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**PREVALENCE OF IRON DEFICIENCY ANAEMIA IN
GIRLS (4-17 YEARS) IN NORTHERN PAKISTAN**

By

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ABSTRACT

A total of 658 schoolgirls ranging from 4 to 17 years of age, belonging to a low socio-economic group, were randomly selected from ten different schools near Rawalpindi and Islamabad, Pakistan

The weights of the Pakistani girls conformed-closely to the Indian standards, yet they weighed less than the WHO standards in all age groups and diverged increasingly after about age 10. When weights for all ages were expressed in terms of WHO Z scores the sample population was shifted to the left by 1 standard deviation. The weight-for-age Z score of the girls 4 to 10 years old ranged from -2.93 to $+1.02$ with a mean value of -0.84 and S.D of 0.85; 8% (n=23) of these young girls were under-weight or wasted. The BMI was calculated for girls 11 to 17 years of age. The mean BMI was 17.81 (SD 3.08) kg/m^2 ; 21% (n=80) were underweight or wasted.

The heights of these Pakistani girls conformed-closely to the Indian standards with minor, deviation in older age groups. They were shorter than the WHO standards in all age groups and diverged increasingly after about age 10. The height-for-age Z score of the girls 4 to 10 years old ranged from -6.88 to $+4.55$ with a mean value of -0.50 (SD 1.22); more than 8% (n=24) of these young girls were stunted. The height-for-age Z score of the girls 11 to 17 years old ranged from -4.6 to $+1.6$ with a mean value of -1.3 and (SD 0.87); more than 15% (n=58) of these girls were stunted.

Blood was collected and analysed for haemoglobin (Hb), hematocrit (Hct), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC), Serum iron, Total Iron Binding Capacity (TIBC), Transferrin saturation and Serum ferritin. The results showed that 23.7% of the girls were anaemic (Hb WHO, 1968); 21% (n=109) suffered mild to moderate anaemia while 2.7% (n=14) suffered severe anaemia. The hematocrit of 18.7% of girls was low. The RBC count of 17.2% of girls was lower than normal. The MCV, MCH and MCHC were low for 17.7%, 33.3% and 42.4% of girls, respectively. Serum

iron results showed that 15.3% of girls were below the normal level, while 20.4% of girls had abnormal total iron binding capacity. In the case of transferrin saturation, 38.5% of girls were below the normal range. Serum ferritin tests were carried out for an age stratified, random sample of 168 girls. 42.3% (n=71) of the girls had depleted iron stores. In the absence of C reactive protein, a higher cut-off point of $< 20\mu\text{g/l}$ was used (Cook and Finch, 1979, Ahmed et al., 2000) which suggested that 79.6% of the girls were iron depleted.

Mean haemoglobin values by age group improved with age. Mean MCHC fell slightly with age. Iron stores improved from the age of five years, but fell from about 8-10 years of age. Therefore, the steady increase of haemoglobin with age did not reflect underlying iron balance. At the age of 16-17 years, when the girls are about to leave school, 21% of the girls were anaemic, 42% had low MCHC, 29% had low serum iron, 26% had increased TIBC, 56% had low transferrin saturation and 55% were iron deficient. In near future, one-third of these girls could expect to get married soon after leaving school and get pregnant. So, about 55% of these girls would be at risk of iron deficiency during pregnancy.

Twenty-four-hour dietary recall was recorded for all girls. Nearly all girls consumed cereals daily. The commonest pattern of dietary intake was to consume vegetables with the cereals. Approximately 34% of the girls ate vegetables with cereals while 1.3% ate cereals only; 29.5% ate meat but only 9% ate fruit. Approximately 34% consumed pulses and 16% consumed milk or eggs. Tea consumption varied from one (7%) to three (8.6%) cups daily with a mean value of 2.02 (SD 0.39) cups. Mean nutrient intake of girls increased with age and reached the Recommended Daily Allowance (RDA) for protein and vitamin C in the case of older girls only. The majority of girls 583 (88.9%) drank tea in the morning.

In the absence of a Pakistani RDA for a nutrient, the Indian or US RDA was used. Since, the Indian and Pakistani eating pattern is similar therefore, Indian RDA for iron was used for final analyses. Iron intake of the girls ranged from 9% to 69% of the Indian RDA. The

energy and protein intake ranged from 19% to 99% and 29% to 169% respectively of the Pakistani RDA. The vitamin C intake ranged from 9% to > 400% of the Indian RDA, while dietary fibre intake ranged from 29% to 399% of the US RDA. The intakes of calcium, zinc, thiamine, riboflavin, retinol, beta-carotene and niacin were also compared with their respective Recommended Daily Allowance.

A total of 180 girls (27.4%) in this study sample were menstruating. The age at menses ranged from 11 to 16 with a mean of 13.1 (SD 0.9) years. The bleeding days ranged from 2 to 10 with a mean of 5.5 (SD 1.4) days. The daily use of sanitary pads (pads) ranged from 1 to 4 with a mean of 1.9 (SD 0.7) pads. Frequency of menstrual cycle ranged from 21 to 60 days with a mean of 30.2 (SD 4.5) days. Six girls (3.3% of menstruating girls) reported heavy bleeding, five girls (2.8% of menstruating girls) had irregular menstrual cycles and fourteen girls (7.8% of menstruating girls) had delayed or no menses for two to five months. The mean serum ferritin values for menstruating and non-menstruating girls were 14.8 μ g/l (SD 13.21) and 18.3 μ g/l (SD 13.61) respectively. Using a cut-off point < 12 μ g/l, 37.1% of non-menstruating and 56.8% of menstruating girls had depleted iron stores.

The relationship between age, height, menstruation, haematological and serum indices showed that at 12 and 13 years of age, the post-menarche girls were somewhat taller than those of pre-menarche. At 12 years of age, the post-menarche girls had better iron stores than those who were pre-menarche but iron stores fell rapidly thereafter. The knowledge of anaemia in the sample was negligible.

It is concluded that the magnitude of anaemia (24%) of this study confirmed the results of National Nutrition Survey 1988 and showed that there had been no improvement in control of anaemia after lapse of more than one decade. Overall dietary intake of girls was very low for nearly all the nutrients. Overall iron intake was low and heme iron intake was negligible. High intake of dietary fibre (phytate) and low intake of fruits (vitamin C) would have inhibited absorption of iron. Culture and tradition had adverse effects on girls' dietary intake. Low purchasing power had adverse effects on meat

consumption. Iron deficiency increased with rapid growth and menstruation. Lack of knowledge was also an important factor contributing to anaemia. This low-income population has little capacity to change the pattern of their diet or nutrient intake. Both education and supplementation before puberty are required. Iron deficiency needs to be addressed in the context of overall low nutrient intake although not in isolation.

Key Words: Pakistan, Anaemia, Iron, Adolescence, Girls.