สำนักงานวิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

CHAPTER II

LITERATURE REVIEW

2.1 Criteria for Diagnosis of Underweight

To diagnose whether someone underweight or not we can using BMI (Body Mass Index). BMI is a measurement derived from someone's weight and height was only recently recommended as an additional routine measurement of growth. (http://kidshealth.org/parent/ nutrition_fit/nutrition/bmi_charts.html).

2.1.1 Body mass index for adult

From http://www.cdc.gov/nccdphp/dnpa/bmi/bmi-adult.htm It is a measure of weight for height. For adult over 20 years old, BMI falls into one of these categories:

BMI	Weight status
Bellow 18.5	Underweight
18.5 – 24.9	Normal
25.0 – 29.9	Overweight
30 – and above	Obese

There are two formulas to calculate BMI

English Formula

Body Mass Index can be calculated using pounds and inches with this equation

$$BMI = \left(\frac{\text{Weight in Pounds}}{(\text{Height in inches}) \times (\text{Height in inches})}\right) \times 703$$

Metric Formula

Body Mass Index can also be calculated using kilograms and meters (or centimeters).

$$BMI = \left(\frac{\text{Weight in Kilograms}}{(\text{Height in Meters}) \times (\text{Height in Meters})}\right)$$

or

$$BMI = \left(\frac{\text{Weight in Kilograms}}{(\text{Height in centimeters}) \times (\text{Height in centimeters})}\right) \times 10{,}000$$

2.1.2 Body mass Index for children

Using BMI percentile standards established by WHO, nutritional status may be classified as shown :

underweight and overweight in children.

Under weight	BMI for age $\leq 5^{th}$ percentile
At risk of overweight	BMI for age 85^{th} percentile to less than 95^{th} percentile
Overweight	BMI for age $\geq 95^{th}$ percentile

2.2 Consequences of Underweight

Underweight or malnutrition is an important problem on its own firstly because good nutrition is an essential determinant for well being, secondly, because good nutrition is a fundamental right (Jonsson,1996), and thirdly because of the consequences associated with malnutrition. The consequences of malnutrition as indicated by anthropometry include childhood morbidity and mortality, poor physical and mental development and school performance and reduce adult size and capacity for physical work (WHO,1995).

Iron deficiency and anemia is the most common nutritional disorder in the world and estimated to affect more than 2b people of whom 1.2b suffer from iron deficiency anaemia. Insufficient intake of iron rich foods is the major cause of iron deficiency and also can be caused by parasitic infections and deficiencies of other nutrients (retrieved at www.child development.org, Dec 3 2004).

In Thailand large differences were found between school children with anaemia and /or iron deficiency and iron replete children in their performance on a Thai language test and a test of general reasoning ability, yet not in arithmetic scores (retrieved at www.childdevelopment.org, Dec 3 2004).

In Indonesia found smaller differences between primary school children with iron deficiencies and anaemia and iron replete children in their performance on a renge of school exams, Although the children did not differ in a test of concentration. Both exam performance and concentration was improved by iron supplementation. (Sumantri, 1985).

Malnutrition potentiates the effects of infection (Pelletier et al., 1993). Malnourished children have more severe diarrheas episodes as measured by duration, risk of dehydration or hospital admission, and associated growth faltering. They also have a higher risk pneumonia. Exposure to phatogens in the environment can effect the growth of children through several mechanisms. One of is the reduction of food intake and poor use of ingested nutrients. In addition, the body has an inflammatory response to many infections. Inflammatory may reduce the length of bones because of the systemic and local disturbances of normal growth (Sherry,1994).

Stunting (low height for age) is a physical indicator of chronic or long term malnutrition and is often linked to poor mental development. Underweight (low weight for age) is an indicator of both chronic and acute under nutrition. Wasting (low weight for height) is an indicator of acute under nutrition.

One of the largest studies of anthropometric status of rural school children in low income countries (Ghana, Tanzania, Indonesia, Vietnam, and India) found the overall prevalence of stunting and underweight to be high in all five counties, ranging from 48 to 56% for stunting and from 34 to 62% for underweight. And the boys in most countries tended to be more stunted than girls and in all countries boys more underweight than girls. (Bulletin of nutrition, Vol 9 no 4, 2002).

2.3 School Snack Program

In many developing countries there are more teachers than health workers and more schools than clinics. The infrastructure of the school system therefore provides an opportunity for health services to reach children in a cost efficient way. New data from the partnership for child development, showing that nutrition problems of school children may be greater and more widespread than previously thought. Furthermore anaemia data from the database on iron deficiency being developed by WHO indicate prevalence of anaemia in school age children than in pre school children (UNICEF The state of the world's children, 1995).

To solve this problem we can provide school snack program and can contribute the protein and calorie requirement that the student is now lack. In the fact this programmes can motivate children to attend school and can motivate parents to enroll their children (Nutrition of the school age children, 1996). And Than there is little evidence to suggest that school snacks programs have a positive impact on nutrition for participating children. (Bulletin of Nutrition, vol 9 no 4, 2002).

Practical experience gained by partnership for child development indicates that school nutrition programmes are feasible and effective to improve the nutrition and growth of school age children. In India, the government funded nutritional support to primary education program and presented varied success, and by the 1998 it is already achieved whole country covered this program. In Indonesia school snack program is still in its early days. Funded entirely by government., the recognition of its importance for long term future of Indonesia is signified By the fact that funding support has been

maintained in spite of the recent economic crisis. In South Africa, a case study shown that vitamin and mineral fortification of biscuits result in a significant improvement of micronutrient status when given as a snack to school children. (Nutrition of the school aged child, 1996). Actually there are three objectives are commonly associated with school snack program (http://www.edc.org/int/capdev/sfp.txt):

- To increase school enrollment and attendance among primary school age children
- To improve the nutritional status of children in school and
- To improve the cognitive or academic performance of these children
- And base on summary of United States department of Agriculture, minimum Snack requirements should be like in this table bellow

Select 2 of the 4 components

	1 – 5 years	6 – 12 years	More than 12 years
Milk	½ cup	1 cup	≥ 1 cup
Juice, Fruit or vegetable	½ cup	¾ cup	≥ ¾ cup
Meat, meat alternates	½ oz	1 oz	≥ 1 oz
Bread, bread alternates, or cereal	½ slice or ¼ - 1/3 cup	1 slice or ½ - 3/4 cup	≥ 1 slice or ≥ ½ - ¾ cup

2.3.1 Principles of School Snack Program

As a function of nutrition knowledge that is given in term school snack program to children schools with parents, teachers, and community participation and also under government's guidance.

2.3.2 Objective of School Snack Program

To increase primary school children's body defense by nutritional and health improvement so that can motivate study's interesting of primary school children.

2.3.3 Target of School Snack Program

Besides to reach primary school children in remote area, this program also has target to all community in remote area, particularly for parents, and teachers so that all of them can get understanding how important school snack program are.

2.3.4 Implementation of School Snack Program in Indonesia

Should be used by local materials

It can not be used fickle materials as a result from factory

Is given minimum three times a week in term good snack for school children

Price of the school snack is Rp.500 for one time

Each portion of school snack should contain at least 200-300 calories and 5-7 grams of protein

2.3.5 Activities of School Snack Program

This program was done by director of primary schools and teachers and cooperated with community member and parents. Supervision and technical guidance was done by nutritional expert, midwifery, and health manpower in that area. Mechanism of this program in big line are :

Total number and name of primary school which will get school snack program was decided by local government with decision letter

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Total number of children which registered in every primary school in the moment of offering school snack program was decided by director of primary school together with teachers and parent's association.

Supplying and cooking that school snack wad done shifted by community and with assistance of parents, and each primary school got cooking tools

School snack was distributed by teachers in their classmate and before starting eating, teachers asked them to wash their hands with soap and praying and also gave them explanation about utilization and nutrient's content of that school snack

Administration and responsibility of finance was handled by director of primary school under supervision of teachers and parents association

Daily, weekly, and monthly reporting was done by director of primary school with the assistance of teachers and they sent to primary school supervisor (at the local government level)

In school snack program implementation, midwifery and teachers gave them worming drugs and they explained about nutrition education and sanitation for environment

2.4 Related Factors to Nutritional Status in Children

2.4.1 Socioeconomic factors and Child Nutrition

Socio economic status is defined as the amount of income, occupation, and education level of the primary providers of the family. In developing countries such as India, a survey was conducted in 1998 by reddy, B.Nirmala showed that there was the positive relationship between socioeconomic and body mass index. Data was collected from 1,119 individuals, aged 18 to 75 years, from socioeconomic diverse populations in south tern Andhra Pradesh, India.

Other survey conducted by Bharati (1989) reported that there was a positive association between body dimensions and socioeconomic status in southern West Bengal. The nutrition situation of any community is based on certain socio economic condition, such as occupation, per capita income and some times even population social background. BMI has a strong relationship with socioeconomic conditions and pattern of food intake.

Delpeach et al (1994) reported a large prevalence of low BMI in rural areas and high BMI in urban areas of the Congo, a central African country. They also found that BMI has positive association between body dimensions and socio economic changes overtime.

Maternal education has a significant positive implication in regards to a child's nutritional status. According to Caldwell's (1979), women's education played an important role in determining child health as education gives women the power and the

confidence to take decisions. There are three important aspects by which maternal education has influence on child health. The first is, reduction in fatalism in the face of children's ill health. The second is, increased capability in knowing about the existence of health facilities and securing the attention and interaction with medical professionals. Finally, education confers growing ability to balance traditional family relationships as they shift in the family power structure. Mother's education affects child survival in two main ways; better child care practices through higher standards of hygiene at home and proper knowledge of diseases; and greater use of preventive and curative medical services for themselves and for their children (Mosley and Chen 1984; Cleland and van Ginneken, 1988).

In developing countries, the increased levels of maternal education are associated with improved chances of child survival. The association between maternal education and child survival was further highlighted during the 1980s by analyzing the World Fertility Survey (WFS) data (Hobcraft, 1993). Hobcraft et al. (1984) covered 28 WFSs while Mensch et al. (1985) covered 15 countries, by analyzed the association between maternal education and child health by controlling for a number of other socio-economic variables. Both the studies showed that increased level of mother's education was associated with improved chances of child survival in a wide range of developing countries.

The study by Hobcraft et al. (loc cit) demonstrated that socioeconomic differentials in child survival widened with increasing age of children and found the greatest consistency in fitted models for mortality between ages one and five where

there was strong effect of both mother's and father's level of education and the father's occupation. In fact the association of maternal education and child health and survival was approximately the same in rural and urban areas, which was as seen as consistent with Caldwell's hypothesized pathways, where husband's educational level was associated with greater child survival in urban areas. However, both the studies suggested that there was no threshold level of maternal education that needed to be reached before starting the improvement in child survival even though a small amount of education was usually associated with improved chances of child survival (Hobcraft et al., 1984; Menschetal., 1985).

Uneducated women tend to be poor and may have less access to health care and poor household resources which may be associated with higher mortality in childhood than infancy. Educated mothers can have significant influence over the child's nutritional status through breast-feeding and supplementary food as educated mothers may be from better economic backgrounds and may have higher access to mass media or health care facilities. Educated mothers also lead in maintaining proper hygiene during food preparation and food practices (Madzingira, 1995). This relationship was found to be weaker in sub-Saharan Africa and Arab states where the effect of the mother's education is less effective (Cleland and van Ginneken, 1988) because of strong household influence and decision making power of the elderly member of the household (Onyango et al, 1994). Bicego and Boerma (1991) using data from 17 developing countries DHS found that stunting and wasting in early life (up to 24 months) is strongly related to maternal education but economic status reduces the excess risks for the children of the less-educated mother's by 50 percent. This suggests

that economic status is independently important in determining long-term nutritional status of children.

The impact of maternal education on the use of prenatal care is found higher among educated mothers. Education has also effect on related demographic variables. Educated women tend to keep their families small and have longer duration of birth intervals than uneducated mothers. The preventive health care practice for children such as the coverage of immunization are also higher among the educated mothers wich reduces the chances of child morbidity and mortality (Bicego and Boerma, 1991). In adequate child care is significantly caused by poor health and heavy work loads of mother, poor education and wrong beliefs of care givers. In term of health care utilization and child growth, their study of DHS data from 17 countries in Asia, Africa, and Latin America showed a greater propensity to use health services among the educated mothers. In the case of use of Hospital services for treatment of their children's sickness, educated women were found more prompt compared to illiterate women or those who believed in traditional remedies of the elderly household members. Educated women were able to mobilize the family decision maker upon taking their children to the medical professional before it become fatal compare to uneducated women (Hobcraft, 1993).

Women's labor force participation has increased the income flow in the family and might improve the family diet sufficiently to improve nutritional well being. The nutritional consequence of employment of mother is ambivalent. It has also given women's autonomy an income and a greater control over household resources, along

with a greater access to knowledge and more efficient use of resources (Sivakami, 1997; Tulasidhar, 1993; and Basu and Basu , 1991). Studies conducted in Panama, Bangladesh and Ghana shows that maternal income is the key to improving dietary intake of children as mother's income is directly spent for child nutrition. Children of working mothers are consuming more energy and protein, calcium and iron than of children of unemployed mothers. This difference is higher in rural areas than in urban areas. The gap between the nutritional status of children of working women and unemployed women is influenced by the economic condition of the family (Mozumder et al, 1997; Abbi et al, 1991; Tucker and Sanjur, 1988).

The negative impact of maternal work on child feeding shows that the length of breast-feeding was shorter in duration and supplementation occurred earlier among working mothers and had a stronger negative effect on full and predominant breast-feeding (Sivakami, 1997; Tulasidhar, 1993; Majumder and Islam, 1993; and Basu and Basu 1991). The amount of supplementary food given to children has two risks; first, the food may not be adequate for the baby in the hand of a care giver and secondly, there is risk of morbidity such as diarrhoea in early infancy which has a serious impact on physical growth. Childhood morbidity such as anemia, low immunization coverage, Vitamin A deficiency is significantly higher among the children of working mothers as compared to unemployed women (Abbi et al, 1991).

Child health and survival is strongly related with women's education and labor force participation. However, knowledge and understanding of health and nutritional issues for children are also important in addition to consideration of maternal time and

income. It is evident that the combined effect of maternal employment and education leads to the increase in efficiency of time use and the ability to make appropriate decisions in resource allocation for child health. Economic activities outside the home are better for women than house based work not only for direct payment for their work but also exposure to modern health care knowledge and to create a demand for the use of services for themselves and for their children (Tulasidhar, 1993).

2.4.2 Breast-feeding and supplementary food

Breast-feeding is universal in all societies although the duration is varied. This is an important determinant of the child's nutritional status. It is evident that fully breast-fed children will not be malnourished during the first six months of life unless exposed to any infection (Ware, 1984). Studies show that exclusive or even predominant breast-feeding provides protection against diseases. Exclusive breast-feeding can provide all nutrients to the infant up to six months of age and the child get protection from infectious diseases from mother's milk. Thus the introduction of supplementary food between 4 to 6 months of age is recommended by WHO since the quality and quantity of breast-milk changes over time in relation to nutritional requirements with the increase of the child's age. While the importance of breastfeeding has been increasingly recognized among the educated women, it has now been established that a trend towards reduced duration of breastfeeding is evident since the 1970s among both rural and urban population.

Studies throughout the developing world have illustrated that breastfeeding children are much less likely to die or become ill, especially when colostrum (first

breast fluid after birth) is given and breastfeeding is exclusive until at least four to six months of age (UNICEF, 1997). Malnutrition and deaths are closely associated. Child care practices such as feeding practices and health seeking practices are direct determinants of child survival. Breast-feeding is significantly associated with reduction of morbidity and mortality in early infancy as well as playing a very important role in children's nutrition status (Thapa & Williamson, 1990; Victora GC et al, 1987).

The children are more susceptible to morbidity and mortality if they were partially breast-fed or artificially fed using formula milk, compared to exclusive breast-feeding. Breast-feeding is a protective factor which restores child growth and is negatively associated with mortality especially in the first year, of life (Mosely and Chen, 1984; Bankole and Olaleye, 1991). Using data from the 1987 Thailand DHS, Bunnag et al (1989; cited in Shah and Khanna, 1990) showed that among children less than two years old , the occurrence of diarrhoea in the two weeks before the interview was about three percentage points higher among children not breastfed than among those children who were breast-fed. This relationship is also significant after controlling for environmental factors and maternal education.

Age of mother is linearly related to breast-feeding but education and urban residence have a negative relationship with duration of breast-feeding by comparison with uneducated mothers and mothers residing in rural areas. The increasing trend of feeding by bottle is common among the young mothers. Educated women tend to introduce artificial feeding very early it is not found to affect child's health. It could be that their educational advantage may enable them to maintain a more hygienic child

feeding practice and afford better and high quality artificial food than the uneducated women (Mannan & Islam,1995; Bankole & Olaleye, 1991). Thus the combined advantages of improved sanitary conditions and high quality of artificial food may override the disadvantages of stopping breastfeeding early.

2.4.3 Cultural beliefs and nutrition

In addition to the availability of food, type of food and dietary intake, cultural beliefs and mother's perception in regards to childcare, breast-feeding, initiation, duration and types of supplementary food practices have significant effects on child health. Good nutrition in the early months of life is determined by feeding practices whether the right food is given at the right time and in the right way. A study in Bangladesh suggested that three-quarters of the mothers discarded colostrum (first fluid from mother's breast) before putting their infant to the breast (Das and Ahmed, 1995) as they believe that it will cause diarrhoea or stomach upset of the newborn (Blanchet, 1991).

A cross-sectional study conducted in four rural sub-districts in Bangladesh showed that women who knew that the first food to the newborns should be colostrum were three times more likely to give coloustrum first than those who did not (Ahmed et al, 1998). In regards to the mother's food during pregnancy in Bangladesh, particularly in rural areas fish, egg, chicken are not given to them as it is commonly believed that the mother will face problem to deliver a healthy baby if they eat good food and pregnant women are encouraged to eat less during pregnancy (Blanchet, 1991). It is commonly known that low birth weight baby as consequence of poor nutritional status

during pregnancy is most susceptible to diseases or even death. Thus, the mothers nutritional status is equally important for better health of her offspring.

Cultural factors such as the effect of religion on breast-feeding have some effect and Muslim women tend to have the shortest mean duration of breastfeeding compared to those of other religions in studied from 19 countries DHS (Bankoleand Olaleye,1991).

2.4.4 Morbidity in children and nutrition

Morbidity particularly diarrhea diseases are among the most important causes of deaths among children in developing countries and these highly prevalent illness have been found to be major determinants of the growth retardation and malnutrition. Malnutrition is a determining factor for diarrhea and severely malnourished children are more likely than children with normal status to have diarrhea longer in duration (Root, 1997).

Study conducted in developing countries shows that diarrhea contributes to have nutritional deficiency, increases the risk of subsequent illness and associated with weight lost (Huffman and Martin, 1994) This also shows that diarrhoea risk and ARI are higher among non-breastfed children. In order to improve the situation measles vaccination, breastfeeding promotion, improving weaning and hygiene promotion and water and sanitation facilities are essential.

A longitudinal study conducted in Matlab, Bangladesh shows the growth faltering of children was due to recurrent diarrhea (Brown et al. 1982). Another study conducted in the same area using longitudinal and prospectively collected monthly by an anthropometric data showed similar results namely that children with underweight (low weight for length) had longer duration of diarrhea than better nourished children (Black et al 1984). Disease reduces the appetite and children becomes malnourished. However, access to health care is equally important in this regard. In Indonesia, access to health services is quite good. The majority of sick children are taken to qualified practitioners for treatment who have any professional training in this respect. This decreased the un severity of the diseases and children with good health.

Briend and Beni suggested that association of diarrhoea and malnutrition " is due to the higher prevalence or severity of diarrhoea in malnourished children". Environmental factors have affect diarrhoea and nutritional intervention that may reduce un favorable consequences on health as diarrhoea control interventions have little impact on malnutrition unless food intake is an increased. Extra nutrition is required during this time to continue the growth of an infant. However, mother's or care taker's lack of knowledge as well as prejudice notion about food required during and just after recovery from diarrhoea, some mothers stops feeding nutritious food and even sometimes stops breast feeding during or after diarrhoea (Brown et al, 1982, Blanchet, 1991).

2.4.5 Sex of child

Preference for specific sex (boys) is an important determinant in relation to the child's nutritional status in many countries, particularly in South Asian countries. A studies conducted in Matlab, Bangladesh using the Harvard weight-for age standard shows that girls are more likely to be moderately to severely malnourished compared to boys. Discrimination in food distribution against the girl child within the family is the probable reason for this. The dietary survey in that area showed that per capita food intake and protein-caloric consumption of boys consistently exceeded the intake for girls (Chen et al. 1981; Bhuiya et al, 1986). Although there were not significant differences found in disease pattern among the boys and girls, differences were found in health care utilization. A higher proportion of male children were bought to the health facilities for treatment of diarrhea compared to a female children even when the services were offered free of charge at the Matlab Diarrhea Disease Treatment Centre (ibid). Maternal education has not been found to have any significant role in this respect and household actions is more prompt and effective for boys even if the mother's concern is equal for the boys' and girls' health. Household decisions are made by the male or the grandparents (Bhuiya, 1989; 1991, Henry et al, 1993) However, discrimination against the female children was not found in the breast-feeding pattern. Cultural factors have a significant effect in alleviating such sex discrimination in societies such as in Kenya, and Thailand. Where bride-prices is found, the child survival rate is slightly higher in females than in males. However, in India, and Bangladesh opposite direction in nutritional status is quite common, which leads to morbidity and mortality. Sons are considered as economic value for the family and women have low status, role and work opportunity, and the female dowry system is the

key of such discrimination (Mosley and Chen, 1984). Although son's preferences exists in Nepal, it does not reflect in the nutritional status of females as the study shows that boys were as likely to be malnourished as girls (Martorell et al. 1984). Although family members' economic roles determine the type of food distribution particularly in cases of dishes containing protein, no significant difference was found among the food given to both boys and girls (Gittelsohn et al, 1997).

2.4.6 Sanitation

An unsanitary environment may have broader effects on children than just those associated with particular bouts of overt illness. Children living in poor conditions are constantly exposed to pathogens that cause persistent tow-level challenge to their immune systems. Children who are not apparently infected, that is, who show no clinical illness, may nonetheless have an immunological response that diverts specific nutrients from normal growth and thus restricts length gain (UNICEF, 1997).

The environmental effect on child morbidity is crucial. Clean water supplies and sanitation facilities has a significant effect on child nutritional status by preventing waterborne diseases such as diarrhea. Living conditions especially water supply and sanitation conditions directly affect contamination of the household environment and thus may facilitate the various infectious diseases, particularly diarrhea. Adequate housing, safe drinking water within the dwelling and good sanitation facilities create the hygienic environment which help to prevent diseases.

Analysis of the DHS 1987 data in Guatemala showed the nutritional status of children is associated with the types of sanitation system. Stunting was lower in children with access to flush toilet in comparison to those who used open latrine or \ who did not use latrines at all. The risk of stunting was almost twice as high in both the rural and urban areas if the households did not have access to flush toilet and there was higher for relatively risk for children in rural areas than in urban areas (Bateman, 1991). Improvement in sanitation is strongly associated with improved health conditions in rural areas than those in urban areas because of living conditions in urban areas (The effect of water supply and sanitation on nutritional status of children in Sri Lanka, Esrey & McGill, 1997) supported the findings of the study done by Bateman (1991). However, they have also shown other associated factors such as having electricity. Household member with more than 5, increasing age of children and a poor household shows as negative effect on children's nutritional status particularly for stunting.

Frequency of disease depends on many factors especially on safe water and sanitation. It is obvious that hygienic practices tend to be improved with income and poor hygiene increases the burden of illness, which is one of the prime reasons of malnutrition. Improved sanitation, clean drinking water, better sewer systems lead to better health of children in urban area through reducing the risk of diarrhea. (Madzingira, 1995).

2.4.6 Family economy and nutrition

The family's economic status measured by factors such as land holding and crop value is associated with better growth. A study in Nepal shows that socio-economic variables were found to be significant determinants of nutritional status. Area of residence, household income, and land holding, were the significant predictors of child nutritional status (Martorell et al, 1984). This indicates that protein energy malnutrition is a problem of poverty.

The studies reviewed so far shows that several factors have influenced the nutritional status of children. The number of possible underlying causes seems almost endless and their interrelation is very complex. Beside school snack program, breast feeding, mother's food practices and mother's food knowledge, environmental effect, child morbidity and socioeconomic have a combined effect on the nutritional status of primary school children.

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2.5 Conceptual Framework:

Conceptual Framework for the relationship between school snack program and nutritional status of primary school children with other confounding factors

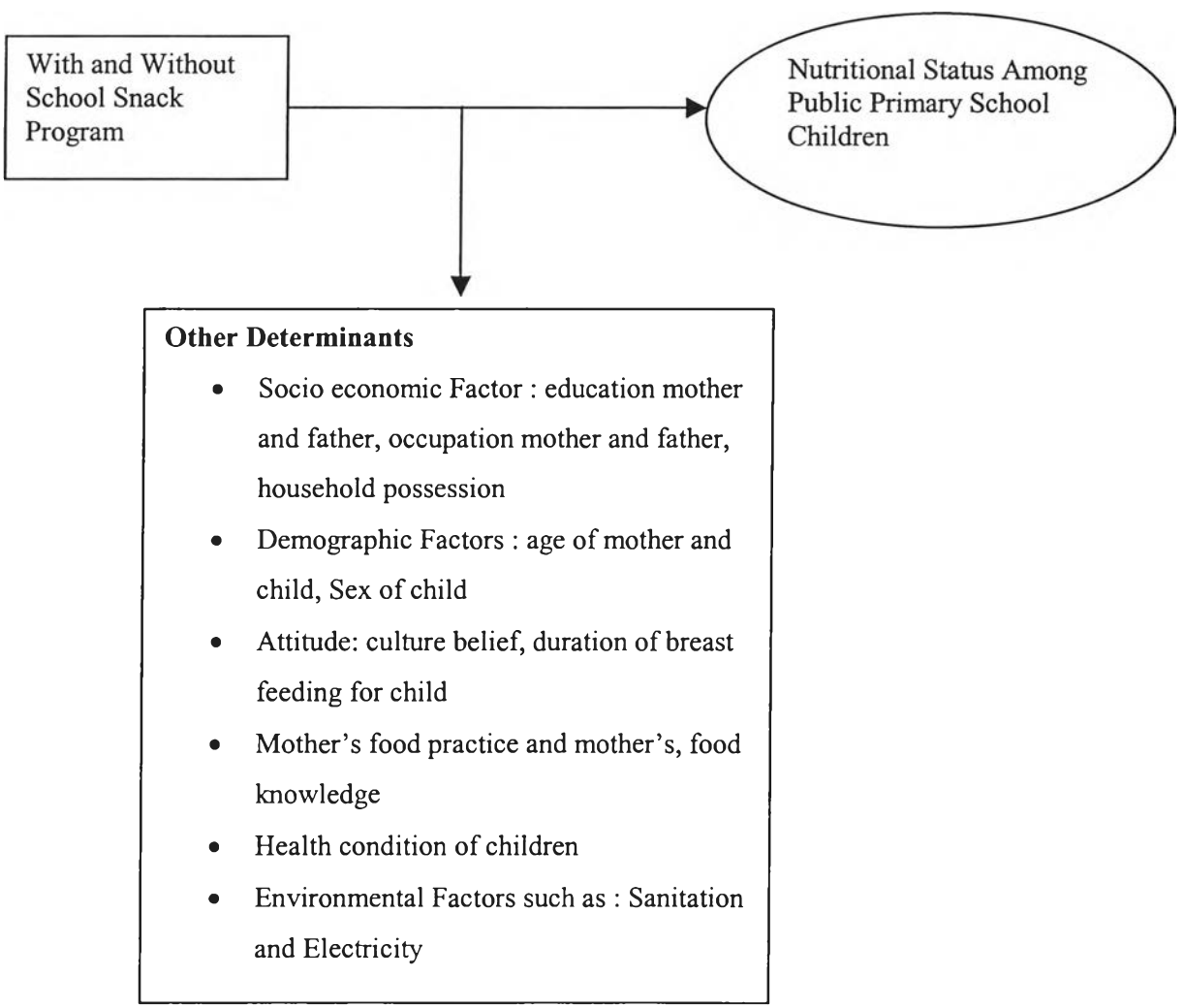

Figure 2.1: Independent Variable Dependent Variable