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**School Feeding Programs in Less Developed Countries:  
An Analysis of Actual and Potential Impact**

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## Executive Summary

Three objectives are commonly associated with school feeding programs (SFPs): (1) to increase school enrollment and attendance among school-aged children; (2) to improve the nutritional status of children in school; and (3) to improve the cognitive or academic performance of these children. This study examines and assesses empirical evidence regarding the hypothesized relationships among SFPs, school attendance, enrollment, cognitive development and academic performance. It also uses research findings to derive SFP design recommendations. Finally, the study proposes an agenda for a needed operations research project on how SFPs influence attendance, enrollment, cognitive development, academic performance and nutritional status.

Four types of studies have been conducted to assess the impact of SFPs on attendance and enrollment: retrospective analyses, comparative studies, non-comparative studies and studies examining the determinants of school attendance and enrollment. To date, retrospective analyses (of which three are reviewed) have not yielded results in which decision-makers can confide. Most fail to use enrollment ratios based on solid demographic data, lack data on contextual variables that might influence school attendance, and do not report longitudinal changes. Because of the inherent weaknesses in this type of study and the inconclusive nature of their findings, they do not lend support for the hypothesized relationships among SFPs, attendance and enrollment.

Six studies are reviewed that examine the impact of SFPs by comparing data on attendance and enrollment between SFP and non-SFP schools. Most were inconclusive. The evidence suggests, however, that SFPs may be most effective in meeting their attendance-related objective in settings where attendance is not already high and where children come from rural, relatively low SES backgrounds. Several of the studies also point to the need for program regularity to achieve an impact on children's school-going habits. These findings suggest the importance of targeting practices that take both need and the probability that program regularity can be maintained into consideration.

Eight studies covering eleven different countries examined the impact of SFPs on attendance and enrollment using primarily impressionistic data drawn from teachers. Most of these failed to provide control groups. Significantly, seven of the eight noted a positive programmatic impact on attendance and enrollment, while only one drew mixed conclusions. However, their methodological imprecision makes these findings suspect.

Two studies examined how nutritional status influences school attendance and enrollment without specifically assessing the impact of SFPs. In one study (Guatemala), the researchers concluded that when economic and family background factors were held constant, size (a proxy for nutritional status) and health of children acted as independent,

positive determinants of both attendance and performance. This study suggests that where SFPs can be designed to have an impact on nutritional status, impact on attendance and performance will also be achieved. Thus, proper targeting and the provision of an adequately sized ration become design issues not only related to changes in nutritional status, but to attendance and performance outcomes as well. The second study (Terai, Nepal) reported similar findings; nutritional status contributed positively and significantly to the probability of a child's being enrolled in school. This study also found that the influence of nutritional status variables on enrollment may differ between boys and girls.

The general conclusion one can derive with respect to SFPs, enrollment and attendance is that feeding programs seem to make a difference when there is a good fit between SFP design and the environment in which the program operates. Judging from the literature, however, this fit is sometimes not present or the evidence to support it is inconclusive. SFP impact appears to be a function of program ecology; nevertheless, crisp guidelines and incontrovertible findings are not available to aid decision-makers in formulating policy for a variety of ecological settings.

This report also examines SFP impact on cognitive development and academic performance in school by reviewing three types of studies: (1) those concerned with the relationship between diet and cognitive development in general; (2) those that examine the relationship between SFP participation and cognitive development in ldc's; and (3) those that analyze the relationship between SFP participation and cognitive development in industrialized nations.

Cognitive function may be defined as the ability to learn categories; process and structure information; and to learn and react to social and environmental cues. Mild to moderate malnutrition, while probably not causing primary learning deficits, does appear to alter processes associated with cognitive function. Passivity, apathy, shortened attention span, reduced short-term memory, failure to acclimate to repetitive stimuli and a lag in the development of sensory-integrative capacity are all associated with mild to moderate malnutrition. These dysfunctions prevent children from taking maximum advantage of their learning environments. Thus, children with PCM tend to function at reduced levels of cognitive development and academic achievement. One study, for example, showed that current diet was the single most significant predictor of classroom achievement.

Mild to moderate malnutrition acts synergistically with social and environmental factors. The risks for a malnourished child, living as he does in a culture of poverty, are multiple, interactive, and cumulative. However, both human and animal studies show that a developmentally facilitative environment can alleviate the potentially harmful consequences of malnutrition. Reversibility and remediation are possible when the child's environment is manipulated to make it more

conducive to his cognitive growth. Although improvement in the child's diet alone can lead to cognitive changes, greater intellectual growth can be achieved when the child's diet as well as his psychological and social environment are enriched. These findings suggest that SFPs can only reach their full potential when they are designed as part of a broader intervention strategy to address developmental lags or deficiencies in students.

Four studies dealing specifically with the impact of SFPs on cognitive development and academic achievement in ldc's are reviewed. The failure to report baseline data renders two of them inconclusive. The other two suggest that factors exogenous to SFPs exert as much influence on school performance as do feeding programs. Despite this, none of the SFPs reviewed incorporated into its design any feature that might mitigate the impact of these "intervening" factors. A need exists to recast the SFP as a more integrated effort to remediate deficits caused by the interaction among acute malnutrition, hunger, and a developmentally non-facilitative home environment. The necessity of an integrated approach notwithstanding, the importance of an SFPs impact on the alleviation of hunger and the improvement of nutritional status should not be underestimated. Cotten, in his analysis of an SFP in Haiti, found, for example, that 7 percent of the variance in IQ scores could be explained by malnutrition. He also found that where the quality of educational opportunity was low, it was especially important to alleviate hunger for student learning to take place.

Studies on SFPs in this country have tended to look at either short- or long-term behavioral effects. Six studies on short-term effects are reviewed in this report. Most emphasize morning feedings and the effects of hunger on classroom behaviors; as a group they yield conflicting results. It should be noted, however, that subjects were not necessarily malnourished. They do suggest, though, that the provision of breakfast may benefit the student emotionally and enhance his capacity to work on school-type tasks.

Long-term behavioral effects of SFPs were evaluated in five studies. They fail to demonstrate conclusively significant relationships between feeding and school performance. All are marred by serious methodological shortcomings.

Chapter IV of the present report examines how SFPs can contribute to the improvement of a school system's internal and external efficiency. Particular attention is given to how feeding can become a springboard for cognitively oriented interventions that will allow the SFP to reach its full potential as an intervention strategy designed to have impact on both attendance and academic performance.

The study's concluding chapter identifies three issues that need to be addressed systematically through an operations research project: (1) What kinds of changes do SFPs promote and for whom? (2) To what extent are those changes interdependent? (3) Given a particular set of

ecological conditions, what is the ideal SFP design to promote improvements in enrollment, attendance, and academic achievement? The methodology proposed consists of seven different treatment types (snack only; breakfast only; lunch only; and each of the above meals combined with a cognitive intervention) applied in each of four markedly different ecological settings. One country is recommended as the research site and a three-to-five year study duration is proposed. Such a project is needed if the real and potential impact of SFPs is ever to be assessed.

## Acknowledgements

Many people helped me in the preparation of this study. To thank them all would add considerably to the weight of an already hefty work. However, there are a few individuals whose contributions are so significant that it is impossible to omit mention of them without misrepresenting the origins of this report.

The idea for the study originated with Judith Gilmore and Hope Sukin, both of the evaluation office in AID's Bureau for Food and Voluntary Assistance. They identified much of the literature that is reviewed in the body of the text, questioned and probed as needed so that I could sharpen my insights, and were marvellously supportive throughout the project.

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Last but not least are the contributions made by staff members at CARE, Catholic Relief Services and Checchi and Company. Without their help it would have been impossible for me to gain access to many of the documents so critical to an adequate review of school feeding programs.

While help has come from many sources, the point of view expressed and all recommendations and conclusions are my own. Although this study was produced under a contract with AID's Bureau of Food and Voluntary Assistance, Office of Evaluation, I received full latitude to praise or damn school feeding programs as the evidence and my inferences would permit. In the end, I found neither unfettered praise nor utter damnation was appropriate. The resultant work, therefore, seeks more to explain and interpret ambiguities than to offer a definitive judgment on the programs's worth.

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## Introduction

Foreign aid is essentially a compromise between the "have" and "have not" countries of the world, a cross between what donor nations are willing or able to provide and what recipient nations actually want. The fit is not always perfect. Bilateral assistance programs in particular are as much products of domestic as international economic and political realities. These forces often operate to widen the gap between what developing nations want and what donor nations give. When a program can meet the differing and often conflicting priorities of both sides of the development assistance equation, support for it is almost always broad, deep and unquestioned. Such a program--representing the essence of positive sum game thinking--responds to the needs of varied and often competing constituencies in ways that are readily perceptible to all.

School feeding programs supported by the Agency for International Development through its Food for Peace operation appear to be the embodiment of such win-win gamesmanship. They, along with other Food for Peace programs, further the aspirations of an important constituency in America's heartland, the farmer. New markets for surplus products are generated and domestic price levels for targeted commodities are maintained. Indeed, with the possible exception of aid to Israel, there is probably no U.S. foreign assistance endeavor that generates more sustained or vocal constituent support than Food for Peace. It serves as a cornerstone of both our domestic and international policies, a unique position enjoyed by no other U.S. foreign aid program.

On the other side of the coin are the needs met in developing countries through Food for Peace, Title II. They are, in a nutshell, very politically popular. Often, they constitute an important tangible sign that a national government is committed to helping the rural or urban poor. And, it is widely held that school feeding programs help quench the ever growing thirst for education (and its attendant benefits) among the poor by removing roadblocks along the path to learning.

Two principle arguments related to the removal of "roadblocks" have been advanced in behalf of school feeding programs (SFPs). First, the provision of a snack or meal serves to increase school attendance and enrollment. Food, in this context, is thus seen as a means to offset some or all of the costs of attending school, including expenditures for books, fees, uniforms, supplies, and transport, as well as a child's foregone earnings. A second argument in support of SFPs is that they improve children's ability to benefit from instruction by removing hunger or nutritional deficiencies as obstacles to learning. Implicit in this argument is the belief that by and large SFPs reach a nutritionally needy segment of the school-aged population with a ration that is nutritionally adequate to overcome these needs. The validity of this argument also depends on the strength of the relationship between cognitive functioning and nutritional status.

These arguments lend support for the three objectives most commonly associated with SFPs:

- o to increase school enrollment and attendance among school-aged children;
- o to improve the nutritional status of children in school;
- o to improve the cognitive or academic performance of these children.

Yet SFPs differ from one another in many significant ways. For example, some SFPs provide only a snack while others offer a complete meal. Some rely solely on donated products while others supplement them with locally purchased commodities. Even among programs that offer complete meals, size and composition of ration vary widely. And, of course, SFPs differ significantly in terms of the populations they serve. Some reach predominantly malnourished children while others do not. Similarly, some operate in settings where primary school enrollment reaches nearly universal proportions while others are conducted in communities where only a small minority of the population completes five or six years of school. Given this wide variety of program characteristics and context, it stands to reason that SFPs will vary according to the results they achieve. Indeed, this is the case.

This study is concerned with three issues. First, through a review of the literature, it examines and assesses the empirical evidence that exists to support the hypothesized relationships among SFPs, school attendance, enrollment, and academic performance. Both the relationships and the methodologies used to posit the relationships are scrutinized. Second, it uses this examination of empirical evidence to distill SFP design recommendations for varying contexts. Not all countries face the same problems; nor will the three objectives typically associated with SFPs be weighted equally by all ldc's. Differing weightings and concerns imply variations in program design. Future research needs is the third issue dealt with in this study. Areas in which additional inquiry would be useful are identified, and methodological recommendations for how such work might be conducted are presented.

This study has been shaped by some very important assumptions about SFPs. Foremost among these is that the program has great appeal to a broad range of interest groups in the U.S. and abroad. In the U.S., lay enthusiasm is for the Food for Peace program in general rather than for any of its specific components, while in ldc's, SFPs in particular enjoy popularity among parents, planners and politicians. Such appeal may make it difficult to discontinue SFPs altogether or even significantly reduce support for them unless strong research designs yield incontrovertibly negative findings.

A second assumption about SFPs concerns the range of impacts they might exert. All students of the development process know that any planned intervention brings about a series of secondary changes, only some of which are foreseen. Robert Hanvey has noted, when making a change within a system, there is no such thing as a side effect, only a surprise effect. In the case of SFPs, the potential for secondary changes is enormous and can influence almost every aspect of the recipient country's social, economic and political structure. Nevertheless, most researchers have limited themselves to assessing impact in terms of attendance, academic performance and nutritional status.

Figure 1 illustrates this point by suggesting the kinds of changes SFPs might plausibly bring about--either intentionally or unintentionally--in a society's basic structures.

Very few of these plausible relationships are addressed in the literature and where mention is made, the data are largely impressionistic. Yet these kinds of relationships--most of which are long-term in nature--may exert more influence on the course of a country's development than the short-term causal linkages generally assumed between SFPs and attendance, performance and nutritional status. Only when retrospective or prospective research is conducted to assess the strength of relationships similar to the ones listed in this chapter can the merits of SFPs be fully considered.

The remainder of this study is presented in four chapters. In the two that follow, topical reviews of the literature on SFPs are presented. Respectively, the chapters single out for special consideration studies examining the impact of SFPs on school attendance and enrollment and cognitive development. Each study is reviewed in terms of its findings and the methodology employed in order to identify implications for the design of SFPs as well as for future research in this area.

While the question of SFP impact on nutritional status is not directly discussed in the main text of the present report, two appendices provide insight into this question. The first summarizes in matrix format key findings, methodologies, strengths and weaknesses of all major international studies concerned with measuring SFP effectiveness. Data on how SFPs have contributed to nutritional status changes are presented there. The second appendix uses the same format to summarize the conclusions drawn by U.S. researchers in evaluating domestic SFPs.

Figure 1. Hypothetical Consequences of SFPs:

Examples of Plausible Relationships

<u>Category of Structural Development</u>	<u>Plausible change that could be brought about through the introduction of an SFP</u>
1) Kinship patterns/ Family relations	There is a persuasive body of literature that suggests that a woman's level of education is the single most important determinant of her fertility behavior. If SFPs could contribute to improved school attendance and enrollment ratios for girls, they might have a long-term impact on family size.
2) Economic activity	Gains in worker productivity in many ldc's can be explained by increases in literacy and school enrollment rates. If SFPs contribute to a reduction in school drop-out rates and improvement in attendance and enrollment rates, they might have a long-term impact on the growth of GNP.
3) Education-related activity	If SFPs contributed to improved academic performance by improving student ability to benefit from classroom instruction, it might be advisable to invest less heavily in in-service teacher training programs and transfer resources to SFPs. This investment pattern might be more cost-effective in the long-run since it obviates the need to deal with such persistent teacher-related problems as rapid turnover in rural areas, costly salary stipends for teachers who improve their qualifications through in-service programs, and the need to provide ongoing refresher courses in order to institutionalize the qualitative changes being introduced through the in-service program. Thus, instead of improving educational efficiency through changes in teacher quality, it might prove more cost-effective to use SFPs to improve student quality.
4) Political activity	In order for a community to obtain an SFP, it first has to achieve a modest degree of organization. Parents may need to band together to exert the political leverage required for their community to be chosen as an SFP site. Once program approval is granted, they must then allocate among themselves such tasks as transporting, preparing and supplementing the donated commodities. In some cases, they must also work together to build a warehouse, kitchen or serving area. Such a positive experience in group action might serve as a stimulus for communities to undertake more ambitious projects in response to local priorities and long-term development objectives. It may also reinforce the belief that community organization can lead to concrete benefits.

5) Agricultural activity

SFPs can create new markets for locally produced vegetables. Such expanded demand can come from two sources, SFPs themselves and a secondary market consisting of the families of children who have acquired new food tastes. A new demand for these products may alter the patterns of local agricultural production with either long-run positive or negative effects on farm family's income.

6) Health-related activity

If ration size and composition are adequate, SFPs may reduce the vulnerability of school-aged children to certain diseases. Local health workers may then be able to allocate an even greater proportion of their resources to pre-natal, neo-natal and preschool health concerns.

Chapter II  
A Review of the Literature:  
School Attendance and Enrollment

Four principle types of studies have been conducted that assess the impact of SFPs on attendance and enrollment. The first type, retrospective analysis, involves the measurement of changes in school attendance or enrollment when SFPs are temporarily or permanently discontinued. Thus, program presence is treated as the independent variable with attendance or enrollment considered as the dependent variable. A major weakness of this design is that program suspensions, if perceived as temporary or if passed unnoticed by parents, are not likely to exert the same kind of influence on attendance as total program discontinuation. Indeed, parents may "grin and bear" such short-term interruption of service precisely because they have confidence that the program will be restored.

A second type of study is comparative. School attendance and enrollment data for SFP and non-SFP schools are compared to discern the relative impact of SFPs on the dependent variables. Frequently, the comparison is based on impressionistic data rather than on actual records. Furthermore, the essential fallacy of such studies is the assumption that SFP and non-SFP schools are comparable. Where targeting of schools occurs, it is reasonable to assume major differences between SFP and non-SFP schools in terms of such important determinants of school attendance as SES, distance of pupils from school, and teacher quality.

A third type of study is non-comparative. This methodology seeks to gauge the impact of SFPs on attendance and enrollment for a group of schools without the use of controls or comparative frameworks. By and large, studies in this category rely on impressionistic testimony from teachers concerning changes in school attendance. The findings are suspect on a number of grounds. First, respondents might attribute an impact on attendance to the program if they think their response might in some measure influence the program's continuation. Second, the conventional wisdom is that SFPs affect attendance favorably. Therefore, teachers commenting on this relationship may not be willing to substitute their own judgment for what they believe ought to happen.

The fourth type of research that has a bearing on the relationship between SFPs and enrollment or attendance does not deal directly with SFPs but rather with an analysis of school attendance or enrollment determinants. In particular, these studies examine the relative impact that such variables as SES, verbal functioning, sex and correlates of nutritional status (primarily height and weight) exert on school enrollment. The reason for including this type of study in a discussion on the relationship between SFPs and attendance is that such research provides two kinds of important insights. First, it sheds light on the extent to which nutritional status influences school enrollment or

attendance. If it could be shown, for example, that nutritional status is a critical determinant of attendance, then a logical argument favoring SFPs that are adequate to affect a child's nutritional status could be advanced. Even if other types of studies suggest a negligible or tenuous relationship between SFPs and attendance, a case in support of SFPs might still be made if those SFPs with marginal impact on attendance were also the ones that had marginal impact on nutritional status.

The second set of insights that such studies provide concerns why some children go to school while others do not. School feeding in part represents an income transfer program. The assumption has been that this income transfer might offset some of the costs of schooling. It is further assumed that without such transfer payments, schooling costs might be prohibitive for a targeted segment of the school-aged population. The research on determinants of school attendance provides a framework for testing such assumptions.

In organizing a review of literature along topical lines, it is possible to distort the researcher's intention somewhat by implying that the study in question dealt only with the issue under consideration. Frequently, this is not the case. Many of the school attendance studies presented in this chapter, for example, also examined SFP impact on cognition or nutritional status. Likewise, some studies that appear methodologically weak with respect to how changes in school attendance were captured may have been much sounder in their approach to measuring changes in nutritional status or cognitive development. Nevertheless, in this chapter only those research procedures and findings that directly relate to school attendance and enrollment are discussed except in those cases where cognitive functioning was mentioned only in passing, and more extensive discussion was thus not warranted elsewhere. Where academic performance impact was also treated systematically, an analysis of the findings and the methodology used to derive them appears in the following chapter. For the reader who wishes to have a fuller understanding of each study's scope, it is advisable to consult the matrices that are appended to this report. There, all research questions and findings are summarized for each study listed.

1. Retrospective Analysis Studies. Three studies looked at the impact of program disruption or suspension on attendance. One found a positive relationship between SFPs and attendance; the other two reported little clearcut evidence of significant impact.

The strongest relationship was presented in the 1982 evaluation of the PL 480 Title II program in the Dominican Republic by Gall, Eckroad and Stansfield (34).\*

In 1962 a school lunch program, under the sponsorship of CARE, was initiated in the Dominican Republic. By 1978, over 214,000 children throughout the country were being served daily. In that same year, CARE and the Dominican government began discussions on ways to shift the

\* - Number in parentheses refer to the bibliographic listing at the end of this report.

program away from its almost complete reliance on donated commodities. As a result, the government, in 1979, moved to terminate the CARE-administered PL 480 portion of the school lunch program. However, for a variety of reasons, the planned substitution of locally produced foodstuffs did not occur. The outcome was a sudden termination of a very ambitious supplemental feeding program. Gall and Eckroa examined the impact of this dislocation on primary school enrollment after the school lunch program ended using data provided by teachers from Santiago Rodriguez, a relatively poor region in the country's northwest.

The data examined were both impressionistic and quantitative. A sample of teachers of unspecified size provided comments on how they viewed the impact of the program's termination. There seemed to be uniform agreement among teachers that enrollment had been adversely affected. The investigators then examined enrollment records over eleven years for four primary schools in and around Santiago Rodriguez, three of which were small and rural. These records covered an eight year period when the lunch program functioned and three years (1980-82) when it did not. They found that in the 1980-82 period enrollments had dropped by 23.4 percent. Teachers were then asked about any possible causes of this decrease. They attributed the enrollment decline exclusively to termination of the lunch program. The authors conclude: "In the aggregate, it appears that approximately one-fourth of the children who would otherwise be in school have dropped out (34: App. 15, p.2)."

The decline in enrollment was lowest for the first grade (-17.6 percent) and highest for the sixth grade (-29.3 percent). The overall trend toward enrollment decline held for both boys and girls. However, for the lower four grades--the ones most crucial for the development of literacy--female enrollment declined more dramatically than that of males. In the first grade, for example, the termination of the feeding program was accompanied by a 12.5 percent drop in male enrollment as compared to 23.3 percent for females. Since more boys than girls had been enrolled in these lower grades, the effects of the school lunch program, according to the authors, were disproportionately felt by girls.

The investigators also compared the enrollment data for the three rural schools in their sample to the urban one. They found an average enrollment decline of 3.1 percent in the rural schools compared to 14.2 percent for the urban school. They thus concluded that the effects of the program's termination appear to be much greater in rural schools, although for both settings the impact was negative. Furthermore, the differential effects of terminating the lunch program for boys and girls were particularly noteworthy in rural areas. There, in the first grade, for example, female enrollment declined by 43 percent while the comparable figure for males was only 19 percent. In the urban school, however, the negative effects of the lunch program's termination appeared to be similar for boys and girls.

Since this study is, as we will see, the strongest retrospective analysis in support of a positive relationship between enrollment and SFPs, it is important to assess the methodology, used in order to determine how much confidence can be placed in the findings. The most serious limitation is that no demographic data is given for the communities under examination. Did the number of school-aged children decline? We do not know. It would have been far more useful to have reported changes in enrollment ratios rather than in the absolute number of children enrolled. Thus, the question of attribution remains largely unresolved. While we do know that enrollments declined, it is impossible to know whether this was primarily a consequence of SFP discontinuation or any one of several possible changes including out-migration, decreases in the number of school-aged children, economic hardship, parental dissatisfaction with the schools or the availability of alternative education opportunities. The size of the sample, four schools in one region, does little to diminish concern for the possibility that intervening variables may have confounded the relationship.

On the other hand, the study potentially offers several important methodological advantages if the question of attribution were resolved by reporting enrollment ratios and by providing more data on contextual variables than can influence school enrollment. If we could substantiate that "all other things were equal," it offers the possibility of treating the presence or absence of an SFP as the only dependent variable influencing enrollment. Problems of a control group are obviated and comparability of data can be assured. Furthermore, because the study deals with program discontinuation rather than a temporary disruption in service, there would be no doubt, if proper care had been taken to account for potential intervening variables, that parental action stemmed from a clearcut understanding of the SFP's future unavailability.

A second retrospective study that examines the impact of SFPs on attendance was done by Drake et al. in 1982 (26). The authors examined retrospective attendance data in Sri Lankan schools to determine the relationship between SFPs and attendance. "Though subject to multiple interpretations, the analysis . . . does point towards a positive relationship between attendance and school feeding (26: iii)." Three strategies were employed to measure the impact of a biscuit distribution program on school attendance.

The first was designed to measure long-term impact by comparing school attendance in the only years out of the last fifty where school feeding was discontinued to the attendance when school feeding was resumed. These comparisons did not involve the biscuit program per se, but all school feeding activities. Enrollment ratios were developed by estimating the school age population from the country's total population and then calculating the proportion of children enrolled by using actual enrollment data. With this approach, they found a clear increase in the enrollment ratio starting in 1957, the year school feeding was resumed.

The authors note they can identify no other variables that can account for this change and therefore suggest that institutional cessation of SFPs seem to induce a decline in school enrollment.

A second strategy involved examining the impact on attendance of temporary program suspensions. This involved tracking attendance in several schools before and after a biscuit shortage in 1981 caused by production and distribution problems. For a three-month period many districts received no biscuits. Four schools that experienced stoppages were paired with ten that had uninterrupted programs. It was posited that the schools with interrupted programs would also experience unusually high decreases in attendance. However, when attendance figures were averaged, there was no noticeable drop during the biscuit stoppage. This may have been due to one of two possible causes. A temporary program discontinuation may not cause a decline in attendance because children continue coming to school with the expectation that feeding will resume at any moment. Or, it could be that biscuits (as opposed to full lunch programs) are not much of an inducement to come to school and therefore exert relatively little influence on attendance or enrollment ratios. It should be noted that the longitudinal study the authors conducted as part of their first strategy did not involve biscuits but some unspecified feeding intervention that may have involved a larger or more economically valuable ration.

The authors also considered comparing enrollment in grades with institutionalized SFPs to those without them. Such a break occurs after the sixth grade, upon completion of primary school. The team did not, however, implement this approach which would have been questionable on any case given the normal decline in enrollment between primary and secondary education.

The two basic weaknesses in the longitudinal portion of this study involve the lack of a description concerning the nature of the feeding intervention and the lack of data for any contextual variables that might explain a rise in the enrollment ratio. Such variables might include governmental campaigns to expand enrollment, overall improved economic conditions, new school construction, general educational reforms that make schooling more attractive, introduction of innovations designed to increase the absorptive capacity of schools such as split shifts or increases in the number of teachers hired. It may also be that the investigators misjudged the size of the school-age cohort. Their method for deriving cohort size was to estimate it at 20 percent of the total population. However, Sri Lanka may have experienced, along with many other countries a post-war baby boom. If so, by 1957, the proportion of the country's population considered of school age would undoubtedly be above the 1952-56 levels. A failure to note growth in cohort size would have the effect of inflating any enrollment ratio derived from this data.

The major advantage of this longitudinal work is that it did attempt to use enrollment ratios rather than absolute enrollment levels. It would have been helpful to see rural-urban and male-female distinctions made in the data reporting, however. This would have furnished some insight into whether males or females and urban or rural children derive any special benefit from SFPs vis-a-vis attendance or enrollment.

The third retrospective analysis of the impact of SFPs on attendance was conducted in Madhya Pradesh, India by Rewal in 1979 (71). It looked at a lunch program that provided 80 grams of grain, 14 grams of protein and 7 grams of oil--a total of 312 calories--180 days a year. Impact was evaluated by comparing children with more exposure to feeding with those who had less exposure. The children with relatively less exposure were used in effect as a control group. It was hypothesized that attendance in schools with higher efficiency programs would be higher than in low efficiency schools. Efficiency was defined as the total number of feeding days divided by the number of days in the school year. The sample included 4,000 children in grades one through five from 409 schools. A three-stage random design was adopted for selecting the children. The food storage point formed the unit of sampling at the first stage; the schools covered by the storage point were the second stage, and children within the schools formed the third stage. Highly inaccessible schools were removed from the sample.

Due to the unavailability of longitudinal information on program efficiency, the schools were grouped de facto at the time of analysis. The cutoff points of the four efficiency groups were decided arbitrarily as low (0-60 percent), medium (61-85 percent), high (86-95 percent), and very high (96 percent and above), so as to have an almost equal number of schools in each group. It should be noted that although the difference in feeding days between high and low program efficiency schools was significant, the high efficiency schools distributed food in excess of the target number of feedings days while food distribution days in the low efficiency schools were close to the target set for the period. An analysis of children's socioeconomic background showed that the four program efficiency groups were not really comparable. In the "very high efficiency" group, 77 percent came from scheduled castes and tribes compared to 48 percent for the low efficiency group. Furthermore, schools in the low efficiency categories were there primarily as the result of recent interruptions in commodity delivery, an unusual experience for those schools.

The data on school enrollment and attendance were obtained from school records. Wastage rates were examined through longitudinal data for each school that compared the number of first graders in a base year to the number of fifth graders five years later.

The investigators found no evidence to support the hypothesized impact of program efficiency on school attendance. Indeed, for each of the five primary grades the low efficiency schools had higher rates of

attendance than those in the "very high" category.

Linear multiple regression was used to assess the relative impact of three factors on attendance: education of father, home caloric intake and family structure. Relatively little of the variance could be explained this way perhaps because of the relative homogeneity of the population and the absence of other significant variables (e.g., education of mother). However, when months of participation in the program was factored into the regression analysis, the effect of the other three variables was reduced. In fact, months of program participation seemed to exert the strongest influence on school attendance. An increase of one month of program participation, where education of father, family structure and home caloric intake were taken into account, resulted in an increase of .136 days of school attendance. The authors suggest that this provides empirical justification for the observation that experience with the program and awareness of its benefits are factors that affect parental decisions about a child's school attendance. The effect of SES on school attendance was reduced when the total number of months of program participation was included in the regression equation.

The major weaknesses of this study are cited by the author who notes that the inferences that can be drawn are not clear because of the lack of a control group (an obstacle caused by near universal participation in the SFP by schools in the region) and baseline data. The four program efficiency groups were formulated for comparison purposes by arbitrarily selecting cutoff points. They were not comparable in terms of their SES, and the "low efficiency" schools came close to meeting the target number of feeding days. Most had also suffered only recent program disruption; during the bulk of the review period, their programs were operating very regularly. Thus, parents were able to view disruptions as temporary breaks rather than long-term phenomena.

The study is particularly significant, however, for the light it sheds on SFP participation as an independent variable influencing school attendance. The use of multiple regression to explain any variance caused by this variable is appropriate. The findings suggest the need to communicate to parents about program benefits if impact on attendance is an objective.

This review of three retrospective studies suggests that such research, while methodologically promising, has not yet yielded results in which decision-makers can confide. In general, they could be improved by incorporating the following features:

- o the use of enrollment ratios based on solid demographic data;
- o the presentation of data on contextual variables that might influence school attendance;

- o the use of multiple regression to explain any variance in school attendance attributable to contextual variables;
- o more attention to parental perceptions concerning the causes and probable duration of program dislocations;
- o the use of more longitudinal data; and
- o the use of multiple sources of data including children, parents, teachers and school records.

Given the inherent weaknesses and (in two of the cases) inconclusive nature of the findings presented, this type of study does not lend support to the hypothesized relationship between SFPs and attendance. However, retrospective analysis appears to be a promising means of assessing impact because it eliminates the need to withhold food deliberately from a matched sample of schools. And, if contextual variables are measured and adequately accounted for, results should be trustworthy. It should be noted that a variation on a retrospective study would be prospective analysis whereby changes brought about by the introduction (rather than discontinuation) of an SFP are carefully measured and assessed. The same methodological suggestions offered for the design of retrospective studies would also apply to prospective analyses.

2. Comparative Studies. Six studies examined the impact of SFPs by comparing data on attendance and enrollment between SFP and non-SFP schools. Most were inconclusive although the reasons for the lack of clearcut evidence varied.

Both Roy and Rath's evaluation of the school lunch program in Orissa, India (76) and Cotten's work in Haiti (25) suggest a positive relationship among SFPs, attendance and enrollment. However, in both cases, this may have been influenced by the selection of schools for the feeding program.

The Orissa researchers obtained data on enrollment, attendance and program participation for 23,401 schools from questionnaires mailed to all sub-inspectors. Enrollment ratios, absenteeism and drop-out rates were compared for fed and non-fed schools. Based on the survey and other official records, the researchers divided the state into four strata: (1) Four predominantly tribal districts in which virtually all accessible schools were in the feeding program. In these districts no comparative sample of non-fed schools could be drawn. (2) Nine non-tribal districts in which fed and non-fed schools could be selected by random procedures and matched on various criteria.

A three-stage random sampling design was used: blocks were drawn at random. In each district one block was assigned for every 12,000 beneficiaries. Within each block, ten fed schools in the four tribal districts and five fed schools in the nine non-tribal districts were selected with a probability proportionate to the size of the school. In the non-tribal districts, a related sample of non-fed schools was selected matching the village and school on various criteria. These included similarity in size of school ( $\pm 20$  percent); village population ( $\pm 30$  percent); the proportion of cultivators in the village ( $\pm 10$  percent); and the proportion of scheduled castes or tribes in the village ( $\pm 10$  percent). Within each school, a random selection of ten boys from the third and fourth grades combined was made. Inaccessible schools were dropped from the sample.

The basic thrust of the research was to test a fed group of children with a comparable non-fed group. Statistical procedures used for this purpose included "t" tests, correlation analysis for item-to-item reliability, Pearsonian correlation to test association between variables and the chi square goodness of fit test to compare samples on various criteria.

The authors concluded that the SFP did seem to affect enrollment positively, particularly for lower, primary grades (especially the first) and especially in the tribal areas. They also noted a small decrease in absenteeism for SFP schools; once again this was particularly observable in tribal areas and especially for the first grade. However, only in the upper primary school of ten tribal districts was there substantially higher attendance in the fed than non-fed schools. Other differences observed in enrollment and attendance, the authors note, could be attributed to the selectivity of the feeding program itself. However, a careful analysis of three to five year longitudinal data indicated that fed schools had lower drop-out rates, although in the survey year the opposite was true. Where the feeding program had operated more than 300 days in the two-year period preceding the study, a decrease in absence in the fed schools was noted; thus, history of program participation (as in the case of Madhya Pradesh) seems to explain some variance in attendance.

Three shortcomings in the methodology somewhat mar the usefulness of these findings. First, the enrollment data were reported in terms of the absolute number of enrolled students rather than as enrollment ratios. The authors' conclusions regarding the relatively sanguine impact of the program on students in tribal areas is particularly weakened by the absence of these data. It may well be that such students form a larger cohort in the villages from which favorable data were reported. This same type of failure to report data in relative as well as absolute terms also makes it difficult to assess impact of the program on attendance. The authors note, for example, that while the fed schools have larger enrollments and actual attendance than the non-fed schools, there was no significant difference in absenteeism rates between the two types of schools, either by class or for the

school as a whole. Nevertheless, they pose most of their discussion and conclusions not in terms of rates but numbers of days present.

A second weakness concerns the construction of the sample and the comparability of fed and non-fed schools. The random selection method used a probability in proportion to size procedure. This gave larger schools a higher probability of being selected. Another bias stems from the fact that in the tribal districts, the bigger schools are those with the largest number of non-scheduled caste and non-tribal students. By and large, these schools are deliberately not covered by the program. Furthermore, fed schools have more tribal students and a smaller number of upper caste children than non-fed schools. This means that either the fed schools are attracting more tribal students or that the program systematically selects schools with more tribal students. If the latter assumption is indeed the case, attribution to the program of gains in enrollment and attendance by these students may be spurious.

A third limitation of the study is the failure to examine variance in school attendance, enrollment and drop-out rates in terms of SES and related variables (e.g., education of father or mother) using multiple regression. This would have strengthened considerably the inference drawn by the investigators that the program exerts relatively more influence on the attendance and enrollment habits of students in tribal areas.

The major strengths of the study include the attempts (if somewhat marred) to use tightly constructed control groups and careful statistical analysis. Another strength in the methodology is the use of "case study" type interviews to probe trends. Thus, for example, a sample of students was asked to explain their days of absence. The use of anecdotal and statistical data provides a potential basis for fresh insights into relationships among the variables. Finally, the focus on examining differential impacts of the SFP is particularly useful and suggests, as in the case of the Dominican Republic study noted earlier, that the impact of an SFP on attendance and enrollment may well be a function of the SES of the student population involved.

Cotten's study of an SFP in Haiti (25) is somewhat similar to the Orissa research in terms of the need it manifests for caution in interpreting differences between SFP and non-SFP schools. The evaluation was designed to provide information on program effectiveness and impact. The data base for assessing effectiveness was drawn from a total of 73 SFP-schools and 1,422 children. The impact survey, incorporating a more rigorous research design, was limited to the Department of the West including metropolitan Port-au-Prince. The total sample for the impact study was 54 schools (half with SFPs) and 1,034 children. The data base for both surveys combined included 100 schools and 1,936 primary school children. It should be noted that this study is the first part of a longitudinal research project.

School attendance findings were captured in the impact portion of the research. The author notes that although it would have been preferable to use the actual attendance records of individual respondents, such information was either non-existent or unreliable. He also found it impossible to restrict the selection of students who met the criteria for age and regular program participation to one grade; thus, records would had to have been obtained from several different teachers, thereby compounding the likelihood of unreliable data.

The investigator therefore opted for a compromise approach whereby the attendance record of a sample of twenty students in the elementary class was used. The average of their attendance was used as the attendance rate for that institution.

Selection of schools for inclusion in the experimental group was based on three criteria. The feeding program had to be in existence for at least two previous school years without major interruption. Second, school enrollment had to exceed 100 students to assure that at least 20 students would fall in the nine to eleven year age group. Third, the schools had to be accessible by four-wheel drive vehicle.

Cotten found significant differences between program and non-program children with respect to home environment. On the average, program children came from a better socioeconomic environment. This finding confounds many of the relationships examined, including school attendance. There was a strong correlation between home environment and attendance in both SFP and non-SFP schools. Thus, the investigator concluded that the significant difference between high attendance in program schools and not so high attendance in non-program schools could be explained by differences in the home environment as well by differences in program. He suggests that this finding demonstrates that cross-sectional data is not sufficient for measurement of impact; longitudinal studies would be more appropriate.

The Haiti analyses enjoys several noteworthy strengths including the presentation of a strong conceptual model to explain relationships among dependent and independent variables, the sound use of statistical methods (including multiple regression analysis) to insure a reasonable interpretation of data, and the forthcoming longitudinal study that will append (and perhaps significantly modify) the findings presented to date.

The conceptual model used sought to establish functional relationships among three sets of variables: x, y and z where y represents the dependent variables implied in the following three hypotheses.

H1: SFPs improve the nutritional status of primary school children.

H2: SFPs improve school attendance.

H3: SFPs improve school performance.

X and z are independent variables. The first, x, is a measure of SFP characteristics; the second, z, measures background or environmental factors generally thought to influence y but which are beyond program control. The research design focused on analyzing each variable in terms of its accuracy and relevance to the research hypotheses and the conceptual model,  $y = f(x,z)$ . This model yielded the following major variables.

Y1: Nutritional Status.

Y2: Performance (as measured by Raven test scores).

Y3: Attendance Rate.

X : Program Exposure (as reflected by ration size, length of time in program, computed leakage).

Z : Environmental Factors (including measures related to SES, quality of instruction and extra-program eating habits).

The investigator concluded that the best way to determine whether the hypothesized improvements were indeed occurring and attributable to the SFP and not other exogenous factors, was to measure relative rates of change in the dependent variables over time, in both SFP and non-SFP populations while controlling for the effects of changes in relevant, environmental variables which have a known correlation with variations in the dependent variables. This led to the adoption of a longitudinal research design, only the first phase of which has been completed. The work done thus far in effect serves as a baseline against which future changes will be measured. A chi square test will be used to determine whether the difference between SFP and non-SFP schools, in terms of their "impact" scores, is significant.

Cotten, however, has used the term "significant" in an unusual and somewhat questionable way, accepting a relatively high (20 percent) level of significance when statistical convention dictates a level no higher than 5 percent. At 20 percent, the probability of rejecting the hypothesis that there is no difference between program and non-program schools, when in fact it is true, is one in five. Cotton justifies this practice with the following premise: There is reason to believe the program does make a difference and therefore to conclude that the null hypothesis (that the program does not make a difference) is false. Accepting a false null hypothesis could have serious consequences, he argues, if decision-makers were to use such evidence of marginal impact to reduce or terminate the program. Therefore, he selected a low probability of accepting a false null hypothesis (80 percent) by testing

at a high level of significance. In other words, he statistically is giving the programs the benefit of the doubt. It would have been preferable to test the conclusiveness of findings at two different levels of significance, .05 and .20 and then offer the necessary data interpretations to aid decision-makers.

Miller's 1982 evaluation (62) of a Sri Lankan school biscuit program's impact on attendance is still another example of the hazards of comparing program and non-program schools when in fact they may not be comparable in terms of SES and other educational variables that impact on school attendance. Attendance rates were calculated for grades kindergarten through five for each month of 1980 in all SFP and non-SFP schools. The attendance in non-SFP schools was higher than for SFP schools in every month. To discover an explanation for this unanticipated finding, Miller disaggregated data by region and grade. His results were still inconclusive. Consequently, a follow-up questionnaire was administered to principals of schools included in the survey. Preliminary findings suggest that many of the non-SFP schools had been deliberately excluded from the program in 1973 because their students had a relatively high level of nutritional wellbeing. Furthermore, many of the non-SFP schools were in relatively advantaged urban areas.

This study suggests the methodological difficulties inherent in using comparisons between SFP and non-SFP schools when targeting has occurred and distinctions on the basis of need determine program participation. Since nutritional status is somewhat dependent on SES and since, furthermore, school attendance is also influenced by SES, comparative studies of this type tend primarily to measure the association between attendance and SES. Consequently, statistical methods that enable inferences to be drawn concerning what portion of the variance in attendance is attributable to SES differences and which portion can be explained by SFP participation are especially necessary when targeting on the basis of nutritional need has occurred.

CARE's 1977 study on school feeding in Karnataka, India (11) examined program impact on attendance and enrollment. The state of Karnataka was selected because it had one of the most efficient program delivery systems in India. The researchers, using a circular systematic random method, selected 36 blocks from 20 districts (the sampling frame). In all, data on 4,400 schools were collected, 1,748 of which had SFPs.

For the study on first grade attendance and enrollment, a sub-sample of 10 percent of the SFP schools (150) and an equal number of non-SFP schools was obtained from block-level education administrators who received monthly attendance and enrollment reports disaggregated by grade for each school. Data were also gathered to study the relationship between the efficiency of food supply and school attendance.

A month-wise weighted mean for attendance and enrollment was computed for SFP and non-SFP schools. A "t" test was used for comparisons of data between SFP and non-SFP schools. Additionally, the variance of the SFP schools for enrollment, attendance and attendance rates was compared with non-SFP schools using an "F" test. Program efficiency was determined on the basis of the quantity of commodities actually delivered at the block level compared to estimated requirements for the block. Blocks were then ranked and grouped into quartiles.

The investigators found that schools not participating in the feeding program had higher recorded enrollments. On the average, a total of eight more children were enrolled in the non-SFP school. No data on SES characteristics and the size of the school-age population were collected. Therefore, no definite conclusions can be drawn from this finding.

Although more pupils attended non-SFP schools, the proportion of children actually attending class was 3 percent greater in SFP schools. This number rose to 7 percent when first grade attendance rates were compared.

The authors also attribute stabilization of enrollment and attendance figures to the SFP. They report that the variance of the number of children enrolled and actually attending the SFP schools is significantly lower than in the non-SFP schools. However, this conclusion would be considerably strengthened if specific data on drop-out rates were presented.

The investigators also indicate that the regular supply of food commodities is critical in attracting children to the schools. Whereas the SFP schools appeared to attract 3 percent more children to attend than those without the program, this gain rose to 6 percent in the higher efficiency food supply blocks. In comparison, impact on blocks with irregular or occasional delivery was nil. The study suggests that efficiency of delivery must be at least at the 80 percent level for gains to be achieved.

Once again, the usefulness of these findings is weakened by certain failings in the study methodology. First, no discussion is presented concerning the ways in which SFP and non-SFP sites are comparable. What were the criteria used for program selection? If the presence or absence of an SFP the only important difference between the two types of schools? No data were provided to ascertain answers to these questions.

A second shortcoming stems from the failure to explain any environmental or socioeconomic factors that might distinguish low and high efficiency blocks. Perhaps higher efficiency blocks are those located in highly accessible urban areas. If so, differences in attendance may well be a function of rural-urban differences rather than SFP exposure.

Still another weakness is the failure to validate independently the data on attendance supplied by block level education administrators from teacher-submitted reports. It is quite possible that SFP teachers would inflate these figures if they have been told that the presence of an SFP is supposed to lead to improved attendance.

The study would have been considerably stronger if data on contextual variables were provided, if efficiency had been determined at the individual school level rather than by blocks and if the impact of the SFP on attendance and enrollment had been analyzed differentially to determine which groups, if any, derive particular benefit from the program. As noted earlier, definitive conclusions about impact on enrollment cannot be derived unless data on enrollment ratios are reported.

A positive contribution of this research is the analysis of SFP impact on attendance variance. It would have been especially useful, however, to examine (other than by grade) the particular types of students for whom attendance was stabilized. Were they primarily rural, scheduled caste and girls as other studies suggest they might be? We cannot draw any conclusions from these data.

The 1982 evaluation of Title II programs in the Philippines by Blumenfeld and colleagues (7) poses an interesting context for studying the impact of an SFP on attendance: one where primary school enrollments are already high. In such a setting it can be presumed that parents and students either value education or see some clear benefit stream associated with it. In the Philippines, overall primary school enrollment is between 94 and 97 percent. Under such circumstances it is not likely that an SFP would have a significant impact on overall enrollment, although it might influence the enrollment behavior of particular segments of the school aged population.

Unfortunately, the research team was not able to compare enrollment ratios for SFP and non-SFP schools. Likewise, no longitudinal data were obtained on drop-out rates. With regard to attendance, days of attendance for two program and two non-program schools were compared for one school year. No statistically significant differences were found.

The investigators did not describe the procedures they used to obtain attendance data, nor the statistical tests they applied. It is therefore difficult to provide a suitable methodological critique. The major study weakness, however, is certainly the failure to examine differential impacts of the SFP on particular segments of the school-aged population. Some studies, for example, suggest that the attendance rate of first-graders is particularly amenable to an SFP intervention while others take the opposite point of view. However, data were not disaggregated by age, sex, community size or SES. Thus, the potential attendance or enrollment impact of the SFP on those most in need or most underserved by existing governmental programs is not assessed.

This review of comparative studies on the attendance-related impact of SFPs concludes with what is perhaps the most ambitious and conceptually complex work presented thus far: the 1974-75 studies by Checchi, Inc. on feeding programs in Colombia, Kenya and the Philippines (28, 29, 30). These studies are comparative in two ways. First, they examine the impact of SFPs by comparing fed to non-fed schools. However, they also offer cross-national comparisons that shed some light on how the ecology of a program influences impact.

Methodologically, the studies offer what appears to be the soundest approach to the examination of SFP impact, sociological path analysis. This technique is an application of multiple regression. Briefly, the approach calls for the computation of correlation coefficients among all the variables of interest in the evaluation. These coefficients are based on the maximal numbers of cases available and measure simple relationships between pairs of factors. They are then combined into a single measure of project impact through the use of multiple regressions, and yield as an ultimate measure of project effects, a statistic known as a beta weight. Technically, this is the standardized partial regression coefficient for the project on an outcome variable, controlling for a package of background and other factors.

Beta weights can be interpreted roughly in the same manner as a Pearson product moment correlation coefficient. The direction of the relationship is given by the sign while its strength is shown by the magnitude of the beta weight. However, the beta weight has a causal implication which the correlation coefficient does not, and it also has no upper or lower bounds.

The researchers examined both SFP and non-SFP schools, where children in the first and third grades were interviewed, measured for height and weight and tested for scholastic ability. Interviews were held with the children's mothers or guardians, their teachers and the principals or headmasters of their schools. All field work was carried out in collaboration with host country researchers.

Conceptually, the research team identified three major types of important variables relating to impact: target population traits, program characteristics and site-related factors. Target population variables include age, social class and sex. Program characteristics refer to type and amount of ration, extent of commodity shortages or delays in delivery, special features such as the use of pre-packaged rations (e.g., Nutribun), quality of local management and age of program. Site-related variables include climate, geography, local food habits, economy, public health services, local government capability and other distinctions needed for cross-national comparisons.

The study used the following approach: (a) a sample was drawn of feeding program recipients; another sample of those not reached by the program was also drawn. (b) Extensive data were gathered on the background of all respondents to allow for some of the more obvious

sources of differences among these two groups of people. (c) An analysis was conducted of the differences between the two groups (fed versus non-fed) and the program's apparent contribution to those differences. (d) An analysis was also conducted among only those with more versus less exposure to the program. This was done in recognition of the researchers' probable inability to anticipate every relevant distinction between the two groups.

The research team concluded that if the fed- and non-fed analysis agreed with the more exposure-less exposure one, they could feel confident about passing judgment on the program. When the analyses were in disagreement, they used other facts at their disposal to see if a sensible interpretation were possible including a great deal of factual and impressionistic data deliberately sought out for this purpose. These two modes of analysis--fed versus non-fed and more exposure versus less exposure--provided the theoretical rationale for three types of summary judgments about feeding programs. Programs were assessed as being of the following:

- o Effective--significant net effects were produced according to both modes of analysis.
- o Probably effective--the two analyses did not agree and additional data were sought out to resolve these ambiguities.
- o Ineffective--neither mode of analysis suggested any impact.

In summary, a child feeding program may look favorable when people in it are compared to those not reached by it. It may also look good by producing evidence of its impact on those who have been in the program for longer periods of time compared to those with less exposure. The researchers felt they could only be confident of the judgment about a program where both criteria agreed.

These principles were operationalized using the beta weights to derive a comparative ranking of school feeding programs based on the relationship between program exposure and measures of impact. To ensure that conclusions would not be drawn from data that might be substantially trivial or statistically insignificant, all of the associations with a strength of less than  $+0.10$  were treated as if they were zero. Any strong negative associations were treated as signs of a badly defective program. In effect, the beta weights reported for school attendance tell the proportion of the variation in attendance patterns of children that can be attributed to feeding, assuming all other factors in the model are held constant. It thus provides a single result based on all of the data available instead of several results each dependent on particular subgroups. This allows the researcher to work with fewer cases than would be needed for an alternative approach.

Of the fifteen programs reviewed by the research team in the three countries noted, three were judged as "effective on attendance" and ten were considered "probably effective on attendance." The remaining two were assessed as "ineffective on attendance."

Three other measures of impact were also used in the study: nutritional status (weight for height), school performance and food habits. Of the four measures of impact, the SFPs had their most pronounced effect on school attendance. Four schools, however, showed negative results when comparisons were made with control schools, but this was primarily due to very high attendance rates at those sites. School children there attended about 98 percent on the average, making it nearly impossible for the program schools to do any better.

Comments by principals concerning attendance tended to concur with the objective data. Nearly all said they thought the SFP encouraged children to come to school daily. Furthermore, some said that the food also encouraged children to stay for the afternoon session instead of leaving at midday.

In all three countries teachers had mixed reactions when asked about the ability of the SFP to attract children. Many said that attendance was already good and that the SFP's impact was therefore small. In Kenya, third grade teachers noted some effect, while first grade teachers saw no impact. The authors suggest that this may well be a function of greater attendance problems for older children. In Colombia, where school attendance was already fairly high, it was inferred that pressing reasons account for those who do not attend regularly, particularly the need for child labor. These observations lead the authors to conclude that it may be difficult for such incentives as low-cost lunches to make a significant difference in Colombian school attendance. In the Philippines, they note, where formal education is probably more greatly valued than in the other two countries, school attendance was already very high, making it difficult for an SFP to have much of a general impact. In the case of Kenya, school attendance was lower overall than the other two countries; however, they assume that the use of school fees there (a practice since dropped) meant that the financial burden of attending school probably outweighed the value of the food incentive.

Retrospective attendance records for the six-year period (1968-1973) were obtained from principals at each school. In most cases, no clear pattern of effects showed up when comparisons were made before and after initiation of the SFP. However, three of the schools did show favorable results when compared with the respective control schools over the six-year period. All three also looked favorable on the basis of the survey analysis.

The researchers' approach to measuring attendance encompassed initial enrollment, dropping out and daily attendance. Of the three, they found that daily attendance provided the most reliable information,

while enrollment and dropout data were difficult or in some places impossible to obtain.

Daily attendance was measured in two ways. First, data were obtained from teachers' records for the number of days individual students were present at the school for the one-month period prior to the survey, as a percentage of the total number of days school was in session during the same period. This provided a measure of each child's current propensity to attend school. Reasons for absences and distances to schools, as reported by children and their mothers, were also recorded. Second, the longitudinal information previously noted was obtained from principals who were asked to provide records for the last six years of average annual school attendance and enrollment, by grade levels. This provided a measure of propensity to attend for each cohort (grade) over a six-year period.

The researchers felt that the measurement of enrollment effects demanded the gathering of data on potential enrollments so that these could be related to actual enrollments. These data proved to be impossible to obtain, however, in all three countries. Problems of defining school "districts," estimating school-aged populations, estimating school capacities, and knowing enrollments of other schools within the same geographic area, were insurmountable obstacles.

The team sought to draw conclusions about those traits that tended to characterize the more effective programs. Among the variables they examined were the type of feeding, the age of the program, how high food fees were, frequency of interruptions to the program, whether food was taken home, how many days per year the food was served, the sponsoring agency, and annual estimates of per-recipient costs. Of all these characteristics, they found several that seemed to distinguish the more effective operations where "effectiveness" refers not only to school attendance, but also nutritional status, school performance and food habits (as measured through a student 24-hour recall survey). These traits include: (a) selectivity within the school as to which children receive the food; (b) having a large number of feeding days per year and few feeding interruptions; (c) having hot lunches as opposed to other forms of feeding; and (d) having less food taken home.

Equally noteworthy are the factors that did not seem to make much of a difference: the age of the programs, the food fees, program sponsor or costs. The researchers' finding that selectivity within the school makes a difference stems mainly from the variations in nutritional status among children rather than differences in attendance. If everyone at school receives an SFP-lunch, then both the more and less healthy students get fed. The effect of the program is then muted because it is more difficult to bestow nutritional status benefits on relatively healthy children. However, this finding appears to be applicable to the nutritional status objective rather than to attendance.

The authors note that, in general, SFPs must be very carefully targeted. Their data suggest that programs are more effective in stable, poorer, rural areas. They attribute this to the fact that in such zones SFPs may be a relatively greater incentive for increased attendance. A strong structural effect can operate in school programs, they surmise, so that a population of those on the borderline of their own development scale--the poorer people among those who are able to send children to school--are especially likely to benefit. They also found that the best predictor of student attendance was household possessions. Children from the better off homes attended the most. This provides additional support for the notion that economically borderline children may appear to derive the most benefit from SFPs. Interestingly, the next most potent predictor for attendance was nutritional status which, of course, was intended to be influenced by the SFP. It appears that when SFPs can impact on nutritional status a useful synergy is created so that attendance benefits are also produced.

One of the most provocative insights from these studies is the notion that models of working feeding programs implicitly reflect a program planner's conceptions about the way an SFP should function. If this is the case, then ineffectiveness is probably due to a lack of fit between the assumptions inherent in the design of the effort and the actual conditions found in the field. The use of path analysis provides a means to test this reasoning by examining where the largest number of "incorrect paths"--a shorthand term for unanticipated cause-and-effect linkages--appear. In this three country SFP analysis, Colombia showed the greatest number of "incorrect" paths, while Kenya showed the lowest. This leads the investigators to conclude that the theoretical model for school feeding is better suited to less developed areas.

The major strengths of this work includes the following:

- o the use of multiple sources of data--Survey research and analysis of retrospective records were incorporated into the study design. Interviews with children, their mothers, teachers and principals permitted access to both factual and impressionistic data.
- o the collaboration with host country researchers in each of the three field sites.
- o the use of a conceptual model together with appropriate statistical methods to facilitate identification of causal linkages and important ecological considerations related to program effectiveness--Path analysis allowed the researchers to assess the relative impact of a complex package of variables on attendance. The methodology also enabled the researchers to account for sources of differences among programs, sites and participants.
- o the use of multiple attendance measures--Data were gathered

to determine the child's current propensity as well as the cohort's longitudinal propensity to attend school.

- o the use of two different modes of analysis to assess effectiveness--Comparisons were made between both the fed versus non-fed and the more exposed versus less exposed. Only when agreement between these two levels of analysis was obtained, did the program receive an "effective" rating. When a beta weight above +.10 was obtained on one but not both measures, additional impressionistic data were gathered and a "probably effective" rating was assigned.

In light of this impressive array of strengths, it is especially important to note the study's weaknesses. These include the following:

- o the failure to examine differential impacts within schools for boys versus girls, more distant versus less distant students, and younger versus older children;
- o the relatively small number of SFP sites (five) in each country;
- o the lack of a satisfactory solution to the problem of gathering enrollment ratio data;
- o the lack of an analysis that takes seasonal variation in attendance patterns into consideration;
- o an incomplete explanation of the specific criteria and processes used in selecting the control sites; and
- o the predominantly cross-sectional nature of the data which consequently fails to provide any insight into longitudinal changes.

It should be noted that Cotten's analysis of the SFP in Haiti discussed earlier in this section is, in large measure, an attempt to address the latter shortcoming by applying much of the methodology used by the Checchi team in a longitudinal fashion. This work by Cotton points up the study's greatest strength: the applicability of its basic methodology to new inquiries on the impact of SFPs. As the number of applications grows, a more fruitful body of literature on the topic will undoubtedly emerge.

What then can we conclude from the six comparative studies reviewed here? Together, the accumulated research suggests that SFPs may be most effective in meeting their attendance-related objective in settings where attendance is not already high and where children come from relatively low SES backgrounds. In such cases, feeding may indeed be an

incentive. Several of the studies also point to the need for program regularity to achieve an impact on children's school-going habits. These findings have serious implications for targeting both to need and the probability that program regularity can be maintained.

In general, the methods used in the Checchi team's work can and should be applied to other comparative studies although provision to address the weaknesses noted earlier should be made.

Other broad guidelines for conducting comparative studies to assess the impact of SFPs on attendance and enrollment include the following:

- o The ration size served at the actual sites under analysis should be determined, and the impact of alternative ration sizes should be assessed. In this same vein, the impact of snack versus hot lunch programs should also be measured more systematically.
- o Tested, culturally relevant and observable indicators of family and community background must be incorporated into the study design. These are especially important in comparative studies so that the interpretation of differences between fed and non-fed schools occurs within the appropriate context. Such differences must be systematically introduced into the analysis along with the many socioeconomic factors that might influence attendance.
- o Survey instruments should be used that are relatively short and simple. It is clearly preferable to work with a small number of well measured variables than many variables captured unreliably or invalidly. Multiple sources of data also enhance the measurement of key variables.
- o A variety of sites and settings within a country should be evaluated so that a realistic picture of how the program operates can be obtained.
- o Quality controls for record-keeping systems should be developed and installed so that attendance and program participation data are useful.
- o A longitudinal or time dimension should be incorporated into study design through repetitive site or cohort measurements.
- o It is necessary to determine the total months during which the individual has actually been participating in the SFP.
- o Suitable methods for calculating enrollment ratios must be devised. This primarily involves a procedure for assessing cohort size. Local birth rates as captured through church records, birth certificates or interviews with midwives and

clinic personnel could be discounted by reasonable estimates of infant mortality rates and out-migration patterns. Or, alternatively, a household sampling procedure might be used. School districts could be empirically set by using mapping techniques to define the geographic area from which the school has drawn students over a five-year period.

- o The differential impacts of SFPs should be included on any assessment of program effectiveness. In particular, analysis should be focus on whether girls proportionately derive any special benefit. If, for example, SFPs act as a greater incentive for girls to enroll and attend, this finding may have significant implications for population programs. This is because of the strong positive relationship that normally exists in ldc's between a women's education and fertility. Likewise, given the very strong positive relationship that also normally exists between a women's education and the educational attainment of her children, special impact on girls may have long-term, cross-generational significance for future enrollment ratios and attendance rates.
- o Care should be taken in selecting an appropriate level of significance to measure differences between fed and non-fed schools. The need to guard against accepting false null hypothesis (the case where researchers conclude that the program makes no difference when indeed it does) must be weighed against the need to accept the null hypothesis when it is true (the case where researchers conclude the program makes no difference and, in fact, this is precisely the case). Using more than one level of significance for interpreting findings may be helpful in this regard. Where findings are significant at both the .20 and .05 levels, there can be little doubt about their validity. Yet, a finding only significant at the .20 level may be justifiably (albeit tentatively) accepted if impressionistic data gathered from interviews and observations suggest that a program ought to be given the benefit of a doubt. Re-evaluation or longitudinal assessment should be conducted, however, to clear up these ambiguities over time.
- o The impact of SFPs on attendance and enrollment cannot be completely measured without longitudinal data on drop-out rates. If such programs reduce the variance for attendance and help stabilize enrollment (as suggested by some of the research), we should expect to see a change in drop-out rates as well. Since school desertion is one of the greatest obstacles to the efficient functioning of educational systems, this potential benefit from SFPs needs to be examined most carefully.
- o The contextual factors that contribute to program regularity

need to be identified and accounted for in future research efforts perhaps through multiple regression procedures. Urban areas, for example, may be more likely to have efficient programs because of their accessibility. They may also attract relatively better off students than inefficient, rural, deprived areas. Thus, impact differences between regular and irregular programs may be less related to efficiency than SES.

In summary, comparative studies such as those conducted by Checchi, Inc. hold out the promise of an increased understanding of what makes programs work in a variety of settings. However, the design of these studies must be based on a thorough understanding of both the differences and similarities among the sites being compared. Where resources do not allow for such differences to be accounted for through fairly complex statistical procedures, retrospective or prospective analyses are probably preferable.

3. Non-Comparative Studies. Eight studies covering eleven different countries examined the impact of SFPs on attendance and enrollment using primarily impressionistic data drawn from teachers. Most of these studies failed to provide systematically for control groups. Likewise, data are neither retrospective nor longitudinal. The major contribution of these studies, consequently, is limited to what they have to say about the conventional wisdom concerning SFPs rather than the insights they contain regarding methodology or impact. Significantly, seven of the eight noted a positive programmatic impact on attendance and enrollment, while only one drew mixed conclusions. Because of their methodological imprecision, they are given relatively cursory review here.

In 1981, the Food for Peace program in Ghana was evaluated by a team, including members from Development Associates, USAID/Ghana, the Ghanaian Ministry of Health and several Ghanaian nutritionists serving as consultants (52). Included in their study were eleven SFPs. Program managers and teachers reported that more children attended when there were meals and that illness was lower. They also felt children were able to pay greater attention to their lessons, thus facilitating learning. Teachers often noted that many of the children came to school without breakfast and that without the lunch it would be difficult for them to study.

Sites were selected to approximate proportionate stratifications based on political region, rural-urban differences, program type, sponsoring agency and number of recipients. Three weeks were spent in the field. All data relating to attendance and enrollment were gathered through interviews of school personnel only.

Gorecki's 1978 study of an SFP in Honduras (40) presents conclusions that are similar to those for Ghana in both their nature and derivation. She reported that 97 percent of the 53 teachers interviewed agreed with the proposition that school snacks increased attendance. It should be noted, however, that all teachers stated that in general morning attendance was always higher than in the afternoon with or without a snack program. The majority also believed that the snack was often the child's first meal of the day, especially among poorer families. Another prevalent teacher opinion was that the children slowed down in the mid-morning and that the snack helped increase their attention span.

The sample for this study was divided into large and small schools, using an enrollment of 100 as the dividing point. This was done to increase the chances of selection for the larger, often urban schools. In total, 21 schools were surveyed.

The 1977 study done by Clapp and Mayne, Inc. on the SFP in Honduras (22) coincides with Gorecki's findings. Means to assess impact on attendance included the review of subjective opinions expressed by teachers, an analysis of school attendance on the morning and afternoon sessions of corresponding periods and a before-after comparison of schools with and without an SFP.

The researchers found that 73 percent of the 51 teachers believed that SFPs were instrumental in stimulating better attendance at school. Several respondents noted that there was better attendance in the morning, when the food was served than in the afternoon. The supporting data with respect to this observation, however, were drawn from only two schools and are inconclusive.

In terms of a direct impact of the meal on attendance, the team secured one example of a school where the food had been served and was discontinued, and another where the program began only the year before. In the first instance, attendance appeared to increase and then drop again. In the other, enrollment increased from 276 to 320 when the SFP was introduced.

None of the findings presented in the report was supported by statistically valid sampling procedures and an adequate number of cases. Virtually all potentially intervening variables are not accounted for in the research design.

Three studies evaluate the impact of SFPs on attendance and enrollment in India (9, 10, 24). They all involve the collection of impressionistic data and the analysis of qualitative aspects of the program. All likewise concurred that SFP positively influenced enrollment and attendance. One of the studies (10), for example, found that 73 percent of the teachers surveyed believed the program led to increased enrollment or attendance. Another (24) reported that all subjects interviewed--including governmental officials, CARE personnel,

teachers and parents--believed that the food served as an attendance incentive for both children and their parents.

The 1981 evaluation of Food for Peace Programs in Upper Volta (49) also included information on school enrollments and absenteeism drawn from interviews with school directors. The authors report that at many schools the directors felt that the SFP provided an important motivation for attendance. However, at several others, the directors said the desire for schooling was high and attendance was good even without the additional incentive of a school lunch. Teachers also reported that the program improved children's attention span, especially in the afternoon. While there is little hard evidence in support of the program's impact, the school directors' remarks about the marginality of the program when attendance is already high is consistent with the findings of Blumenfeld for the Philippines and the Checchi three-country survey.

An eight country global assessment of the Food for Peace programs of Colombia, Dominican Republic, Ghana, Indonesia, Malaysia, Morocco, the Philippines and Sri Lanka was undertaken by Checchi, Inc. in 1972 (21). With respect to SFPs, the researchers found that there was little conclusive evidence to support the notion that the programs have a long-term positive impact on nutritional status, learning receptivity or attendance of children who are in school. In the eight countries sampled, the only evidence available to the team was in the form of teacher judgment. Most respondents reported that children appeared to be more alert or active when they received a meal or snack. The authors rightfully note, however, that more research is necessary before any positive correlation between SFPs and improved attendance or performance can be made. This judgment is based not on the presence of contradictory data, but on the lack of firm support for the program's hypotheses.

4. Determinants of School Attendance and Enrollment Studies. Unlike the other research reviewed thus far, the two studies included here do not deal specifically with the impact of SFPs. Rather, they represent an attempt to examine the interrelationships among a wide variety of SES-related variables. Included in the analyses are important insights into why some children are likelier than others to attend school. They also deal very specifically with how school enrollment is influenced by nutritional status.

Malnourished Children of the Rural Poor (4) describes the findings of the Berkeley Project on Education and Nutrition. The overall work, published in 1981, presents findings on: (a) the effects of nutrition and health on school participation and performance; (b) the relationship between literacy and agricultural productivity; and (c) the relationship between women's education and family size. The data base for these analyses came from two related research projects. The first was a longitudinal study done by the Institute for Nutrition in Central America and Panama (INCAP) and funded by the National Institute

of Child Health and Development between 1969 and 1978. The other was done by RAND (through Rockefeller Foundation funding) in 1974-75. The earlier projects involved the collection of data in four eastern Guatemalan villages on physiological, nutritional, socioeconomic and psychological variables, where particular attention was paid to interactions among types of variables. The Berkeley team used the wealth of material amassed to conduct additional analytical studies.

The investigators found that in Guatemala, decisions to enroll a child in school appear to be affected by parents' need for the child's help, by parental perceptions concerning the value of schooling and by the child's apparent competence. In the one village where work for children was readily available and where parents' educational background was relatively low, school enrollment was affected positively by family affluence but not by apparent differences in the child's weight, height or verbal proficiency. In the other villages, where parents had relatively more education and work was not so readily available for children, the factors of height and verbal performance at age seven were positively and highly significantly related to school enrollment.

When family economic groups were separated, it was found that for children of semi-subsistence farming families decisions on enrollment appear to be positively determined by affluence of parents, size of child, and by the child's position in the family. Children born earlier in the family order were more likely to attend school than those with older siblings. In general, the researchers concluded that when economic and family background factors were held constant, size and health of children acted as independent, positive determinants of children's school attendance and performance. Size of child is, in effect, a proxy for prior nutrition.

There are several implications of these findings for SFP design. First, it seems likely that where the need for child labor and availability of employment opportunities for children co-exist, SFPs are likely to act as incentives for school attendance only when the ration size is large enough so that feeding can be viewed by parents as a significant income transfer program. In such circumstances, it might even be desirable for children to take part of the ration home.

Second, the impact of any SFP seems to be the function of an interaction between the environment in which it operates as well as the features incorporated into its design. To have an impact on attendance or enrollment in a very marginal community, an SFP must incorporate special design features that may not be needed for a borderline community. And, once a threshold is crossed (as in the case of Colombia or the Philippines), impact on enrollment or attendance is likely to be relatively small.

Third, the Berkeley team found very different patterns of school enrollment for boys and girls with girls' work in the household being highly valued and therefore serving as a significant disincentive to school enrollment. This tends to suggest, once again, the need to look at differential impacts of SFPs on attendance between boys and girls. Even relatively small overall enrollment gains may be highly significant if new female enrollment accounts for much of the change.

Finally, the finding that size and health of child act as independent, positive determinants of children's school attendance and performance has important ramifications for SFPs. Since size is a proxy for nutritional status, this suggests that where SFPs can be designed to have an impact on nutritional status, impact on attendance and performance will also be achieved. Thus, proper targeting and the provision of an adequately sized ration become design issues not only related to changes in nutritional status, but to attendance and performance outcomes as well.

A second study to demonstrate the negative effects of malnutrition on school enrollment and grade attainment is Moock and Leslie's 1982 work in the Terai region of Nepal (64). Their research involved a population of approximately 400 school-aged children from subsistence farm families as part of a follow-up study initiated by the World Bank to investigate the relationship between schooling and various dimensions of rural development. Earlier research by Jamison and Lockheed (1981) found that important determinants of school enrollment were sex (with boys much more likely to enroll), caste, parental schooling, and the presence of "modern" attitudes.

With respect to school enrollment, the purpose of the analysis was to determine how individual, parental, household and community variables affect the probability of a child's being enrolled in school. The researchers found that older children were significantly more likely than younger children to be in school. Both height-for-weight and weight-for-height (but not a third nutritional status variable, hemoglobin level) also contributed positively and significantly to the probability of a child's being enrolled in school. Height-for-age, a measure of chronic malnutrition, appeared to be a better predictor than weight-for-height, a measure of acute malnutrition and, in fact, was the best single predictor of whether or not a child was enrolled in school. The influence of the nutritional status variables appeared to be greater for boys than for girls.

The statistical relationship between nutritional status and enrollment remained strong when additional variables were entered into the analysis as controls. Four background variables were also found to have significant direct effects on the probability of a child's enrollment in school: father's schooling, farm size, income from rice and wheat, and membership in a low-status caste. Farm size exerted a negative influence that seemed to be greater for children whose height for age fell in the normal range than for stunted children whose

potential contribution to farm production is probably smaller.

These findings are consistent with those of the Berkeley team's. Once again, the need emerges for an SFP to be both an effective income transfer scheme and sufficiently nutritious so that it influences height-for-weight and height-for-age measurements.

Moock and Leslie note that the importance of height as a determinant of school enrollment and performance depends on the general level of nutrition in the population. In an impoverished environment, height is a good indicator of an individual's long-term nutritional status.

This study, along with the Berkeley work, adds to the evidence supporting the view that efforts to improve child nutritional status may have educational as well as survival and health benefits. The implication for SFP design is that programs that are most effective in improving nutritional status, are also most likely to be effective in improving enrollment and attendance.

5. Other Relevant Studies: the United States. To conclude this literature review on the impact of SFPs on school enrollment and attendance, three studies conducted in the U.S. will be briefly noted. All three found no positive relationship between feeding and attendance or enrollment. Their inclusion here is mainly to highlight the breadth and scope of research in this field as well as to emphasize once again the need for appropriate targeting, longitudinal research and care in reaching judgments about program effectiveness based on incomplete or inadequate comparisons.

Lieberman's 1967 evaluation of a ghetto school breakfast program (60) involved a comparison between two adjacent elementary schools, only one of which was fed. Interviews were held to gather dietary and social data, and student attendance and performance records were reviewed. In addition, physical, anthropometric and psychological tests were conducted on the sample which included third through sixth graders. Lieberman's major findings can be summarized as follows: (a) average nutrient intake as reported by students was similar at both schools; (b) there were no significant differences in student height and weight between the two schools; (c) no significant differences in attendance existed between the two schools; and (d) no significant differences in student performance existed between the two schools.

Although this work was longitudinal, the time span was probably too short to detect any program effect. Much more significant, however, is the fact that the program was not serving students who showed signs of malnutrition. This inadequate targeting undoubtedly influenced impact. Furthermore, the researcher did not attempt to control for student participation in other SFPs available at the same site, thereby making it difficult to generalize from these research results.

Fellers' 1967 research (cited in 67 and 68) examined the effect of school breakfast programs on school grades and drop-out rates. Participants and non-participants were found to have similar final grades and no differences in drop-out rates. The sample included 198 participants and non-participants drawn from the tenth grade of one school. At the end of the school year, a comparison of grades and drop-out rates was made. The methodology did not control for program exposure (no records were kept on the number of servings received by each child) although it was clear that not all children participated equally. Furthermore, data drawn over the course of one school year seem inadequate when gauging drop-out behaviors.

A different kind of comparison was undertaken by Koonce in 1972 (cited in 67 and 68) in attempting to detect differences between children who received both breakfast and lunch at school and those who were served only lunch. Children who participated in neither program were also included. The sample included 60 children from first to third grades. The attendance portion of the study involved the review of school records. No difference was found with respect to absenteeism when the two participation groups were compared to each other and with non-participating students. The researcher, however, did not control for frequency of program participation and limited the study to a very small number of subjects. Furthermore, data on attendance was drawn over a three-month period. This may be too short to capture attendance trends.

In summary, the three studies cited here capture some of the methodological problems inherent in examining the attendance- and enrollment-related impacts of school feeding: the need to control for program exposure, SES and seasonal variations as well as the difficulty of discerning long-term effects (particularly on drop-out rates) without longitudinal data. As a result, their findings must be treated as inconclusive. They do tend, however, to support the observation advanced by Checchi, Inc. in its three-country study of SFPs. The Checchi researchers noted the increasing likelihood of "incorrect paths" where schooling is nearly universal. Perhaps the situation in the U.S.--even in its relatively poorest communities--is not sufficiently precarious for SFPs to influence attendance, enrollment or drop-out behaviors.

6. Conclusions, Do SFPs make a difference with respect to school attendance and enrollment? The most appropriate answer seems to be that they probably do when there is a good fit between the SFP design and the environment in which the program operates. In many cases, however, judging from the literature, the fit may not be present or the evidence to support it is inconclusive.

Perhaps the most interesting conclusion one can draw from the 22 studies discussed in this review is that, in general, the most rigorously designed studies are also, as a group, the least conclusive.

The impact of SFPs on attendance and enrollment stems from a complex set of assumptions and relationships among many variables that are neither linear nor clearcut in many cases. It is, therefore, not surprising that a consistent pattern does not emerge from an analysis of the research done in this area. There is a need for a conceptual model that can explain these relationships for a variety of environments. If nothing else, the major finding one reaches when looking at the body of literature as a whole is that SFP impact is a function of program ecology. Yet, we do not have crisp guidelines to aid us in formulating policy for a variety of ecological settings.

Several of the attendance studies seem to support the view that SFPs work best in poor, stable, rural areas. They seem to be less effective when the poverty is abject and the need for child labor is great. However, alternative designs that stress the income transfer potential in SFPs might alter this pattern.

Our picture of how SFPs operate on different segments of the population is incomplete. Are older or younger students more likely to remain in school because of an SFP? How does impact for boys differ from girls? If we had a better picture of differential impact, it would be possible to alter program designs accordingly. For example, if the enrollment ratio of girls is significantly lower than for boys, and if program planners were particularly interested in closing this gap (perhaps because of their awareness of how a mother's education influences fertility and the health and education prospects of future generations), it might be advisable to consider alternative means for targeting programs to girls. This might include a larger ration for girls, different eligibility requirements for boys and girls, and different messages to parents about the program and its benefits. This example illustrates why additional research is needed about how environmental factors influence program impact. If such a body of knowledge existed, program designers could put together the right package of features to achieve desired outcomes. The findings we currently have at our disposal do lead to a few design recommendations. These include the following:

- o In very marginal communities, SFPs must be designed as both an income transfer scheme and as a nutrition supplement for enrollment and attendance benefits to occur.
- o In general, it appears that those SFPs with the greatest impact on nutritional status will also be most effective in improving attendance.
- o Program regularity (or efficiency) is critical to the success of any effort to increase enrollment or attendance through an SFP.
- o Parents must be made aware of the program and its benefits for the full potential impact on attendance and enrollment

to be achieved.

With respect to methodology, both retrospective and comparative studies show great promise when contextual variables are accounted for in the research design. The sociological path analysis used by Cotten in Haiti and the Checchi team in Colombia, Kenya and the Philippines is especially promising in terms of the insights it can offer when applied longitudinally. In general, care must be taken when doing either kind of study to use multiple measures to gauge both program participation and impact. For comparative studies, the systematic biases introduced by targeting must also be accounted for in the research design. These biases sometimes operate to favor affluent schools, while in other cases the opposite is true. Finally, for both types of studies more attention needs to be focused on how SFPs alter drop-out rates and seasonal variations in attendance.

In the following chapter the impact of SFPs on academic performance and cognitive development is examined. We will once again be confronted with evidence that suggests that impact is most decidedly a function of both program characteristics and the environment in which the SFP operates.

Chapter III  
A Review of the Literature:  
Cognitive Development and School Achievement

This chapter will focus on three categories of research that are useful in assessing the actual and potential impact of school feeding programs on the cognitive development and academic achievement of participating students. The first type of study analyzes the relationship between diet and cognitive development. This body of research suggests that the level of a student's cognitive performance is, in part, a function of the adequacy of his diet. The importance of these studies is that they establish a theoretical and empirical framework for a major claim made by advocates of SFPs, namely that when such programs provide undernourished participants with an adequate diet, cognitive development outcomes can be reasonably anticipated. These outcomes would include improved test scores, decreased repetition of grades, and, to the extent that school desertion is in part a response to academic difficulty, decreased drop-out and absenteeism rates. The level of an individual's educational attainment is closely associated with a raft of development concerns including worker productivity, family health/nutrition status, income, fertility rates, propensity to modernize and risk-taking. Thus, the SFP that demonstrably promotes improvements in students' academic performance and cognitive development is, from a developmental standpoint, potentially quite significant.

The second category of studies to be reviewed in this chapter analyzes the relationship between SFP participation, and cognitive development in ldc's. The purpose of the first group of studies is to test the linkage between food intake in general and cognitive development. The second set of analyses permits us to test this same linkage in the context of an SFP operating in a developing country.

The final group of studies to be examined analyzes the relationship between SFP participation and cognitive development in industrialized nations. In the previous chapter, it was argued that the ecology in which an SFP operates significantly influences the nature and extent of program outcomes. It is in keeping with this line of reasoning--which appears valid for outcomes related to school attendance and enrollment--that the distinction between developed and developing countries has been introduced.

1. Studies on the Relationship Between Diet and Cognitive Development. The Nutritional Academy of Sciences was asked by the President in 1979 to determine what the research community could do to alleviate world malnutrition. In response to this invitation, a study team was formed and research objectives were identified. Investigation of the relationship between food intake and function was given the highest priority due to the consensus achieved in support of the view that malnutrition affects human capacities and behaviors in ways

inimical to societal development.

Subsequently, AID, in an effort to advance such a research program further, asked the Committee on International Nutrition Programs of the Food and Nutrition Board, National Research Council, to convene a workshop (held in July 1977) to identify the major functional areas to be investigated. Eventually, five were selected, including three that are relevant to the present study: work output, cognitive function and social/behavioral function.

In 1978, the University of California, Berkeley, was awarded a planning grant by AID to establish a collaborative research program in these areas. In partial fulfillment of this contract, the University published a report in 1980 (8), that summarizes the state of knowledge concerning how varying levels of food/energy intake affect the individual's ability to function in society.

With respect to cognitive development and social functioning, the report noted that mild-moderate malnutrition acts synergistically with social-environmental factors to affect cognitive function. Experimentally, however, it is difficult to separate the specific contributions of each. Most of the reports relating malnutrition with cognitive deficits come from animal research (particularly rat studies) and neurobiological evidence. Mildly malnourished primates do not demonstrate primary learning deficits but they do show passivity, apathy, shortened attention span, and failure to acclimate themselves to repetitive stimuli. Studies on preschool and school-age children are consistent with these findings, further suggesting that malnutrition may be associated with deficient performance of tasks involving short-term memory and attention.

With respect to activity, the report notes that very little is known about the relationship between food intake and the ability to perform work. However, some evidence from studies undertaken in Guatemala suggests that increased caloric intake affects work output positively. There is no doubt that severe nutritional deficit restricts an individual's ability to work. Individuals with mild to moderate deficiencies, however, appear to perform at some "adapted" activity level. For example, one adaptation to caloric restriction appears to be an increase in resting or quiet activities.

A background paper on nutritional status and cognitive functioning by Riciutti and Brozek appears as an appendix to this report. The authors consider cognitive function to include memory, learning, problem solving, language acquisition and use, and abstract thinking. They note that because of the interaction between undernutrition and the adverse social and environmental circumstances in which it occurs, evidence of a direct causal relationship between mild-moderate undernutrition alone and impaired intellectual competence has not yet been established. Consequently, they argue, one of the major issues to which future research should be directed is the question of how mild-moderate

malnutrition and sociocultural, economic and other environmental influences combine in affecting mental development and cognitive capacity. One important aspect of this question is whether the consequences of mild-moderate malnutrition and of improved nutritional status due to supplementation vary as a function of an individual's social and physical environment. Recent research on severe malnutrition is cited by the authors to suggest that the effects of supplementation are greater in "unfavorable" environments than in "supportive" ones.

Riciutti and Brozek point out that in research on undernourished children, cognitive assessments have tended to be global, composite measures that rely heavily on IQ measurement. They conclude, however, that such assessments are likely to add relatively little new information into the ways in which nutrition and cognitive function are related. They posit that measures of specific cognitive processes hold out greater promise for obtaining useful data. Among the processes singled out for special consideration are: ability to mobilize and maintain attention; memory (both the acquisition and retention phases); behaviors for exploring and information-seeking; reaction to stimuli; the child's acquisition of language; and the child's progression through "stages" in the structure of thought (i.e., along the lines of the Piagetian model).

There has also been little research to date on other processes underlying intellectual performance and their relationship to malnutrition. These processes include sensory ability, (psychomotor function, speed of response, activity level and motor coordination) and temperament (apathy vs. striving, emotional stability, aggressiveness, impulse control, attitudes and responses to stress). These processes all involve maturation and change. Therefore, serial measurements will likely provide more useful answers to how nutritional status and behavior interact than measurements obtained at a single point in time.

Three other appendices to the Berkeley collaborative research report provide excellent literature reviews on malnutrition and the acquisition of competencies related to intellectual development and learning (Riciutti; Ratoosh; Barrett and Radke-Yarrow). Riciutti, summarizing many of these studies, notes that it is generally well known that protein-caloric malnutrition (PCM) may lead to substantial impairment of physical growth, including altered brain development, particularly if the nutritional deficits are early, severe, and long lasting. It also is the case that children who have experienced PCM tend to show reduced levels of intellectual development and school performance. However, the research of the past decade has shown that it is extremely difficult, if not impossible, to evaluate the independent effect of malnutrition as such on mental development, apart from the influence of various adverse social and environmental conditions typically associated with malnutrition and capable of having a substantial impact on children's intellectual development in their own right. There has thus been a tendency to move away from the assumption of a direct, causal relationship between early malnutrition, altered

brain development, and impaired intellectual functioning or mental retardation. Rather, there is increasing acceptance of the view that malnutrition must be examined in the environmental context in which it occurs and treated as one of the contributing factors leading to sub-optimal mental development. This is particularly true in the case of early, severe and prolonged malnutrition. The effects of mild-to-moderate, chronic undernutrition on intellectual development, however, are less well understood.

Several recent studies reflect this growing concern for understanding how malnutrition and various aspects of the child's social environment may interact in combination to influence psychological development synergistically. These investigations have particularly sought to obtain estimates of the independent contribution of nutritional versus socio-environmental factors on cognitive development. Most studies employing this analytic approach typically find that simple indices of nutritional status (e.g., height, weight, hemoglobin count) and of socioeconomic factors are positively correlated ( $r$ 's in the .20's to .30's), with correlations of about the same order of magnitude being found between each of these predictors and measures of intellectual competence. Regression analyses tend to show that both social factors and nutritional history make some independent contribution to intellectual competence, with the percentages of variance attributable to each source varying substantially from study to study. In Richardson's study (1976) of six-to-ten-year old Jamaican boys, for example, 29 percent of the variance was attributed to social factors versus 5 percent for severe early malnutrition. On the other hand, work by Christiansen, et al. (1974) on Colombian children ranging in age from six to thirty months attributed 18 percent of the variance to social factors and 32 percent to nutritional status. Regardless of the precise contribution of each category of variable, it has become increasingly apparent, however, on the basis of both human and animal studies, that a developmentally facilitative social environment may substantially attenuate or even prevent the potentially unfavorable consequences of early, severe malnutrition. Work by Richardson, Lloyd-Still et al., and Levitsky (see 8: pp. 272-273) is particularly relevant in this regard. Winnick, et al., for example, related the IQ's and school achievement scores of adopted Korean children in American homes to the degree of early nutrition as indexed by height and weight before age two. They found that the children's new, enriched environments led to significantly improved cognitive development.

Research findings suggest that the malnourished child's interactions with his environment make him less likely to seek out, utilize and respond to available opportunities for learning and social interactions. Although in the late sixties and early seventies it was assumed by many researchers that the brain changes produced by malnutrition led directly to an impairment of learning, which was often irreversible, more recent studies have led most investigators to abandon this position. Currently, the most widely accepted hypothesis is that malnutrition exerts its major influence on behavioral competencies

through dysfunctional changes in attention, responsiveness, motivation and emotionality, rather than through a more direct impairment of basic ability to learn. This situation implies quite hopeful prospects for reversibility or remediation (e.g., through an SFP with a cognitively oriented component attached to it), since it is possible to manipulate the child's environment--particularly the school segment--to make his interaction with it more intellectually facilitative. Ratoosh, in his analysis of research related to nutrition and psychological development, goes one step further and argues that empirical evidence drawn from current research supports the view that improvement of a child's diet alone can lead only to small changes in cognitive and social development. Meaningful change in this area only occurs when dietary change is accompanied by enrichment of the child's psychological and social environment (8: 301). Richardson's work, for example, indicated that malnourished boys differed significantly from the comparison boys on a number of unmatched but relevant variables (see 8: 305). He concluded that emphasis needs to be shifted away from nutrition as a primary cause of impairment to a broader concern for the total ecology of child development.

Related findings were reported by DeLicardie and Cravioto (1974) in their study of the responsiveness of 22 five-year-olds who survived clinically severe malnutrition to the "cognitive demands" of an intelligence test administration (see 8: 306). Results indicated that survivors of malnutrition showed a lower proportion of work responses than controls matched for IQ and sex.

In a similar vein, Patel, et al. (1974), reported on the effects of undernutrition as opposed to severe malnutrition in young children (see 8: 306). The authors concluded that nutritional status was only one environmental influence on intelligence. They found evidence to suggest that any nutritional intervention program must also consider factors other than nutrition that might serve to rehabilitate deficiencies initially caused by poor nutrition.

One of the most frequently cited studies in the malnutrition literature was carried out in Guatemala by Cravioto, DeLicardie and Birch (1966). Children from a rural village population were rank ordered by height. The upper and lower quartile groups were then compared on a number of cross-modal sensory tasks. The rationale for comparing the upper and lower quartiles was that the upper quartile children were assumed to represent the group with the least likelihood of having been at earlier nutritional risk. The authors found that the subjects in the lower quartile for height showed poorer intersensory integration with respect to the visual, tactile and kinesthetic modalities than children in the highest quartile. Results were interpreted as supportive of the hypothesis that malnutrition results in a lag in the development of sensory integrative capacities. This lag, presumably, could be addressed in an educational intervention.

Four studies have attempted to establish functional relationships between malnutrition and child behaviors using experimental intervention strategies. Primarily, they have involved an analysis of the effects of a food intervention program on the cognitive or social development of chronically malnourished children or children at risk for undernutrition. Each will be discussed in turn.

The INCAP Guatemala study (Klein, Yarbrough, Laskey and Habicht, 1974; Klein, Habicht and Yarbrough, 1970; and Habicht, Yarbrough and Klein, 1974, cited in 8: 312-313) was a seven-year longitudinal effort concerned with the effects of protein-calorie deprivation on children's physical and mental development. The study's experimental design provided for the feeding of a protein-calorie supplement to children in two villages and a non-protein, low calorie supplement to children in two neighboring villages. Over 600 children were included in the two feeding programs and participated in one or more tests of cognitive abilities at ages five or seven.

The investigators found generally positive and significant correlations between each of the cognitive measures (short-term auditory memory, memory for designs, reasoning and vocabulary) and the two indices of nutritional status used, height and head circumference at ages five and seven. A second set of analyses, however, showed that differences in food intake (as opposed to nutritional status measures) over the two-year period from age five to seven could not predict changes in psychological test performance on any cognitive measure between the ages of five and seven. It did not matter whether differences in food intake were defined in terms of home nutrition, food supplements ingested, membership in experimental feeding groups or attendance at supplementation centers. In other words, given information about a child's test performance at age five, one could not predict differences in improvement on that test over the next two years on the basis of information about protein-calorie intake over the two-year period. This may well be a function of the inadequacy of the intervention design, providing, as it did, dietary supplementation but no specific, cognitively oriented treatment program.

The significance of the Guatemala study, however, lies in the experimental evidence it provides of the rehabilitating effects of nutritional supplementation on the sensorimotor and cognitive functioning of young children from an "at risk" population. The findings suggest a functional relation between chronic undernutrition and intellectual deficit. Further analyses examining relations between supplement intake and psychological test performance at higher age levels are needed to shed further light on the role of nutritional status in cognitive development.

The Cali Preschool Study (61) is an important effort to examine the effects of a combined program of nutritional supplementation, cognitive stimulation, and health care on the cognitive development of lower-class preschool children in Cali, Colombia. The researchers, McKay, McKay and

Sinesterra, used tests of immediate memory, verbal reasoning, color recognition and object recognition as criterion variables in the study.

The investigation involves 240 three-year-old subjects who were assigned to either a nutrition plus stimulation plus health care condition or to a nutrition plus health care only treatment. Within each of these two general groupings, subjects received either one, two or three years of continuous intervention. The study included a control group of low SES children who received no intervention and a comparison group of upper income Colombian children, whose test performance was comparable with the low SES children at any point in the study.

This elaborate design provides a basis for inferences not only about the effects of nutritional rehabilitation on children's cognitive development, but also about the importance of social and cognitive stimulation with respect to behavioral change. It also allows for an examination of differential treatment effects related to duration of intervention.

Results obtained at the end of the study's second year showed that subjects experiencing two years of the comprehensive intervention improved in verbal reasoning and general knowledge, while children in the nutrition plus health care only groups did not show comparable improvements. Furthermore, the performance of the nutrition plus health care only groups on the cognitive measures was not substantially different from those of low SES subjects in the control group. In no group, however, did subjects show significant improvement in tests of immediate memory.

The Tezonteopan, Mexico study (Chavez, Martinez and Yaschine, 1974) was designed to assess the effect of a feeding program on mother-child interactions and child behaviors in the home. Subjects were under two years of age. The investigators concluded, on the basis of parental reports, that experimental children tended to be more demanding than children in the control group, both for attention and for food. In fact, the demands for food resulted in higher levels of feeding in the home for the supplemented subjects. Results of the study also indicated that children supplemented with proteins and calories were more independent and active than those not supplemented and elicited greater stimulation from their environments. It may be that a primary effect of undernutrition is to cause the child to withdraw from active participation with his environment, with the result that changes in cognitive abilities and perhaps patterns of social interaction occur.

The Bogota study (Mora et al., 1974; see 8: 313) examined the impact of a nutritional intervention program on developmental quotients of previously well-nourished and malnourished preschoolers. Analyses provided for a determination of empirical relationships among several social, physical, health and intellectual variables. In particular, they allowed for an assessment of the impact of the experimental intervention on intelligence test scores.

The investigators found that malnourished children scored lower on every "social" variable than well-nourished children. But they also found that height and weight measures significantly predicted initial status on the Griffiths Mental Development Scale for both younger and older children, even with social and "current health" variables controlled. This analysis suggested the importance of nutrition, independent of other social and medical factors, with respect to cognitive development.

The next step in the analysis was to examine directly the effects of the nutritional intervention on changes in intellectual performance. Results of the analyses for changes in Griffiths test scores showed that there was a general tendency for scores of well-nourished children to decline over the one year period, regardless of experimental condition and scores of malnourished children to increase. Since initial scores of well-nourished children were significantly higher than the initial scores of malnourished children, these changes were interpreted as a "regression to the mean" effect. However, the increase on Griffiths scores for the malnourished children in the supplemented group was significantly greater than for children in the non-supplemented group, a difference which the investigators suggested might be attributable to the effects of the food supplementation program.

This study provides additional evidence for the effects of chronic malnutrition on intellectual development. It also demonstrates that a one year food supplementation program administered during the preschool years may significantly improve IQ performance.

The evidence from the studies received thus far strongly suggests that early nutritional deficiencies may significantly retard intellectual development. Although the precise nature of the abilities which may be impaired has not been thoroughly investigated, it appears that sensory-integrative capacities, short-term memory and attention may be particularly harmed. While the implications of chronic undernutrition are less clear, research suggests that cumulative nutritional deprivation, like severe malnutrition, may interfere with optimal cognitive functioning during later childhood. Furthermore, as reported by Richardson, children who experience early severe nutritional deprivation tend to be socially immature relative to their peers and have difficulty controlling their behaviors. Although the bases for these difficulties in adjustment have not been specifically investigated, some of the problems observed in the social-emotional sphere may be due to the same type of "performance" factors known to influence cognitive functioning: apathy, reduced curiosity, inability to attend to and utilize complex stimuli, and lack of persistence. Such impairments would most certainly influence a child's performance in school. Other research results point to the need to treat the child's cognitive and nutritional deficiencies holistically. Finally, the studies suggest that such deficiencies are indeed amenable to treatment, particularly where dietary and intellectual enrichment occur together.

Balderston (4), in another literature review, examined the few longitudinal studies undertaken in which the impacts of specific interventions were assessed (e.g., the Cali, Bogota, Guatemala and Mexican studies cited earlier). She derives two important set of conclusions from this body of research. First, nutritional intervention alone may account for bigger and cognitively more advanced children. In this regard, it is important to note that findings by Weinberg and others (1974) show that bigger children consistently do better in school, remain in school longer, and show higher test scores. Second, the nutritional and educational intervention studies show that the longer the treatment period, the greater the effect of the treatment; and, the younger the child, the greater the impact of the intervention.

Other research reported by Balderston (e.g., Barnes, et al., 1968) lends support for the hypothesis that early problem-calorie deprivation creates lasting effects upon behavior. Some of these can be altered through later enrichment of diet; these behaviors, however, may not altogether disappear. Citing findings by Rosenzweig and Bennett (1980), she notes that the nervous system appears to be relatively plastic. Change in its structure occurs if the environment provides certain kinds of stimuli.

These views are echoed by Gussow (43), in another review of literature on nutritional deficiency and mental development. She cites the work of Yarkin and McLaren (1970) in which the DQ's--development quotients--of severely malnourished Arab children were compared. Ample food and medical care were provided for one group; in the other case, the same food and care plus a stimulating environment were offered. With recovery from acute malnutrition, both groups improved their DQ scores as measured by the Griffiths Mental Development Scale. However, the stimulated group improved significantly more than the unstimulated group over the four month period, though "normal" levels of functioning were not attained.

In examining the implications of this work along with the research by McKay, et al. in Colombia and Richardson in Jamaica, Gussow concludes that the evidence, while still tentative, suggests the importance of providing malnourished children with stimulation for both mind and body. This combination may enable them to make up for infancies spent in environments which were inadequate in both respects.

Gussow also reviews the research on the relationship between hunger and mental development, arguing that hunger is not malnutrition. The severely malnourished child often is not hungry, while the very hungry child may or may not be malnourished in ways that are measurable. She cites Riciutti's comment that, "The school child who frequently misses breakfast or lunch may perform poorly because of inattentiveness and distractability associated with hunger. However, these potential influences on school performance and learning, about which we know very little, clearly need to be differentiated from those effects which are the result of long-term protein-calorie malnutrition (42: 31)."

Where subclinical levels of malnutrition are involved, Gussow notes, the hard scientific evidence to support the notion that children's present biological condition correlates with their learning is best described as fragile. However, she reports that the few studies available have all tended to show that children who were better nourished did better. One study, for example, linked blood levels of Vitamin C to IQ while two others evaluated the effect of iron-deficiency anemia on various measures of functioning (42: 12). Nevertheless, there have been no controlled studies to show whether the child who is very hungry is unable to work as well as one who is not hungry, or whether he is just unwilling to do so.

Gussow, in a separate article (45), argues that given the probability that hunger interferes with learning, it would be preferable for schools to offer breakfast rather than lunch programs when only one meal can be provided. She notes that most learning in school takes place before lunch and it makes little sense, therefore, for children to sit through this period hungry.

Wilson (4) also addresses the issue of hunger and its impact of school work in his review of the literature on interrelationships among diet, physical growth, verbal development and school performance. He too notes that the effects of current diet upon school performance are not well documented. Several studies find, though a few fail to do so, that even in relatively well nourished populations in the United States, temporary hunger (as opposed to malnutrition) may adversely affect attention, interest and learning (Read, 1973, 1975; Pollitt, Gersovitz and Garguilo, 1978). Wilson reports that such findings are consistent with Latham and Cobo's (1971) suggestion that low energy leading to inactivity has short-term effects upon learning which can be cumulative, regardless of long-term nutritional status.

The most significant aspect of Wilson's work, however, is his own analysis of the longitudinal data drawn from the INCAP and RAND studies in Guatemala on diet and school performance. He reports that the child's total diet was the largest and most significant factor affecting a teacher's assessment of performance, when holding constant prior verbal attainment, size and a large number of other variables. Wilson concludes that this clear finding provides strong support for Latham and Cobo's thesis that current levels of energy have an important impact on learning and performance even among children with comparable prior nutritional status and comparable levels of ability. This is consistent with work by Chavez, Martinez and Yashine (1975) that suggests that healthier children are more exploratory, active and expressive and, therefore, elicit a more favorable and responsive social environment, as well as avail themselves better of existing learning opportunities.

Two other studies lend additional support for the relationship between diet and school performance. In their research on Filipino children, Popkin and Lim-Ybanez (1982) discovered a significant positive association between weight-for-height (a measure of current nutritional

status) and the child's ability to concentrate in school. They also noted that children with higher hemoglobin levels were less likely to be absent from school.

Moock and Leslie's study of childhood malnutrition and schooling in the Terai region of Nepal (64) provides additional evidence for the view that efforts to improve child nutritional status may have educational as well as health and survival benefits. Of the children in their sample enrolled in school, taller children tended to be in higher grades than shorter children of the same age. Given the high rates of academic failure and repetition, grade attainment can be treated as a proxy for academic achievement. Moock and Leslie report that Jamison (78) has reached the same conclusion for Beijing as well as the Gansu and Jiangsu provinces of China.

What is the relevance of this literature to SFPs and their potential to facilitate cognitive development? The following observations seek to address that question.

- o Cognitive function may be defined as the ability to learn categories; process and structure information; and to learn and react to social and environmental cues. It includes the ability to ask appropriate questions and give appropriate answers within a given environment and to identify and solve relevant problems. It embraces general conceptual ability, appropriate actions within a given culture, and the mental adaptiveness needed to entertain new categories and see new possibilities. Mild to moderate malnutrition, while probably not causing primary learning deficits, does appear to alter processes associated with cognitive function. Passivity, apathy, shortened attention span, reduced short-term memory, failure to acclimate to repetitive stimuli and a lag in the development of sensory-integrative capacity are all associated with mild to moderate malnutrition. These dysfunctions prevent children from taking maximum advantage of the learning opportunities available to them in their environments. Not surprisingly, children with PCM tend to function at reduced levels of intellectual development and academic achievement. Children appear to adapt to malnutrition by seeking out more quiet and restful activities. The contribution of SFPs to cognitive development must be assessed in this context.
- o Given the complexity of cognitive function and the range of learning-related impairments associated with malnutrition, research on supplementation and cognitive development must rely on more complex measures of cognition than IQ. Instrumentation that can capture changes in school-aged children related to ability to mobilize and maintain attention; development of sensory-integrative capacity; reaction to stimuli; and behaviors related to exploring and seeking information are especially needed. Because many of

these processes are a function of maturation, there is a need for serial measurement that can capture the rate of change in subjects.

- o Mild to moderate malnutrition acts synergistically with social and environmental factors. The risks for a malnourished child, living as he does in a culture of poverty, are multiple, interactive and cumulative. However, both human and animal studies show that a developmentally facilitative environment can alleviate the potentially harmful consequences of early malnutrition. Reversibility and remediation are possible when the child's environment is manipulated to make it more conducive to his cognitive growth. Although improvement in a child's diet alone can lead to cognitive changes, greater intellectual development can be achieved when the child's diet as well as his psychological and social environment are enriched. These findings suggest that SFPs can only reach their full potential for stimulating cognitive development when they are designed as part of a broader intervention to address developmental lags or deficiencies in students.
- o A school-aged child's nutritional status exerts significant influence on his academic performance. In Wilson's study, for example, current diet was the single most significant predictor of classroom achievement. Likewise, hunger seems to cause inattentiveness and distractibility and thus is likely to influence school performance and learning. Hunger, of course, is not the same as malnutrition. SFPs that are successful either in reducing a child's feelings of hunger or improving his nutritional status are likely to facilitate cognitive development as it has been broadly defined in this chapter (i.e., mobilization and maintenance of attention; development of sensory-integrative capacity; exploratory, problem-solving behaviors; memory, etc.). These changes may not be well captured on IQ tests.

In the section that follows we shall turn our attention to an examination of four studies on the impact of ldc-based SFPs on cognitive development. The observations and conclusions drawn from the review presented thus far will be instrumental in evaluating the methodological soundness of the research designs.

2. Studies on the Relationship Between SFP Participation and Cognitive Development in LDC's. Roy and Rath, in their evaluation of the school lunch program in Orissa, India (76), compared the academic performance of fed to non-fed boys. Using examination scores, they found no significant differences between the two groups. Earlier in this report (pages 23-27), the methodology employed by the researchers with respect to sampling and analytic proedures was descried and

critiqued. This section, therefore, will be confined to an assessment of those findings specifically related to achievement and cognitive development.

The authors note that student performance in examinations and the proportion of failures are indicative of a school's academic standards. They, therefore, analyzed the distribution of student scores on the examination administered nearest to the time of the study. Virtually no difference was observed in the distributions of scores achieved by fed and non-fed children. The former obtained a median score of 38.1, while the latter's median was 38.9. The failure rate for both groups was also nearly equal (approximately 28 percent) when data were taken both for entire schools and for individual grades (with the exception of grade three where a statistically significant difference was obtained in favor of the non-fed schools).

These findings, however, are difficult to interpret for several reasons. First, the authors fail to report whether the examination was standardized or teacher-made. If it was teacher-made, the results are not surprising given most teachers' tendency to use their own classes as reference groups for grades rather than objective criteria. This practice usually leads to fairly constant distributions of students' marks so that a normal curve is maintained even when groups differ quite notably from one another. Thus, the proportion of individuals on the "honor roll" in a school where students are cognitively advanced is not dramatically different from that of a school where many pupils suffer cognitive deficits. Children tend to be judged in relation to one another particularly in situations where the teachers are not pedagogically sophisticated.

Even if the examinations were standardized, the scores alone cannot help us judge the efficacy of the SFP intervention vis-a-vis school achievement. The fed schools (as noted on page 26 of this report) had more tribal students and a smaller number of upper caste children than non-fed schools. Since SES exerts a significant influence on school achievement, and since the student bodies in the fed schools had a lower SES than those from non-fed schools, it would be expected that, without the intervention, students from non-fed schools would score higher on standardized tests. Therefore, it can be argued that the SFP was successful by raising the level of academic achievement obtained by the fed, lower SES students to that obtained by the more advantaged non-fed children. The lack of a statistical difference in scores, thus, may be one measure of the program's success in providing equality of educational opportunity for children regardless of their social or economic background. This discussion underscores the need for researchers to control for SES when comparing academic achievement or cognitive development for fed and non-fed students.

Kanno's study of how an SFP impacted on the learning of primary school children in Lesotho (53) was based on a sample of 155 children, ages six to eleven, from 27 villages. The study was conducted for one

year and involved visits to 115 households and the administration of a questionnaire to determine the adequacy of home meals as related to the school feeding program.

To test the effects of the SFP on learning among primary school children in Lesotho, the investigator used an intelligence test, anthropometric measurements, close observations in classrooms and teachers' reports. No significant differences were noted on intellectual measurements or on anthropometric increments between fed and non-fed children. School and home meal patterns were both deficient for the children, school feedings provided the only source of protein in the children's diets.

This study, as in the previous case, fails to present an analysis of data that controls satisfactorily for SES. Thus, once again, the finding of "no difference" may in fact be attributable to the success of the SFP in "bridging the gap" between more and less advantaged pupils. When targeting takes place, fed schools will have larger numbers of children in need than those not served by an SFP. On the other hand, the research methodology does have a significant strength: the use of multiple measures that can serve as proxies for intellectual development.

Two studies discussed in the previous chapter--Cotten's work in Haiti and Checchi Company's comparative evaluation of SFPs in Colombia, Kenya and the Philippines--also include an assessment of SFP impact on cognitive development. Because Cotten was significantly influenced by the Checchi team's work, the same methodological critique applies to both studies. Therefore, findings from the two studies will be reported separately but interpreted together.

With regard to SFP influence on cognitive performance, Cotten's data indicated that program children scored higher than non-program children on the Raven Coloured Progressive Matrices Scale, an IQ test, but the difference was not statistically significant. In noting the very positive relationship between the Raven score and a set of indicators that measured the student's home environment, Cotten surmises that the preponderant cause of marginal differences in performance between program and non-program children could be due to differences in home environment (with program children tending, on the average, to come from higher SES environments) rather than differences in nutritional status.

Support for this argument is found through the analysis of another variable, tuition. A positive correlation was found between what a child's family had to pay for schooling and the child's cognitive performance as measured by Raven. Tuition was viewed by Cotten as a surrogate indicator of SES for the child's family. The implied linkage was thus interpreted by the investigator as follows: a wealthier family can afford higher tuition; higher tuition implies better education, which in turn results in a child who performs better in school. The

results of a t-test on the tuition variable indicated that tuition in non-program schools was higher than in program schools, because of the inclusion of private schools in the sample. Cotten concludes that this finding supports the argument that exogenous factors--which the SFP does not attempt to influence--provide just as plausible an explanation for differences in performance as does participation in the SFP. He views the longitudinal study that is planned to supplement this assessment as being helpful in shedding greater light on this issue.

Cotten also found that about 7 percent of the variance among schools in average Raven test scores could be explained by variance in the prevalence of acute malnutrition. With the addition of home environment, 19 percent of the variance in cognitive performance was accounted for, while inclusion of the tuition variable improved the association another percentage point. All three variables thus combined to account for 20 percent of the variance in aggregate performance on the Raven test. This finding once again suggests the need to design intervention strategies that address both nutritional status and environmental factors that influence intellectual development.

The importance of the interaction between the school environment and a child's nutritional status is also illustrated by another study finding. Cotten constructed a "quality of education" index that measured such variables known to influence learning as illumination, classroom density, teacher/student ratio, teacher education and experience, and the proportion of students passing the Primary School Certificate Exam. In the rural milieu, as is the case in virtually all ldc's, the "quality of education" indices were significantly lower than for urban areas. In this environment, there was a significant difference between mean Raven scores obtained by children who were well nourished as compared to children who exhibited wasting. In urban areas, on the other hand, where the availability of external influences on a child's mental performance are greater, there was no significant difference in cognitive performance between the well nourished children and those showing signs of wasting. This discrepancy points to the need for intellectual and nutritional stimulation for children living in environments that are not developmentally facilitative in order for SFPs to meet their cognition-related objective.

Cotten also investigated the relationship between hunger (as opposed to malnutrition) and intellectual performance. Citing research by Keys, he hypothesized a relationship between hunger ("a psychological and physiological state resulting from insufficient food intake to meet immediate energy needs") and a classroom behavioral pattern characterized by irritability, apathy and similar dysfunctions. Individual children in the sample survey who came to school without breakfast were identified, and their performance on Raven was compared to average performance for the school.

It was observed that within the SFP-schools, there was a highly significant difference between the performance levels of the two groups. Children who came to school without breakfast did markedly worse than their less hungry counterparts. On the non-program side, however, there was no significant difference between the two groups. No explanation of this finding for non-program schools is offered. Perhaps the inclusion of more private schools (with their attendant higher quality of education) in the non-program sample is the cause. If so, this, too, would suggest that quality of the learning environment and diet interact in the determination of a child's intellectual ability. When the environment is developmentally rich, the intellectual stimulation available can compensate for some of the effects of hunger and, quite possibly, malnutrition. This finding also highlights the need to research whether school breakfasts should be offered instead of or in addition to lunches.

In short, Cotten's work demonstrates the importance of accounting for background factors, particularly SES, and the need to hold these variables constant over time in order for the researcher to isolate program effects on cognitive development. His evaluation design, using as it did cross-sectional data, did not show how fed children changed over the time they participated in the program. The forthcoming longitudinal study will treat this issue. Specifically, it will be able to address whether cognitive development occurs at a faster rate for fed children when SES-related variables are held constant.

The Checchi study examined SFP impact on school performance as measured by teacher grades controlled for the child's IQ (derived from the Raven Progressive Matrices). The sample consisted of children from first and third grades. In all, five school programs in each of three countries (Colombia, Kenya and the Philippines) were examined. Net direct effect of participation in the program was assessed; such background characteristics as family income, mother's education and the tested scholastic aptitude of children were taken into account. All associations that had a beta weight less than + .10 were treated as if they were zero.

Comparisons were made between fed versus non-fed children as well as between children with more versus less exposure to the feeding program within the fed group. The authors note that most of the large negative fed versus non-fed results could be traced to comparisons with advantaged control groups. Hence the more versus less exposure criterion appears to be the more valid one.

The research team determined that it was necessary to obtain a measure of intelligence for school children and to control teacher-assigned grades by child's IQ. This procedure was decided upon as a way of holding constant any difference in school performance abilities related to past influences (such as a child's parents or the conditions of his upbringing).

The Raven Coloured Progressive Matrices Test was used to obtain this measure of intellectual ability. The authors describe it as widely used in developing countries and especially appropriate for cross-cultural research as it is relatively culture-free. The test was administered without time limits. When given timed, it becomes more heavily loaded with scholastic performance factors.

The instrument itself is a perceptual test of spatial and pattern relationships in which the student matches one of six tabs with a pattern on it against a larger pattern with a missing tabular piece. When untimed, it is designed to assess a subject's present capacity for intellectual activity, irrespective of previously acquired knowledge. As a whole, the scale is described as a test of observation and clear thinking.

The effect of school feeding on performance was inconclusive and apparently unrelated to the ability of programs to reach other goals (e.g., improved attendance and nutritional status). It had been posited by the research team that performance could be affected by food in at least two ways: through the effect of nutrition on mental growth and development or through the effect of nutrition on energy levels. The former claim could not be substantiated through a study of this type since the subjects were all school-aged children past the period of rapid brain growth. However, the second claim was investigated by the research team which noted that nearly all the first and third grade teachers interviewed reported that children participating in SFPs performed better after eating. These subjective but uniform judgments were somewhat offset by the mixed pattern of effects that emerged from the more objective survey data.

A significant relationship between increased feeding and good grades was found in six of the fifteen schools. In the other schools, there appeared to be few performance effects which could be attributed to feeding. At first glance, this may seem to be a relatively negative finding with respect to the efficacy of SFPs as a tool for improving student intellectual development. On the other hand, Jencks et al. in their landmark study on the determinants of school achievement note that the effects of IQ and family background are so powerful that relatively few interventions designed to improve student performance can override them. When judged in this context, a program that yields gains for disadvantaged students in six locales may appear to be a cup two-fifths full rather than three-fifths empty.

The research team notes that further thinking about indicators of performance is warranted. One alternative to school grades where the child's IQ is controlled for, they suggest, is a measure of matriculation (staying in school). They argue that this is especially so in the context of feeding in poor countries where the basic educational need is literacy. To measure this, it would be necessary to follow up recipients to study how many stay in school from one grade to the next. A record of persistence in staying in the educational system

would constitute "good performance" for these children. In most developing countries, where emphasis is placed on providing the bulk of the school-aged population with basic education, a measurement of matriculation would capture the degree to which SFPs assist in promoting this goal.

An analysis of the Cotten and Checchi studies must fundamentally focus on two principle issues: how can cognitive development or school performance be best measured, and by what standard should a program be judged as either successful or unsuccessful? A search through the psychometric literature (see Appendix to this chapter) uncovered not a single article that tested the hypothesis that the Raven scale was truly culture-free when administered to children. One researcher, Abul-Hubb, used it with populations above age fourteen in Iraq. For ages 14 to 17, the Iraqi subjects attaining a raw score of 40 were at the median. The test manual gives a raw score of 44 for the fiftieth percentile.

It seems highly likely that cultural factors might account for group differences with respect to tolerance for abstraction. Other reviewers note that the test measures IQ in terms of a single intellectual function, visual perception. Since hunger and malnutrition are believed to influence a range of intellectual functions, this instrument may not be sensitive to the kind of cognitive development that could be promoted by a successful SFP.

Most reviewers and the test author also claim that the instrument measures "innate" intellectual ability. If this is the case, it is questionable whether such a scale would be sufficiently sensitive to changes in intellectual functioning derived from an educational or school-based program. Some reviewers have also noted that the test's reliability is not very high when administered to young subjects. Furthermore, validity is threatened in those ldc's where reliable age data are difficult to obtain.

Given this situation, the test is probably useful in controlling for teacher-assigned grades or as part of a student background assessment (although its cross-cultural validity is somewhat suspect) but not adequate by itself as a proxy for intellectual development. Indeed, the test's author recommended that it be used in concert with vocabulary scales for an assessment of current intellectual functioning.

Earlier in this chapter, it was suggested that procedures that capture changes in children's ability to mobilize and maintain attention, develop sensory-integrative capacity, react to stimuli, and engage in information-seeking and problem-solving behaviors would be especially useful in assessing the impact of SFPs on intellectual functioning. Cognitive development, as implied in the term, is a dynamic process that is best assessed through maturational scales rather than through relatively static, unidimensional IQ tests.

In conjunction with such scales, simple measures of school success should be used. The Checchi team's recommendation that a matriculation measure be employed is very direct and appropriate to the nature of the inquiry. Of course, it will be necessary to control for SES. What we want to learn is whether fed children stay in school longer and develop intellectual capacities at a rate that exceeds that of non-fed students when all other things are equal.

The second question that needs to be addressed is the standard for judging an SFP "successful" in overcoming cognitive dysfunctions related to acute malnutrition. When targeting practices result in a fed population with an average SES below that of non-fed students, a successful program may be one in which the gap between the two groups has been narrowed rather than closed. A very successful program, following this line of reasoning, would be one where no difference between the two groups is observed while at the highest success level, the fed group would surpass the non-fed population. This discussion highlights the need for baseline data and more prospective research. Once again, the principle focus for investigation must be how groups compare to each other with respect to rate of change when SES is controlled.

When inadvertant targeting occurs and the fed population has a higher SES than the non-fed group (as in the case of Haiti and Orissa), success will, of course, be defined differently. However, once again, the key to program assessment will lie in how the two groups (fed versus non-fed) compare with respect to rate of change. Quality of education and SES must be factored into the analysis.

In conclusion, the following additional observations are offered with respect to the efficacy of SFPs in promoting cognitive development:

- o The evidence for the proposition that SFPs can enhance cognitive development is inconclusive. More research is needed in which longitudinal data are collected and multiple measures of school achievement are used. Comparisons between fed and non-fed schools on measures of achievement are only relevant when they can be interpreted in light of SES differences between the two populations.
- o Likewise, comparisons between fed and non-fed schools should be augmented by an analysis of differences between students with more versus less exposure to the program in the fed group.
- o Factors exogenous to SFPs exert as much influence on school performance as do feeding programs. Nevertheless, none of the SFPs discussed here incorporates into its design any feature that might mitigate the impact of these "intervening" factors. The SFP intervention strategy needs to be recast as a more integrated effort to remediate deficits caused by

the interaction among acute malnutrition, hunger and a developmentally non-facilitative home environment.

- o Cotten noted that 7 percent of the variance in Raven scores could be explained by malnutrition. While this proportion may appear at first glance to be small or insignificant, a gain in intellectual competence of this magnitude (the equivalent of raising a child's IQ from 93 to 100) would actually have far-reaching impact on the quantity and quality of classroom learning. This finding, therefore, underscores the need for SFPs to offer meals that are nutritionally adequate to overcome chronic malnutrition.
- o Cotten's research suggests that in schools where the quality of education is low, it may be especially important to alleviate hunger for learning to take place. Research on the efficacy of breakfast versus lunch programs is needed in the context of ldc's.

In the next section of this chapter we will have the opportunity to examine the impact of program context on the promotion of cognitive development. Is there a difference between ldc's and industrialized nations in the evidence linking SFPs to school performance?

3. Studies on the Relationship Between SFP Participation and Cognitive Development in Industrialized Nations. Most reviewers (see for example, 67 and 68) have divided this literature, which except as noted deals with the U.S., into two basic categories: (1) studies dealing with short-term behaviors (with an emphasis on morning feedings and the effects of hunger) and (2) studies on long-term effects (with an emphasis on school performance). In this chapter, six studies pertaining to the first category and five relevant to the second will be reviewed.

The existence of two major categories reflects the presence of two general approaches that have been used to investigate the effects of SFPs on non-nutritional aspects of student behavior. Studies of short-term effects have yielded conflicting results. Investigations of the long-term effects of SFPs on school achievement and attendance have failed to demonstrate conclusively significant relationships. It is important to note, however, that these programs were not expressly targeted to malnourished students. Thus, the question of whether SFPs could have a beneficial effect on the academic achievement of malnourished children is left unanswered.

As Pollitt has noted, research on the behavioral effects of SFPs is in most instances methodologically weak. It is marked by ambiguity in the definition of variables, a lack of data on the validity and reliability of the measures used, and an absence of specific hypotheses. Therefore, a great deal of caution must be exercised in interpreting

findings.

3a. Studies on Short-Term Behavioral Effects. These studies have investigated the effects of eating or not eating breakfast and of eating a midmorning snack. The behaviors targeted for research included nervousness (Laird et al., 1931 and Keister, 1950 as cited 67 and 68); hyperactivity, withdrawal and hostile behavior (Keister, 1950); aspects of mental performance including arithmetic and decoding tasks (Matheson, 1970 as cited in 67 and 68), and short-term attention (Dwyer et al., 1954; Arvedson et al., 1969 as cited in 67 and 68). Each study will be briefly reviewed before turning to their collective implications.

Laird et al. (1931) examined the relationship between hunger and nervousness in children. The sample consisted of 48 first-, second-, and third-graders who had been rated as nervous by their teachers on the basis of a behavior checklist. The children were assigned to one of three groups: a control group that received no special feeding; those who received milk only; and those who were given milk and a calcium supplement. The children were fed for a two-week period at 9:30 a.m. after which their behavior was reassessed, presumably by their teachers, who supposedly did not know the treatment groups to which children had been assigned. For the group fed milk, it was reported that their nervousness had declined by an average of 6 percent. However, half the group showed either no decline or an increase in nervousness at the end of the two weeks. Laird and colleagues concluded that the nervousness of elementary school students is associated with hunger and can, therefore, be alleviated through midmorning milk programs.

This study is methodologically weak for several reasons. There is no discussion of how the observation procedures were validated and the high level of subjective judgment required to complete the checklist (e.g., "mentally lethargic") argues against the probability that the instrument could be used with any degree of reliability. Furthermore, the data were not subjected to statistical tests.

Keister (1950) studied the effects of a midmorning fruit juice program on hyperactivity, withdrawal behavior, hostility and nervousness on 133 children for two to five years of age attending a nursery school. The investigation lasted a year. Each child was studied four times during this period--twice after receiving fruit juice and twice after having gotten water. The child's behaviors were observed at thirty-second intervals for two hours following the feeding. Keister found that the juice-drinkers exhibited significantly fewer negative behaviors than those who received water. Despite an absence of any significant age differences, males who received juice showed a greater reduction in negative behaviors than females who were given juice.

As with the work by Laird et al., Keister's study suffers from an apparent lack of reliability and validity. Data were obtained through a checklist designed by the investigator. However, no information on the instrument's validity and reliability is reported. Although

experimental and control conditions were imposed, there is no evidence to suggest that the observers were unaware of the treatment received by each child.

Tuttle and Daum (1954) tested the effects of different breakfast conditions on physical performance in children. Boys aged twelve to fourteen alternated between periods of basic cereal and milk breakfasts and no breakfast for 17 weeks. The total daily nutrient intake, however, was kept constant. Six categories of physiologic responses were tested in the late morning hours. Omission of breakfast had no effect on neuromuscular tremor magnitude, choice reaction time, maximum grip strength, or grip strength endurance. However, maximum work rate and maximum work output were less when breakfast was omitted. The students' attitudes and scholastic performances were rated by their teachers and were reported to be better for the majority of the boys when breakfast was eaten.

Vermeersch et al. (67) in their review of this study note that the portion of the research that measured breakfast/no breakfast effects on student attitudes was not as well controlled as the portion dealing with the effects on physical performance. No systematic behavioral checklist was used by the teachers rendering judgments. Furthermore, the teacher-observers were aware of whether the boys had received breakfast on the days they offered their assessments.

Arvedson et al. (1969) sought to test the assumption, prevalent in the 1950's, that breakfast should provide one quarter of the total daily protein and caloric intake to ensure maximum physical and mental efficiency in the late morning hours. For this purpose, a sample of 203 children aged seven to seventeen was drawn from several Stockholm schools.

They found that of these children, only one third consumed a breakfast at the "ideal" level. Their next step was to determine if this low intake had any effects on physical capacity. The investigators then studied 40 boys, ages 11 to 17. They were divided into four groups each receiving a different type of breakfast (high carbohydrate, 400 calories; high carbohydrate, 560 calories; high protein, 400 calories; high protein, 560 calories). The subjects were given a work test involving a bicycle ergometer. No differences in physical capacity were found for the various types of breakfasts. Concentration, hunger and tiredness were measured on the days that work tests were not administered. The authors also found no significant difference in the physical and mental performances or in the reports of hunger and tiredness among the groups eating the various breakfast types.

This study does not, of course, address the effects of breakfast omission on school performance. Rather, it suggests that breakfast type (rather than presence or absence) is of little importance in determining work output. Breakfast type also appears to be insignificant in terms of influence exerted on such learning dysfunctions as inability to

concentrate and fatigue.

Matheson (1970) measured the effects of midmorning orange juice feeding on 100 fifth grade students from three classrooms at three different schools. The study was conducted over a ten-day period. The outcome variables studied was an addition and letter symbol decoding test. The same children were exposed to both the experimental and control conditions. The midmorning orange juice feeding was associated with a significantly better performance at 9:15, 10:30, and 11:45 a.m. on tasks of decoding and addition. Testing following the orange juice feeding at 10:30 showed the most significant improvement on the decoding tasks. The researcher also found that the performance of the tasks at different times during the morning did not differ significantly between children whose usual breakfast intake was good or poor; however, breakfast intake was not measured for the day of the testing but was obtained through a three-day written record collected several weeks after the experiment was conducted. Matheson concluded that students score higher on school type tasks undertaken shortly after they receive food.

This study only lasted ten days, an interval that Vermeersch and colleagues (67) suggest may not have been long enough to bring about adjustments in children whose breakfast habits were longstanding. Pollitt suggests that this investigation offers the strongest methodological treatment of short-term effects of feeding. It, therefore, in his view, provides important support for the contention that early in the day food supplementation in school brings about some beneficial effects on a child's performance in school-type tests.

Dwyer et al. (1973) measured the effects of an instant breakfast on children's school performance. The study subjects were 139 first grade boys, half of whom received the liquid meal in the morning while the half received it in the afternoon. The researchers, comparing morning performance on several attention tasks, found no differences between the two groups.

Pollitt, in trying to account for the different conclusions obtained by Dwyer and Matheson, suggests this might be attributable to differences in lower breakfast intake between the populations used in the two studies. Furthermore, the two studies may have been tapping different mental abilities. The attention measures used by Dwyer were tests of slow tapping, digit recall and blocks as well as observations of eye gaze to assess maintenance of attention in the classroom. Matheson, on the other hand, tested for addition and letter decoding.

It is difficult to draw conclusions about the implications of these studies for SFPs in ldc's. First of all, the children in these studies were not necessarily malnourished. Second, the studies used different types of measurements so that they are not comparable to each other. In some cases, the midmorning feedings may have acted as supplements to breakfast, while in others they may have been substitutes. Furthermore,

only Matheson and Dwyer were directly concerned with cognitive dimensions of behavior. The other studies--dealing as they do with emotional dimensions of behavior and physical activity--have important although less direct impact on the degree to which a child can take full advantage of the opportunities present in his learning environment. Finally, four of the studies (Dwyer et al., 1973; Keister, 1950; Laird et al., 1931; Matheson, 1970) suffered from a lack of systematic controls on the observations made to categorize behavior and from a failure to assess adequately food intake of children prior to their arrival at school. The other two experiments (Arvedson et al., 1969; Tuttle et al., 1954), as Vermeersch notes, were more adequately controlled but there is no way to assure that some of the results were not affected by the subjects' knowledge of the treatment they received. As Pollitt states in his review, these methodological weaknesses are the strongest evidence of a need for additional research in this area. However, he also notes, in light of the evidence, that the provision of breakfast may benefit the student emotionally and enhance his capacity to work on school-type tasks.

3b. Studies on Long-Term Behavioral Effects. Five studies have looked at long-term cognitively related behavioral effects of SFPs (Kreitzman, 1973; Lieberman et al., 1976; Lininger, 1933; Pinkus, 1970; and Tisdall et al., 1951). Unlike the short-term studies, these investigations exhibit more uniformity. Most use a longitudinal approach, and the most common outcome measures were closely linked to school performance. Major differences among the studies include the treatments investigated, the sample's characteristics, the programs that were analyzed, and the specific tests and modes of analysis used.

Lininger (1933) studied the effects of a school milk program on scholastic progress over a two year period among 4,133 "undernourished" (not defined) students ages six to 16 years. The subjects were enrolled in special health classes in which the use of milk was emphasized as part of a broader strategy to improve health. An index of scholastic progress was obtained from teachers' subjective comments. Over the study period, 45 percent of the children receiving milk were shown to have improved "scholarship." Where milk wasn't used, improvement was noted in 24 percent of the cases. However, teachers probably knew which students were receiving milk. Therefore, it is difficult to say whether these results stem from the intervention or teacher expectations. This study also suffers from probable defects in reliability given the nature of the checklist and lack of rigor in determining criteria for selection of malnourished students.

Kreitzman (1973) looked at attendance and school grades to determine the effects of a school breakfast program in a year-long study. The subjects were third and fifth graders from two schools in Atlanta, Georgia who were living in a government housing project. One school had no breakfast program while the other began one in January. At the end of the school year, there was no difference between the two groups in achievement test scores. It should be noted, however, that

Figure 2. Summary of Studies of Short-Term Behavioral Effects of Morning Feedings

STUDY	TREATMENT	SAMPLE	MEASURES	ANALYSIS	RESULTS
Laird et al., 1931	Children received milk, milk plus calcium supplement or no special feeding at 9:30 a.m.	Children from grades 1, 3, and 5 who were rated as "nervous" N = 48	Behavior checklist to assess nervousness	Comparisons of pre- and post-treatment ratings of nervousness. No statistical tests.	Nervousness of groups receiving milk was reduced an average of 6%
Keister, 1950	Children were fed pineapple juice or water at 10:00 a.m.	Nursery school children N = 133	Observation of hyperactivity, withdrawal, hostile behavior and nervous habits for two hours after feeding	Comparisons of frequency of observed hyperactivity, withdrawal, hostile behavior and nervous habits after receiving juice or water	Children receiving juice exhibited fewer negative behaviors than children receiving water
Tuttle et al., 1954	Subjects alternated between eating breakfasts and not eating breakfasts; total daily intake was kept constant	12- to 14-year old boys from one school N = 7	Neuromuscular tremor magnitude, choice reaction time, grip strength, work rate, work output, attitudes and scholastic performance	Comparison of individual and group mean scores on measures taken when eating and not eating breakfast.	Maximum work rate and work output lower when breakfast was not eaten
Arvedson et al., 1969	One group received breakfasts that provided 400 calories and one group received breakfasts that provided 560 calories; the protein and carbohydrate composition of both groups' breakfasts were alternated weekly	11- to 17-year-old boys from one school N = 40	Blood glucose, work tests, concentration, hunger, tiredness	Comparison of measures among groups eating various types of breakfast	No differences were found except that blood glucose levels were higher when a protein-rich rather than a carbohydrate-rich breakfast was eaten
Matheson, 1970	Each student received orange juice or nothing alternately at 10:30 a.m. for ten days	Fifth-graders from three schools N = 100	Performance on math and decoding tests at 9:15, 10:30 and 11:45 in the morning; 3 day record of breakfast intake	Comparisons of performance when orange juice was given and when it was not. Comparison of performance at different times according to usual breakfast intake of children.	Performance was better on days orange juice was given. Performance of children with good and poor diets did not differ at various test times.
Dwyer et al., 1973	One group received liquid meal in morning; one group received liquid meal in afternoon	First-grade boys N = 139	Attention tasks; dietary recall of breakfast intake	Comparison of morning performance on attention tasks	Performance did not differ between those children fed the liquid meal in the morning and those fed in the afternoon.

Source: (67: 493)

this finding may have been related to a supplementary educational program that was being offered for third graders in the control group. This ambiguity points to the need noted elsewhere in this report for a greater understanding of the potential interaction and interdependence between cognitive development interventions and SFPs. Where no such program was operating (in the fifth grade), those in the experimental group did as well or better on every segment of the achievement test than the control school. This ambiguity points to the need noted elsewhere in this report for a greater understanding of the potential interaction and interdependence between cognitive interventions and SFPs. Where no such program was operating (in the fifth grade), those in the experimental group did as well or better on every segment of the achievement test than the control group.

Unfortunately, Kreitzman does not report any statistical treatment of the data collected. "Significant differences" were reported strictly on the basis of observation, rendering this study of limited usefulness to policy-makers.

Tisdall et al. (1951), in the Canadian Red Cross School Meal Study, evaluated over 200 school lunch participants and control students who ranged in age from 5 1/2 to ten. The investigation lasted three years. School performance measures included teacher-assigned school grades, scores on IQ tests, and scores on objective tests of reading and arithmetic. The experimental and control groups were matched for sex, school grade, classroom, age, height, weight, SES, dental conditions, mental ability, school achievement and health status as measured on a health exam.

The authors found no evidence to indicate that the SFP had any effect in accelerating mental or educational development. It is difficult to analyze this conclusion, however, as no statistical analysis was presented in the report. It is also unclear whether the degree of program exposure was controlled. Furthermore, the nutritional status of students is not disclosed.

Pinkus (1970) examined the breakfast habits, school performance and hunger-related behaviors of two groups of fourth graders, those attending a school breakfast program and those in schools where the program was unavailable. All children came from eight Louisiana schools that met federal requirements for the program. The two groups were matched by predominant student race, class size and faculty size. Questionnaires were used to gather data on breakfast and behavior patterns for approximately 200 students.

More children in the non-SFP site reported a higher frequency of crying, being angry, and being asked to pay attention or stop misbehaving. However, no significant differences were observed between the two groups when the comparison was made on the basis of one-week behavior records kept by parents and teachers. Furthermore, no significant differences were found on scholastic achievement as measured

by the number of D's and F's during a one-month period. As noted earlier, many teachers grade on a curve. If this were the case in this study, it would be unreasonable to see a change in the distribution pattern of grades. The relatively short duration of the grade comparison period may also have been insufficient to uncover any trends in this area.

Lieberman et al. (1976) studied the effects of a breakfast program among low-income black ghetto children in grades three through six over one school year. A school with a breakfast program (n=281) was compared to an adjacent school (n=300) without the feeding intervention. Five psychological tests were administered to measure ability to concentrate, remember, think abstractly and work in a classroom. The authors found no long-term program effect associated with psychological test scores. However, children in both groups were well nourished. Furthermore, 52 percent of the children participated in between 35 to 54 percent of the breakfasts although exposure was not controlled.

Pollitt observes that this study is a good illustration of how the nature of the sample determines the nature of the investigator's results. Because the recipients of the school breakfast were well nourished before they entered the SFP, it is unlikely that their participation brought any additional nutritional benefit to them. Given that situation, it is not surprising that the SFP brought no additional educational benefit. Such a study fails to answer the crucial question of whether a program that starts with poorly nourished recipients and brings about nutritional status improvement will also yield educational benefits.

The apparently contradictory findings of these studies make it difficult to draw conclusions about them. Two investigators (Lenninger and Kreitzman) found a beneficial program effect while the others did not. The research set, as a whole, does suggest the need to understand and account for the many and often confounding intervening variables in feeding and achievement studies as well as the need to control for program exposure. The differences in findings may also be due in part to differences in the designs and samples employed.

In summary, the findings with which we are left fail to provide a strong basis for any policy decisions regarding the relationship between SFP participation and cognitive development in malnourished children. Lack of methodological rigor and, in particular, designs that fail to account for moderating variables characterize these studies.

The investigations, however, do highlight the need for additional research into the relationship between SFPs and cognitive development. Some recommendations with respect to future work include the following:

- o Longitudinal research is needed. One year is probably not adequate to detect all cognitive development effects produced by SFP participation. Any shorter time period is clearly

insufficient. A two to three year research project in this area would be most desirable.

- o Program effectiveness on malnourished children must be measured. Since impact varies with a program's ecology, it is important to avoid drawing inferences for malnourished children from data that were obtained on well nourished subjects.
- o Kreitzman reported that third-graders who participated in a supplementary education program but received no school breakfast did as well on achievement tests as students who received breakfast but did not have access to the remedial intervention. In the fifth grade, where no supplementary education was available, the breakfast program participants surpassed the control group on the performance measures. This finding highlights the need to design studies that can compare and assess the cognitive impact of SFP interventions with and without additional intellectual development components incorporated into the treatment package.

In the final section of this chapter, the general implications of the research on nutrition, SFPs and cognitive development are discussed. Special attention is given to the concerns of policy-makers.

4. Conclusions. Without question, the cognitive abilities of a nation's citizenry are of utmost importance to planners. Worker productivity is so intimately linked to problem-solving skills and more generalized cognitive development that it is difficult to imagine how any high level decision-maker could fail to be concerned with removing impediments to the optimal intellectual functioning of young people. However, despite the need, the present collection of studies offers relatively little guidance to the policy-maker who must choose among alternative social investments.

The studies are inadequate to planners for a variety of reasons including lack of methodological rigor (particularly with respect to the work done in industrialized countries) and comparability of findings. Consequently, the definitive answer to the question of whether SFPs make a significant difference in the cognitive development of students is unknown. However, preliminary indications are that they do.

Two studies, both methodologically sound in all respects, particularly provide the basis for this assertion; Wilson's work in Guatemala and Mook and Leslie's research in Nepal. In the former study, the child's total diet was the largest and most significant factor affecting a teacher's assessment of performance when all other relevant variables were controlled. This finding lends support to the thesis that current energy levels have an important impact on learning

Figure 3. Summary of Studies of Long-Term Behavioral Effects of School Nutrition Programs

Study	Program(s)*	Treatment	Sample	Measures	Analysis	Results
Lininger, et al., 1933	SMP**	Students did or did not use milk	"Under-nourished" students ages 6-16 N = 4,133	Teachers' ratings of scholastic progress; reports of milk consumption	Percent of children receiving milk who improved compared with percent of children not receiving milk who improved.	Improved scholarship found for 45% of students using milk and for 24% of those not using milk.
Tisdall et al., 1951	NSLP**	Lunch program implemented and students selected to participate by modified randomization	Participants aged 5 1/2 to 10 1/2 and matched non-participants from three Canadian schools N = 200+	School grades; intelligence, reading and arithmetic test scores	Comparison of scores between participants and non-participants; no statistical analysis presented.	Grades and intelligence, reading and math scores of participants and non-participants did not differ.
Fellers, 1967	SBP**	Not clear from report	10th-grade participants and non-participants in one school N = 198	School grades, drop-out rate	Comparison of final grades and drop-out rate between participants and non-participants at end of school year.	Final grades and drop-out rates of participants and non-participants did not differ.
Pinkus, 1970	SBP	Students did or did not participate in breakfast program	Grade 4 from 8 Louisiana schools participating and not participating in SBP N = approximately 200	Pupil breakfast habits; pupil recall of crying, anger and misbehavior; parent and teacher records of pupil crying, anger and misbehavior; absenteeism; school grades for 1 month	Comparison of results between pupils in participating and non-participating schools.	Proportionally more no-program students went without breakfast than program students did. More no-program students than program students reported crying, being angry or misbehaving frequently; however, this difference was not reflected in teachers' and parents' records. Absenteeism and scholastic achievement of program and no-program children did not differ.
Koonce, 1972	SBP + NGLP vs. NSLP only	Students participated in school lunch, or school lunch plus breakfast, or neither program	Grades 1-3; students receiving free lunch and breakfast, free lunch only, or no school meals N = 60	Attendance; teacher ratings of students' disposition, responsiveness and classroom participation	Comparison of teachers' ratings between NSLP-only and NSLP + SBP participants; comparison of absence rates among the two participation groups and non-participation groups.	Teacher ratings were higher for NSLP + SBP children than for NSLP-only children. Absenteeism did not differ among groups.
Kreitzman, 1973	SBP**	Breakfast program implemented at treatment school but not at control school	Grades 3-5; one program and one no-program school in Atlanta, GA. N not reported	Attendance, grades, scores on achievement tests	Comparison of spring measures between program and no-program students. No statistical tests applied.	Achievement scores did not differ between program and no-program third-graders but tended to be higher for program fifth-graders than no-program fifth-graders.
Lieberman et al., 1976	SBP	Breakfast program implemented at treatment school but not at control school	Grades 3-6; one program and one no-program school in low-income neighborhood in Compton, CA. N = 551	Standardized tests for concentration, memory, abstract thinking performance	Comparison of fall and spring scores of students in program and no-program schools.	Test scores of program and no-program students did not differ.

\*SMP = Special Milk Program  
 SBP = School Breakfast Program  
 NSLP = National School Lunch Program

\*\*May include programs not sponsored by USDA.

Source: (67: 500)

and performance even among children with comparable nutritional status and levels of ability. In the latter work, taller children tended to be in higher grades than shorter children of the same age. This led the authors to hold that efforts to improve child nutritional status may have educational as well as health and survival benefits for the children involved.

Unfortunately, the policy-maker cannot simply accept that a child's nutritional status influences his school achievement--particularly when that child is malnourished or hungry--and derive a course of action from this assertion. The research findings are fairly uniform with respect to an important point: mild to moderate malnutrition acts synergistically with social-environmental factors to effect cognitive function. Therefore, the policy-maker must decide the extent to which he can deal with malnutrition in the environmental context in which it occurs. If he treats malnutrition as one of the factors leading to sub-optimal mental development (as the literature suggests), what other factors should he also address, and what will the coverage and cost implications of his decision be? From the cost standpoint, it might prove politically and otherwise expedient to reach nearly everyone in the "at risk" school-age population with a partial intervention than a smaller beneficiary population with a more nearly perfect treatment strategy. If the choice is made to opt for a food-only intervention, the planner can bolster his decision with the assertion (Latham and Cobos) that low energy levels lead to inactivity which in turn produces short-term effects upon learning that can be cumulative regardless of long-term nutritional status. If, on the other hand, he selects a nutrition intervention program that also addresses factors other than nutrition in order to rehabilitate deficiencies initially caused by poor nutrition, he may be distressed if fewer children are reached (because of cost considerations) although the intervention is sounder.

Some other conundrums also face the planner. How nutritionally adequate must the feeding intervention be for cognitive outcomes to occur? Arvedson's study suggested that the type of breakfast was not important (although the subjects were Swedes who presumably were not malnourished) while Checchi's three-country study found that the effect of an SFP on performance was unrelated to the program's ability to reach nutritional status goals. On the other hand, Cotten found that 7 percent of the variance on an IQ test--not at all an insignificant proportion--could be explained by presence or absence of malnutrition. Once again, the answer appears to vary according to the program's ecology. Where acute malnutrition is endemic, nutritional adequacy is probably more important than when hunger but not malnutrition produces learning dysfunctions. If hunger is a major impediment to learning, school breakfasts may be the most appropriate intervention. However, the planner must determine the criteria; for selecting breakfast versus lunch or snack programs. Selection of one type of program over another should be based on a careful assessment of need as well as past practice and custom.

Finally, planners need to look at who precisely is benefiting from SFPs. Aggregate data may obscure important results. If, for example, the program is particularly successful in overcoming the cognitive deficits of girls or socioeconomic groups that are particularly at the margin of their country's development, the resultant closing of the equity gap may well justify investment in the program.

All of these issues have implications for the design of SFPs. In the next chapter, recommendations for how SFPs can be designed to yield the maximum benefit in terms of attendance, enrollment and cognitive development are presented.

Appendix to Chapter III

Special Bibliography on Literature  
Related to Raven Progressive Matrices

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## Chapter IV Design Implications

1. Introduction. The purpose of this chapter is to identify approaches that can maximize the educational impact of AID-supported school feeding programs. Generally, SFPs are designed to meet three objectives: (1) to improve nutritional status of school-aged children; (2) to increase school attendance through the provision of a snack or meal; and (3) to improve children's ability to benefit from instruction by removing hunger or nutritional deficiencies as obstacles to learning. These objectives suggest that SFPs are intended to support or strengthen the typical array of host country strategies designed to improve the internal and external efficiencies of school systems. Nevertheless, there have been few if any attempts in the literature to state in explicit terms how SFPs can contribute to school system efficiency. The present chapter is an initial effort to fill this void.

Internal efficiency generally refers to the relationship between a school system's curricular expectations for students and what actually happens to students within the system. Typical indicators used to gauge a system's internal efficiency include the proportion of students in a given grade who are "over age," enrollment ratios, absenteeism, wastage rates, repetition rates, subject or examination failure rates, and the proportion of students in a cohort of school entrants who successfully complete a given level of schooling in the prescribed number of years. In other words, these measures focus on whether the student is learning what the curriculum prescribes and if the learning takes place at the prescribed pace. Education sector strategies that are designed to improve school attendance, expand school enrollments and facilitate greater mastery of curriculum objectives (either by improving teacher quality or providing improved instructional materials)--all are geared toward the goal of enhancing internal efficiency.

External efficiency is used to connote the relationships between what schools teach (or try to teach) and what a country needs to meet its development goals. For example, the curriculum for rural primary school students in a given ldc might emphasize the values and lifestyle of the urban elite. This may encourage most primary school leavers to emigrate from the countryside. At the same time, however, the country's development plans might stress rural micro-enterprise development. The education system is subtly undermining the government's ability to achieve this goal; an external inefficiency of far-reaching consequences is operating. Typically, education sector reforms designed to address external efficiency questions feature attempts to make curriculum more relevant. This may be accomplished by introducing vocationally oriented studies, by regionalizing the curriculum, by stressing life-long learning skills, and by creating a milieu in which students have ample opportunity to apply what is learned at school to home and community.

From the foregoing, it can be seen that SFPs could, if properly designed, improve both internal and external efficiencies. Yet seldom are programs planned to take full advantage of this potential. In this chapter's next two sections, specific design issues are raised and suggestions presented that will help planners begin to focus more concretely on how SFPs can have a greater educational impact.

2. SFPs and Enhanced Internal Efficiency. At the outset a critical assumption concerning SFPs must be made explicit: food alone, while necessary, is insufficient to overcome cognitive deficits in school-aged children who have a prior history of significant nutritional deprivation. Food can, however, be an important weapon in the arsenal of approaches. Let us see how.

The key to using SFPs as a means for supporting the school's cognitive development efforts is in using the feeding activity as a springboard for cognitively oriented interventions. The meal or snack period, for example, can become the occasion for structured verbal interactions between students and adults. Vocabulary, language fluency and syntax can all be improved by encouraging children to talk about shared interests or topics of importance in a non-threatening setting. Likewise, children can be helped to acquire the competence needed to prepare all or part of the meal. This would involve mastery of such critical skills as: following directions; measuring; translating written symbols into concrete actions; planning future actions; and evaluating performance for the purpose of improving it. Social skills would also be developed by enabling children to work together in the preparation and serving of food.

Needless to say, unless teachers are trained to use the SFP as a means for promoting cognitive development, it is unlikely that such outcomes will occur. Many attempts to improve teacher quality fail because the training program is not able to provide the support needed for teachers to "unlearn" deeply ingrained behaviors. A two-week workshop, for example, designed to help teachers use fewer rote techniques in class and to rely more heavily on student-centered active learning principles depends in part for its success on the trainer's ability to undo years of practice (first as a student, later as a teacher) with rote methods. This is the equivalent of breaking a long-standing habit. In contrast, the task of helping teachers acquire new behaviors related to school feeding is much easier because their belief systems concerning such programs are not nearly as deeply etched as many other beliefs related to classroom instruction. Thus, SFPs can serve as an entry point for providing teachers with pedagogically sound training that is likely to be applied in the classroom (or cafeteria) setting.

Changing teacher behaviors is a nearly impossible task if those who supervise them do not support the proposed changes. This means that any teacher training effort must be paralleled by work with school inspectors and headmasters. At this level, training should focus on identifying a broad range of interventions that can be carried out to overcome whatever cognitive deficits exist in the student population.

SFPs should be viewed in this broader context.

Most strategies for improving the internal efficiency of schools focus to some extent on improving teacher quality. Training around the SFP is one means for accomplishing this end if feeding and cognitive development can be purposefully and deliberately linked. At the same time, however, care must be taken so that SFPs do not significantly decrease the time teachers have available for classroom instruction. Otherwise, internal efficiency gains made through training may be more than offset by lost instructional time. When this occurs, we can say that the opportunity costs of participating in SFPs become too high. Strategies to reduce or minimize the opportunity costs of SFPs include parental or student involvement in food preparation; teacher participation in the design of SFPs; use of easy-to-prepare foods and recipes; and the careful scheduling of food preparation time so that it doesn't compete with instructional demands.

In most ldc's it is not possible to provide all schools with SFPs. Thus, targeting recipient schools becomes a critical task. Frequently, targeting is based on the assumed or assessed nutritional status of school-aged children. In some cases, the targeting is done at the level of individual schools or geographic zones; occasionally, the program is targeted to specific children within the school setting. In looking at how the educational impact of SFPs can be improved and, specifically, how SFPs can increase a system's internal efficiency, several implications for targeting practices suggest themselves. First, targeting to individual schools or geographic area is preferable to targeting practices that focus on specific children. Aside from the fact that targeting within schools tends to promote ration dilution, the practice also dilutes such educational payoffs as teacher participation or interest in SFP-related training, integration of feeding with cognitively oriented activities, and widespread parental involvement or contact with the school through its feeding program. If SFPs are to become a springboard for far-reaching educational improvements, they cannot reach only a portion of the students enrolled where they operate.

In addition to deliberate targeting, inadvertent targeting may also operate in the selection of SFPs. This occurs when the requirements of site selection tend, unwittingly perhaps, to favor certain categories of schools over others. For example, if the selection criteria call for the presence of a storage area, a minimally equipped kitchen and some community capacity to supplement or transport the food, it is easy to see how less wealthy communities frequently fail to meet these standards. The result, of course, is that those communities most in need of the food from both the nutritional and cognitive development vantage points may be less likely to receive it than communities where the need is not as great. Program designers and managers may wish to develop strategies for identifying communities where children are both cognitively and nutritionally most at risk. In those cases where the community is unable to meet site selection criteria, special assistance or dispensations should be considered.

Most frequently, SFPs are conducted as either school lunch or snack programs. In only a relatively small number of cases have breakfast programs been implemented. Yet one of the most commonly cited justifications for SFPs is that they increase students' attentiveness and therefore academic performance (the critical dimension of internal efficiency). If this line of reasoning is valid--and several studies suggest it is although others lend themselves to contradictory interpretation--then it may well make most sense to schedule the meal or snack immediately prior to the time when the most cognitively demanding part of the curriculum is taught. In most cases this will mean at the beginning rather than in the middle of the school day. Afternoons, in contrast, are more often used for art, physical education and vocationally oriented studies. The advantages of placing an SFP early in the day may be offset by the disadvantages associated with a child's returning home at noon; the need to expend calories to walk long distances, an inadequate lunch that fails to compensate for this caloric expenditure, and the increased probability of absenteeism in the afternoon. On the other hand, early morning feeding programs probably do not produce the substitution effect that lunch programs do since many lde families don't serve breakfast to children. The correct decision concerning the timing of the SFP depends on many factors. However, if all other things are equal and the school schedule is more demanding in the morning, school breakfasts or early morning snacks may have a greater impact than other kinds of SFP interventions.

Earlier, it was noted that enrollment ratios and absentee rates are two frequently used measures of a system's internal efficiency. SFPs are often defended on the grounds that they serve to draw students to enroll in school and encourage them to attend once enrolled. Once again the evidence for the claim is mixed and the methodologies employed in gaining the evidence are not of a uniformly even quality. However, it seems that the degree to which SFPs attract students is a function of many variables. Two of the most important are:

- o a comparison of the opportunity costs of school attendance compared to the market value of the food;
- o the probable return on a student's investment in education compared to the revised opportunity cost of schooling (where revised opportunity costs equals fees, books, uniforms and foregone wages minus the market value of the food).

Where the opportunity costs are high and the market value of the food is low, families are better off keeping their school-aged children at home unless it is likely that school enrollment will contribute to an enlarged stream of earnings in the future. Even in countries where fees, books and uniforms are minimal, the opportunity cost of schooling may be high if the child's labor can be gainfully used (or if it enables someone else to seek gainful employment as in the case of a child who takes care of younger siblings so that her mother can work as a domestic in the capital). The implication of this analysis is that ration size may be a powerful determinant of an SFP's ability to attract students in those countries where opportunity costs of schooling are high and the

probable return on investing in just a few years of primary school is low. Full breakfasts or lunches will be inducements to enroll whereas snacks probably will not draw more students. Conversely, in cultures where education has a clear economic benefit and where opportunity costs of schooling do not serve as a widespread barrier to enrollment, SFPs are likely to have little impact on attendance and enrollment. In these cases, snack programs may be a more cost-effective intervention than full meal programs for meeting nutritional and cognitive needs.

In summary, then, SFPs can contribute to the increased internal efficiency of school systems if they are properly planned. Such planning must begin with the recognition that food alone cannot completely overcome cognitive deficits present in nutritionally deprived school-aged children. However, SFPs can serve as the springboard for a variety of activities designed to improve teacher quality and the cognitive functioning of students. Decisions about the timing of feeding (early morning or mid-day), ration size and target population should also be governed by the level of educational impact that is deemed desirable. Let us now turn to a discussion of how SFPs can influence external efficiency.

3. SFPs and Enhanced External Efficiency. Any discussion about improving a school system's external efficiency is rooted in the belief that education exerts a powerful influence on the attainment of a country's development objectives. This influence can be either positive or negative. Where negative, the curriculum is largely irrelevant and the values it emphasizes inappropriate. Often this negative influence is exerted in such a subtle manner that teachers, parents and students are unaware of it. Educators have a term for the unintentional lessons schools teach; they call them the "hidden curriculum." SFPs provide educators with many opportunities to shape the hidden curriculum in a way that supports more broadly based development efforts.

A key aspect of SFPs is that they provide an avenue for all segments of the community to participate in school activities. Under the best of circumstances, parents will organize to supplement the commodities with locally raised produce or purchased foodstuffs. This creates the opportunity for some dynamic synergisms between classroom nutrition education and community decision-making. Immediately, that portion of the curriculum is bestowed with a special relevance.

Local groups of parents often need to organize themselves in support of an SFP if the program is to succeed. Not only must they work to supplement donated commodities, but they also need to make decisions about program logistics including meal preparation, product delivery and maintenance of cooking facilities. The net result of this participation is twofold; parental involvement in a broader range of school matters is promoted, and local community development efforts are stimulated. The degree to which community involvement is deemed important to program planners may influence a number of management decisions. For example, on-site cooking probably offers more community development potential than programs using ready-to-eat foods. Similarly, SFPs that serve all enrolled children probably stimulate more widespread parental

involvement than programs targeting only some children for participation.

SFPs can be designed to encourage the production of local foods either by parents or children. Thus, they can become a departure point for teaching about soil preparation, prevention of soil erosion, seed germination and other aspects of food cultivation. These principles may be applied in a school garden. All too often, however, school gardens prove unsuccessful. Many factors contribute to their failure: vacation breaks, thieving, and unsuitable land, for example. Decision makers need to ask themselves what the educational message of a failed garden is? It may well be advisable to explore alternatives to the traditional school plot. One possibility is to have students grow food on nearby working farms in cooperation with landowners. Such an approach would probably promote a higher degree of transfer between school and home while contributing to increased relevance of the curriculum to local conditions and needs.

If the SFP is structured so that imported commodities will be phased out over a specified period of time, the program may also contribute to the promotion of community self-reliance. This would certainly be an important lesson to include in the hidden curriculum. Self-reliance, however, will only be achieved if the community involvement has been carefully nurtured.

Decisions about the size and type of rations should also be examined from the perspective of the hidden curriculum. What behaviors are modeled for children when the SFP is based either on snacks or unbalanced meals? What is the implicit nutrition education message conveyed by the ration? It may well be that the SFP unwittingly contradicts the more carefully planned intent of the school's nutrition education curriculum.

Effective nutrition education can make an important contribution to a system's external efficiency since what is learned by one generation has a significant bearing on the rearing of future generations and therefore a country's stock of human capital, a critical ingredient in all development strategies. SFPs provide a valuable opportunity to make nutrition education efforts meaningful. They can become the basis for exploring best nutrient buys; proper handling and storage of foods; food preservation and preparation; and alternative sources of important nutrients. For classroom nutrition education to reach its potential, targeting messages to local priorities is essential as is the use of sound pedagogy.

In summary, SFPs can be designed to improve external efficiency by reinforcing more broadly based development objectives. Programs that encourage community participation, supplementation and eventual phaseout of donated commodities, local production of foodstuffs, and consistency between SFP and nutrition education messages will have the greatest educational impact.

4. Conclusions. In examining the literature on SFPs, it appears that the potential impact of SFPs may not have been reached. This is in part because they were designed exclusively or primarily from the standpoint of nutritional rather than educational needs. Effective program planning must be based on a careful examination of both sets of needs and how they relate to each other. In some situations, educational needs might be given a higher planning priority; in others, the reverse will be true.

In evaluating SFPs, greater clarity is needed concerning the relative priorities given to each objective. Where internal efficiency questions are of paramount interest, simple proxies for cognitive development are needed. Perhaps the rate of students successfully completing a given grade might prove useful if such critical intervening variables as teacher quality, distance between home and school, prior education of the mother and family, and socioeconomic status can be controlled.

Research is also needed to compare the relative impact of lunch and breakfast programs on school performance. Either a longitudinal approach within the same school setting or a comparison of matched communities might prove to be a useful framework. Once again, a pass/fail rate might be suitable in gauging cognitive development if intervening variables can be controlled. Any comparison between breakfast and lunch programs should also measure differential effects on school attendance.

Additionally, further research is needed to assess the impact of alternative distribution modes. For example, would a snack and lunch be a more potent combination in terms of nutritional status, attendance, and school performance than a breakfast and snack program? To what extent can commodity levels be reduced without diluting an SFP's educational (as opposed to nutritional) benefits? These are all questions that require serious analysis and discussion.

The methodological difficulties of conducting good research in this area are numerous. The relationships between SFPs (the independent variable) and school attendance or performance (the dependent variables) are seriously confounded by a series of intervening variables that collectively may exert more influence on the hypothesized relationship than the independent variables alone. Adding to the difficulties of inferring relationships is the need to take into account seasonal variations that might influence school attendance and attentiveness.

For planners, however, the most pressing concern should be the identification of whatever other inputs are needed in combination with SFPs to promote educational change. Children do not live by bread alone, and while food is undoubtedly a necessary condition for healthy growth and development, it certainly is not sufficient. Only when SFPs are viewed as but one component of broader schemes to improve education will they be able to achieve their full potential as vehicles for improving the internal and external efficiency of school systems in ldc's.

This study's concluding chapter presents a framework for an operations research project that could provide answers to these questions. Specifically, the proposed analytical framework would assist planners in matching the ecology of a program setting to design features so that the right mix of inputs could be made available at every program site.

## Chapter V Conclusions and Next Steps

Do school feeding programs increase attendance, improve academic performance and contribute to higher enrollment ratios? The studies that have been undertaken thus far fail to provide us with a conclusive answer to this question. They also neglect by and large, to relate impact to beneficiary population characteristics so we can draw a picture of those individuals for whom SFPs are most likely to make a difference. Clearly, what is needed is further research. Of equal clarity, however, is the need for a new approach to the problem of assessing program benefit.

In this chapter, the broad outlines of an operations research project on the impact of SFPs are sketched. It is intended not as a complete, self-contained methodological guide to inquiry in this area (which it most definitely is not) but to highlight the kinds of issues that must be systematically addressed in order for policy-makers to answer three basic and interrelated questions: (a) What kinds of changes do SFPs promote and for whom? (b) To what extent are these changes interdependent? (c) Given a particular set of ecological conditions, what is the ideal SFP design to promote improvements in enrollment, attendance, and academic achievement?

The justification for an operations research approach lies in five major weaknesses within the body of research on SFPs that is presently available. First, not a single study involved the use of baseline data collected prior to the advent of the SFP. Thus, it is virtually impossible to assess the degree to which the program prompted changes in the beneficiary population. Specifically, the lack of prior measures for attendance rates, enrollment ratios and academic achievement leave us without a strong basis for inferences concerning the impact of the intervention on these variables. Second, in only a few studies were such intervening variables as SES and quality of the educational environment adequately controlled. Thus, it is difficult to determine the extent to which differences are attributable to the intervention itself or to dissimilarities in the sample populations. In many of the comparative studies, particularly, the control and experimental groups were not really comparable. Third, data are generally reported in aggregated terms making it impossible to measure impact on groups of students generally deemed to be most vulnerable to nutrition-related problems: girls, rural children from landless families, ethnic minorities, children from incomplete families, and children from the most economically marginal households. Fourth, with the exception of Cotten's work in Haiti, the studies are not longitudinal and therefore tell us nothing about how SFPs influence rate of change in the variables of interest, attendance, enrollment and academic performance. Finally, none of the programs evaluated to date appears to be "state of the art." Thus, we cannot learn what the optimal impact of an SFP might be under very favorable but highly replicable conditions. In the case of a

program that seeks to induce cognitively oriented changes in students, "state of the art" at the very least probably means that the intervention design must incorporate a component concretely related to the desired cognitive outcomes.

These limitations impede the search for definitive answers to the three basic questions noted earlier. Let us look at each of these issues in turn and break them into a series of interrelated probing hypotheses that would form the agenda of an operations research project in this area. The first question asked about the kinds of changes SFPs promote and the characteristics of students most affected by these changes. The probing hypotheses associated with this issue include the following:

- (a) Do SFPs lead to positive changes in school enrollment ratios? What are the characteristics of those students for whom SFPs do and do not constitute an inducement to enroll? Are SFPs effective in promoting enrollment among students deemed to be most vulnerable to nutrition-related problems?
- (b) Do SFPs lead to improvements in school attendance among enrolled students? What are the characteristics of those students for whom SFPs do and do not constitute an inducement to attend? Are SFPs effective in promoting attendance among students deemed to be most vulnerable to nutrition-related problems?
- (c) Do SFPs lead to reductions in the wastage rate as measured by the proportion of students in the first grade who complete primary school in the prescribed number of years? What are the characteristics of those students for whom SFPs do and do not constitute an inducement to complete primary school in the prescribed number of years? Are SFPs particularly effective in reducing the wastage rate among students deemed to be most vulnerable to nutrition-related problems?
- (d) Do SFPs contribute to a student's increased ability to engage in the cognitive processes closely associated with learning (e.g., ability to concentrate and attend to instruction; short- and long-term memory; intersensory integration)? What are the specific cognitive processes most amenable to change through a school feeding intervention? What are the characteristics of those students particularly benefited by SFPs in the area of cognitive development? Are SFPs particularly effective in promoting cognitive development among students deemed to be most vulnerable to nutrition-related problems?
- (e) Do SFPs contribute to improvements in student academic performance? What are the characteristics of those students whose academic performance appears to benefit from

the presence of an SFP? Are SFPs effective in improving the academic performance of students deemed to be most vulnerable to nutrition-related problems?

- (f) Do SFPs contribute to improvements in student nutritional status? What are the characteristics of those students who nutritionally derive greatest benefit from SFPs? Are SFPs effective in improving the nutritional status of students deemed to be most nutritionally vulnerable?

The second broad issue concerned the extent to which changes promoted by SFPs are or need be interdependent. The first set of questions focused on six change variables: enrollment ratios; school attendance rates; wastage rates; intellectual development; academic achievement; and nutritional status. This new issue seeks to identify which (if any) of these variables is necessary (and/or sufficient) to promote change in the other variables under consideration. Examples of probing hypotheses that might constitute the research agenda in this area include the following:

- (a) For what segments of the school population is improvement in nutritional status a necessary and/or sufficient condition for increased cognitive development and improved academic achievement? For what segments of the school population is alleviation of temporary hunger without nutritional status change a necessary and/or sufficient condition for improved academic performance?
- (b) For what segments of the school population is improvement in nutritional status a necessary and/or sufficient condition to improve school attendance rates? For what segments of the school population is alleviation of temporary hunger alone a necessary and/or sufficient condition for improved school attendance?
- (c) To what extent are changes in enrollment ratios and wastage rates dependent upon changes in nutritional status? Can the alleviation of temporary hunger alone contribute to change in these areas?

Matching the design characteristics of an SFP to a particular set of ecological conditions is the final concern on which an operations research project ought to focus. Some probing hypotheses related to this issue and especially suited for inclusion in a research agenda include the following:

- (a) For what settings would breakfast, lunch, snack or some combination of these feedings (e.g., breakfast and lunch) be most appropriate?

- (b) In what settings should feeding be integrated with a cognitively-oriented intervention?
- (c) In what settings should the feeding program attempt to close the gap between average daily intake and minimum daily requirements? Where should the program attempt only to alleviate temporary hunger?

If this list of probing hypotheses constitutes the outline of an agenda for an operations research project, then attention must now be given to methodological issues including overall approach, sample selection and modes of analysis. What follows is a broad discussion of each of these topics.

To provide responses to the probing hypotheses noted earlier, an operations research project on SFPs must have three important characteristics. First, it should be longitudinal; rate of change over time needs to be measured. Second, it should assess the impact of alternative designs in a variety of ecological settings. Last, at least some of the designs tested ought to incorporate a cognitive component in order to assess maximum potential impact for "state of the art" programming.

The operation research project proposed here would be of a three to five year duration, involve a wide variety of sites in one country, and would track first graders in relation to attendance, wastage, academic achievement and nutritional status. In addition, data on enrollment ratios would be gathered for the length of the study. Ideally, the study should monitor the first grade cohort for the same number of years as covered by the primary school curriculum. However, since the bulk of attrition generally takes place by the end of the third grade, it is probable that a shortened study period, while not preferable to one that coincides with the primary school cycle, would be adequate for discerning most of an SFP's impact on the variables under consideration.

Seven basic treatment programs would be tested: snack only; breakfast only; lunch only; snack plus cognitive intervention program; and cognitive intervention program only. A "no treatment" control group would also be included in the design.

The cognitive intervention program to be replicable and appropriate to a wide cross-section of teachers in ldc's must be easy to use and free from any dependence on materials that are expensive or difficult to obtain. For the purposes of this project, a flashcard program of games built around the alphabet, numbers and vocabulary items matched with pictures seems highly appropriate. These games would be teacher-led, last an average of fifteen minutes daily, and, insofar as possible, be played in conjunction with the meal or snack activity. As students advanced beyond the first grade, the games would, of course, become

increasingly complex and could involve small groups of student players working independently of one another. Of course, a modest teacher training program would be needed to mount the flashcard program.

Each of the seven treatments would be tested in four different types of settings in order to assess how program ecology acts as a mediating variable. These settings would be ranked from "most favorable" to "least favorable" through the construction of three indices, one for SES, one for the quality of the education available and one for nutritional status. It is expected that the "most favorable" environments would be placed between the fifty-first and sixty-fifth percentiles on each index, while the "least favorable" would fall below the twentieth percentile on all the indices where the frame of reference is a representative sample of schools within the target country. In operational terms, a school would be placed in a given category if at least 60 percent of the first graders fell within the specified ranges and if the majority of the remaining students fell within + 10 percentile units of the specified ranges.

The SES index would be constructed to include family income, education of father, education of mother, physical characteristics of the family dwelling (e.g., number of rooms, presence or absence of latrines, roofing material) and presence or absence of key possessions (e.g., radio, bed, chair). The quality of education index would reflect teacher qualifications and school facility characteristics. Measures of teacher background include highest grade completed, and years of teacher experience. School plant adequacy would be reflected in the ratio of total enrollment to number of school desks, the ratio of total enrollment to books in school, illumination, and occupancy density (number of students per square foot of classroom space). Student-teacher ratio would also be included in this index along with the ratio of first graders to students enrolled in the last year of primary. The nutritional status index would be a simple comparative measure of weight for height.

In the table below, characteristics of the various ecological settings and the distribution of treatment programs are summarized. It shows that the proposed project involves four distinct ecological settings, seven different experimental treatments and a total of 88 research sites. This relatively large number of sites is needed to insure an appropriate mix of rural and urban schools, as well as an adequate number of first grade subjects. Each cell in Figure 4 will include one urban school; the remainder will be rural. A sample of this size will also facilitate comparisons of impact on the basis of program exposure (i.e., the number of days the program actually operated at the school site) and differential program impact on boys and girls. It is expected that schools with fewer than 20 first grade students would be eliminated from the sample due to the longitudinal nature of the study and the need to have a reasonable number of subjects in the study's concluding phase.

Figure 4

SAMPLE CONSTRUCTION OF OPERATIONS RESEARCH PROJECT ON SFP IMPACT

Setting	Percentile Rankings on All 3 indices	Snack Only	Breakfast Only	Lunch Only	Snack + Cognitive Treatment	Breakfast + Cognitive Treatment	Lunch + Cognitive Treatment	Cognitive Treatment Only	No Treatment	TOTALS
Most Favorable	65th - 51st	2	2	2	2	2	2	2	2	16
Moderately Favorable	35th - 50th	3	3	3	3	3	3	3	3	24
Moderately Unfavorable	20th - 34th	3	3	3	3	3	3	3	3	24
Most Unfavorable	below 20th	3	3	3	3	3	3	3	3	24
	Totals	11	11	11	11	11	11	11	11	88

It is recommended that both the breakfast and lunch programs be designed, insofar as possible, to provide students with approximately 30 percent of minimum daily nutritional requirements. This may well involve the supplementation of donated commodities. The snack ration should contain approximately one half the nutritional value of the breakfast or lunch programs and should be served mid-morning. Periodic data on the food consumption habits of students will be gathered to determine the degree to which the SFP is alleviating temporary hunger and the extent to which it promotes supplementation of the current diet or the substitution of SFP products for normally consumed foods.

In Chapter II of this report, the path analysis techniques used by the Checchi team in its three-country study of SFPs were reviewed (see pages 45-47). It was noted that a strength of this approach is that it provides a framework for testing the "fit" between the assumptions inherent in the design of an SFP and the actual conditions found in the field. This is achieved by enabling researchers to examine where the largest number of "incorrect paths" (i.e., unanticipated cause-and-effect linkages) lie. Given the nature of the operations research project proposed here--an attempt to match a variety of ecological settings to alternate intervention designs--this approach seems most appropriate.

Data analysis will, of course, need to focus on more than how each intervention's impact differed according to the ecological setting in which it was tested. Comparisons will also have to be made that point up differences between boys and girls, rural and urban students, relatively younger and older first graders and students with more versus less exposure to the program (as determined by the number of days the SFP actually was operational at the study site).

To conclude this chapter, probing hypotheses related to each of the three issues proposed for consideration are analyzed according to the relevant independent and dependent variables, operational definitions and the kind of instrumentation needed to investigate them. These examples are offered to illustrate the breadth and complexity of the proposed operations research project as well as the wealth of invaluable information that would be generated through such an effort.

The one question remains: Is such a complex and presumably costly research effort worthwhile? The savings that will stem from a more cost-effective intervention program will undoubtedly justify the initial investment many times over. Food is a valuable resource. Our country has a responsibility to see that the essential dilemma of foreign aid--the tension between what donor nations are willing to give and what recipient nations actually want--results in a positive sum game where all parties gain. With school feeding, this dilemma is minimized for it is one of a relatively small number of programs that can satisfy objectives of a broad range of constituencies from U.S. farmer to ldc planner. As such, it appears to be the embodiment of win-win gamesmanship. Every effort must be made to assure ourselves and our ldc

partners that this appearance is firmly rooted in fact. Otherwise both donor and recipient nations alike will become losers in the struggle to create conditions favorable to global peace and security.

Figure 5

Selected Examples of Probing Hypotheses  
For an Operations Research Project on School Feeding Programs

Probing Hypotheses	Independent Variables	Intervening Variables	Dependent Variables	Operational Definitions	Instrumentation	Comment
<p>1) Do SFPs lead to positive changes in school enrollment ratios? What are the characteristics of those students for whom SFPs do and do not constitute an inducement to enroll? Are SFPs effective in promoting enrollment among students deemed to be most vulnerable to nutrition-related problems?</p>	<p>SFP (presence or absence)  SFP (intervention mode)  SFP (efficiency)</p>	<p>Nutritional status; nutrition-related vulnerability; student background factors; school background factors</p>	<p>School enrollment ratio</p>	<p>a) SFP = snack, breakfast or lunch program served in school using a combination of donated commodities and locally purchased products or relying solely on one or the other. Breakfasts or lunches provide approximately 30 percent of MDR; snacks offer half this amount.  b) School enrollment ratio = the proportion of students in a specified age cohort who are currently enrolled in school.  c) Nutrition-related vulnerability = children at or below the 90th percentile of weight-for-height or height-for-age norms and children from families with one or more of the following characteristics:</p>	<p>a) SFP Control Sheet = to monitor content, frequency and participation in SFP.  b) Census Form = to determine size of cohort.  c) Enrollment Data Sheet = to derive data on school enrollment from which enrollment ratios can be calculated.  d) Student Case History Form = to assess the student background factors and degree of nutrition-related vulnerability.  e) School Background Factor Scale = to record and assess teacher qualifications and school plant adequacy.</p>	<p>Changes in school enrollment ratios will be correlated with each of the following variables: type of SFP; nutritional status of students; degree of nutrition-related vulnerability; student background factors; school background factors; nutritional status changes within students and SFP efficiency and intervention mode. These correlations will be derived periodically throughout the study period commencing with</p>

Figure 5

Selected Examples of Probing Hypotheses  
For an Operations Research Project on School Feeding Programs

Probing Hypotheses	Independent Variables	Intervening Variables	Dependent Variables	Operational Definitions	Instrumentation	Comment
1) continued				<p>rural and landless; one or both parents absent; economically marginal (below the 30th percentile in real income); ethnic minority.</p> <p>SFP intervention mode = one of the following: breakfast only; lunch only; snack only; and each of the above combined with a cognitive intervention consisting of 15 minutes a day of structured games using flash-cards with numbers, letters and vocabulary items.</p> <p>SFP efficiency =</p> $\frac{\text{Number of days program functioned}}{\text{Number of days in school year}}$	<p>f) Student height-weight chart = form to monitor changes in weight-for-height over time. Nutritional status comparison of weight-for-height with locally or internationally accepted norms.</p> <p>g) Student Background Factors Scale = sex of student; family SES as reflected by the education of child's father and mother; physical characteristics of the family dwelling; and absence or presence of targeted possessions including a radio, bed and chair; student IQ as measured by Raven.</p> <p>h) School Background Factors Scale =</p>	<p>a baseline measure administered to first graders. Regression analysis will be used to identify the proportion of variance attributable to each of the independent and intervening variables.</p>

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Figure 5

Selected Examples of Probing Hypotheses  
 For an Operations Research Project on School Feeding Programs

Probing Hypotheses	Independent Variables	Intervening Variables	Dependent Variables	Operational Definitions	Instrumentation	Comment
(1) continued					qualifications of teaching staff (e.g. highest grade completed; number of years teaching); school plant adequacy as measured by ratio of total enrollment to number of desks and books; occupancy per square foot of space and adequacy of illumination; pupil-teacher ratio and average wastage rate between first and last year of primary cycle.	

Figure 5

Selected Examples of Probing Hypotheses  
For an Operations Research Project on School Feeding Programs

Probing Hypotheses	Independent Variables	Intervening Variables	Dependent Variables	Operational Definitions	Instrumentation	Comment
<p>2) Do SFPs lead to improvements in school attendance among enrolled students? What are the characteristics of those students for whom SFPs do and do not constitute an inducement to attend? Are SFPs effective in promoting attendance among students deemed to be most vulnerable to nutrition-related problems?</p>	<p>SFP (presence or absence); SFP (intervention mode); SFP (efficiency)</p>	<p>Nutritional status; nutrition-related vulnerability; student background factors; school background factors</p>	<p>School attendance rate</p>	<p>School attendance rate = average daily attendance for 50 preselected days divided by average total enrollment on each of the 50 preselected days. Days preselected would not be contiguous to a weekend, holiday or vacation period and would be seasonally stratified.</p> <p>See #1 for other terms.</p>	<p>All instruments noted in #1 and Student Attendance Form to record attendance as well as enrollment on preselected days.</p>	<p>Changes in attendance will be correlated with the same variables and analyzed in the same manner as described in #1.</p>

Figure 5

Selected Examples of Probing Hypotheses  
For an Operations Research Project on School Feeding Programs

Probing Hypotheses	Independent Variables	Intervening Variables	Dependent Variables	Operational Definitions	Instrumentation	Comment
<p>3) Do SFPs lead to reductions in the wastage rate? What are the characteristics of those students for whom SFPs do and do not constitute an inducement to complete primary school in the prescribed number of years? Are SFPs particularly effective in reducing the wastage rate among students deemed to be most vulnerable to nutrition-related problems?</p>	<p>SFP (presence or absence); SFP (intervention mode); SFP (efficiency)</p>	<p>Nutritional status; nutrition-related vulnerability; student background factors; school background factors</p>	<p>Wastage rates</p>	<p>Wastage rate = for a primary school curriculum of 5 years:                       number of students enrolled in the fifth grade in <math>y^5</math> divided by the number of students who entered first grade in <math>y^1</math> where <math>y^1</math> = base year and <math>y^5</math> = base year + 5. Intermediate wastage rates can be calculated for <math>y^2 - 4</math> using this same approach.                       See #1 for other terms.</p>	<p>See #1</p>	<p>Changes in wastage rate (<math>y^2 - y^5</math>) will be correlated with the same variables and analyzed in the same manner as described in #1.</p>

Figure 5

Selected Examples of Probing Hypotheses  
For an Operations Research Project on School Feeding Programs

Probing Hypotheses	Independent Variables	Intervening Variables	Dependent Variables	Operational Definitions	Instrumentation	Comment
<p>4) Do SFPs contribute to a student's increased ability to engage in cognitive processes closely associated with learning? What are the specific cognitive processes most amenable to change through a school feeding intervention? What are the characteristics of those students particularly benefited by SFPs in the area of cognitive development? Are SFPs particularly effective in promoting cognitive development among students deemed to be most vulnerable to nutrition-related problems?</p>	<p>SFP (presence or absence); SFP (intervention mode); SFP (efficiency)</p>	<p>Nutritional status; nutrition-related vulnerability; student background factors; school background factors</p>	<p>Cognitive development</p>	<p>Cognitive development = ability to concentrate and attend to instruction; ability to retain information in the short- and long-term; ability to integrate stimuli and information obtained through various sensory modes.</p>	<p>Scale of Ability to Attend to Instruction* = students are individually given sequences of directives and tested on their ability to follow directions of increasing length and complexity. Example: Put the ball on the book (two behavioral steps, no qualifiers). Put the red ball on the book (two behavioral steps, one qualifier). Put the red ball on the blue book (two behavioral steps, two qualifiers).</p>	<p>Test scores will be correlated with each other as well as with the same variables and analyzed in the same manner as described in #1.</p>
					<p>Short-term Memory Test* = an individually administered test in which students are asked to duplicate number, word and</p>	

Figure 5

Selected Examples of Probing Hypotheses  
 For an Operations Research Project on School Feeding Programs

Probing Hypotheses	Independent Variables	Intervening Variables	Dependent Variables	Operational Definitions	Instrumentation	Comment
(4) continued					<p>and picture sequences presented by tester.</p> <p>Long-term Memory Test* = essentially the same test as above except that students duplicate each sequence after 90 seconds of an intervening activity.</p> <p>Portius Maze Test = Although originally designed as an IQ test, the items can be administered in an untimed fashion and scored somewhat differently so that eye-hand coordination difficulties do not influence assessment. If these adjustments are made, this instrument will measure foresight, ability to plan, attention, and</p>	

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Figure 5

Selected Examples of Probing Hypotheses  
 For an Operations Research Project on School Feeding Programs

Probing Hypotheses	Independent Variables	Intervening Variables	Dependent Variables	Operational Definitions	Instrumentation	Comment
4) continued					intersensory integration capacity.  See also instrumentation on items #1-3.  * - tests to be specially developed for this project.	

Figure 5

Selected Examples of Probing Hypotheses  
For an Operations Research Project on School Feeding Programs

Probing Hypotheses	Independent Variables	Intervening Variables	Dependent Variables	Operational Definitions	Instrumentation	Comment
<p>5) Do SFPs contribute to improvements in student academic performance? What are the characteristics of those students whose academic performance appears to benefit from the presence of an SFP? Are SFPs effective in improving the academic performance of students deemed to be most vulnerable to nutrition-related problems?</p>	<p>SFP (presence or absence); SFP (intervention mode); SFP (efficiency)</p>	<p>Nutritional status; nutrition-related vulnerability; student background factors; school background factors</p>	<p>Student academic performance</p>	<p>Student academic performance = ability to perform essential school-related tasks as evidenced by scores on standardized tests and normal progress through a school system (i.e., one year of academic credit for each year spent in school)</p>	<p>Boehm Test of Basic Concepts for first and second graders; math and vocabulary portion of test similar to Stanford or Metropolitan Achievement Tests (i.e., instrument with multi-levels) adapted for local use.  See also instrumentation in items #1-4.</p>	<p>Changes in school performance as measured by appropriate achievement test and academic progress will be correlated and analyzed in the same manner as described in #1. The Boehm Test of Basic Concepts measures essential concepts needed by children to cope with classroom instruction. It correlates highly with a child's ability to learn reading and math/facts. It contains 50 basic relational concepts (e.g., same/different;</p>

Figure 5

Selected Examples of Probing Hypotheses  
 For an Operations Research Project on School Feeding Programs

Probing Hypotheses	Independent Variables	Intervening Variables	Dependent Variables	Operational Definitions	Instrumentation	Comment
(5) continued						right/left; more/less; first/last).

Figure 5

Selected Examples of Probing Hypotheses  
For an Operations Research Project on School Feeding Programs

Probing Hypotheses	Independent Variables	Intervening Variables	Dependent Variables	Operational Definitions	Instrumentation	Comment
<p>6) For what segments of the school population is improvement in nutritional status a necessary and/or sufficient condition for improved cognitive development and academic achievement? For what segments of the school population is alleviation of temporary hunger without nutritional status change a necessary and/or sufficient condition for improved academic performance?</p>	<p>Nutritional status; ----- alleviation of temporary hunger</p>	<p>Student background factors; school background factors.</p>	<p>Level of cognitive development; student academic performance</p>	<p>See #4 and #5</p>	<p>See #4 and #5;  Food Consumption Habits Inventory*: Record designed to measure food intake of students over a 24-hour period. It is especially sensitive to the quantity of food consumed prior to participation in an SFP by recording time and level of intake.</p>	<p>Changes in nutritional status will be correlated with changes in cognitive development and academic achievement. These changes will be derived periodically over life of study commencing with a baseline measure. Likewise, presence or absence of hunger will be correlated with changes in student academic performance. Regression analysis will be used to identify the proportion of variance attributable to each independent and intervening variable.</p>

Figure 5

Selected Examples of Probing Hypotheses  
For an Operations Research Project on School Feeding Programs

Probing Hypotheses	Independent Variables	Intervening Variables	Dependent Variables	Operational Definitions	Instrumentation	Comment
7) In what settings would breakfast, lunch, snack or some combination of these feedings be most appropriate?	SFP intervention mode (breakfast only, lunch only, snack only)  SFP efficiency	Student background factors; school background factors	School enrollment ratios; school attendance rate; nutritional status; level of cognitive development; student academic performance	See items #1 - #5.	See item #1 for descriptions of SFP Control Sheet; Census Form; Enrollment Data Sheet; Student Case History Form; School Background Factors Scale; Student Background Factors Scale; School Background Factors Scale and see items #4 and #5 for remaining instrumentation.	SFP intervention mode will be correlated with each of the dependent variables while controlling for the intervening variables. Regression analysis will be used to identify the proportion of variance attributable to each independent and intervening variable.

Figure 5

Selected Examples of Probing Hypotheses  
For an Operations Research Project on School Feeding Programs

Probing Hypotheses	Independent Variables	Intervening Variables	Dependent Variables	Operational Definitions	Instrumentation	Comment
8) In what settings should feeding be integrated with a cognitively oriented intervention?	SFP intervention mode (breakfast only; snack only; lunch only or any of the above <u>plus</u> cognitive intervention). ----- SFP efficiency	Student background factors; school background factors	School enrollment ratios; school attendance rate; level of cognitive development; student academic performance; nutritional status	Same as previous item	Same as previous item	Same as previous item

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APPENDIX 1

SUMMARY MATRIX OF STUDIES RELATED TO SCHOOL FEEDING:

INTERNATIONAL

SUMMARY MATRIX OF STUDIES RELATED TO SCHOOL FEEDING: INTERNATIONAL

STUDY [logographic order]	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
[1] Rwanda Evaluation School Feeding Program	a. shows statistically significant improvement in students' health after received supplements of calories and nutrients, as compared to those who didn't	Amundson and Wecker, 1982  p. 3	-strong control but unequal 2/1; -strong SES comparable; -arbitrary nutritional status measure; -coverage limited; -no information on substitution or extraneous factors	lunch	-3 schools; 2 with SF, 1 without SF; -SES comparable; -comparable height/weight; -90th percentile of height/weight ratios used as standard of health				X			Gikongo
[4] Determinants of Children's School Participation	a. children's school participation appears to be affected by parents' need for children's help, by parents' perceptions of value of schooling, and by child's apparent competence  b. school participation affected positively by family affluence but not by apparent	Balderston, 1981  p. 102, 104	-INCAP longitudinal and school performance data, 1969-1978; -RAND data, 1974-75, not available for same subjects; -strength of looking at family SES; -strength of using hypothetical models;		-4 rural villages; -regression and logit analyses--estimated determinants of school enrollments corresponding to each of 3 models; -cross-sectional analysis; -size used as measure of nutritional status	X	X	X		family affluence and education		Guatemala

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
	<p>differences in child's height, health, or verbal proficiency, in one village where parents had low education and work readily available</p> <p>c. where parents had more education and work wasn't so readily available for children, height and verbal performance at 7 years are positively and highly related to school enrollment</p> <p>d. when economic and family background factors kept constant, size and health of children act as independent, positive determinants of children's school attendance and performance</p>	<p>p. 102, 104</p> <p>p. 102, 104</p> <p>p. 102, 104</p>	<p>-strength of identifying dependent/independent variables</p>			X	X	X		family differences and education		

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
<p>Research review, The Guatemala Experiment of The Berkeley Project on Education and</p>	<p>a. bigger children do better in school; size of child considered best measure of nutritional status</p> <p>b. early protein-calorie deprivation creates lasting effects upon behavior, some of which can be altered through later enrichment of diet, but never completely disappear. Both mild and severe malnutrition appear to affect learning.</p> <p>c. change in structure of nervous system seen to occur if environment provides certain kinds of stimuli</p>	<p>Balderston, 1981 (Weinberg et al., 1974) p. 4</p> <p>(Barnes et al., 1968) p. 9</p> <p>(Rosenzweig and Bennett, 1980) p. 10</p>	<p>research review</p>		<p>-multiple regression analysis to provide estimates of the effect of head or height circumference in predicting educational outcome</p> <p>-animal experiments, malnutrition and later rehabilitation</p>			<p>X</p>	<p>X</p>			<p>X</p>

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
Longitudinal Analysis of Diet, Physical Growth, Verbal Development, and School Performance	<p>a. children with severe early malnutrition leading to clinical marasmus show subsequent, impaired mental functioning; moderate chronic PCM is associated with lower scores on mental tests</p> <p>b. substantial relationship between nutrition and mental development</p> <p>c. temporary hunger, as opposed to malnutrition, may adversely affect attention, interest, and learning</p>	<p>Wilson, 1981</p> <p>(Klein et al., 1972) p. 40</p> <p>(Chavez, Martinez, and Yaschine, 1974; Christiansen, Vuori, Mora and Wagner, 1974; Cravioto and DeLicardie, 1972; Richardson, 1976) p. 40</p> <p>(Read, 1973, 1975; Pollitt, Gersovitz, and Garguilo, 1978) p. 40</p>	(literature reference)	free high protein supplements				X X	X			Atole villages in Guatemala

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d.	predictive effect of height at 36 months on verbal performance; height, as proxy for cumulative health from conception to 36 months, affects performance at age 3, and also predicts growth--(learning)--year by year through age 7	p. 69	-hypothetical framework; -multiple variables; -possible errors in measurements of home diets--so constraints imposed on parameters; -treat familial background variables as controls		-INCAP longitudinal data--look at effects of variations in recent diet upon school performance (judged by teachers); holding constant prior cumulative nutritional status, verbal attainment, and many background characteristics (data collected by RAND, 1974-75)	X	X	X	social and environmental response; teacher assessment; substitution		X	
e.	healthier children elicit a more favorable and responsive social environment	(cf. Chavez et al., 1975) p. 69	----- (literature reference)		sample--100 students complete one or more years of school, sat for first year language and math examinations							
.f.	children with superior verbal attainment before school age are most likely to enroll. Large differences among villages in the proportion of children who enroll	(Irwin et al., 1980) p. 71	----- sought internal consistency across models  (literature reference) -----		INCAP teachers tend to normalize estimates of performance--so added dummy variables to counter; head circumference and stature taken as fallible indicators of							

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	<p>g. child's diet is the largest and most significant factor affecting a teacher's assessment of performance when holding constant prior verbal attainment, size, and a large number of other variables</p> <p>h. current levels of energy have an important impact on learning and performance even among children with comparable prior nutritional status and comparable levels of ability</p> <p>i. the availability of free high-protein supplements led to: an increase in total caloric intake, partial replacement of home diet, a substantial increase in the proportion of protein in the diets of the village children</p> <p>j. children having high current energy intakes perform better in school</p>	<p>p. 74</p> <p>(ref. Latham and Cobos, 1971) p. 75</p> <p>p. 76</p> <p>p. 76</p>	<p>(literature reference)</p> <p>(literature reference)</p>		<p>hypothetical construct "size" -coefficients of social and economic indicators included eclectically--not robust</p>	X	X		X	X		X

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[7] Study of Impact of Food Assistance Program	<ul style="list-style-type: none"> <li>a. marginal nutritional impact of SFP</li> <li>b. program not targeted to moderately or severely malnourished</li> <li>c. in 3 out of the 4 schools (in Bicol) analyzed, participants' nutritional status was higher during summer when <u>not</u> participating in program--possibly attribute to substitution</li> <li>d. Nutribun provides only small percentage of daily caloric needs vs. whole meal</li> <li>e. no significant impact on attendance and enrollment</li> <li>f. SFP does best in maintaining those children who start school year in adequate condition; for those in poor condition, SFP makes no difference</li> </ul>	<p>Blumenfeld et al. 1982 p. 15</p> <p>p. 15</p> <p>p. 16-17</p> <p>p. 16-17</p> <p>p. 122</p> <p>p. 118</p>	<ul style="list-style-type: none"> <li>-potential difference in data collected by MEC and by the team directly re accuracy of on-site measurements;</li> <li>-no information on method of school selection;</li> <li>-participants only mildly or non-malnourished;</li> <li>-overall primary enrollment already rather high;</li> <li>-weight gain measure completeness;</li> <li>-separated outcome from process--limited;</li> <li>-limited controls</li> </ul>	Nutribun snack	<ul style="list-style-type: none"> <li>-collected data for 2-year time period;</li> <li>-discussions with CARE and CRS staff;</li> <li>-selected schools;</li> <li>-discussions with local and school officials; observations;</li> <li>-collection of weight for age data for previous school year or more;</li> <li>-height and weight for age data;</li> <li>-10 category nutrition scale for categorizing children;</li> <li>-used Wilcoxon Signed rank test to analyze shift in level of data set for each school;</li> <li>-used Nutribun and non-Nutribun schools</li> </ul>	X	X		X			Phi- lip- pines



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	<p>e. facts are established as follows:</p> <ul style="list-style-type: none"> <li>-work capacity is related to body size, lean body mass, muscle mass and cell residue;</li> <li>-total circulating hemoglobin affects work capacity;</li> <li>-it is suggested that present energy deficit does not decrease physical fitness in short term activities but can adversely affect endurance;</li> <li>-physical activity and energy expenditure are related to energy intake in both children and adults; recent studies show that relative inactivity of children reduces growth rate during rapid growth periods;</li> <li>-high probability that chronic energy intake restriction reduces productivity;</li> <li>-behavior adaptation to caloric restriction may occur with an increase in resting or quiet activities</li> </ul>	<p>p. 39</p> <p>p. 40</p> <p>p. 40</p> <p>p. 40</p> <p>p. 40</p>			<ul style="list-style-type: none"> <li>-dependent variables= disease, reproduction, activity, cognition, and social competence;</li> <li>-two-dimensional stratification sampling</li> </ul>							

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	<p>f. evidence suggests that mild-moderate malnutrition acts synergistically with social/environmental factors to affect cognitive function</p> <p>g. the effects of malnutrition on the body's structural integrity is more firmly established than the effects on adaptive behavior, capacity for learning, and dealing with social and environmental demands</p>	<p>p. 40</p> <p>p. 41</p>										
<p>Appendix A: nutrition, physical activity and Work output</p>	<p>h. human activity is goal directed and responds to the environment and the physical and mental condition of the subject. The economist will insist that work should be related to productivity. This places emphasis on physical dexterity, mental alertness, and so on, and away from the nutritionists' traditional emphasis on the maintenance of the body and energy output</p>	<p>(Bliss, 1978) p. 27, Appendix A</p>	<p>background paper</p>		<p>-background paper; -review of economists' literature; -caloric accounting approach to nutrition</p>			<p>X</p>	<p>X</p>	<p>X</p>		<p>X</p>

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Appendix B: Physical Activity and Work Output: Biological Perspec- tives	i. there is adequate evidence to indicate that vitamin deficiencies and fasting result in poor performance in tasks requiring attention, adequate visual perception, coordination of fine movements and performance of skilled tasks requiring little energy expenditure above maintenance	(Viteri, 1978) p. 4, Appendix B	state of art research		state of art research re nutrition and productivity; background paper							
Appendix 11-4: Intro- duction	j. although agricultural and economic conditions set the amount of food available to a particular community, the structure of local society and the family determines the actual proportions that are eaten by adult family members, sold or bartered, fed to animals or fed to children	(Riciutti, Brozek, et al., 1978) pp. 24, 26, Appendix 11-4	introduction to background papers		introduction to background papers			X	X	X		X

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	k. moderate malnutrition, caused by limitation of food intake, can influence the child by modifying cognition and the socialization pattern so critical to adaptation to family and societal structure, and in the adult in influencing his social, reproductive, and work competence, all so critical to his contribution to national productivity -----	p. 26, Appendix 11-4 -----										

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Appendix 11-4: Malnutrition and the Development of Intellectual Competencies: Research Issues and Priorities	<p>1. increasing acceptance of the view that malnutrition may be implicated in important ways as <u>one</u> of the contributing factors leading to sub-optimal or impaired mental development</p> <p>m. thus far there appears to be relatively little evidence that the provision of nutritional supplementation for children exposed to moderate to mild malnutrition can substantially enhance their intellectual development</p> <p>n. it has become increasingly apparent that a developmentally facilitative social environment may substantially attenuate or even prevent the potentially unfavorable consequences of early, severe malnutrition</p> <p>o. nutritional deficits seem to alter the child's attentional competencies and responsiveness to the environment</p>	<p>p. 3, Appendix 11-4</p> <p>p. 3, Appendix 11-4</p> <p>pp. 8,9 Appendix 11-4</p> <p>p. 14, Appendix 11-4</p>						X	X	X		X

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91 An Evaluation of the School Feeding Program	<p>a. 73.4% of teachers perceived that enrollment or attendance increased by SFP</p> <p>b. 34% of teachers perceived that nutrients provided to children/or health improved with SFP with increase</p> <p>c. 24% of teachers perceived that SFP provided supplementary food to reach students</p> <p>d. difficult to separate school location influence from food factor re attendance and enrollment</p> <p>e. efficiency variables of supply, consumption and ration were higher in the schools where community support was indicated by the teacher than the schools without such support</p>	<p>CARE, 1975</p> <p>p. 9</p> <p>p. 9</p> <p>p. 10</p> <p>p. 11</p>	<p>-impressionistic; -ambiguity between process/ impact evaluation -limited statistical analysis; limited variables -some allowance for extraneous factors; -poor nutritional data and measures</p>	lunch	<p>-10 states selected; random selection of blocks; circular systematic sampling of schools; at least one school/block; -questionnaire; trained interviewers for survey; -school visits</p>	x	x		x	commu- nity support		India

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1) school feeding	<p>a. schools not participating in SFP found to have higher enrollments</p> <p>b. small impact of SF on attendance</p> <p>c. SFP stabilized enrollment and attendance and decreased absenteeism</p> <p>d. SFP reduced variance in enrollment</p> <p>e. regular supply of food critical in attracting students</p> <p>f. efficiency of delivery must be improved 80%</p>	<p>CARE, India, 1977</p> <p>p. 25</p> <p>p. 25</p> <p>p. 18</p> <p>p. 14</p> <p>p. 26</p> <p>p. 26</p>	<p>-no SES or size of population re children of 6-11 years on whom data collected;</p> <p>-little explanation of extraneous factors leading to existing poor attendance</p>	lunch	<p>-20% of administrative blocks, all schools, 36 blocks selected by circular systematic random method; sub-sample 10% of class 1 MDM and non-MDM schools with complete data;</p> <p>-data collected by CARE field officers;</p> <p>-T-test and variance analysis</p>	X	X			community organization		Karnataka
3) nutritional impact of Nutribun feeding	<p>a. gradual weight improvement by grade with CARE Nutribun, larger gains in upper grades</p> <p>b. positive correlation between regularity of feeding and weight gain</p>	<p>CARE, 1974-75</p> <p>p. 4</p> <p>p. 8</p>	<p>-sample did not include isolated rural schools;</p> <p>-school self-selected: biased sample;</p> <p>-no controls;</p> <p>-measures fairly precise, but not complete, limited;</p> <p>-no extraneous factors taken into account;</p> <p>-no model</p>	Nutribun	<p>-45 selected elementary schools in 11 regions;</p> <p>-31,006 children, 27,826 had complete weight records;</p> <p>-school criteria: participation in CARE Nutribun last two years; enrollment 300 or more; officials and teachers willing to participate;</p> <p>-Wilcoxon Signed Rank Test used to analyze data--calculated weights as percents of standards to obtain growth response</p>				X			Philippines

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c. d. e. f.	<p>no statistical significance in prevalence of acute undernutrition between children particularly in SF and non SFPs; however, a tendency toward fewer acutely malnourished children in schools with SFPs</p> <p>age group comparison shows that six-year-olds in SFPs appear to have a higher acute undernutrition rate than their counterparts in non-SFPs -- nutritional status of kids entering SFPs worse than that of kids entering schools without SFPs--opposite true of upper ages</p> <p>nutritional status appears to improve in children particularly in SFPs--no similar improvement in non-SFPs</p> <p>chronic undernutrition increases significantly with age, among the primary school children</p>	<p>CARE, 1981</p> <p>pp. 4, 33</p> <p>p. 4</p> <p>p. 4</p> <p>p. 6</p>	<ul style="list-style-type: none"> <li>-controls used;</li> <li>-baseline data obtained;</li> <li>-no analysis of extraneous factors;</li> <li>-limited explanation of nutrition measurement cut-off;</li> <li>-no hypothetical model;</li> <li>-questionable application of NCHs reference to this population</li> </ul>	<p>biscuits; Triposha</p>	<ul style="list-style-type: none"> <li>-cross-sectional study;</li> <li>-sampled children in schools with and without SFPs, without including those with better nourished children as indicated by 1973 and circumference survey, as well as new schools established since that survey;</li> <li>-129,170 children, aged 5-11 years old;</li> <li>-NCHS reference standard for comparing anthropometric measurements; used nutrition indices of height-for-age and weight-for-height</li> </ul>				X	Sharing		Sri Lanka

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	<p>g. significant higher level of chronic undernutrition among children in schools with feeding programs than in schools without SFPs, when identified by age group and sector--SFPs appear successful in reaching nutritionally neediest</p> <p>h. concurrent acute and chronic undernutrition is significantly higher in children participating in SFPs than non-SFPs regardless of age or sector</p> <p>i. supplemental feeding ration needs to be increased if expected to reduce under-nutrition</p> <p>j. teachers must supervise consumption of biscuits on-site to prevent take home and sharing</p> <p>k. in case of chronic undernutrition smallness of food supplement leads to question of positive effect of ration on stunting within a short period of time</p>	<p>p. 6</p> <p>p. 8</p> <p>p. 12</p> <p>p. 12</p> <p>p. 40</p>										

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[ 20] Food for Peace: An Evaluation- A Global Assessment Volume I	<p>a. small discernible difference in physical measurements between Sfed and non-Sfed children within a one-year time frame</p> <p>b. programs don't reach children who are not enrolled in school and probably the most malnourished</p> <p>c. teachers' judgements that pupils appeared more alert and active when received meal or snack at school</p> <p>d. where school lunches rather than snacks provided, school supervisors of agriculture and industrial arts helped to establish school gardens to produce fresh foods to supplement Title II</p> <p>e. no conclusive evidence that Title II SFP has decisive impact on learning receptivity, school attendance, or physical stamina on program participants</p>	<p>Checchi and Co., 1972</p> <p>p. 78</p> <p>p. 78</p> <p>p. 78</p> <p>p. 80</p> <p>p. 81</p>	<p>-essentially judgemental; impressionistic;</p> <p>-no systems analysis or mathematical modelling;</p> <p>-no baseline data</p>	<p>lunch, snack</p>	<p>-reviewed USAID and Volag documentation in the field;</p> <p>-interviewed host country government officials and local citizens and personnel at projects sites</p>		X	X	X	<p>gardens; school system</p>		<p>global</p>

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f. SFP needs full legitimacy of being integral part of primary school education -- needs acceptance of school system	p. 82	Checchi and Co., 1972	<ul style="list-style-type: none"> <li>-essentially judgemental, impressionistic;</li> <li>-no systems analysis or mathematical modelling;</li> <li>-no clarity or explanation of variables of concern;</li> <li>-limited data on assumptions;</li> <li>-no baseline nutritional or background data;</li> <li>-imprecise measures</li> </ul>	<ul style="list-style-type: none"> <li>-sampling selected to maximize variations in country settings; types and scopes of Title II endeavors; operating agency differences and AID support;</li> <li>-fieldwork-file reviews; host country official meetings, informal talks with local citizens; interview teachers and administrator reports</li> </ul>								
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Part I: Philippines	<ul style="list-style-type: none"> <li>a. getting and building adequate ovens a problem</li> <li>b. getting adequate scales a problem</li> <li>c. often less malnourished are inappropriately targeted</li> <li>d. school personnel often overburdened by SFP</li> <li>e. delivery poses problems</li> <li>f. measuring charts have questionable validity</li> <li>g. students more attentive, more interested in coming to school, experience improved health with presence of SFP</li> <li>h. weight charts are a motivator and educational device</li> </ul>	pp. 31-34		Nutrition Snack			X	X	X	community organization; school personnel		Philippines
Part III: Colombia	<ul style="list-style-type: none"> <li>a. education officials are not involved enough</li> <li>b. CARITAS is too distant from the government-eliminates collaboration</li> <li>c. educational uses of weight measures are not being exploited</li> </ul>	p. 30		hot lunch snacks						collaboration; educational applications		Colombia

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Part V: Morocco	a. secondary economic payoffs result from SFP: programs serve, in some cases, a partial day care function in that they free mothers for work	p. 18		lunch						eco- nomic-- mothers work		Morocco
Part VI: Ghana	a. SFP has positive effect on school attendance--note compulsory education law b. SFP perhaps contributes to dissolution of taboos re certain foodstuffs	p. 22		lunch	-visited programs		X			taboos		Ghana
Part VII: Indonesia	a. SFP has potential for transmission of parasitic disease if not prepared properly b. some children take SF rations home	p. 38		milk						disease; sharing		Indo- nesia

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221 Evaluating Feeding Programs: L 480 Title II	<p>a. present food allowance is not sufficient to make a worthy contribution to improve nutritional status</p> <p>b. teachers believe SFP has positive impact on attendance; note better attendance in a.m. than p.m.</p> <p>c. no difference in a.m./p.m. attendance when compared one grade in school; but whole school shows increase in p.m. attendance;</p> <p>d. attendance rises and falls regardless of SFP or not;</p> <p>e. SFP demands on teachers may detract from educational activities</p>	<p>Clapp and Mayne, Inc., 1977</p> <p>pp. 42, 46</p> <p>p. 45</p> <p>p.45</p> <p>p. 46</p> <p>p. 95</p>	<p>-need larger sample;</p> <p>-evidence too limited and not long enough time period of study;</p> <p>-a.m. attendance is generally better than p.m. anyway;</p> <p>-lack of accurate, up-to-date reports;</p> <p>-control positive;</p> <p>-no explanation of nutritional measures' completeness;</p> <p>-no explanation of extraneous factors</p>	snack	<p>-25 days in Honduras;</p> <p>-visited programs in nine different departments;</p> <p>-rural and urban;</p> <p>-interviews with officials and workers;</p> <p>-observation and clinical measures (of height and weight, weight/age and weight/height measures)--baseline data;</p> <p>-random sample of centers (including controls);</p> <p>-a.m. and p.m. attendance records;</p> <p>-teacher reports</p>		X		X	educa- tional activ- ities		Hon- duras

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23) Effects of Education on Health	<p>a. literacy is most important variable in multivariate analysis of life expectancy which includes measures of per capita income; but, in multivariate analysis of infant mortality, it is less important</p> <p>b. income distribution is the second most important variable; amount of calories per capita ceases to be important and number of doctors becomes significant;</p> <p>c. suggests that literacy is less important when measures of income inequality are included, but that literacy still makes important contribution, even when controlling for income inequality</p> <p>d. literacy always remains significant variable; income inequality varies substantially in</p>	<p>Cochrane et al., 1980</p> <p>(Hicks, 1979) p. 23</p> <p>(Hicks, 1979) p. 24</p> <p>(Chao, 1979) p. 25</p>	<p>literature review and analysis</p> <p>-recognition of multitude of variables;</p> <p>-statistical analyses;</p> <p>-models;</p> <p>-no specific examples</p>	<p>general re health and education</p>	<p>-assess socioeconomic determinants of mortality on a cross-national basis;</p> <p>-using aggregate data reviews and reanalyses literature on international differences in mortality and life expectancy; looks at relationship between education and mortality as education is important variable in cross-national evidence;</p> <p>-reviews and reanalyzes evidence at subnational level;</p> <p>-reviews individual evidence on relationship between parental education and both child nutrition and infant mortality-- compares to aggregate data</p>				X	X	X	X

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	<p>relative and absolute importance; income per capita significance varies greatly, depending on what other variables included; income distribution and literacy extremely important in explaining life expectancy at any time</p> <p>e. important to recognize that education of one person may affect others' health; may in fact be easier to detect influence of parents' education on their children's health than on their own, because children's health is more sensitive to current diet and environment than that of adults</p> <p>f. in population as whole, education and health are jointly determined, with substantial influences running from health to education</p>	<p>p. 30</p> <p>p. 37</p>							x	x	x	x

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	<p>f. an empirical relationship "explaining" life expectancy in part by literacy rates does not capture any clear causal mechanism</p> <p>g. maternal education is closely related to child health and child mortality; unequivocal evidence of a relationship</p> <p>h. on the average an additional year of schooling for a mother results in a reduction of 9/1000 in mortality of her offspring</p> <p>i. estimate that effect of husband's education is about 1/2 effect of wife's; accordingly, of the reduction of 9/1000, approximately 3/1000 is the result of the wife's own education, and 3/1000 the result of her husband's education</p>	<p>p. 54</p> <p>p. 92</p> <p>p. 92</p> <p>p. 92</p>			<p>bivariate analysis of infant and child mortality;</p> <p>multivariate analysis - part of effect results from fact that more educated women tend to be married to more educated men</p>				X	X	X	X

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24 ] Evaluation of PL 480 Title II	<ul style="list-style-type: none"> <li>a. local on-the-spot cooking and consumption provided impetus for parental and community involvement and responsible participation of children too</li> <li>b. initiative of teachers critical</li> <li>c. danger of food taken home being shared</li> <li>d. reports that MDM positive effect on attendance-- an incentive</li> <li>e. younger age group in lower grades most needy</li> <li>f. MDM may have nutritional effect on intended recipient although substitution for other family foods that diminish its impact</li> <li>g. recommend that headmasters and teachers involved in management of MDM program get special training re community development</li> </ul>	<p>Community Systems Foundation, 1979</p> <p>p. 72</p> <p>pp. 72, 74, 75</p> <p>p. 72</p> <p>p. 73</p> <p>p. 73</p> <p>p. 74</p> <p>p. 76</p>	<ul style="list-style-type: none"> <li>-sought multiplicity of views, but still impressionistic;</li> <li>-not really an impact evaluation;</li> <li>-no hypothetical model, systems analysis; statistical analysis;</li> <li>-no controls, no delineation of variables</li> </ul>	lunch	<ul style="list-style-type: none"> <li>-visits to representative sampling of various kinds of school programs at 45 sites in nine states;</li> <li>-interviewed parents, children, food handlers, teachers, officials</li> </ul>		x		Community development; teacher development		India	

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51 Evaluation Research PL 480 Title II School Feeding Program	<p>a. when nutritional status considered directly, urban sub-sample significantly worse off nutritionally than rural</p> <p>b. mixed evidence re substitution: eating habits at home significantly better among non-SFP participants; substitutions may be occurring, however, on percentage basis, more non-SFP children come to school hungry</p> <p>c. indication that prevalence of acute malnutrition significantly less in SF schools; however, SES of SFP children, on average, is higher also in SFP children sample</p>	<p>Cotten, 1982</p> <p>p. 9</p> <p>pp. 9, 132</p> <p>p. 14</p>	<p>-need to hold SES constant--do not know pre-SFP nutrition status;</p> <p>-cross-sectional data not sufficient, need longitudinal data</p> <p>-analytical framework useful</p> <p>-controls obtained</p> <p>-baseline data obtained</p> <p>-nutritional measures may be inadequate--research hypothesis rests on premise that weight-height measurement is on indicator of nutritional status. Weight-for-Height is age free--eliminates</p>	lunch	<p>-major variables and indicators included: for Nutrition, indicators of Percent of Standard Weight-for-Height (WTSTD), Weight Dispersion Measure (WDM) and Prevalence (PREV); for Performance indicator of Raven Test Scores (RAVN); for Attendance, indicator of attendance rate (AR); for Program Exposure, Indicators of Size of Ration (ACTRAT/RDA) Length of Time the child has been in program (controlled), and Leakage (computed); for environmental factors, indicators of Socio-economic status (KAYBA/BET/TUTN), Quality of Education</p>		X	X	X	Substitution; educational awareness; gardens		Haiti

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	<p>d. SFP children seem to come from better SES environment. SFP schools have significant lower prevalence of malnutrition--possibly explained by fact that SFP children tend to come from a better home environment than nonSFP counterparts</p> <p>e. strong positive relationship between Raven Test Scores and KAYBA-SES lead to believe that preponderant cause of marginal differences in performance between SFP and nonSFP children could be due to differences in home environment rather than differences in nutritional status</p> <p>f. schooling tuition paid by child's family found to correlate with child's cognitive performance; tuition here viewed as surrogate indicator of SES of child's family--linkage is: wealthier family can afford the higher tuition, higher tuition implies better education, which leads to child performing</p>	<p>p. 146</p> <p>p. 147</p>	<p>difficulty of obtaining participants' ages</p>		<p>(QUALED), and Extra Program Eating Habits (MANGE) -analysis included both program effectiveness and impact study-- impact: institutional and student questionnaire, weight and measure children re nutritional status, with non-verbal test re cognitive performance--27 SFP schools + 27 non SFP schools; 54 schools/1034 children</p>							

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	<p>better in school-- supports argument that exogenous factors, separate from SFP influence, provide equally plausible explanation for performance differences as SFP</p> <p>g. significant difference between high attendance in SFP schools and lower attendance in nonSFP schools could be explained by home environment differences as well as by SFP differences</p> <p>h. data suggest that, in general, the frequency and quality of the home consumption is less for those children who participate in SFP than for nonSFPs</p> <p>i. some evidence that SFP plays some role in raising awareness of need nutrition training</p> <p>j. more SFPs with gardens than nonSFPs, implying that improved awareness of importance of fresh vegetables in diet may be spinoff from SFP</p>	<p>pp. 147-148</p> <p>p. 148</p> <p>p. 184</p> <p>p. 188</p> <p>p. 189</p>										

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[26] Nutrition Programs Using U.S. Food Aid, Evaluation of PL480 Title II Programs	<ul style="list-style-type: none"> <li>a. results inconclusive</li> <li>b. positive relationship between SF and attendance</li> <li>c. biscuit needs to be enhanced with milk and wheat flour for nutrition</li> <li>d. impossible to quantify benefits of SF at this time</li> <li>e. ration believed too small to close nutrient gap of poorer children</li> <li>f. sharing of biscuit evident</li> <li>g. when averaged, attendance figures did not show any drop during biscuit shortage</li> <li>h. targeting the worst schools is adequate approach-do not target individual</li> </ul>	<p>Community Systems Foundation Drake et al., 1982</p> <ul style="list-style-type: none"> <li>p. 49</li> <li>p. iii</li> <li>p. vi</li> <li>p. iii</li> <li>p. 46</li> <li>p. 47</li> <li>p. 49</li> <li>p. 67</li> </ul>	<ul style="list-style-type: none"> <li>-no regularly collected anthropometric data;</li> <li>-used "existing" data</li> <li>-design inadequate--need estimates of perception of each school re causes and unexpected duration of interrupted service; records of biscuit stock on school-by-school basis; stratification of school size; longer, more complete time series.</li> <li>-interpretation of results confounded by fact that some schools so small that absence of only a few children substantially changes percentage in attendance</li> </ul>	biscuit	<ul style="list-style-type: none"> <li>-examined retrospective attendance for primary school children;</li> <li>-compared school attendance in the only years out of last 50 where SF discontinued and resumed;</li> <li>-estimated percentage school age children enrolled in school each year;</li> <li>-compared enrollment in grades with institutionalized SF to where non-institutionalized;</li> <li>-looked at impact of temporary breaks in SF on attendance;</li> <li>-tracked several schools; followed shortage.</li> <li>-used WHO suggested daily calorie allowance figure for comparison with biscuit</li> </ul>		X		X			Sri Lanka

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[28] Comparative Evaluation on Ongoing Programs (ref #32)	<p>a. SF has small impact on attendance</p> <p>b. SFP led to limited occurrences of improved nutritional status; except for Kenya</p> <p>c. no change in food habits generally</p> <p>d. inconclusive effect of SFP on school performance</p> <p>e. Kenya SFP showed small positive effect on nutritional status of participants</p> <p>f. Kenya SFP showed little impact on attendance</p> <p>g. Kenya SFP showed small positive impact on school performance</p> <p>h. No SFP of 15 was successful in meeting both nutritional and attendance objectives</p> <p>i. indirect benefits of SFP were of political or diplomatic nature</p> <p>j. differences in impact on SFP: -targeting of students within school;</p>	<p>Checchi and Co., Ellis et al, 1974</p> <p>p. 39, 34 p. 36</p> <p>p. 36</p> <p>p. 36</p>	<p>-measures imprecise; inaccurate survey data;</p> <p>-attendance already high;</p> <p>-site specific nature of impacts;</p> <p>-complicated and limited by diversity of SFPs and background factors;</p> <p>-statistical procedures are conservative; they treat only the net direct effects of the programs (one Kenya program may have begun with more nutritionally disadvantaged children)</p> <p>-age less easy to ascertain</p>	lunch	<p>-cross-sectional data;</p> <p>-school feeding examined at program and control schools;</p> <p>-interviewed children, 1st and 3rd grades;</p> <p>-height and weight measured; weight dispersion measures; scholastic ability tested;</p> <p>-interviews held with children's mothers or guardians; their teachers; and principals of their schools;</p> <p>-unit of analysis was single program activity in particular place-structured survey techniques;</p> <p>-15 schools studied weight dispersion measures</p>		X	X	X	political; diplomatic; substitution		Colombia, Kenya, Philippines

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	<ul style="list-style-type: none"> <li>-number feeding days per year and number feeding interruptions;</li> <li>-hot lunches compared to others;</li> <li>-less food taken home;</li> <li>-local management;</li> <li>-initial economic and nutritional status;</li> <li>-nature of ration and distribution method;</li> <li>-source of ration</li> </ul> <p>k. no program treated as only supplementary -- seen as substitution too</p> <p>l. there are predictors of nutritional status, in order of least to most importance and varying between countries: includes program participation, mother's food knowledge, distance from school, child's food habits, mother's 24-hour food, mother's education, child's food knowledge, child's 24-hour food, school attendance, household size, household possessions, Raven ability score.</p>	<p>p. 51</p> <p>p. 28</p> <p>p. 53</p> <p>p. 69</p>					X	X	X	X		

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30] Judging the Merit of Child Feeding (see #11)	<p>a. what makes a project effective as a nutritional intervention cannot be the same as what makes a project effective as an educational one</p> <p>b. inclined to think of school projects in two rather distinct ways, as nutrition efforts, but also as a type of supportive community development endeavor</p>	<p>Ellis et al., 1975</p> <p>p. 196</p> <p>p. 196</p>	<p>-development handbook;</p> <p>-discusses issues: project definition of target population, control population, sample size, site context, expected outcomes, intervening conditions, feeding inputs</p>		<p>-development handbook;</p> <p>-discusses field evaluation tasks: sampling recipients and controls, interviewing, data from files and records, giving tests and taking measurements, keeping diaries of field activities, editing and cross-checking raw data, coding and assembling data for processing</p>			X	X	X		X ref Phi- lip- pines, Col- ombia, Kenya

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34] Annexes; #15: Termination of a SFP	<p>a. between 1980-82 enrollment dropped by 23.4%</p> <p>b. teachers convinced drop in enrollment due to end of SFP</p> <p>c. decline fairly constant for all grades; first grade least and sixth grade highest decline-- thus 1/4 children dropped out</p> <p>d. effects of SFP termination appear greater in rural schools, though effects in rural in town are negative</p> <p>e. in lower four grades, tendency for girls' enrollment to decline more than boys'. In lower grades, more boys than girls enrolled, so effects of SFP ending are being disproportionately felt by children</p> <p>f. in upper grades, generally more boys enrolled; termination of SFP disproportionately more negative for boys than girls</p>	<p>p. 2</p> <p>p. 2</p> <p>p. 2</p> <p>p. 5</p> <p>p. 2</p> <p>p. 2</p>	<p>-impressionistic; -no controls; -baseline data, partial; -no analysis of extraneous variables, no contextual information</p>		<p>-data by sex and school from three poor, rural and one town area in northwest; collected by primary school teachers; -data from when program operated from 1972-1979 and from three years after program ended, 1980-1982</p>	X	X			X		X

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	<p>g. termination of SFP may be keeping more girls than boys from getting minimum education</p> <p>h. may be that lack of SFP keeps more boys from getting higher levels of education than girls who make it through 4th grade</p>	<p>p. 2</p> <p>p. 2</p>	<p>-impressionistic; -no controls; -baseline data, partial; -no analysis</p>		<p>-data by sex and school from three poor, rural and one town area in northwest; collected by primary school</p>	X	X			X		X
<p>[35] Evaluation of PL 480 Title II Program</p> <p>Care pre-school feeding program</p>	<p>a. food seen as incentive for mothers to enroll their children</p> <p>b. families contribute to cost of food, firewood, and preparation</p>	<p>Gall et al., 1982</p> <p>p. 15</p> <p>p. 15</p>		<p>lunch</p>	<p>-46 project sites;</p>	X	X			<p>male-female differences</p> <p>community involvement</p>		<p>Dominican Republic</p>

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[36] Supple- mentary Feeding Programs for Young Children in Developing Countries	<p>a. general impression is that food distribution programs directed toward young children, as now being operated, are rather expensive for the measured benefit</p> <p>b. anthropometric improvement was surprisingly small</p> <p>c. children with greatest apparent weight deficit at program entry tended to show greatest response to supplementary feeding</p> <p>d. if programs are to expand to the point where they can exert real impact, it is essential that their true objectives be defined</p>	<p>Ghassemi and Benton, 1979</p> <p>p. i</p> <p>pp. i,ii</p> <p>pp. i,ii,59</p> <p>p. iv</p>	<p>research review:</p> <p>-pilot projects generally more effective than ongoing projects, creates a bias;</p> <p>-many programs did not have appropriate controls;</p> <p>-difficult to determine leakage;</p> <p>-inadequate data re target population;</p> <p>-relied on anthropometric data;</p> <p>-limited analysis of contextual factors;</p> <p>-sample sizes generally adequate</p>	SFP, MCH	<p>-200+ reports reviewed:</p> <p>-research on pilot projects primarily;</p> <p>-some longitudinal data;</p> <p>-some controls; some cross-sectional;</p> <p>anthropometric measures included; mean weight for age, mean height for age, mean height for height, mean energy intake kcal/day, mean energy gap kcal/day</p>			X	X	X		X

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e.	Ugandan children adapt to chronic energy undernutrition, in part by reducing voluntary activity; but maintain physical growth rates at reasonable levels	(Rutishauser and Whitehead) p. 16						X	X	X		X
f.	nutritionally supplemented pregnant women and children in Mexico responded with increased voluntary activity	(Chavez et al.) p. 16										Uganda
g.	physical growth and development is only one, and not necessarily the most important, of many potential benefits from supplemental feeding	p. 16										Mexico
h.	general conclusion is that magnitude of responsiveness, measured anthropometrically and at a group level, is a function of the relative severity of the undernutrition that exists in the population	p. 23										

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	<p>i. circumstantial evidence is strong enough to state that not all outcomes of supplemental feeding have been measured and recorded. It is conceivable that unmeasured effects are more significant in overall development of individual and community than the relatively small improvements in weight gain</p> <p>j. a serious failing of many supplemental feeding programs now operating is that the real objectives have not been clearly identified and probably have not been sufficiently considered in program design</p> <p>k. matters such as physical location of the food distribution point, both in terms of distance and usual patterns of family travel, affect participation</p>	<p>p. 35</p> <p>p. 58</p> <p>p. 61</p>						X	X	X		X

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	<p>1. program effectiveness, as well as cost, should be expected to be affected by the socio-economic setting and the overall level of development, including the stage of development of infrastructures in the community</p> <p>m. there may be a threshold level of development below which it is unrealistic to expect long term health benefits from a food distribution program as an isolated activity</p> <p>n. experience of programs to date has suggested some areas that offer opportunities for improvement of program impact: clear definition of program objectives; improved assessment of the nature and size of the nutritional gap at the level of the program participants,</p>	<p>p. 62</p> <p>p. 62</p>						X	X	X		X

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	<p>and the design of supplements to fill these gaps in a complementary manner; careful selection of infrastructures including consideration of both population coverage (accessability) and community attitude toward the selected infrastructure; increased attention to program management and program monitoring; maximum integration with other community development activities including in particular primary health care activities where this is feasible; and encouragement of community participation in both the design and implementation of the program</p>	<p>p. 65</p>						X	X	X		X

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[40] Nutri- tional Evaluation of School Feeding	a. teachers reported nutrition program increased attendance and attention span	Gorecki, 1978  p. 7, 8	-impressionistic data; -attendance always higher in the p.m.; -teachers only evaluators; -strong baseline data obtained re malnutrition; -age data unreliable; -height and weight data direct and fairly precise; -no allowance for extraneous factors	snack	-random sample of large and small schools in CARE/MOE feeding program -limited student back- ground data -children measured using height-weight-age indicators; -sample commodities for proper preparation; -poll teachers for acceptability and use of commodities; -1400 students, alternate grades		X	X				Hon- duras
[42] Poor Children and the Schools	a. fragile scientific evidence to support notion that children's present biological condition correlates with their learning but studies have tended to show that better nourished children did better	Gussow, 1970(?)  p. 12	literature review; discussion					X	X		X	X

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[43] Nutrition and Mental Develop- ment	a. malnourished children who received several hours of cognitive stimulation each day in addition to food and medical care showed improved per- formance on a variety of mental tests	Gussow, 1974 (McKay et al., 1973)  p. 28	-pilot studies only -need explanation of food and medical care -no explanation of "performance" cut-off -no discussion of extraneous factors -how choose mental tests	"food"	-pilot studies; -follow severely deprived children 3-6 years old, to identify kinds of interventions that might be effective in over- coming effects of mal- nutrition; -long-term; -mental functioning tests administered; -untreated siblings = controls			X				Col- ombia
[49] Food for Peace, Title II Evaluation	a. SFP apparently has positive effect on nutritional status of participating children	International Science and Technology Institute, Inc., 1981  pp. 14, 52, 53	-interview data insufficient- impressionistic; -weight for	lunch	-visited 23 school canteens; -discussion with GOUV officials;	X	X		X	govern- ment, poli- tical		Upper Volta

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	<ul style="list-style-type: none"> <li>b. SFP provides for network of government, political support</li> <li>c. inconclusive, impressionistic reports of positive effect of SFP on attendance and enrollment</li> <li>d. food transportation costs are sometimes problem for schools, as is water source</li> <li>e. parents at some schools built cooking area for SFP; some schools built separate warehousing</li> <li>f. some substitution occurs when some children take food portion home to share</li> <li>g. very little nutrition-related education in curriculum at present</li> <li>h. one school had garden producing vegetables to eat and sell</li> <li>i. ration has economic value for parents: substitute for buying cheaper foods, or additive (additive more likely)</li> </ul>	<ul style="list-style-type: none"> <li>p. 48</li> <li>p. 53</li> <li>p. 49</li> <li>p. 49</li> <li>p. 50</li> <li>p. 50</li> <li>p. 50</li> <li>p. 50</li> </ul>	<ul style="list-style-type: none"> <li>height measure considered a nutrition status indicator most sensitive to short term changes;</li> <li>-limited measurement cut-off</li> <li>-explanation</li> <li>-unaware of environmental factors which influence institutional status;</li> <li>-no hypothetical framework or correlational analyses</li> </ul>		<ul style="list-style-type: none"> <li>-discussions with AID and CRS officials;</li> <li>-observational visits to 23 schools;</li> <li>-identification, logistics, opinions;</li> <li>-discussions with participants;</li> <li>-used growth surveillance system records-- heights and weights recorded three times/year, study used only weight for height which was available on master charts and measured heights and weights of all children in 13 schools, 1980 and 1981; comparison of measurements</li> </ul>	X	X		X	network; garden; economic; substitutions		

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	j. SFP costs to community include: parents-food transport to schools and on-site preparation; ministry of finance-transport and internal warehousing charges; ministry of education-salaries of personnel administering SFP and food storage	p. C5				X	X		X	X		
52] Evaluation of Title II Food for Peace	<p>a. more students attended school when meals available; illness lower; attention greater</p> <p>b. weight data indicate program impact, but sample too small to draw country wide conclusions</p> <p>c. indirect employment benefits from FFP: warehouse, loading, trucking</p> <p>d. indirect effects on reduction of possible increased inflation from food shortages; impact on family income</p>	<p>Development Associates, Inc. Jones et al, 1981</p> <p>p. 87</p> <p>p. 88</p> <p>p. 144</p> <p>p. 144</p>	<p>-impressionistic reporting, data from managers and teachers;</p> <p>-no children weighed (data from clinic or health cards);</p> <p>-limited information from recipients</p>	lunch or late a.m.; pre-school	<p>-55 distribution centers selected on basis of political, urban/rural, program types, sponsoring agency, number of recipients;</p> <p>-2 site questionnaires;</p> <p>-participant survey;</p> <p>-report form designed for direct quantification;</p> <p>-direct and indirect nutritional impact measures;</p> <p>-weight change over time and changes in dietary habits and nutrition-related knowledge;</p> <p>-growth monitoring;</p> <p>-market/community surveys;</p>		X	X	X	employment; economic		Ghana

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[53] Effect of School Feeding Schemes upon Learning among Primary School Children	a. no significant difference between SF and non-SF	Kanno, 1973  p. 3103, dissertation abstracts	-no information re control group; targeting; baseline data		-155 children; 6-11 years; in primary school; 27 villages; 115 households visited; questionnaire re home meals and food v/v school; one year study;  -used intelligence test, anthropometric measures; classroom observation; teacher reports			X				Lesotho
[55] Economics of Supplemental Feeding of Malnourished Children: Leakages, Costs and Benefits	a. three types of leakages occur in supplemental feeding programs: intra-family, income group children in FP not malnourished or sufficiently poor, and income leakages where family's opportunity costs to participate in FP reduces net value of food transfer  b. a partial feeding program, unless it can change through education or other means the pattern of food consumption within the	Knudson, 1981  pp. 1,5,6,20,21	-research review; -models; statistical analysis; multiple variables; contextual issues; -derivative only	lunch	-calcium intake data from National Nutrition Monitoring Bureau; caloric intake households and individuals; -National Sample Survey of calories/consumer unit; -USAID survey, caloric intake; -statistical analysis/mathematical models -Squire and van der Tak methodology of social benefit analysis and Scandizzo-Knudson approach to evaluation of basic needs programs (p. 39)				X	leakage; opportunity costs		Tamil Nadu, India data

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	<p>family, will have high leakages to other family members</p> <p>c. unless food provided in partial feeding program has higher caloric density per unit of expenditure than food being fed at home, the take-home program will be more effective than on-site partial feeding since it offers the possibility to resell the higher value food and substitute lower value food at home</p>	<p>p. 10</p> <p>p. 11</p>										
[57] Impressions Concerning Child Nutrition in Developed and Developing Countries	<p>a. food service for food per se is overriding those considerations of food as an educational experience;</p> <p>food education as added dimension could increase significance of SFS long-range usefulness</p> <p>b. critical importance of training teachers and administrators for tasks and develop positive attitudes and motivation</p>	<p>Lachance, 1980</p> <p>p. 18</p> <p>p. 15</p>	<p>-inferential from literature;</p> <p>-notes inter-relation of education functions and personnel with nutritional objectives of school feeding;</p> <p>-no mention of extraneous factors affecting education and nutritional status</p>	<p>school food service</p>	<p>-search of scientific literature; inquiries to representatives of international relief agencies; questionnaire</p>			X	X	<p>training education personnel</p>	X	X

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
(62) School Feeding Attendance Study-Preliminary Results	a. attendance in nonSF schools was higher than in SF schools for every month, 1980	Miller, 1982 p. 1, 3	-bias in sample selection procedure?: in favor of prestigious urban schools which often exhibit higher attendance rates?-- -drop out rate hard to analyze over just one year	biscuit	-MOE data: attendance rates; calculated K-5th grades each month of 1980 in all SFs and nonSFs -disaggregated data by region and by grade		x					Sri Lanka
	b. interruption in biscuit delivery did not affect attendance c. seasonality in school attendance	p. 8 p. 8	-need greater contextual information; need to select schools proportionally from various types; need to pinpoint biscuit availability at level of individual school	biscuit	-CARE data: attendance rates in two delivery-interrupted schools calculated for each of several months.							

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
[64] Childhood Malnutrition and Schooling in the Terai Region of Nepal	<p>a. male sex, high caste, parental schooling, and "modern" attitudes found to be significant positive determinants of school participation among 6-16 year old group</p> <p>b. older children found to be significantly more likely than younger children, and girls significantly less likely than boys, to be enrolled in schools</p> <p>c. a child's hemoglobin level is not found to be related to school enrollment;</p> <p>d. both height-for-age and weight-for-height contribute positively and significantly to the probability of a child's being enrolled</p> <p>e. height-for-age, the inverse of which is a measure for chronic malnutrition, appears to be a stronger influence than weight-for-height</p>	<p>Moock and Leslie, 1982</p> <p>(Garrison and Lockheed) p. 8</p> <p>p. 20</p> <p>p. 20</p> <p>p. 20</p> <p>p. 20</p>	<p>-difficulty obtaining ages;</p> <p>-malnutrition reported may be overstated;</p> <p>-theoretical framework;</p> <p>-multiple variables</p>		<p>-follow-up (1980-81) survey of subsistence farm households; obtained information on approximately 600 children, 3-6 years old, of earlier nutritional status survey;</p> <p>-longitudinal;</p> <p>-stratified random sample of households;</p> <p>-interviewed respondents;</p> <p>-collected anthropometric measures: height, weight, arm circumference, triceps skinfold;</p> <p>-derived nutritional status indicators using NCHS reference population: height-for-age; weight-for-height;</p> <p>-looked at blood hemoglobin;</p> <p>-used probit analysis of the analysis of the dichotomous dependent variable, enrollment;</p> <p>-grade attainment analysis by two ordinary least-squares analysis;</p> <p>-delineated variables: characteristics of the</p>	X	X	X	X	X		Nepal

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
	<p>f. variables of father's schooling, farm size, income from rice and wheat and membership in one of low status castes have significant direct effects on probability of a child's being enrolled</p> <p>g. influence of nutritional status variables on probability of enrollment, ceteris parabis, appears greater for boys than girls</p> <p>h. negative impact of farm size on enrollment probability seems greater for children with normal range height</p> <p>i. farm size appears marginally, or totally, unrelated to child's grade attainment</p> <p>j. mother's education found positively related to son's grade attainment in school</p> <p>k. height found to be strong determinant of enrollment and grade attainment</p>	<p>pp. 20, 21</p> <p>pp. 20, 21</p> <p>p. 26</p> <p>p. 29</p> <p>p. 29</p> <p>p. 31</p>			<p>child, of the parents, of the household of the community; the price of schooling; benefits expected from schooling; income constraint</p>							

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
	1. the importance of height as determinant of school enrollment and school performance depends on general level of nutrition in the population	p. 31										
[71] Evaluation of Impact of Mid day Meals Program on Tribal Children	<ul style="list-style-type: none"> <li>a. no clear data on attendance</li> <li>b. total number of months in program is an important determinant of school attendance</li> <li>c. four influences on attendance: months of participation in SFP, father's education, home caloric intake, family structure</li> <li>d. experience of SFP and awareness of benefits affect parents' decision about school attendance--and</li> <li>e. thus parents did not keep children away from school during temporary food breaks</li> </ul>	<p>Rewel and Bhatia, 1979</p> <p>p. 106</p> <p>p. 104</p> <p>p. 79</p> <p>p. 81</p> <p>p. 82</p>	<ul style="list-style-type: none"> <li>-no matching control groups;</li> <li>-no baseline data available;</li> <li>-low efficiency the result of program interruptions</li> <li>-delineated variables and dependence/independence (one of the better studies)</li> </ul>	lunch	<ul style="list-style-type: none"> <li>-comparing children attending schools with high and low SFP efficiency;</li> <li>-schools grouped de facto;</li> <li>-three-stage random sampling for selecting children;</li> <li>-interviews with program managers, participants, mothers;</li> <li>-dietary survey--24-hour recall;</li> <li>-participant background on SES, household;</li> <li>-interview mothers for dietary information;</li> <li>-school records re attendance, enrollment, and feeding operations</li> <li>-home caloric intake compared to Indian Council of Medical</li> </ul>		X		X	parental attitudes; substitution		Madhya Pradesh

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
	<p>f. no significant variation in monthly attendance</p> <p>g. size of family emerged as important variable bearing on home caloric intake and school attendance</p> <p>h. SFP has positive impact on nutritional status</p> <p>i. weight gain assisted by SFP</p> <p>j. children in high efficiency SFP schools have higher nutritional status than those in low efficiency SFP schools</p> <p>k. physical measurements have significant relationship with number feeding days in schools</p> <p>l. higher efficiency SFP schools had greater number children from scheduled castes and tribes who were living in a nuclear family with illiterate parents</p> <p>m. children eating at school had higher caloric intake</p> <p>n. school meal did not affect caloric intake of boys</p>	<p>p. 100</p> <p>p. 97</p> <p>pp. 104, 82</p> <p>p. 85</p> <p>p. 106</p> <p>p. 106</p> <p>p. 98</p> <p>p. 98</p> <p>p. 98</p>			<p>Research RDA;</p> <p>-indices for grading nutritional status= percentages--weight-for-age, height-for-age-and weight-for-height and weight-for-height combined with height-for-age;</p> <p>-data collected in one and half months;</p> <p>-review period of 15 months;</p> <p>-linear multiple regression analysis;</p> <p>-longitudinal enrollment data;</p> <p>-“t” tests and “F” tests of variance, chi square and correlations</p>							

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
o.	intake of school meal did not affect home protein intake	pp. 98, 76					x		x	x		
p.	all the protein in the school meal supplemented the home food protein	pp. 99, 100										
q.	in school with high efficiency SFP, SFP was a supplement; in low efficiency SFP schools, 1/3 meal calories were used as substitute--and the rest as supplement	p. 100										
r.	higher SES family background and land holding at higher efficiency schools	p. 76										
s.	the major portion of the school meal supplements the home food	pp. 105, 73										

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
<p>[73] Evaluation Report of PL 480 Title II</p>	<p>a. biscuit needs improving--but SFP organization sound b. need more local participation and local foods c. need better selection criteria and charting of recipients' progress</p>	<p>Robert Nathan Associates, Inc., 1978  pp. 4-9; 38-47; 49-53; 61-63; 66-68; 74, 77, 78, 86, 87-89, 115-117</p>	<p>-no hypothetical framework; -no controls; -impressionistic; -between process and impact evaluation perspective; -inconsistent methodology; -no allowance for extraneous factors; -no measurements</p>	<p>biscuit; sometimes Thriposha</p>	<p>-reviewed reports and studies; -interviews; -visited cross-section of activities; sometimes observed distribution, sometimes only talked with recipients and staff; -12 of 23 administrative districts; -wet and dry zones; -depressed and developing areas; -13 schools, rural/urban and estate, some combined MCH/SFP, some not</p>					<p>local participation</p>		<p>Sri Lanka</p>

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
[76] School Lunch in Orissa	<p>a. school lunch program in Orissa operates as a supplement and not as a substitute for the home meal; thus children in SFP better fed than children not in SFP</p> <p>b. the physical effects of additional nutrition are not very large, because diets were more closely related to socio-economic characteristics than to the feeding program</p> <p>c. SFP seems to affect enrollment in lower primary schools, particularly class 1 and particularly in tribal areas</p> <p>d. small but significant decrease in absence in the SF schools, where the SFP had more than 300 feeding days in two years (particularly in class 1 schools and tribal areas)</p>	<p>Roy and Rath, 1972</p> <p>p. 104</p> <p>p. 104</p> <p>p. 104</p>	<p>-theoretical framework;</p> <p>-limited controls;</p> <p>-limited sample substitution bias;</p> <p>-10% reliability check;</p> <p>-compared questionnaire and interview data;</p> <p>-age data unreliable;</p> <p>-attitude data about SFP and health status unreliable;</p> <p>-difficult to isolate physical benefits without controls for SES variance;</p> <p>-longitudinal data;</p> <p>-limited baseline data</p>	lunch	<p>-frame development survey to determine sample universe;</p> <p>-obtained data on enrollment, attendance, and the FP;</p> <p>-reviewed official records;</p> <p>-sample of 4 tribal districts with FPs at all schools</p> <p>-sample of 9 non-tribal districts, selected blocks and SF schools by random sampling plus non-SF schools sample</p> <p>-3-stage random sampling design;</p> <p>-subsample of 4 schools/block for nutritional study;</p> <p>-nutritional self-record keeping;</p> <p>-correlational analysis;</p> <p>-nutritional status measures: weight, height, chest circumference, skinfold measurements at biceps and sub-scapular point</p>	X	X	X	X	X		Orissa, India

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
	<p>e. differences observed in enrollment and attendance could be attributed to the selectivity of SFP itself</p> <p>f. when dropout rates computed longitudinally the SF schools had lower dropout rates</p> <p>g. children in SFP schools had better overall diet than children in non-SFP schools</p> <p>h. school lunch wasn't a substitute for home lunch which was saved for them when they went home</p> <p>i. however, overall diet of children in Orissa showed that their total caloric intake was below recommended Indian standards</p> <p>j. even though protein intake was sufficient, there was danger that proteins may be used to make good the caloric deficiencies</p>	<p>p. 105</p> <p>p. 105</p> <p>p. 105</p> <p>p. 105</p> <p>p. 105</p> <p>p. 105</p>				X	X	X	X	X		X

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
	<p>k. no significant physical differences found on random sample of SF and non SF school children correlation analysis showed modest but statistically significant relation between days of feeding and some physical measures like weight and chest circumference</p> <p>l. in schools with better SFPs, days of absence lower</p> <p>m. no significant differences found on academic performance, measured by examination marks between SF and non-SF school boys</p> <p>n. students, teachers, and parents expressed favorable attitudes with respect to SF being clean, healthy, tasty, enough</p> <p>o. physical improvements on age group 6-11 years are likely to be modest and this should not be considered the overriding objective of SFP</p>	<p>p. 105</p> <p>p. 105</p> <p>p. 106</p> <p>p. 106</p> <p>p. 106</p>				X	X	X	X	X	X	X

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
	<p>p. goodwill reflected in semantic attitudes toward SFP have filtered through the teachers and students and back to the parents</p> <p>q. data seem to indicate that SFP is likely to pay highest dividends in enrollment and attendance in more backward areas</p> <p>r. SFPs provide possible nutritional educational opportunity</p>	<p>p. 106</p> <p>p. 106</p> <p>p. 107</p>				X	X	X	X	X	X	X
791 Assessing the Uses of Food Aid-- PL489 Title II	<p>a. availability of SF results in higher enrollments and better attendance</p> <p>b. initiative of teacher crucial in effective use of commodities</p> <p>c. administrators and teachers need special training re objectives of SFP--for effectiveness to occur</p> <p>d. nutritional impact minimal</p>	<p>Community Systems Foundation Sahn, Rogers, and Nelson, 1980</p> <p>p. 110</p> <p>p. 110</p> <p>p. 110</p> <p>p. 110</p>	<p>-impressionistic;</p> <p>-analysis of qualitative aspects;</p> <p>-in control group</p>	<p>lunch (prepared at site or delivered)</p>	<p>-informal site visits;</p> <p>-discussions, direct observation, interviews;</p> <p>-2 months, selected sites to represent widest variety of geographic areas and program types</p>	X	X		X	educator training		India

APPENDIX 2

SUMMARY MATRIX OF STUDIES RELATED TO SCHOOL FEEDING

DOMESTIC

STUDY [geographic order]	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
3] An assessment of the conduct of the Expanded Food and Nutrition Program (EFENP) in Selected Sites	<ul style="list-style-type: none"> <li>a. benefits to children of EFENP participants were not significant</li> <li>b. dietary changes appear to be adopted first by the parent, and then through teaching, urging, or example, may be adopted by the child</li> <li>c. a lower percentage of EFENP recruits' children were reported to consume 4 recommended servings per day in the two main food groups</li> </ul>	<p>French, Roessel and Shieh</p> <p>p. 7.4</p> <p>p. 5.44</p> <p>p. 5.47</p>	<ul style="list-style-type: none"> <li>-height/weight measures were limited;</li> <li>-subjective self-report;</li> <li>-no controls;</li> <li>-no hypothetical framework;</li> <li>-no long enough</li> </ul>	<ul style="list-style-type: none"> <li>nutrition education;</li> <li>-individual instruction program;</li> <li>-teach low income mothers;</li> <li>-rural and urban</li> </ul>	<ul style="list-style-type: none"> <li>-systematic stratified random sample of EFENP recruits, participants, graduates and staff;</li> <li>-quasi-experimental, cross-sectional design;</li> <li>-program record files searched;</li> <li>-self-report interview questionnaire;</li> <li>-9 states, 36 counties;</li> <li>-fall 1980</li> </ul>				X		X	
44] Review of Literature on Educational Effects of Nutrition	<ul style="list-style-type: none"> <li>a. argues that SF programs have mostly negative educational effects</li> <li>b. kids sell food to others kids so they can buy junk food</li> <li>c. few controlled studies showing evidence for impact of nutritional status on school performance</li> </ul>	<p>Gussow, 1977</p> <p>p. 43</p> <p>p. 48</p> <p>p. 4</p>	<ul style="list-style-type: none"> <li>-literature review</li> </ul>	<ul style="list-style-type: none"> <li>lunches</li> </ul>	<ul style="list-style-type: none"> <li>-literature review</li> </ul>			X		X	X	

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
					<ul style="list-style-type: none"> <li>-measure effects of extraneous factors on school performance;</li> <li>-inadequate measures of nutritional impact;</li> <li>-no full hypothetical framework;</li> <li>-no multivariate or covariance analysis to control for nonlinear and interaction effects;</li> <li>-inadequate random sampling</li> </ul>		X	X	X		X	
[65] Study in aspects of School lunch program	<ul style="list-style-type: none"> <li>a. schools flounder in developing a school lunch program that is an integral part of total school program</li> <li>b. administration of school adequate, but weak in integrating lunch period into entire school day, meeting food needs of all students, financing, evaluation, community use and relationships</li> </ul>	Morton, 1960	<ul style="list-style-type: none"> <li>-qualitative, impressionistic;</li> <li>-no mention of variables or measures;</li> <li>-no hypothetical model;</li> <li>-established criteria</li> </ul>	lunch	<ul style="list-style-type: none"> <li>-schedule of questions survey of 102 public schools operating school lunch programs</li> </ul>					X	X S. Car- ro- lina	

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
	<ul style="list-style-type: none"> <li>c. contributed to physical, social, mental, emotional growth, but not exploiting all possibilities</li> <li>d. no correlation with many areas of classroom teaching--except health</li> <li>e. school lunch facilities and personnel seldom hindered development of educationally sound school-lunch program</li> </ul>	pp. 541-42, dissertation abstracts								X	X	
[60] [57] Evaluation of a Ghetto School Breakfast Program	<ul style="list-style-type: none"> <li>a. average reported intake similar at both schools</li> <li>b. height and weight do not differ significantly</li> <li>c. no significant attendance difference</li> <li>d. no significant performance difference</li> </ul>	Lieberman et al., 1967  pp. 40-42 (60)	<ul style="list-style-type: none"> <li>-longitudinal; but perhaps too short to detect effect;</li> <li>-no one showed signs of malnutrition at beginning of study--poor target controls;</li> <li>-obtained data on SS at-home food intake;</li> <li>-did not attempt to control for participation in other school food programs;</li> </ul>	breakfast	<ul style="list-style-type: none"> <li>-physical, anthropometric, psychological tests;</li> <li>-elementary school;</li> <li>-black ghetto;</li> <li>-two adjacent elementary schools, 1 control, 1 breakfast; 3rd-6th graders;</li> <li>-social and dietary interviews;</li> <li>-attendance and performance records</li> </ul>	X	X	X		X		

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
[ 67 ] Ten State Nutrition Survey (TSNS): School Lunch Program and Dietary Intakes	a. daily mean intakes higher for participants than non-participants b. contribution of NSLP to nutrient intake higher for students from low income ration states	(U.S. DHEW, H.R.A., C.D.C., 1972)  p. 426	-didn't describe program clearly; -no distinction between USDA and other programs; -sampling problems; -participation definition unclear; -no tests of statistical significance reported for differences in any comparisons; -no allowance for fluctuating student popu- lation	lunch	-cross-sectional; -ages 10-16, low-income quartiles of 10 states, N=8,495; -24 hour dietary recall; -comparison of mean 24- hour nutrient intakes between participants and non-participants; -contribution of NSLP to nutrient intake of participants; -students did or did not participate				X		X	

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
[ 67] Health Examination and Nutrition Survey (HANES) Effects of School Lunch on Daily Nutrient Intakes	<p>A.</p> <p>a. intakes of SBP and of SMP participants, but not NSLP participants, were higher than intakes on non-availables</p> <p>b. SBP + NSLP participants had higher MARS than either SBP or NSLP participations</p> <p>c. nutrient intakes decreased with increasing age and family size but increased with higher educational level of family head</p> <p>d. children from wealthier homes tended to consume higher MARS overall but fewer calories and less vitamin A</p>	<p>(U.S. Congress, Congressional Budget Office, 1980) (Hoaglund, 1978, 1979)</p> <p>p. 426</p>	<p>-did not describe program clearly;</p> <p>-designation of participation unclear;</p> <p>-good control for certain extraneous factors;</p> <p>-generalizable;</p> <p>-based on probability sample with respectable response rate, although numbers in some cells of analysis quite small</p>	<p>lunch, breakfast, milk</p>	<p>-cross-sectional;</p> <p>-ages 6-21; probability sample of US population (HANES), N=3,155;</p> <p>-24-hour dietary recall, hemoglobin, hematocrit, serum protein, serum albumin, serum cholesterol;</p> <p>-comparison of 24-hour nutrient intakes as NAR and MAR of participants and non-availables;</p> <p>-regression analysis with program participation and SES variables;</p> <p>-comparison of proportions of children with abnormal biochemical values (no statistical test applied);</p> <p>-students did or did not participate in programs</p>				X		X	

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
7] Washington state study (WSS) Effects of Lunch and School Breakfasts on Health	<ul style="list-style-type: none"> <li>a. participants had higher vitamin A intakes and serum calcium levels, lower iron intakes, lower serum phosphorus, serum vitamin C, and serum albumin levels and lower albumin/globulin ratios</li> <li>b. contribution of school meals to total intake greater for lower level income than high income NSLP participants</li> <li>c. full SBP participation related to higher vitamin C intakes and serum vitamin C levels</li> <li>d. full MSLP participants had lower intakes of iron than non-participants and higher intakes of energy, protein, calcium, and riboflavin than partial NSLP participants</li> <li>e. NSLP participation related to higher serum albumin and lower serum carotene levels</li> </ul>	<p>(Price et al., 1975)</p> <p>p. 426</p>	<ul style="list-style-type: none"> <li>-controlled for some extraneous factors;</li> <li>-participation definition varied depending on analyses being performed;</li> <li>-allowed for equal number of subjects in specified cells, to more readily discriminate differences, but</li> <li>-insufficient number subjects for some cells in sample districts;</li> <li>-numerous assignments of students to cells;</li> <li>-didn't consider combined break/lun program effects;</li> </ul>	lunch, break-fast	<ul style="list-style-type: none"> <li>-cross-sectional; cluster design;</li> <li>-ages 8-12; participants and non-participants of NSLP in Washington state stratified by income and ethnicity N=1,103;</li> <li>-24-hour dietary recall, household food habits, height, weight, fatfold, and arm and head circumferences, blood pressure, large battery of biochemical tests;</li> <li>-comparisons of mean values of students by income/ethnic participation categories;</li> <li>-regression analysis for nutrient intakes and selected biochemical values using program participation, SES factors and household food habits;</li> <li>-students did or did not participate in programs</li> </ul>				X		X Washington State	

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
67] Effects of School Lunch Partici- pation on Family Food Expendi- tures	B. a. income, household assets, family size, dollar value of food stamps and free lunches all exerted significant influence on dollar value of food obtained in household ("marginal propensities to consume")	pp. 511, 516	-didn't test for whether race-by- program inter- actions were significant or significantly different from each other	lunch	-households of partici- pants; -families interviewed at home; -generally adult who prepared family's food served as respondent; -questionnaire concerned demographics, SES, school lunch attitudes, meal planning and preparation; homemaker management style; -regression analyses; -factors influencing dollar value of food obtained by household; -analysis of variance re use of food groups; -principal components analysis with varimax rotation					family, economic	x	
Parents' Opinions of School Lunch	C. a. opinion that lunches reasonably priced b. 43% of sample thought they could prepare a sack lunch for less cost than SLP c. answers varied by ethnic group d. suggest that mothers' work status, perceived quality of lunch, home management style, all might influence value placed on sack lunch	p. 513  p. 514  p. 514  p. 514										

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
[67] Effects of School Lunch on Family Food Consumption	D. a. very few significant differences among food consumption patterns of families with participating and non-participating children	p. 515								food consumption	x	
67) NSLP Dietary Intake	a. 24-hour mean intake and consumed RDA percentage of calcium higher for participants b. lunch-only mean intakes and consumed RDA percentages of all nutrients except niacin higher for participants c. participants consumed more than 1/3 of RDA of 6 nutrients at lunch	(Howe and Vaden, 1980)  p. 426	-participation or non-participation determined on basis of student response to questionnaire; -failed to consider extraneous factors; -lack of program description; -no hypothetical framework; -no multi- or covariance analysis	lunch	-cross-sectional; -random sample of participants and non-participants from grades 10, 11 of one high school, N=104; -24-hour dietary recall; -comparison of mean nutrient intakes and RDA percentages for total day and for lunch only by participation and gender; -students did or did not participate in program				x		mid-western city	

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
[67] Health Status and Lunch/ Breakfast	a. spring intakes of needy children in both districts were higher than their fall intakes	(Emmons et al., 1972)	-not long enough to detect effect?; -may not have really identified nutritionally needy children; -no control school; -difficult to account for regression and measurement effects; -arbitrary designation of participation; -considered multiple milk participation	lunch + break- fast, lunch + milk	-longitudinal; -grades 1-3, two school districts, N=844; -24-hour dietary recall, height, weight, hemo- globin or hematocrit; -comparison of fall and spring measure of "nutritionally needy" and "nutritionally adequate" students; -change in measures from fall to spring; -change in "needy" status from fall to spring; -breakfast program implemented in a district that offered NSLP but not in a comparison district that offered SMP and NSLP				X		Up- state New York	

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67] School Lunch Program Impact on Biochemical and Anthropometric Measures	a. no significant differences between participants and non-participants	(Paige et al., 1972) p. 426	-no explanation of criteria for students' classification; -don't know if self-selection was a factor in results; -may not be long enough to detect effect; -no attempt to determine how many participants ate SL over school year; -didn't look at multiple program participation	lunch	-longitudinal -grades 1, 2, 6 in 4 low-income schools participating in NSLP N=751; -height, weight, hemoglobin, hematocrit; -comparison of fall and spring measures for participants and non-participants; -change in measures from fall to spring on participants and non-participants; -students did or did not participate in program				x		Bal-ti-more	



STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
67, 68   Effects of Mid-a.m. Juice on Hostile Behavior or Nervous Habits of Children	a. children receiving juice exhibited fewer negative behaviors than children receiving water the frequency in appearance of target behaviors lower when children received fruit juice rather than water no significant age differences	(Keister, 1950)  p. 493 (67)  pp. 19-20 (68)	-behavior terminology subjective; -apparent lack of reliability and validity of measures to assess behaviors; -positive use of experimental and control groups; -can't tell if mid-a.m. feeding substitutes or supplements  -no explanation of extraneous factors	juice	-nursery school children N=133; -observation of hyper- activity, withdrawal, hostile behavior and nervous habits for two hours after feeding; -comparisons of frequency of observed hyper- activity, withdrawal, hostile behavior, and nervous habits after receiving juice or water; -children were fed pine- apple juice or water at 10:00 a.m.  -133 children; 27-60 months, nursery school; 4 times/year studied children; 2 times juices, 2 times water; behaviors assessed by child observation; 30 second period after feeding			X			X	

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
67,68] Test Effects of Different Breakfast Conditions on Physical Performance of Children	<p>A.a. omission of breakfast had no effect on neuromuscular tremor magnitude, choice reaction time, maximum grip strength, or grip strength endurance</p> <p>b. maximum work rate and output less when breakfast omitted</p> <p>-----</p> <p>B.a. no significant difference in physiological response after either breakfast</p>	<p>(Tuttle and Daum, 1954)</p> <p>p. 21 (68), 493 (67)</p> <p>p. 21</p> <p>p. 21</p>	<p>-poor control of section on student attitudes;</p> <p>-no systematic observation of individual behavior;</p> <p>-can't tell if mid-a.m. feeding substitutes or supplements</p>	<p>cereal and milk breakfasts</p> <p>-----</p> <p>alternate cereal and milk with bacon and eggs</p>	<p>-12-14 year old boys alternate breakfast and no breakfast; for 17 weeks, kept total daily nutrient intake constant; gave tests of six categories of physiological responses</p> <p>-----</p> <p>25 boys</p> <p>-neuromuscular tremor magnitude, choice reaction time, grip strength, work rate, work output, attitudes and scholastic performance;</p> <p>-comparison of individual and group mean scores on measures taken when eating and not eating breakfast;</p> <p>-subjects alternated between eating breakfasts and not eating breakfasts; total daily intake was kept constant eating and not eating</p>			X	X		X	

STUDY	FINDINGS	CITATIONS	METHODOLOG <sup>y</sup> strengths ; 1 weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
[ 67, 68] Test Breakfast Provision of 1/4 Total Daily Protein and Caloric Intake to Insure Maximum Physical and Mental Efficiency	<p>a. only 1/3 children ate breakfast containing 25% of daily protein and caloric intake</p> <p>b. no differences in physical efficiency for various types of breakfasts</p> <p>a. no differences were found except that blood glucose levels were higher when a protein rich rather than a carbohydrate rich breakfast was eaten</p>	<p>(Arvedson et al., 1969)</p> <p>p. 22 (68)</p> <p>-</p> <p>p. 493 (67)</p>	<p>-no baseline data;</p> <p>-questionable measures;</p> <p>-no model</p> <p>-used some objective measures;</p> <p>-no systematic observation of individual behaviors</p> <p>-teachers knew who were/weren't receiving breakfast;</p> <p>-can't tell if mid-a.m. feeding substitutes or supplements</p>	break-fast	<p>a. 203 children; ages 7-17; -Stockholm schools;</p> <p>b. 40 boys, 11-17 years, 2 groups; 4 breakfasts; work tests</p> <p>-11-17 year old boys from one school, N=40;</p> <p>-blood glucose, work tests, concentration, hunger, tiredness;</p> <p>-comparison of measures among groups eating various types of breakfast;</p> <p>-one group received breakfasts that provided 400 calories and one group received breakfasts that provided 560 calories;</p> <p>-the protein and carbohydrate composition of both groups' breakfasts were alternated weekly</p>			x	x			x Stockholm

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
67, 68] Effect of Mid-a.m. Juice on Performance	<p>a. performance was better on days orange juice was given</p> <p>b. performance of children with good and poor diets did not differ at various test times</p>	<p>(Matheson, 1970)</p> <p>p. 493(67), 493 (68)</p>	<p>-didn't assess breakfast intake during experimental period;</p> <p>-length of experiments relatively short</p> <p>-controls questionable</p>	juice	<p>-5th graders from schools N=100;</p> <p>-performance on math and decoding tests at 3 times in a.m.;</p> <p>-3-day record of breakfast intake;</p> <p>-comparisons of performance when orange juice was given and when it was not;</p> <p>-comparison of performance at different times according to usual breakfast intake of children;</p> <p>-each student received orange juice or nothing alternately at 10:30 a.m. for ten days</p> <p>-10-day study; arithmetic and decoding tests = outcome variables; children used as their own controls; tests at different times</p>			x			x	

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[67, 68] Effects of Instant Breakfast on Students	a. no difference between control and supplemented group on any tasks measured	(Dweyer, Elias and Warren, 1973)  pp. 20-21 (68), 493 (67)	-breakfast at home by dietary recall, without particu- lar intake data on testing days;  -lengths of experiments relatively short; -reported data from dietary recall in ambigu- ous categories; -don't know if a.m. feeding -supplements or substitutes	break- fast	139 males, 1st grade; tested individually on attention tasks; half fed a.m., controls fed in afternoon  -1st grade boys, N=139; -attention tasks; dietary recall of breakfast intake; comparison of morning performance on attention tasks; -one group received liquid meal in a.m.; one group received liquid meal in p.m.			X				

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67, 68] Relation- ship Between Milk Consump- tion and Scholastic Performance	a. Improved scholarship found for 45% of students using milk and for 24% of those not using the milk	(Lininger et al., 1933)  p. 493 (67), 24 (68)	-subjective teacher assessments; -teachers presumably knew which students received milk -malnourished children not described  -impressionistic; -impossible to determine whether effects caused by milk supplement or teachers' expectations; -need definition of "scholarship"	milk	-"undernourished" students age 6-16, N=4,133 -teachers' ratings of scholastic progress; reports of milk consumption; -percent of children receiving milk who improved compared with percent of children not receiving milk who improved; -students did or did not			x			x	

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[67, 68] Effect of School Lunch Program on Psycho- logical Develop- ment and School Achievement	a. grades and intelli- gence, reading and math scores of participants and non-participants did not differ	(Tisdall et al., 1951)  p. 493 (67), 26 (68)	-no statistical tests; -small number of subjects; -short duration; -hard to draw valid conclu- sions; -no attempt to control for multi-program participation and extraneous factors	lunch	-participants aged 5-1/2- 10-1/2 and matched non- participants from 3 Canadian schools N=200+; -school grades: intel- ligence, reading, and arithmetic scores; -comparison of scores between participants and non-participants; -lunch program imple- mented and students selected to participate by modified randomi- zation  -200 school lunch participants and non- participants (controls); -5-1/2 - 10 years old; -3 year study; -school performance indicators=marks by teachers; intelligence test scores; objective tests of reading and math scores; -matched other variables too			X			X	

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
67, 68 ] Effects of Breakfast Program on Grades and Dropout Rates	a. final grades and dropout rates of participants and non-participants did not differ	(Fellers, 1967)  p. 493	-treatment not clear from report; -no control for frequency of participation; -no indication of records kept on number of servings  -degree of parti- pation less than maximum; -failed to consider participation as a moderating variable	break- fast	-10th grader participants and non-participants in one school N=198; -school grades, dropout rate; -comparison of final grades and dropout rate between participants and non-participants at end of school year;			X			X	

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
[67, 69] Comparison of Breakfast Habits, School Performance, and Hunger Related Behaviors	<ul style="list-style-type: none"> <li>a. breakfast skipped by nearly 1/4 pupils in schools with no breakfast program and less than 1/10 in participating schools</li> <li>b. educational level of mother not related to child eating habits</li> <li>c. higher proportion of children in non-participating schools had hunger behavior problems more frequently</li> </ul>	(Pinkus, 1970)  pp. 26-27	<ul style="list-style-type: none"> <li>-no indication of how teachers graded</li> <li>-collected data on students' at-home food intake;</li> <li>-no control for frequency of participation;</li> <li>-no measure of extraneous factors</li> </ul>	breakfast	<ul style="list-style-type: none"> <li>-4th graders in participating and non-participating schools;</li> <li>-8 schools - matched size of grade, race, number of teachers in grades 1-6;</li> <li>-used attendance records;</li> <li>-questionnaires to students, parents, teachers</li> <li>-pupil breakfast habits; pupil recall of crying, anger and misbehavior; parent and teacher record of pupil behavior; absenteeism; school grades for 1 month;</li> <li>-comparison of results between pupils in participating and non-participating schools;</li> <li>-students did or did not participate in breakfast program</li> </ul>			X	X		Louisiana	



STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STATUS	OTHER	DOMESTIC	INTERNATIONAL
[67,68 ] Effect of Breakfast Program on School Attendance and Grades	a. achievement scores did not differ between program and no-program 3rd graders but tended to be higher for program 5th graders than no-program 5th graders	(Kreitzman, 1973)  p. 493	-unclear on frequency of participation -no indication of records on number of times break- fasts served to children -finding may have been related to a supplementary educational program that was operating in the control school; -no report on statistical treatment; -fails to discuss apparent discrepancies in results	break- fast	-grades 3-5; one program and one no-program school, N=unreported; -attendance, grades, scores on achievement tests; -comparison of spring and measures between program and no-program students; -breakfast program implemented at treatment school but not at control school		X	X			At- lan- ta	

STUDY	FINDINGS	CITATIONS	METHODOLOGY strengths and weaknesses	PROGRAM	STUDY DESCRIPTION sample/analysis	ENROLLMENT	ATTENDANCE	PERFORMANCE	NUTRITIONAL STAT.	OTHER	DOMESTIC	INTERNATIONAL
4. [89] Response to U.S. Senate Resolution 90	<p>a. low-income participant children receive higher proportion of important nutrients from school lunch than high income</p> <p>b. lunchroom based nutrition related activities evidenced increased gains in food knowledge and other nutrition related measures compared to students who received no nutrition education</p> <p>c. students participating in both breakfast and lunch program had higher overall nutrient intakes than students participating in only one program</p> <p>d. not all children determined nutritionally needy by nutritional criteria. were identified as needy by economic criteria; thus program targeting criteria unclear</p> <p>e. schools provide substantial market for many agricultural commodities, particularly dairy products, poultry, and common fruits and vegetables</p>	<p>U.S.D.A., 1981</p> <p>p. iv</p> <p>p. v</p> <p>p. 56</p> <p>(Paige, 1971) p. 59</p> <p>p. 79</p>	<p>-literature review</p>	<p>lunch and breakfast</p>	<p>-literature review</p>				X	X	X	