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Exploring the health status, nutritional deficiencies, dietary patterns, and laboratory investigation among tribal populations of villages in HD Kote, Karnataka: A cross-sectional study

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Abstract

The development of a nation hinges upon the health and well-being of its populace. However, tribal communities, often marginalized and neglected, face numerous challenges due to their reluctance to engage with other communities for essential services. Understanding the health status of these communities is paramount. This study aims to evaluate the health status, nutrition, and dietary practices among the tribes of Heggadadevanakote (HD Kote), located in the Mysore district of Karnataka, India, focusing on the anemic population.

This study was a baseline analysis of the project titled "Evaluation of efficacy and tolerability of select Ayurveda formulations in moderate Iron Deficiency Anemia", conducted as a part of the Tribal Health Care Research Programme (THCRP) under the Central Council for Research in Ayurvedic Sciences (CCRAS), Minsitry of AYUSH. The trial was conducted as an outreach activity to address

the health needs of the tribal population of HD Kote village, Karnataka.
A survey was conducted among 370 participants aged 18 to 55 years, comprising 77 males and 293 females. Clinical screening for anemia and associated symptoms was performed following the World Health Organization classification. Statistical analysis using MS Excel was employed to determine the prevalence of various health issues within the tribal population.
The findings reveal a significant prevalence of physiological complications among the tribal population, particularly among women, where the majority are affected by anemia, indicating an urgent need to address their health status. To address these challenges and raise awareness, the Ministry of Ayush, along with health professionals, has identified causative factors and implemented various frontline demonstrations, schemes, and promotive and therapeutic activities using Ayurveda to enhance the overall well-being of the tribal community.
This study highlights the importance of understanding and addressing the health needs of tribal populations, emphasizing the necessity for targeted interventions to improve their health status and quality of life.

Keywords: Anemia, Ayurveda, Nutritional, Tribal population, Therapeutic, Health

Introduction

Tribal populations in India are among the most vulnerable and marginalized communities in the country, facing significant challenges related to health and nutrition. These populations often have limited access to healthcare services and suffer from high rates of poverty, illiteracy, and malnutrition. As a result, many tribal communities in India experience a high prevalence of various health problems, including nutritional deficiencies, infectious diseases, and anemia (Kumar et al., 2020; Jain et al., 2015).
Anemia is a condition in which the body lacks sufficient red blood cells or hemoglobin to carry oxygen to the tissues. The causes of anemia are diverse, but in tribal Indian communities, nutritional deficiencies are a primary factor leading to anemia. It is often related to poor diet, specifically a lack of iron and other essential micronutrients (Kotecha, 2011). Insufficient intake of iron, vitamin B12, and folic acid, as well as poor absorption and utilization of these nutrients, can lead to anemia (Song et al., 2010). The prevalence of anemia in tribal populations is often linked to poverty, limited access to education, and a lack of awareness about proper nutrition (MTA, 2020).
Many tribal communities in India have traditional dietary patterns that are rich in locally available plant-based foods. However, these diets often lack diversity and do not provide sufficient amounts of key nutrients, such as iron and vitamin B12, which are necessary for the production of red blood cells (Ghosh-Jerath et al., 2016). Additionally, the consumption of certain foods and practices, such as tea, tobacco, and beetle nut chewing, can further contribute to the development of anemia (Ome-Kauis et al., 2015; Kaltwasser et al., 1998).
Given the significant burden of anemia and other health problems among tribal populations in India, it is crucial to better understand the factors contributing to these issues and develop effective interventions to address them. This may involve promoting healthy dietary patterns, improving access to healthcare services, and addressing the social determinants of health that contribute to the vulnerability of these populations.

Materials and Methods

This is a baseline analysis of a prospective Randomised Controlled Trial titled “Evaluation of efficacy and tolerability of select Ayurveda formulations in moderate Iron Deficiency Anemia – A randomized controlled trial” on the Tribal population of HD Kote village, Karnataka, conducted as a part of outreach activity under the Tribal Health Care Research Programme (THCRP) at Research institutes of CCRAS.

A standard protocol was prepared and approval was obtained. The Institutional Ethics Committee approved the study. Written informed consent was obtained from all study participants.
The number of patients enrolled during the study period determined the sample size. On enrolment, a clinical research form (CRF) including socio-demographic data, medical and dietary history and physical examination was completed. Blood samples were examined. All conditions were managed according to standard protocol.
A complete blood count, including red blood cell (RBC) count, haemoglobin, haematocrit, RBC indices [i.e., mean cell volume (MCV), mean cell haemoglobin (MCH), MCH concentration], white blood cell count, platelet count and peripheral smear was performed. Vitamin B12 and serum iron studies, including serum iron, serum ferritin, transferrin saturation and total iron binding capacity, were performed for all patients. Renal function test, Liver function test and Thyroid profile were also tested.
The data presented in this study is extracted and analysed from the THCRP study without using the original data parameters.

Statistical Analysis

MS Excel was used to analyse the data. The data collected were tabulated and analysed by proportions and percentages. Descriptive statistics were applied to draw conclusions.

Results

A total of 370 participants, comprising 77 males and 293 females aged between 18 to 55 years, underwent clinical screening for anemia or associated symptoms. Among these participants, anemia was suspected in 159 patients based on clinical features such as easy fatigability with weakness and tiredness (*shrama*), edema (*shotha*), weakness (*daurbalya*), etc. Blood samples were drawn from these 159 patients for further laboratory investigations to confirm anemia. The mean age of these patients was 36.9 ± 9.5 years, ranging from 18 to 55 years. The male-to-female ratio was 1:38.75, indicating a significantly higher prevalence of anemia among females. Approximately 53% of female participants (155 out of 293) were found to be anemic, while only 5% (4 out of 77) of male participants were anemic.
Easy fatigability with weakness and tiredness was the most common complaint, observed in 72.95% of patients, followed by generalized body pain (6.91%), gastritis symptoms including chest burning sensation, loss of appetite, and bloating with weakness (5.03%), weakness with headache (5.03%), weakness with body pain (4.40%), headache (1.25%), weakness with high menstrual bleeding (0.06%), weakness with palpitation (0.06%), breathlessness (0.06%), and general check-up (2.51%).
The mean value of hemoglobin was 10.51 ± 2.18 g/dl, with a range of 4.8 g/dl to 15.7 g/dl. Low hemoglobin levels (<11 g/dl in females and <12 g/dl in males) were observed in 55.35% of the participants. Anemia characterization based on RBC indices and peripheral smear revealed that microcytic hypochromic anemia was the most common type, observed in 51.57% of patients, followed by normocytic normochromic anemia (2.52%) and dimorphic anemia (1.89%).
Additional laboratory findings included low serum iron (<50 µ/dl) in 59.12% of participants, low serum ferritin (<13 ng/ml) in 49.06%, low transferrin saturation in 69.18%, and high total iron-binding capacity (>425 µ/dl) in 50.94%. Vitamin B12 deficiency (<300 pg/ml) was observed in 62.89% of participants, with severe deficiency (<150 pg/ml) noted in 9.43%.
Furthermore, other laboratory findings indicated high blood urea nitrogen (>20 mg/dl) in 31.45% of participants, high serum creatinine (>0.95 mg/dl) in 0.63%, high uric acid (>6 mg/dl) in 2.52%, high total protein (>8.30 g/dl) and high albumin (>5.20 g/dl) in 0%, high globulin (>3.5 g/dl) in 6.29%, high serum glutamic-oxaloacetic transaminase (SGOT) (>35 U/L) in 9.43%, high serum glutamic-pyruvic transaminase (SGPT) (>35 U/L) in 1.10%, and high alkaline phosphatase (>120 U/L) in 7.55%. Thyroid-stimulating hormone (TSH) was found to be high (>5.50 µIU/mL) in 9.43% of participants and low (<0.35 µIU/mL) in 1.26%.

Graph 1: Age and gender distribution of the study population

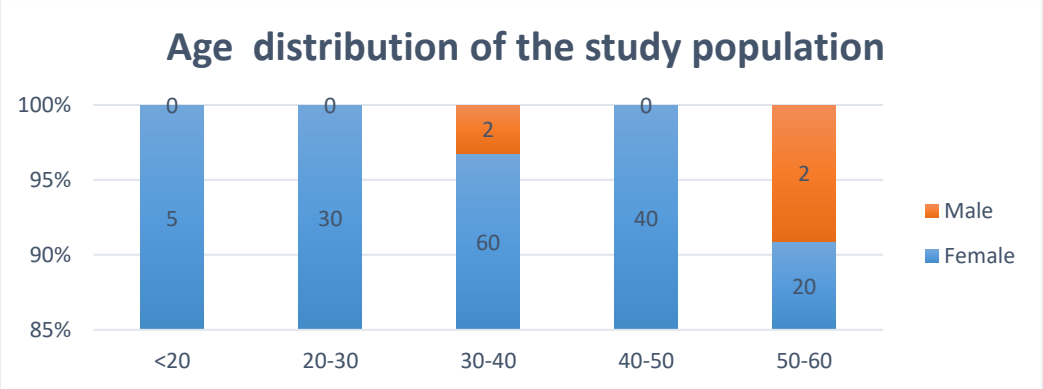

Table 1: Distribution of symptoms among the study population

Symptoms	Female	Male	Total	%
Weakness, tiredness and fatigue	114	2	116	72.95
Body pain	9	2	11	6.91
Breathlessness	1	0	1	0.06
General check-up	4	0	4	2.51
Headache	2	0	2	1.25
Burning sensation of Chest, Loss of Appetite, Bloating and weakness	8	0	8	5.03
Weakness with Body pain	7	0	7	4.40
Weakness with head ache	8	0	8	5.03
Weakness with menstrual bleeding	1	0	1	0.06
Weakness with palpitation	1	0	1	0.06
Total	**155**	**4**	**159**	

Table 2: Distribution of haemoglobin among the study population

Level of Anemia	Hemoglobin (gm/dl)	Female	Male	Total	
Severe Anemia	<7	13	0	13	88
Moderate Anemia	7-9.9	52	0	52	
Mild Anemia	10-10.9 (In Female), 10-11.9 (In Male)	22	1	23	
Normal	>11 (In Female), >12 (In Male)	68	3	71	71
Total		**155**	**4**	**159**	**159**

Table 3: Types of Anaemia among the study population

Parameters	Numbers (159)	Percentage
Microcytic Hypochromic Anaemia	82	51.57
Normocytic Normochromic Anaemia	4	2.52
Dimorphic Anaemia	3	1.89
Normocytic Normochromic Blood Picture	70	44.02
Total	**159**	**100**

Table 4: Distribution of vitamin B12 among the study population

Level of Vitamin B12	Vitamin B12 (pg/ml)	Female	Male	Total	
Severe Deficiency	<150	21	0	21	100
Deficiency	150-200	29	0	29	
Borderline Deficiency	200-300	49	1	50	
Normal	>300	56	3	59	59
Total		**155**	**4**	**159**	**159**

Table 5: Various parameters among the study population

Parameters	Low	Normal	High
Hemoglobin (Female 11-15g/dl, Male 12-16 g/dl)	88 (55.35%)	71(44.65%)	0
MCV (80-100 fl)	97(61.00%)	62(39.00%)	0
MCH (27-31 pg)	101(63.52%)	50(31.45%)	8(5.03%)
MCHC (32-36 g/dl)	83(52.20%)	75(47.17%)	1(0.63%)
S. Iron (50-170 µ/dl)	94(59.12%)	60(37.74%)	5(3.14%)
S. Ferritin (13-150 ng/ml)	78(49.06%)	75(47.17%)	6(3.77%)
TIBC (250-425 µ/dl)	3(1.89%)	75(47.17%)	81(50.94%)
Transferrin Saturation (15-50 %)	110(69.18%)	46(28.93%)	3(1.89%)

Discussion

HD Kote is a region located in the southern Indian state of Karnataka, where agriculture is the primary occupation of the people. The local diet in HD Kote is largely influenced by the availability of locally grown crops and is known for its traditional and cultural significance. The staple food of the region is rice, which is often consumed with a variety of vegetable curries and lentils like horse gram and green gram. Millets such as ragi, jowar, and bajra are also commonly consumed as a source of carbohydrates. These grains are often used to prepare traditional dishes such as ragi mudde, jowar roti, and bajra khichdi. Vegetables play a significant role in the local diet, and a variety of locally grown vegetables such as eggplant, okra, beans, potato and gourds are used in curries. The region is also known for its use of a variety of spices and herbs, such as turmeric, ginger, cumin, coriander, and fenugreek, in cooking, which add flavour and health benefits. Non-vegetarian food is also consumed in the region, with chicken and fish being the most common sources of protein. Dairy products such as milk and yoghurt are also consumed among the study population.

Like the normal population, a significant number of the tribal female population had Anaemia than male populations owing to multiple factors like menstruation, pregnancy, dietary habits and improper access to nutritious and iron-rich food. While irregular and heavy bleeding during menstruation and excessive blood loss during childbirth play a major role in the manifestation of Anemia, certain dietary habits like eating less nutritious, iron deficit, and leftover food items also contribute significantly to the development of Anemia in females.

Iron deficiency and vitamin B12 deficiency are two of the primary contributors to Anemia in tribal Indian populations (Dhanuka et al., 2019). This study also showed a significant finding of Anemia in 55.35% of the population. Iron deficiency was observed in 51.57% and Vitamin B12 deficiency in 62.89%. Inadequate intake of these nutrients, as well as poor absorption and utilization, could possibly be the cause of Anemia in this population. Iron deficiency anaemia is a common type of Anaemia that occurs when the body does not have enough iron to produce haemoglobin. Iron is found in many foods, including red meat, poultry, fish, beans, lentils, leafy green vegetables, and fortified cereals. However, in tribal communities, dietary patterns are often limited due to a lack of resources and access to a variety of foods. This can result in an inadequate intake of iron, leading to Anemia. Additionally, the consumption of foods high in phytates, such as cereals, legumes, and seeds, can inhibit iron absorption, contributing to iron deficiency anaemia (Piskin et al., 2022).

A significant number of our population (90%) were habituated to either of many addictive behaviours like tea, coffee, tobacco chewing or beetle nut chewing. Multiple cups of tea are consumed throughout the day. It is observed that people often skip meals or have an untimely meal to fulfil their habit.

Tea contains compounds called tannins, which can bind to iron in the stomach and intestines and prevent its absorption into the bloodstream. When tea is consumed with a meal, the tannins in tea can inhibit the absorption of iron from plant-based sources of iron, such as leafy greens, legumes, and fortified cereals. Similarly, drinking tea after a meal can reduce the absorption of iron from animal sources, such as meat, fish, and poultry (Disler et al., 1975).

A significant number (49.06%) of the study population showed reduced Iron stores. In individuals who already have low iron stores or are at risk of iron deficiency anaemia, excessive consumption of tea can further exacerbate the condition. Excessive consumption of tea, particularly on an empty stomach or with meals, can interfere with iron absorption and contribute to Anemia in susceptible individuals (Fan, 2016).

Improper food timing can have various effects on the human body, including disrupting the body's natural biological rhythms and affecting digestion and metabolism. Skipping meals or eating at irregular intervals can lead to nutrient deficiencies, as the body may not receive an adequate amount of nutrients from food. This can affect overall health and lead to deficiencies of essential vitamins and minerals (Voigt et al., 2019).

Tobacco and beetle nut chewing habits are common practices in many tribal communities including HD Kote village. However, these habits can have several adverse effects on health, including contributing to the development of Anemia. Both beetle nut and tobacco contain compounds that can interfere with the absorption of nutrients, including iron, which is essential for the production of red blood cells. Tobacco contains nicotine, which can cause blood vessels to narrow, reducing blood flow and oxygen delivery to the body's tissues. This can lead to the development of Anemia. In addition to interfering with nutrient absorption and reducing oxygen delivery, tobacco and beetle nut chewing can also lead to other health problems that can contribute to Anemia. Both habits are associated with an increased risk of oral cancer, respiratory disease and cardiovascular disease which can lead to Anemia (Fan, 2016; Voigt et al., 2019; Benowitz and, 1997).

The consumption of alcohol has been associated with the development of Anemia, especially in populations with limited access to healthcare, such as tribal populations living in rural areas like HD Kote. Alcohol consumption can lead to Anemia through a variety of mechanisms, including nutritional deficiencies, gastrointestinal bleeding, reduced erythropoiesis, haemolysis, and liver disease (Ballard, 1975).

Vitamin B12 is an essential nutrient that plays a crucial role in the production of red blood cells, DNA synthesis, and neurological function. A deficiency in Vitamin B12 can cause Anemia, neurological disorders, and other health problems. In tribal communities, a predominantly vegetarian diet can contribute to vitamin B12 deficiency. Vitamin B12 is mainly found in animal-based foods such as meat, fish, eggs, and dairy products. The tribal population of HD Kote village have limited access to these foods due to poverty, cultural preferences, and limited availability of animal-based foods in the local diet (O'Leary and Samman, 2010). Gastrointestinal disorders such as Helicobacter pylori infection, inflammatory bowel disease, and other gut infections may be prevalent, leading to the malabsorption of Vitamin B12 in this population. Parasitic infections such as tapeworms and hookworms can lead to malabsorption of nutrients, including Vitamin B12. These infections are common in tribal populations due to poor sanitation and hygiene practices. Pernicious Anemia and genetic factors could also be one of the causes of Vitamin B12 deficiency (Yakoon et al., 2003).

The high prevalence of Anemia and deteriorating health status in tribal populations like HD Kote village is a cause for concern. Anaemia is a condition that can have serious long-term consequences, including impaired cognitive development, reduced work productivity, and increased mortality. The causes of Anemia in these populations are multifactorial, including poor nutrition, limited access to healthcare, and social and economic factors.

Nutrition plays a crucial role in the prevention and treatment of Anemia. A diet rich in iron, folate, and vitamin B12 can help increase the production of red blood cells and prevent the development of Anemia. However, many tribal populations in rural areas of HD Kote have limited access to a varied and nutritious diet due to poverty, limited availability of food, and poor infrastructure (Roy et al., 2023; Renuka Jyothi et al., 2023).

Addressing the high prevalence of Anemia and deteriorating health status in tribal populations like HD Kote villages requires a comprehensive approach. This includes improving access to healthcare and nutritional support, promoting education and awareness about Anemia and its causes, and addressing the social and economic factors that contribute to poor health outcomes.

Efforts to improve nutrition should focus on promoting the consumption of a diverse and nutritious diet, including increasing the availability and accessibility of nutrient-rich foods and supporting agricultural production and food security initiatives. In addition, interventions to address Anemia should be integrated with other health and development programs, including maternal and child health, education, and livelihoods (Veena et al., 2022).

Conclusion

Addressing the high prevalence of Anemia and deteriorating health status in tribal populations of HD Kote requires a multifaceted approach that prioritizes access to healthcare, nutrition, education, and development opportunities. Such interventions can help improve the health and well-being of these populations and promote sustainable development in the region.

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