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Full Length Research Paper

Nutritional status of undergraduates in a Nigerian university in south-west Nigeria

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The study evaluated the nutritional status and eating habits of undergraduate students in a Nigerian University. One hundred undergraduates (ages 15 to 40 years) of the Lagos State University, Ojo participated in the study. General information, anthropometric data, as well as a 7-day dietary recall were obtained by means of questionnaire. Venous blood samples were collected from the respondents and analyzed for vitamins A and C, creatinine, zinc, iron, total and differential blood counts. Mean body mass index (BMI), mid arm circumference (MAC), vitamins A and C, iron (Fe), zinc (Zn) and creatinine concentrations were 24.56 ± 3.3 kg/m^2, 26.7 ± 3.0 cm, 20.5 ± 14.3 µg/dl, 1.5 ± 71.27 µg/dl, 19.62 ± 5.65 µmol/L, 6.6 ± 1.9 mg/kg and 1.24 ± 1.53 µg/dl, respectively. Mean PCV, WBC and Hb were 39.2 ± 4.9%, 5.34 ±1.73 × 10^6 /L and 12.22 ± 1.93 g/dl, respectively. 53% of the respondents were over-weight; 6%, obese and 15% under weight. PCV, Hb and lymphocytes were significantly higher in males than in females. There was positive correlation between serum vitamin C and Zn concentrations (r = 0.203), Fe and Zn (r = 0.539), Zn and neutrophil (r = 0.210) and vitamin A and basophil (r = 0.559). There was however a negative correlation between Zn and eosinophil count. Number of meals and milk intake had no effect on the status of the subjects. However, fruit intake positively affected neutrophil count (r = 0.202); vegetable intake positively affected serum Fe concentration (0.256); and intake of nutritional supplements positively affected serum Zn concentration. Also, serum vitamin A concentration in both male and female students was low.

Key words: Adolescent nutrition, anthropometry, body mass index, hematology, nutritional status, serum zinc, vitamin A status, undergraduates.

INTRODUCTION

Recent trends in the results of major examination in the country have indicated that there is a decline in academic performance of students at all levels (Ighodalo, 2004). This decline has been attributed to some major factors like poor academic background, attitude of students towards examinations and attitudes of teachers to work. Another remote cause of poor academic performance of students could be linked to the worsening socio-economic condition of the country, which has affected the feeding habit of students (Ighodalo, 2004). Malnutrition is a major problem in both developed and developing countries and deficiencies in some nutrients have been reported to cause diseases which could lead to impaired cognitive development (Simeon and McGregor, 1989). Other studies have related lifestyle of students, particularly breakfast consumption, to their cognitive abilities as reflected in their academic performance (Pollit, 1982, 1987; Lisa, 1998). However, most of these studies have excluded young adults in the tertiary institution.

In developing countries, many children with mild to moderate malnutrition survive to reach adolescence, when malnutrition tends to remain mild but chronic, being de-

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Table 1. Mean ± SD of some nutritional parameters of undergraduate students.

Parameters	Male (n= 41)	Female (n= 59)	Total (n= 100)
Weight (Kg)	65.38± 10.43^{a}	63.54 ± 7.65^{a}	64.00 ± 9.09
Height (m)	1.66± 0.26^{a}	1.61± 0.18^{a}	1.63± 0.23
BMI (Kg/m^{2})	24.19 ± 3.46^{a}	24.83 ± 2.92^{a}	24.53 ± 3.34
MAC (cm)	27.15 ± 3.22^{a}	26.58 ± 2.71^{a}	26.70 ± 3.00
Vitamin A (/dl)	21.94 ± 12.7^{a}	19.41± 15.41^{a}	20.49± 14.34
Vitamin C (mg/dl)	1.73± 1.34^{a}	1.47± 1.24^{a}	1.57± 1.27
Iron (mol/l)	19.64 ± 5.62^{a}	19.79 ± 5.70^{a}	19.62 ± 5.65
Zinc (mg/Kg)	6.79± 1.90^{a}	6.44± 2.09^{a}	6.57± 1.97
Creatinine (mg/dl)	1.05± 0.84^{a}	1.39 ± 1.88a	1.24± 1.53
PCV (%)	41.45 ± 3.80^{a}	37.56 ± 5.03b	39.22 ± 4.88
WBC (x10^{6}/L)	5.68± 1.65^{a}	5.02 ± 1.77a	5.35± 1.74
Hb (g/dl)	12.95 ± 1.18^{a}	11.66 ± 2.22^{b}	12.22 ± 1.93
N (%)	66.15 ± 8.04^{a}	64.02 ± 9.08^{a}	64.95 ± 8.61
L (%)	26.31 ± 6.46^{a}	29.64 ± 8.24^{b}	28.21 ± 7.63
M (%)	3.15± 2.58^{a}	2.41± 2.00^{a}	2.69± 2.27
E (%)	3.49± 1.80^{a}	3.36± 2.25^{a}	3.46± 2.05
B (%)	0.05± 0.22^{a}	0.13± 0.38^{a}	0.09± 0.33

^{ab}Values with different superscripts within row are statistically significant at $P < 0.05$).

tectable only by anthropometric measurements. On the other hand, relatively well-nourished children may develop malnutrition in adolescence as a result of acquired dietary habits, influenced by obsession with thinness (WHO, 1986; Matsuhashi, 2000; Ryan et al, 1998). Several studies, mainly from developed countries, have demonstrated that, despite the increasing trends in the prevalence of overweight and obesity, fatness phobia is common during adolescence, especially in females (Thompson and Chad, 2003; Jones et al., 2001; Weinshenker, 2002).

Nutritional status is the combination of an individual's health as influenced by intake and utilization of nutrients and determined from information obtained by physical, biochemical and dietary studies (Durning and Fidanza, 1985). Information on the nutritional status and dietary habits of the adolescent population in Nigeria is however scanty.

This study was therefore intended to evaluate the nutritional status and eating habits of adolescents and young adults in a Nigerian University.

MATERIALS AND METHODS

Subject

The study was conducted using undergraduate students of the Lagos State University, Ojo Campus. Subjects were randomly selected from across the 6 faculties on Ojo Campus. Subjects who had taken ill in the last 4 weeks and those currently on medication were exempted from the study. In the end, 100 students (ages 15 – 40 years), which included 41 males and 59 females participated in the study.

Data collection

Data on general information, socioeconomic status, and eating habits were obtained by the administration of structured questionnaires. Anthropometric assessment was carried out according to the method of Scrimshaw and Gleason (1992). Dietary assessment was done using a 7 day dietary recall.

Ten millilitre of venous blood was drawn from the forearm of the subjects and evenly divided into three bottles. One bottle contained EDTA and the two were plain bottles. The blood sample in the EDTA bottle was used for the haematological analysis and the other two bottles were centrifuged in a Haereus labofuge for 5 min at 2000 rpm. The serum obtained was used for the mineral and biochemical analyses.

Analyses

Packed cell volume (PCV), haemoglobin (Hb), total white blood cell (WBC) and differential white blood counts were determined according to the method described by Baker and Silverton (1985) . Serum creatinine was determined according to the modified Jaffe method using the creatinine kit (Quimica, SA). Serum vitamins A and C con-centrations were determined as described by Baker and Silverton (1985) . Serum iron (Fe) and zinc (Zn) concentrations were deter-mined by atomic absorption spectrophotometry using a Phillip PUX 1000 atomic absorption spectrophotometer.

Statistical analyses

Sample mean and standard deviation values were calculated and means were compared using student's t test. Pearson' correlation was used to test for association. All statistical analyses were done using the SPSS version 11.0 software.

RESULTS

Table 1 shows the values of some anthropometric, biochemical and haematological parameters of subjects. There was no statistical difference between male and female undergraduate students except PCV, Hb and lymphocyte values which were significantly higher ($p < 0.05$) in male students.

Age, BMI and MAC distribution of the undergraduates in this study are shown in Figures 1 to 3. 83% of the students' populations were aged between 21- 25 years, 12% were 26-30 years, 3% were 15- 20 years and 2% were 31-40 years. 53% of the student populations were overweight, 36% had normal weight, 15% were under-weight and 6%, obese. Only 3% of the student population involved in the study had MAC lower than normal (< 22 cm).

Figure 4 shows the frequency of milk, fruit and vegetable and nutritional supplement intake by respondents. 41% of the students consumed milk daily; 24%, weekly, and 28%, occasionally. About 7% of the students did not take milk at all. Well over half (55%) of the respondents consumed fruit occasionally, 31% weekly and 11% daily. About 3% of them did not consume fruits at all. Consumption of vegetables was also low among the students. 50% of them consume vegetables occasionally; 39% of them, weekly and only 11% of them daily. Intake of nutritional supplements among the students was also very low. Up to 30% of them did not take any form of nutritional supplements, 44% took supplements occasionally and only 7% took their supplements daily.

Table 2 shows the Pearson correlation values for some of the parameters measured. There was no corre-lation between milk and frequency of meals intake, and nutritional status of the students. However, there was a positive relationship between fruit intake and neutrophils count ($r = 0.202$); vegetable intake and serum Fe concentration ($r = 0.205$); and supplements intake and serum Zn concentration. There was also a positive correlation between serum vitamin C and Zn concentrations ($r = 0.203$); Zn concentration and neutrophils count ($r = 0.210$); and vitamin A and basophil count ($r= 0.559$). Over 80% of the student population had low vitamin A concentration (<24 g/dl).

DISCUSSION

The present study is a preliminary report of ongoing efforts by the authors to elucidate from the nutritional point of view, the underlying cause of the increasing poor academic performance among undergraduates in tertiary institutions. Results from studies like this are important for effective policy formulation and implementation, especially where nutritional interventions are required.

Previous reports (Ryan et al., 1992) have indicated essential roles of diet and nutrition in determining health status. A good number of the study population ate at least 3 meals daily, but the dietary recall showed that they ate mostly carbohydrates, with very little protein (data not shown) . This was in agreement with the report of Umoh (1977) in his study of nutritional and health problems in South-eastern Nigeria.

BMI and MAC were used to assess leanness and these two parameters are indicators of the long term dietary history of the respondents. In this study, BMI value greater than 31.5 kg/m^2 was considered as an indication of obesity and below 18.0 kg/m^2 as leanness (WHO, 1995). Leanness as a result of under nutrition causes reduced metabolism, reduced energy production and non availability of free glucose which is both required for studying and stress management. About half of the students who participated in the study (53%) were over weight, 6% obese and 15% underweight. Obesity has been associated with an increased propensity for the development of kidney, heart and circulatory diseases; diabetes and complications during pregnancy and child birth in females (Guthrie, 1979; Wardlaw and Kessel, 2002; WHO, 2003). A recent report (Cannon and Leitzmann, 2005) indicated a staggering rise of obesity in young people in middle income countries, and this has serious implications in later life.

With the exception of serum vitamin A concentration, all other serum metabolites and haematological parameters were within normal range. Mean serum vitamin concentration for both male and female subjects was low.

Consumption of fruits, vegetables and nutritional supplements among the undergraduates in the study was low. Consumption of fruits and vegetables among adolescents between the ages of 12 and 19 years has been reported to decrease with age (AIHW, 2007). This trend could be as a result of waning parental influence as adolescents get into tertiary institutions or the problem of easy accessibility to these foods on the university campus. This factor might also have contributed to the low vitamin A status of the subjects.

The positive correlation between zinc and iron was contrary to previous reports (Solomon and Jacob, 1981) where ingestion of zinc and iron in various ratios led to reduced zinc absorption. Davidson et al. (1995) however reported that iron ingestion had no effect on zinc absorption. There was a positive relationship between Zn, vitamins A and C, and some cells of the immune system. Vitamin C, apart from having antioxidant activity, also helps in immune function. White blood cells which are the major immune cells contain the highest Vitamin C concentration of all body constituents (Wardlaw and Kessel, 2002). Several reports have also shown the importance of Zn in both specific and non specific immune responses (Cunningham et al., 1990; Shankar and Prasad, 1998).

Over 80% of the subjects had low serum vitamin A con-

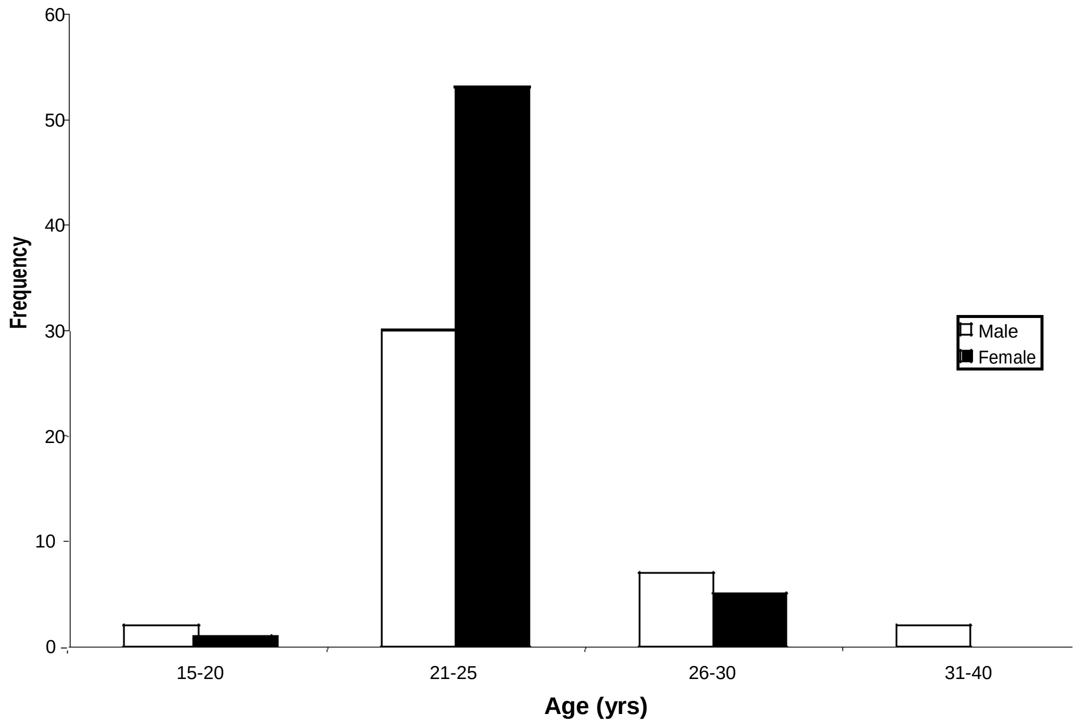

Figure 1. Age distribution of respondents by gender.

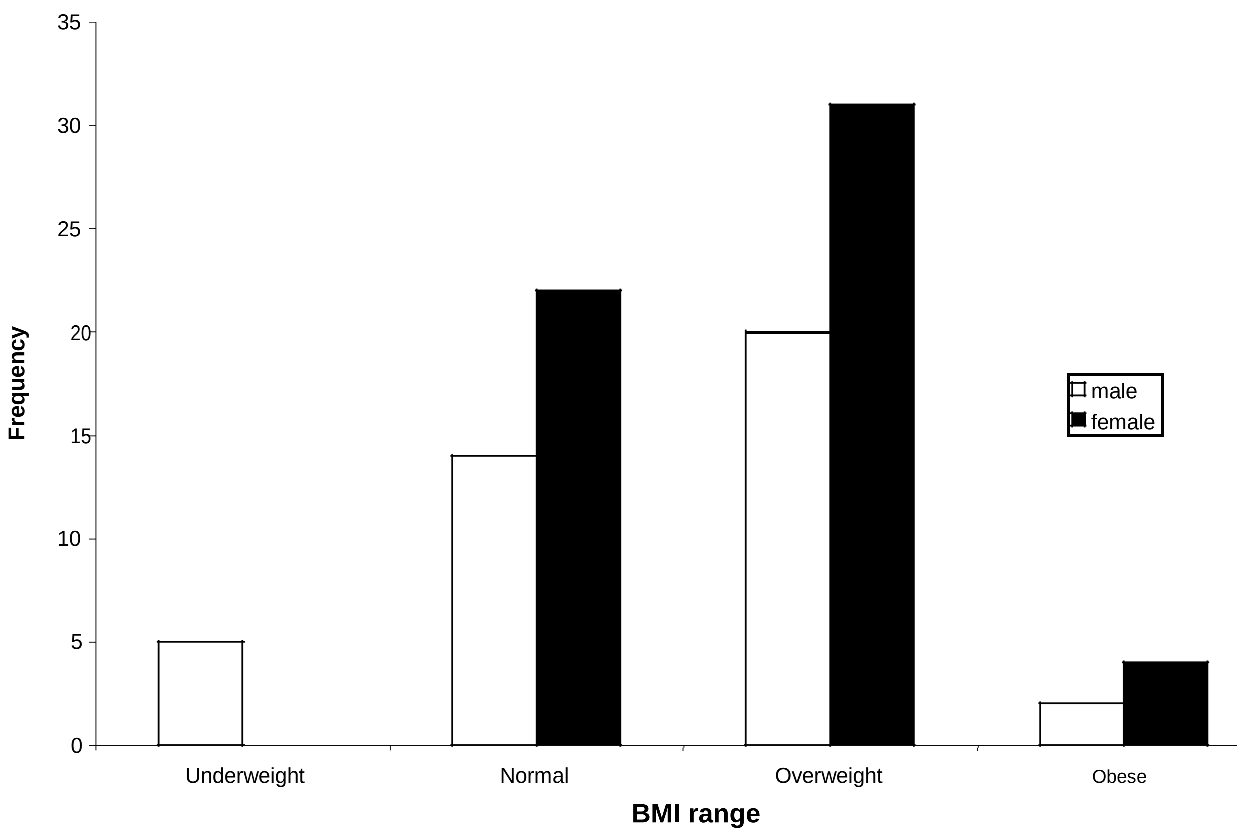

Figure 2. BMI distribution of respondents by gender.

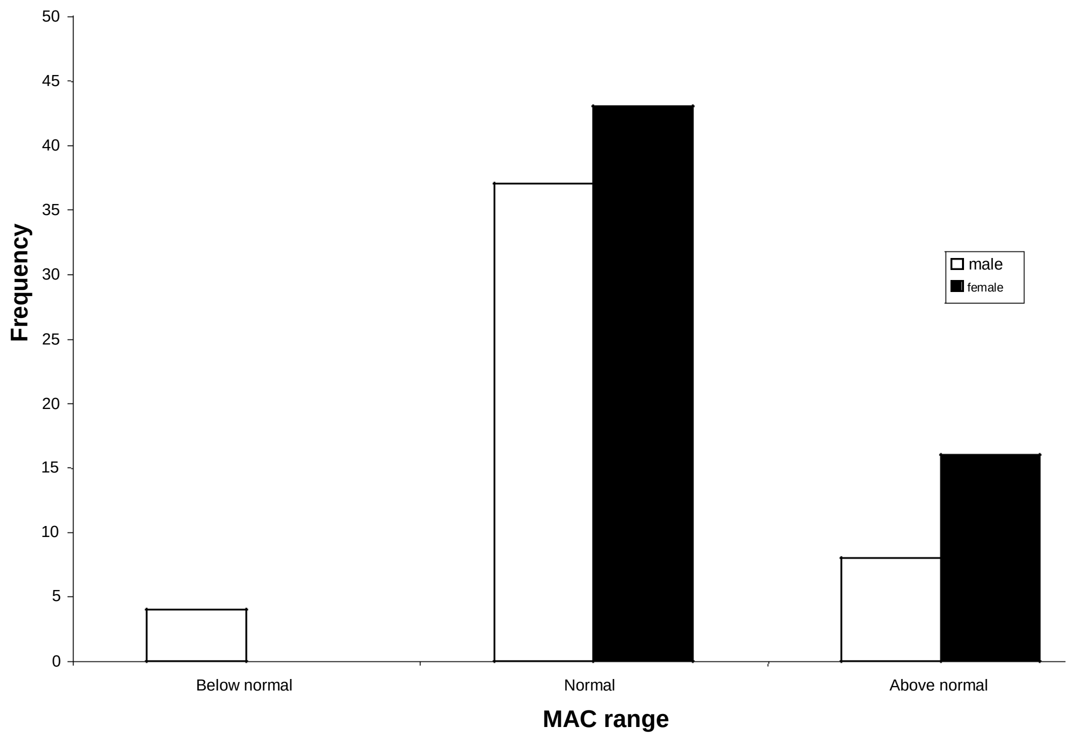

Figure 3. MAC distribution of undergraduate students.

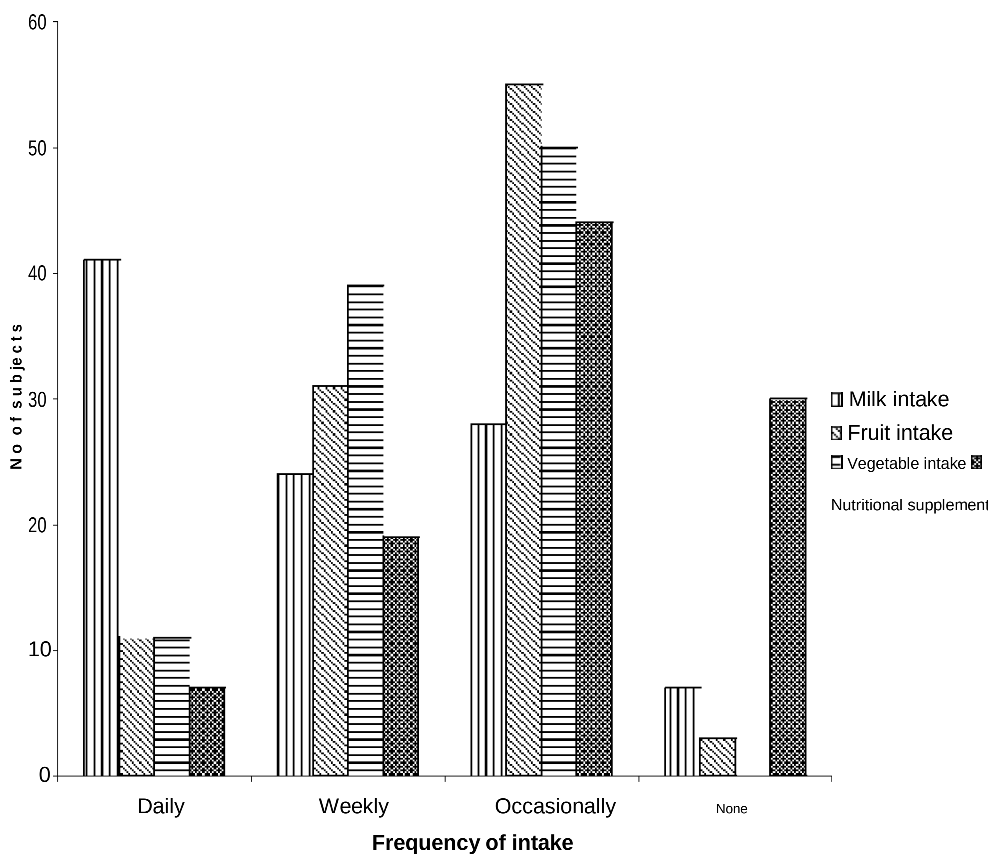

Figure 4. Frequency of milk, vegetables and supplement intake by respondents.

Table 2. Pearson correlation between nutrient intake, nutritional and immunological status of undergraduates.

Parameter	Correlation	Vitamin A	Vitamin C	Creatinine	Zinc	Iron	N	L	M	E	B
	Pearson correlation	-0.154	0.102	-0.034	-0.021	-0.055	0.071	-0.087	0.078	-0.065	0.002
No of meals	Sig. (2-tailed)	0.133	0.313	0.735	0.838	0.593	0.484	0.388	0.443	0.518	0.983
	N	96	100	99	97	97	100	100	100	100	100
	Pearson correlation	0.011	0.035	0.022	-0.121	-0.051	0.057	-0.05	-0.026	-0.098	-0.003
	Sig. (2-tailed)	0.917	0.73	0.831	0.238	0.55	0.575	0.624	0.798	0.333	0.974
Milk intake	N	96	100	99	97	97	100	100	100	100	100
	Pearson correlation	0.054	-0.038	-0.092	0.004	0.12	.202*	-0.127	-0.104	-0.153	0.094
Fruit intake	Sig. (2-tailed)	0.603	0.707	0.367	0.968	0.24	0.044	0.209	0.301	0.128	0.353
	N	96	100	99	97	97	100	100	100	100	100
Vegetable	Pearson correlation	-0.023	0.056	-0.005	0.166	.256*	-0.071	-0.006	0.057	0.004	-0.035
intake	Sig. (2-tailed)	0.825	0.582	0.958	0.105	0.011	0.486	0.956	0.574	0.965	0.732
	N	96	100	99	97	97	100	100	100	100	100
Supplement	Pearson correlation	0.136	0.138	0.041	0.041	.221*	0.039	-0.031	0.093	-0.065	0.055
Intake	Sig. (2-tailed)	0.187	0.169	0.686	0.686	0.03	0.703	0.756	0.358	0.523	0.584
	N	96	100	99	99	97	100	100	100	100	100
	Pearson correlation	1	-0.133	-0.115	-0.057	-0.107	0.004	-0.018	-0.035	0.128	.559**
Vitamin A	Sig. (2-tailed)		0.275	0.268	0.588	0.305	0.971	0.861	0.732	0.213	0
	N	96	96	95	97	93	96	96	96	96	96
	Pearson correlation	-0.133	1	-0.094	.203*	0.097	0.082	-0.033	0.117	-0.167	-0.173
Vitamin C	Sig. (2-tailed)	0.275		0.354	0.046	0.346	0.418	0.742	0.247	0.097	0.084
	N	96	100	99	97	97	100	100	100	100	100
	Pearson correlation	-0.115	-0.094	1	-0.163	-0.148	0.162	0.162	0.002	0.045	0.051
Creatinine	Sig. (2-tailed)	0.268	0.354		0.113	0.15	0.11	0.11	0.986	0.656	0.616
	N	95	99	99	96	96	99	99	99	99	99
	Pearson correlation	-0.057	.203*	-0.163	1	.539**	.210*	-0.119	0.067	-0.249*	-0.107
Zinc	Sig. (2-tailed)	0.588	0.046	0.113		0	0.039	0.245	0.517	0.014	0.298
	N	97	97	96	98	97	97	97	97	97	97
	Pearson correlation	-0.107	0.097	-0.148	.539**	1	0.163	-0.052	0.003	-0.151	-0.164
Iron	Sig. (2-tailed)	0.305	0.346	0.15	0		0.112	0.613	0.974	0.14	0.108
	N	93	97	96	97	97	97	97	97	97	97
	Pearson correlation	0.021	0.06	-0.008	0.027	-0.136	0.081	-0.091	0.173	-0.01	-102
PCV	Sig. (2-tailed)	0.844	0.567	0.941	0.798	0.194	0.438	0.385	0.095	0.927	0.327
	N	90	94	93	92	92	94	94	94	94	94
	Pearson correlation	0.19	0.042	-0.063	-0.071	-0.189	.250*	-0.264*	0.004	-0.082	0.146
WBC	Sig. (2-tailed)	0.075	0.686	0.554	0.502	0.072	0.016	0.011	0.966	0.433	0.162
	N	89	93	92	91	91	93	93	93	93	93
	Pearson correlation	0.067	0.034	-0.009	0.004	-0.137	0.084	-0.099	0.121	0.026	0.018
Hb	Sig. (2-tailed)	0.529	0.745	0.933	..971	0.194	0.42	0.341	0.243	0.801	0.86
	N	90	94	93	92	92	94	94	94	94	94

centration, despite the claims by most respondents that they took fruit, milk and vegetables regularly. Although these foods are good sources of the vitamin, the method of storage and processing and the adequacy of intake could be responsible for the low serum concentration. Vitamin A deficiency has been associated with non-accidental blindness, impairment of growth and immunity and follicular hyperkeratosis (Wardlaw and Kessel, 2002). Nutritional education and intervention therefore is expedient in order to prevent cases of visual impairment among the students.

Conclusion

There was a high incidence of over weight and vitamin A deficiency among the student population. In curbing this trend, there is therefore an urgent need for sustained nutritional education among young adolescents.

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