REVIEW ARTICLE

Strategies for achieving better health status for women and children by targeting anemia deficiency in Himachal Pradesh

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ABSTRACT

The prevalence of anemia in India is among the highest in the world. Anemia reduces physical capacity, productivity and negatively impacts quality of life. It is also the single largest cause of maternal mortality in India, another health index India does not fare too well on. Anemia interventions have long been an integral part of public health management. However, the results yielded by anemia targeting programs are less than satisfactory, reflecting room for improvement in order to meaningfully alleviate or eliminate the disease burden. This paper outlines current anemia management strategies in the Indian state of Himachal Pradesh and infuses the discussion with best practices in order to improve efficiency of the program. The immense burden of the disease borne by some districts of Himachal make it imperative for policymakers to look at the health interventions being employed currently and overhaul the system.

Key Words: *Anemia; Health; Efficiency; Infants.*

INTRODUCTION

Indian women and children are alarmingly anemic, and the recently released National Family Health Survey (NFHS) 5 (2019-20) reflects a worrying trend of reversals or static numbers in terms of combating the disease. With a high prevalence rate of almost 50% India is home to the largest number of reproductive age women with anemia, which also contributes to various other health conditions. The diminished oxygen-carrying capacity in red blood cells of anemic people affects energy efficiency, working capacity, productivity and general wellbeing. In children particularly anemia has been linked to impaired development in behavior, cognition, and psychomotor skills. For expecting mothers in India, anemia is arguably the most significant cause of Maternal Mortality (MMR) and anemic mothers give birth to anemic children.

Iron Deficiency (ID), a situation when cells of the body have exhausted all iron reserves, is the most prevalent single nutritional deficiency. It is estimated by the WHO that almost 2 billion people or nearly 25% of the world's population, mostly in the developing world, are affected by this condition. Infants, adolescents, pregnant women and women of reproductive age are most vulnerable. More than 85% of the nutritional anemias are IDA alone, or of iron combined with folate or other nutrient deficiencies [1].

Anemia is most prevalent in the cold Himalayan desert areas as reflected in the NFHS-5 data. In Himachal, according to the latest figures 55.4% of children aged 06 months to 59 months are anemic, nearly two percentage points up from NFHS-4's 53.7%, and 53% of all women (06 months - 59 months.) are anemic which is only marginally lower than the 53.5% of the previous round. The district wise disparity paints an even bleaker picture. In the Lahaul & Spiti region, a staggering 91% of children (06 months - 59 months) and 82% of all women (06 months - 59 months.) are anemic. Other districts fare slightly better but overall, the numbers are higher than the national averages (NFHS-5).

The data shows that in the last five years there has been scant improvement in the anemic conditions of the people of the state.

DISCUSSION

Economic and social cost of anemia

Information on the costs of micronutrient deficiencies to people as individuals and communities is not easily calculable or attributable to any single cause and thus not available. Conservative estimates are made to calculate the loss of life, medical costs and cost associated with loss of productivity due to long term ill health impacts of anemia. Iron-Deficiency Anemia (IDA) is the leading cause of the disease; however micronutrients such as vitamin B12, vitamin A, folate and zinc also contribute to the intractable anemia levels. It is imperative to address all these for any effective strategy to combat anemia.

The most vulnerable groups in the population are children and pregnant women, while others such as non-pregnant women and the elderly are next affected. The World Health Organization (WHO) estimated that 56% of all pregnant women in developing countries are anemic. In Southern Asia, the prevalence of anemia in pregnancy is about 75% in contrast to statistics in North America and Europe with about 17% prevalence. Furthermore, 5% of pregnant women suffer from severe anemia in the worst affected parts of the world. While the situation in Himachal may not be so bad on this particular parameter but even 42% is an alarming figure as the health condition of the mother during pregnancy has a direct and long lasting impact on the health of the child. Iron deficiency anemia (IDA) is highly prevalent among Indian children in spite of substantial economic growth and numerous programs aimed at the reduction of anemia [2]. Iron deficiency in early childhood is especially detrimental due to increased mortality and its permanent impact on cognitive development, which leads to an irreversible loss of productivity in adult life [3]. An estimated 10%- 20% of preschool age children in developed countries and 30%-80% in developing countries are anemic at 1 year of age. IDA in 06 month-23 month-old children remains a major health problem in India and its social costs remain extremely high, both in terms of DALYs (Disability Adjusted Life Years) and income losses. There is an urgent need for effective interventions capable of improving the nutritional status of children fewer than 5 and in particular of the 06-month-olds -23-month-olds [4]. The cost of one DALY (Disability Adjusted Life Years) lost due to IDA in India is approximately ₹30,000 and the cost incurred to avert IDA led one DALY is just ₹1,545. Addressing this issue would evidently accrue an enormous economic benefit to India. There is evidence that anemic conditions play a role in aggravating diseases or making disease management difficult. While a direct correlation with malaria exists but diseases like high blood pressure, heart ailments, cancer may also be impacted. Iron deficiency and anemia are common comorbidities associated with heart failure, with reduced ejection fraction (HFrEF). Low Hb and transferrin saturation are significantly associated with advanced heart failure [5]. Thus anemia has important implications in the management of heart failure and other diseases as well.

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Present Status of Government Interventions

The Governments of India and Himachal Pradesh have fixed a target to reduce the prevalence of anemia by 3% points per annum. The past experience and comparison of data available from various National Family Health Surveys does not support the present strategies as incidence of the disease does not show a continuous downward trajectory. The present strategies being adopted to manage anemia include:

- Prophylactic iron folic acid supplementation.
- Periodic deworming of children, adolescents, women of reproductive age and pregnant women.
- Intensified year-round behavior change communication campaign including ensuring delayed cord clamping
- Testing of anemia using digital methods and point of care treatment.
- Mandatory provision of iron and folic acid fortified foods in public health.

To implement these interventions, Himachal Pradesh, like other states in the country, has created institutions. Primary Health Centers (PHCs), especially in rural areas, have been acting on the guidelines and directions issued by the central government on different programs/interventions like Poshan Mission, Anemia Mukt Bharat (Anemia Free India), Janani Suraksha Yojna etc. Existing institutional mechanisms of the government include:

- Intra-ministerial coordination
- National Anemia Mukt Bharat Unit
- National Centre of Excellence and Advanced Research on Anemia Control
- Convergence with other ministries
- Strengthening supply chain and logistics
- Anemia Mukt Bharat dashboard and digital portal - one-stop shop for anemia
- Poshan Abhiyan

Many of these programs and interventions are old or have been redesigned with new names and a more focused approach. Despite following these strategies and interventions for many years, studies in Himachal reflect that the situation has remained static or only marginally improved. In a significant study conducted on female college students in district Mandi (HP), prevalence of anemia was detected to have been quite high at 55%. Self-awareness of the condition among those anemic was dismally low at 10%. Health education constitutes an important approach to increase awareness about anemia in terms of exposure, risk factors, essential nutrients and the importance of iron supplementations [6]. To improve the outreach and performance of these government efforts, an integrated strategy should be followed. The supplementation and additions in these interventions are necessary to achieve desired results i.e. to achieve a target of reduction of 3% per year in anemia figures.

Strategies for Management of Anemia in HP

Iron Deficiency (ID) affects people of all ages but women of reproductive age and growing children are more vulnerable. Due to intestinal blood loss and reduced iron absorption, ID is a threat to Inflammatory Bowel Disease patients, women, and children the most. Some of the current therapies, which are adopted in acute cases, can efficiently recover normal serum transferrin saturation and hemoglobin concentration but also run the risk of several side effects, including intestinal inflammation. ID patients can benefit from innovative nutritional supplements that would satisfy iron needs without side effects. There is a growing interest in new iron-rich super foods, like algae and mushrooms, which combine antioxidant and anti-inflammatory properties with iron richness [7]. It is clear from the discussion held earlier in this paper that there must be concerted efforts involving all the stakeholders to adopt multi-pronged strategies. Ideally, there is a need for environment specific solutions which may vary from locality to locality. Given that it is estimated that at least half of anemia cases will have causes other than iron deficiency, current strategies to control anemia need to be re-evaluated to ensure that the various factors contributing to anemia are identified and addressed properly in an integrated manner. To alleviate the disease burden of Himachal Pradesh, concentrating particularly in areas with extraordinarily high rates of prevalence through a multifaceted strategy, includes organization of awareness camps, spread of information on adequate diet, regular testing for efficient monitoring, better targeting and compilation of data. Changes in food systems, dietary habits and a robust food-fortification program has been proven to be effective for diminishing anemia in women of reproductive age and will be one of the primary methods relied upon. Where prevalence of anemia is exceptionally high, fortification can be augmented with intermittent (weekly) iron supplementation or intravenous administration, depending on the need.

Changes in Food System and Diet Patterns

Traditionally, in Himachal, the cuisine is varied and diverse, in terms of both ingredients and preparation. Local crops were used and differed as per seasonal availability. Today, as observed pan nation, wheat and rice are the dominant food crops and diversity in food has virtually diminished. Now, certain foods like millets are not available or easily accessible having fallen out of favor with planters. Millets can have a major impact on improving iron status, hemoglobin levels, and in reducing iron deficiency anemia [8]. Balancing diets and ensuring variety is not only about meeting caloric requirements but also providing all essential micronutrients. Studies have shown correlation between diet quality and hemoglobin levels in adolescent girls. Diversity of diets results in a positive impact on hemoglobin levels. Since one food item cannot have all types of nutrients or vitamins, this necessitates focus on quality of diet as well in managing iron deficiency induced anemia. Higher diversity in food has resulted in better management of anemia [9]. Additionally, imbalance of certain micronutrients/vitamins impacts the bio-absorption of other micronutrients/vitamins. For this the food system and diet patterns of a locality have to be studied and combinations of foods/ diets suggested, in consonance with food habits, taste, environment and traditions of the people. Such cultivars or varieties should be grown which are rich in iron and other associated micronutrients. Development of bio fortified cultivars of staple crops can make significant contributions to reducing micronutrient malnutrition and several associated adverse health consequences. Pearl millet variety Dhanashakti, bred for high iron content, is an early maturing open-pollinated variety that has the highest level of iron content in any pearl millet cultivar produced so far. Dhanashakti also marks the first high-iron bio fortified cultivar of any crop officially released and already adopted by farmers in the country [10]. Changes in food systems and diet patterns will help in addressing the problem of anemia. A diet rich in wholegrain, legumes, nuts, seeds, dried fruits, iron-fortified cereals and green leafy vegetables provides an adequate iron intake. While non-heme iron (from plant sources) is more difficult for the human body to absorb than heme-iron vitamin C and other organic acids enhance non-heme iron absorption, a process that is carefully regulated by the gut. It is notable however, that even non-heme iron is infinitely superior in its bioavailability and absorption than artificial vitamin and micronutrient sources. People with low iron stores or higher physiological need for iron will tend to absorb more iron and excrete less [11]. Anemia induced by iron deficiency and vitamin deficiencies are the major types of anemia responsible for anemic conditions in the populace. An anemia diet focuses on foods that can help correct (and prevent) iron deficiency while avoiding those that can inhibit iron absorption. The recommended iron intake for most adults is 7 grams -18 grams per day. If an individual's diet is deficient in nutrients like iron, folic acid, B12, vitamin C or said person has certain health conditions, or is pregnant, iron/vitamin intake needs to be adjusted accordingly. Diet patterns and food systems need to be managed in the following ways-

- Analysis of dietary pattern of target population to understand the deficiency status of normal diets of people and estimate the gap (For iron and other vitamins).
- Suggest dietary changes without changing basic food habits. Cereals and other staples, if need be, can be supplemented with adequate and right types of varieties of fruits/vegetables, millets etc.
- Changes in agriculture pattern so that crops/varieties rich in iron and vitamins are cultivated.
- Periodic monitoring of hemoglobin levels of the population for assessment of the impact.
- Iron-rich fruits and vegetables to boost hemoglobin levels can be promoted. These include but are not limited to:
- Sun-dried tomatoes (9.1 mg/100 gm), Spinach (6.4 mg/100 gm.), Apricots, dehydrated (6.3 mg/100 gm.), Hearts of palm (4.6 mg/100 gm.), Raisins (3 mg/100 gm.), Green soy beans (4.5

mg/100 gm.), Persimmons, raw (2.5 mg/100 gm.), Pureed tomatoes (4.5 mg/100 gm.), Mulberries, raw (1.7 mg/100 gm.), Asparagus (4.4 mg/100 gm.), Dates (1 mg/100 gm.), Snap peas (3.8 mg/100 gm.), Currants (1 mg/100 gm.), Baby lima beans (3.5 mg/100 gm.), Prune (0.9 mg/100 gm.), Pumpkin (3.4 mg/100 gm.), Pomegranate (0.3 mg/100 gm.), Sweet potato (3.4 mg/100 gm.), Watermelon (0.2 mg/100gm.), Potato (3.2 mg iron/100 gm.).

- Supplemental Iron/Fortified Foods

Fortification with multiple micronutrient powder has been proposed as a public health intervention to reduce micronutrient deficiencies in children. Fortification with multiple micronutrient powder and drug supplementation in prevention and treatment of iron deficiency and anemia is being adopted at many places. Studies have established fortification as an effective strategy in preventing iron deficiency and anemia in children aged 06 months-48 months In anemic children; it is necessary to supplement the dose of multiple micronutrient powder with ferrous sulfate [12]. Sometimes, even with a balanced diet, it may not be adequate to meet the daily requirement of iron or other associated micronutrients thus necessitating reliance on fortifications. The Government has also mandated that foods available through the Public Distribution System, like wheat flour and rice be fortified with iron. Also, the Food Standards & Safety Authority of India (FSSAI) has prevailed that some of the foods like milk, oil, wheat flour; pulses etc., available in the market should offer fortified versions to consumers. In vitamin B12 insufficient folate replete pregnant women, vitamin B12 supplementation is associated with a reduction of plasma total homo-cysteine concentration in late pregnancy [13]. In an experimental study on healthy women, subjected to a 12-week intervention with breakfast rolls fortified with either 166-mg or 355-microg folic acid, serum homo-cysteine concentration decreased and erythrocyte folate increased. The lower level of fortification seems to be sufficient to improve folate status. Folic acid is stable in fortified bread for 90 days storage at -20oC. Home fortification of foods with micronutrient powders (MNP) is an effective intervention for reducing anemia and iron deficiency in children younger than two years of age. Providing MNP is better than providing no intervention or placebo and may be comparable to using daily iron supplementation. However, the benefits of this intervention as a child survival strategy or for developmental outcomes are unclear. MNP intake adherence was variable and in some cases comparable to that achieved in infants and young children receiving standard iron supplements as drops or syrups [14]. Ferrous sulphate, added to the water in which rice was cooked, lowered the prevalence of iron deficiency anemia of infants in the DPR Korea with no adverse reactions. This simple fortification would be suitable as a nationwide program in the DPRK and other countries with large infant nurseries [15]. Himachal can also try such simple fortifications. Several recent interventions using innovative approaches to dietary fortification that ensure the delivery of adequate quantities of bioavailable iron have demonstrated that iron fortification of food can be an effective and implementable strategy for controlling nutritional iron deficiency in non-industrialized countries [16]. Fortified beetroot extract intervention had a high impact on nutritional status and blood profile. Trials were held and it was concluded that while sodium iron ethylenediaminetetraacetate (NaFeEDTA)-fortified flour reduced ID in Fe-depleted children it had no bearing on taste and texture. Thus the study recommended use of NaFeEDTA-fortified flour for wider use in national school feeding programs. A study held among women and children in Cameroon established that iron, zinc, folate, and vitamin B-12 status increased after mandatory wheat flour fortification. A study in Bangladesh evaluated the sensory properties of uncooked and cooked milled lentils that were fortified with varying concentrations of Fe and Zn in the form of NaFeEDTA and ZnSO4. H2O, respectively. It was concluded that the fortification process minimally affects dual-fortified lentil sample (fortified with 16 mg of Fe and 8 mg of Zn per 100 g of lentil), which was compared to another cooked sample (unfortified control), in terms of consumers liking for all four attributes (appearance, odor, taste, and texture). Fortification per se will increase the intake of bioavailable iron and zinc. Corn mass flour or whole maize should be fortified with sodium iron ethylenediaminetetraacetate (NaFeEDTA), ferrous fumarate, or ferrous sulfate and degreed corn flour should be fortified with ferrous sulfate or ferrous fumarate. The choice of zinc fortificant appears to have a limited impact on zinc bioavailability. Phytic acid is a major inhibitor of both iron and zinc absorption. Degermination at the mill will reduce phytic acid content, and degermed maize appears to be a suitable vehicle for iron and zinc fortification. Enzymatic phytate degradation may be a suitable home-based technique to enhance the bioavailability of iron and zinc from fortified maize.

Bioavailability experiments with low phytic acid-containing maize varieties have suggested an improved zinc bioavailability comparedto wild-type counterparts. The bioavailability of folic acid from maize porridge was reported to be slightly higher than from baked wheat bread. The bioavailability of vitamin A provided as encapsulated retinyl esters is generally high and is typically not strongly influenced by the food matrix, but has not been fully investigated in maize. Dual-fortified lentil consumption can cost-effectively provide a significant part of the daily bioavailable Fe and Zn requirements of people with these 2 globally important micronutrient deficiencies [16]. In Colombia, consumption of wheat flour containing foods is associated with lower levels of anemia in preschool children.

Oral/intravenous administration

These interventions, used in acute iron deficient persons by hospitals, must be continued.

Regular testing (Monthly), monitoring and compilation of data

This is essential not only to monitor the progress of interventions but also design course corrections in ongoing interventions. New and easy methods for screening of Anemia may be tried. Quarterly reviews and biannual field checks can be done. Use of digital methods of mobile applications and hemoglobin estimation will be useful.

Stakeholder Involvement

Partnerships of relevant actors in the government and/or market systems, civil society organizations, as well as other institutions must exist. It will be helpful in changing food systems, diet patterns and ensure acceptability of interventions. Patient group meetings for sharing good practices also encourage their adoption.

Coordinated Management

Coordinated management efforts for convergence, support and consolidation of efforts of various departments of government are also critical for success of this program. Efforts must be made to associate and evaluate the following departments.

- Department of Food, Public Distribution and Consumers affairs for monitoring distribution of fortified wheat flour, rice, oil through PDS (Public Distribution System). Also ensuring supply of fortified milk, oil, and wheat flour being available in the market for private purchase. Coordination with the consumer welfare department for creating awareness about fortified foods and its benefits is also essential.
- Department of Women and Child Development- For monitoring the benefits given under ICDS (Anganwadi) and Poshan Abhiyan movement.
- Department of Health & Family Welfare- For monitoring the progress of Anemia Mukt Bharat and other initiatives like breastfeeding campaign, Janani Suraksha Yojna etc. through ASHA workers. This needs to work in tandem with the Food safety commissioner for ensuring FSSAI directions on supplementary/ dietary/fortified food.
- Department of Agriculture, Animal Husbandry, Horticulture etc., for bringing change in food system, cropping patterns and dietary habits.
- Department of Rural Development for monitoring MGNREGA and other employment schemes so that women have enough money to buy healthy food for their families.

Communication, Awareness and Use of Social Media

Organization of awareness camps and other mass information dissemination tactics use of mobile phones and social media among women of Himachal is one of the highest in the country. Use of social media can spread awareness on public health issue programs covering a large number easily. Communication strategies must be effective and must highlight the positive impact of intervention. In one case, a study in Gujarat showed covering out of schoolgirls still remains a formidable challenge to the success of anemia control that while the intervention was effective it failed to educate girls and create positive awareness regarding adoption of balanced diets. Iron Folic Acid (IFA) supplementation to adolescent girls through institutions, in particular, schools, was found to be an effective intervention to reduce anemia and was scalable within the system. The experience to educate the girls on dietary behavior has not been satisfactory on the other hand.

Addressing non-nutritional causes of anemia in endemic pockets, with special focus on malaria

It was discovered that anemia in young sub-Saharan African children may be due to the double burden of malaria and iron deficiency. Continued long-term routine use of micronutrient powder containing prophylactic iron reduced anemia, iron deficiency and iron deficiency anemia among preschool children living in rural Ghana's malaria endemic area [17]. Iron fortification of foods in infants and use of iron pots with children may have prophylactic benefits for malaria endemic low-risk populations. A similar situation may prevail in India as well. While incidences of malaria are comparatively low in Himachal but other diseases may have the similar effect of anemic conditions, and thus there is a need to address this issue along with other causes.

CONCLUSION

As is evident from the discussion above, to achieve better health status for women and children in Himachal Pradesh it is imperative that the burden of anemia be sufficiently mitigated and eventually demolished. While hundreds of anemias exist and each requires a specifically tailored approach to address it, by and large, iron and micronutrient deficiencies prove to be the two most prevalent forms of this disease. The burden of anemia is all the more insidious for its associated impact on the social economic and health costs for those living with the disease.

While strategies to target anemia abound, the abysmal results reveal a need to fine tune the government's intervention strategies. Some interventions have fared better than others, but awareness and information levels remain wretchedly low. The different methods outlined above all have significant scientific backing and proven results in alleviating the burden of anemia and should be adapted to suit local environments in the government's approach to better public health management. There is also a need for coordinating efforts between different departments for increasing efficiency of the present program. It is only through an integrated and sustained effort that the dream of Anemia Mukt Bharat can actually be achieved.

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