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Rural Versus Urban Secondary School Students' Knowledge about Some Selected Micronutrients (Comparative Study)

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Abstract:
Aims of the study*: To assess secondary school students` knowledge about some selected micronutrients and compare between rural and urban school students regarding their knowledge.*
Subjects & Method: *A descriptive cross-sectional research design was used. The present study was carried out in 8 schools in Assiut District. The sample consisted of 880 subjects: 440 students from rural schools and 440 from urban schools. Two tools were used: the Socio- economic scale developed by* ***Abd El-Twaab (2004)*** *and a self- administered questionnaire which was designed to assess students` knowledge about vitamin A, iron and iodine.*
Results: *More than half of the rural students and more than two thirds of the urban students were aged 16 < 17 years. Females constituted 58% and 57.3% of the rural and urban students respectively. Less than half of the rural students and less than one third of the urban students had low social class. There were no statistically significant differences between rural students' total score of knowledge and their socio-demographic characteristics, also between urban students' knowledge and their social class.*
Conclusion: *The majority of the rural and urban students from both sexes and all social classes had poor scores of knowledge about vitamins A, iron and iodine.*
Recommendations: *A health education program should be conducted to educate students about micronutrients.*
Keywords: *rural – urban- students - micronutrients .*

I. Introduction

Micronutrients are very small molecules needed for the body in only tiny amounts. Micronutrients consist of vitamins and minerals and play an essential role in metabolic pathway and immunity **(Hussain et al., 2007).** Iodine, vitamin A and iron are most important in global public health terms; their lack represents a major threat to the health and development of populations, particularly children **(Micronutrient Initiative, 2010).**

Kyle (2009) stated that micronutrient deficiency occurs all over the world, particularly in developing countries. Not all population is equally at risk of each type of micronutrient deficiency. While iron deficiency anemia may affect all countries, the likelihood of iodine and vitamin A deficiency varies from region to region. Special attention should therefore be given to population groups who come from areas of known specific deficiency.

Vitamin A is involved in the immune function, vision, reproduction, and cellular communication **(Johnson and Russell, 2010)**. Vitamin A is critical for vision as it supports the normal differentiation and functioning of the conjunctiva membranes and cornea. Vitamin A also supports cell growth and differentiation, playing a critical role in the normal formation and maintenance of the heart, lungs, kidneys, and other organs (**Ross et al., 2010).** Different forms of vitamin A include β carotene, which is found in plants, and preformed vitamin A, which is found in animal sources, fish, and meat especially liver **(Black et al., 2010)**.

Vitamin A deficiency (VAD) is a major public health problem in more than half of all countries in the world. It is the leading cause of preventable blindness in children **(Rahman and Sapkota, 2014)**. Vitamin A deficiency increases vulnerability to a range of illnesses including diarrhea, measles, and respiratory infections. These are leading causes of mortality among children in low and middle income countries (**Black et al., 2010)**.

Datta (2014) reported that iron has great significance as a nutritional element. It is an important mineral in the formation of hemoglobin and myoglobin. It helps in the development and function of the brain, regulation of body temperature, muscular activity and catecholamine metabolism. It is essential for the production of antibodies, enzymes and cytochromes. The most important function of iron is oxygen transport and cell respiration.

Iron deficiency anemia (IDA) is the only nutrient deficiency which is also significantly prevalent in industrialized countries **(WHO, 2013).** A national survey recently conducted on adolescents detected an overall prevalence of anemia of 46.6% among the age group 10-19 years **(Mikki et al., 2011).**

Mikki et al., (2011) mentioned that the main cause of iron deficiency anemia is inadequate intake of bioavailable iron from the diet. Furthermore, it may be due to factors which reduce absorption during meals or to infection with intestinal helminthes, which cause blood loss or interfere with iron absorption in the intestinal tract. The risk factors for IDA include high birth order, big family size, limited maternal education, and low family income. **Gitau et al., (2013)** stated that adolescents with chronic illness or heavy menstrual blood loss are at increased risk for iron deficiency.

Iodine is a significant micronutrient essential for the synthesis of thyroid hormones. It is also required in small amounts for growth and development. Important sources of iodine are seafood and vegetables grown in soil rich in iodine. A smaller amount is available from milk, meat and cereals **(Datta, 2014). Szybinski et al., (2010)** estimated that iodine deficiency disorders (IDDs) affect between 800 million and 2 billion people worldwide; reduction in salt intake is likely to drive those numbers still higher.

The main strategies for the prevention and control of micronutrient deficiencies are nutrient supplementation, food-based strategies of fortification and dietary diversification, deworming, malaria control. Education should target both the pupils and mothers/caregivers and focus on good eating habits **(Gitau et al, 2013).**

Children must be fed a variety of foods to ensure that their daily requirements are met. Ensuring that children consume an adequate nutritional diet is a preventative strategy towards micronutrient deficiencies such as vitamin A and iron deficiency. Another strategy for improving vitamin A deficiency (VAD) is supplementation. Egypt's vitamin A program for children begins at nine months of age, where children are given one vitamin A capsule 100,000 international units. One additional capsule 200,000 units is given to children at age 18 months (**El-Zanaty and Way, 2008).**

Strategies to control IDA include daily and intermittent iron supplementation. Home fortification with micronutrient powders and fortification of staple foods and condiments are activities to improve dietary diversity. Fortified bread nationwide in Egypt is a goal to compact anemia from 2012. Supplementing children after the first year of age with fortified cow's milk and with iron supplements is also important to prevent anemia. Activities to control and prevent IDDs include improvement of dietary intake of iodine containing food in balanced diet, compulsory use of iodized salt and creating awareness about the use and preservation of iodized salt **(Zawilla, 2013).**

The important responsibility of nurses is to provide nutritional counseling and guidance to the parents and also to the children, with the goal of achieving optimum nutrition throughout the years of growth and development. Nutritional counseling and guidance should be provided at all ages of growth and development considering the feeding patterns, dietary habits, food fads, culture, religion, and availability of food, educational level and socioeconomic status of the family (**Datta, 2014).**

Significant of the study:

Micronutrient deficiencies negatively affect child survival, growth, brain development, educational achievement and resistance to illness. To combat the deficiency of micronutrients, awareness of their importance and their source plays a vital role **(Micronutrient Initiative, 2010).** In Egypt not many studies have been conducted on this problem in children **(Elalfy et al., 2012)**. So, the aim of this study was to assess secondary school students` knowledge about some selected micronutrients and to compare between them regarding their knowledge.

II. Aim of the study

1- To assess secondary school students` knowledge about some selected micronutrients.
2- To compare between rural and urban school students regarding their knowledge.

Research questions:

1- What is the students' level of knowledge about some selected micronutrients?
2- Is there any effect of socioeconomic status on the knowledge of school students?
3-Is there any differences between rural and urban school students regarding their knowledge?

Subjects and Method

Research design: A descriptive cross-sectional research design was used in this study.

Setting: The study was conducted in eight schools in Assiut District which were chosen randomly: four schools from Assiut City (urban area); i.e. El-Moushir Ahmed Ismail, Naser Secondary School for boys, El-Khayat, and El-Wilidiya Secondary School for girls. Four schools from four villages, i.e. Mostafa Hassanein, Refa, Elwan and Bany Hussein secondary mixed schools (rural area).

Sample:

A multi-stage random sampling was used. Assiut City contains 12 governmental secondary schools. The rural areas in Assiut district contain 11 governmental secondary schools. First selection of 30 % from the

total number of secondary schools in Assuit district (rural and urban) area. First, second, and third year students were included in this study.

The sample size was calculated to measure an assumed satisfactory knowledge rate of 50% or higher among students, with a 95% confidence level, and a 15% standard error, using the sample size equation for estimation of single proportion, with finite population correction (Epi-Info 6.04d). The required sample size turned to be 800. This was increased to 880 students to compensate for a dropout rate. Total numbers of studied students has been taken equally from each group (440 in each group). Students were selected from each school by using convenient sampling.

Tools of the study:

Two tools were developed to conduct the study

Tool I: The Socio-economic scale: This tool was developed by **Abd El-Twaab (2004)** to assess the socioeconomic status. It included four items, namely level of education of parents (8 items), family income (6 items), job of parent (2 items), and life styles (3 items). Each item has one score and the total score was classified into three classes as follows: high class from 85-100%, moderate class from 60 to less than 85%, and low class less than 60%. The item of income of social class was modified by the researchers as following; according to the rate of inflation and increase to be conforming with recent income through comparing difference of the value of the golden pound at 2004 to that at 2010 and multiplying the rate of inflation to the scale.

Tool II: The self-administered questionnaire: It includes the students` knowledge about some selected micronutrients as follow:

a) Vitamin A which included; hearing about vitamin A, its functions, sources, problems and prevention of vitamin A deficiency.
b) Iron which included; hearing about iron, its functions, sources, factors prevent absorption of iron, taking iron tablets provided from school and causes of don't taking .knowledge about iron deficiency anemia which included; definition, risk factors, sign and symptom and its prevention.
c) Iodine which included; hearing about iodine, it functions, sources, problems and prevention of iodine deficiency.

III. Method of data collection

1- An official approval letter was obtained from the dean of Faculty of Nursing, Assiut University to the Under-Secretary of Education at Assuit Governorate. The letter included a permission to carry out the study and explained the purpose and nature of the study.
2- A self-administered questionnaire was developed by the researchers on the basis of the relevant literature.
3- The tool was presented to five experts in the pediatric nursing and community health nursing field for content validity and its result was 95%. Reliability was estimated by Alpha Cronbach's test for the tool and its result was R=0.66.
4- A pilot study was carried out before starting data collection on 10% of students, who were excluded from the sample. The aim of the pilot study was to test the clarity of the tool and to estimate the time required to fill in the questionnaire. Based on the results of this pilot study modifications were done in the tools.
5- The researchers introduced themselves to the students; the purpose and nature of the study were explained. Then the researchers explained the main parts of the questionnaire. After that, the questionnaire was distributed to students by the researchers. Students were asked to complete the questionnaire and if they had any difficulty during answering the questionnaire. Filling in the questionnaire took 15-25 minutes by students.
6- After the students completed the questionnaire, the researchers collected the questionnaires, paying careful attention to incomplete answers to ask students to complete them. Finally, the researchers thanked the students and teachers for their cooperation.
7- Data was collected in the period from the first of October 2015 until the end of December 2015.
8- Ethical approval was obtained from the relevant research ethical committee at the Faculty of Nursing, Assiut University. The written consent of the managers of schools was taken. The researchers explained the purpose and nature of the study to each student. The students had the right to agree or disagree to participate in the study; consent to participate in the study was secured orally from every student and the participants were informed that the information obtained would be confidential and used only for the purpose of the study.

Scoring System:

Total scoring for knowledge was *(96)* grade. Each Question was scored *one* grade for the correct answer, and zero for the incorrect response or no response. The scores of each item was summed up and then

converted into a percent score using the following score system to assess the level of knowledge (poor = score <50%, fair = score 50-70%, and good = score >70% **(Shalkamy et al., 2013)**.

Statistical Analysis:

Data analyses were performed with the IBM SPSS 20.0 software. Categorical variables were described by number and percent (N, %), where continuous variables were described by mean and standard deviation (Mean, SD). Chi-square test and Fisher exact test were used to compare between categorical variables. A two-tailed $p < 0.05$ was considered statistically significant.

IV. Results

Table (1): illustrates that more than half and more than two thirds of rural and urban students respectively were aged 16 <17 years. Females constituted 58% and 57.3% among rural and urban students respectively. A high percentage of students' fathers for the two groups graduated from university (33.4% & 42.3%, respectively), while (43.0% and 15.9%) of rural and urban students' mothers were illiterate respectively. Less than half (46.1%) of the rural students and less than one third (31.5%) of the urban students had low social class.

Table (2): showed that, more than half (55.7%) of rural students heard about vitamin A compared with more than two thirds (67.7%) of urban students. All students from the two groups mentioned bone and teeth growth as function of vitamin A. Less than two thirds (60.5%) of rural students mentioned vegetables as a sources of vitamin A compared to 73.6% of urban students. More over 40.9 % of rural and 70% of urban students mentioned eye problems as one of the most common problems of vitamin A deficiency. More than half (52.2%, 55.5%) of the two groups mentioned supplement of vitamin A at 9 months prevent vitamin A deficiency. There were statistically significant differences between rural and urban students' knowledge except, for prevention of vitamin A deficiency.

Table (3): represented that more than three quarters of rural students (77.7%) and more than half (54.1%) of urban students didn't hear about iron. Less than half (43.6%) and about one third (32.3 %) of rural and urban students respectively didn't know the function of iron. Less than half of rural students (44.8%) mentioned honey as source of iron compared to (31.4%) of urban students. Also, 59.5% and 60.5% of rural and urban students respectively didn't take iron tablets provided from school and. There were statistically significant differences between rural and urban students' knowledge except, for the factors that prevent iron from absorption (p=0.062).

Table (4): revealed that, more than half (51.6%) of the rural students gave incorrect answer regarding definition of iron deficiency anemia compared with 42.9 % in urban students. More than two thirds (36.1%) of rural students mentioned adolescence girls as risk factors while two fifth (41.4%) of urban students mentioned women during reproductive age. More than half of rural students (58.0%) said use iron supplementation as a method to prevent iron deficiency anemia compared with (66.8%) in urban students. There were statistically significant differences between rural and urban students' knowledge regarding all items of iron deficiency anemia.

Table (5): showed distribution of the studied students according to their knowledge about Iodine. The results indicated that 57.3%, 43.2%, 46.8% 52.9% and 47.0% of rural students didn't know any knowledge about iodine such as hearing about Iodine, functions, sources, problems and prevention of iodine deficiency compared with 41.4 %, 55.9 %, 26.4% 33.2% and 31.4% in urban students respectively. Statistically significant differences were detected between rural and urban students' knowledge about all items regarding iodine (p=< 0.001).

Figure (1): it is clear that less than one third (30.1%, 29.2%) of rural and urban students respectively mentioned teachers as the main source of information about some selected micronutrients followed by parents (24.1%, 26.3%) and friends (16.2%, 15.0%) respectively.

Table (6): indicates that the majority of students who had good score of knowledge regarding vitamin A, iron and iodine were from urban areas and statistically significant differences were detected between rural and urban students' knowledge (p=0.000).

Figure (2): shows that the majority of rural and urban students (92.4%) and (81.6%) respectively had poor score of knowledge about some selected micronutrients.

Table (7): revealed that, no statistically significant relationship between rural students' knowledge and some variables of socio-demographic characteristics as age, sex and social class .While statistically significant relationship were found between urban students' knowledge and their age and sex (P 0.022, 0.020) respectively.

Table (1): Frequency and percentage distribution of the studied students regarding their socio-demographic characteristics

Socio-demographic Characteristics	Rural Students (n=440)		Urban Students (n=440)		P. value
	No.	%	No.	%	
Age: (years)					
< 16	52	11.8	60	13.7	<0.001**
16 < 17	228	51.8	302	68.6	
17 and more	160	36.4	78	17.7	
Mean ± SD	16.62±1.52		16.57±0.92		0.847
Sex:					
Males	185	42.0	188	42.7	0.838
Females	255	58.0	252	57.3	
Father's education:					
Illiterate	82	18.6	21	4.8	<0.001**
Read & write	62	14.1	51	11.6	
Basic education	64	14.5	68	15.5	
Secondary	85	19.3	114	25.9	
University	147	33.4	186	42.3	
Father's occupation:					
Employee	177	40.2	275	62.5	<0.001**
Not employee	263	59.8	165	37.5	
Mother's education:					
Illiterate	189	43.0	70	15.9	<0.001**
Read & write	58	13.2	65	14.8	
Basic education	102	23.2	65	14.8	
Secondary	51	11.6	110	25.0	
University	40	9.0	130	29.5	
Mother's occupation:					
Worked	94	21.4	216	49.0	<0.001**
Not worked	346	78.6	224	51.0	
Social class:					
Low	203	46.1	139	31.5	<0.001**
Moderate	179	40.7	222	50.5	
High	58	13.2	79	18.0	

(**) Statistically significant at p<0.001

Table (2): Frequency and percentage distribution of the studied students according to their knowledge about Vitamin A

Items	Rural Students (n=440)		Urban Students (n=440)		P. value
	No.	%	No.	%	
Hearing about vitamin A					
Yes	245	55.7	298	67.7	<0.001**
No	195	44.3	142	32.3	
Functions of vitamin A #					
Bone and teeth growth	440	100.0	440	100.0	<0.001**
Maintains healthy hair and skin	48	10.9	120	27.3	
Maintains health of the immune system	48	10.9	82	18.6	
Improve vision	126	28.6	76	17.3	
Helps in the healing of wounds	13	3.0	6	1.4	
Prevent the formation of gallstones	16	3.6	6	1.4	
Don't know	114	25.9	66	15.0	
Sources of vitamin A #					
Eggs yolk, Milk and milk products	237	53.9	374	85.0	<0.001**
Vegetables (spinach, Broccoli Red pepper and carrot)	266	60.5	324	73.6	
Fruits (mango,cantaloupe)	32	7.3	42	9.5	
Beans and liver	48	10.9	134	30.5	
Don't know	76	17.3	72	16.4	
Problems of vitamin A deficiency#					
Eye problems	180	40.9	308	70.0	<0.001**
Bone and denture problems	114	25.9	116	26.4	
Skin problems	48	10.9	100	22.7	
Immune system problems	37	8.4	110	25.0	
Don't know	154	35.0	92	20.9	
Prevention of vitamin A deficiency #					

Supplementary vit A at 9 month of age	230	52.2	244	55.5	0.607
Supplementary vit A at 18 month of age	123	27.9	114	25.9	
Uses plant oil in diet	38	8.6	30	6.8	
Don't know	54	12.2	58	13.2	

More than one answers # **(**) statistically significant at p<0.001**

Table (3): Frequency and percentage distribution of the studied students according to their knowledge about Iron

Items	**Rural Students (n=440)**		**Urban Students (n=440)**		**P. value**
	No.	**%**	**No.**	**%**	
Hearing about Iron					
Yes	98	22.3	202	45.9	<0.001**
No	342	77.7	238	54.1	
Functions of Iron #					
Transport oxygen to the body through hemoglobin	118	26.8	152	34.5	<0.001**
Formulate body enzymes	143	32.5	182	41.4	
Don't know	192	43.6	142	32.3	
Sources of Iron #					
Meat and poultry	101	22.9	196	44.5	<0.001**
Liver and eggs	61	13.9	186	42.3	
Latencies, bread, rice	72	16.4	132	30.0	
Vegetables (spinach)	130	29.5	142	32.3	
Dried Fruits, chocolate	72	16.4	96	21.8	
Honey	197	44.8	138	31.4	
Don't know	48	10.9	58	13.2	
Factors prevent Iron from absorption #					
Drinking tea after meal directly	282	64.0	258	58.6	0.062
Not take fibers	35	7.9	56	12.7	
Not take vitamin C	37	8.4	34	7.7	
Don't know	93	21.1	110	25.0	
Taking iron tablets provided from school					
Regular	61	13.9	82	18.6	0.047*
Irregular	117	26.6	92	20.9	
Don't take	262	59.5	266	60.5	
Causes of don't take iron tablet regular					
Not benefit	61	52.1	40	43.5	0.007**
Don't like tablet	20	17.1	33	35.9	
Don't know its function	36	30.8	19	20.6	

More than one answers #
(*) statistically significant at p<0.05 **(**) statistically significant at p<0.001**

Table (4): Frequency and percentage distribution of the studied students according to their knowledge about Iron deficiency anemia

Items	**Rural Students (n=440)**		**Urban Students (n=440)**		**P. value**
	No.	**%**	**No.**	**%**	
Definition					
Complete correct answer	83	18.9	98	22.3	0.037*
Incomplete correct answer	130	29.5	153	34.8	
Incorrect answer	227	51.6	189	42.9	
Risk factors #					
Children under 2 years	69	15.7	86	19.5	<0.001**
Adolescent girls	159	36.1	154	35.0	
Vegetarians persons	85	19.3	48	10.9	
Women during reproductive age	154	35.0	182	41.4	
Increase blood donor	47	10.7	176	40.0	
Don't know	121	27.5	120	27.3	
Signs and symptoms #					
Easy fatigue	274	62.3	312	70.9	<0.001**
Eye and nail problems	39	8.9	62	14.1	
Irritability	24	5.4	52	11.8	
Glossitis and stomatitis	37	8.4	46	10.5	
Don't know	132	30.0	94	21.4	
Prevention #					

Prevent and treat bleeding	66	15.0	94	21.4	<0.001**
Prevent and treat parasitic diseases	122	27.7	52	11.8	
Healthy dietary practice	129	29.3	88	20.0	
Use iron supplementation	255	58.0	294	66.8	
Don't know	17	3.9	26	5.9	

More than one answers #
(*) statistically significant at p<0.05 (**) statistically significant at p<0.001

Table (5): Frequency and percentage distribution of the studied students according to their knowledge about Iodine

Items	**Rural Students (n=440)**		**Urban Students (n=440)**		**P. value**
	No.	**%**	**No.**	**%**	
Hearing about Iodine					
Yes	188	42.7	258	58.6	<0.001**
No	252	57.3	182	41.4	
Functions of Iodine #					
Bones and teeth growth	74	16.8	94	21.4	<0.001**
Healthy skin and wound healing	37	8.4	90	20.5	
Immune and nervous system health	60	13.6	32	7.3	
Improve vision	82	18.6	14	3.2	
Prevent formation of gallstones	29	6.6	46	10.5	
production of thyroxin hormone	18	4.1	68	15.5	
Prevent hypertension and arteriosclerosis	11	2.5	20	4.5	
Don't know	190	43.2	246	55.9	
Sources of Iodine #					
Eggs, milk and milk products	66	15.0	58	13.2	<0.001**
Iodized salt	79	18.0	256	58.2	
Fish, sardines, tuna	103	23.4	72	16.4	
Vegetables (spinach, Garlic)	50	11.4	58	13.2	
Strawberry	10	2.3	16	3.6	
Don't know	206	46.8	116	26.4	
Problems of Iodine deficiency #					
Goiter	24	5.5	230	52.3	<0.001**
Overweight	152	34.5	74	16.8	
Multiple abortions	21	4.8	32	7.3	
Constipation	45	10.2	22	5.0	
Mental retardation	3	0.7	32	7.3	
Don't know	233	52.9	146	33.2	
Prevention of Iodine deficiency #					
Iodized salt in diet	149	33.9	258	58.6	<0.001**
Iodized water	85	19.3	32	7.3	
Use of iodine capsule	20	4.5	38	8.6	
Don't know	207	47.0	138	31.4	

More than one answers # (**) statistically significant at p<0.001

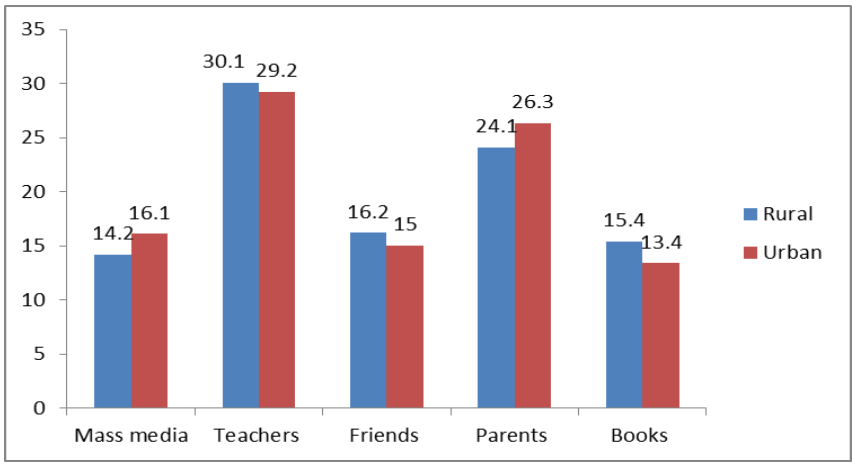

Figure (1): Frequency and percentage distribution of studied students regarding to their Sources of information about some selected micronutrients

Table (6): Frequency and percentage distribution of studied students regarding their total score of knowledge about vitamin A, iron and iodine

Schools	Knowledge about vitamin A						P. value
	Poor		Fair		Good		
	No	%	No	%	No	%	
Rural	420	52.5	17	34.0	3	10.0	0.000**
Urban	380	47.5	33	66.0	27	90.0	
	Knowledge about iron						
	Poor		Fair		Good		
Rural	401	52.6	35	52.2	4	8.0	0.000**
Urban	362	47.4	32	47.8	46	92.0	
	Knowledge about iodine						
	Poor		Fair		Good		
Rural	412	51.8	25	41.0	3	13.0	0.000**
Urban	384	48.2	36	59.0	20	87.0	

**** Statistically significant at p < 0.001**

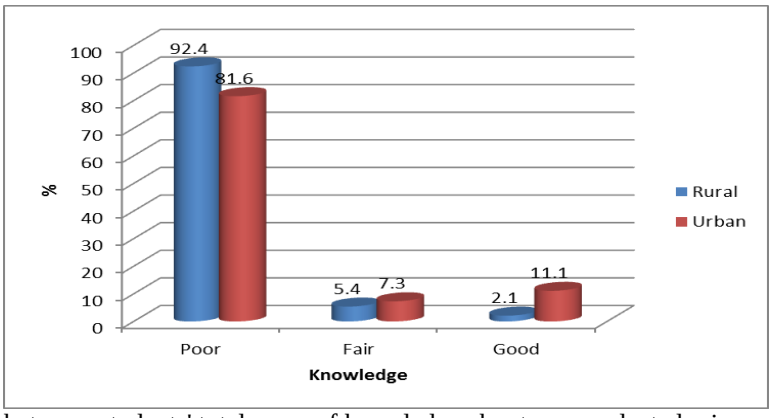

Fig 2: Relation between students' total score of knowledge about some selected micronutrient and their residence

Socio-demographic	Rural Students						P. value	Urban Students						P. value
	Poor		Fair		Good			Poor		Fair		Good		
	No.	%	No.	%	No.	%		No.	%	No.	%	No.	%	
Age: (years)														
< 16	51	12.5	0	0.0	1	11.1	0.246	44	12.3	10	31.2	6	12.2	0.022*
16 < 17	212	52.1	11	45.8	5	55.6		255	71.0	16	50.0	31	63.3	
17 and more	144	35.4	13	54.2	3	33.3		60	16.7	6	18.8	12	24.5	
Sex:														
Males	175	43.0	5	20.8	4	44.4	0.100	157	43.7	18	56.2	13	26.5	0.020*
Females	232	57.0	19	79.2	5	55.6		202	56.3	14	43.8	36	73.5	
Social class:														
Low	129	31.7	11	45.8	4	44.4	0.598	165	46.2	15	46.9	23	46.9	0.999
Moderate	205	50.4	10	41.7	4	44.4		146	40.7	13	40.6	20	40.8	
High	73	17.9	3	12.5	1	11.2		48	13.1	4	12.5	6	12.2	

Table (7): Relation between students' total score of knowledge about some selected micronutrient and their Socio-demographic characteristics

Socio-demographic	Rural Students						P. value	Urban Students						P. value
	Poor		Fair		Good			Poor		Fair		Good		
	No.	%	No.	%	No.	%		No.	%	No.	%	No.	%	
Age: (years)														
< 16	51	12.5	0	0.0	1	11.1	0.246	44	12.3	10	31.2	6	12.2	0.022*
16 < 17	212	52.1	11	45.8	5	55.6		255	71.0	16	50.0	31	63.3	
17 and more	144	35.4	13	54.2	3	33.3		60	16.7	6	18.8	12	24.5	
Sex:														
Males	175	43.0	5	20.8	4	44.4	0.100	157	43.7	18	56.2	13	26.5	0.020*
Females	232	57.0	19	79.2	5	55.6		202	56.3	14	43.8	36	73.5	
Social class:														
Low	129	31.7	11	45.8	4	44.4	0.598	165	46.2	15	46.9	23	46.9	0.999
Moderate	205	50.4	10	41.7	4	44.4		146	40.7	13	40.6	20	40.8	
High	73	17.9	3	12.5	1	11.2		48	13.1	4	12.5	6	12.2	

(*) Statistically significant at P < 0.05

V. Discussion

Micronutrients are nutrients that are only needed in minute amounts. They have a role in the production of enzymes, hormones and other substances. They also help to regulate growth activity, cognitive development and functioning, and the activity of the immune and reproductive systems **(Centers for Disease Control and Prevention (CDC), 2012).**

The results of the present study revealed that more than half and more than two thirds of rural and urban students, respectively, heard about vitamin A. This result disagrees with **Krishna et al., (2011)** who reported that all the study subjects were aware about vitamin A. Also this result is inconsistent with **Bhavesh et al., (2010)** who found that 23.9% of students in the secondary schools of tribal areas in Gujarat had never heard of vitamin A.

The current study indicated that all rural and urban students knew at least one function of vitamin A. Also, one hundred percent of them knew that it is important for bone and teeth growth, while a minority of rural and urban students stated that vitamin A is useful for the healing of wounds. These results disagree with **Bhavesh et al., (2010)** who stated that 65.8% of students were aware of at least one function of vitamin A in the body and 54% of students knew that it is important for eye sight, and 1.7% stated that it is useful for healthy skin.

Concerning students' knowledge about sources of vitamin A, the present study reported that less than two thirds of rural students mentioned vegetables, while most of urban students mentioned egg yolk, milk and milk products. These results are in line with **Krishna et al., (2011)** who mentioned that green leafy vegetables, milk and carrots were identified as the source of vitamin A.

The results indicated that a high percentage of the rural and urban students mentioned eye problems as an important problem which results from vitamin A deficiency. Also, the results of **Mayo-Wilson et al., (2011)** reported that 75.0% of the study samples were aware about night blindness as the manifestation of vitamin A deficiency and 75.5% identified its role in vision.

The results showed that more than half of the two groups said that supplements of vitamin A at 9 months prevent vitamin A deficiency. This result is in line with **Srilakshmi (2008**) who stated that nearly 49.5% of the study subjects were of the opinion that vitamin A deficiency can be treated by vitamin A rich food only.

Regarding students' knowledge about iron, the present study revealed that more than three quarters and more than half of the rural and urban students, respectively, didn't hear about iron. These results disagree with **Sebotsa et al., (2009)** who mentioned that 20.7% of the school students never heard about iron. As regards the sources of iron, less than half of rural and urban students mentioned honey, meat and poultry, respectively. Our results agree with **Singh et al., (2015**) who reported that 49.4% of the students knew at least one dietary source of iron. Vegetables, legumes and cereals were stated as good sources of iron.

The results reported that more than two-thirds and more than half of rural and urban students mentioned that drinking tea after meal directly prevents absorption of iron. The results are not consistent with the study conducted by **Ghasemi and Keikhaei (2014)** who mentioned that drinking tea mainly influences the absorption of non-haem iron as haem iron is relatively unaffected by tea. This does not necessarily mean that high tea consumption is associated with an unfavorable iron status at the population level. Also, the results of the present study indicated that more than half of the rural and urban students said they didn't take iron tablets provided by schools. This can be explained by the fact that the students didn't know the importance of the tablet and fear medication.

The current study found that a low percentage of rural and urban students knew the correct definition of iron deficiency anemia. Also the present study found that more than one third of rural and urban students mentioned adolescence girls and women during reproductive age as risk factors for iron deficiency anemia. This can be explained by the fact that blood loss and heavy menstrual bleeding are one of the most important contributing factors to iron deficiency anemia. Also women during pregnancy and lactation need additional iron requirements. This finding disagrees with **Singh et al., (2015)** who mentioned that all rural and urban students defined anemia correctly and stated heavy menstrual bleeding as a common cause of anemia in females.

The present study reported that more than half and more than two thirds of rural and urban students said that they use iron supplementation as a method to prevent iron deficiency anemia. These results in accordance with**, Tatala et al., (2008)** who hesitated that ,more importance in prevention of IDA is the consumption of iron-rich foods.

The results indicated that more than half of rural students and less than half of urban students didn't hear about iodine. These results are in agreement with **Bhavesh et al., (2010)** who stated that 20.7% of students had never heard of iodine. Our results also disagree with **Buxton and Baguune (2012)** who mentioned that the majority of the subjects (86.9 %) did not know what iodine is. Our results showed that a high percentage of rural and urban students didn't know the functions of iodine. The results disagree with the study conducted by **Buxton and Baguune (2012)** who reported that all students knew at least one benefit of iodine

Regarding the sources of iodine the present study found that less than one quarter of rural students mentioned fish, sardines, and tuna, while more than half of urban students mentioned iodized salt. The results disagree with **Allen et al., (2006)** who stated that fifteen percent of the study subjects knew that iodized salt is the most important or main source of iodine. Lower percentages, between 4.9 and 5.8% of respondents, believed that seafood, vegetables or meat was the most important dietary source of iodine.

The current study revealed that more than half of rural and one third of urban students didn't know the problems resulting from iodine deficiency. This is in agreement with **Amare et al., (2012)** who found that the majority of the studied samples (89.1%) did not know the most important harmful effect on the health of children if they did not get enough iodine from food.

Concerning students' knowledge about prevention of iodine deficiency, it was reported that about one third of rural and more than half of urban students mentioned iodized salt in diet. These results are in line with **Buxton and Baguune (2012)** who stated that fortification of salt with iodine has been the most effective preventive measure against iodine deficiency disorders.

The main sources of information about micronutrients for students from the two groups were teachers and parents. Our results disagree with the findings of **Brugnara et al., (2013)** who stated that school teachers were the major source of information followed by television and newspaper. These findings are also inconsistent with **Krishna et al., (2011)** who found that the main source of information was school followed by primary health care providers and friends or other sources.

The present study found that, the majority of rural and urban students had poor scores of knowledge about vitamin A, iron and iodine. This can be explained by the school curriculum do not contain information about micronutrients, illiteracy of some population about the importance, sources, functions and harmful effects of micronutrient deficiency. Although social media exist in rural and urban areas, the students didn't use them correctly. The present study agrees with **Bhavesh et al., (2010)** who revealed that the students had poor information about micronutrients, their dietary source and their usefulness for health.

The present study revealed that, there is no statistically significant relationship between the rural students' knowledge and their age but statistically significant relationship were detected between the urban students' knowledge and their age. While the study conducted by **Sebosta et al., (2009)** who stated that, there was statistically significant relationship between knowledge and the age of students.

The results indicated that, no statistically significant relationship between rural students' knowledge and their sex. While statistically significant differences were detected among urban students and the female students had high scores of knowledge when compared to male students. This finding can be accounted for by the fact that girls are more concerned with health and need to be healthier. The results conducted by **Micronutrient Initiative (2010)** reported that girls had significantly higher information on many micronutrients.

VI. Conclusion

The majority of rural and urban students from both sexes and all social classes had poor scores of knowledge about vitamins A, iron and iodine, with higher percentages of knowledge among students in urban areas.

VII. Recommendations

1- Micronutrients should be included in school syllabuses and the school teachers should communicate information to students.
2- School directors are recommended to use and disseminate posters and pictures about micronutrients in all visible areas at school to increase students` knowledge about micronutrients.
3- Increasing the public' knowledge about micronutrients through mass media.
4- Conducting health education programs for students about micronutrients

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