 and 8 giving the excerpts from the protocols of elderly mothers (#92 and #94) for the cause and treatment of marasmus in the child.

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According to Siddha medical literature a common pediatric problem is *thodam (dosham)*, which is defined as "touching" which may be effected by touching with hand, by casting an evil eye and/or by bodily contact. *Therai thodam* is said to be caused by the feeling of airy touch from the moving toad. The clinical features include dryness of the body, marasmus, narrowing of the eyes, fast folding of the limbs on the trunk, distension of the abdomen, thirst and change in voice. These are followed by dyspnoea, refusing of feeds, loss of hearing, dry limbs with pallor, shrieking voice and emaciation in spite of feeds (Krishnamurthy, 1983).

This concept of *dosham*, in Siddha literature, is compared to the modern concept of micro bacterial and viral infections and treatment involves the administration of a *ghee* (viscous oily liquid) prepared with the decoction from a number of leaves and herbs (Krishnamurthy, 1983). However, the practice of tying the live *therai* for treatment, as suggested by the mothers in this study, may infact prove harmful and a source of infection in the already weak child. Moreover the practice of giving nourishing food only after the child improves with the tying of the *therai*, as seen in Figure 8, would delay the treatment in a child requiring immediate dietetic supplementation.

R. Shows the mother a picture of the child with symptoms of marasmus S This is because the mother has eaten 'therai coconut', then the child has 'therai' The pregnant mother should not eat such coconuts For treatment, tie a live 'therai' onto the child's stomach. As water oozes out of the 'therai', the child will gain strength The 'therai' will die and as the 'therai' dries up, the water enters the child's body and he gains strength It is stitched in a cloth bag and sold Tie it around the child's stomach and hang it from his shoulder. Give food as usual



FIGURE 7: Explanation Protocol And The Semantic Representation Of The Protocol Of An Elderly Lady (#92) For The Cause And Treatment Of Marasmus In The Child.

R. Shows the mother a picture of a child with symptoms of marasmus S. This is 'therai'. When the 'therai' falls on the pregnant mother, it drains the 'rasam' (nutrients). They get it even when they are 6 months to I year old For treatment, the 'therai', the 'rasam' is returned to the child and he becomes alright Then give nourishing food It can also happen due to worms Then give worm medicine



FIGURE 8: Explanation Protocol And The Semantic Representation Of The Protocol Of An Elderly Lady (#94) For The Cause And Treatment Of Marasmus In The Child

#### Kanai

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Thirty eight percent of the elders in the study associated height-weight retardation in the child to dietary factors. Twenty nine percent of the elders, however, recognized a state of diminished growth in the child as *kanai*, a condition in which the child remains slightly warm (referred by them as *kanai kachal*) and keeps becoming thin. It was associated with excess body heat. Wheezing and cough were mentioned as additional symptoms by several of these subjects.

The term *kanai* as used in the Siddha literature refers to primary complex, a disease which affects a large percentage of children in India. The disease results in muscular wasting and fever, makes the child irritable, and the child loses appetite. This affects the growth of the child. Siddha medicine recommends the administration of *Neem oil*, since Nimidin, one of the two bitter principles in *Neem*, inhibits the growth of M.Tuberculosis (Thottarn, 1983).

Figure 9 presents excerpts from the explanation protocol of an elderly lady practicing traditional medicine in this community for the last 40 to 50 years and the mother of 16 children, on the cause and treatment of heightweight retardation in the child. The condition is attributed to *kanai* which causes the child to remain thin, and for treatment she recommends the use of *kanai oil* prepared by her. This herbal preparation is also locally available and was said to be *neem oil* by some mothers, although others were not sure of the composition. It was being purchased locally and given to the breast fed child at night, for administration at day time would necessitate certain
R. Lets consider a child under 5 years of age. If that child does not gain height and weight at the desired rate, why do you think that happens? S. It is because of 'kanai', then the child keeps on becoming thin. 'Kanai' means the child does not gain weight, and the body remains slightly warm, even at night. We give 'kanai ennai' (an oil) at night. In the morning the child will have clean stools and it removes all the heat ('kanai kachal') We make this oil from a lot of leaves, roots and medicines. We buy all this from the local market. We boil all this, filter and keep the oil ready. For 6 to 7 year olds, I ask the mother to give good food



FIGURE 9: Explanation Protocol And The Semantic Representation Of The Protocol On The Reasoning About Causality And Treatment Of Chronic PEM By A 65 Year Old Untrained Traditional Practitioner.

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dietary restrictions for the lactating mother. This *kanai oil* is said to remove the body heat and also clean the bowel as reflected in Figure 9.

Although the mothers' handling of the problem and her treatment strategy has a strong bearing on traditional medicine, her interpretation of every case of height-weight retardation in the child (the only clinical features seen in the nutrition problem presented to her) as *kanai* may not be desirable. The administration of the traditional preparation (*kanai oil*) with laxative effects to a malnourished but otherwise normal child may do more harm than good.

Moreover, it is important to note that there were other harmful practices associated with the elimination of *kanai* in the child. For example, given below is an excerpt from the protocol of a mother with no schooling (#18) for the cause and treatment of height - weight retardation in the child:

S: It is due to kanai (heat), so the child does not grow. Body is kanai. we have to remove the kanai. At home we apply cow dung on the back of the child. The kanai shows up like thorns. Pluck them and give bath with hot water-do this once a month for three months. That would reduce the body heat. If the child does not gain weight, remains thin, and hair becomes discoloured, then we do this.

The condition has been recognized as *kanai*, due to body heat, which prevents the child from growing and also causes hair discolouration. In an attempt to reduce the body heat and *kanai*, the mother recommends the application of cow dung on the back of the child. Similar treatment strategies were evident in the protocols of five other mothers in the study. Such

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practices could prove a source of infection which may further worsen the malnourished state.

## Diarrhea, indigestion and phlegm

Although both diarrhea, indigestion and phlegm were not mentioned specifically as causal agents for growth failure in children, they were two very common health concerns among children. The mothers' reported the use of traditional herbs regularly, both as a preventive and as a therapeutic measure for these conditions. The local names for these herbs are listed on the left hand side of Table 5. The right hand side of Table 5 gives their botanical names and their mechanism of action as reported in Siddha medical texts (Subramaniam & Madhavan, 1983).

One of the important components of traditional medicine is preventive and promotive health. Sound traditional practices that aim at the prevention and treatment of frequently occuring childhood problems such as diarrhea and respiratory infection are definitely beneficial and their use should be encouraged by nutrition education programs.

### Seer

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Another common cause of concern regarding the health of the child was the concept of *seer*. Twelve percent of the mothers with no schooling, 14% of the mothers with primary schooling, 9% of the mothers with secondary schooling and 10% of the elders in the study revealed the presence of this concept.

A child with symptoms of vomiting, diarrhea, anorexia and the feeling of faintness was considered to be suffering from seer, a condition

## **TABLE 5**

The herbs recommended for use by the mothers for prevention and treatment of diarrhea, indigestion and phlegm in the child, along with their botanical name and mechanism of action as given in Siddha literature.

Herb	Botanical name	Mechanism of	
		action	
For diarrhea:			
Perungayam	Asafoetida	Antiflatulent	
Chuku	Gingiber	Digestent,	
	officinalis	antiflatulent, mild	
Milagu	Piper nigrum	antibactericidal,	
		anti-	
		inflammatory,	
		stomachic agent	
Jadhikai	Myristica fragrans	Analgesic,	
		anti-spasmodic	
		and styptic,	
		anti-	
		inflammatory, &	
		sedative	
Manjal	Cucuma longa	Antiseptic	
Vasambu	Aconus calamus		
For phlegm:			
Thulasi	Ocimum sanctum	Expectorant,	
	L.	decongestant,	
Karpooravalli	Coleus aromaticus	anti-	
		inflammatory,	
		antibacterial,	
		antiseptic, mild	
		anodyne	

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caused by the child looking at an "unclean" person. One example of an "unclean" person was a woman just after abortion. This has a strong bearing on the Siddha concept of female *thodam* which is described as being of six kinds according to the cause. It is said to be caused by 1) the sight or touch of the woman who has not taken bath after intercourse 2) the woman during her menstrual period 3) the woman who just wore an amulet wanting gestation 4) the woman after routine bath during her menstrual period 5) the woman in her menstrual period carrying the baby and 6) the woman just after abortion (Krishnamurthy, 1983).

The treatment recommended in Siddha literature includes the oral administration of a herbal preparation, giving of bath to the child after applying a herbal paste on the anterior fontanel and tantric therapy. The application of pasty medicine over the anterior fontanel of the baby to produce quick relief by cutaneous absorption is a common remedy prescribed in Siddha medicine. Given below is an excerpt from the protocol of a mother with no schooling (#26 )for the cause and treatment of *seer* in the child:

S: If child sees unclean people, he gets seer. Child will have vomiting and diarrhea. Apply "seer pattu" (pattu is the local terminology for the application of a paste) in Achampattu (the place where the folk healers for this condition are located). They apply something on the head and after 3 days give head bath - it becomes alright.

She interprets the symptoms of vomiting and diarrhea in the child as *seer*, caused by the child seeing "unclean" people. In this community women are viewed as "unclean" during certain periods, such as during the

menstrual period and after having an abortion. The application of secr pattu on the head, as suggested by her, reflects the traditional practice in Siddha medicine. It is however, important to recognize that the child showing symptoms of diarrhea, vomiting and feeling of faintness, is probably extremely dehydrated. The interpretation of such a condition, that needs immediate medical attention, as "seer", and the folk handling of the condition thereafter, may delay the much needed rehydration in the child and may even result in death of the child due to extreme dehydration.

## **Reasoning about marasmus**

According to the biomedical model, as obtained from the protocols of local physicians, a marasmic child, suffering from extreme wasting of muscle and subcutaneous fat is identified as *nonjan*, in local medical terminology. This concept could be identified in the protocols of 38% of the mothers with secondary schooling. However, only 12% of the mothers with no schooling and 10% of the mothers with primary schooling were able to label the condition as *nonjan*.

The condition was linked to several factors by the mothers in the study. The major categories of causality and treatment identified in the protocols are listed on the left hand side of Table 6. Their frequency of occurrence in mothers with different levels of formal education is presented on the right hand side of the table. The treatment strategies recommended by the mothers had strong bearings on their reasoning about the cause of the condition.

The condition was identified as *therai* by most of the mothers with no schooling (42%), primary schooling (69%) and elders (43%). Among the

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## TABLE 6

Number and percentage of responses to the cause and treatment of marasmus in the child given by mothers with varying levels of formal education and by the elders in the study.

Category of response *	Number and percentages			
	Mothers with no schooling	Mothers with primary schooling	Mothers with secondary schooling	Elders
	N(%)	N(%)	N(%)	N(%)
Causes				
Therai	11(42)	20(69)	9(28)	9(43)
Less food	9(35)	3(10)	10(31)	5(24)
Maternal	4(15)	5(17)	4(13)	3(14)
Worms	2(8)	3(10)	7(22)	3(14)
Lack of	2(8)	4(14)	8(25)	0(0)
immuniz-				
ation				
Kanai	3(12)	0(0)	0(0)	4(19)
Treatment				
Tying therai	8(31)	16(55)	5(16)	9(43)
Food	8(31)	3(10)	15(47)	5(24)
Tonics/	9(35)	13(45)	8(25)	0(0)
doctor				
Can't do anything	0(0)	5(17)	0(0)	2(10)

\* All factors noted by atleast 10% of the subjects have been included in the table.

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mothers with secondary schooling, however, less food was considered as the causative factor for marasmus in the child by a majority (31%) of the mothers. Fifteen percent of the mothers with no schooling, 17% of the mothers with primary schooling, 13% of the mothers with secondary schooling and 14% of the elders, associated the condition with malnutrition in the mother. Worm infections in the child and a lack of immunization were identified as the cause for the problem, particularly by mothers with higher levels of formal education. Twelve percent of the mothers with no schooling and 19% of the elders, interpreted the condition as *kanai*, a concept that featured in the explanatory model for height and weight retardation in the child as well.

Tying of therai, provision of sufficient food, administration of tonics and consultation with the doctor were the main treatment strategies recommended by the mothers. Treatment by tying a live *therai* on the waist of the child was the most frequently reported treatment measure in mothers with lower levels of formal education and in the elders in the community. A majority of the mothers with secondary schooling (47%), however, resorted to treatment by diet supplementation. Seventeen percent of the mothers with primary schooling and 10% of the elders in the community revealed a state of helplessness regarding the problem. This was also the group wherein treatment by tying of the *therai* was most frequently recommended.

A detailed description of each of these factors of causation and treatment follows.

## Therai

In a majority of the mothers in the study, marasmus in the child was not attributed to dietary factors, but to the effect of contact of the pregnant mother with *therai* or *therai* foods. The child so affected, showing marasmus like symptoms, was termed as a *therai pillai* ( child affected by *therai*). Tying of a live *therai*, also described in the earlier section, was the major treatment strategy (refer to figures 7 & 8). Some mothers even specified that it should be a male *therai* for girls and a female *therai* for boys. Seventeen percent of the mothers with primary schooling and 10% of the elders in the study also felt that the fate of the child affected by *therai*, was in God's hands, and that they could not do anything about it, apart from tying the *therai*. This suggests the prevalence of a feeling of helplessness on the part of the mothers. Such an interpretation can have serious consequences for the health of the child affected by a simple dietary deficiency of food.

Moreover, the mothers reported the spending of Rupees. 15 to buy the *therai* from local folk healers visiting the rural areas. The money so spent could be used to buy food.

### Less food

According to the biomedical model, the major causative factor for marasmus in the child is a dietary lack of food, predominantly calories, which eventually leads to an extreme wasting of muscle and fat. However, dietary factors seem to have taken a back seat to *therai* in the mothers' explanations. Relatively fewer mothers were able to relate the condition to a lack of food or insufficient food. However, the awareness of the importance

of dietary factors in both causation and treatment of the condition, is more in mothers with higher levels of formal education (secondary education).

However, a large percentage of the mothers from all the groups (see **Table 6) mentioned consultation** with the local physicians, and administration of tonics prescribed by them to the child.

## Maternal malnutrition

Fifteen percent of the mothers with no schooling, 17% of the mothers with primary schooling, 13% of the mothers with secondary schooling and 14% of the elders in the study, associated marasmus in the child to an insufficient food intake by the pregnant mother.

According to the biomedical model, maternal malnutrition prior to and/or during pregnancy is likely to produce an underweight newborn, which when compounded after birth by insufficient food intake to catch up to the normal growth results in PEM in the child (as seen in Figure 2). The traditional Siddha model of health, also recognizes the importance of these factors. Child care in Siddha medicine starts long before the child appears as an individual in the world. It is a well recognized fact that the food the mother consumes contributes towards the well being of the growing foetus and considerable importance is given to the food of the expectant mother. It is an interesting custom in this community in which all close relatives and friends of the expectant mother invite her to a feast and serve all her favourite food. And when they visit her, they take something nourishing as a gift (Thottam, 1983).

### Worm infection

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Eight percent of the mothers with no schooling, 10% of the mothers with primary schooling, 22% of the mothers with secondary schooling and 14% of the elders in the study associated the condition of marasmus to the presence of worms in the child.

The co-occurrence of malnutrition and parasitic infections in children have been demonstrated by several studies in the past (Anandan et al, 1983). According to the biomedical model, treatment of parasitic infections includes the use of chemotherapeutic agents to destroy the parasites. Although prepurgation tends to eliminate the mucus and the fecal debris that protect the parasite, and post purgation aids in the removal of the killed or anaesthetized worms, purgation is not needed before or after administration of the drug in most cases of parasitic infections such as hookworm or roundworm (Brown & Neva, 1983). Furthermore, the increased peristalsis due to purgation may accelerate the passage of the drug through the intestinal tract. The worm infection may cause diarrhea, in which case purgation may do more harm than good.

However, the treatment strategies recommended by the mothers in this study suggests the presence of very traditional concepts involving the use of purgatives. More than 50% of the mothers recommended the use of extracts of the *neem* plant and/or castor oil for elimination of the worms. Castor oil is a well known laxative recommended as a remedy for worms in Siddha literature . Some leaves (such as *neem* leaves) have been shown to have antiprotozoal action (Thottam, 1983). Figure 10 presents an elderly mother's (#100) reasoning about the cause and treatment of marasmus in the

R. Shows the mother a picture of a child showing the symptoms of marasmus S. This happens if you give more sugar in milk Then the child has worms and the worms get the nourishment For treatment, give bitter things like 'vepellai' crushed, once a week for 10 weeks or give tablets from the doctor As you give bitterness, the worms come out With sugar it increases



FIGURE 10: Explanation Protocol And The Semantic Representation Of The Protocol Of An Elderly Lady (#100) For The Cause And Treatment Of Marasmus In The Child

child. According to her, the condition is attributed to worm infection caused by the consumption of excess sugar by the child. To counteract the effect, she recommends that the child be given bitter things such as *neem*, which will cause the worms to come out. Besides having a strong bearing on the treatment as suggested by Siddha medical literature, the mother's reasoning also reflects upon the traditional notions of "balance" with respect to all aspects of diet and body functioning, in general.

## Lack of immunization

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Eight percent of the mothers with no schooling, 14% of the mothers with primary schooling and 25% of the mothers with secondary schooling attributed the condition to a lack of immunization for both the pregnant woman and the child. This could be the effect of the nutrition education programme, the primary focus of which is immunization. The mothers are frequently shown pictures of children with various health problems, and the importance of adequate and timely immunization, both for the mother and the child are repeatedly stressed upon. The presence of this concept increases with an increase in the level of formal education.

## Kanai

Like height - weight retardation, marasmus, characterized by extreme wasting of muscle and fat in the child, has been identified as *kanai* by 12% of the mothers with no schooling, and by 19% of the elders in the study. The condition is associated with body heat, and the treatment strategies, similar to those discussed in the section on chronic PEM, have a strong bearing on the traditional theories.

### Reasoning about kwashiorkar

Kwashiorkar is caused when the child is abruptly weaned from the breast on to a high carbohydrate and low protein diet. The child who is therefore not getting enough body building foods, or proteins, although he may be getting enough energy foods, shows symptoms of apathy, generalized edema, skin changes (dry, flaky and peeling skin) and thin, dry hair on the head. There is liver enlargement and the abdomen is frequently protruding due to distension (Shils, 1988).

A child with symptoms of kwashiorkar is termed as *savalai* in local terminology, as evident from the protocols of local physicians. For example, Figure 11 gives excerpts from the protocol of a pediatrician/medical officer attached to the nutrition program in Madurai, for the cause and treatment of kwashiorkar in the child.

The condition has been identified as 'savalai' (the term 'savalai' in the Tamil language typically refers to the older child showing the symptoms of kwashiorkar, when the next child is born within a short interval of time). A predominantly carbohydrate rich weaning diet of rice gruel, given on account of poverty and ignorance, and an improper weaning age (2 years) have been identified as causative factors for the condition. The pediatrician suggests that weaning be started at 4 months of age.

The mothers in the study have, however, associated the condition with a number of factors. This can be seen in Table 7 which lists the various categories of causality and treatment identified in the mothers' protocols

R. Shows the doctor a picture o child with symptoms of kwashiorkar. S. This child is 'savalai'. It is caused mainly due to a poor weaning diet. The child is not weaned at the right age. The mother gives breast milk till two years. The child develops breast addiction and does not eat anything else. They don't start weaning from the fourth month and even if they start, they give only rice gruel. They cannot afford tinned foods like Cerelac, Farax. They don't make 'kepai' (local food) because they don't have that knowledge. Therefore it results in PEM.



FIGURE 11: Explanation Protocol And The Semantic Representation Of The Protocol Of A Pediatrician For The Cause And Treatment Of Kwashiorkar In A Child.

## TABLE 7

Number and percentage of responses to the cause and treatment of kwashiorkar in the child given by mothers with varying levels of formal education and by elders in the study.

Category of response *	Number and Percentage			
	Mothers with no schooling	Mothers with primary schooling	Mothers with secondary schooling	Elders
	N(%)	N(%)	N(%)	N(%)
Causes:				
Savalai	5(19)	7(24)	10(31)	1(5)
Less food	1(4)	2(7)	6(19)	4(19)
Too much food	5(19)	4(14)	4(13)	5(24)
Mud eating	8(31)	11(38)	7(22)	6(29)
Sokai	3(12)	10(34)	9(28)	6(29)
Indigestion	8(31)	3(10)	6(19)	7(33)
Treatment:				
With food	5(19)	5(17)	3(9)	2(10)
Consultation of doctor	6(23)	6(21)	7(22)	6(29)
With digestives	6(23)	3(10)	3(9)	5(24)

\* All factors noted by atleast 10% of the subjects have been included in the table

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along with the number and frequency of their occurrence in mothers with various levels of formal education and among the elders in the study.

The condition has been identified as *savalai* by 19% of the mothers with no schooling, 24% of the mothers with primary schooling, 31% of the mothers with secondary schooling and by 5% of the elders in the study. The use of this concept is thus more by the mothers with higher levels of formal education. Only 4% of the mothers with no schooling, 7% of the mothers with primary schooling, 19% of the mothers with secondary schooling and 19% of the elders, associated the condition with a dietary deficiency. Nineteen percent of the mothers with no schooling, 14% of the mothers with primary schooling, 13% of the mothers with secondary schooling and 24% of the elders, however, have related the symptoms to the feeding of excess food by the mother to the child, who is *savalai*. Concepts of mud/clay eating, *sokai*, and indigestion featured in the mothers' explanatory model for the cause of kwashiorkar in the child, irrespective of the levels of formal education.

Dietary supplementation, consultation with the doctors and administration of digestives to the child were the chief treatment strategies recommended by the subjects in the study.

A description of the various concepts that feature in the mothers' reasoning about the condition are as follows:

### Savalai:

The condition has been labelled as *savalai* caused by repeated pregnancies by several mothers in the study as seen in Table 7. However, the

mothers' interpretation of the underlying causal mechanism is very different from the biomedical explanation given by pediatricians/medical officers, even in mothers with higher levels of formal education. This is evident in Figure 12, which shows excerpts from the protocol of a mother (#63) with secondary schooling for the cause and treatment of kwashiorkar in the child.

The mother identifies the condition as *savalai*, caused in a child by the mother becoming pregnant again. However, according to her, the enlarged abdomen is caused not by a dietary deficiency, but because the child deprived of breast milk is now given more food. This in turn leads to problems of indigestion, diarrhea, growth failure and an enlarged abdomen. Similar interpretations were seen in the protocols of 19% of the mothers with no schooling, 14% of the mothers with primary schooling, 13% of the mothers with secondary schooling and 24% of the elders, who have likewise, related the condition to the consumption of too much food by the child.

## Less food

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The importance of malnutrition in the etiology of the condition and the need to provide adequate food, particularly protein rich food for treatment has not been recognized by a majority of the mothers in the study. A relatively small percentage of the mothers, as evident in Table 7 were able to relate the condition to a dietary deficiency of food, although the awareness was more among the mothers with higher levels of formal education. Only 2 mothers out of these were able to specify that the condition is due to the deficiency of protein rich foods (referred to as *puradha sathu* in local terminology). Similarly only 19% of the mothers with no schooling, 17% of the mothers with primary schooling and 9% of the mothers with secondary

R. Shows the mother a picture of a child with symptoms of kwashiorkar. S. This child is 'savalai' It happens because the mother becomes pregnant aagain. The child misses mother's milk.. But we keep giving food and so the stomach becomes big. This child cannot say that it is full. But the food is not digested well and the child keeps having diarrhea and so it will not grow viell. Give tonics.



FIGURE 12: Explanation Protocol And The Semantic Representation Of The Protocol Of Mother (#63)With Secondary Schooling For The Cause And Treatment Of Kwashiorkar I' The Child

schooling recognized the need to provide more food for treatment of the condition.

However 23% of the mothers with no schooling, 21% of the mothers with primary schooling, 22% of the mothers with secondary schooling and 29% of the elders in the study suggested the consultation of the medical doctor attached to the nutrition centres for the treatment of kwashiorkar in the child.

## Mud or clay eating and sokai:

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These two factors are being discussed together because of their close association with each other.

The eating of mud or clay by the child featured as the most frequently mentioned causative factor for the symptoms of kwashiorkar in the child, as seen in Table 7. According to the biomedical model, *pica* (or clay eating) is a condition in which the child eats various materials which are not suitable for human consumption, such as earth (geophagy), clay and ashes, and it could be due to various causes such as: a) libidinous satisfaction and exploring the outside world in infancy (upto 1year) b) response to hunger c) maternal deprivation which occurs at weaning due to emotional factors such as an unsatisfactory mother child relationship, frustration and neglect.

Children so affected show intestinal polyparasitism, as the constant swallowing of dirt is a potent cause of heavy infection, particularly, with ascaris. The worms often cause discomfort, indigestion and weakness, and children with many roundworms often have very swollen bellies. The

mud/clay eating children also exhibit iron deficiency, since clay chelates the iron and prevents it from absorption.

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The concept of mud/clay eating as it appears in the mothers' causalive model for kwashiorkar, however, differs considerably from the biomedical interpretation. This can be seen in Figure 13 which gives excerpts from the protocol of a mother (#57) with secondary schooling for the cause and treatment of kwashiorkar in the child.

The condition has been recognized as *sokai*, characterized by an enlarged head and stomach and thin hands and legs, caused by the child eating mud or ashes. Worm infections in the child are recognized as the causative factors for mud eating. This in turn is considered to be leading to a filling up of the stomach, indigestion (*mandham*) and drainage of all the nourishment by the mud and clay thus leading to *sokai* in the child. For treatment, the mother recommends administration of medicines to kill the worms, and the administration of tonics or covering of the child's hands to prevent mud eating.

This concept of *sokai* featured in the explanations of kwashiorkar in the protocols of several other mothers in the study (12% of the mothers with no schooling, 34% of the mothers with primary schooling, 28% of the mothers with secondary schooling and 29% of the elders in the study), irrespective of the levels of formal education. The problem was related to the eating of mud/ashes by the child in the explanations of 31% of the mothers with no schooling, 38% of the mothers with primary schooling, 22% of the mothers with secondary schooling, and 29% of the elders in the study.

R. Shows the mother a picture of a child with symptoms of kwashiorkar S. Child is 'sokai', only head and stomach are big, hands and legs will be like stick It is because the child eats mud and clay and so the stomach swells up Nourishment is drained by the mud and clay Mud and stones fill up the stomach and so digestion is impaired and the stomach is 'mandham' and big There is a tonic which prevents the child from eating mud Child has worms which make the child eat mud Give medicines to kill the worms or cover child's hands with a cover



FIGURE 13: Explanation Protocol And The Semantic Representation Of The Protocol Of A Mother (#57) With Secondary Schooling For The Cause And Treatment Of Kwashiorkar In The Child.

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This interpretation as evident in the mothers protocols has a strong bearing on the reasoning given by Siddha physicians. For example, Figure 14 shows excerpts from the protocol of a Siddha physician interviewed, for the cause and treatment of kwashiorkar in the child.

The condition was identified as *sokai* or cirrhosis of the liver. Less iron was considered to be the root cause of the problem, leading to fluid accumulation in the liver, liver enlargement and liver malfunctioning. For treatment, the physician recommended herbs like *keezhanalli* and *neermulli*, that have a diuretic action (removal of the fluid from the liver) and facilitate RBC production (haematinic action). The mode of action for several of these herbs has been documented in Siddha literature. For example, *keezhanalli* (Phillanthrus Niruri) has been used in India for several centuries for the treatment of liver disorders. It contains the alkaloid glucosides which are very effective in liver disorders along with protein, iron, flavin and calcium. It also contains a phenolic compound which has antiseptic properties. The iron content in it facilitates RBC production in the body (Geetha, 1983).

Modern medicine also recognizes the prevalence of a condition called Indian childhood cirrhosis typically seen among children in India. The presenting features and pathological changes are not very different from those seen in kwashiorkar. In its terminal phase, the disease is characterized by apathy, emaciation, abdominal protrusion, edema of the limbs, liver and spleen enlargement, severe ascites and deep jaundice (Gopalan, 1978).

It is quite likely that the child with symptoms of kwashiorkar has been identified as *sokai* by a number of mothers in the study because of the R. Shows the physician a picture of a child showing symptoms of kwashiorkar. S This is 'sokai' or cirrhosis of the liver Fluid accumulates in the liver, which swells up and does not function well This happens because of less iron. First there is 'rathasokai (anemia) or deficiency of blood which then turns into 'sokai' We give iron rich substances such as 'keevanalli', 'neermulli' etc. in powder form or as an extract These extracts can drain the fluid in the liver so that the liver functions and produces RBC's We also give hematinic medicines that create blood Substances like 'keevanalli' and 'neermulli' remove fluid, stomach swelling is removed, blood circulation improves and the child becomes healthy.



FIGURE 14:. Explanation Protocol And The Semantic Representation Of The Protocol Of A Siddha Physician For The Cause And Treatment Of Kwashiorkar

similarity of the presenting features. As pointed out by David Werner (1990), sometimes diseases with different causes and which require different treatments result in problems that look very much alike. According to him a child who slowly becomes thin and wasted, while his belly gets more and more swollen, could have any (or several) of the following problems: malnutrition, heavy roundworm infection, advanced tuberculosis, severe urinary infection, problems of spleen and liver, or leukemia. A study among women of Andhra Pradesh, India (Bai & Ratnamalika, 1981) has also reported that 90% of the illiterate mothers and 90% of primary, 85% of secondary and 50% of college educated mothers suspected liver disease whenever there is abdominal distension, and many children at toddler age receive indigenous medicine for "liver cure".

However, it is important to realize that the role of malnutrition as the cause of kwashiorkar in the child, seems to be ignored by the mothers in the present study, and only 4% mothers with no schooling, 10% mothers with primary schooling and 19% mothers with secondary schooling have associated the condition to dietary factors. Mud eating leading to indigestion and *sokai*, seem to be the major factors considered as important in the etiology of the condition.

## Indigestion:

According to the mothers' reasoning, as evident in Figures 12 and 13, the occurrence of digestive disturbances in the child appears to be the mediating mechanism by which both excessive feeding of the child and mud or clay eating ultimately lead to symptoms similar to those seen in kwashiorkar. Digestive disturbances are recognized as a major problem

during childhood by the traditional health model. This is reflected in the importance given to conditions such as *mandham*, *perali*, and *thokam* in the child. All these states are associated with some kind of digestive impairment.

Thirty one percent of the mothers with no schooling, 3% of the mothers with primary schooling and 19% of the mothers with secondary schooling thought the problem was related to one of indigestion per se and the treatment suggested by several of them, as seen in Table 7, was the administration of herbs to facilitate digestion. The herbs recommended included those discussed in the section on *thokam*, diarrhea and indigestion, with well documented modes of action, according to Siddha literature.

Impaired digestion and absorption due to decreased gastro intestinal secretions in a state of predominant protein deficiency is an important pathological change in kwashiorkar, as evident in the biomedical model for the condition (as seen in Figure 3). The administration of locally available herbs, as suggested by the mothers, that have potent digestive action, would therefore facilitate digestion and improve the child's health. However, the problem of kwashiorkar is not viewed by the mothers in this study as a nutritional problem. It is, therefore, important to increase awareness among the mothers with respect to the need for recognizing and correcting the underlying deficiency through the provision of more protein in the child's diet.

## **Reasoning about vitamin A deficiency**

According to the biomedical model (chapter III), vitamin A deficiency results in "night blindness" or an inability to see in dim light. Dryness

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(xerosis) of the conjunctiva follows and may lead to Bitot spots, which are whitish/greyish patches in the conjunctiva, caused by a heaping up of desquamated, keratinized epithelial cells. Corneal involvement, proceeding to xerosis and varying degrees of ulceration and liquefaction (keratomalacia) frequently results in blindness.

Night blindness, an early symptom of the deficiency, is locally termed as *malaikan*, as evident from the protocols of local physicians. Whitish patches in the eye have generally been referred to as "*pu viyundiruku*" (although sometimes this term may also be used to refer to symptoms of cataract in the eye).

These two biomedical concepts could be identified in the protocols of several mothers in this study. Table 8 gives the number and percentage of mothers with varying levels of formal education and the elders in the study who revealed the presence of these two concepts. As seen from the table, the awareness of the concepts increased with an increase in the level of formal education.

The major cause of vitamin A deficiency in the child is an inadequate intake of vitamin A rich foods in the diet, and treatment involves the correction of the dietary deficiency (as described earlier under the biomedical model). However, according to the mothers in this study, the deficiency states were thought to be caused by a number of causal factors. The treatment strategies recommended, revealed the presence of very traditional ideas and concepts. Table 9 lists the various categories of causality and treatment identified in the mothers' protocols on the left hand side of the table. The right hand side of the table gives the number and frequency of their

# TABLE 8

Frequency of occurrence of concepts related to vitamin A deficiency in the child as identified in the explanations by mothers with varying levels of formal education and in elders in the study.

Concepts	Number and Percentage			
	Mothers with no schooling	Mothers with primary schooling	Mothers with secondary schooling	Elders
	N(%)	N(%)	N(%)	N(%)
Malaikan	16(62)	20(69)	26(81)	16(76)
Pu viyundiruku	13(50)	18 <b>(62</b> )	23(72)	7(33)

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## TABLE 9

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Number and percentage of responses to the cause and treatment of vitamin A deficiency in the child given by mothers with varying levels of formal education and by elders in the study.

Category of response *	Number and Percentage			
	Mothers with no schooling	Mothers with primary schooling	Mothers with secondary schooling	Elders
	N(%)	N(%)	N(%)	N(%)
Causes:				
Less food	3(12)	3(10)	16(50)	1(5)
Heat	6(23)	5(17)	1(3)	4(19)
God's doing	4(15)	8(28)	5(16)	2(10)
Treatment:				
Food	6(23)	6(21)	20(62)	5(24)
Doctor	13(50)	17(59)	14(44)	9(43)
Oil bath	7(27)	16(55)	9(28)	11(52)
Breast milk/castor oil	4(15)	5(17)	4(13)	5(24)
Kanmalar	1(4)	8(28)	3(9)	4(19)
Nandiyar- vattai	2(8)	3(10)	3(9)	9(43)
Goat/hen pittu	8(31)	2(7)	0(0)	6(29)

\* All factors noted by atleast 10% of the subjects have been included in the table

occurrence in mothers with different levels of formal education and among the elders in the study.

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Heat was identified as the cause of the eye changes in the child by a majority of mothers (23%) with no schooling. The existence of this concept, however, decreased with increased exposure to formal education. A majority of the mothers with secondary schooling (50%), associated the condition to some kind of dietary deficiency. The eye changes, particularly Bitot spots were viewed as God's doing by 15% of the mothers with no schooling, 28% of the mothers with primary schooling, 16% of the mothers with secondary schooling and by 10% of the elders from the study.

Provision of dietary supplements was the most common treatment strategy suggested by mothers with secondary schooling. Traditional measures such as giving of oil baths to the child, application of castor oil and/or breast milk to the eye, the offering of *kanmalar* to the Gods and the use of *nandiyarvattai* and goat/hen's *pittu*, also featured in the mothers' explanatory model for treatment of the changes in the eye associated with vitamin A deficiency. These treatments were more commonly suggested by the elders in the community and by the mothers with lower levels of formal education. Fifty percent of the mothers with no schooling, 59% of the mothers with primary schooling, 44% of the mothers with secondary schooling and 43% of the elders, recommended the consultation of local physicians inorder to deal with the problem.

As the treatment recommended involved very specific traditional practices, the causal factors and the treatments suggested are being discussed individually, rather than under the same sub-headings.

### **Causative factors**

### **Dietary factors**

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It is important to note that the vitamin A deficiency conditions were related to dietary factors only by a small percentage of the elders and mothers with less than primary education. Only 12% of the mothers with no schooling, 10% of the mothers with primary schooling, and 5% of the elders in the study linked night blindness to dietary factors. Almost none of the mothers from these groups were able to relate Bitot spots to a dietary deficiency. The association of the deficiency states to factors in the diet, however, increased with higher levels of formal education. A relatively large percentage (50%) of the mothers with secondary schooling related night blindness to a dietary lack of vitamin, and 13% were able to relate Bitot spots to a dietary deficiency.

### Heat:

Heat featured as the number one cause of the conditions in mothers with no schooling and primary schooling and also in the elders from the community. Night blindness and Bitot spots were attributed to body heat, and measures such as giving cooling foods like vegetables and greens, giving oil baths to the child and application of mothers' milk and castor oil to the eye (discussed later) were recommended as preventive and therapeutic measures. Heat was said to be the cause for *kanvali* (which commonly refers to an eye infection) and that was said to be leading to night blindness and Bitot spots. However, only 3% of the mothers with secondary education associated the conditions with body heat.

### Peravi problem (problem present at birth)

Although night blindness was not considered to be present at birth, Bitot spots were considered to be a *peravi* problem by a large number of mothers in all the groups, who therefore felt that you cannot do anything about it. Formal education did not appear to influence the mothers' way of thinking. The condition was therefore considered to be of God's doing and therefore measures to please the Almighty such as the offering of *kanmalar* (a silver model of the eye)to God were suggested by a large percentage of mothers, as seen in Table 9.

#### **Treatment modalities**

#### **Dietary factors**

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Only 23% of the mothers with no schooling, 21% of the mothers with primary schooling, and 24% of the elders in the community recognized the importance of dietary factors in the treatment of the eye conditions, particularly night blindness. Almost none of the mothers in these groups mentioned the importance of diet in the treatment of Bitot spots. The foods recommended for inclusion in the diet were greens and carrots (for their cooling effect) and meat. The latter was mentioned because of the recognition of a condition called *karimalai* [a specific type of night blindness which responds only to *kari* (meat)]. The recognition of the importance of dietary factors in the treatment of the deficient state, however, was more in the mothers with secondary schooling. Sixty two percent of these mothers recognized the conditions as a state of vitamin A deficiency, which could be corrected by the administration of vitamin A rich foods in the diet.

A large percentage of the mothers from all the groups (refer to Table 9), however, suggested the consultation of the doctors/medical personnel associated with the nutrition centres.

### Measures to reduce heat

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Two commonly stated methods to reduce body heat, both as a preventive and therapeutic measure against vitamin A deficiency symptoms were the administration of oil bath to the child and the application of mothers milk and/or castor oil to the eye.

The practice of giving oil baths to the children was very common in this community. The frequency of administration of oil bath to the child was every alternate day for very small children. The frequency decreased with increasing age, and oil baths were given once in a week or once in two weeks for older children. It was given as a routine practice on Fridays for girls and on Saturday/Sunday for boys. Most frequently it was *til oil* (sesame oil) which was used. The oil was applied all over the body including the head, allowed to soak in for about 5 minutes and then washed off. Another common practice observed was called *ennai kataradhu* in the eye. This refers to the pouring of either a mixture of three oils or just *til oil* in the eye, allowing it to soak in. Both these practices of giving oil bath and administration of oil in the eyes. This is in accordance to the mothers' conception of the eye conditions as a heat related problem.

According to Siddha medicine, oilbaths and local applications to the eye are known to be good prophylactic measures against several eye

conditions. Medicated oil baths are much praised both as a cure and a preventive for eye diseases in general (Krishnan, 1983). The practice, as followed by the mothers, therefore has a very strong bearing on the traditional beliefs.

Fifteen percent of the mothers with no schooling, 17% of the mothers with primary schooling, 13% of the mothers with secondary schooling and 24% of the elders in the community suggested the application of breast milk, either by itself or along with castor oil to the eye. This was said to be eliminating dust/dirt from the eye, in addition to being very cooling. In Siddha medicine, breast milk is often used as a vehicle for all local applications to the eye (Krishnan, 1983).

### Nandiyarvattai for Bitot spots

The traditional practice of using extracts of *nandiyarvattai* (a locally available flower) for the treatment of Bitot spots was apparent in several of the protocols, especially amongst the elders in the community. Details of preparation of the flowers for application in the eye was given by some mothers, as evident in the following excerpts from the protocol of a mother (#7 )with no schooling:

S: For white spots in the eyes, you get nandiyarvattai flowers. Take a mud vessel, add some whole green gram (a lentil), add 5 or 9 flowers (the number is governed by certain rules). The flowers have to be purchased from the temple, you cannot pluck them as the ones outside may have been eaten by cow, goat etc. In the temple they do not allow women to go in and pluck since they may be "unclean" The priest plucks and gives. Soak the

flowers with the whole green gram and pour the extract in the eye for atleast 15 days. The extract is like ice water and it removes all the white spots.

This has a strong bearing on the writings from Siddha medical books. Several flowers including *nandiyarvattai* (Tabernal montana coronaria) are considered as local anodyne agents (analgesic), and recommendations are made for its juice to be extracted and applied as eye drops (Saroja & Veluchamy, 1983).

### Goat/hen *pittu* for night blindness

A large percentage of the elders (29%) and mothers with no schooling (31%) recommended the administration of hen/goat *pittu* to the child with *malaikan* (night blindness). *Pittu* in local terminology refers to the liver, an excellent source of vitamin A. The child or the pregnant mother, suffering from *malaikan* was made to swallow the *pittu* preferably by keeping it inside a banana, because of its bitter taste.

Liver is a well known rich source of vitamin A. The advice to take goat liver in cases of vitamin A deficiency has been made in several ancient texts, including the Siddha medical texts and such practices must have been very effective because if its rich vitamin A potential.

The practice of using the goat/hen *pittu*, easily available in their homes, must therefore be encouraged by nutrition education programs. It is worthwhile noting that the awareness of this very effective traditional practice, however, decreases with increasing formal education. None of the mothers with secondary school education and only 7% of the mothers with

primary schooling mentioned the use of this very effective traditional practice for the treatment of night blindness in the child.

### **Reasoning about anemia**

Anemia, characterized by symptoms of pallor, especially in the skin, inside eyelids, gums and fingernails, weakness and fatigue is identified as *rathasokai* in local terminology as evident from the protocols of local physicians interviewed. Twenty seven percent of the mothers with no schooling, 38% of the mothers with primary schooling, 66% of the mothers with secondary schooling and 24% of the elders in the study were able to recognize the symptoms described to them as the symptoms of *rathasokai* in the child. Formal education resulted in a greater usage of this biomedical concept. Table 10 gives the various categories of causality and treatment of anemia identified in the mothers' protocols along with the number and frequency of their occurrence in mothers with varying levels of formal education and in the elders from the study.

Nineteen percent of the mothers with no schooling, and 21% of the mothers with primary schooling had no idea about the causation and treatment of the condition. On the other hand, only 9% of the mothers with secondary schooling were ignorant about the etiology of the condition.

The two main causative factors listed were insufficient blood (or a lack of blood) in the child's body and an insufficient dietary supply of food/nourishment, as evident from Table 10. A greater percentage of mothers with secondary schooling associated the symptoms of anemia in the child to less blood (28%) and less food (25%). However, none of the mothers were able to provide any detailed mechanistic explanations for the etiology
## TABLE 10

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Number and percentage of responses to the cause and treatment of anemia in the child as given by mothers with varying levels of formal education and elders in the study.

Category of response *	Number and Percentage				
	Mothers with no schooling	Mothers with primary schooling	Mothers with secondary schooling	Elders	
	N(%)	N(%)	N(%)	N(%)	
Rathasokai	7(27) 11(38) 21(66)		21(66)	5(24)	
Causes:					
Don't know	5(19)	5(19) 6(21) 3(9)		2(10)	
Less blood	5(19)	6(21)	9(28)	5(24)	
Less food	3(12)	6(21)	8(25)	7(33)	
Treatment					
With nourishing food	7(27)	5(17)	11(34)	7(33)	
With greens specifically	2(8)	1(3)	5(16)	0(0)	
With tonics/ medicines	11(42)	15(52)	15(47)	3(14)	

\* All factors noted by atleast 10% of the subjects have been included in the table

or the symptoms of the deficiency. The association with food was also very general, with only one mother in the entire sample mentioning specifically a dietary lack of iron as the causative factor.

For treatment of the condition, a majority of the mothers, 42% with no schooling, 52% with primary schooling, 47% with secondary schooling and 14% of the elders, recommended the administration of tonics or other tablets prescribed by the physicians. The need to provide a nourishing diet was, however, recognized by only 27% of the mothers with no schooling, 17% of the mothers with primary schooling, 34% of the mothers with secondary schooling and by 33% of the elders in the study. None of the elders in the study and only 8% of the mothers with no schooling, 3% of the mothers with primary schooling and 16% of the mothers with secondary schooling mentioned the importance of including greens in the diet of a child with symptoms of anemia.

The major findings of the above analyses on the mothers' reasoning about the causes and treatment of all the presented childhood nutritional problems are summarized below.

# Summary of mothers' reasoning

Overail, the mothers' reasoning about the cause and treatment of major commonly occuring childhood nutritional problems appears to be interpreted within the traditional theory of health and disease. Concepts identified in the mothers' responses were related to the concepts and their interpretations as seen and practiced in Siddha medicine, the system of traditional medicine indigenous to a specific part of India (Tamil Nadu), where this study was conducted. More socialized forms of Siddha medicine,

commonly referred to as 'granny medicine' or 'folk medicine' were popular in the region where this study was conducted.

Although height and weight retardation, the symptoms of chronic PEM in the child, have been largely associated with a dietary inadequacy, traditional concepts dominated the mothers' reasoning about the cause and treatment of both marasmus and kwashiorkar in the child. The former was linked to notions of *therai*, and the latter to factors such as mud or clay eating, *sokai* and indigestion. The treatment strategies suggested, reflected the mothers' understanding of the underlying cause. The problem of malnutrition, was thus largely ignored.

Traditional concepts such as thokam, mandham, perali, and karpan governed the choice of foods considered as suitable for consumption by the child. The mothers' reasoning about the cause and treatment of vitamin A deficiency symptoms in the child also revealed a preponderance of traditional notions of causation (such as heat), and treatment (such as measures to reduce body heat through oil baths for the child, and the application of breast milk and/or castor oil to the child's eye, treatment with goat/hen pittu and treatment with nandiyarvattai). Traditional concepts, however, did not feature in the mothers' reasoning about the cause and treatment of anemia in the child and this condition was explained by a majority of the mothers in terms of biomedical concepts alone. One explanation for this could be that anemia, characterized by tiredness, lassitude, easy fatigability, and pallor is recognized in Siddha medicine as well, although the underlying mechanism and symptoms are explained in terms of degree of derangement of the humours. For example, in Siddha,

pallor is described in anemia especially when *pitham & kapham* (two of the three humours) are in predominant positions (Rajeswari, 1983).

# Directionality of mothers' reasoning

As described in the section on methodology in Chapter III, the mothers in the present study were presented with the symptoms of the childhood nutritional deficiencies (the facts in a problem) in a pictorial form, as well as in the form of a verbal description of the presenting symptoms.

It is evident from the semantic representations of the mothers' protocols for the various nutritional problems, presented in Figures 4, 7, 8, 10, 12, 13, 15, 16 and 17, earlier in this manuscript, that the mothers' reasoning in all cases proceeds first by the provision of a diagnosis for the presented problem. This is then followed by an explanation of the cause and treatment of the said condition.

As discussed earlier in Chapter II, two kinds of reasoning strategies have been identified in problem solving in different domains. Forward reasoning, in which the individual reasons forward from the given data to a hypothesis about the presented condition, is usually contrasted with backward reasoning, in which the problem solver works backward from a hypothesis about the problem to the given information. The mothers in this study, use an inductive form of reasoning to arrive at an hypothesis (for example, *therai* in Figure 7) about the presenting features of the nutritional problem (that is, marasmus, in this case). Next, they attempt to confirm their hypothesis by explaining the underlying causal mechanism and by establishing the presented symptoms. In doing so, they resort to forms of

deductive or backward reasoning, from their hypothesis to the given data (the symptoms of the problem).

Forward reasoning is a strategy that is used whenever an individual possesses a highly developed knowledge base that can be brought to bear on the problem solving situation (Groen & Patel, in press). It is characteristic of experience (Hunt, 1989) and is, therefore, the method used for reasoning by experts in many domains (Larkin et al, 1980; Simon & Simon, 1978; Patel & Groen, 1986).

The mothers in this study, particularily those with no formal education and those with lower levels of formal education, may not possess the technical or scientific knowledge with respect to child nutrition and childhood nutritional problems, characteristic of an expert in that domain. They do, however, possess a sufficiently strong background of traditional knowledge and beliefs, which can be viewed as a different kind of expertise, referred to as "cultural expertise" by Groen and Patel (in press). The mothers in this study, with such cultural expertise with respect to child nutrition and health, thus, reason in ways not very different from that of individuals possessing well developed technical expertise or the so called "experts' in any domain.

The use of such forward reasoning strategies in dealing with the childhood nutritional problems by almost all the mothers in this study, irrespective of the level of formal education, suggests that they view their existing knowledge about childhood nutrition and problems therein, as adequate. This makes it all the more difficult to acheive any kind of change in their knowledge base, as a result of nutrition education.

# Effect of formal education on mothers' reasoning

No major shift occurs with formal education in relation to a dramatic restructuring of information. Traditional concepts prevail even in mothers with secondary schooling. This can be seen in Table 11 which lists the traditional concepts identified in the mothers' protocols and the number and frequency of their occurrence in mothers within the three levels of formal education. It is evident from the table that although the traditional concepts were observed more frequently in mothers with no schooling and primary schooling than in mothers with secondary schooling, formal education has not resulted in a purely biomedical explanation for the deficiency states.

Concepts derived from the biomedical model, on the other hand occur with an increased frequency in mothers with secondary schooling than in mothers with no schooling or primary schooling. This can be seen in Table 12 which lists the various biomedical concepts identified in the protocols of mothers, along with the number and frequency of their occurrence in mothers from the three levels of formal education.

Results of the statistical analysis on the biomedical score (total number of specific biomedical concepts) and the traditional score (total number of specific traditional concepts) calculated for each subject is presented below. Table 13 gives the mean and the standard deviations for the two scores in mothers within the three levels of formal education. Results of the multivariate analysis showed that the mean biomedical score for the three groups were significantly different (F(2,84)=9.38, p<.0005). The mean traditional score for the three groups were also significantly different (F(2,84)=5.39, p<.0005). Results of the Tukey's post hoc test revealed that

# TABLE 11

# Number and percentage of traditional concepts used by mothers with varying levels of formal education in their explanations for the nutritional problems.

Deficiency	Concept	Number and percentages			
		Mothers with no schooling	Mothers with primary schooling	Mothers with secondary schooling	
		N(%)	N(%)	N(%)	
Chronic PEM	Therai	3(12)	4(14)	0(0)	
	Thokam	9(35)	9(31)	7(22)	
	Mandham	8(31)	15(52)	15(47)	
	Perali	8(31)	11(38)	9(28)	
	Karpan	1(4)	3(10)	5(16)	
Marasmus	Therai	11(42)	20(69)	9(28)	
	Kanai	3(12)	0(0)	0(0)	
	Tying therai	8(31)	16(55)	5(16)	
Kwashiorkar	Sokai	3(12)	10(34)	9(28)	
	Mud eating	8(31)	11(38)	7(22)	
	Indigestion	8(31)	3(10)	6(19)	
	Digestives for treatment	6(23)	3(10)	3(9)	

Continued.....

Vitamin A deficiency	Heat	6(23)	5(17)	1(3)
	Oil bath	7(27)	16(55)	9(28)
	Breast milk /castor oil	4(15)	5(17)	4(13)
	Kanmalar	1(4)	8(28)	3(9)
	Nandiyar- vattai	2(8)	3(10)	3(9)
	Goat/hen pittu	8(31)	2(7)	0(0)
Anemia	No traditional concepts were seen			

# TABLE 12

Number and percentage of biomedical concepts used by mothers with varying levels of formal education in their explanations for the nutritional problems.

Deficiency	Concept	Number and percentages			
		Mothers with no schooling	Mothers with primary schooling	Mothers with secondary schooling	
		N(%)	N(%)	N(%)	
Chronic PEM	Less &/or improper food	18(69)	24(83)	3) 27(84)	
Marasmus	Nonjan	3(12) 3(10)		12(38)	
	Less food	9(35)	3(10)	10(31)	
	Maternal malnutrition	4(15)	5(17)	4(13)	
	Worms	2(8)	3(10)	7(22)	
	Lack of immuni- zation	2(8)	4(14)	8(28)	
	Food for treatment	8(31)	3(10)	15(47)	
	Tonic/doctor consultation	9(35)	13(45)	8(25)	
Kwashiorkar	Savalai	5(19)	7(24)	10(31)	
	Less food	1(4)	2(7)	6(19)	
	Food for treatment	5(19)	5(17)	3(9)	
	Doctor consultation	6(23)	6(21)	7(22)	

Continued.....

Vitamin A deficiency	Malaikan	16(62)	20(69)	26(81)
	Pu viyundiruku	13(50)	18(62)	23(72)
	Less food	3(12)	3(10)	16(50)
	Food for treatment	6(23)	6(21)	20(62)
	Doctor consultation	13(50)	17(59)	14(44)
Anemia	Rathasokai	7(27)	11(38)	21(66)
	Less blood	5(19)	6(21)	9(28)
	Less food	3(12)	6(21)	8(25)
	Food for treatment	7(27)	5(17)	11(34)
	Greens for treatment	2(8)	1(3)	5(16)
	Tonics/medi- cines for treatment	11(42)	15(52)	15(47)

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# TABLE 13

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# Mean and standard deviations for the biomedical score and the traditional score in mothers with varying levels of formal education

SCORE	Mothers with no schooling		Mothers with primary schooling		Mothers with secondary schooling	
	Mean	S.D	Mean	S.D.	Mean	S.D.
Biomed- ical score	6.077	3.084	6.414	2.500	8.906	2.728
Traditio- nal score	4.000	2.577	4.966	2.471	2.969	2.102

mothers with secondary schooling had a significantly greater biomedical score than mothers with no schooling and mothers with primary schooling. They also had a significantly lower traditional score than mothers with primary schooling. The other differences were not statistically significant.

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Detailed semantic analyses of the explanations provided by mothers for the cause and treatment of the nutritional deficiencies also does not present evidence for any major restructuring of information with formal schooling. This was seen to be the case with respect to the mothers' reasoning for all the presented nutritional problems. However, to illustrate this point, an example of the reasoning about the cause and treatment of marasmus given by mothers with varying levels of formal education is presented below.

Figure 15 is a semantic representation of the explanation for this condition given by a mother (#7) with no formal education in which marasmus, characterized by extreme wasting of muscle and fat in the child (seen by the mother as enlarged stomach and head, and thin legs and hands) is associated with *therai*. The condition, according to her, occurs when the pregnant mother goes near cool areas such as the well, water storage areas (*kochil*) or the bath areas with thatched roof. The *therai*, which is of the same color as the roof, is often seen in such cool spots. Marasmus, referred to as *therai* by the mother, occurs due to the physical contact of the pregnant mother with the live *therai*. For treatment, she recommends the tying of a live *therai*. As the *therai* dies and its blood and meat dry up, the child, according to her becomes well. However, if the mother is only three months pregnant, then the effect of the *therai* is only slight, and in such cases the child becomes alright with medicines and injections. The importance of

R. Shows the mother a picture of a child with symptoms of marasmus. S This is 'therai'. Only stomach and head will be big, hands and legs will be thin. Tie a live 'therai' in a leather bag on the child, the 'therai' would fall on the child's chest. As the 'therai' dies and its meat and blood dries up, the child becomes alright. When the mother is 3 months pregnant, if it falls on the mother, then it affects little and it become alright with medicines and injections. When the pregnant mother goes near a well, or 'thoti' in which water is stored, or she has bath in a 'kochil' made of thatched roof, because of the coolness, the 'therai' will be sitting there. The 'therai' is of the same color as the roof, and so we cannot notice it. In food we give the same food



FIGURE 15: Explanation Protocol And The Semantic Representation Of The Protocol Of A Mother (#7) with no schooling For The Cause And Treatment Of Marasmus In The Child.

malnutrition is obviously not recognized by the mother, as she recommends the same food, which had resulted in a state of marasmus in the child to start with.

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The reasoning has strong bearings on the traditional concept of *therai* discussed in the sections on height and weight retardation and marasmus presented earlier. The treatment suggested and the mother's understanding of the cause parallel each other, and therefore provide a coherent framework of understanding of the traditional concept of *therai*. Evidence for even greater details of mechanism of *therai* action were seen in the protocols of elderly mothers in the study, as seen in Figures 7 & 8.

The explanations given by mothers with education equivalent to primary schooling was also consistent with the traditional theory. For example, Figure 16 gives the reasoning about the cause and treatment of marasmus in the child given by a mother (#50) with primary schooling. The condition (child like a stick) is identified as *therai* caused by the mother drinking the water from a *therai* coconut, characterized by a soft interior. For treatment, the mother recommends the tying of a *therai* and as the *therai* dies, the child, according to her, becomes well.

She also includes factors related to western medicine (care, injections, medicines and tonics). However, only traditional measures (such as the tying of a *therai*) which are supported by a strong causal explanation, are recognized by her as effective treatment strategies. The nutritional problem, is obviously not viewed by her as related to nutrition. She, therefore, does not consider the provision of care, injections, medicines and tonics as effective treatment methods.

R. Shows the mother a picture of a child with symptoms of marasmus. S. This is 'therai'. Child is like a stick. If mother drinks fike water rom a softened coconut when pregnant, then the child gets 'therai'. This 'therai' coconut is soft with very little coconut. Give care, injections, medicines and tonic. We get 'therai', tie on the child. As 'therai' dries up, the child becomes alright. Child will not feel hungry and will not become alright with injections and medicines. Only 'therai' works.

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FIGURE 16: Explanation Protocol And The Semantic Representation Of The Protocol Of A Mother (#50) With Primary Schooling For The Cause And Treatment Of Marasmus In The Child.

R. Shows the mother a picture of a child with symptoms of marasmus S. This is 'therai'. Child will be only bone, hands and legs will be like stick. Tie 'therai'. Give food and milk.

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FIGURE 17: Explanation Protocol And The Semantic Representation Of The Protocol Of A Mother (# 65) With Secondary Schooling For The Cause And Treatment Of Marasmus In The Child.

With further exposure to formal education, as evident from the explanations of mothers with secondary schooling, there is increased use of concepts derived from the biomedical model. There is, however, persistence of the traditional concepts. For example, Figure 17 shows the reasoning about the cause and treatment of marasmus given by a mother (#65) with secondary schooling. The condition continues to be identified as *therai* by her. However, the treatment strategies included both factors related to western medicine (food and milk) and traditional medicine (tying of *therai*). The mother views the condition as one related to nutrition and therefore suggested giving foods and milk. But the traditional practice of tying *therai* persists even after exposure to several years of formal education.

The mothers' reasoning about the other nutritional problems presented reveals a similar phenomenon. Thus, what seems to be happening with an increase in formal education is an increase in the use of concepts derived from the biomedical model. However, the way of thinking is still very much rooted in traditional theory, and the core concepts remain the same.

The results of this study, presented so far, reveal several positive and negative aspects of the traditional belief structure. These were identified and a description of the same is presented in Chapter V in the section on conclusions. It is of fundamental importance for the success of any nutrition education program to identify such negative aspects of the traditional belief structure and to replace it with safer and more sound concepts, without altering the beneficial aspects of the former. Further research in this area, would focus on the means for achieving such objectives.

#### CHAPTER V

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# CONCLUSIONS AND IMPLICATIONS FOR EDUCATION IN NUTRITION

In the field of nutrition and health care, although the treatments and the technologies for dealing with nutritional deficiencies and ill health are known, what is lacking is their successful implementation. This is mainly because the peoples' concepts of disease causation and treatment influence the extent of their utilization of the available nutrition and health care facilities (Abou-Zahr, 1990). Concern for the cultural factors and beliefs about disease etiology and treatment, are therefore important factors for the successful implementation of any nutrition and health care program.

A preliminary study carried out on a population of immigrant mothers of East Indian origin, living in Canada for the last 5 to 20 years, served as a basis for this research. The results from the above study revealed a significant role of traditional knowledge of East Indian medicine on the mothers' reasoning about childhood nutritional problems. The immigrant mothers' explanations for all the presented nutritional problems in children, appeared to be situated in traditional Ayurvedic theory of Indian medicine, irrespective of the extent of formal education. There was an increase in the use of biomedically oriented concepts in the explanations of mothers with college or university degrees. However, the interpretations of the concepts continued to be based on traditional theory.

In rural India, the practice of traditional Indian medicine is popular even to-date. Systems of Siddha medicine prevail in Southern India, and Ayurvedic medicine is practiced throughout India. Socialized forms of

traditional medicine, particularly Siddha medicine, are popularly practiced by the lay people in South India, under the name of "folk medicine" or "granny medicine". Aspects of traditional knowledge influence peoples' reasoning about the causality and treatment of diseases. This study examined the relative influence of traditional and modern biomedical theories on the reasoning about major childhood nutritional problems, PEM (chronic and acute, characterized by kwashiorkar and marasmus), vitamin A deficiency and anemia, by the mothers in rural South India.

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The study was conducted in the rural areas of Madurai district in Tamilnadu, India. The mothers were interviewed in their homes, in the local dialect, Tamil, and all interviews were audiotaped and transcribed. Pictures of Indian children with symptoms of the deficiencies were used along with a verbal description of the deficiency state, as stimuli to obtain information on the mothers' reasoning about the cause and treatment of the conditions. The data obtained was subjected to both quantitative and qualitative analyses, the latter using methods developed in cognitive psychology. Concepts identified in the mothers' protocols were compared with concepts and their interpretations within the traditional and biomedical theories. The influence of formal education on the mothers' reasoning was examined by comparing the responses given by mothers with varying levels of formal education. The explanation protocols generated by the mothers were examined for the nature of the reasoning processes and for the extent of coherence in their explanations.

The results of the study revealed that the mothers' reasoning about the presented nutritional problems appeared to be grounded in traditional theory of illness. Concepts generated in the mothers' protocols matched the

concepts and their interpretations as seen and practiced in traditional Siddha medicine. Enhancement of understanding of biomedical concepts was seen with increase in formal education. This was evident in the significantly decreased use of traditional concepts and a significantly increased use of biomedical concepts by mothers with secondary schooling as compared to the mothers with no schooling and primary schooling. However, the knowledge and practice of traditional theory persisted even in mothers with 10 years of formal education.

The results on the effects of schooling on the mothers' knowledge of childhood nutritional problems are interpreted with respect to the theories of cognitive structure and conceptual change, discussed in Chapter II of this manuscript. Recent research on learning and knowledge acquisition have indicated that the process of knowledge acquisition can be characterized in terms of two types of restructurings, a weak restructuring and a strong restructuring. Restructuring of the weaker type is said to occur when two conceptual systems differ in terms of the relations between concepts or in the presence of superordinate concepts in the later system that are not present in the earlier system (Carey, 1986). Strong restructuring, on the other hand, involves changes in individual concepts, changes in explanatory mechanisms and a change in the theory itself.

The restructuring of knowledge with respect to childhood nutritional problems, with increase in formal education among mothers in this study suggests only a weak restructuring of knowledge, involving the addition of a few concepts and relations from the biomedical theories, to the pre-existing knowledge structures. There is, however, no evidence of any strong or

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radical restructuring of knowledge involving a change in underlying theory, occurring with an increased exposure to formal schooling.

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The nature of restructuring has implications for the planning of efficient and effective educational strategies. The emphasis to be placed on prior knowledge during instruction is more important for the operation of weak restructuring, of the type seen among the mothers in this study. If the purpose of education is to promote strong restructuring of knowledge involving a major shift from a pre-existing traditional theory to a totally new biomedical theory, then it may be preferable to present the new theory alone ignoring what they already know (Vosniadou & Brewer, 1987).

However, with regards to nutrition knowledge, there are several aspects of the traditional knowledge structure that are beneficial to the child's health. The purpose of education should therefore be to identify such positive aspects of the traditional theory, which should then be reinforced by education and to identify any negative aspects, which should be replaced by more sound biomedical views.

All the mothers in the study used the strategy of forward reasoning in diagnosing the problem, suggesting a presence of a different kind of expertise, referred to as "cultural expertise". They behave like "experts" in other domains, namely the technical domains. However, the subjects in this study are considered cultural experts rather than technical experts. This has implications for the degree of resistance likely to be offered to any attempt at changing the pre-existing traditional knowledge. The mothers when reasoning forward, view their knowledge as adequate, and are therefore, not likely to give up the existing notions, easily. There are, however, many conditional links in the subjects' explanations. These conditions are of the weak kind where the conditions are sufficient, but not necessary for actions to occur. It may be possible to manipulate such links.

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The traditional conceptual system of Indian medicine thus appears to provide a coherent framework of indigenous knowledge that guides beliefs and health practices among mothers in this study. In dealing with childhood nutritional problems in everyday situations, the mothers make use of aspects of both the traditional and modern biomedical theories of health and disease. What emerges is therefore, a composite model of nutritional knowledge, best suited to solve the problem at hand.

This supports the theory of everyday reasoning proposed by researchers like Rogoff (1984), Lave (1988) and Saxe (1990), which have been reviewed in the literature presented in Chapter II. Reasoning in childhood nutritional problems by the mothers in this study, like reasoning in any other everyday situation, appears to be of a very practical nature. The structure of the mothers' reasoning is of a narrative nature which appears opputunistic and not logical (in a scientific sense). Instead of drawing solutions to the problems after considering all possible alternatives, the mothers make use of aspects of the socially provided practices, related to both the traditional and modern biomedical theories, to arrive at solutions to everyday problems with respect to child nutrition and health.

Traditional beliefs, such as *therai*, *thokam*, *mandham*, *perali*, and *kanai* are well understood as evident from the protocol excerpts presented in the earlier chapters of this manuscript. The emergence of biomedical explanations, on the other hand, was naive, showing a poor understanding

of the concepts in biomedical terms. For example, kwashiorkar was associated specifically with a deficiency of protein in the child by only two mothers, and anemia with a deficiency of iron in the child by only one mother from the entire sample of 108 mothers in this study. The nutrition education program and the subject matter taught in the schools (Appendix IV) does, however, relate the conditions of deficiency of *puradha sathu* (protein nourishment) and *irumbu sathu* (iron nourishment) to kwashiorkar and anemia respectively.

Furthermore, detailed mechanistic actions were not provided by the subjects for any of the biomedical concepts. For example, in accordance with the biomedical theory, the conditions were associated with an insufficient and/or improper food intake, by several mothers in the study. However, the mothers lacked information on the underlying causal mechanisms. Traditional concepts, on the other hand, are supported by strong causal attributions. For example, body heat is understood to be the cause for the changes in the eye and therefore, oil baths that reduce body heat are recommended for treatment. Similarly, marasmus is believed to be caused when the *therai* falls on the pregnant mother and sucks the nutrition from the foetus. Treatment, therefore, involves the tying of the *therai* on the child, so that the nourishment is returned to the child and he/she becomes well. The explanation provided is in a form of a story with an ordered sequence of events.

The nature of naive knowledge in individuals has been an issue of increasing concern as discussed in Chapter II. Some researchers (Chi et al, 1981; diSessa, 1988) view the naive knowledge as one that is spotty, superficial and fragmented, with loosely connected concepts. Others

(Vosniadou and Brewer, 1987; McCloskey, 1983; Clement, 1983) are of the opinion that the naive knowledge, like any other scientific theory, is coherant and systematic.

"Naive knowledge" among mothers in rural India, as evident in their explanations in this study, suggests the presence of traditional concepts supported by notions of causality. This causal nature of the explanation, although naive, makes the knowledge structure coherent. The findings from this study, therefore, appear to support the views on the coherent and systematic nature of naive knowledge proposed by researchers like Vosniadou and Brewer (1987) and others. Such a belief structure with respect to child nutrition, among the mothers in this study, by virtue of its coherence, is resistant to change.

However, the mothers in this study are considered as "cultural experts" in the domain of childhood nutrition. Traditional knowledge among these mothers, therefore, does not really fall into the category of the so called "naive knowledge" as used by the above researchers. The mothers knowledge of modern biomedical concepts can, however, be viewed as "naive". The nature of this knowledge among the mothers in this study is fragmented and piecemeal, involving the use of isolated concepts without supporting causal explanation. This is in agreement with the views of researchers like Chi et al (1981) and diSessa (1988) described above.

Formal education does improve the understanding of modern biomedical knowledge, but does not necessarily alter fundamental precepts that are a product of exposure to an indigenous tradition. One reason for this may be that no specific attempts are made in the nutrition education

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programs to integrate the more modern biomedical and traditional views of illness and disease. For example, findings from this research suggest that the traditional concept of *therai* dominates the mothers' reasoning about an important childhood nutritional problem, namely marasmus. However, no reference to this very popular traditional notion is being made in the educational material currently in use in the schools or in the nutrition education programs. The understanding and natural integration of the biomedical concepts (with respect to marasmus in the child, in this case) may therefore be enhanced by presenting the biomedical concepts in the context of prior knowledge (that is knowledge, with respect to *therai*, in this case) rather than as a separate isolated entity.

Furthermore, the biomedical information presented must, like traditional knowledge, be supported by underlying causal mechanisms. For example, a greater emphasis in the educational material, on why an insufficient and/or improper food intake can lead to the said childhood nutritional problems may facilitate a better understanding of the biomedical view. Instruction has been defined as anything that is done in order to help someone acquire a new capability (Resnick, 1983). Nutrition instruction should be designed in such a way that it facilitates understanding of the biomedical concepts. However, the beneficial features of the traditional belief structure should also be reinforced.

The findings from this study reveal many beneficial aspects of the traditional belief structures, which could and should be reinforced by formal education. For example, the use of traditional well balanced weaning foods such as "idli" should be encouraged. The mothers recommendations for the control of diarrhea and vomiting, associated with conditions such as

thokam, mandham and perali in the child, and the treatments suggested for problems of cold and phlegm in the child, revealed the use of traditional herbs with well documented digestive and anti-emetic properties (refer to Table 4).

For the treatment of the symptoms of vitamin A deficiency in the child, the mothers recommended the administration of hen/goat *pittu* (liver) and the juice from flowers, such as *nandiyarvattai*. The vitamin A rich potential of the former, and the analgesic effects of the latter in the eye, are documented in Siddha literature, as discussed in the earlier sections of this manuscript. *Neem* leaves used to treat worm infections in the child are proved to have antiprotozoal action.

Traditional beliefs, such as these, can have positive influence on a child suffering from a nutritional deficiency and from common problems associated with the deficient state (vomiting, diarrhea, worm infections and colds). Such practices should therefore be encouraged and the knowledge with respect to such beliefs, be reinforced by nutrition education. As Werner (1990) points out "if we can use what is best in modern medicine, together with what is best in traditional healing, the combination may be better than either one alone", attempts should be made to extract the best out of the two views. The values of cultural practices such as care and concern for the diet of the pregnant mother should be emphasized.

However, the results also reveal aspects of the mothers' knowledge, which can harm the already malnourished and weak child. Folk practices such as the tying of a live *therai* on the child suffering from marasmus, blowing with a tube inserted into the mouth of the child to remove *thokam* 

and the application of cow dung on the back of a child suffering from kanai, associated with kwashiorkar, can prove to be a source of infection in such children and would thus increase the likelihood of morbidity and mortality. It should be noted, however, that no documentation for such practices could be seen in the Siddha literature. Neither were such strategies recommended by the Siddha/Ayurveda physicians that were interviewed. The explanation of the folk practice has an underlying structure, that is, a structure of causal narrative sequence of events, which tells a story. Theoretically they could, therefore, be replaced with either adequate biomedical concepts or with another causal sequence of events that could serve the same functions as the pre-existing story (for example, the "therai" story) but do less harm to the child.

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Such beliefs and practices deter the mothers' thinking away from the problem of malnutrition. The association of nutritional deficiency states such as marasmus and kwashiorkar with factors such as *therai* and *sokai* respectively, results in an ignorance of the problems of malnutrition. This is further illustrated by the mothers' reasoning about a nutritional deficiency such as kwashiorkar, to be the result of excess rather than inadequate feeding of the child. Moreover, the withdrawal of several foods from the child's diet based on traditional notions of *mandham*, *perali*, *thokam* and *karpan*, described earlier, may further aggravate the malnourished state. A feeling of helplessness on the part of the mothers is reflected in practices including the tying of *therai* on the child, or the offering of *kanmalar* to the Gods. The link between problems such as *therai* and *sokai* in the child and states of nutritional deficiency, should be emphasized. The mothers handling of the problem of diarrhea associated with conditions such as *thokam*, *mandham*, *perali* and *seer*, indicates a lack of understanding of the concept of dehydration associated with the diarrheal state. This is reflected in the use of castor oil and other oils such as *perali ennai*, *mandha ennai* and *kanai ennai* (*ennai* in Tamil refers to an oil) for the treatment of a variety of childhood problems as described in Chapter IV. Oral Rehydration Therapy, according to some of them, is therefore not effective for all cases of diarrhea seen in these conditions, as it does not stop the diarrhea. This can be seen in Figures 4 and 6. The mothers apparently expect the diarrhea to stop with ORT. The association is, therefore, between ORT and diarrhea, and not between ORT and dehydration. This needs to be corrected.

Further research in this area would focus on achieving these goals. For example, attempts will have to be made to specifically design new stories and scenarios to replace harmful concepts in the existing explanations, and to test their acceptability among the mothers. The findings from the study have implications for instruction aiming at alternate knowledge organization. Instructional strategies involving the replacement of undesirable preexisting stories with alternate and more desirable stories, as suggested, could complement methods such as Socratic dialogues and the use of analogies proposed by other researchers (Vosniadou and Brewer, 1987). The findings have implications for improved education in other domains as well. For example, if the beliefs about the "therai" story can be successfully replaced, attempts could be made to replace similar belief structures that have harmful effects. This finding is a general finding and its implications are not limited to any particular domain of study or to any specific cultural group.

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APPENDIX I

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## HOUSES IN RURAL MADURAI





APPENDIX II

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# PICTURES OF CHILDREN WITH NUTRITIONAL DEFICIENCIES MARASMUS

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Taken from New Scientist, 17 February, 1990 (p 38) with prior permission

## <u>KWASHIORKAR</u>



Taken from New Scientist, 17 February, 1990 (p 42) with prior permission



Taken from the WHO Technical Report Series No. 590, 1976, with prior permission

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APPENDIX III

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### CHILDREN'S GROWTH CHART USED IN THE NUTRITION CENTRES



Translated into English by the author

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APPENDIX IV

\*\*. \* ...\* NUTRITION EDUCATION MATERIAL USED IN NUTRITION PROGRAMS AND IN SCHOOLS (AVAILABLE UPON REQUEST) APPENDIX V

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## **GLOSSARY OF TERMS**

## Local dialect

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## **English/Botanical**

| Agni/tejas       | Fire                           |
|------------------|--------------------------------|
| Akasa            | Ether                          |
| Anganwadi        | ICDS centre in villages        |
| Anganwadi worker | Local village woman working    |
|                  | at the anganwadi               |
| Ap               | Water                          |
| Balwadi          | Child welfare centre           |
| Bengal gram      | A lentil                       |
| Dosha            | Humor                          |
| Ennai            | Oil                            |
| Ennai kataradhu  | Administration of oil in the   |
|                  | eye                            |
| Ghee             | Clarified butter/thick viscous |
|                  | liquid                         |
| Idli             | Traditional preparation using  |
|                  | rice and lentils               |
| Jaggery          | Brown sugar                    |
| Kachal           | Fever                          |
| Kanai            | Primary complex                |
| Kanai ennai      | Oil extracted from herbs       |
| Kanmalar         | Silver model of the eye        |
| Kanvalli         | Eye infection                  |
| Kapha/kapham     | One of the three humors        |
| Kari             | Meat                           |
| Karimalai        | Night blindness responding to  |
|                  | meat                           |
| Karpan           | A skin condition               |
| Kayamarundu      | A herbal preparation           |
| Keezhanalli      | A herb                         |
| Kochil           | Water storage area             |
| Kodal            | Intestine                      |

#### Local dialect

Koyambu

Ladoo Mahabhutas Malaikan Mandha ennai Mandham

Mantras Nandiyarvattai Neermulli Nonjan

Omam Oramarundhu Pattu Perali Perali ennai Peravi Pillai Pitha/pitham Pittu Poduthalai Prithvi Puradhasathu Pu viyundiruku

Ragi Rasam Rathasokai Roti Sangellai Savalai

and a

#### English/botanical

Traditional preparation using lentils and vegetables Sweet balls Gross elements Night blindness Oil extracted from herbs Gastro-intestinal problems in small children Sacred words Tabernal Montana Coronaria A herb Local terminology for child with symptoms of marasmus Trachyspermum ammi A herbal preparation Herbal paste applicant Green diarrhea in children Oil extracted from herbs Birth Child One of the three humors Liver Lippia nodiflora Earth Protein nourishment Local terminology for Bitot spots A cereal Nutrients Local terminology for anemia Indian bread A herb Local terminology for child

with symptoms of kwashiorkar

## Local dialect

Seer Sokai Til Therai

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Therai coconut Thodam/dosham Thokam

### English/botanical

Evil spirit Cirrhosis of the liver Sesame A kind of toad/condition in children in which child resembles a kind of toad Coconut with a soft interior Effect of evil spirit Condition caused by something obstructing the intestine