

Correlation Between Nutritional Status and *Giardia lamblia*  
Infection of Primary Schoolchildren in Al-khalis City

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**Abstract**

**Objective:** Malnutrition is produced and perpetuated in a complex pattern in the tropical countries where it is endemic. Gut parasites could produce malnutrition. In children, giardiasis is more often associated with diarrhea and malabsorption.

**Materials:** Stool samples were random collected from 289 students (142 males and 147 females) between the ages 6–14 from khalis city hospital during 2008-2009. Height, weight and Body Mass Index (BMI) parameters have been used in the present study to determine the nutrition status.

**Results:** A total percentage of malnutrition (wasting, stunting and BMI) were 37.7 %, 73.7% and 49.5% against 62.3%, 26.3% and 50.5 were normal, respectively. No significant differences observed between boys and girls and according to age groups. A parasitological stool examination result showed *Giardia lamblia* in only 11.4% of children. There was evidence of 15.6%, 14.1% and 14% of malnutrition status by W/H, H/Age and BMI concepts, respectively were associated with positive giardiasis.

**Conclusion:** The study concluded that giardiasis could be a factor participate with other hygienic social factors that effect on nutritional status in primary school children in khalis city.

**Key words:** school children, *Giardia lamblia*, nutrition status

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**العلاقة بين الحالة التغذوية و الإصابة بطفيلي *Giardia lamblia* عند اطفال المدارس الابتدائية في مدينة الخالص**

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**الخلاصة**

الموضوع: يستوطن مرض سوء التغذية في البلدان الاستوائية ويعد مرض وبائي في تلك البلدان . كما انه مرض يتسبب عن طفيليات الامعاء مثل الجيارديا التي تحدث الاسهال في الاطفال .

المواد وطرائق العمل: جمعت عينات البراز من 289 طالب (142 ذكر و147 انثى) تراوحت اعمارهم بين 6-14 سنة وقد تم اختيارهم عشوائيا من مستشفى مدينة الخالص . استخدم الطول ، الوزن ودليل كتلة الجسم لتحديد الحالة التغذوية للاطفال . النتائج: كانت النسب المئوية لسوء التغذية للمعايير الوزن ، الطول ، كتلة الجسم 37.3% ، 73.7% و 49.5% مقابل 62.3% ، 26.3% و 50.5% كانوا طبيعيين وعلى التوالي. لم تكن هناك فروق معنوية بين الذكور والاناث اعتمادا على العمر. اجري المسح الطفيلي وسجلت نسبة اصابة بالجيارديا بلغت 11.4% . وجد ان هناك دليل على ترابط ايجابي بين الاصابة بالطفيلي و سوء التغذية اعتمادا على الوزن/ الطول ، الطول/ العمر ودليل كتلة الجسم.

الاستنتاج: استنتجت الدراسة الحالية ان داء الجيارديا قد يساهم في تدهور الحالة التغذوية لطلاب المدارس الابتدائية مضافا الى عوامل صحية واجتماعية اخرى .

الكلمات المفتاحية : طلاب المدارس ، *Giardia lamblia* ، الحالة التغذوية

**Introduction**

Intestinal parasitic infection is a common affliction of much of the world's population and it has been an important problem in public health (1). Studies had shown that intestinal parasitoses is common in the developing world (2) presumably because of poor environmental and personal hygiene largely caused by poor sewage disposal and inadequate water supply (3) The relationship between intestinal parasite infection and nutritional status is an important problem (1). Malnutrition is produced and perpetuated in a complex fashion in the tropical countries where it is endemic (4). Gut and urinary parasites produce malnutrition (5). In children, giardiasis is more often associated with diarrhea and malabsorption (2). Mucosal damage associated with giardiasis and leads to substantial malabsorption of carbohydrates, fat and essential nutrients that may be cause malnutrition especially in the rapidly growing period of childhood (5, 6, 7). In Iraq many studies reported high percentage with *Giardia lamblia* in

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Iraqi cities such as in Al-Hila city (11.32%), Duhuk city (38.5%) and Al-Shula and Al-Kadimya (13.64%) in 2002, 2006 and 2011, respectively (22, 23, 24). To date, not enough attention has been focused on this parasite and its relationship to malnutrition status.

This study was designed to demonstrate the relationship of the *Giardia* infection and nutrition status of children in Al-Khalis city, Diyala province.

### Materials and Methods

This study was carried out at Al-Khalis hospital from October 2008 to February 2009. 289 students (142 males and 147 females) between the ages 6 – 14 years were randomly chosen to be included in study. Stool samples were collected from all students. Each patient was given a clean container and asked to provide a stool sample. Samples obtained were dated and labeled. Direct smear method and formalin ether centrifuged sedimentation technique were performed for each specimen to determine *Giardia lamblia* infection according to (8). The ages of the children were obtained from interviewing mother with the help of local event calendar. Heights were taken to the minimum of 1mm and weight were taken to the minimum of 10 gm with minimum clothing. Weighing scale was calibrated periodically against known standards and weighing scale was calibrated to the zero before taking every measurement. All the measurement were taken as per guideline of WHO (9 and 10). Height, weight and Body Mass Index (BMI) have been used in the present study to determine the nutrition status (11, 12, 13). All the anthropometric measurements were taken following the standard recommended by WHO (10). Body Mass index was determined by the CDC table for calculated Body Mass Index for selected heights and weight for age ages 2 to 20 years and it was computed using the following formula(14):

$$\text{BMI (kg/m}^2\text{)} = \text{Weight (kg)} / \text{Height (m}^2\text{)}$$

### Results

The numbers of boys and girls in each group and their mean weight and mean height with standard deviation is given in table (1a). The findings indicate that mean height and mean weight of boys are higher than girls except for the age group 11 to

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14 where mean weight of the girls were higher. There was no significant difference in the mean BMI of boys and girls ( $X=38.44, P>0.05$ ). Also, the analysis of result clearly shown no significance difference for weight and height for both boys and girls, table (1b).

**Table (1a): Age and sex variation in anthropometric characteristics of children**

| Age(year) | Gender(No. ) | Height (cm)  | Weight (kg) | BMI(Kg/m <sup>2</sup> ) | BMI(NHCS/WHO standard ) |
|-----------|--------------|--------------|-------------|-------------------------|-------------------------|
|           |              | Mean±SD      | Mean±SD     | Mean±SD                 | Mean                    |
| 6         | M=11         | 107.23±4.86  | 15.20±2.18  | 13.23±2.67              | 15.37                   |
|           | F=14         | 106.8±4.18   | 14.94±2.93  | 13.10±2.46              | 15.32                   |
| 7         | M=11         | 114.32±4.60  | 17.10±4.52  | 13.09±3.76              | 15.59                   |
|           | F=12         | 113.58±3.87  | 16.06±3.18  | 12.46±3.80              | 15.51                   |
| 8         | M=13         | 120.11±7.60  | 17.98±4.12  | 12.46±4.70              | 15.87                   |
|           | F=13         | 121.91±7.70  | 17.23±4.21  | 12.60±3.99              | 15.85                   |
| 9         | M=20         | 123.77±7.92  | 21.00±3.93  | 13.90±4.19              | 16.68                   |
|           | F=18         | 122.90 ±7.47 | 20.24±4.66  | 13.60±3.42              | 16.32                   |
| 10        | M=19         | 128.12±6.40  | 23.80±2.75  | 14.52±2.69              | 16.66                   |
|           | F=19         | 126.20±4.60  | 22.81±2.99  | 14.37±3.19              | 16.90                   |
| 11        | M=15         | 132.21±6.44  | 26.41±3.77  | 15.16±3.54              | 17.20                   |
|           | F=20         | 133.45±6.12  | 27.08±4.59  | 15.31±3.27              | 17.57                   |
| 12        | M=20         | 138.68±4.13  | 27.93±4.54  | 14.66±2.67              | 17.84                   |
|           | F=19         | 135.98±5.90  | 29.77±5.99  | 16.33±2.48              | 18.36                   |
| 13        | M=18         | 141.38±5.33  | 31.18±4.60  | 17.11±3.43              | 18.58                   |
|           | F= 16        | 139.85±4.65  | 32.01±5.44  | 16.56±3.89              | 19.15                   |
| 14        | M=15         | 146.11±4.58  | 39.40±4.52  | 18.48±4.19              | 19.35                   |
|           | F=16         | 142.53±4.23  | 35.10±5.80  | 17.41±4.20              | 19.88                   |

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Table (1b): Analysis of the height and weight for boys and girls

| T-value    | Height                |                       | Weight |                        |
|------------|-----------------------|-----------------------|--------|------------------------|
|            | Boys                  | Girls                 | Boys   | Girls                  |
| calculated |                       |                       | 0.166  | 0.102                  |
| tabulated  | 0.756<br>p>0.05<br>NS | 0.855<br>p>0.05<br>NS | NS     | P>0.05<br>P>0.05<br>NS |

61.3% of boy and 63.3% of girls table ( 2) were found to be normal as per their weight for height (wasting). 38.75% of boys and 36.7% of girls were reported malnourished and to test the significance of wasting between normal and malnutrition according to sex and age group there was no significance difference at 5% level. As per their height for age (stunting) 28.9% of boys and 23.8% of girls were Found to be normal. 71.1% of boys and 76.2% of girls were reported to be malnutrition. There was no significance difference according to age and sex but there was a high significant difference between normal and malnutrition status at 5% level (table 3).

Table(2): prevalence of wasting (W/H) according to age and sex

| Sex           | Boys |                 |               |                   | Girls           |     |                 |                | Total             |                  |                  |                    |
|---------------|------|-----------------|---------------|-------------------|-----------------|-----|-----------------|----------------|-------------------|------------------|------------------|--------------------|
|               | No   | Normal<br>(%)No | Mild<br>(%)No | Moderate<br>(%)No | Severe<br>(%)No | No. | Normal<br>(%)No | Mild<br>(%)No. | Moderate<br>(%)No | Severe<br>No.(%) | Normal<br>No.(%) | Patients<br>No.(%) |
| Age<br>(year) |      |                 |               |                   |                 |     |                 |                |                   |                  |                  |                    |
| 6-9           | 35   | 22(62.9)        | 8(22.9)       | 4(11.4)           | 1(2.9)          | 39  | 25(64.1)        | 10(25.6)       | 4(10.3)           | 0                | 27(36.5)         | 47(63.5)           |
| 9-12          | 54   | 33(61.1)        | 15(27.8)      | 4(7.4)            | 2(3.7)          | 57  | 36(63.2)        | 12(21.1)       | 6(10.5)           | 3(5.3)           | 69(62.2)         | 42(37.8)           |
| 12&<br>above  | 53   | 32(60.4)        | 13(24.5)      | 5(9.4)            | 3(5.7)          | 51  | 31(60.7)        | 12(23.5)       | 7(13.7)           | 1(2.0)           | 63(60.6)         | 41(39.4)           |
| Total         | 142  | 87(61.3)        | 36(25.4)      | 13(9.2)           | 6(4.2)          | 147 | 93(63.3)        | 33(23.8)       | 17(11.6)          | 4(2.7)           | 180(62.3)        | 109(37.7)          |

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Table( 3) : prevalence of stunting (Height for age)according to age and sex

| Sex        | Boys |                |              |                  | Girls          |     |                |              | Total            |               |           |          |
|------------|------|----------------|--------------|------------------|----------------|-----|----------------|--------------|------------------|---------------|-----------|----------|
|            | No   | Normal No. (%) | Mild No. (%) | Moderate No. (%) | Severe No. (%) | No. | Normal No. (%) | Mild No. (%) | Moderate No. (%) | Sever No. (%) |           |          |
| Age (year) |      |                |              |                  |                |     |                |              |                  |               |           |          |
| 6-9        | 35   | 9(25.7)        | 9(25.7)      | 10(28.6)         | 7(20.0)        | 39  | 9(23.1)        | 11(28.2)     | 10(25.7)         | 9(23.1)       | 56(75.7)  | 18(24.3) |
| 9-12       | 54   | 17(31.5)       | 15(27.8)     | 12(22.2)         | 10(18.5)       | 57  | 13(22.8)       | 18(31.6)     | 17(29.8)         | 9(15.8)       | 81(73.0)  | 30(27.0) |
| 12&Above   | 53   | 15(28.3)       | 16(30.2)     | 10(18.9)         | 12(22.6)       | 51  | 13(25.5)       | 15(29.4)     | 13(25.5)         | 10(19.6)      | 76(73.1)  | 28(26.9) |
| Total      | 142  | 41(28.9)       | 40(28.2)     | 32(22.5)         | 29(20.4)       | 147 | 35(23.8)       | 44(29.9)     | 40(27.2)         | 28(19.1)      | 213(73.7) | 76(26.3) |

Prevalence of malnutrition based on <5 percentile of BMI show that 29.2% of boys and 22.5 of girls were reported to be malnutrition (table 4). There was no significant difference between two age group 9-12 and 12 & above but there was a significant difference between these groups and age group 6-9 years . There was no difference between male and female in age group 6-9 but there was a significant difference between them in age group 9-12 and 12& above.

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**Table ( 4): Prevalence of malnutrition (based on<5th percentile of BMI) according to age and sex**

| Nutritio nstatus | Normal      |                 | Undernutrition  |                 | Overall undernutrition | Overall normal         |                        |
|------------------|-------------|-----------------|-----------------|-----------------|------------------------|------------------------|------------------------|
|                  | Age (years) | Males No.(%)    | Females No.(%)  | Males No.(%)    | Females No.(%)         | Males & Females No.(%) | Males & Females No.(%) |
| 6-9              |             | 17(48.5)        | 20(51.3)        | 18(51.5)        | 19(48.7)               | 37(50.0)               | 37(50.0)               |
| 9-12             |             | 20(37.1)        | 34(59.6)        | 34(62.9)        | 23(40.4)               | 58(51.3)               | 54(48.7)               |
| 12& above        |             | 20(37.7)        | 29(56.7)        | 33(62.3)        | 22(43.3)               | 55(52.9)               | 49(47.1)               |
| <b>Total</b>     |             | <b>57(40.7)</b> | <b>83(59.3)</b> | <b>85(57.0)</b> | <b>64(43.0)</b>        | <b>149(51.6)</b>       | <b>140(48.4)</b>       |

The results showed that only *Gairdia lamblia* was identified and the prevalence of giardiasis was 11.4% among all children (table 5). There was evidence of 15.6%, 14.1% and 14% of malnutritional status in student by Wt/Ht , Ht/age and BMI concept , respectively were associated with positive *Giardia* infection (table 6).

**Table (5):The prevalence rates of *Giardia lamblia* infection among all children**

| Age(years)   | No. examined | No. infected (%) |
|--------------|--------------|------------------|
| 6            | 25           | 3 (12.0)         |
| 7            | 23           | 6(26.1)          |
| 8            | 26           | 5(19.2)          |
| 9            | 38           | 5(13.2)          |
| 10           | 38           | 4(10.5)          |
| 11           | 35           | 4(11.4)          |
| 12           | 39           | 5(12.8)          |
| 13           | 34           | 4(11.8)          |
| 14           | 31           | 3(9.7)           |
| <b>Total</b> | <b>289</b>   | <b>39(11.4)</b>  |

**Table (6) : Distribution of children with giardiasis by their nutritional status**

| Nutritional status | Concept                         |              |               |
|--------------------|---------------------------------|--------------|---------------|
|                    | Wt/HI                           | HI/age       | BMI           |
|                    | No. infected / No. Examined (%) |              |               |
| Normal             | 22/180(12.2)                    | 9/76(11.8)   | 21/140(15.0)  |
| Undernutrition     | 17/109(15.6)                    | 30/213(14.1) | 18/149 (12.1) |

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**Discussion**

World Health Organization (10) has recommended various indices based on anthropometry to evaluate the nutritional status of the school age children. This study has stated the nutritional status by three concepts namely, Wt/Ht/age and BMI. The first concepts used as indicator of present malnutrition and the second as indicator of past or long term under nutrition (14, 15). While the third concept BMI is the preferred method of expressing the body fat percentiles of group (13). It has now been well established that the Body Mass Index (BMI) is the most appropriate variable for nutritional status among adolescents (14).

The result show significant differences between normal and malnutrition status but there was no significant differences according to sex and age. These observation are important if any recommended interventions to improve health and parasites eradication are to be appropriate and specific to local problems.

Total average of malnutrition among the examined students were 35.6% , 73% and 51.9 % by Wt/Ht, Ht/age and BMI concept , respectively . The finding of present study indicate that malnutrition of children was both due to long-term deprivation as well as recent causes . This result agree with the finding of (15) who show that their results indicate that malnutrition of children of Tea Garden was due to long-term deprivation as well as recent causes. Alongside the fact that most of these children are from family of low socio-economic background mainly farmers, workers and unemployed who had low level education and live in houses where unhygienic living standard , lowered sanitation and simple supply. Such environmental factors contribute to the survival of disease agents such as parasite, bacteria and viruses(16) after being infected with this agent these children loose the protein energy, iron and vitamins intake to the benefit of these disease agents which later adversely affect the growth and nutritional status of individual (3,17, 18).

Giardiasis is positively correlated with diminished jejunal surface area and a reduced D-xylose excretion especially in newly infected individual (5). It seems logic to suppose that giardiasis and its association of an increased prevalence of wasting in children (19). The present study noted a relationship between *Giardia* infection and malnutrition ; wasting and stunting but observed that factors other than parasitism such as social class



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and hygiene were more important this agree with (20). While (21) reported a strong association between *Giardia* infection and nutritional status but there was no evidence of an association between social class and other factor with nutritional status. This study was concluded that gairdiasis could be an participate factor with anther such socio-economy, education and hygien factors responsible to aggravate nutritional status in primary school children of Al-Kalis city .

Giving iron tablets or micronutrient fortification are not answers to the problem in this situation (according to socio and educational status of families) but what they need is more food which is of good nutritive value. School lunch as it can be designed to prevent severe malnutrition . In Iraq were already giving lunch to pupils in years between 1981- 1986 but its was ended later due to wars and economic blocked.

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