The Impact of Malnutrition on the Academic Achievement among Jordanian Students in the Primary Schools

Malnutrisyonun İlkokulda Okuyan Ürdünlü Öğrencilerin Akademik Başarısına Etkisi

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ABSTRACT

Objective: This study aims to assess the nutritional status of primary school students aged 6-12 years in relation to gender, age, demographic and socioeconomic status, and to assess the relationship between nutritional status of primary school students and their academic achievement.

Methods: A descriptive correlational cross-sectional design utilizing predictive method was used. A cluster random sample of 453 primary school students was obtained from all public and private primary schools for both genders, in northern Jordan. Anthropometric measurements of weight and height were used and educational achievement was measured by “Jordan Certificate of Primary Education”.

Results: The result showed that there was a significant and negative correlation between wasting (rpb (451) = -25, p<.001), stunting (rpb (451) = -.14, p< .01) and thinness (rpb (451) = -.12, p< .01) with academic achievement. Person’s correlation coefficient (r) between BMI and academic achievement showed a strong significant and positive correlation (r (451) =.21, p< .001). Multiple hierarchical regression that all variables in the study can predict 28% (R2 = .28) of variance on academic achievement.

Conclusion: The vast majority 67.1% of primary school students in this study face nutritional problems that adversely affect their ability to take advantage of the available educational opportunities.

Key Words: Malnutrition, nutritional status, academic achievement, Jordan, school students

Original Investigation / Özgün Araştırma

ÖZET

Amaç: Bu çalışma, 6-12 yaş arası İlköğretim öğrencilerinin beslenme durumlarını cinsiyet, yaş, demografik ve sosyoekonomik durum açısından değerlendirir ve analiz etmektedir.

Yöntem: Prediktif yöntemi kullanan betimsel bir ilişkisel kesitsel tasarım kullanılmıştır. Ürdü'nün kuzeyindeki her iki cinsiyet için tüm kamu ve özel İlköğretim okullarından 453 İlköğretim okulu öğrencisi kümemerli rastgele bir örnek seçilmişdir. Antropometrik ölçümler ve eğitim başarısı “Ürdün İlköğretim Sertifikası” ile ölçülmüştür.

Bulgular: Sonuçta tükemişlik (rpb (451) = -.25, p <.001), büyüme geriliği (rpb (451) = -.14, p <.01) ve zayıflık (rpb (451) = -.12, p <.01) ile akademik başarı arasında anlamlı negatif bir ilişki olduğu görülmüştür. Kişinin VKİ ile akademik başarı arasındaki Person korelasyon katsayısı (r) güçlü ve anlamlı bir ilişki olduğu görülmüştür.  Kişinin VKİ ile akademik başarı arasındaki Person korelasyon katsayısı (r) güçlü ve anlamlı bir ilişki olduğu görülmüştür. Çalışmadaki tüm değişkenlerin akademik başarısı göre varyansın % 28'ini (R2 = .28) tahmin edebileceğiz bilirlenmiştir.

Sonuç: İlköğretim öğrencilerinin büyük çoğunluğu olan % 67,1'i mevcut eğitim fırsatlarından yararlanamadıkları ve eğitim yetenekleri etkilenen beslenme sorunları ile karşı karşıya kalmaktadır.

Anahtar Sözcükler: Kötü beslenme, beslenme durumu, akademik başarısı, Ürdün, okul öğrencileri

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INTRODUCTION

Malnutrition is a serious and universal public health problem, particularly in developing countries (1). Malnutrition is defined as condition resulting from insufficient or inadequate diet, excess or imbalance in the intake of calories, proteins, and. This leads to harm physical, mental and behavioral development of millions of students, and it is also a major cause of child death (2, 3, 4). Malnutrition escorts to death 16,000 students every day in the developing world (4). This reflects that six million students die annually from the consequences of malnutrition. Furthermore, malnutrition affects school achievement of students. Poorly nourished students are more likely to: receive lower math scores, repeat a grade, visit a psychologist, and have difficulty getting along with other students (5, 6,7).

In 2002, the number of malnourished students in the Jordanian population was 400,000, which constitutes 7% of Jordanian population. Additionally, Jordanian students who are moderately or severely underweight equal 4.4% (8). The prevalence of stunting among Bedouin students was 20% (9). Jordan in the vein of other countries considers nutritional problems and unhealthy nutritional behaviors as serious health problems especially among school students that might put them at jeopardy for both acute and chronic diseases (10).

Nutrition is essential to health and education. The numbers of Jordanian students who enter schools with chronic health conditions is increasing; particularly nutritional problems. Malnutrition among Jordanians rose from 7 percent in 2002 to 25 percent in 2017. This percentage is considered “critical level” according to WHO 2012 criterion (11). Therefore, this study intends to assess the effect of malnutrition on academic achievement among primary school students.

The Study Purpose

This study aims to assess the nutritional status of primary school students aged 6-12 years in relation to gender, age, demographic and socioeconomic status, and to assess the relationship between nutritional status of primary school students and their academic achievement. In addition, it aims to identify any factor/s considered strong predictor/s that will provide information for policy makers about school student’s malnutrition in order to develop school health nutritional management programs in Jordan.

Research questions

1. Is there a relationship between (stunting, wasting, thinness, overweight, obesity and BMI) and the academic achievement among primary school students in northern Jordan?

2. What is the significance of nutritional status (stunting, wasting, thinness, overweight, obesity and BMI) in predicting academic achievement after controlling for demographic variables (age, gender, family income, number of family member and mothers’ education) among primary school students aged 6-12 years in northern Jordan?

METHOD

Research Design

A quantitative approach using a descriptive correlational cross-sectional design utilizing predictive method was applied to identify the levels of nutritional status and academic achievement among primary school students aged 6-12years. A cross-sectional survey is an observational study in which exposure is determined at the same point in time in a given population (27). The researcher selected this research design because it can precisely measure and quantify the phenomenon of interest, as well as help the researcher to compare different population groups at a single point in time. It was also the most appropriate method for the descriptive purpose of the study (27).

Population and Study Sample

The target population of this study was the Jordanian primary school students. A cluster random sample was obtained from entire public and private primary schools for both genders, in northern Jordan. The sample size was estimated to be at least 345 primary school students, accepting a margin of error not exceeding 5% with a confidence level of 95%. Using simple table technique and utilizing the G power system, R2 deviation from zero after calculating and fixing the effect size as small (.05). Sample size calculation, version 3.0 at two-tail .05 level of significance, power of .80 and small effect size of .05.

The population was consisted of governmental and private of primary schools students aged 6-12 years in three areas of northern Jordan includes Irbid governorate, Jarash governorate and Ajlon governorate. Exclusion criteria were students less than 6 and students more than 12-years to exclude the changes that occur during puberty period, and students with chronic diseases because some diseases and related drugs affect child body weight and height by interfering with the child appetite, eating ability and absorption of digestive system. All none Jordanian nationality students was excluded with attention to allow them to participate and excluded them later for ethical consideration.

Study Tools

An instrument consist of three sections was utilized for collecting the data for this study purposes. Section one was the demographic, developed by the investigator depending on the literature review, which consists of checklist and fill in blank type questions concerning all the variables addressed by the study such as age, sex, educational level, mothers’ education, family members, income and eating breakfast. This section was answered by child parents or caregivers. Second section was about the Anthropometric measurements or a standard standing scale for measurement of weight (in kilogram) and height (in centimeter, cm). “The Seca Digital Scale and a Wooden Portable Adult and Infant Measuring Unit” were used and demonstrated by the researcher.

Third section was about the educational achievement which was measured by using the values that were derived from the raw data for all participants “Jordan Certificate of Primary Education.” These raw score of the “Jordan Certificate of Primary Education” consist of all students grades in all subjects of the curriculum. Also, it included the scores mean for each student. These scores mean were compared with the mean of the participants in relation to anthropometric measurements. The schools usually keep a copy of this certificate. These records for a period of one year were retrieved. A scale of 0 and above out of 100 meaning excellent, while 80-89% was very good; 70-79% = good; 60-69% = poor , 50-59 = very poor and less than 50% failed.

Ethical Considerations

The study was approved by the research ethical committees at the University of Jordan and Ministry of Education. A letter was sent to the Ministry of Education describing the nature and significance of the study, and requesting permission to have access to students and their records. Official administrators and staff members in the primary schools were informed about the study purposes and permission was requested to conduct the study using the appropriate channels of communication. In addition, a letter explaining the study and its purposes was sent to the parents/caregivers in order to obtain consent form and the permission for their students participation, and requesting mothers/caregivers to answer demographic questionnaire. Students and parents not wishing to participate were asked to return it unfilled. Furthermore, the participants was instructed that in the absent of permission and the care giver answers the questionnaire; their completion of the questionnaire will be considered as a written consent for their participation. The confidentiality and anonymity of the information and measurements were assured. Moreover, the demographic questionnaire and measurements were coded by numbers to maintain confidentiality of the data.

Each student measurement was preceded by informing students about the purpose and objectives of the study. Anthropometric measurements were conducted on private room that have privacy measures such as curtains or screen. Teachers were asked to leave during data collection procedure. Finally all the data was kept in locked Cabinet for five years and then will be destroyed safely.

Data Analysis Procedures

Data analyses were conducted using the Statistical Package of Social Science (SPSS) version 17. Descriptive statistics was used to describe the characteristics of the sample according to mean, standard deviation, and the percentage. Point biserial correlation coefficient (rpb) was used to assess the relationship between the five nutritional status (stunting, wasting, overweight, obesity and thinness) (Table 1) and academic achievement. While, Pearson correlation coefficient (r) was used to explore the relationship between BMI and academic achievement. The measures of academic achievement assessed through reviewing the school examination records for a period of one year that derived from the one year recent school examination records.
Table 1: The Conceptual and Operational Definitions of Variables of the Study

| Study Variables | Conceptual Definition | Operational Definition |
|-----------------|-----------------------|------------------------|
| Wasting         | low weight for age    | < -2 WAZ (Z-score for weight-for-age) of NCHS |
| Stunted         | low height for age    | < -2 HAZ (Z-score for height-for-age) of NCHS |
| Thinness        | low body mass index for age | < -2 BMIZ (Z-score for BMI-for-age of NCHS) |
| Body mass index | weight for height     | is an indicator for acute malnutrition, computed by standard formula: BMI (kg/m^2) = Weight (kg) / Height^2 (m^2). |
| Height-for-age  | is an indicator for chronic malnutrition | < -2 Z score of NCHS |
| Weight-for-height| is an indicator for acute malnutrition | < -2 Z score of NCHS |
| Overweight      | High weight for age   | BMI > 95% of NCHS |
| Primary school students | Students aged 6-12 years | extended from kindergarten to pre-adolescent periods |
| Academic achievement | adequately of students to learn while at school | School examination records of one year: a scale of 90 and above out of 100 meaning excellent, while 80-89% was very good; 70-79% = good; 60-69% = poor, 50-59 = very poor and less than 50% failed |
| Malnutrition classification | Mild | Cut-point for wt & ht < -1 to > -2 Z-score (WHO, 2003) |
|                | Moderate              | Cut-point for wt & ht < -2 to > -3 Z-score (WHO, 2003) |
|                | Severe                | Cut-point for wt & ht < -3 Z-score (WHO, 2003) |

(NCHS& WHO, 2003)

RESULTS

Descriptive Characteristics of Study Sample

Seven hundred and fifty questionnaires were distributed to randomly selected class of primary school students and 453 agreed to complete participation were returned, thus yielding a 60.4% response rate. As noted in (table 2) the characteristic of this sample as follows; age ranged from 6-12 years with a mean of 9.4(1.8) years. The subjects were male 53.2% (n=241) and female 46.8% (n=212). Educational level of respondents was 19.9% (n=89) 1st elementary classes, 15.2%(n=69) 2nd elementary classes, 15.5%( n=70) 3rd elementary classes, 15.2%( n=69) 4th elementary classes, 15.5%( n=70) 5th elementary classes and 19%( n=86) 6th elementary classes. The grades of academic achievement regarding this sample range from 50-99 with mean 79.8 and SD (12). The percentage of students that usually take their breakfast before going to school was 22.7 % (n=103), whereas, the percentage of students skipping breakfast was 77.3 % (n=350) (Table 2).

In terms of mother’s education, the results revealed that 60.9 % (n=276) had Tawjehi or less and 39.1 % (n=177) higher than Tawjehi. Most respondents 87.8 % (n=440) reported living in families of more than four persons. Monthly income ranged from 50 JD to 4000JD with a median of 360 JD (SD=577) (Table 2).

Table 2: Descriptive Characteristics of the study participants (Primary School Students in Northern Jordan) (N=453)

| Variables               | Actual Range | M (SD) | % (n) |
|-------------------------|--------------|--------|-------|
| Age (Years)             | 6-12         | 9.4 (1.8) |       |
| Gender                  |              |        |       |
| Male                    |              | 53.2%(241) |       |
| Female                  |              | 46.8%(212) |       |
| Academic achievement    |              | 50-99   | 79.8(12) |
| Breakfast               |              |         |       |
| Skipping Breakfast      |              | 22.7%(103) |       |
| Not Skipping breakfast  |              | 77.3%(350) |       |
| Mother’s education      |              |         |       |
| Tawjehi or less         |              | 60.9%(276) |       |
| Higher than Tawjehi     |              | 39.1%(177) |       |
| Number of family Members|              |         |       |
| 1-3                     |              | 02.9%(13)  |       |
| 4-6                     |              | 51.6%(234) |       |
| 7-9                     |              | 36.2%(164) |       |
| ≥ 10                    |              | 09.3%(42)  |       |

The study results showed that 28.5% (n=129) out of the study sample were stunted, 12.1% (n=55) were wasted, thinness was observed among 5.1% (n=23), overweight 8.2% (n=37) and obesity 13.2% (n=60). Regarding the classification of students according to the malnutrition status, mild malnutrition had the highest percentage 36.9% (n=167) followed by moderate malnutrition 26% (n=118) and the severe malnutrition was 2.4% (n=11) (Table 3).
Table 3: Percentage and Number of Primary School Students in Northern Jordan According to Nutritional Status and malnutrition classification (N = 453)

| Variables     | %    | N   |
|---------------|------|-----|
| Nutritional Status |      |     |
| Stunted       | 28.5%| 129 |
| Wasted        | 12.1%| 55  |
| Thinness      | 05.1%| 23  |
| Overweight    | 08.2%| 37  |
| Obese         | 13.2%| 60  |
| Normal        | 32.9%| 149 |
| Malnutrition Classification |      |     |
| Mild          | 36.9%| 167 |
| Moderate      | 26.0%| 118 |
| Severe        | 2.4% | 11  |

Table 4. Mean, SD, Percentage and Number of Primary School Students in Northern Jordan according to Academic Achievement (N=453)

| Academic Achievement | Mean | SD  | %    | n   |
|----------------------|------|-----|------|-----|
| 1st elementary classes | 77.9 | 12.2 | 15.2 | 69  |
| 2nd elementary classes | 82.5 | 10.4 | 15.2 | 69  |
| 3rd elementary classes | 77.1 | 11.5 | 15.5 | 70  |
| 4th elementary classes | 78.2 | 1.7  | 15.2 | 69  |
| 5th elementary classes | 83   | 10.8 | 15.5 | 70  |
| 6th elementary classes | 80.7 | 12.2 | 19   | 86  |

Academic Achievement Range

| Range    | Mean | SD   | %    | n   |
|----------|------|------|------|-----|
| 90-100   |      |      | 37.5 | 170 |
| 80-89    |      |      | 22.8 | 106 |
| 70-79    |      |      | 49   | 114 |
| 60-69    |      |      | 10.7 | 49  |
| 50-59    |      |      | 3.1  | 14  |

Gender

| Gender | Mean | SD  | %    | n   |
|--------|------|-----|------|-----|
| Male   | 80.1 | 12.3| 53.2 | 241 |
| Female | 79.5 | 11.8| 46.8 | 212 |

Stunting

The mean scores of stunted and academic achievement showed that the students with stunted had lower score on academic achievement (M= 76.8, SD= 11.9). Whereas, the students that had normal stature got higher score on academic achievement (M= 81.1, SD= 11.9) (Table 5).

Wasted

The study results showed a negative relation between wasted and academic achievement among primary school students. The wasted students had lower scores on the academic achievement (M= 73.1, SD= 11.2) than students with normal body weight (M= 80.1, SD= 11.8) (Table 5).

Thinness

The study results exhibited that students with thinness had lower scores on the academic achievement (M= 73.4, SD= 8) than students without thinness (M= 80.2, SD= 12) (Table 5).

Overweight

The study results revealed that the mean score on the academic achievement approximately equal between students with overweight (M= 79.4, SD= 13) and students with normal weight (M=79.8, SD=12) (Table 5).

Obesity

The study results indicated that obese students had higher mean scores on the academic achievement (M= 82.4, SD=12.9) than students with normal body weight (M= 79.5, SD=12) (Table 5).

Body Mass Index

The mean of body mass index of primary school students on the academic achievement was (M=16.7, SD= 2.8) with range from 10.3-28.5 (Table 5).
Table 5: Mean and SD of Academic Achievement of Primary School Students in Northern Jordan in relation to Malnutrition Predictors (N=453)

| Variable       | Academic Achievement | M    | SD  |
|----------------|----------------------|------|-----|
| Stunting       |                      | Yes  | 76.8| 11.9|
|                |                      | No   | 81.1| 11.9|
| Wasted         |                      | Yes  | 73.1| 11.2|
|                |                      | No   | 80.1| 11.8|
| Thinness       |                      | Yes  | 73.4| 8   |
|                |                      | No   | 80.2| 12  |
| Overweight     |                      | Yes  | 79.4| 13  |
|                |                      | No   | 79.8| 12  |
| Obesity        |                      | Yes  | 82.4| 12.9|
|                |                      | No   | 79.5| 12  |
| Body Mass Index|                      |      | 16.7| 2.8 |

Relationship between Nutritional Status and Academic Achievement

The relationship between the five variables (stunting, wasting, obesity, thinness and overweight) and academic achievement was examined using the point biserial correlation coefficient (rpb). The analysis showed that there was a significant and negative correlation between academic achievement and the malnutrition indicators: stunting (rpb = -.14, p<.01), wasting (rpb = -.25, p<.001), thinness (rpb = -.12, p<.01). This indicates that students with high reports of stunting, thinness, and wasting are more likely to have low reports of academic achievement. High level of these malnutrition indicators associated with lower level of academic achievement. The highly significant correlation appeared with wasting and academic achievement. Whereas the overweight (rpb = -.01, p>.88) and obesity (rpb = .09, p>.068) had no significant correlation with academic achievement as noted in Table 6.

On the other hand, the result of Pearson’s correlation coefficient (r) between BMI and academic achievement showed significant and positive correlation (r(451) = .21, p<.001). This indicates that primary school students with higher BMI reports are most likely to have higher level of academic achievement than those with lower reports of BMI. Although the correlation between the malnutrition variables was significant, the magnitude of correlation is considered almost weak based on Cohen (1988) guidelines (12). This might be explained in terms of large sample size used in this study and conserved level of power used to calculate the sample size. This might contributed to a significant correlation with lower magnitudes.

Table 6: Point Biserial (rpb) Correlation between Nutritional Status and Academic Achievement of Primary School Students in Northern Jordan (N= 453)

| Malnutrition Indicators | Academic Achievement |
|-------------------------|----------------------|
| Stunting                | -.14*                |
| Wasting                 | -.25**               |
| Thinness                | -.12*                |
| Overweight              | -.01                 |
| Obesity                 | .09                  |

** Correlation is significant at 0.001 levels (two tailed)
* Correlation is significant at 0.01 levels (two tailed)

Table 7: Two-Step Multiple Hierarchal Regressing to Examine the Most Significant Predictors of Academic Achievement in relation to Selected Demographics and Nutritional Status

| Variables             | β     | P-Value | β     | P-Value |
|-----------------------|-------|---------|-------|---------|
| Gender                | 1.4   | .21     | .63   | .56     |
| Age                   | .52   | .08     | .21   | .5      |
| Breakfast             | 8     | <.001   | 7.2   | <.001   |
| Income                | .01   | <.001   | .01   | <.001   |
| Educational level     | .52   | .08     | .21   | .5      |
| Number of family members | -.17 | .53     | -.15  | .57     |
| Mothers’ education    | 2.9   | <.001   | 3.0   | <.001   |
| Stunting              | -4.3  | <.001   |       |         |
| Wasting               | -2.1  | .26     |       |         |
| Thinness              | -2.5  | .36     |       |         |
| Overweight            | -2.1  | .22     |       |         |
| Obesity               | -2.4  | .30     |       |         |
| BMI                   | .74   | <.01    |       |         |

| Model | R² | Adjusted R² | R² change | P-Value |
|-------|----|-------------|-----------|---------|
| Model 1 | .12 | .10 | - | <.001 |
| Model 2 | .28 | .21 | .16 | <.001 |

DISCUSSION

A correlation between malnutrition indicators and academic achievement indicated that four variables out of six were significantly correlated with academic achievement. The most powerful correlation was BMI (r = .21, n = 453, p<.01) followed by wasting (rpb = -.25, n = 453, p<.001), stunting (rpb = -.14, n = 453, p<.01) and thinness (rpb = -.12, n = 453, p<.01).

The results showed that the child nutritional status as determined by malnutrition indicators have a specific effect on the child academic achievement. These malnutrition indicators (BMI, wasting, thinness and stunting) were found to do good predictor of academic achievement than overweight and obesity, this result is consistent with the finding of Brito and Onis (2006) study in which they found that stunting (low height for age) have a specific effect on the academic achievement specifically on arithmetic(13).
Another study by Tarleton et al. (2006) found similar result in which primary school child’s nutritional status exerts significant influence on academic achievement in which it was found that malnutrition status such as stunting and wasting negatively influenced test scores of students (14)(Table 7).

Similarly, Hall, et al. (2003) used experimental design to study the association between chronic under-nutrition and educational test scores of Vietnamese students. The authors measured height for age, weight for age, and weight for height. In addition to, test mathematics and Vietnamese language for 3055 third grade school students. The result revealed that chronic malnutrition such as stunting was associated with poor academic achievement score in both math and language (15). Also, in a study by Hutchinson et al. (1997), taller school students did better in school than shorter school students, but academic achievement was not associated with body mass index (16).

In the present study, BMI was a predictive of academic achievement. Similar results were found in Mukudi (2003) study, the author conducted experimental study and collected data from 851 students from 5 elementary schools included height, weight, attendance records, and raw scores from standardized tests. The study results showed that standardized tests successfully predicted from weight for height (BMI) (17). Differently, in Hall, et al. (2001) study the result revealed that no significant association found between BMI (weight for height) and academic achievement.

Overweight and obesity in this study have no significant correlation with academic achievement (15). By comparison, Baranowski (2000) found that overweight and obesity affect school students to learn (18). Likewise; in Anuar, et al. (2005) study revealed that obese students had poor academic achievement in Mathematics, English, Science and Raven’s test than normal weight students (19). Thinness is another significant factor that negatively affects academic achievement in this study. This is consistent with Acham (2008) study in which it was found that thinness among students was negatively associated with students educational grades (20).

It was found in the current study that BMI (weight for height) and stunting (height for age) are the strongest and the only significant predictors from all malnutrition indicators of academic achievement. This result is congruent with Mukudi (2003) study that included BMI is the second strongest predictors of academic achievement (17). This is also consistent with the result of Crosone and Muller (2004) that found students with large BMI would have lower academic achievement (21). In addition, Kar, Rao and Chandrajouli, (2008) found that stunted students showed poor attention span, visual perception, verbal comprehension, and working memory tests. Thus, in the presence of all of these difficulties it is likely to lead to poor academic achievement (22).

Furthermore, verbal and nonverbal tests among Bangladesh school students aged 6-9 years revealed that scores were negatively associated with stunting and wasting among students (14).

In this study, mothers’ education found to be a positive predictor of malnutrition and students academic achievement. In a study with the similar result was found in which, mothers’ education significantly was associated with academic achievement and malnutrition (19). Differently, in Hoffman and Lee (2005) study mothers’ education was not a significant predictor of stunting (24). Income is another significant factor; it was found that low family income was associated with malnutrition and poor academic achievement among students in the current study. This result is consistent with Crooks (2005) finding that poor students show signs of stunting and poor school achievement (24). Differently, Gur et.al in (2006) found no correlation between wasting, income and other socio-demographic factors (26).

CONCLUSION

In this study, we conclude that, height for age (H/A), weight for age (W/A) and body mass index (BMI) have an association with academic achievement. The vast majority 67.1% of primary school students in this study face nutritional problems that adversely affect their ability to take advantage of the available educational opportunities. Many of these students have a history of protein-energy malnutrition such as stunting, wasting, overweight and obesity. The consequences of these problems include; slow students physical and mental development, increase susceptibility to infections and reduces academic achievement. There is a lack of proper and adequate nutrition and skipping breakfast can be considered as a barrier to optimal learning.

Conflict of interest

No conflict of interest was declared by the authors.

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