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Prevalence and Socio-Demographic Correlates of Anaemia among G.C.E (A/L) Students in Jaffna Zonal Schools

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Abstract: Anaemia is a global public health problem affecting both developing and developed countries with major consequences for human health as well as social and economic development. This study assessed the prevalence of anaemia and the socio-demographic correlates among G.C.E (A/L) adolescent students in Jaffna zonal schools. A cross sectional study was carried out and 191 male (48.2%) and 205 female (51.8%) students aged 15 to 18 years from twenty schools (four National schools) out of twenty seven schools in Jaffna educational zone were interviewed and examined. Blood was collected to determine hemoglobin (Hb) and albumin levels. The mean (±SD) Hb levels of males and females were 13.97 (±1.26) and 12.23 (±1.34) g/dL respectively and male students had higher Hb level than female students ($p<0.001$). The mean Hb level was significantly higher for students from the families with less than or equal to 5 members [13.12 (±1.57) g/dL when compared with students from families with more than 5 members [12.85 (±1.53) g/dL, ($p<0.05$)]. Prevalence of anaemia was 32.6% and was more pronounced in females (43.9%) than in male students (20.4%) ($p<0.001$). The prevalence of mild, moderate and severe anaemia was 26.8, 5.6 and 0.3%, respectively. The trend of anaemia was not changed with age [the prevalence of anaemia among students aged 16, 17 and 18 years was 36.8, 29.4 and 36.1% respectively (Pearson's chi-squared trend $p>0.05$)]. Prevalence of anaemia among students from urban and rural areas was 35.7 and 29.9% respectively. Almost half of the females from urban areas (49.5%) were anemic while it was 39.5% among the females from rural. Prevalence of anaemia was significantly high among students studying in schools in Jaffna District Secretariat (DS) division [Jaffna – 43.8%, Kopay – 30.3% and Nallur – 24.4% ($p<0.01$)]. Prevalence of anaemia among students from National schools was 30.5% while it was 33.9% from Provincial schools. In this study population, the mean (±SD) albumin concentration was 3.73 (±0.3) g/dL (in males-3.81; in females-3.67; gender difference $p<0.001$). Serum albumin level was increased with increasing Hb level (Pearson Correlation=0.125; $p=0.014$). In conclusion, the household size and gender were significantly associated with Hb level ($p<0.05$) while gender, DS division of the school and distance from the school were significantly associated with anaemia ($p<0.05$). This study indicated that prevalence of anaemia was high in adolescent students in Jaffna Zonal Schools and the anaemia is a severe public health problem among G.C.E. (A/L) students in Jaffna zone. The female students and students from urban areas are more anaemic. The prevalence of anaemia was influenced by gender, sector and household size in this region.

Keywords: Anaemia, Gender, Albumin, Urban and Rural sector.

I. Background And Objective

Anaemia is a condition characterized by a decrease in the concentration of hemoglobin in blood. Hemoglobin is necessary for transporting oxygen to tissues and organs in the body to prevent hypoxic condition. The reduction in oxygen availability to organs and tissues when hemoglobin levels are low is responsible for many of the symptoms experienced by anemic people. The consequences of anaemia in adolescents include general body weakness, frequent tiredness, and lowered resistance to disease. Furthermore, Anaemia is a global public health problem affecting both developing and developed countries with major consequences for human health as well as social and economic development. It occurs at all stages of the life cycle, but is more prevalent in pregnant women and young children [1]. Very few studies have been carried out in Jaffna on adolescents, even though approximately one fifth (17%) of the population fall into this group, as defined by World Health Organization [12].

Anaemia is classified as mild, moderate or severe based on the concentrations of hemoglobin in the blood (Table 1). The threshold depends mainly on age, gender, physiological status of the person. Severity of anaemia in terms of public health significance in an area is classified as mild, moderate and severe public health significance based on the WHO criteria (Table 2) [12].

Table 1: Thresholds of stages of anaemia

Stages of Anaemia	Anaemia measured by hemoglobin (g/dL)	
	Male	Female
Severe Anaemia	<9.0	<7.0
Moderate Anaemia	9.0–11.9	7.0–9.9
Mild Anaemia	12–12.9	10–11.9

Source: [13]

Table 2: Public health significance of anaemia

Prevalence of Anaemia (%)	Category of Public Health Significance
≤4.9	No public health problem
5.0–19.9	Mild public health problem
20.0–39.9	Moderate public health problem
≥40.0	Severe public health problem

Source: [12]

Nutritional Anaemia caused predominantly by iron-deficiency and anaemia is inextricably linked with people's nutritional status and hunger. Vitamin A, B Vitamins, folic acids, copper, zinc and selenium has their interactions in etiology anaemia [8].

The G.C.E. (A/L) students among the adolescent group are at a phase of highly demanding and competitive educational program. Their performance at this period will decide their future life and majority are under emotional stress, which is then coupled with unbalanced diets resulting in poor nutrition and health. Health is strongly associated with educational achievement [9]. Furthermore adolescents are considered to be a nutritionally vulnerable segment of the population. A rapid growth rate combined with a marginal nutrient intake increases the risk of nutritional deficiencies in this population [5]. The prevention and correction of micronutrient deficiencies among adolescents have become critical goals because of their negative consequences, which include decreased immunity, increased morbidity and impaired cognitive performance. It is important to

ensure that a satisfactory nutritional status is maintained especially in adolescent girls in order to meet the nutritional and physiological stresses in their later life of pregnancy and lactation [10]. Thus, the aim of the study was to determine the prevalence of anaemia and assess the relationships of the Socio-demographic factors with anaemia in adolescent students in Jaffna Zonal Education.

II. Subjects And Methods

2.1. Study area

The study area is Jaffna zonal division of Education, situated in Jaffna district of Northern most part of Sri Lanka, which comprises the major part of the peninsula.

2.2. School setting

There are 27 schools with Advanced level classes located in this zone, of which twenty schools were selected randomly, which included 4 National and 16 Provincial schools. The schools with Advanced Level classes are classified as 1C (Arts and Commerce) and 1AB (Arts, Commerce, Mathematics and Bio) based the streams available in the schools.

2.3. Sampling

The target population was G.C.E. Advanced Level students who sat for the G.C.E. Advanced level examination in 2012 and 2013 as first attempt in Jaffna Zonal schools. To find out the minimum number of subjects to be recruited to demonstrate a statistically significant association of anaemia, formula of $[z^2p(1-p)/d^2]$ was used and sample size was 396 after adjusted with non-respondent. Information about the total number of students in each school and gender ratio was used to obtain the total number of students to be involved in the study proportionately. Accordingly, sampling frame was prepared by collection of all students based on the registration order with class wise. Then the required numbers of students were randomly selected from each class. Students were randomly selected from each class by visiting the twenty schools.

2.4. Ethical issues

The ethical approval was obtained from Ethical review committee of Faculty of Medicine, University of Jaffna and ethical principles were observed throughout the research. A consent form explaining purpose and procedure of the study translated in Tamil was given and the informed consent was obtained from the students (above 18years) and parents of the students (students below 18 years).

2.5. Data collection

A teacher from each school and the students were invited to Faculty of Medicine, University of Jaffna. Height and weight were measured by using SECA 881 weighing scale and SECA 213 stadiometer respectively. Each student filled an interviewer administered questionnaire which contained household information, socio-economic factors and demographic information. Blood was collected for the analysis of serum albumin and blood hemoglobin concentration.

2.6. Sample analysis

Blood hemoglobin and serum albumin were estimated by cyanmethaemoglobin [11] and Bromocresol green dye binding methods [3] respectively by using Semi-Automated Biochemical analyzer (Teco Diagnostic:TC-3300, USA).

2.7. Statistical analysis

Data pertaining to questionnaire were entered and analyzed in SPSS version 16.0. The association between nutritional status, socio-demographic and socio-economic factors was tested using the chi-squared test. Student t-tests were used to compare the prevalence of deficiencies and their differences between groups. Pearson correlation coefficients were used to investigate the relationship between anaemia associated factors. Pearson's Product Moment Correlation test was carried to assess significant directional relationship (correlation) between the two variables and *r* value (the correlation coefficient) gave strength and direction. All statistical tests were carried out at the 5% significance level.

III. Results and Discussion

3.1. Characteristics of study population

Of the 396 students, 48.2% (n191) were males. Their age ranged from 15 to 18 years. Mean (±SD) height and weight of the study population was 162.31 (±8.23) cm and 51.90 (±10.71) kg respectively. BMI-for-age z score was significantly higher in female (-0.68) than that in male students (-0.98) ($p=0.013$) (Table 3). The prevalence of stunting was 8.8% (10.4% in males and 7.4% in females); out of which 0.7% (1.6% in males and 0% in females) was severely stunted. The prevalence of thinness was 14.9% and the prevalence of severe thinness was 3.4%. The prevalence of overweight was 8.3% and the prevalence of obesity and severe obesity were 1.2% and 0.2% respectively. Thinness was significantly high in males (19.7%) than in females (10.6%) ($p<0.05$).

The numbers of students residing in urban areas [46.0% (n182)] were lower than those residing in rural areas [54.0% (n214)]. Among the adolescent students, 38.1% (n151) were from National Schools. Majority of the students were living with their parents [95.2% (n377)] while the others living with relatives [3.0% (n12)] and others (friends, in hostels and Children homes) [1.8% (n7)] (Table 4).

3.2. Anaemia and correlates

The mean hemoglobin (±SD) level of male and female students were 13.97 (±1.26) and 12.23(±1.34) g/dL respectively and males had higher hemoglobin level than female students ($p< 0.001$). The mean hemoglobin level was significantly higher in students from the families with less than or equal to 5 members [13.12 (±1.57) g/dL] when compared with those from families with more than 5 members [12.85(±1.53) g/dL], ($p<0.05$).

Prevalence of anaemia was 32.6% [Mild, Moderate and severe anaemia was 26.8% (n106), 5.6% (n22) and 0.3% (n1) respectively]. Anaemia is more pronounced in female than in male students [20.4% in males and 43.9% (severe public health problem) in females; $p<0.001$]. Among the female students, prevalence of mild anaemia and moderate anaemia were 38.0 and 5.9%, respectively.

Table 3: Anthropometric indices of the study sample[1]

Anthropometric indices	Sex		Total (*n*396) Mean (±SD)	t-test[2]	*p*-value
	Male (*n*191) Mean (±SD)	Female (*n*205) Mean (±SD)			
Height (cm)	168.46 (±6.23)	156.58 (±5.16)	162.31 (±8.23)	20.736	<0.001
Weight (kg)	55.79 (±11.76)	48.29 (±8.13)	51.90 (±10.71)	7.422	<0.001
Height for Age Z-Score	-0.96 (±0.82)	-0.96 (±0.78)	-0.96 (±0.79)	0.044	0.965
BMI for Age Z-Score	-0.98 (±1.30)	-0.68 (±1.10)	-0.83 (±1.21)	-2.496	0.013

[1]Height-for-age and BMI-for-age Z-scores derived from Anthroplus version 1.0.4 based on the WHO growth reference, 2007 for 5-19 year; [2]two-sample t-test comparing males and females.

Table 4: Socio-demographic correlates of anaemia among G.C.E. (A/L) adolescent students in Jaffna zonal division of education

Description of the study population	No. (%)	Anaemia No (%)	% within anaemia
Sector			
Urban	182 (46.0)	65 (35.7)	50.4
Rural	214 (54.0)	64 (29.9)	49.6
Gender ***			
Male	191 (48.2)	39 (20.4)	30.2
Female	205 (51.8)	90 (43.9)	69.8
Age			
16	76 (19.2)	28 (36.8)	21.7
17	211 (53.3)	62 (29.4)	48.1
18	108 (27.3)	39 (36.1)	30.2
School Type			
1AB	339 (85.6)	109 (32.2)	84.5
1C	57 (14.4)	20 (35.1)	15.5
School Status			
Provincial Schools	245 (61.9)	83 (33.9)	64.3
National Schools	151 (38.1)	46 (30.5)	35.7
*Household size**			
≤ 5 members[a]	248 (62.6)	77 (31.0)	59.7
> 5 members	148 (37.4)	52 (35.0)	40.3
*Distance from the school**			
Within 2 km	213 (53.9)	81 (38.0)	63.3
2 to 10 km	149 (37.7)	38 (25.5)	29.7
10.1 to 20 km	23 (5.8)	4 (17.4)	3.1
Above 20 km	10 (2.5)	5 (50.0)	3.9
*DS Division of School***			
Jaffna	144 (36.4)	63 (43.8)	48.8
Nallur	176 (44.4)	43 (24.4)	33.3
Kopay	76 (19.2)	23 (30.3)	17.8

* p<0.05, ** p<0.01, *** p<0.001 significance level of difference.
[a]Mode of the household size.

Prevalence of anaemia among students from urban areas was 35.7% (n65) while the prevalence of anaemia among students from rural areas was 29.9% (n64). Almost half of the females from urban sector (49.5%) were anemic while the prevalence of anaemia among female from rural sector was 39.5%.

Prevalence of anaemia was significantly high among students who had been studying in the schools of Jaffna District Secretariat (DS) division [Jaffna–43.8%, Kopay–30.3% and Nallur–24.4% ($p<0.01$)]. Prevalence of anaemia among students from National schools was 30.5% (n46) while the prevalence of anaemia among students from Provincial schools was 33.9% (n83) (Table 4).

Table 5 shows the prevalence of anaemia and albumin deficiency (<3.5g/dL) by age and gender. There was no significant association between anaemia and age. (*Pearson's chi squared trend* $p>0.05$). Prevalence of anaemia among students aged 16, 17 and 18 years was 36.8, 29.4 and 36.1% respectively.

In this study population, the mean (±SD) of albumin concentration was 3.73 (±0.3) g/dL (in males-3.81; in females-3.67; gender difference $p<0.001$). Serum albumin level was increased with increasing Hb level (Pearson Correlation= 0.125; p=0.014).

According to the Demographic Health Survey (DHS), 2009, the prevalence of anaemia in females aged 15-19 years was reported as 31.4% [2]. Prevalence of mild, moderate and severe anaemia in females of this age group were 28.9%, 2.5% and 0.0%, respectively [2]. Further, prevalence of anaemia among females from urban sector was higher than females from rural sector (43.9% and 38.4%) respectively [2]. These data are similar to the findings of the present study.

Table 5: Hemoglobin and albumin status with the prevalence

Age (Years)	Sex	Hb (g/dL) Mean (±SD)	*p*-value[1]	Prevalence of Anaemia	*p*-value[2]	Albumin Level (g/dL) Mean (±SD)	*p*-value[3]	Prevalence of Albumin Deficiency	*p*-value[4]
16	Male	13.7 (±1.6)	0.222	28.6 (*n*10)	0.167	3.8 (±0.30)	<0.001	14.3 (*n*30)	0.335
	Female	12.3 (±1.3)		43.9 (*n*18)		3.7 (±0.28)		23.1 (*n*30)	
17	Male	14.1 (±1.1)	0.001	17.8 (*n*18)	<0.001	3.8 (0.33)	<0.001	14.3 (*n*84)	0.126
	Female	12.3 (±1.3)		40.0 (*n*44)		3.7 (±0.26)		22.6 (*n*82)	
18	Male	13.8 (±1.3)	0.001	20.4 (*n*11)	0.001	3.8 (±0.30)	<0.001	13.2 (*n*46)	0.012
	Female	12.0 (±1.5)		51.9 (*n*28)		3.6 (±0.27)		34.0 (*n*35)	
Total	Male	14.0 (±1.3)	<0.001	20.4 (*n*39)	<0.001	3.8 (±0.32)	<0.001	13.9 (*n*161)	0.004
	Female	12.2 (±1.3)		43.9 (*n*90)		3.7 (±0.27)		25.8 (*n*147)	

[1]$p<0.05$ significance of two-sample t-test comparing the mean haemoglobin between males and females,
[2]the prevalence of anaemia between males and females, [3] mean albumin between males and females and
[3]prevalence of albumin deficiency between males and females.

However, higher prevalence of anaemia has been reported from Galle district, (49.5% in males and 58.1% in females, overall 54.8%, gender difference, p=0.004) [5] which significantly differed from this study ($p<0.05$).

The prevalence of anaemia among adolescents in developing countries is reported as 27% [4]. However, in India the prevalence of anaemia was found in Vellore and Wardha to be 44.8 [6] and 59.8% [7]. Hence the prevalence of anaemia still exists in the adolescent population especially in the developing countries. Factors significantly associated with anaemia were gender ($p<0.001$), DS division of the school ($p<0.01$), Distance from the school ($p<0.05$).

IV. Conclusion

This study revealed that, the prevalence of anaemia was high in adolescent students in Jaffna Zonal Schools. This finding demonstrates that the anaemia is a moderate public health problem among G.C.E. (A/L) students in Jaffna zone (32.6%). Based on this studies female students and students from urban areas are more anaemic than male students and students from rural areas. Household size and gender were significantly associated with Haemoglobin level. Furthermore, the factors significantly associated with anaemia were gender, DS division of the school and distance from the school. As a result, an interventional program should be initiated to minimize the prevalence and associated factors for anaemia in this region for the development of normal physical and mental status of adolescents.

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