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# Diet, Breakfast, Giardia and School Success of Children in Ardebil, Iran

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**Abstract:** Nutritionists have traditionally recognized that breakfast as the most important meal of the day. Eating breakfast is important for growing and nutritional well-being of children. The aim of this study were comparison of nutrients intake, giardia infected, mean score and anthropometric factors in two groups of skip and breakfast eating. This cross-sectional study was performed during 2005 on twenty primary schools from two region of Ardebil province in Iran which were randomly selected. Anthropometric factors including height, weight and Midarm muscle Circumference (MAC) of total 795 children (401 males, 394 females) were measured. The food intake was estimated for energy and other nutrients by the 24 h-recall method for three days in week and breakfast eating was also asked to be recorded. From each stool specimen a direct preparation in saline was prepared and examined by light microscopy. The data were analyzed by using Independent Samples-T Test and Chi-square and Iranian food processor. 18.7 % (20.8% girls and 16.7% boys) of participants reported that they have skip breakfast. Height in skipping breakfast girls was more than breakfast eating, significantly ($p<0.05$), but was not significant in boys. Weight, BMI and MAC in skip breakfast children were more than breakfast eating, significantly ($p<0.05$). Average mean score of children was not significant two groups of eating and skipping breakfast. There was not association between breakfast consumption and giardia infected. Calorie and nutrient intake of children (exception of vitamin B2 and calcium intake of 7-10 years old boys) were not significant between two groups of breakfast consumption and breakfast skipping. In the present study, skip breakfast is seen in higher prevalence in primary school children and can affect on anthropometric factors.

**Key words:** Children, school, breakfast, anthropometric factors, nutrients

## INTRODUCTION

Breakfast can be defined simply as the first meal of the day. What this bald definition fails to account for, however, is the importance of eating breakfast, particularly for growing children, who tend to skip breakfast more frequently than any other meal (Singleton *et al*., 1982). This dietary omission has been associated with poor school performance (Meyers *et al*., 1989) and lower daily nutrient intake, which could lead to dietary inadequacies (Nicklas and Bao *et al*., 1993) for these children. Furthermore, poor eating habits established in childhood often continue into adulthood (Subar *et al*., 1992). A limited number of studies have investigated secular trends of breakfast consumption or the influence of breakfast consumption on the total daily nutrient intake of children and young adults (Gordon *et al*., 1995; Haines *et al*., 1996). Studies have shown that breakfast provides important nutrients and that individuals who skip breakfast do not compensate for potential nutrient and energy losses at other meals (Nicklas and O'Neil *et al*., 2004). Deficiencies in vitamins A and B-6, iron, calcium, magnesium, copper and zinc pose special problems for children (Hill *et al*., 1991). Moreover, many studies have shown significant relationships between skipping breakfast and high Body Mass Index (BMI) in adolescents (Godin *et al*., 2005; Kumar *et al*., 2004; Berkey *et al*., 2003; Barton *et al*., 2005). For children, breakfast consumption has been associated with learning and better school performance (Vaisman *et al*., 1996). Despite breakfast's positive attributes, many children go to school without breakfast (Wirths, 1976). There was a strong association between giardial infection and undernutrition, wasting and stunting in the children (Loewenson *et al*.,

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1986). The aims of the present study, were comparison of nutrients intake, giardia infected, mean score and anthropometric factors in two groups of skipping and eating breakfast.

## MATERIALS AND METHODS

**Study design and population:** In descriptive cross-sectional study, 795 children (401 males, 394 females) from 20 primary schools in 2 region of Ardebil province in Iran were selected by the multi stage sampling method and their age, anthropometric factors including height, weight and midarm Muscle Circumference (MAC), dietary methods, school success and stool examination were measured. A questionnaire was used to assess skipping and eating breakfast and mean score.

**Anthropometric measurements:** Height and weight were obtained using a portable digital scale and portable digital stadiometer following standard technique. Height and weight were measured without shoes and in light summer school uniform in a private room by the first author and trained research assistants. Height was measured to the nearest 0.5 cm using a portable stadiometer. Weight was measured to the nearest 0.1 kg using portable Soenle digital scales with a range of 0-200 kg. BMI was calculated from the students' height and weight.

**Dietary methods:** The food intake was estimated for energy and other nutrients by the 24 h-recall method three days in a week and breakfast eating was also asked to be recorded. Data of calorie and nutrients intake were analyzed by Iranian food processor.

**School success:** Educational progression including average test score of base class primary school for school children. The school success was out of 20.

**Stool examination:** Participants were aged between 7 and 12 years. Each student was given a clean glass container to collect the stool samples. From each stool specimen a direct preparation in saline was prepared and examined by light microscopy. Samples that did not reveal any intestinal parasite on the direct smears were searched using the zinc sulfate flotation method.

**Statistical analysis:** Results are expressed as mean±SD. The data were analyzed by using Independent Samples-T Test and Chi-square. Significance was assumed at $p<0.05$.

## RESULTS

18.7 % ( 20.8% girls and 16.7% boys) of participants reported that they have skip breakfast. Height in skip breakfast girls was more than breakfast eating,

Table 1: Association between breakfast eating and anthropometric factors in school children

| | | Boys | | | | Girls | | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | Age (year) | Breakfast eating (x±SD) | N | Omission breakfast (x±SD) | N | Breakfast eating (x±SD) | N | Omission breakfast (x±SD) | N |
| Height (cm) | 7 | 121.5±5.4 | 49 | 123.1±6.1 | 12 | 120.6±5.5 | 68 | 116.3±6.2 | 5 |
| | 8 | 125.5±4.7 | 71 | 128.3±5.6 | 13 | 124.1±5.8 | 59 | 125.7±6.1 | 9 |
| | 9 | 131.7±5.9 | 78 | 131.1±6.2 | 16 | 130.8±7.4 | 55 | 132.9±4.8 | 18 |
| | 10 | 134.2±6.4 | 61 | 134.2±9 | 10 | 134.3±7.7 | 59 | 136.7±9.1 | 25 |
| | 11 | 141.1±5.9 | 46 | 146.8±7.4* | 9 | 140.1±6.9 | 54 | 136.8±6.6 | 18 |
| | 12 | 143±5.6 | 29 | 141.5±6.6 | 7 | 144.1±6.9 | 17 | 139.7±11.3 | 7 |
| | Total | 131.6±8.9 | 334 | 132.7±10 | 67 | 130.3±10.1 | 312 | 133. 7±9.4* | 82 |
| Weight (kg) | 7 | 23.4±3.2 | 49 | 25.4±4.5 | 12 | 22.5±3.5 | 68 | 22.2±2.2 | 5 |
| | 8 | 23.7±2.6 | 71 | 24.1±2.9 | 13 | 23.9±3.5 | 59 | 29.4±5.2* | 9 |
| | 9 | 28.9±6.4 | 78 | 28.7±5.3 | 16 | 27.3±4.9 | 55 | 32.6±8.7* | 18 |
| | 10 | 30.9±5.7 | 61 | 30.6±5.4 | 10 | 30.6±6.7 | 59 | 33.2±9.5 | 25 |
| | 11 | 33.6±4.8 | 46 | 41.4±12.7* | 9 | 33.6±6.3 | 54 | 32.1±5.8 | 18 |
| | 12 | 35.2±7.2 | 29 | 41.4±10.9 | 7 | 38.2±7.2 | 17 | 38.6±9.9 | 7 |
| | Total | 28.6±6.6 | 334 | 30.5±9.4* | 67 | 27.9±7 | 312 | 32.2±8.4* | 82 |
| BMI ($kg\,m^{-2}$) | 7 | 15.8±1.5 | 49 | 16.7±2.9 | 12 | 15.4±1.6 | 68 | 16.4±1.6 | 5 |
| | 8 | 15.1±1.6 | 71 | 14.7±2.5 | 13 | 15.5±1.5 | 59 | 17.1±2* | 9 |
| | 9 | 16.5±2.8 | 78 | 16.6±2.6 | 16 | 15.8±1.6 | 55 | 17.6±3.8* | 18 |
| | 10 | 17.1±2.3 | 61 | 16.9±1.8 | 10 | 16.8±2.8 | 59 | 17.5±2.9 | 25 |
| | 11 | 16.9±2.3 | 46 | 18.8±3.7* | 9 | 17.1±2.5 | 54 | 17.1±1.8 | 18 |
| | 12 | 17.1±2.7 | 29 | 20.4±3.8* | 7 | 18.3±2.6 | 17 | 19.6±3.6 | 7 |
| | Total | 16.3±2.3 | 334 | 17±3.2* | 67 | 16.2±2.2 | 312 | 17.5±2.9* | 82 |
| MAC (cm) | 7 | 17.6±1.5 | 49 | 18.9±2.4* | 12 | 17.5±1.6 | 68 | 17.7±1.9 | 5 |
| | 8 | 18.1±1.9 | 71 | 18.4±1.7 | 13 | 17.8±1.4 | 59 | 20±1.5* | 9 |
| | 9 | 18.9±2.3 | 78 | 19±2.4 | 16 | 18.6±1.7 | 55 | 20.7±3.7* | 18 |
| | 10 | 19.5±2.4 | 61 | 18.6±1.1 | 10 | 19.3±2.3 | 59 | 20.2±2.9 | 25 |
| | 11 | 20.3±2.3 | 46 | 22.8±2.8* | 9 | 19.9±2.4 | 54 | 20.4±2.7 | 18 |
| | 12 | 20.5±2.3 | 29 | 22.6±3.4* | 7 | 21.1±2.1 | 17 | 21.6±4.3 | 7 |
| | Total | 18.9±2.3 | 334 | 19.7±2.8* | 67 | 18.7±2.2 | 312 | 20.3±3* | 82 |

Values are mean±SD, *$p<0.05$

Table 2: Association between breakfast eating with calorie and other nutrients intake in boys

| | Boys | | | | | |
|---|---|---|---|---|---|---|
| | 7-10 years | | | 11-12 years | | |
| Variable | Breakfast eating (x±SD) N = 258 | Omission breakfast (x±SD) N = 51 | p value | Breakfast eating (x±SD) N = 74 | Omission breakfast (x±SD) N = 16 | p value |
| Calorie(cal) | 1812.4±450.1 | 1695±532.9 | 0.10 | 1972.2±603.3 | 1904±671.1 | 0.69 |
| Protein(g) | 66.7±25.5 | 59.8±25.9 | 0.07 | 69.9±27.5 | 67.8±32.6 | 0.79 |
| CHO(g) | 255.6±68.2 | 244.8±77.8 | 0.31 | 293.8±95.4 | 272.1±116.4 | 0.42 |
| Fiber(g) | 10.2±6.4 | 10.1±5.7 | 0.95 | 12.5±7.4 | 10.1±6.9 | 0.24 |
| Total fat(g) | 59.2±24.2 | 53.6±29.1 | 0.15 | 61.3±23.4 | 61.6±23.1 | 0.96 |
| Vitamin B1(mg) | 1.3±0.4 | 1.2±0.4 | 0.09 | 1.5±0.5 | 1.4±0.7 | 0.65 |
| Vitamin B2(mg) | 1.1±0.5 | 0.9±0.4 | 0.007* | 1.1±0.5 | 0.9±0.5 | 0.28 |
| Vitamin B3(mg) | 19.6±10.4 | 17.6±8.9 | 0.20 | 21.3±10.6 | 19.6±10.5 | 0.56 |
| Vitamin B6(mg) | 1.1±0.7 | 0.9±0.5 | 0.34 | 0.9±0.4 | 0.9±0.6 | 0.84 |
| Folacin($\mu$g) | 102.7±9.6 | 91.7±7.2 | 0.41 | 107.6±76.7 | 103.6±64.4 | 0.84 |
| Vitamin B5(mg) | 3.5±1.5 | 2.5±1.2 | 0.13 | 2.7±1.3 | 2.6±1.6 | 0.96 |
| Vitamin C(mg) | 46.3±35.9 | 37.9±25.2 | 0.11 | 44.2±26.1 | 57.3±45.3 | 0.12 |
| Vitamin E(mg) | 3.1±2.1 | 3.2±3.1 | 0.62 | 3.1±1.7 | 3.3±2.6 | 0.49 |
| Ca(mg) | 503.1±291.3 | 403.6±250.9 | 0.02 | 485.7±251.2 | 438.4±282.8 | 0.50 |
| Cu(mg) | 0.69±0.6 | 0.63±0.4 | 0.47 | 0.75±0.5 | 0.70±0.43 | 0.70 |
| Fe(mg) | 16.6±6.3 | 15.8±6.3 | 0.40 | 19.9±8.3 | 19.5±11.1 | 0.87 |
| Mg(mg) | 116.8±67.5 | 108.3±55.3 | 0.39 | 118.9±53.1 | 118.9±70.2 | 0.99 |
| P(mg) | 675.8±317.2 | 595.8±279.6 | 0.09 | 681.5±295.5 | 610.6±299.6 | 0.38 |
| K(mg) | 1579.4±915.2 | 1374.9±759.1 | 0.13 | 1599.7±705.3 | 1543.9±940.3 | 0.78 |
| Se($\mu$g) | 35.2±21.3 | 35.8±20.9 | 0.85 | 29.3±8.8 | 40.6±24.1 | 0.80 |
| Na(mg) | 2157.6±1141.3 | 1954.7±1083.9 | 0.24 | 2556.1±1401.5 | 2503.9±1395.8 | 0.90 |
| ZN(mg) | 5.2±3.1 | 4.6±2.7 | 0.22 | 5.4±2.4 | 5.3±2.9 | 0.84 |

CHO= Carbohydrate, Ca= Calcium, Cu=Copper, Fe=iron, Mg= Magnesium, P=Phosphorus, K=Potassium, S=Selenium, Na=sodium, Zn=Zinc, *p<0.05

Table 3: Association between breakfast eating with calorie and other nutrient s intake in girls

| | Girls | | | | | |
|---|---|---|---|---|---|---|
| | 7-10 years | | | 11-12 years | | |
| Variable | Breakfast eating (x±SD) N = 252 | Omission breakfast (x±SD) N = 45 | p value | Breakfast eating (x±SD) N = 83 | Omission breakfast (x±SD) N = 13 | p value |
| Calorie(cal) | 1723.6±474.1 | 1606.9±471.2 | 0.09 | 1827.9±412.5 | 1692.3±628.9 | 0.22 |
| Protein(g) | 61.8±27.6 | 60.6±25.7 | 0.76 | 68.3±23.9 | 57.7±33.7 | 0.09 |
| CHO(g) | 246.4±78.8 | 230.3±65.3 | 0.15 | 266.3±70.6 | 245.9±95.7 | 0.26 |
| Fiber(g) | 11.1±7.9 | 9.6±4.7 | 0.16 | 11.2±5.7 | 10.6±7.1 | 0.65 |
| Total fat(g) | 56.7±22.5 | 53.2±20.5 | 0.27 | 55.5±22.2 | 56.5±31.8 | 0.86 |
| Vitamin B1(mg) | 1.2±0.4 | 1.2±0.3 | 0.92 | 1.3±0.3 | 1.2±0.5 | 0.09 |
| Vitamin B2(mg) | 1.1±0.5 | 0.9±0.7 | 0.83 | 1.1±0.5 | 0.9±0.4 | 0.11 |
| Vitamin B3(mg) | 17.7±9.7 | 18.3±10.5 | 0.65 | 19.5±8.8 | 17.2±12.4 | 0.30 |
| Vitamin B6(mg) | 0.9±0.5 | 0.9±0.4 | 0.96 | 1.1±0.6 | 0.9±0.6 | 0.38 |
| Folacin($\mu$g) | 92.3±65.3 | 93.9±38.8 | 0.86 | 93.4±65.9 | 85.1±74.5 | 0.59 |
| Vitamin B5(mg) | 2.8±1.5 | 2.6±1.4 | 0.76 | 2.9±1.7 | 2.3±1.5 | 0.14 |
| Vitamin C(mg) | 48.6±37.2 | 52.2±66.6 | 0.58 | 44.2±33.4 | 41.6±27.7 | 0.73 |
| Vitamin E(mg) | 2.9±2.1 | 2.8±1.8 | 0.61 | 2.9±2.8 | 4.2±2.1 | 0.14 |
| Ca(mg) | 508.1±301.5 | 443.5±255.9 | 0.13 | 488.9±259.1 | 409.8±217.9 | 0.17 |
| Cu(mg) | 0.7±0.4 | 0.6±0.3 | 0.18 | 0.7±0.4 | 0.7±0.5 | 0.87 |
| Fe(mg) | 15.8±7.3 | 16.4±10.1 | 0.63 | 17.3±5.5 | 15.1±8.2 | 0.12 |
| Mg(mg) | 115.6±60.9 | 116.6±85 | 0.91 | 119.2±56.3 | 101.8±63.1 | 0.20 |
| P(mg) | 656.3±322.6 | 639.5±262.5 | 0.66 | 669.7±330.2 | 600.8±376.4 | 0.39 |
| K(mg) | 1590.2±863.7 | 1469.3±787.9 | 0.33 | 1568.1±794.2 | 1521.3±1095.8 | 0.82 |
| Se($\mu$g) | 36.6±21.2 | 34.8±24.6 | 0.58 | 42.3±24.7 | 44.3±35.7 | 0.75 |
| Na(mg) | 2049.3±1149.2 | 2079.8±1137.2 | 0.85 | 2059.8±1122.8 | 1906.9±1414 | 0.58 |
| ZN(mg) | 4.6±2.4 | 4.5±2.2 | 0.78 | 5.2±2.6 | 4.8±3.2 | 0.58 |

CHO= Carbohydrate, Ca= Calcium, Cu=Copper, Fe=Iron, Mg= Magnesium, P=Phosphorus, K=Potassium, S=Selenium, Na=Sodium, Zn=Zinc

significantly ($p<0.05$), but was not significant in boys. Weight, BMI and MAC in omission breakfast were more than breakfast eating children, significantly ($p<0.05$) (Table 1). Average mean score of breakfast eating was more than skip breakfast girls (19±1.4 vs. 18.8±1.4), but there was not significant relation between of they. There was not significant average mean score between breakfast eating and skipping breakfast boys (18.7±1.5 vs.18.9±1.6). 14.5% of girls had giardia infected. Giardia infected in breakfast eating girls was more skipping breakfast (15.4

vs. 12.2%), but was not relation between of they significantly. 10.6% of boys had giardia infected. Giardia infected in skipping breakfast boys was more than breakfast eating (17.9 vs. 9.6%), but was not relation between of them significantly. Calorie and nutrients intake (exception of vitamin B2 and calcium intake of 7-10 years old boys) were not different significantly between two groups of eating and skipping breakfast children (Table 2 and 3).There was no significant between giardia infected and average mean score.

## DISCUSSION

Overall, 18.7% ( 20.8% girls and 16.7% boys) of participants reported that they have skipped breakfast. Nicklas *et al.* (2004) and Shaw (1998) reported that 19% of American and 12% of Australian adolescents skipped breakfast, respectively. Haapalahti *et al.* (2002) showed skipping meals appear not to be common among Finnish children aged 10-11 years (Haapalahti *et al.*, 2002). Skipping breakfast was associated with a higher BMI (Utter *et al.*, 2007). In present study weight, BMI and MAC in skipping breakfast children were more than breakfast eating, significantly; also children with breakfast eating had a lower risk of being overweight. Our findings do confirm and clarify the impact of skipping breakfast on BMI, that high BMI in skipping breakfast children is related to omission breakfast. The eating of breakfast may be caused normal BMI in children. In similar present study other studies including Stockman *et al.* (2005) and Berkey *et al.* (2003) have yielded similar results, showing that inconsistent or irregular breakfast eating was significantly associated with being overweight. Irregular breakfast eating is positively associated with being overweight. The reduced likelihood of breakfast consumption in the morning is of particular concern when considered in light of growing evidence of the link between breakfast consumption and academic performance, school attendance and other psychosocial factors (Murphy *et al.*, 1998). When the children completed a visual perception task or a spatial memory task, they generally performed better after consuming either breakfast versus no breakfast at all. The benefit is most likely facilitated via the blood glucose response following a meal. Modest increases in circulating glucose enhance learning and memory (Korol *et al.*, 1998), perhaps through the synthesis of acetylcholine (Durkin *et al.*, 1992). However, only limited data suggests that the type of breakfast also influences cognitive functioning (Holt *et al.*, 1999; Benton *et al.*, 2003). Studies have shown that breakfast provides important nutrients and the individuals who skip the breakfast, do not compensate for potential nutrient and energy losses at other meals (Hanes *et al.*, 1984; McGarey *et al.*, 1987). Our study showed average mean score was not significant between of breakfast eating and skipping breakfast groups. In children, consumption of breakfast has been linked to nutritional adequacy. In spite of this study, Chitra *et al.* (2007) was showed average total energy intake was significantly lower for children who did not eat breakfast than for those who ate breakfast. Children who consumed breakfast had higher daily intakes of energy and protein than children who skipped breakfast (Chitra *et al.*, 2007). Compared with the breakfast group, a significantly higher percentage of the no-breakfast group failed to meet two-thirds of the National Academy of Science's recommended dietary allowances for vitamins A, B-6 and D, calcium, magnesium, riboflavin, folacin and the nutrients such as zinc, phosphorus and iron ( Nicklas and Bao *et al.*, 1993). Our study was showed energy and protein and some nutrient intake of breakfast eating school children was slightly more than skipping breakfast school children.

## CONCLUSION

Despite of our study limitations, it is shown that a high proportion of school children in Ardebil province of Iran skipping breakfast during school days omission breakfast correlates with being overweight, but has not correlated with giardia infected, school success and calorie and nutrients intake.

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