
The Relation Between Nutritional Habits and Social Factors on School Performance of Students of Elementary Schools in Fayoum

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Abstract: Background: Malnutrition among children in developing countries continues to impair health and development. School feeding is supposed to eliminate hunger of school age children improving their health, education and future productivity as adults. Objective: to assess the effect of breakfast and school feeding program (SFP) on the academic performance of primary school children in Fayoum governorate. Methods: The intervention group consisted of 576 pupils in the 5th grade chosen randomly from schools have taken school meal for five years. The control group was 233 age and sex-matched pupils chosen randomly from schools have never taken school meal. The snack consists of a pie fortified with minerals and vitamins. Assessment of nutritional status, socio-demographic variables and dietary behaviour was performed. Grades of pupils were taken. Results: Children, who have got school meal for five years, 81.8% and 88.7% of them passed in school and math respectively, for girls the effect was higher. Other nutritional factors have less positive effect. Social factors have less effect on both school achievement and math. Multiple regression analysis presents school meal as the main predictor of school achievement and math grades, while sex and family income are the only socioeconomic variables predictors of school achievement and math grades. Conclusion: School snack has the opportunity to alleviate short-term hunger during the school day. Providing students with important micronutrients especially iron, regularly through daily intake of school snacks, results in improvement in school grades. School meal should be one of multiple interventions designed to improve the environment in which poor children live and learn.

Keywords: School Meal, Breakfast, Micronutrients, Math Grades, School Achievements

1. Introduction

Nutrition, or the lack of it, has recently been recognized as an important additional factor because studies have identified under-nutrition with poor school achievement (Powell & Grantham-McGregor, 1980; Grantham-McGregor *et al.*, 1998; Ahmed, 2004). Iron deficiency in schoolchildren also reduces some aspects of their ability to learn and providing iron improves these capacities. Hook worm infection, one cause of iron deficiency anemia and malnutrition, is also linked to diminished learning capacity (Acham *et al.*, 2012).

Children who are already at risk due to nutritional inadequacy come to school tired, hungry, or hurting, unable to cope and benefit from their lessons (Ani & Grantham-McGregor, 1999). Absenteeism, delayed enrolment, lowered

cognitive capacity, and reduced academic achievement are all associated with either an over or under supply of important nutrients (Grantham-McGregor, 2002). We still do not fully understand the actual mechanisms linking nutrition to learning, or even IQ. But, it can be said that malnutrition brings with it harmful consequences for body and mind alike (Gorman, 1995; Grantham-McGregor, 1995; Levitsky & Strupp, 1995; Wachs, 1995; Grantham-McGregor *et al.*, 2000).

One of the most common and wide spread nutritional insults to children is iron deficiency. Severe anaemia is associated with increased childhood mortality, and mild to moderate anaemia is associated with lowered work capacity and productivity, immune function, altered behaviour, and cognitive development (Bhaskaram, 2001; Neumann *et al.*,

2002).

Ekaju's study (2011) citing the World Bank (2011) notes that programs that address hunger, malnutrition, and disease among school children significantly improve their academic performance, a reason why school-based feeding and health programs can be valuable.

The aim of this study was to assess and demonstrate the effect of breakfast and midday meal consumption on academic achievement of primary schoolchildren (grade 5) in Fayoum governorate, Upper Egypt.

2. Subjects and Methods

2.1. Study Design

The static group comparison design was employed as there was no baseline data to apply Pretest- posttest control design; the ideal to achieve our objective (Trochim, 2006) Egypt's Ministry of education used a "poverty map" to determine which schools have the priority to receive school meals in each governorate. The evaluation covered a period of eighteen months starting from October 2009 till May 2011. This cross-sectional study was conducted in Fayoum representing rural, urban areas.

The intervention group consisted of 569 pupils in the 5th grade chosen randomly from schools that have taken school meal for five years. The control group was 240 age and sex-matched pupils chosen randomly from schools that have never taken school meal.

Inclusion criteria: apparently healthy prepubescent boys and girls in the 5th grade.

Exclusion criteria: Students proved to have any mental disorder, chronic disease, visual or auditory impairment, were excluded.

The study was approved by the Ethical Committees of the National Research Centre and Agricultural Research Centre. Permission to conduct the research in the selected schools was also obtained from the Egyptian Ministry of Education. Data were collected between March 2010 and May 2010.

3. Methods

A well-structured questionnaire: was applied to each student through an interview to collect socio-demographic and nutritional data. The information collected included age, gender, number of family members, birth order of the child under study, parent's education level, parent's occupation, and household income.

3.1. Dietary Pattern Assessment

To evaluate dietary habits and behaviour of children (skipping breakfast, number of meals consumed per day, eating of the served school meal, source of other meals consumed through school day).

The students' grades in math were collected for first terms from official school records.

3.2. Statistical Analysis

Data were analyzed using Statistical Package for Social Sciences (SPSS) version 16. Quantitative Data were presented as means \pm SD. The independent sample-t test was used to analyze mean difference. Qualitative data were summarized as percentages and comparison between groups was done using Chi square-test. For all tests, probability values (P) of less than 0.05 were regarded as statistically significant. ANOVA with Post-hoc test was used to study the association of cognitive function and the intake of school snack and breakfast eating pattern. Multiple linear regression analysis was done to assess the contribution of each independent variable (SFP, socio-economic status, breakfast eating habit, and nutritional status) in explaining the variation in the dependent variables.

4. Results

School Feeding Program (SFP) was established by the Ministry of Agriculture and Land Reclamation (MOLAR) in Egypt, to attract children in disadvantaged rural and urban communities to attend primary schools. Nutritious fortified snacks in the form of sweet pies were provided to those children in the mid-morning, to supply them with nutrients essential to their development and concentration ability. A field evaluation of the effectiveness of SFP was conducted by the collaboration between Agricultural Research Center and National Research Center in Egypt.

4.1. Composition of the School Snack

The snack consists of a pie fortified with minerals and vitamins. Elements in the fortified flour are: Vitamin A, vitamin C, thiamin, riboflavin, vitamin B₆ and B₁₂, niacin, folate, calcium, iron, zinc and phosphorus. Although the school meal provides only 16.9 % of RDA for energy, 4.3% of RDA for vitamin C; 5.5% of RDA for calcium; yet it provides 35.8 % of RDA for iron and 41.7% of RDA for folate, and about 26.81% of RDA for protein. The pie contains either minced dry date or a jam to be more nutritious and acceptable.

Table 1. Analysis of the School Meal.

| | RDA | Pie | %RDA |
|---------------------|------|---------|-------|
| Energy | 2000 | 338.067 | 16.90 |
| Protein | 28 | 7.506 | 26.81 |
| Vit A | 3300 | 332.629 | 10.08 |
| Vit C | 45 | 1.923 | 4.27 |
| Thiamin | 1 | 0.094 | 9.40 |
| Riboflavin | 1.2 | 0.141 | 11.75 |
| Vit B ₆ | 1.2 | 0.053 | 4.42 |
| Folate | 100 | 41.762 | 41.76 |
| Niacin | 13 | 1.03 | 7.92 |
| Vit B ₁₂ | 1.4 | 0.122 | 8.71 |
| Calcium | 800 | 44.477 | 5.56 |
| Zinc | 10 | 0.692 | 6.92 |
| Iron | 10 | 3.588 | 35.88 |
| Phosphorus | 800 | 109.138 | 13.64 |

4.2. Characteristics of the Participants

Most of the participants were aged 11 to 12 years, of which most (70.6%) lived in relatively large households (with more than 5 people). More than half (65.4%) were born to mothers who had either no formal education or had incomplete primary education, (50.3%) were born to fathers who had either no formal education or had incomplete primary education.

4.3. Effect of Nutritional Factors on Academic Performance

It can be noticed that school meal has a direct positive and significant effect on passing school. 81.8% of children receiving the school meal passed in school exams compared with only 51.9% of children not having a meal (OR=2.83).

Having the school meal in the morning had positive significant effect on passing school (OR=2.78 and OR=4.92) compared with the afternoon and no specific time respectively. Also, the regularity of meals and the mid-day snack have positive, but less, significant effect on passing school exams (OR= 0.62 and 1.71) respectively. A combination of breakfast and school meal has a highly positive effect (OR= 4.92). Other nutritional factors have no significant effect on passing school exams. Our results agree with previous work by Adrogué and Orlicki, 2013, who reported that eating breakfast, in contrast to fasting, may improve performance on the morning eaten. The long-term effects of eating breakfast on the performance of school children who do not have physical signs of severe undernourishment are less certain.

Table 2. School Achievement for Boys, Girls and the Combined Group vs. some Nutritional Factors.

| | Boys | | | | Girls | | | | Combined | | | |
|-------------------------------------------|------|----------------|----------------|-------------------------|-----------------------|---------------|----------------|-------------------------|----------------------|----------------|----------------|-------------------------|
| | n | Failed <50 | Passed >50 | X ² (sig) | n | Failed <50 | Passed >50 | X ² (sig) | n | Failed <50 | Passed >50 | X ² (sig) |
| Receiving School Meal | | | | | | | | | | | | |
| No Meal | 120 | 66 (55.0%) | 54 (45.0%) | 43.39 (0.000) | 120 | 51 (42.5%) | 69 (57.5%) | 42.33 (0.000) | 240 | 112 (48.1%) | 121 (51.9%) | 43.55 (0.000) |
| Meal | 293 | 64 (21.8%) | 229 (78.2%) | | 276 | 36 (13.0%) | 240 (87.0%) | | 569 | 154 (18.2%) | 471 (81.8%) | |
| OR=4.37 (2.78-6.89) | | | | | OR= 4.93 (2.98-8.15) | | | | OR= 2.83 (2.04-3.93) | | | |
| Regularity of Meals | | | | | | | | | | | | |
| No | 123 | 29 (23.6%) | 94 (76.4%) | 5.07 0.02 | 132 | 24 (18.2%) | 108 (81.8%) | 1.657 0.123 | 255 | 53 (20.8%) | 202 (79.2%) | 6.92 0.008 |
| Yes | 290 | 101 (34.8%) | 189 (65.2%) | | 264 | 63 (23.9%) | 201 (76.1%) | | 554 | 164 (29.6%) | 390 (70.4%) | |
| OR= 0.58 (0.36-0.93) | | | | | OR= 0.71 (0.42-1.20) | | | | OR= 0.62 (0.44-0.89) | | | |
| Mid-Day Snack | | | | | | | | | | | | |
| No | 60 | 21 (35.0%) | 39 (65.0%) | 0.40 (0.53) | 35 | 14 (40.0%) | 21 (60.0%) | 7.281 (0.009) | 95 | 35 (36.8%) | 60 (63.2%) | 5.50 (0.02) |
| Yes | 353 | 109 (30.9%) | 244 (69.1%) | | 361 | 73 (20.2%) | 288 (79.8%) | | 714 | 182 (25.5%) | 532 (74.5%) | |
| OR= 1.21 (0.68-2.15) | | | | | OR= 2.63 (1.26-5.42) | | | | OR= 1.71 (1.09-2.67) | | | |
| Time of Distribution & Eating School Meal | | | | | | | | | | | | |
| Afternoon | 32 | 10 (31.2%) | 22 (68.8%) | 4.76 (0.03) | 139 | 17 (12.2%) | 122 (87.8%) | 0.05 (0.82) | 56 | 13 (23.2%) | 43 (76.8%) | 3.81 (0.05) |
| Morning | 63 | 8 (12.7%) | 55 (87.3%) | | 63 | 7 (11.1%) | 56 (88.9%) | | 126 | 15 (11.9%) | 111 (88.1%) | |
| OR= 3.13 (1.09-8.96) | | | | | OR= 1.11 (0.44-2.84) | | | | OR= 2.24 (0.98-5.09) | | | |
| Time of Distribution & Eating School Meal | | | | | | | | | | | | |
| No Specific Time | 41 | 15 (36.6%) | 26 (63.4%) | 8.23 (0.004) | 47 | 9 (19.1%) | 38 (80.9%) | 1.40 (0.24) | 88 | 24 (27.3%) | 64 (72.7%) | 8.21 (0.004) |
| Morning | 63 | 8 (12.7%) | 55 (87.3%) | | 63 | 7 (11.1%) | 56 (88.9%) | | 126 | 15 (11.9%) | 111 (88.1%) | |
| OR=3.97 (1.49-10.53) | | | | | OR= 1.89 (0.65-5.53) | | | | OR= 2.78 (1.36-5.67) | | | |
| School Meal & Breakfast | | | | | | | | | | | | |
| No School Meal& No Breakfast | 40 | 31 (77.5%) | 9 (22.5%) | 76.54 (0.000) | 48 | 23 (47.5%) | 25 (52.1%) | 27.01 (0.000) | 88 | 46 (52.27%) | 42 (47.73%) | 45.88 (0.000) |
| School Meal& Breakfast | 224 | 31 (13.8%) | 193 (86.2%) | | 188 | 26 (13.8%) | 162 (86.2%) | | 412 | 75 (18.2%) | 337 (81.8%) | |
| OR= 21.44 (9.32-49.35) | | | | | OR= 5.73 (2.84-11.56) | | | | OR= 4.92 (3.02-8.01) | | | |

Results from table 2 shows that, when comparing the effect of nutritional factors on boys and girls in the sample, there is a difference in factors affecting the school passing performance. In girls, having a meal has a significant positive

effect which is higher (OR=4.93) compared with boys (OR= 4.37). Also, the mid-day snack has a significant positive effect (OR=2.63) and the combination of breakfast and school meal (OR=5.73). As for boys, having a meal has a significant

positive effect which is lower (OR= 4.37) compared with girls. Other factors, as regularity of meals and time of eating meal, have significant effect in boys (OR=0.58, OR=3.13 and

OR= 3.97) respectively. The combination of breakfast and school meal has a higher effect in boys than girls (OR= 21.44 and OR=5.73 respectively).

Table 3. School Achievement for Boys, Girls and the Combined Group vs. some Social Factors.

| | Boys | | | | Girls | | | | Combined | | | |
|-------------------------------|----------------------|-------------|-------------|----------------------|----------------------|------------|-------------|----------------------|----------------------|-------------|-------------|----------------------|
| | n | Failed<50 | Passed>50 | X ² (sig) | n | Failed< 50 | Passed>50 | X ² (sig) | n | Failed<50 | Passed> 50 | X ² (sig) |
| Child Order | | | | | | | | | | | | |
| Child 3 rd or more | 208 | 66 (31.7%) | 142 (68.3%) | 0.01 (0.91) | 202 | 42 (20.8%) | 160 (79.2%) | 0.33 (0.56) | 410 | 108 (26.3%) | 302 (73.7%) | 0.10 (0.754) |
| Child 1-2 | 205 | 64 (31.2%) | 141 (68.8%) | | 194 | 45 (23.2%) | 149 (76.8%) | | 399 | 109 (27.3%) | 290 (72.7%) | |
| | OR= 1.02 (0.68-1.55) | | | | OR= 0.87 (0.54-1.40) | | | | OR= 0.95 (0.70-1.30) | | | |
| Family Size | | | | | | | | | | | | |
| Large | 289 | 85 (29.4%) | 204 (70.6%) | 1.90 (0.17) | 282 | 55 (19.5%) | 227 (80.5%) | 3.58 (0.06) | 571 | 140 (24.5%) | 431 (75.5%) | 5.25 (0.022) |
| Small | 124 | 45 (36.3%) | 79 (63.7%) | | 114 | 32 (28.1%) | 82 (71.9%) | | 238 | 77 (32.4%) | 161 (67.6%) | |
| | OR= 0.73 (0.47-1.14) | | | | OR= 0.62 (0.38-1.03) | | | | OR= 0.68 (0.49-0.95) | | | |
| Mother Education (Low-High) | | | | | | | | | | | | |
| Low | 287 | 83 (28.9%) | 204 (71.1%) | 2.85 (0.09) | 281 | 53 (18.9%) | 228 (81.1%) | 5.45 (0.019) | 568 | 136 (23.9%) | 432 (76.1%) | 8.05 (0.005) |
| High | 126 | 47 (37.3%) | 79 (62.7%) | | 115 | 34 (29.6%) | 81 (70.4%) | | 241 | 81 (33.6%) | 160 (66.4%) | |
| | OR= 0.68 (0.44-1.06) | | | | OR= 0.55 (0.34-0.91) | | | | OR= 0.62 (0.45-0.86) | | | |
| Father Education (Low-High) | | | | | | | | | | | | |
| Low | 255 | 77 (30.2%) | 178 (69.8%) | 0.51 (0.48) | 230 | 46 (20.0%) | 184 (80.0%) | 1.24 (0.27) | 485 | 123 (25.4%) | 362 (74.6%) | 1.32 (0.251) |
| High | 158 | 53 (33.5%) | 105 (66.5%) | | 166 | 41 (24.7%) | 125 (75.3%) | | 324 | 94 (29.0%) | 230 (71.0%) | |
| | OR= 0.86 (0.56-1.31) | | | | OR= 0.76 (0.47-1.23) | | | | OR= 0.83 (0.61-1.14) | | | |
| Father Job (Low-High) | | | | | | | | | | | | |
| Low | 242 | 76 (31.4%) | 166 (68.6%) | 0.001 (0.97) | 247 | 56 (22.7%) | 191 (77.3%) | 0.19 (0.66) | 489 | 132 (27.0%) | 357 (73.0%) | 0.02 (0.892) |
| High | 171 | 54 (31.6%) | 117 (68.4%) | | 149 | 31 (20.8%) | 118 (79.2%) | | 320 | 85 (26.6%) | 235 (73.4%) | |
| | OR=0.99 (0.65-1.51) | | | | OR= 1.12 (0.68-1.83) | | | | OR= 1.02 (0.74-1.41) | | | |
| Mother Job (Low-High) | | | | | | | | | | | | |
| Low | 358 | 111 (31.0%) | 247 (69.0%) | 0.28 (0.60) | 341 | 70 (20.5%) | 271 (79.5%) | 2.98 (0.08) | 699 | 181 (25.9%) | 518 (74.1%) | 2.26 (0.133) |
| High | 55 | 19 (34.5%) | 36 (65.5%) | | 55 | 17 (30.9%) | 38 (69.1%) | | 110 | 36 (32.7%) | 74 (67.3%) | |
| | OR= 0.85 (0.47-1.55) | | | | OR= 0.58 (0.31-1.08) | | | | OR= 0.72 (0.47-1.11) | | | |

The majority of children who passed school (75.5%) came from large families. Also, children with fathers which are illiterate or can only read and write and children with parents that are non-professionals or semi-professionals had passed school. There were no significant differences in these results. But children with illiterate or can only read and write mothers passed school with a significant difference than those with high educated mothers (OR=0.62).

When comparing the effect of these factors in boys and girls of the sample, we found that there are no significant differences in boys. But in girls, the mother's education has a significant difference (OR= 0.55) (Table 3).

The majority of children who had school meal passed math (88.7%) verses 11.3% who failed. While children not having meal, only 21.9% passed and 78.1% failed (OR= 28.05). But eating the meal in the morning has a high positive effect (OR=3.55) when comparing it with afternoon, or non-specific time (OR=5.16). And, similarly, those reported to consume breakfast had the same, but less obvious positive effect (OR= 1.37), 60.9% of children having breakfast passed verses 39.1% failed). These results agree with work by Adrogué and Orlicki, 2013, who reported that eating breakfast, in contrast to fasting, may improve performance on the morning eaten. The long-term effects of eating breakfast on the performance of school children who do not have physical signs of severe undernourishment are less certain.

Having a mid-day snack has a positive effect (OR=2.54). The combined effect of breakfast and school meal has a high positive effect (OR=24.19), only 23.9% of children not having breakfast or a meal passed math. Dinner and snacking between meals had no significant effect on passing math (Table 4). Nutritional factors had increased chances of passing math.

Table 4. Math Achievement for Boys, Girls and the Combined Group vs. some Nutritional Factors.

| | Boys | | | | Girls | | | | Combined | | | |
|-------------------------------------------|------------------------|-------------|-------------|----------------------|-------------------------|------------|-------------|----------------------|-------------------------|-------------|-------------|----------------------|
| | n | Failed<50 | Passed>50 | X ² (sig) | n | Failed<50 | Passed>50 | X ² (sig) | n | Failed<50 | Passed>50 | X ² (sig) |
| School Meal | | | | | | | | | | | | |
| No Meal | 120 | 102 (85.0%) | 18 (15.0%) | 197.13 | 120 | 86 (71.7%) | 34 (28.3%) | 174.04 | 233 | 182 (78.1%) | 51 (21.9%) | 349.30 |
| Meal | 293 | 38 (13.0%) | 255 (87.0%) | (0.000) | 276 | 21 (7.6%) | 255 (92.4%) | (0.000) | 576 | 65 (11.3%) | 511 (88.7%) | (0.000) |
| | OR=38.03 (20.74-69.71) | | | | OR= 30.71 (16.92-55.76) | | | | OR= 28.05 (18.37-42.01) | | | |
| Time of Distribution & Eating School Meal | | | | | | | | | | | | |
| Afternoon | 32 | 5 (15.6%) | 27 (84.4%) | 3.25 | 24 | 1 (4.2%) | 23 (95.8%) | 2.66 | 56 | 6 (10.7%) | 50 (89.3%) | 5.73 |
| Morning | 63 | 3 (4.8%) | 60 (95.2%) | (0.07) | 63 | 0 | 63 (100.0%) | (0.10) | 126 | 3 (2.4%) | 123 (97.6%) | (0.02) |
| | OR= 3.70 (0.83-16.63) | | | | OR= Undefined | | | | OR=4.92 (1.18-20.44) | | | |
| Time of Distribution & Eating School Meal | | | | | | | | | | | | |
| Break | 152 | 22 (14.5%) | 130 (85.5%) | 4.09 | 139 | 13 (9.4%) | 126 (90.6%) | 6.30 | 291 | 35 (12.0%) | 256 (88.0%) | 9.88 |
| Morning | 63 | 3 (4.8%) | 60 (95.2%) | (0.04) | 63 | 0 | 63 (100.0%) | (0.01) | 126 | 3 (2.4%) | 123 (97.6%) | (0.001) |
| | OR= 3.38 (0.98-11.75) | | | | OR= Undefined | | | | OR= 5.61 (1.69-18.58) | | | |
| Time of Distribution & Eating School Meal | | | | | | | | | | | | |
| No Specific Time | 41 | 8 (19.5%) | 33 (80.5%) | 5.71 | 47 | 7 (14.9%) | 40 (85.1%) | 10.02 | 88 | 15 (17.0%) | 73 (83.0%) | 14.46 |
| Morning | 63 | 3 (4.8%) | 60 (95.2%) | (0.016) | 63 | 0 | 63 (100.0%) | (0.001) | 126 | 3 (2.4%) | 123 (97.6%) | 0.000 |
| | OR= 4.85 (1.20-19.53) | | | | OR= Undefined | | | | OR= 8.42 (2.36-30.09) | | | |
| Breakfast | | | | | | | | | | | | |
| No | 111 | 40 (36.0%) | 71 (64.0%) | 0.31 | 141 | 44 (31.2%) | 97 (68.8%) | 1.95 | 252 | 118 (46.8%) | 134 (53.2%) | 4.22 |
| Yes | 302 | 100 (33.1%) | 202 (66.9%) | (0.58) | 255 | 63 (24.7%) | 192 (75.3%) | (0.16) | 557 | 218 (39.1%) | 339 (60.9%) | (0.024) |
| | OR= 1.38 (0.72-1.79) | | | | OR= 1.38 (0.88-2.18) | | | | OR= 1.37 (1.01-1.85) | | | |
| Breakfast Before School | | | | | | | | | | | | |
| No | 109 | 38 (34.9%) | 71 (65.1%) | 0.06 | 152 | 53 (34.9%) | 99 (65.1%) | 7.71 | 261 | 122 (46.7%) | 139 (53.3%) | 4.31 |
| Yes | 304 | 102 (33.6%) | 202 (66.4%) | (0.80) | 244 | 54 (22.1%) | 190 (77.9%) | (0.005) | 548 | 214 (39.1%) | 334 (60.9%) | (0.023) |
| | OR= 1.06 (0.67-1.68) | | | | OR= 1.88 (1.20-2.95) | | | | OR=1.37 (1.025-1.84) | | | |
| School Meal & Breakfast | | | | | | | | | | | | |
| No School Meal & No Breakfast | 40 | 31 (77.5%) | 9 (22.5%) | 76.54 | 48 | 36 (75.0%) | 12 (25.0%) | 118.41 | 88 | 67 (76.1%) | 21 (23.9%) | 170.26 |
| School Meal& Breakfast | 224 | 31 (13.8%) | 193 (86.2%) | (0.000) | 188 | 17 (9.0%) | 171 (91.0%) | (0.000) | 412 | 48 (11.7%) | 364 (88.3%) | (0.000) |
| | OR= 21.44 (9.32-49.35) | | | | OR= 40.24 (17.98-90.03) | | | | OR= 24.19 (13.61-43.01) | | | |
| Number of Meals | | | | | | | | | | | | |
| Less than 3 meals/day | 41 | 10 (24.4%) | 31 (75.6%) | 1.84 | 63 | 19 (30.2%) | 44 (69.8%) | 0.37 | 104 | 64 (61.5%) | 40 (38.5%) | 14.03 |
| 3 or more meals/day | 372 | 130 (34.9%) | 242 (65.1%) | (0.18) | 333 | 88 (26.4%) | 245 (73.6%) | (0.54) | 705 | 296 (42.0%) | 409 (58.0%) | (0.000) |
| | OR=0.60 (0.28-1.26) | | | | OR= 1.20 (0.67-2.17) | | | | OR= 2.21 (1.45-3.37) | | | |
| Snacks Between Meals | | | | | | | | | | | | |
| No | 88 | 28 (31.8%) | 60 (68.2%) | 0.22 | 60 | 9 (15.0%) | 51 (85.0%) | 5.18 | 148 | 56 (37.8%) | 92 (62.2%) | 1.02 |
| Yes | 325 | 112 (34.5%) | 213(65.5%) | (0.64) | 336 | 98 (29.2%) | 238 (70.8%) | (0.02) | 661 | 280 (42.4%) | 381 (57.6%) | (0.18) |
| | OR= 0.89 (0.54-1.47) | | | | OR=0.43 (0.20-0.90) | | | | OR= 0.83 (0.57-1.19) | | | |
| Mid Day Snack | | | | | | | | | | | | |
| No | 60 | 18 (30.0%) | 42(70.0%) | 0.48 | 35 | 15 (42.9%) | 20 (57.1%) | 4.88 | 97 | 60 (63.2%) | 37 (36.8%) | 3.58 |
| Yes | 353 | 122 (34.6%) | 231 (65.4%) | (0.49) | 361 | 92 (25.5%) | 269 (74.5%) | (0.03) | 714 | 288 (40.3%) | 426 (59.7%) | (0.038) |
| | OR=0.81 (0.45-1.47) | | | | OR= 2.19 (1.08-4.46) | | | | OR=2.54 (1.63-3.95) | | | |
| Meals on Time (Regular Meals) | | | | | | | | | | | | |
| No | 123 | 32 (26.0%) | 91 (74.0%) | 4.86 | 132 | 34 (25.8%) | 98 (74.2%) | 0.16 | 554 | 341 (61.6%) | 213 (38.4%) | 41.49 |
| Yes | 290 | 108 (37.2%) | 182 (62.8%) | (0.03) | 264 | 73 (27.7%) | 191 (72.3%) | (0.69) | 255 | 95 (37.3%) | 160 (62.7%) | (0.000) |
| | OR= 0.59 (0.37-0.95) | | | | OR= 0.91 (0.56-1.46) | | | | OR= 2.70 (1.96-3.66) | | | |
| Dinner | | | | | | | | | | | | |
| No | 21 | 7 (33.3%) | 14 (66.7%) | 0.004 | 41 | 15 (36.6%) | 26(63.4%) | 2.12 | 62 | 27 (43.5%) | 35 (56.5) | 0.107 |
| Yes | 391 | 133 (34.0%) | 258(66.0%) | (0.95) | 355 | 92 (25.9%) | 263(74.1%) | (0.15) | 746 | 309 (41.4%) | 437(58.6%) | (0.421) |
| | OR=0.97 (0.38-2.46) | | | | OR= 1.65 (0.84-3.25) | | | | OR=1.09 (0.65-1.84) | | | |

When comparing the effect of nutritional factors in boys and girls in the sample, there is a difference in factors affecting the passing math. In girls, having a meal had a significant effect (OR=30.71); eating the meal (OR=3.48). Having the school meal in the morning had positive significant effect on passing math compared with the

afternoon an on no specific time respectively. Also, having breakfast before school (OR=1.88), the mid-day snack has a significant effect (OR=2.19) and the combination of breakfast and school meal (OR=40.24).

As for boys, having a meal (OR= 38.03); has a significant effect which is lower compared with girls. Having the school

| | Boys | | | | | Girls | | | | |
|-----------------------|-----------------|--------------|-------------|---------------|-----------------------|-----------------|--------------|-------------|---------------|-----------------------|
| | Not Having Meal | | Having Meal | | <i>t</i> (<i>p</i>) | Not Having Meal | | Having Meal | | <i>t</i> (<i>p</i>) |
| | <i>n</i> | Mean ± SD | <i>n</i> | Mean ± SD | | <i>n</i> | Mean ± SD | <i>n</i> | Mean ± SD | |
| Less than 3 meals/day | 12 | 47.31±8.67 | 29 | 63.56±18.10 | -4.32 (0.000) | 16 | 48.83±14.20 | 47 | 66.89±18.44 | -3.57 (0.001) |
| 3 or more meals/day | 106 | 48.63±10.10 | 266 | 68.48±16.27 | -8.01 (0.000) | 99 | 51.78±9.88 | 234 | 70.91±16.84 | -10.55 (0.000) |
| <i>t</i> (<i>p</i>) | | -0.44 (0.66) | | -1.51 (0.13) | | | -1.04 (0.30) | | -1.47 (0.14) | |
| Meals on Time | | | | | | | | | | |
| No | 32 | 47.96±9.33 | 91 | 61.94±17.97 | -5.81 (0.000) | 42 | 49.93±10.61 | 90 | 70.69±17.09 | -5.91 (0.000) |
| Yes | 86 | 49.96±11.44 | 204 | 68.80±17.11 | -6.83 (0.000) | 73 | 53.86±10.12 | 91 | 70.02±17.22 | 9.31 (0.000) |
| <i>t</i> (<i>p</i>) | | -0.44 (0.66) | | -3.11 (0.002) | | | -1.94 (0.05) | | 0.30 (0.76) | |
| Dinner | | | | | | | | | | |
| No | 7 | 48.25±5.82 | 14 | 63.73±18.06 | -3.77 (0.001) | 14 | 49.07±14.18 | 27 | 69.11±13.42 | -4.45 (0.000) |
| Yes | 111 | 48.52±10.16 | 280 | 71.46±15.60 | -8.36 (0.000) | 101 | 51.69±10.01 | 254 | 70.35±17.52 | -10.07 (0.000) |
| <i>t</i> (<i>p</i>) | | -0.07 (0.95) | | -1.57 (0.12) | | | -0.87 (0.39) | | -0.36 (0.72) | |
| Mid-Day Snack | | | | | | | | | | |
| No | 17 | 47.26±10.47 | 43 | 62.62±18.15 | -3.27 (0.002) | 17 | 50.85±10.51 | 18 | 58.43±16.80 | -1.59 (0.12) |
| Yes | 101 | 48.71±9.88 | 252 | 64.33±17.97 | -8.25 (0.000) | 98 | 51.46±10.62 | 263 | 71.04±16.91 | -10.70 (0.000) |
| <i>t</i> (<i>p</i>) | | -0.55 (0.58) | | -0.58 (0.57) | | | -0.22 (0.83) | | -3.06 (0.002) | |

Table 6. Continued.

| | Combined | | | | <i>t</i> (<i>p</i>) |
|-------------------------|-----------------|--------------|-------------|---------------|-----------------------|
| | Not Having Meal | | Having Meal | | |
| | <i>n</i> | Mean ± SD | <i>n</i> | Mean ± SD | |
| Breakfast | | | | | |
| No | 88 | 49.80±9.58 | 164 | 67.15±18.41 | -7.90 (0.000) |
| Yes | 145 | 50.10±11.51 | 412 | 67.06±17.62 | -11.22 (0.000) |
| <i>t</i> (<i>p</i>) | | -0.21 (0.83) | | 0.06 (0.96) | |
| Breakfast Before School | | | | | |
| No | 94 | 49.45±11.33 | 167 | 66.99±17.59 | -8.52 (0.000) |
| Yes | 139 | 50.23±9.62 | 409 | 67.31±18.46 | -10.70 (0.000) |
| <i>t</i> (<i>p</i>) | | -0.56 (0.58) | | -0.19 (0.85) | |
| Number of Meals per day | | | | | |
| Less than 3 meals/day | 28 | 48.18±11.97 | 76 | 67.64±17.56 | -5.41 (0.000) |
| 3 or more meals/day | 205 | 50.15±10.09 | 500 | 67.00±17.89 | -12.68 (0.000) |
| <i>t</i> (<i>p</i>) | | -0.95 (0.34) | | 0.29 (0.77) | |
| Meals on Time | | | | | |
| No | 74 | 48.86±9.96 | 181 | 65.85±18.05 | -8.22 (0.000) |
| Yes | 159 | 52.17±10.81 | 395 | 69.79±17.08 | -11.19 (0.000) |
| <i>t</i> (<i>p</i>) | | -2.30 (0.02) | | -2.47 (0.014) | |
| Dinner | | | | | |
| No | 21 | 48.80±11.87 | 41 | 66.88±18.09 | -5.89 (0.000) |
| Yes | 212 | 50.03±10.19 | 534 | 69.91±14.06 | -12.78 (0.000) |
| <i>t</i> (<i>p</i>) | | -0.52 (0.60) | | -1.05 (0.29) | |
| Mid-Day Snack | | | | | |
| No | 34 | 49.06±10.49 | 61 | 61.39±17.73 | -3.70 (0.000) |
| Yes | 199 | 50.06±10.32 | 515 | 67.76±17.74 | -13.23 (0.000) |
| <i>t</i> (<i>p</i>) | | -0.52 (0.60) | | -2.65 (0.008) | |

As for boys, the average school grades were not significantly affected by nutritional factors, except in case of the regularity of meals in combination with school meal, which had a significant positive effect. The same is true for girls, where the regularity of meals alone had a significant positive effect and the mid-day snack in combination with school meal had a significant positive effect. It can be noticed that, both boy and girls, receiving a school meal had significantly higher grades than those not a school meal regardless the other factor.

When considering the effect of social factors we found that they had no significant effect on school grades of the children (the sample or in boy and girls separately) not receiving

school meal. But when comparing the effect of each of these factors on children receiving school meal, we found a significant positive effect on school grades for the children of the sample. Our results agree with previous work done by

As for boys, we found a significant positive effect for all factors except for order of birth and mother's job for children receiving school meal. But for girls receiving the school meal, only the parent education and father's job showed a significant positive effect, while other factors showed non-significant effects (Table 7). In general girls scored higher than boys, these results are in contrast with work by Kamogawa, 2003 and Hamid Jan *et al.*, 2011 who reported that female Malaysian students earned better grades than males.

Table 7. School Achievement Scores for Boys, Girls and the Combined Group vs. School Meal and some Social Factors.

| | Boys | | | | | Girls | | | | |
|----------------------------------------|-----------------|--------------|-------------|---------------|----------------------|-----------------|--------------|-------------|---------------|----------------------|
| | Not Having Meal | | Having Meal | | <i>t</i> <i>p</i> | Not Having Meal | | Having Meal | | <i>t</i> <i>p</i> |
| | <i>n</i> | Mean ± SD | <i>n</i> | Mean ± SD | | <i>n</i> | Mean ± SD | <i>n</i> | Mean ± SD | |
| Child Order of Birth | | | | | | | | | | |
| Child 3 rd or more | 49 | 48.94±10.14 | 159 | 62.35±18.67 | -4.81 (0.000) | 51 | 51.81±10.85 | 151 | 68.73±16.77 | -6.74 (0.000) |
| Child 1 st -2 nd | 69 | 48.19±9.86 | 136 | 66.11±16.97 | -8.10 (0.000) | 64 | 51.01±10.40 | 130 | 71.98±17.49 | -8.85 (0.000) |
| <i>t(p)</i> | | 0.40 (0.69) | | -1.79 (0.07) | | | 0.40 (0.69) | | -1.59 (0.11) | |
| Family Size | | | | | | | | | | |
| Large | 56 | 48.62±10.37 | 233 | 62.95±18.22 | -5.66 (0.000) | 53 | 50.57±10.69 | 229 | 69.86±17.06 | -7.87 (0.000) |
| Small | 62 | 48.40±9.61 | 62 | 68.36±16.45 | -8.25 (0.000) | 62 | 52.05±10.49 | 52 | 71.89±17.62 | -7.44 (0.000) |
| <i>t(p)</i> | | 0.12 (0.91) | | -2.12 (0.04) | | | -0.75 (0.46) | | -0.77 (0.44) | |
| Mother Education (Low-High) | | | | | | | | | | |
| Low | 47 | 47.89±9.78 | 240 | 62.59±17.88 | -5.47 (0.000) | 52 | 52.25±11.17 | 229 | 68.78±16.97 | -6.70 (0.000) |
| High | 71 | 48.90±10.09 | 55 | 70.61±17.40 | -8.91 (0.000) | 63 | 50.64±10.06 | 52 | 76.65±16.62 | -10.35 (0.000) |
| <i>t(p)</i> | | -0.54 (0.59) | | -3.03 (0.003) | | | 0.81 (0.42) | | 0.68 (0.003) | |
| Father Education (Low-High) | | | | | | | | | | |
| Low | 35 | 46.36±10.79 | 220 | 61.71±18.05 | -4.89 (0.000) | 38 | 52.06±11.16 | 192 | 68.15±17.12 | -5.56 (0.000) |
| High | 83 | 49.40±9.48 | 75 | 71.05±15.89 | -10.52 (0.000) | 77 | 51.03±10.31 | 89 | 74.72±16.43 | -10.93 (0.000) |
| <i>t(p)</i> | | -1.53 (0.13) | | -3.98 (0.000) | | | 0.49 (0.62) | | -3.03 (0.003) | |
| Father Job (Low-High) | | | | | | | | | | |
| Low | 47 | 46.34±9.75 | 195 | 62.11±17.63 | -5.91 (0.000) | 51 | 50.88±11.21 | 196 | 67.20±17.14 | -6.44 (0.000) |
| High | 71 | 49.93±9.87 | 100 | 67.93±18.09 | -7.62 (0.000) | 64 | 51.75±10.08 | 85 | 77.24±15.07 | -11.69 (0.000) |
| <i>t(p)</i> | | -1.94 (0.05) | | -2.66 (0.008) | | | -0.44 (0.66) | | -4.67 (0.000) | |
| Mother Job (Low-High) | | | | | | | | | | |
| Low | 82 | 47.79±9.36 | 276 | 63.60±17.91 | -7.68 (0.000) | 78 | 51.46±11.41 | 263 | 69.76±17.13 | -8.87 (0.000) |
| High | 36 | 50.10±11.11 | 19 | 71.07±17.98 | -5.34 (0.000) | 37 | 51.18±8.63 | 18 | 77.17±16.43 | -7.72 (0.000) |
| <i>t(p)</i> | | -1.16 (0.25) | | -1.76 (0.08) | | | 0.13 (0.89) | | -1.78 (0.08) | |

Table 7. Continued.

| | Combined | | | | <i>t</i> (p) |
|----------------------------------------|-----------------|--------------|-------------|---------------|----------------|
| | Not Having Meal | | Having Meal | | |
| | n | Mean ± SD | n | Mean ± SD | |
| Child Order of Birth | | | | | |
| Child 3 rd or more | 100 | 50.41±10.55 | 310 | 65.46±18.02 | -7.92 (0.000) |
| Child 1 st -2 nd | 133 | 49.55±10.18 | 266 | 68.98±17.44 | -11.87 (0.000) |
| <i>t</i> (p) | | 0.63 (0.53) | | -2.37 (0.02) | |
| Family Size | | | | | |
| Large | 109 | 49.57±10.52 | 462 | 66.37±17.97 | -9.34 (0.000) |
| Small | 124 | 50.22±10.19 | 114 | 69.96±17.01 | -10.97 (0.000) |
| <i>t</i> (p) | | -0.48 (0.63) | | -1.93 (0.05) | |
| Mother Education (Low-High) | | | | | |
| Low | 99 | 50.18±10.71 | 469 | 65.61±17.69 | -8.36 (0.000) |
| High | 134 | 49.72±10.07 | 107 | 73.55±17.03 | -13.51 (0.000) |
| <i>t</i> (p) | | 0.34 (0.74) | | -4.22 (0.000) | |
| Father Education (Low-High) | | | | | |
| Low | 73 | 49.33±11.28 | 412 | 64.71±17.89 | -7.10 (0.000) |
| High | 160 | 50.18±9.89 | 164 | 73.04±16.24 | -15.26 (0.000) |
| <i>t</i> (p) | | -0.59 (0.56) | | -5.17 (0.000) | |
| Father Job (Low-High) | | | | | |
| Low | 98 | 48.70±10.72 | 391 | 64.66±17.56 | -8.60 (0.000) |
| High | 135 | 50.79±9.98 | 185 | 72.21±17.36 | -12.86 (0.000) |
| <i>t</i> (p) | | -1.53 (1.13) | | -4.83 (0.000) | |
| Mother Job (Low-High) | | | | | |
| Low | 160 | 49.58±10.54 | 539 | 66.61±17.78 | -11.52 (0.000) |
| High | 73 | 50.65±9.87 | 37 | 74.03±17.28 | -9.03 (0.000) |
| <i>t</i> (p) | | -0.73 (0.46) | | -2.46 (0.01) | |

When comparing math grade with regard to nutritional factors, for children not receiving school meal, it was found that the regularity of meals only had a statistically significant positive effect on math grades. While for children receiving school meal, it was found that the regularity of meals and the midday snack had a statistically significant positive effect on

math grades.

While for boys, having the breakfast and school meal or meal regularity with school meal had a positive significant effect on math grades. As for girls, having a mid-day snack with the school meal had a statistically positive significant effect on math grades (Table 8).

Table 8. Math Test School Achievement Scores for Boys, Girls and the Combined Group vs. School Meal and some Nutritional Factors.

| | Boys | | | | | Girls | | | | |
|-------------------------|-----------------|--------------|-------------|---------------|----------------------|-----------------|--------------|-------------|--------------|----------------------|
| | Not Having Meal | | Having Meal | | <i>t</i> <i>p</i> | Not Having Meal | | Having Meal | | <i>t</i> <i>p</i> |
| | <i>n</i> | Mean ± SD | <i>n</i> | Mean ± SD | | <i>n</i> | Mean ± SD | <i>n</i> | Mean ± SD | |
| Breakfast | | | | | | | | | | |
| No | 40 | 24.56±14.32 | 159 | 60.63±21.09 | -16.44 (0.000) | 48 | 27.86±19.12 | 93 | 68.97±19.76 | -11.83 (0.000) |
| Yes | 78 | 27.17±16.02 | 136 | 64.19±17.72 | -9.42 (0.000) | 67 | 29.89±18.30 | 188 | 69.66±19.63 | -14.49 (0.000) |
| <i>t(p)</i> | | -1.14 (0.26) | | -3.02 (0.003) | | | -0.57 (0.57) | | -0.28 (0.78) | |
| Breakfast Before School | | | | | | | | | | |
| No | 39 | 24.78±16.27 | 70 | 63.64±20.09 | -10.34 (0.000) | 55 | 26.18±19.21 | 97 | 68.81±21.19 | -12.32 (0.000) |
| Yes | 79 | 26.54±16.28 | 225 | 64.35±19.32 | -15.82 (0.000) | 60 | 31.67±17.77 | 184 | 69.76±18.82 | -13.80 (0.000) |
| <i>t(p)</i> | | -0.60 (0.55) | | 0.26 (0.80) | | | -1.59 (0.11) | | -0.39 (0.70) | |
| Number of Meals per day | | | | | | | | | | |
| Less than 3 meals/day | 12 | 25.00±15.15 | 29 | 63.42±20.27 | -7.99 (0.000) | 16 | 30.31±19.47 | 47 | 66.47±18.68 | -6.62 (0.000) |
| 3 or more meals/day | 106 | 25.40±15.05 | 266 | 67.41±15.59 | -17.48 (0.000) | 99 | 28.84±18.54 | 234 | 70.03±19.81 | -17.67 (0.000) |
| <i>t(p)</i> | | -0.09 (0.93) | | -1.03 (0.31) | | | 0.29 (0.77) | | -1.14 (0.26) | |
| Meals on Time | | | | | | | | | | |
| No | 32 | 23.20±14.47 | 91 | 61.41±20.16 | -10.60 (0.000) | 42 | 30.83±15.81 | 90 | 71.29±17.99 | -5.53 (0.000) |
| Yes | 86 | 31.17±15.07 | 204 | 69.20±18.20 | -15.93 (0.000) | 73 | 28.01±20.05 | 191 | 68.56±20.35 | -18.01 (0.000) |
| <i>t(p)</i> | | -2.63 (0.01) | | -3.16 (0.002) | | | 0.78 (0.44) | | 1.09 (0.28) | |
| Dinner | | | | | | | | | | |
| No | 7 | 25.20±15.11 | 14 | 63.37±20.07 | -6.24 (0.000) | 14 | 25.00±25.65 | 27 | 66.06±20.81 | -5.53 (0.000) |
| Yes | 111 | 27.86±13.88 | 280 | 71.37±15.87 | -18.14 (0.000) | 101 | 29.60±17.49 | 254 | 69.79±19.52 | -18.01 (0.000) |
| <i>t(p)</i> | | -0.45 (0.65) | | -1.58 (0.12) | | | -0.87 (0.39) | | -0.94 (0.35) | |
| Mid-Day Snack | | | | | | | | | | |
| No | 17 | 24.65±14.90 | 43 | 62.10±19.93 | -6.08 (0.000) | 17 | 28.09±19.03 | 18 | 59.69±15.88 | -5.35 (0.000) |
| Yes | 101 | 29.56±17.97 | 252 | 64.10±19.89 | -17.99 (0.000) | 98 | 29.21±18.61 | 263 | 70.10±19.72 | -17.79 (0.000) |
| <i>t(p)</i> | | -1.25 (0.21) | | -0.61 (0.54) | | | -0.23 (0.82) | | -2.19 (0.03) | |

Table 8. Continued.

| | Combined | | | | <i>t</i> <i>p</i> |
|-------------------------|-----------------|--------------|-------------|---------------|----------------------|
| | Not Having Meal | | Having Meal | | |
| | <i>n</i> | Mean ± SD | <i>n</i> | Mean ± SD | |
| Breakfast | | | | | |
| No | 88 | 26.84±16.16 | 164 | 66.42±19.81 | -15.11 (0.000) |
| Yes | 145 | 27.73±18.22 | 412 | 66.90±20.32 | -21.65 (0.000) |
| <i>t</i> (<i>p</i>) | | -0.39 (0.70) | | -0.26 (0.79) | |
| Breakfast Before School | | | | | |
| No | 94 | 26.33±17.96 | 167 | 66.40±19.74 | -16.06 (0.000) |
| Yes | 139 | 27.75±16.24 | 409 | 66.94±20.49 | -20.81 (0.000) |
| <i>t</i> (<i>p</i>) | | -0.63 (0.53) | | -0.30 (0.77) | |
| Number of Meals per day | | | | | |
| Less than 3 meals/day | 28 | 27.06±16.87 | 76 | 66.51±20.31 | -10.02 (0.000) |
| 3 or more meals/day | 205 | 28.04±17.64 | 500 | 66.83±17.46 | -24.55 (0.000) |
| <i>t</i> (<i>p</i>) | | -0.29 (0.78) | | -0.13 (0.90) | |
| Meals on Time | | | | | |
| No | 74 | 25.41±17.27 | 181 | 64.87±20.54 | -16.40 (0.000) |
| Yes | 159 | 30.98±15.39 | 395 | 70.24±18.08 | -21.34 (0.000) |
| <i>t</i> (<i>p</i>) | | -2.36 (0.02) | | -3.03 (0.003) | |
| Dinner | | | | | |
| No | 21 | 25.95±22.07 | 41 | 66.25±20.02 | -7.75 (0.000) |
| Yes | 212 | 27.30±16.40 | 534 | 68.07±19.28 | -25.28 (0.000) |
| <i>t</i> (<i>p</i>) | | -0.35 (0.73) | | -0.51 (0.61) | |
| Mid-Day Snack | | | | | |
| No | 34 | 26.89±16.97 | 61 | 61.39±18.73 | -8.42 (0.000) |
| Yes | 199 | 28.82±16.84 | 515 | 67.17±20.01 | -25.11 (0.000) |
| <i>t</i> (<i>p</i>) | | 0.61 (0.54) | | -2.15 (0.03) | |

When considering the social factors, we found that they had a significant effect on math grades in the combined sample and in boy and girls separately, except for child's order of birth (Table 9).

Table 9. Math Test School Achievement Scores for Boys, Girls and the Combined Group vs. School Meal and some Social Factors.

| | Boys | | | | | Girls | | | | |
|----------------------------------------|-----------------|--------------|-------------|---------------|----------------------|-----------------|-------------|-------------|---------------|----------------------|
| | Not Having Meal | | Having Meal | | <i>t</i> <i>p</i> | Not Having Meal | | Having Meal | | <i>t</i> <i>p</i> |
| | <i>n</i> | Mean ± SD | <i>n</i> | Mean ± SD | | <i>n</i> | Mean ± SD | <i>n</i> | Mean ± SD | |
| Child Order of Birth | | | | | | | | | | |
| Child 3 rd or more | 49 | 26.17±16.02 | 159 | 60.63±21.09 | -10.53 (0.000) | 51 | 31.91±18.77 | 151 | 68.55±19.22 | -11.84 (0.000) |
| Child 1 st -2 nd | 69 | 24.78±14.32 | 136 | 67.54±17.72 | -17.36 (0.000) | 64 | 26.76±18.27 | 130 | 70.46±20.15 | -14.64 (0.000) |
| <i>t(p)</i> | | 0.49 (0.62) | | -3.02 (0.003) | | | 1.49 (0.14) | | -0.81 (0.42) | |
| Family Size | | | | | | | | | | |
| Large | 56 | 26.70±15.46 | 233 | 62.53±20.42 | -12.31 (0.000) | 53 | 29.95±18.27 | 229 | 69.20±19.78 | -13.20 (0.000) |
| Small | 62 | 24.15±14.59 | 62 | 68.61±16.97 | -15.64 (0.000) | 62 | 28.27±18.98 | 52 | 70.47±19.15 | -11.78 (0.000) |
| <i>t(p)</i> | | 0.92 (0.36) | | -2.15 (0.03) | | | 0.48 (0.63) | | -0.42 (0.68) | |
| Mother Education (Low-High) | | | | | | | | | | |
| Low | 47 | 27.92±13.12 | 240 | 62.44±19.10 | -11.85 (0.000) | 52 | 33.17±17.66 | 229 | 68.51±18.51 | -12.53 (0.000) |
| High | 71 | 23.66±15.98 | 55 | 69.80±22.19 | -13.56 (0.000) | 63 | 25.63±18.79 | 52 | 73.52±23.79 | -12.06 (0.000) |
| <i>t(p)</i> | | 1.52 (0.13) | | -2.50 (0.013) | | | 2.20 (0.03) | | -1.67 (0.09) | |
| Father Education (Low-High) | | | | | | | | | | |
| Low | 35 | 29.43±15.28 | 220 | 61.24±19.07 | -9.39 (0.000) | 38 | 31.32±19.26 | 192 | 68.23±18.29 | -11.27 (0.000) |
| High | 83 | 23.64±14.63 | 75 | 71.36±20.38 | -17.02 (0.000) | 77 | 27.92±18.28 | 89 | 72.03±22.16 | -13.86 (0.000) |
| <i>t(p)</i> | | 1.94 (0.06) | | -3.90 (0.000) | | | 0.92 (0.36) | | -1.51 (0.13) | |
| Father Job (Low-High) | | | | | | | | | | |
| Low | 77 | 27.92±18.28 | 89 | 72.03±22.16 | -13.86 (0.000) | 51 | 32.30±20.13 | 196 | 66.82±19.31 | -11.27 (0.000) |
| High | 71 | 23.59±14.99 | 100 | 67.64±20.79 | -15.25 (0.000) | 64 | 26.45±16.98 | 85 | 75.48±19.17 | -16.22 (0.000) |
| <i>t(p)</i> | | 1.59 (0.12) | | -2.39 (0.02) | | | 1.69 (0.09) | | -3.46 (0.001) | |
| Mother Job (Low-High) | | | | | | | | | | |
| Low | 82 | 25.33±14.32 | 276 | 63.21±19.80 | -16.11 (0.000) | 78 | 31.15±18.74 | 263 | 69.46±18.81 | -15.81 (0.000) |
| High | 36 | 25.42±16.65 | 19 | 72.61±19.42 | -9.43 (0.000) | 37 | 24.59±17.72 | 18 | 69.06±29.99 | -6.91 (0.000) |
| <i>t(p)</i> | | -0.03 (0.98) | | -2.00 (0.05) | | | 1.78 (0.08) | | 0.09 (0.93) | |

Table 9. Continued.

| | Combined | | | | <i>t</i> <i>p</i> |
|----------------------------------------|-----------------|--------------|-------------|---------------|----------------------|
| | Not Having Meal | | Having Meal | | |
| | <i>n</i> | Mean ± SD | <i>n</i> | Mean ± SD | |
| Child Order of Birth | | | | | |
| Child 3 rd or more | 100 | 29.10±17.63 | 310 | 64.49±20.55 | -15.48 (0.000) |
| Child 1 st -2 nd | 133 | 25.73±16.31 | 266 | 68.97±18.97 | -22.46 (0.000) |
| <i>t(p)</i> | | 1.51 (0.133) | | -2.70 (0.007) | |
| Family Size | | | | | |
| Large | 109 | 28.28±16.88 | 462 | 65.84±20.36 | -17.86 (0.000) |
| Small | 124 | 26.21±16.98 | 114 | 69.46±17.94 | -19.10 (0.000) |
| <i>t(p)</i> | | 0.93 (0.35) | | -1.74 (0.08) | |
| Mother Education (Low-High) | | | | | |
| Low | 99 | 30.68±15.81 | 469 | 65.40±19.03 | -16.95 (0.000) |
| High | 134 | 24.59±17.32 | 107 | 71.61±22.95 | -18.12 (0.000) |
| <i>t(p)</i> | | 2.75 (0.006) | | -2.92 (0.004) | |
| Father Education (Low-High) | | | | | |
| Low | 73 | 30.41±17.37 | 412 | 64.50±19.01 | -14.29 (0.000) |
| High | 160 | 25.70±16.57 | 164 | 71.73±21.31 | -21.67 (0.000) |
| <i>t(p)</i> | | 1.98 (0.05) | | -3.78 (0.000) | |
| Father Job (Low-High) | | | | | |
| Low | 98 | 30.26±17.80 | 391 | 64.34±19.37 | -15.83 (0.000) |
| High | 135 | 24.94±15.97 | 185 | 71.24±20.39 | -21.92 (0.000) |
| <i>t(p)</i> | | 2.39 (0.02) | | -3.92 (0.000) | |
| Mother Job (Low-High) | | | | | |
| Low | 160 | 28.17±16.82 | 539 | 66.26±19.56 | -22.30 (0.000) |
| High | 73 | 25.00±17.09 | 37 | 70.88±24.83 | -11.36 (0.000) |
| <i>t(p)</i> | | 1.33 (0.19) | | -1.36 (0.17) | |

Our findings indicated unsatisfactory academic achievement in terms of test scores, which did not significantly differ between boys and girls who did not have a school meal. But when considering the effect of the school

meal, we noticed a significant difference between boys and girls; girls had better grades in both math and total score. Our results agree with work by Tan, Lane, and Lassibille (1999) who evaluated the impact of the school feeding program in the Philippines. The authors found that school feeding, either alone or with parent–teacher partnerships, had a positive and statistically significant effect on mathematics test scores. Also, Vermeersch and Kremer (2004) found that the school

meals increased test scores in schools where the teacher was experienced.

Step-wise multiple linear regression analysis in table (10) shows that school meal, father's job, sex, regularity of meals and a mid-day snack were found to be significantly ($p < 0.001$) associated with school achievement. While, math grades were associated with school meal, sex, regularity of meals and father's job.

Table 10. Order of Variables Associated with School Achievement and Math Grades According to Step-wise Regression.

| Dependent variable | Order of predictor variables ^b | R ² % | F | P value |
|--------------------|---------------------------------------------------------------------|------------------|--------|---------|
| School achievement | School meal, father job, sex, regularity of meals and mid day snack | 27.0 | 58.42 | <0.001 |
| Math grades | School meal, sex, regularity of meals and father job | 53.0 | 227.68 | <0.001 |

Multiple regression analysis^a

a: All studied variables (social, dietary behaviour and indicators of nutritional status) entered in the analysis as independent variables.

b: Variables were presented in descending order according to the value of the regression coefficients.

5. Discussion

Taras (2005) who reviews research from published studies on the association between nutrition among school-aged children and their performance in school and on tests of cognitive functioning, finds the following: Children with iron deficiencies sufficient to cause anemia are at a disadvantage academically, unless they receive iron therapy. Students with mild iron deficiencies and no anemia do not routinely exhibit problems in cognition or academic performance. Food insufficiency is a serious problem affecting children's ability to learn.

Research indicates that school meal programs contribute to improving academic performance and to providing healthier dietary behavior in participating students (Gross and Cinelli, 2004). Kim *et al.*, 2003 found that the regularity of breakfast and lunch was associated with academic performance. Also, a weak association of having a regular dinner with academic performance was seen by them. The finding of our study demonstrates that consumption of school meal has a positive impact on mathematics achievements; other nutritional factors are consumption of 3 or more meals per day and eating breakfast. This finding was demonstrated by other studies done in different countries (Grantham-McGregor, 2005; McCann & Ames, 2007).

It has been previously reported that short-term breakfast omission diminishes short-term memory in children (Simeon, 1998, Pollitt *et al.*, 1998, Benton & Patker, 1998, Adrogué and Orlicki, 2013). In the long-term, school breakfast consumption was shown to improve school attendance and scholastic achievement of children (Meyers *et al.*, 1989, Powell *et al.*, 1983). Also, eating meals at a regular time may be a reflection of food security (Wolfe & Frongillo, 2001). In addition, meal regularity also may reflect family care, (Kleinman *et al.*, 1998; Murphy *et al.*, 1998) investigators found that school-age children identified as hungry and/or at risk of hunger were more likely to have impaired psychosocial function and academic outcome. Using data from NHANES III, Alaimo and coworkers, 2001 also found that family food insufficiency was associated with school-age

children's academic and psychosocial development. Alaimo *et al.*, 2001 outlined several possible mechanisms for their results that could also be relevant to explaining the relation between meal irregularity and poorer school performance: 1) poorer health status, 2) irritability, distractibility, and emotional changes, 3) anxiety resulting from feelings of deprivation, 4) parental stress, anxiety, and behavior, and 5) family functioning.

Giving children a daily breakfast or a meal at school improves their scholastic achievement through several mechanisms, for example by activation of the brain, which is sensitive to short-term variations in the availability of nutrient supplies (Grantham-McGregor *et al.*, 1998; Pollit, 1995).

This indication is particularly strong for undernourished children. Meals at school also play important roles in alleviating short-term hunger in malnourished or even well-nourished children, motivate parents (especially among the poor) to enroll their children in school and have them attend regularly, address micronutrient deficiencies among children and increase community participation and involvement in schools (Del Rosso, 1999). Achamet *et al.*, 2012 finding on the relationship between supplying breakfast and midday meals with academic achievement should be given credibility as it has provided a picture of the experience of rural schoolchildren in Uganda. Also, regular attendance is closely related to scholastic achievement. They found that an attendance rate above 70% was significantly positively associated with achievement, corroborating findings by others (Del Rosso & Marek 1996).

Evidence of the importance of parental education in shaping children's school performance is mixed. In Egypt, student performance was marginally, but positively, influenced by the father's educational level but the mother's education did not play a significant role (Hanushek & Lavy, 1994).

It is not surprising that the SFP improves both nutritional status and test scores. Although the SF biscuits look like typical biscuits, they are not. These high-energy biscuits provide 75percent of the recommended daily allowance of vitamins and minerals for a primary school-age child. Most of the program

children had been eating these biscuits every school day for more than a year before the survey (Ahmed, 2004).

Ahmed (2004) evaluated the impact of the in-school meal program in Bangladesh on test scores using data on achievement test scores for 1,648 students in grade5 attending primary school. Using an econometric specification to isolate the effects of the program, he found that students in program schools score 15.7 percent higher than did students in the control schools. This increase is statistically significant. He further decomposed this increase into the three subjects that make up the total score and found that the improvement was due mainly to an increase in the mathematics test score.

Student's gender strongly affects their academic performance, with girls performing better in the subjects of Mathematics, and English as well as cumulatively. Kamogawa, 2003 and Hamid Jan *et al.*, 2011 reported that female Malaysian students earned better grades than males. Girls usually show more efforts leading towards better grades at school (Ceballo, McLoyd & Toyokawa, 2004).

6. Conclusion

School snack in this study has the opportunity to reduce the short-term hunger in the classroom so that the students can concentrate and learn better. Providing students with important micronutrients especially iron, on a regular basis through daily intake of school snacks, results in improvement in nutrient intake status school performance. School breakfast should be considered for both low-income children and children receiving little attention at home. Meanwhile, dietary behavior especially having breakfast beside meals is considered as enabling environment' supportive to having school meal. Accordingly, the ongoing process of the National School Feeding Program, should reach a sustainable mechanism of providing fortified school meals to all children thus helping extend the school feeding program to include the increasing number of families and their children now under threat of falling below the poverty line, who have been exposed to food hardship as a result of the recent high food prices.

School meal should be one of multiple interventions designed to improve the health and development of poor and disadvantaged children. It should be combined with other interventions as Awareness nutrition and health education programs are recommended to educate caregivers how to increase caloric and essential micro nutrients (food for the brain) of their children diets, using available food in their communities.

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