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Prevalence of Anaemia and Nutritional status of Adolescent Students in Tellipalai Medical Officer of Health (MOH) Area, Jaffna: a preliminary study

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Abstract: Adolescents are tomorrow's adult population and their health and well-being are crucial. The aim of the study was to assess the prevalence of anaemia and nutritional status of adolescent students in Tellipalai Union College located in Tellipalai MOH area. A cross sectional descriptive study was carried out and a total of 170 students were recruited from aged 12-19 years. Anthropometric measurements were obtained and an interviewer-administered questionnaire was used to collect the details on socio-demographic and economic status and dietary pattern. The number of males and females were 100(58.8%) and 70 (41.2%) respectively. Mean (\pm SD) age of the male and female students were 15.4 (\pm 1.8) and 16.1(\pm 2.0) in years respectively. The mean (\pm SD) hemoglobin (Hb) level for males and females were 12.67(\pm 0.12) and 11.81(\pm 0.14) g/dL respectively (p <0.001). Mean (\pm SD) of serum ferritin concentration was 8.62 (\pm 8.07) μ g/dL with range between 0.2 μ g/dL-39.1 μ g/dL. Mean (\pm SD) of PCV, MCV, MCH and MCHC were 40.47 (\pm 4.14) %, 86.79 (\pm 7.3) femto litre, 26.56 (\pm 2.28) pg/cell and 30.49(\pm 3.05)g/dL respectively. Among the 170 students, 56.5% (n=96) of the students was affected with anaemia (Hb=<13g/dL in males and <12g/dL in females). In this study, 22.4 (n=38), 56.4 (n=95) and 56.5 % (n=96) of students had low PCV (<36% for female; <38% for male), low MCH and low MCHC respectively. Among the anaemic adolescents, 60.8% (n=87) was affected with iron deficiency anaemia (serum ferritin <15 μ g/dL in males and serum ferritin <12 μ g/dL in females) and prevalence of iron deficiency anaemia was 34.4%. Prevalence of stunting (<-2SD of height-for-age), thinness (<-2SD of BMI-for-age) and overweight (>+2SD of BMI-for-age) were 11.3, 20.8 and 0.6% respectively. Under logistic regression model, gender, income, educational level of parents and low consumption of leafy vegetables were significantly associated with anaemia (p <0.05). This study revealed that, prevalence of anaemia and undernutrition were observed to be high in this population and main cause of the anaemia is iron deficiency. Moreover, the selected associated factors such as gender, income, educational level and low consumption of leafy vegetables were influencing on anaemia.

Keywords: Adolescents, Anaemia, Blood indices, Stunting and Thinness.

I. INTRODUCTION

Adolescent students are the future generations of any country and their nutritional needs are critical for the wellbeing of the society. This group faces a series of serious nutritional challenges not only affect their growth and development but also their livelihood as adults [1]. Adolescence is a particularly unique period in life because it is a time of intense physical, psychosocial and cognitive development [2]. In addition, their performance at this period will decide their

future life and majority are under emotional stress, which is then coupled with unbalanced diets result in poor nutrition and health. Health is strongly associated with educational achievement [3]. Adolescents remain a largely neglected, difficult to measure and hard to reach population, in which the needs of adolescent girls are often ignored [4]. Among adolescents, girls are more vulnerable, particularly in developing countries due to various adverse socio-cultural and economic reasons. They are future mothers to-be and nutritional problem

of any adolescent girls may have adverse effect on nutritional status of future generations [5].

There are multiple causes of anaemia which make it difficult to identify the significance of each factor on its own [6]. Inadequate production of normal red blood cells by the bone marrow due to nutritional deficiency; excessive destruction of red blood cells due to haemolysis; blood loss due to haemorrhage can cause anaemia. Accordingly, anaemia can be categorized into nutritional anaemia (iron deficiency, vitamin B₁₂, folic acid, B₆ and copper, etc.), anaemia of chronic disease, chronic parasitic infection, and congenital haemolytic diseases [7]. However, iron deficiency is the most common nutritional cause of anaemia in most parts of the world. It can be classified into three stages, according to its severity. In the earliest stage, iron stores may be depleted. The next stage involves decreased serum iron and increased iron-binding capacity but without overt anaemia. In the latest stage, haemoglobin synthesis is impaired with the development of frank anaemia [6]. When anaemia prevalence reaches 50%, the proportion of individual with iron deficiency is about double those with anaemia. Iron deficiency may result from insufficient absorption of iron due to decreased bioavailability of iron in the diet or increased body requirements (growth) or both [8].

In the modern world, attitude of adolescents are changed and their energy intake is greater than expenditure. Because of the busy schedule of life nowadays the attractions towards fast foods are increased, adolescents fail to take foods rich in iron and many essential nutrients, which lead them to be affected by anaemia.

Already some researchers have been done on anemia in pregnant mothers [9] and among the G.C.E (A/L) students [10] and they found that, prevalence of anemia is observed to be high. Adolescents subjected to anaemia look pale and they are less active and lazy in doing their day today activities, which affect their personality and performance in the school and in their home also.

Thus this preliminary study is aimed to determine the prevalence of anaemia and nutritional status of adolescent students who attending Tellipalai Union College, Tellipalai MOH area, Jaffna.

II. METHODS

Setting

A descriptive cross sectional study design was conducted. The study area was Tellipalai Medical Officer of Health (MOH) area which is one of the 12 MOH areas in Jaffna District.

Study population

Study population is all the adolescent students attending Tellipalai Union College, Tellipalai, Jaffna.

Sample size & Sampling method

The sample size was 170. A Multi-stage cluster random sampling procedure was adopted to select target adolescents proportionate to population size. The Primary Sampling Unit (PSU) was Tellipalai Union College where the students attended varies places in Tellipalai MOH division. From the PSU, required numbers of clusters [Secondary Sampling Units (SSU)] were selected (8 classes). From a SSU, a division from each grade was selected and required number of students were randomly selected from each division based on the exclusion criteria, and students affected with any kind

of illness during the date of data collection were not considered.

Data collection tools and techniques

Data regarding participants' socio-demographic and economic characteristics and dietary pattern via 24-hour dietary recall were collected by using a structured interviewer administered questionnaire. From each student, 5mL of blood sample was withdrawn via venipuncture and transported to the Laboratory of the Department of Biochemistry and to the Department of Medicine with ice box (0-4°C). From the blood sample, the haemoglobin (Cyanmethaemoglobin method), ferritin (ELISA method), packed Cell Volume (PCV), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC) were obtained by using fully automated haematological analyser at Department of Medicine, Teaching Hospital Jaffna.

The weight and height of the students were measured according to standard WHO procedures [11] and those were used to compute age and sex specific BMI-for-age z-scores to detect thinness, stunting, and overweight [8].

Ethical considerations

Ethical clearance was obtained from the Ethical Review Committee (ERC), Faculty of Medicine, University of Jaffna, Sri Lanka. Written informed consent was obtained from the parents of participating students.

Statistical analysis

Results are presented as means \pm standard deviation (SD) and frequencies as well as percentages. Comparisons between two means were conducted using Student's t-test for continuous variables. The chi-square test

was used to compare some selected categorical variables. All statistical analyses were performed using IBM SPSS Statistics for Windows, Version 21.0 (Armonk, NY: IBM Corp.). P-value less than 0.05 was considered statistically significant.

III. RESULTS

A total of 170 adolescent student samples were analyzed among 100 (58.8%) were males and 70 (41.1%) were females. Mean (\pm SD) age of the male and female students were 15.4 (\pm 1.8) and 16.1 (\pm 2.0) in years respectively. In this study, 56.5% (n=96) of them were anemic of which 65.6% (n=63) males (Hb \leq 13.0g/dL) and 34.4% (n=33) females (Hb \leq 12.0g/dL). Among the anaemic students, majority [38.2% (n=65)] of the adolescents were mildly anaemic (Table 1).

Table 1: Prevalence of anemia with severity and gender variation.

| Gender | mild anemia* No. (%) | moderate anemia** No. (%) | severe anemia*** No. (%) | Total No. (%) |
|--------------|-------------------------|------------------------------|-----------------------------|------------------|
| Male | 34 (52.3) | 29 (96.7) | 0 (0) | 63 (65.6) |
| Female | 31 (47.7) | 1(3.3) | 1 (0.6) | 33 (34.4) |
| Total | 65 (38.2) | 30 (17.6) | 1 (0.6) | 96 (56.5) |

*Haemoglobin concentration \leq 12.9g/dl in male and \leq 11.9g/dl in female

** Haemoglobin concentration 9.0–11.9g/dl in male and 7.0–9.9g/dl in female

*** Haemoglobin concentration $<$ 9.0 g/dl in male and $<$ 7.0 g/dl in female

The mean (\pm SD) hemoglobin (Hb) level for males and females were 12.67(\pm 0.12) and 11.81(\pm 0.14) g/dL respectively and males had a higher mean Hb level than females (p $<$ 0.001).

Prevalence of stunting ($<$ -2SD of height-for-age), thinness ($<$ -2SD of BMI-for-age) and overweight ($>$ +2SD of BMI-for-age) were 11.3, 20.8 and 0.6% respectively. The adolescents within the normal Body Mass Index (BMI) range, 29.4% of adolescents

were affected with anaemia while among the thinness and stunted students, 17.6 & 9.4% were affected with anaemia respectively. Moreover, Overweighed participants also have affected with anaemia (0.6%). This explains that, occurrence of anaemia was not associated with BMI in this study.

Mean (\pm SD) of PCV, MCV, MCH and MCHC were 40.47 (\pm 4.14) %, 86.79 (\pm 7.3) femto litre, 26.56 (\pm 2.28) pg/cell and 30.49(\pm 3.05) g/dl respectively. Among the 170 students, 22.4% (n=38) were having low PCV (<36% for female; <38% for male). Among the students with low PCV, all students were affected with anaemia based on the haemoglobin cut off values.

Most of the students had low MCH (56.4%). Among them most were anemic (37.65%). Among the students most of them were not anemic (24.71%).

Students with low MCHC were 56.5%. Among them high amount of students (66.6%) were anemic. Within them 40.6, 25 and 1% were mild, moderate and severe anemic respectively. Prevalence of anemia was increasing with decreasing MCH.

Mean (\pm SD) of serum ferritin concentration was 8.62 (\pm 8.07) μ g/dL with range between 0.2 μ g/dL-39.1 μ g/dL. Geometric mean of the ferritin was 10.35 μ g/dL. Among the anaemic adolescents, 60.8% (n=87) was affected with iron deficiency anaemia (serum ferritin <15 μ g/dL in males and serum ferritin <12 μ g/dL in females).

Among 170 students, most of students consumed vegetables. The prevalence of anemia among the students who did not consume Vallarai, Pasali, Mulzhaikeerai, Akaththi, Ponnangaanni were 56.5, 56.1, 59.4, 56.6 and 56.7% respectively.

Under logistic regression model, gender, income, educational level of parents and low consumption of leafy vegetables were significantly associated with anaemia ($p < 0.05$) while the chronic illness such as respiratory tract infection was not associated with anaemia.

IV. DISCUSSION

In this study, 20.8% of adolescent students were affected with undernutrition (Thinness). A study was conducted in Kandy, Sri Lanka and they found that, the prevalence of thinness (<5th percentile) was 49%, the prevalence of risk of overweight (85th -95th percentile) was 6.5%, and prevalence of overweight (>95th) was 2.1% [12]. In Kalutara District, the prevalence of thinness (< 5th percentile) was 35.4% (n=226) and those at risk of overweight (\geq 85th percentile) was 6.7% (n=43) [13]. Another study in Kalutara revealed that, the prevalence of thinness (<5th percentile) was 35.4% and the prevalence of being at risk of overweight (\geq 85th percentile) was 6.7% [14]. All these studies explained clearly, the adolescent population was significantly affected with undernutrition.

Even though the only one student was found to be overweight, he was affected with anemia. This reveals that, the students might more concern about the consumption of macro nutrition rather than micro nutrition. However from this study we could realize that we didn't encounter significant samples of overweight/obese students to analysis anemia among them. In this study, undernourished adolescents were highly affected with anaemia when compare to the well-nourished adolescents. But in other studies regarding BMI and anemia, the frequency of anemia was significantly lower among overweight & obese students than normal/thinning/stunting students [15].

A study on 'Prevalence of iron deficiency anemia among adolescent girls and its risk factors' conducted in Tangail region of Bangladesh on June 2014, also stated that among overweight and obese population, no any girls had anemia and most of the anemic student were underweighted [16]. Of the total study population 56.5% were anaemic where 65.6% were males and 34.4% were females. The prevalence of mild, moderate and severe anemia were 38.2, 17.6 and 0.6% respectively. In contrast to that, other researches had revealed that prevalence of anaemia is higher among females than in males [9], [10]. The mean haemoglobin value from other researches is higher for males than females [10] as the finding of this study. Even though our research results showed that, higher mean haemoglobin value for males than females the prevalence of anaemia among adolescents was higher for males than or females according to haemoglobin concentration in Tellipalai MOH area.

Our findings showed that thinness students have affected with high percentage of anemia than that of normal ones. So thinness also can be considered as a factor influencing anemia.

In PCV based analysis of anaemia, all the students with low PCV were affected with anemia based on Hb. In addition to that, within normal PCV level, most of students are normal. Chance of getting anemia was increasing with decreasing of PCV. Thus PCV is a good indicator of anemia [17]. Based on the PCV cut off value, most of the male were affected with anemia. However in this population, the anaemia was detected by Hb and PCV was 56.5 and 26% respectively.

With MCH based analysis most of students with low MCH are anemic and high MCH

level students are normal. MCH also can be used as an indicator but it is not a good indicator [17]. Based on the MCHC analysis in both low MCHC level and high MCHC level students had obtained anemia in high percentage.

According to the age groups, the prevalence of anemia is varies. Among the 170 adolescents, 96 were anemic (56.5%) and 74 were normal (43.5%). So, most of the adolescents with varies age group were affected with anemia. This may be due irregular and lack of consumption of meals which contains more iron and vitamins due to their ignorance and less diversity in the meal.

According to the sex difference, there was a significant difference ($p < 0.05$) among the males and females with regard to the prevalence of anemia. More males were affected with anemia than the females. Family income and the family background may have influenced in anaemia [18].

Dietary assessment is based on the food intake per person. The dietary history is an essential part in of the nutritional assessment of adolescence. We assessed their nutrient consumption based on input given by 170 adolescents in order to find a relationship between the dietary pattern and risk of acquiring anemia. Anaemic students consumed less frequency of vegetables and fruits compared with non-anaemic adolescents.

V. CONCLUSION

This study concluded that, the prevalence of anaemia and undernutrition are high among the students of Union College, Tellipalai MOH area in Valikamum, Jaffna and this is found that, prevalence is higher than that of the previous studies which were reported from Jaffna. Based on the PCV, MCV,

MCH, MCHV the type of the anaemia is microcytic. In addition to that, more than 50% of the students were affected with anaemia and iron deficiency is the major cause for anaemia. In this study, the prevalence of anaemia among the

adolescence males is higher than that of females.

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