FOOD AND NUTRITION NEWS

Acharya N.G. Ranga Agricultural University

Vol. 2 APRIL 1997 No. 1

Iron Nutritional Status and Work Performance

Iron deficiency anaemia (IDA) and lesser degrees of iron is the most prevalent micronutrient deficiency in the world, affecting an estimated 2000 million people both in developed and developing countries. Iron is an essential element for the formation of haemoglobin (Hb) of red cells and in modulating several cellular functions. Iron deficiency causes a reduction in number of RBC or the amount of circulating haemoglobin, hence, iron nutritional status is measured by Hb levels (< 11g/dl as anaemic). Multiple factors contribute to IDA, but the immediate cause is inadequate bio-availability of iron in the diet. Inadequate iron intake, low bio-availability and iron loss lead to negative iron balance. Increased iron requirements during rapid growth periods, iron loss during menstruation and iron transfer to featus during pregnancy cause iron deficiency. Inadequacy of folic acid, Vitamin C, Vitamin A, and Protein in the diet also contribute to its insufficiency. Parasitic infestations, Malaria, Chronic infections and genetic factors may also cause anaemia.

The consequences of IDA vary with the age group. Its wide spread prevalence among pregnant and lactating women in child bearing age, lead to higher mortality and morbidity rates in mothers and low birth weight and other health complications among the new born. In preschool children, potentially irreversible impaired mental development results in impaired attention span and cognitive development. Poor memory and decreased academic performance including reading knowledge and vocabulary have been reported in iron deficient children. Up to 25% of all men are also iron-deficient, which impairs their work capacity and productivity. Iron deficiency causes thermogenesis i.e. inability to maintain body temperature, and disturbances in immune system also.

PHYSICAL WORK CAPACITY AND IDA

Physical work capacity was defined as the potential of an individual to engage in activities involving muscle action, ranging from strenuous exercise of short duration to mild exercise of long duration. It is the ability to perform maximal physical work, which varies with intensity and duration of work. The work capacity of an individual is influenced by physical, nutritional and health parameters. The overall determinant is the ability of the body to supply oxygen to the working muscle.

Iron deficiency may impair work performance and exercise capacity in two ways

a) by decreasing the Hb concentration thus the oxygen carrying capacity of blood,

b) by reducing muscular performance due to reduced concentration of iron containing enzymes.

The functional capacity and fitness is the ability to perform physical work. This mainly depends on the efficiency of cardio-vascular, respiratory and neuromuscular systems in relation to function of all the other systems in the body. Total fitness requires adequate muscular strength and endurance, an efficient cardiovascular system with a good level of aerobic fitness.

Pulse rate, cardiac output and oxygen uptake are related to physical work done by an individual. The increased work shows an increase in

the heart rate which is linear to oxygen uptake of heart. At rest in the supine position the cardiac output is 4-6 Lit/min, with an extraction of 40-50 ml of oxygen/l of blood and a total uptake of 0.2 - 00.3 lO_2/Min. During exercise, the stroke volume is reduced and heart rate is increased, therefore, the cardiac output increase with the increase in oxygen uptake, but not linearly. A person who is physically fit can increase the O_2 uptake from 0.25 to 5.0 L/min or more during work or exercise. This O_2 is met by an increase in heart rate from 50-200. The skeletal muscle which receives only 15% cardiac out put in rest, receives 80-85% of cardiac out put during work and utilize the O_2 in the blood. If the exercise becomes heavier the extraction of O_2 from arterial blood is increased.

From stand point of physical work capacity and anaemia, it is important to consider about respiratory adjustments necessary to supply O_2 during work, total blood flow and distribution to heart, and muscle and total O_2 delivery capacity of blood. Hb levels are of fundamental importance in this context, as they determine the capacity of blood to transport oxygen.

Physiological compensatory mechanisms allow even severely anaemic people to continue activities at a lower level of efficiency until decompensation results in congestive heart failure. In anaemic conditions to provide adequate supply of O_2 to the tissues, there will be a reduction in tissues O_2 tension which results in more nearly complete extraction of O_2 from the blood. The other symptoms are increased cardiac output with increased velocity of blood flow. Greater utilisation of anaerobic sources of energy during work was observed.

The measurement of physical work capacity is concerned with cardio-vascular, muscular and respiratory systems. It can be measured at maximal or submaximal grades with determinations of O_2 uptake either directly or by indirect prediction procedures based on heart rates. There are many laboratory modes of exercise like tread mill, bicycle ergometer and step test for measuring physical work capacity. There are no field techniques which are on par with these laboratory tests. Such field techniques for measurement of physical work capacity are being tried in research projects, and improved physical work capacity and productivity has also been observed by iron supplementation, in studies conducted in Acharya N.G. Ranga Agricultural University.

Work Efficiency of Farm Women - Iron Fortified Salt Supplementation

The effect of regular supplementation of iron fortified salt (IFS) for a period of 6 and 12 months on Hb levels and work efficiency in anaemic farm labour women (Hb levels below 11 g/dl) of child bearing age was studied. Work capacity of the subjects was assessed by their ability to pump water and to carry it (50 meters distance) to water a plant for 15 minutes. Pulse rate and blood pressure were noted before and after the work to test the physical endurance capacity.

It was observed that incidence of mild to moderate anaemia was more in the subjects. Only 25 per cent of the subjects were severely anaemic. Subjects with lower Hb levels had a low working capacity with higher pulse rate and blood pressure.

Iron fortified salt (IFS) supplied for 12 months to the subjects to include in their family diet, provided 13.5mg of iron everyday. This improved the iron intake by 62.5 per cent of actual intake.

Table 1 : Supplementation effect on Hb levels and water pumping capacity.

Particulars	Initial	Period of supplementation in months	
		0 - 6	6 - 12
Mean Hb level (g/dl)	8.14	8.94**	9.64**
Water Pumped (Lit/15 Mint.)	72.6	84.0**	93.6**

** P > 0.01

Supplementation with IFS resulted in a significant increase in mean Hb level and all the work capacity parameters of the subjects, compared to their initial levels. (Table 1) A decrease in pulse rate and blood pressure was also observed during the work with an increase in water pumping capacity after supplementation.

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D. Sharada

The Physical Work Capacity of Farm Women

The ability to perform a physical task is influenced by physical, nutritional and health parameters. Farm women are involved in agricultural activities besides their regular work at home. Hence, the work capacity of women in different farms was measured.

Forty subjects were randomly selected from Agricultural, Forage and Dairy farms of Andhra Pradesh Agricultural University, Rajendranagar. Anthropometry, body composition and haemoglobin levels were measured by standard techniques. Physical work capacity was assessed by measuring the heart rate response to work load on a stepping exercise.

Results have shown that sixty four per cent of the subjects were suffering with mild iron deficiency anaemia. Majority of these subjects were mildly under-nourished with a mean body mass index of 18.49±2.08 Kg/m^2. Heart rate response was measured at rest, during exercise (L_1, L_2, L_3) and during three minutes of recovery (R_1, R_2, R_3). A 55 per cent increase from the basal heart rate was found in the subjects. Lower haemoglobin levels and BMI might be Effecting the response of heart to exercise.

The type of activity varied in these farms, hence the physical and physiological response was studied in relation to occupation. A significant difference in the heart rates was found in anaemic subjects (Table 2) who were under a greater stress to perform the same level of exercise than normals. A faster recovery in the anaemics might be attributed to higher level of habitual physical activity. The disadvantage of lower body weight was also found to be compensated by physical activity. Physical activity was the lone parameter which had a major role to play in altering efficiency.

Reshma Syed
D. Sharada

Table 2 : Heart rate response based on haemoglobin levels

Hb level/ HR/minute	n	RHR	L_1	L_2	L_3	R_1	R_2	R_3
		bpm						
> 12	11	81.73±4.58 (72-86)	90.45±6.31 (80-98)	102.09±9.16 (88-112)	115.36±6.45 (107-129)	96.27±5.85 (89-104)	93.54±6.00 (87-103)	89.00±5.91 (80-98)
11 - 11.99	17	83.12±19.25 (78-92)	100.88±10.76 (79-124)	115.11±14.00 (89-148)	133.24±13.9 (116-167)	103.53±10.66 (85-126)	98.29±11.9 (75-121)	94.34±10.39 (72-114)
10 - 10.99	8	83.75±6.71 (74-94)	98.75±8.58 (90-110)	112.75±9.27 (102-129)	129.25±10.19 (116-141)	103.75±11.17 (87-120)	96.62±10.28 (79-108)	90.5±15.15 (87-98)
9 - 9.99	-	-	-	-	-	-	-	-
8 - 8.99	4	80.75±5.19 (76-87)	100.00±5.42 (96-108)	117.00±3.37 (115-122)	138.75±5.85 (134-146)	111.00±8.79 (101-121)	104.75±4.35 (101-111)	100.75±4.99 (97-108)

Figures in parentheses indicate range

Physical Work Performance of Anaemic Adolescent Girls in Rural A.P.

Adolescence is the stepping stone to adulthood in girls. In India the prevalence of anaemia in adolescent girls vary with socioeconomic levels and it is about 40-50%. There is a need to improve the iron nutritional status of adolescents, so that the risk is reduced in adulthood.

A study on measurement of work performance of adolescent girls in 13-15 years is taken up in this centre. To develop a field test for measurement of work performance different tests were employed. The work performance of the girls was compared with a standard test (tread mill), the O_2 consumption and heart rate were recorded. VO_2 max of different grades of anaemic girls in GxT were compared with FxT, and it was observed that except in the severely anaemic there was no significant difference between VO_2 max and 800m run. This reveals that the 800m run can be considered on par with the VO_2 max in GxT when there is positive correlation with submax ($r=0.59$, $P>0.001$) and VO_2 max ($r=0.371$ $P>0.001$). The per cent increase in heart rates during FxT in 800m run was comparable to that of VO_2 max. Therefore the 800m run can be taken as a field technique to test the work performance of rural adolescent girls of 13-15 years age group.

V. Vijaya Lakshmi
D. Sharada

Short Course Held on "Recent Developments in Fruit & Vegetable Processing"

A three week short course on "Recent Development in Fruit & Vegetable Processing" from 3rd - 22nd February, 1997 was conducted at the Centre of Advanced Studies in Foods & Nutrition, Post Graduate & Research Centre - (H.Sc.,), Rajendranagar, Hyderabad. Participants from various state Agricultural Universities viz., from Rajendra

Agricultural University, PUSA, Samasthipur, Bihar; University of Agricultural Sciences, Dharwad, Karnataka; Sri Avinashlinam Institute for Home Science and Higher Education for women, Coimbatore, Tamil Nadu ; ANGR Agricultural University, Andhra Pradesh attended the short course. The participants belong to both the faculties of Home Science and Agriculture (Horticulture). During the three weeks programme not only theory classes on recent developments in processing, but also skill oriented fruit processing demonstrations were arranged along with visits to fruit & vegetable processing Industries. Scientists from CFTRI, Mysore and Hyderabad were invited to deliver talks on recent issues and technologies. ANGR Agricultural University Officials were invited for deliberations at the valedictory function on 22nd February, 1997. Dr. (Mrs.) Vijaya Khader, Director, CAS, welcomed the gathering. Dr. G. Sarojini, Course coordinator, presented report about the short course, Dr. M.V. Rao, Vice-Chancellor was the chief guest, Dr. V. Prabakar Rao, Registrar, presided over the function, Dr. P. Raghavulu, Dean, P.G. Studies distributed certificates to the participants. During his delibeations the Chief guest emphasized the need for processing fruits and vegetables to reduce post harvest losses and to add value to produce. Participants have expressed their utmost satisfaction regarding the course content and its coverage. Dr. V. Vimala proposed vote of thanks at the end.

ANNOUNCEMENT

A short course on "Recent developments in grain processing" will be held from 4-8-1997 to 23-8-1997, by the Centre of Advanced studies, Department of Foods & Nutrition, Post graduate and Research Centre, College of Home Science, ANGR Agricultural University, Hyderabad. Free boarding and lodging will be provided. Nominations of trainees from State Agricultural University teachers may be sent to

The Director
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Rajendranagar, Hyderabad 500 030.

Last date for receipt of Nominations : 1-6-1997

The Food and Nutrition News is published by the Centre of Advanced Studies, Department of Foods & Nutrition, College of Home Science, ANGR Agricultural University. The funds for the centre have been granted by the Indian Council of Agricultural Research, New Delhi.

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