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Original Research

Prevalence of iron-deficiency anaemia and risk factors in 1010 adolescent girls from rural Maharashtra, India: a cross-sectional survey

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ABSTRACT

Objective: Iron-deficiency anaemia (IDA) is the most common nutritional disorder observed in adolescent girls in India. Our aim was to investigate the prevalence and risk factors associated with IDA in rural Maharashtra, India, to address current evidence gaps.
Study design: Cross-sectional survey.
Methods: The study recruited 13- to 17-year-old adolescent girls living in 34 villages of Osmanabad district. Data were collected on individual health, dietary, sociodemographic factors, and anthropometric measurements were taken. Haemoglobin (Hb) levels were measured using Sahli's haemometer. Logistic and linear regressions were used to identify risk factors associated with IDA and Hb levels, respectively.
Results: Among 1010 adolescent girls (response rate 97.5%), the mean Hb was 10.1 g/dl (standard deviation = 1.3), and 87% had anaemia (Hb < 12 g/dl). The prevalence of mild (11.0–11.9 g/dl), moderate (8.0–10.9 g/dl) and severe (Hb ≤ 7.9 g/dl) anaemia was 17%, 65% and 5%, respectively. Anaemia likelihood increased significantly with age (odds ratio (OR): 1.41 per year, 95% confidence interval (CI): 1.17–1.70). Factors associated with decreased anaemia risk were mid-upper arm circumference (MUAC) ≥22 cm (OR: 0.51, 95% CI: 0.31–0.82), ≥3 days/week consumption of fruit (OR: 0.35, 95% CI: 0.23–0.54) or rice (OR: 0.39, 95% CI: 0.17–0.91), and incomplete schooling (OR: 0.47, 95% CI: 0.24–0.91). In the final model lower age, MUAC and fruit consumption were significantly associated with Hb level.
Conclusion: Anaemia prevalence was extremely high among adolescent girls in rural areas of Maharashtra. Whilst we identified risk factors that could be used for targeting interventions, there is urgent need of comprehensive preventative interventions for the whole adolescent girl population.

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Introduction

Iron-deficiency anaemia (IDA) is the most common nutritional disorder observed in India particularly in under-five year old children, adolescent girls and pregnant women.[1] About 56% of adolescent girls in India are affected by IDA.[1,2] During adolescence, IDA may lead to growth retardation, impaired physical and mental development and poorer reproductive outcomes continuing through childbearing years; thus, it is a serious public health issue in the country.[3,4] The government has emphasized the need for education programmes and national iron supplementation initiatives for adolescent girls. However, practical implementation has revealed important health services and infrastructural issues as well as inadequate iron tablet supplies for young girls; as a result, IDA prevalence remains much higher than predicted targets.[3,4]

One of the largest surveys of adolescent girls reported an overall anaemia prevalence of 89% with substantial regional variation.[5] This survey was described to be nationally representative and reported higher prevalence in older girls (15–19 years). Studies published in the past 10 years from Maharashtra state of India reported 40%–65% anaemia prevalence in western Maharashtra[6,7] and 35%–40% in eastern Maharashtra[8] with a higher prevalence in deprived areas (up to 90%).[9] However, evidence from central Maharashtra (the Marathwada region) is limited to a 2012 study of 385 adolescent girls, which reported 68% anaemia and assessed dietary preference, parents' education and menarche in addition to factors studied in the national survey.[2]

There are no published studies from rural areas particularly in the Marathwada region on anaemia prevalence in adolescent girls, and there is limited evidence on their sociodemographic, dietary and medical risk factors. Therefore, we conducted a cross-sectional study of 1010 adolescent girls; the first conducted in the Osmanabad district and largest from rural areas of Maharashtra state, India.

Methods

Study context

The Maharashtra Anaemia Study (MAS) was a joint collaboration between the Halo Medical Foundation (HMF), India, and the University of Nottingham, UK. The cross-sectional study was conducted to investigate anaemia prevalence in adolescent girls and associated risk factors in villages of Marathwada region of Maharashtra state. The target population was all unmarried girls aged 13–17 years from 34 villages (total population: 60,921) in the Tuljapur and Lohara blocks of Osmanabad district. We decided on this age group following consultation with our local partner (HMF). Upper age limit (17 years) was suggested because of early marriages (typically at 18 years) and also due to migration of girls for higher secondary education in our study region, while lower age limit (13 years) was agreed following ethical requirements (where independent decision processing) was necessary to provide written consent to participate in the study. Between April 24, 2014, and June 30, 2015, villages were visited with the aim of recruiting 1000 participants.[10] No formal sample size calculation was performed as the project was designed as an initial feasibility study. The study was approved by the Institutional Ethics Committee of the Government Medical College Aurangabad (Pharma/IEC/GMA/196/2014), and the Medical School Ethics Committee of the University of Nottingham, UK (E10102013).

Field area

Osmanabad district is one of the most marginalized areas of India; 83% of its 1.6 million population lives in rural areas.[11] The 2013 state report showed that the annual per capita income of the district was only half of the state average.[12] Overall literacy was 76% (53% in underprivileged communities), and the district ranked 28th in the state out of 35 based on the human development index.[12] HMF's head office is in Andur, on the Mumbai–Hyderabad national highway. The project villages were accessible with semipermanent paved roads connecting to the highway and had limited electricity and transport facilities. The nearest and farthest project villages were 5 and 57 km from the head office, respectively.

Participant recruitment and data collection

The primary investigator (PI) and a trained project assistant worked with the network of village health workers developed by HMF across the field area to identify, contact and recruit eligible participants. Each eligible adolescent girl present on the village's assigned data collection day was approached in the presence of a local guardian. Those who agreed to participate were recruited after obtaining a written consent. The data collection form was used to obtain information on sociodemographic, medical history, iron folic acid (IFA) and other supplements, 7-day dietary food frequency recall, family assets and menstrual history data as self-reported by participants, in accordance with the Standard Operating Procedures Guidelines.[10] The main occupation in our field area is farming; therefore, following consultation with HMF, land size was judged to be an appropriate proxy marker for socio-economic status.

Diseases such as malaria or other conditions that could influence haemoglobin (Hb) levels were assessed based on past 1 year medical history, and clinical examination conducted at the time of data collection by the PI. Height and mid-upper arm circumference (MUAC) of the dominant hand were recorded using standard measuring tapes, and weight was recorded using a digital machine (OMRON health care). MUAC was recorded using the circumference measured at the midpoint between tip of elbow and the tip of shoulder. MUAC of <22 cm was used as a recommended cutoff for the identification of malnutrition.[13] Capillary Hb investigation was performed using the third finger of the non-dominant hand by a qualified laboratory personnel using Sahli's haemometer method. The device is an economical and portable tool commonly used for Hb assessment in India.[14] Sahli's method is a well-established technique in the country and recommended by the Government of India mainly for use in the rural setting.[14] The technician involved in the MAS study had