The Correlation between the Helminthes Infection and Nutritional Status among School-going Children in the Rural Area of Mardan Khyber Pakhtunkhwa Pakistan

Shakir Ullah[1], Amjad Ali Amin[2], Umair Islam[3], Hamza Khan[1], Noor Muhammad[5], Muhammad Iqbal Khan Rahman[4], Muhammad Ilyas[6], Usman Saeed[1], Kabir Ahmad[7], Iqbal Muhammad[5], Shah Khalid[7], Abbas Nawab[7]

[1]Takht Bhai Institute of Health and Management Sciences, Pakistan.
[2]Department of Computer Science, Kunduz University, Afghanistan.
[3]Hayat Abad Medical Complex, Khyber Pakhtunkhwa, Pakistan.
[4]University of Swat, Pakistan.
[5]Kohat University of Science & Technology (KUST), Kohat, Pakistan.
[6] THQ Hospital Takht Bhai Mardan, Pakistan.
[7]Abdul Wali Khan University Mardan, Pakistan.

*Corresponding Author: shakirullah1992@gmail.com

ABSTRACT

Malnutrition contributes directly or indirectly to more than 60% of 10 million child deaths each year. Soil-transmitted helminths (STH) infections are a major public health problem that affects more than two billion people around the world. Iron deficiency anemia is the most prevalent hematologic disorder in school-going children. Therefore, the aims were the study to assess the correlation between the helminthes infection and nutritional status among school-going children in the rural areas of Mardan Khyber Pakhtunkhwa Pakistan. A total of 300 samples were taken from the school-going children. The samples were taken through cross-section survey, physical examination, lab investigations and clinical examination from the both the helminthic and anemic children. The current research work shows that 1 of 3rd of the school-going children who had signs and symptoms of iron deficiency anemia were affected with iron deficiency anemia the ages of 4 to 7 years 40(40%), 7 to 10 years 35(35%) and 10 to 13 years 25(25%) respectively. severe anemia was rare at 10%, moderate anemia at 25% led by the mild type of anemia with a high percentage of 65% on the basis of Hb level. lower class families were more affected by iron deficiency anemia with 60%, children of middle class were less affected by anemia with 35% while children of upper class families were much less affected by anemia which may be due to the socioeconomic state of the family. Therefore it is recommended that iron supplementation, nutrition education and helminthic awareness programs should be conducted in schools.
Keywords: Iron, deficiency, anemia, prevalence, children, helminths

INTRODUCTION

Iron is essential for normal human growth. Iron is required for many essential body functions, including oxygen transport, adenosine triphosphate (ATP) production, DNA synthesis, mitochondrial function, and protection of cells from oxidative damage. Iron deficiency anemia is the most prevalent hematologic disorder in school-going children. It is estimated that around 2.15 billion individuals suffer from iron deficiency anemia (**McCann et al 2007**). In a recent review of the prevalence of iron deficiency anemia in the United States, 9% of toddlers and up to 11% of adolescent girls were iron-deficient. The absorption of dietary iron is assumed to be 5-10%, but it increases 3-5 times when iron storage is depleted. Inadequate dietary iron, iron absorption and intense exercise, along with blood loss and parasitic infections are some etiologies of iron deficiency anemia (IDA). Some consequences of IDA are growth retardation, exercise intolerance, behavioral changes, and abnormal thermogenesis. Although the prevalence of IDA has declined in industrialized countries, there have been few changes globally (**Cook et al 1994**). According to a UNICEF report, two billion people suffer from anemia worldwide and most of them have IDA, especially in underdeveloped/developing countries, where 40-50% of children under age 5 are iron deficient. It has been reported that 46.5% of Indonesian and 30-60% of Guatemalans under the age of 5 have suffered from IDA (**Yip 1999**). In Iran, 30-50% of women and children, especially those in low-income families, are suffering from iron deficiency (**Karemi et al 2004**). Anemia has been shown to affect mental development and learning capacity. In infancy it may cause a permanent loss of IQ later in life, shortened attention span, irritability, and fatigue, difficulty with concentration, lethargy, weakness and increased susceptibility to infection. Consequently, anemic children tend to do poorly on vocabulary, reading, and other tests (**Arlappa et al 2010**). In Saudi Arabia most of the studies on anemia were based on nutritional status and concentrated on preschool children who were under six years old, so data on the nutritional status of children and adolescents in the Kingdom are insufficient (**Rao 2015**). According to a World Health Organization (WHO) report, IDA is most frequent in children and women around the world, especially in non-industrialized countries. It is the only nutrient deficiency which is also significantly prevalent in virtually all industrialized nations. In addition, there are no current global figures for iron deficiency.

Anemia as an indirect indicator it can be estimated that most female preschool children and pregnant women in non-industrialized countries, and at least 30-40% in industrialized countries, are iron deficient. Intestinal helminth infections that are transmitted through the soil occur mostly in students of elementary school age, because they often have the most frequent contact with dirt (playing in playgrounds, rare use of shoes). Some species of STHs that commonly infect humans are roundworm (*Ascaris lumbricoides*), whipworm (*Trichuris trichiura*) and hookworm (*Ancylostoma duodenale* and *Necator American;us*). The harm caused by intestinal worms is huge, especially in the physical development, intelligence and productivity of children. Helminths can cause malnutrition, anemia and impaired growth, which in turn will have an influence on a child's level of intelligence (**Kordas et al 2004**).

The main aim of the present study was to assess the prevalence of anemia among school-going children of rural area of Mardan Khyber Pakhtunkhwa**,** to detect prevalence and clinical presentation of iron deficiency anemia (IDA) in school-going children**,** to detect socioeconomic factors of iron deficiency anemia**,** to detect age wise prevalence of iron deficiency anemia

MATERIALS AND METHODS

A cross-section survey was conducted on randomly selected school-going children with iron deficiency anemia aged from 4 to 13 years in Mardan Khyber Pakhtunkhwa after obtaining ethical approval from the School Head Teachers and the research ethics committee of faculty of medicine at Tehsil Head Quarter Hospital Takht Bhai Mardan.

Sample size

A total of 300 samples were taken from those children with signs and symptoms of iron deficiency anemia as well as the helminthes Infection.

Children aged

Aged wise three groups were made including 4-7, 7-10, and 10-13 years of aged

Questionnaire

Questionnaires were set to collect data about age, black tea intake, gender, education, and social classes based on monthly income14, use of unfortified cow milk, vitamin supplementation drugs, and dietary intake. The principal author validated the Pashto version of questionnaire by involving two independent bilingual translators who performed forward and back translation and an expert committee at Tehsil Headquarter Hospital Takht Bhai Mardan.

 History

Data history is taken to fulfill the following

• Clinical history was taken from children and relatives including age, onset of anemia, nutritional history, and intake of iron supply.

• History of fatigue, poor activity, exertion, dyspnea. Breathless ness at rest.

• History of blood transfusion

Thorough Physical Examination:

• Clinical examination, general, chest, cardiac, abdominal, and neurological examination

Lab investigations and Tests: All patients were subjected to:

• Complete blood picture and reticulocyte count. Patients with microcytosis underwent the following:

• Serum iron, ferritin and TIBC

An automatic hematological analyzer and biochemistry analyzer were used for clinical examination

Sample type

Blood samples were taken from all patients through EDTA tubes and whole blood for CBC test and in gel tube for serum to test ferritin ,iron TIBC for the transporting to hospital

Statistical analysis:

After collecting information from the selected sites of the study area through questionnaires, and the completion of laboratory tests, the statistical analysis of data was carried out through excel 2010.

RESULTS

Table 1. Shows that 1 of 3rd of the school-going children who were sign and symptoms of iron deficiency anemia were effected with iron deficiency Anemia with age of 4 to 7 years 40(40%), 7 to 10 years 35(35%) and 10 to 13 years 25(25%) respectively.

Table 1. Age wise prevalence of anemia

Age	Sample size	Normal	Anemic
4-7	100	60	40
7-10	100	65	35
10-13	100	75	25
total	300	200	100

Examination of patient with sign and symptoms of iron deficiency anemia where pale skin children were more frequent, leading by weakness of children with percentage of 35% while symptoms of fatigue were very less as compare to other sign and symptoms.

Table: 2 Signs of anemia and examination of patients under the study

Symptoms	No. children (Hb < 11.5 gm/dL) N	Percentage (%)
Pale skin	55	55%
Weakness	35	35%
fatigue	10	10%
total	100	100%

Table.3 shows that severe anemia was rare with 10%, moderate anemia 25% leading by mild type of anemia high percentage of 65% on the basis of Hb level.

Table.3 Prevalence of iron deficiency anemia on the basis of types

Type of anemia	Hb level	Sample size	Percentage (%)
Severe anemia	(Hb < 7.0 g/dL)	10	10%
Moderate anemia	(Hb 7 < 10 g/dL)	25	25%
Mild type of anemia	(Hb 10 < 11 g/dL)	65	65%

Table.4 shows that children of lower-class family were more affected by iron deficiency anemia with 60%, children of middle class were less effected by anemia with 35% while children of upper-class family were very less effected with anemia which may be due to the socioeconomic state of the family. The prevalence of anemia is a severe nutritional problem of public health significance. Therefore, iron supplementation and health and nutrition education programs should be strengthened. The community needs to be encouraged to diversify their diets by consuming iron-fortified and iron-rich foods.

Table.4 prevalence of iron deficiency anemia on the basis of socioeconomic state

Economic state	Normal Hb	Low Hb	No.sample
Lower class	40	60	100
Middle class	65	35	100
Upper class	95	5	100
Total	200	100	300

Table.5 This study found that the prevalence of STH among study subjects was 20(6.65%), of age 4-7 years were 10(3.33%), age of 7-10 years were 8(2.66%) while the age of 10-13 years were 2(0.66%). The most common types of worm infections were Ascaris lumbricoides (25.0%), Trichuris trichiura (11.2%) and mixed infections (3.8%). A significant correlation was found between the presence of STH infection and underweight nutritional status. Conclusions the presence of STH infection in children is strongly influenced by their hygiene practices. Small clinics and student healthcare units should play an active role in conducting periodic assessment of children's nutritional status and in providing them with information on STH symptoms and prevention.

Table.5 Overall prevalence of helminthic infection in school going children

Age	Sample size	Normal	No. Helminthes Children	Percentage %
4-7	100	90	10	3.33%
7-10	100	92	8	2.66%
10-13	100	98	2	0.66%
total	300	280	20	6.65%

DISCUSSION

The current research work shows that the prevalence of STH among study subjects was 20(6.65%), of age 4-7 years were 10(3.33%), age of 7-10 years were 8(2.66%) while the age of 10-13 years were 2(0.66%). The most common types of worm infections were Ascaris lumbricoides (60%), Trichuris trichiura (35%) and mixed infections (5%). A significant correlation was found between the presence of STH infection and underweight nutritional status. Conclusions the presence of STH infection in children is strongly influenced by their hygiene practices. Small clinics and student healthcare units should play an active role in conducting periodic assessment of children's nutritional status and in providing those with information on STH symptoms and prevention similar work also conducted (**Ezeamama et al 2005**)

The current study shows that the 1 of 3rd of the school-going children who were sign and symptoms of iron deficiency anemia were effected with iron deficiency anemia with age of 4 to 7 years 40(40%), 7 to 10 years 35(35%) and 10 to 13 years 25(25%) respectively. Similarly a research work also conducted by [16] A majority (81%) of the rural children of West Bengal were anemic, and the prevalence was significantly (p<0.001) higher among 1–3-year-old (91%) as compared to 4–5-year-old (74.6%) children. A significantly (p<0.01) higher proportion of 1+ (OR = 7.7; 95% CI: 2.6–22.4) and 2+ year children (OR = 3.0; 95% CI: 1.5–6.0) and those belonging to lower socio-economic heduled Caste and Scheduled Tribe communities were at risk for anemia (OR = 2.3; 95% CI 1.3–3.9).

Examination of patient with sign and symptoms of iron deficiency anemia were pale skin children were more frequent, leading by weakness of children with percentage of 35% while symptoms of fatigue were very less as compare to other sign and symptoms. The current results shows that severe anemia were rare with 10%, moderate anemia 25% leading by mild type of anemia high percentage of 65% on the basis of Hb level. Same work also performed by (**Dewayani et al 2004**) risk factors for moderate to severe anemia included incomplete immunization, stunted growth, recent infection, absence of bed net, low household living standard, rural residency (Mali), low maternal education, and low community development index (Benin). In addition, multilevel analysis indicated a clustering level of anemia in communities (intra class correlation) of 14% and 19% in Benin and Mali, respectively.

The study showed that children of lower class family were more effected by iron deficiency anemia with 60%, children of middle class were less effected by anemia with 35% while children of upper class family were very less effected with anemia which may be due to the socioeconomic state of the family. The prevalence of anemia is a severe nutritional problem of public health significance. Therefore, iron supplementation and health and nutrition education programs should be strengthened. The community needs to be encouraged to diversify their diets by consuming iron-fortified and iron-rich foods. (**Masyithah et al (2017)** Similarly the anemia percentage was recorded high in lower socioeconomic family children, than middle class and upper class. The percentage of anemic children was also high in age group of 10 - 12 years. Pale skin was the most common symptom of anemia.

CONCLUSION

The prevalence of anemia is a severe nutritional problem of public health significance. Therefore, iron supplementation and health and nutrition education programs should be strengthened. The community needs to be encouraged to diversify their diets by consuming iron-fortified and iron-rich foods Nutritional status of school children in district Mardan at Khyber Pakhtunkhwa in Pakistan.

ACKNOWLEDGEMENT
Authors feel grateful to the Microbiology Department of Takht Bhai Institute of Health and Management Sciences and Pathology Department of THQ Takht Bhai Mardan for providing facilities during research activities.

COMPETING INTERESTS
The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS
All authors equally contributed in the designing, experiments and wrote the manuscript. All authors read and approved the final manuscript.

REFRENCES

Arlappa, N., Balakrishna, N., Laxmaiah, A., & Brahmam, G. N. V. (2010). Prevalence of anemia among rural pre-school children of West Bengal, India. *Annals of human biology*, *37*(2), 231-242.

Cook JD, Skikne BS, Baynes RD. Iron deficiency: The global perspective. Adv Exp Med Biol 1994; 356: 219-228.

Dewayani BS, Situmeang R, Sembiringet T, et al. Albendazole Pada (2003). Soil Transmitted Helminthiasis. Fakultas Kedokteran, Universitas Sumatera Utara; 2004.

Kadivar MR, Yarmohammadi H, Mirahmadizadeh AR, Vakili M, Karimi M. (2003). Prevalence of iron deficiency anemia in 6 months to 5 years old children in Fars, Southern Iran. Med Sci Monit.; 9(2): 100-104.

Ezeamama AE, Friedman JF, Acosta LP, et al. (2005). Helminth infection and cognitive impairment among Filipino children. Am J Trop Med Hyg; 72(5): 540–548.

Karimi M, Mirzaei M, Dehghani A. Prevalence of anemia, iron deficiency and iron deficiency anemia in 6-60 month old children in Yazd's rural area. Intern Pediatr 2004;19(3): 180-184.

Kordas K, Lopez P, Rosado JL, García Vargas G, Alatorre Rico J, Ronquillo D, Cebrián ME, Stoltzfus RJ. **(2004).** Blood led, anemia, and short stature are independently associated with cognitive performance in Mexican school children. J Nutr 134(2): 363-371.

Masyithah Darlan, D., Alexandra, T., & Tala, Z. (2017). Soil Transmitted Helminth Infections in Medan: a cross--sectional study of the correlation between the infection and nutritional status among elementary school children. *Family Medicine & Primary Care Review*, (2), 98-103.

McCann J, Ames B.N . (2007). An overview of evidence for a causal relation between iron deficiency during development and deficits in cognitive or behavioral function. Am J Clin Nutr., 85(4): 931-945.

Ngnie-Teta, I., Receveur, O., & Kuate-Defo, B. (2007). Risk factors for moderate to severe anemia among children in Benin and Mali: insights from a multilevel analysis. *Food and Nutrition Bulletin*, *28*(1), 76-89.

Rao, A., & Parikh, A. (2015). Prevalence of anemia in school age children. *Journal of advanced Medical and Dental Sciences Research*, *3*(6), S32.

Ross J, Horton S. Economic Consequences of Iron Deficiency report in United Nations Children's Fund (UNICEF) Focus on nutrition. The Micronutrient Initiative Publisher.1998; 1-48

Yip R. (1995). The challenge of controlling iron deficiency: Sweet news from Guatemala. Am J Clin Nut; 61(5): 1164-1165.

World Health Organization (2006). Preventive chemotherapy in human helminthiasis. Preventive Chemotherapy and Transmission Control (PCT). Department of Control of Neglected Tropical Diseases (NTD), World Health Organization; 2006.