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A study on prevalence of anaemia with respect to body mass index and socio demographic factors among nutrition workers in the District Sangrur

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Abstract
The present work was carried out to estimate the prevalence of anaemia with respect to body mass index and socio-demographic factors among nutrition workers in the District Sangrur of Punjab. For this, a total 70 nutrition workers from the rural areas of two blocks of the district aged between 25-55 years were selected and their haemoglobin (Hb) level was measured using standard method. Body Mass Index (BMI) and socio-demographic profile of the subjects were also recorded. The findings of the study revealed that the mean value of Hb level of the total subjects was 9.9 g/dl. A total 65.7 and 20.0 percent of the subjects were found mildly and moderately anaemic with an average Hb value of 11.3 and 9.2 g/dl, respectively. The average BMI of the total subjects was calculated as 25.3 kg/m^2 and majority of the subjects were categorised as normal according to their BMI value which ranged between 18.5-24.99 kg/m^2. Further, no significant association was found between various socio-demographic factors and the prevalence of anemia.

Keywords: Anaemia, body mass index, nutrition workers, socio-demographic factors

Introduction
Iron deficiency anaemia takes hold into the body due to cessation of the production of red corpuscles haemoglobin which in turn is a result of deficient hematopoietic nutrients (Johnson-Wimbley and Graham, 2011) [1]. Amongst the elements which contribute to the formation and development of red corpuscles and to the synthesis of haemoglobin, iron occupies first place followed by other minerals like copper, zinc, magnesium, cobalt, molybdenum. Among vitamins, folic acid and vitamin B$_{12}$ are the most specific elements (Obai *et al.* 2016) [2]. Basically, anaemia is the decreased ability of the red blood cells (RBCs) to provide adequate oxygen to body tissues. It may be due to decreased amount of haemoglobin in RBCs which is an oxygen carrier substance (Okafor *et al.* 2017) [3]. In fact, anaemia has been defined as the Hb concentration below 12 g/dl in females and below 13 g/dl in males (WHO, 2001) [4]. Almost one-third (33 percent) of women of reproductive age worldwide suffer from anaemia, which also put the nutrition and health of many children at risk. The Indian scenario has also illustrated worrisome picture of anaemia in women. For instance, the incidence of anaemia among non pregnant and pregnant women aged between 15-49 years has been reported as 53 and 50 percent, respectively (NFHS, 2016) [5].

Punjab is one of India's the richest and agriculturally the most developed state. The state is well known as the "Bread Basket" of India which creates an apparent impression that problems related to availability aspect of food security don't exist here (Gupta *et al.* 2011) [6]. But the recent situation analysis is showing contrary reality of this affluent state. As per the latest report of National Family Health Survey-4 (NFHS-4), anaemia seems to be a major problem amongst children in Punjab. The proportion of anaemic women has gone up from 38 to 53.5 percent. The occurrence of anaemia is on higher side among non-pregnant women of 15-49 years of age (54.0 percent) too (NFHS, 2016) [5]. This matter is of serious concern for the state government. In Punjab, Sangrur has been reported as educationally backward district, owing to its low literacy rate of 59.88 percent against 69.95 per cent of the state, high rural-urban gap of 14.35 percent against 13.97 per cent of the state and high gender gaps in literacy and it also ranks second from the bottom as far as (HDI) human development index is concerned (Gill *et al.* 2010) [7].

Nutrition workers also known as *anganwadi* workers in India play a key role at forefront in data collection and maintenance pertaining to nutritional status of the pregnant and lactating mothers, infants and children below 6 years of age (Vasundhara and Harish, 1993) [8]. Across India, females have been appointed as nutrition workers in all the states under Integrated Child

Development Service (ICDS) programme (Gragnolati, 2005) [9]. Being an integral part of ICDS, these workers have given a remarkable contribution for providing supplementary nutrition to the vulnerable groups in rural sector (Joshi, 2018) [10]. But, data related to nutritional status of these frontline warriors are scanty. Therefore, the present study was conducted to estimate the prevalence of anaemia among district's nutrition workers at term based on the haemoglobin level and also, to understand the socio-demographic factors associated with the anaemia prevalence.

Materials and Methods
A total 70 nutrition workers from the rural areas of two blocks namely Sunam and Bhawanigarh of the district aged between 25-55 years were examined and studied during the heath camp organised on the occasion of World Health Day at the premises of Farm Science Centre, Sangrur. The subjects who were suffering from any chronic disease like diabetes, hypertension, arthritis, renal disease or any gastrointestinal disease and those who were on some medication, whether ayurvedic or allopathic, were excluded from study. Only rural subjects were included in the study. A formal permission was also obtained from the regional headquarters of nutrition workers for their participation in the present study.

Haemoglobin estimation
The subjects were undergone haemoglobin (Hb) examination during the camp with the help of technician of civil hospital, District Sangrur. The Cyanmethaemoglobin method was used to estimate the Hb levels as it is being commonly used and has been considered more accurate as compared to the hemocue or the hematology counter (Kapoor *et al.* 2002) [11]. An informed consent was obtained from the subjects before blood estimation.

Cyanmethaemoglobin method
For estimation of Hb by Filter Paper Cyanmethaemoglobin method, 20 µl of blood was taken with the help of haemoglobin pipette on to a Whatman Filter Pape No. 1 utilizing the standard methodology. The blood was allowed to dry on the filter paper, the portion of the filter paper with the blood was cut and eluted in 5 ml Drabkin's solution for 2 hours. The solution was put on vortex for complete elution of blood. The Hb concentration was read at a wavelength of 540 nm utilizing a spectrophotometer. The Hb level was calculated using formula given below:

$$\text{Hb Concentration (g/dl)} = \frac{\text{Concentration of standard (mg/dl)}}{1000} \times \text{Dilution factor}$$

$$\text{Dilution factor} = \frac{\text{Total volume}}{\text{Volume of blood}}$$

Total volume = Volume of Drabkin's solution + Volume of blood
Further, WHO guidelines were used to define the prevalence and severity of anaemia (WHO, 2001) [4]. In females, mild anaemia is defined as an Hb of 10.0-11.9 g/dl; moderate anaemia with Hb of 7.0-9.9 g/dl and severe anaemia as an Hb of < 7.0 g/dl. The subjects having Hb level > 12.0 g/dl were categorized as non-anaemic.

Body Mass Index
All the individuals had their height and weight measured. Body Mass Index (BMI) was calculated as the weight in kilograms, divided by the square of the height in meters. The BMI was further categorized into low (<18.5 kg/m^2), normal (18.5-24.9 kg/m^2) and high (>25 kg/m^2) according to the WHO criteria (WHO, 2004) [12].

Socioeconomic status
The socioeconomic status (SES) was represented by the approximate monthly family income. Three groups were constituted and the subjects were categorized into low SES (<5000), middle SES (5000-15000), and high SES (15000 and above).

Statistical Analysis: The results were analyzed on a percentage scale.

Results and Discussion
The socio-demographic profile of the selected subjects has been presented in the Table 1. The data revealed that nearly half of the subjects (48.6%) were found in the age group of 36-45 years of age. The most of the subjects (85.7%) studied up to matriculation level and majority (82.9%) was living in the family having less than 5 family members. It was observed from the socioeconomic status of the subjects that per month family income of the majority of the subjects (61.4%) was more than Rs. 15000. Besides, more than half of the subjects (68.6%) had less than 1 hectare agricultural land holding.

Table 1: Socio-demographic profile of the selected subjects

Characteristics	Total (N=70)	Percentages
Age (years)		
25-35	29	41.4
36-45	34	48.6
46-55	07	10.0
Education		
Illiterate	04	5.7
Matric (up to 10th standard)	60	85.7
Above Matric	06	8.6
Family size		
<5	58	82.9
≥5	12	17.1
Family Income/Month (Rs.)		
< 5000	18	25.7
5000-15000	9	12.9
>15000	43	61.4
Agricultural land holding		
Marginal (<1 hectare)	48	68.6
Small (1-2 hectare)	15	21.4
Semi-medium (2-4 hectare)	05	7.1
Medium (4-10 hectare)	02	2.9
Large (≥ 10 hectare)	-	-
Body Mass Index (BMI) (kg/m^2)	25.3	-
Average Haemoglobin (g/dl)	9.9	-

Body Mass Index
The average BMI of the total subjects was calculated 25.3 kg/m^2. Further, only 3 percent of the subjects were found underweight (BMI <18.50 kg/m^2) according to WHO classification. Whereas, equal number of the subjects such as 40 percent were found in the normal as well as overweight categories according to their BMI (Table 2). The percentage of obese subjects was recorded as 15.7 who had BMI value more than 30 kg/m^2. In earlier studies, researchers observed that majority of the subjects (57.7%) were found in the normal category followed by pre-obese (36.7%) and underweight (25.6%) (Grover and Choudhary, 2017;

Choudhary *et al.* 2014) [13, 14]. Underweight is major issue which needs special concern among young females as a poor nutritional status obstruct the health of mother and her offspring (Blössner and de Onis, 2005; WHO, 2013) [15, 16]. But, the present study witnessed that most of the subjects were in normal category as per the BMI classification given by WHO (2004) [12].

Table 2: Distribution of subjects (%) according to their BMI

Body Mass Index (BMI) (kg/m²)	Total (N=70)	Percentage
Underweight (<18.50)	3	4.3
Normal (18.5-24.99)		
18.50-22.99	17	24.3
23.00-24.99	11	15.7
Overweight (25.00-29.99)		
Pre-obese 25.00-27.49	20	28.6
27.50-29.99	8	11.4
Obesity (≥ 30.00)	11	15.7

Prevalence of anaemia
The results of the present study revealed that the mean value of Hb level of the total subjects was 9.9 g/dl. According to classification, it was observed that 65.7 and 20.0 percent of the subjects were mildly and moderately anaemic with an average Hb value 11.3 and 9.2 g/dl, respectively (Fig. 1). Further, the percentage of severe anaemic subjects was recorded as 2.9. The average value of Hb level in the severe anaemic subjects was observed as 6.8 g/dl. And, a total 11.4 percent of the subjects were found non-anaemic with an average Hb value 12.3 g/dl. In our study, the prevalence of mild anaemia among female subjects was 65.7 percent, which was much more as compared to NFHS-4 data wherein, a 38.6 percent of the females were reported as anaemic (Table 3). In another study, the prevalence of moderate anaemia among females was 38.2 percent (Gupta *et al.* 2011) [6]. In contrast, the present study highlights a lower prevalence of moderate anaemia in females. Moreover, a higher prevalence in all the categories of anaemia was observed in the present study in comparison to the average percentage of anaemic subjects in Punjab. The prevalence of mild, moderate and severe anaemia among Punjabi women (15- 49 years) was recorded as 26.2, 10.4 and 1.4 percent, respectively (NFHS, 2016) [5].

Table 3: Incidence of anaemia in comparison with previous studies and surveys

Category	Present study	Gupta et al. 2011	NFHS-4
Mild	65.7%	49.8%	38.6%
Moderate	20.0%	38.2%	15.0%
Severe	2.9%	1.5%	1.8%

Association between prevalence of anaemia and BMI
There is a scarcity of data regarding the prevalence of anaemia with respect to the BMI in females in Punjab. The prevalence of anaemia in the subjects distributed according to their BMI in our study has been illustrated in the Fig. 2. It was observed that all the subjects suffering from severe anaemia i.e., 2.9 percent were found in the overweight category. The highest prevalence of mild anaemia (32.9%) was found in the subjects with normal BMI followed by the overweight group wherein the corresponding figure was observed as 25.7 percent. All the subjects (4.3%) in underweight category were suffering from moderate anaemia. Equal number of the subjects (4.3%) having Hb level above 12 g/dl range were found in normal and overweight category. The correlation analysis of the data revealed that BMI of the subjects did not

have a significant bearing on the prevalence or severity of anaemia (Table 4). Similarly, Gebre and Mulugeta (2015) [17] reported no significant correlation of BMI with anemia in female subjects. One another study also documented that BMI of the subjects did not have a significant effect on the prevalence or severity of anemia (Mehrotra *et al.* 2018) [18].
In contrast, a study by Ramachandra and Kasthuri (2008) [19] has shown the association between the higher prevalence of anaemia and a low BMI. In the NFHS-2 study, it was stated that shorter women and women with a low BMI had a somewhat higher prevalence of anaemia than other women (NFHS, 1999) [20]. One another study described that the prevalence of anaemia in females was found to increase with a decrease in the BMI. They found that the prevalence was 91.4 percent in females with low BMI and the corresponding figures in the subjects normal and high BMI were 83.6 and 73.7 percent, respectively (Gupta *et al.* 2011) [6]. But, our study observed an opposite trend in the anemia prevalence with respect to BMI.

Table 4: Pearson coefficient of correlation between different variables

Variables	Total (N=70)
Age and Hb	0.034 (+)[NS]
Education and Hb	0.066 (-)[NS]
Income and Hb	0.023 (-)[NS]
Hb and BMI	0.011 (+)[NS]
Age and BMI	0.016 (+)[NS]

NS- No significant differences, Hb- Haemoglobin

Association between prevalence of anemia and socio-demographic factors
In the present study, we found a non-significant association between various socio-demographic factors and the prevalence of anemia (Table 4). An earlier study has also found that socio-cultural factors play an important role in determining prevalence of anaemia. In our study, we found that the prevalence of anemia was higher (48.6%) in women who were in the age group of 36-45 years of age whereas severity of anemia (2.9%) was found more in the age group of 25-35 years of age (Fig. 3). A similar study from Haryana also showed that younger age had significant association with haemoglobin levels (Mangla and Singla, 2016) [21]. Similarly, one another study reported that prevalence of anemia was more below 25 and above 35 years of age. The association between education status and anemia was also documented in previous studies and was found significant (Mangla and Singla, 2016; Dutta *et al.* 1992) [21, 22]. In contrast, our study revealed an inverse but non-significant association between literacy status and prevalence of anaemia in the subjects. Similarly, Mehrotra and co- researchers found that education had weak and inverse statistically significant effect on the prevalence and severity of anemia (Mehrotra *et al.* 2018) [18].
The prevalence of anaemia among subjects with different SES has been depicted in the Fig. 4. In the present study, the prevalence of anaemia in the subjects was 25.7, 12.8 and 61.4 percent in the low, medium and high SES group, respectively. In contrast, an opposite trend was observed in the NFHS-2 data, where the prevalence of anaemia was found to be decreased with an increase in the socioeconomic status. The prevalence of anaemia in women (15-49 years) was 60.2, 50.3 and 41.9 percent in the low, medium and high living index group, respectively (NFHS, 1999). In our study, the lowest percentage of anaemia was found in middle SES group i.e., 12.8 percent. But, Aggarwal *et al.* (2003) [23] reported the

prevalence of anaemia as 45 percent from a middle socio-economic group of North East Delhi. In another study, the researchers documented the prevalence of anaemia as 14 percent in adolescent girls where the household income was more than Rs. 5000 per month (Jondhale *et al.* 2001) [24].

Limitations of the study
The limitation of our study was that the nutrition workers working only in the nearby blocks were selected for the study and their blood samples were collected at the first visit to the Farm Science Centre, Sangrur. Therefore, there was no way to know the initial haemoglobin levels. Moreover, the subjects working in other blocks of the district may have different picture of prevalence of anaemia and different demographic

factors contributing to the same. But such subjects were not included in this study. Secondly, to impart nutrition interventions, vegetable seed kits and fruit seedlings were distributed to the selected subjects during in-service training session at periodic intervals so as to promote nutrition garden at home. But, due to over occupied schedule of nutrition workers, same subjects couldn't make it convenient to attend these intervention sessions. So, the data pertaining to effect of nutrition interventions couldn't be obtained and studied thoroughly. Therefore, further studies involving whole district in collaboration with District Rural Development Department are required to assess the actual extent of problem, factors responsible and measures required for the same.
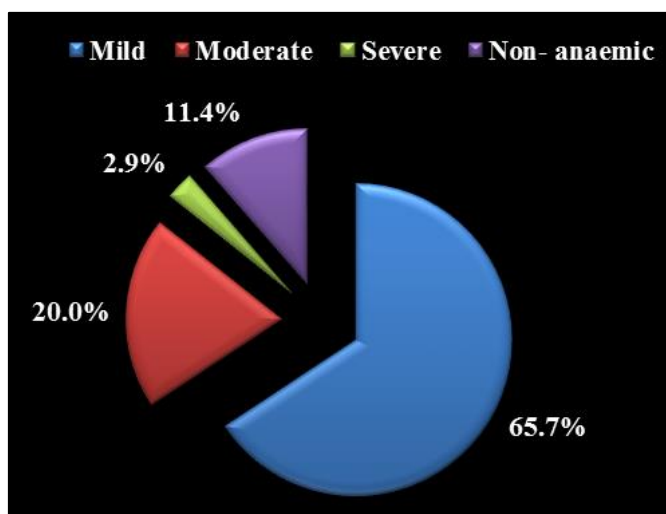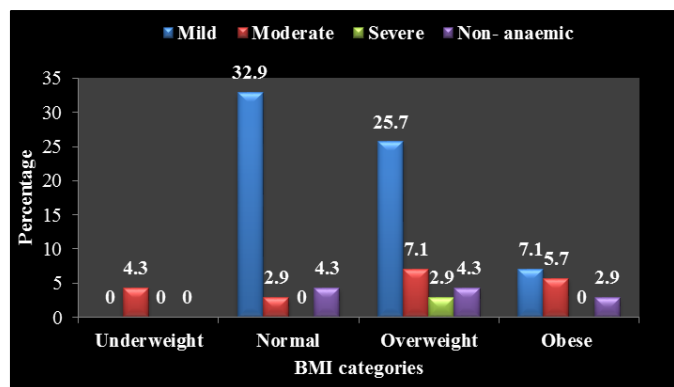

Fig 1.

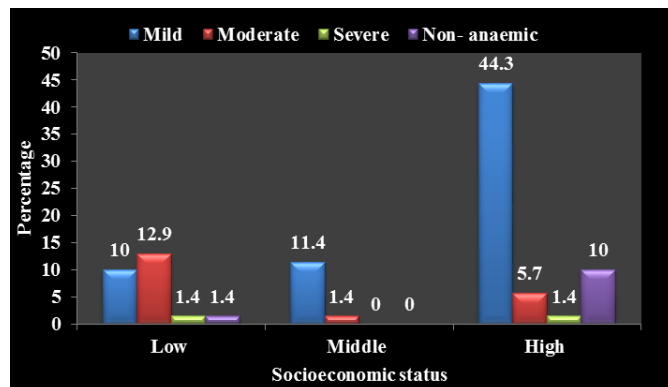**Fig 2:** BMI of the subjects and prevalence of anaemia

Fig 3: Age of the subjects and prevalence of anaemia

Fig 4: Prevalence of anaemia among subjects with different socioeconomic status

Conclusion
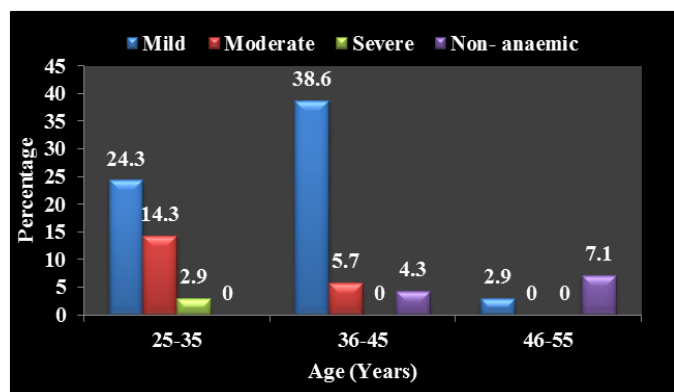Our study concluded that anaemia was prevalent at different levels among nutrition workers. The present study also solicited a few socio-demographic factors that may contribute to occurrence of anaemia. Frontline health workers of any country play a fundamental role in successful execution of nutrition related programmes launched by the state and national governments. Therefore, a sharp vision and strong interventions are needed to support the health of these leading community workers of the society. An elaborative study including all the indicators of nutritional status may provide a better insight into the situation which may further help in devising interventions for the prevention and the treatment of anaemia.

References
1. Johnson-Wimbley TD, Graham DY. Diagnosis and management of iron deficiency anemia in the 21st century. Therapeutic Advances in Gastroenterology. 2011; 4:177-84.
2. Obai G, Odongo P, Wanyama R. Prevalence of anaemia and associated risk factors among pregnant women attending antenatal care in Gulu and Hoima Regional Hospitals in Uganda: A cross sectional study. BMC Pregnancy and Childbirth. 2016; 16:76.
3. Okafor IM, Okpokam DC, Antai AB, Usanga EA. Iron Status of Pregnant Women in Rural and Urban Communities of Cross River State, South-South Nigeria. Nigerian Journal of Physiological Sciences 2017; 31:121-125.
4. WHO. Iron deficiency anaemia: assessment, prevention and control, a guide for programme managers. World Health Organization, Geneva, 2001, 1-107.
5. NFHS. National Family Health Survey 4 (2015-16) and 3 (2005-06). International Institute for Population Sciences, Ministry of Health and Family Welfare, Government of India, Mumbai: India, 2016.
6. Gupta VK, Maria AK, Kumar R, Bahia JS, Arora S, Singh R *et al.* To Study the Prevalence of Anaemia in Young Males and Females with Respect to the Age, Body Mass Index (BMI), Activity Profile and the Socioeconomic Status in Rural Punjab. Journal of Clinical and Diagnostic Research. 2011; 5(5):1020-1026.
7. Gill SS, Singh I, Singh L, Singh K, Kumar P. District Human Development Report, SANGRUR. Department of Economics, Punjabi University, Patiala, 2010, 1-162.
8. Vasundhara MK, Harish BN. Nutrition and health education through ICDS. Indian Journal of Maternal and Child Health. 1993; 4:25-6.
9. Gragnolati M, Shekar M, Gupta MD, Bredenkamp C, Lee YK. India's Undernourished Children: A Call for Reform and Action. Washington, DC: Health, Nutrition and Population Family (HNP). Human Development Network. The World Bank, 2005.
10. Joshi K. Knowledge of Anganwadi workers and their problems in Rural ICDS block. IP Journal of Paediatrics and Nursing Science. 2018; 1(1):8-14.
11. Kapoor SK, Kapil U, Dwivedi SN, Anand K, Pathak P, Singh P *et al*. Comparison of the haemocue method with the cyanmethaemoglobin method for the estimation of haemoglobin. Indian Paediatrics. 2002; 39:743-46.
12. WHO. Appropriate body-mass index for Asian population and its implications for policy and intervention strategies. The Lancet. 2004; 3:157-163.
13. Grover K, Choudhary M. Community Based Preventive Measures to Combat Iron Deficiency Anaemia among Young Pregnant and Non-pregnant Women. Anthropologist. 2017; 30(2):202-209.
14. Choudhary M, Grover K, Javed M. Nutritional Profiles of Urban and Rural Men of Punjab with Regard to Dietary Fat Intake. Ecology of Food and Nutrition. 2014; 53(4):436-452.
15. Blössner M, De Onis M. Malnutrition: Quantifying the Health Impact at National and Local Levels. WHO Environmental Burden of Disease Series, No.12, Geneva, 2005.
16. WHO. The World Health Report, Chapter 4: Childhood and Maternal Under Nutrition. Geneva: WHO, 2013.
17. Gebre A, Mulugeta A. Prevalence of anemia and associated factors among pregnant women in North Western zone of Tigray, Northern Ethiopia: A cross-sectional study. Journal of Nutrition and Metabolism 2015; 2015: 165430.
18. Mehrotra M, Yadav S, Deshpande A, Mehrotra H. A study of the prevalence of anemia and associated sociodemographic factors in pregnant women in Port Blair, Andaman and Nicobar Islands. Journal of Family Medicine and Primary Care. 2018; 7(6):1288-1293.
19. Ramachandra SS, Kasthuri A. Anaemia in the elderly who resided in a south Indian rural community. Indian Journal for the Practising Doctor. 2008; 10:5(4):4.
20. NFHS-2. National Family Health Survey (NFHS-2), 1998–99: India. Mumbai: IIPS, 1999.
21. Mangla M, Singla D. Prevalence of anaemia among pregnant women in rural India: a longitudinal observational study. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 2016; 5:3500-5.
22. Dutta PK, Nagraj T, Gopinath VP. A case control study of anemia in pregnancy. Indian Journal of Preventive and Social Medicine. 1992; 23(1):1-5.
23. Agarwal KN, Gomber S, Bisht H, Som M. Anaemia prophylaxis in adolescent school girls by weekly or daily iron-folate supplementation. Indian Paediatrics. 2003; 40:296-301.
24. Jondhale JP, Reddy S, Vijaya N, Nalwade M. Nutritional status of school going adolescent girls of Parbhani. Indian Journal of Nutrition and Dietetics. 2001; 38:262-68.