GENERAL STUDIES IV

Vitamin B12 Deficiency in Indian Adolescents – UPSC 2026

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A recently reported study suggesting widespread vitamin B12 deficiency among Indian adolescents has highlighted the importance of addressing hidden hunger and micronutrient deficiencies. Vitamin B12 plays a crucial role in red blood cell formation, DNA synthesis and neurological functioning. Civil Service Gurukul examines the causes, consequences, nutritional challenges, government initiatives, constitutional provisions and policy recommendations for improving adolescent health and nutritional security from the UPSC Prelims and Mains perspective.

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Current Affairs – Executive Summary

A recently reported study suggesting widespread vitamin B12 deficiency among Indian adolescents has renewed concerns regarding hidden hunger, micronutrient deficiencies and nutritional inequality. Addressing this challenge requires reliable health surveillance, dietary diversification, evidence-based food fortification, appropriate clinical screening and effective implementation of adolescent nutrition programmes.

Vitamin B12

10–19 Years

Article 47

SDG 2 & 3

1. Why Is Vitamin B12 Deficiency in the News?

A newspaper report dated 27 November 2026 highlighted a study suggesting that approximately two-thirds of Indian adolescents may have vitamin B12 deficiency.

The reported findings raise important questions regarding adolescent nutrition, dietary diversity, micronutrient intake, healthcare accessibility and the effectiveness of India's public health interventions.

> **Important Current Affairs Clarification**
> The reported two-thirds estimate should not be treated as an independently established nationwide prevalence figure without examining the original study, sample size, age groups, geographical coverage, laboratory thresholds and statistical methodology.

2. What Is Vitamin B12?

Vitamin B12, also known as cobalamin, is a water-soluble vitamin essential for several biological processes, including red blood cell formation, DNA synthesis and normal neurological functioning.

Major Functions of Vitamin B12

- Supports normal red blood cell formation.
- Participates in DNA synthesis.
- Maintains normal nervous system functioning.
- Supports the formation and maintenance of myelin.
- Participates in important metabolic reactions.
- Supports normal growth and development.

3. Important Scientific Facts About Vitamin B12

Particulars	Details
Scientific Name	Cobalamin
Vitamin Category	Water-soluble vitamin
Important Mineral Component	Cobalt
Major Functions	DNA synthesis, neurological function and red blood cell formation.
Principal Storage Organ	Liver

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Particulars	Details
Important Absorption Factor	Intrinsic factor produced by gastric parietal cells.
Principal Absorption Site	Terminal ileum of the small intestine.
Associated Deficiency Disorder	Megaloblastic anaemia and neurological complications.

UPSC Prelims Memory Trick

B12 = Cobalamin = Cobalt + Blood Cell Formation + Nervous System

4. Why Is Adolescence a Critical Stage for Nutrition?

Adolescence generally refers to the age group of 10–19 years. It represents a transitional period between childhood and adulthood involving rapid physical, psychological and cognitive development.

- Rapid physical growth increases nutritional requirements.
- Balanced nutrition supports learning and educational participation.
- Healthy dietary habits influence long-term health outcomes.
- Adolescent nutrition contributes to future reproductive and maternal health.
- Improved health supports productivity and human capital formation.

Nutritional deficiencies during adolescence may therefore have consequences extending beyond individual health to educational achievement, economic productivity and intergenerational development.

5. What Is Hidden Hunger?

Hidden hunger refers to inadequate intake or availability of essential vitamins and minerals, even when a person consumes sufficient calories.

Unlike visible hunger, micronutrient deficiencies may remain undetected for considerable periods because individuals do not necessarily appear undernourished.

Micronutrient	Important Deficiency Consequences
Vitamin B12	Megaloblastic anaemia and neurological problems.
Iron	Iron deficiency anaemia.
Vitamin A	Night blindness and impaired immune function.
Vitamin D	Rickets in children and osteomalacia in adults.
Iodine	Goitre and impaired development associated with iodine deficiency.
Folate	Megaloblastic anaemia and increased risk of neural tube defects during pregnancy.
Zinc	Impaired growth and immune function.

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6. Major Causes of Vitamin B12 Deficiency

Inadequate Dietary Intake

Diets lacking reliable sources of vitamin B12 may increase deficiency risk, particularly when fortified foods or appropriate supplements are unavailable.

Absorption Disorders

Certain gastrointestinal conditions and problems involving intrinsic factor may interfere with vitamin B12 absorption despite adequate dietary intake.

Economic Inequality

Limited household income may restrict access to diverse and nutrient-rich food products.

Low Nutritional Awareness

Lack of awareness regarding micronutrient requirements can contribute to inadequate dietary planning.

Healthcare Accessibility

Limited access to screening, laboratory testing and professional nutritional guidance may delay identification and treatment.

7. Dietary Sources of Vitamin B12

Food Category	Examples	Important Consideration
Dairy Products	Milk, curd and cheese.	Can contribute to B12 intake in vegetarian diets.
Eggs	Egg-based foods.	Contain naturally occurring vitamin B12.
Animal Source Foods	Fish, meat and poultry.	Common natural dietary sources.
Fortified Foods	B12-fortified cereals and plant-based beverages.	Check product labels for actual B12 content.
Supplements	Vitamin B12 preparations.	Use according to appropriate professional guidance.

Vegetarian Nutrition Perspective

A well-planned vegetarian diet can support good health. However, ordinary unfortified fruits, vegetables, pulses and grains are not reliable sources of vitamin B12. Individuals with limited dairy or other animal-source food intake may require suitable fortified foods or professionally recommended supplementation.

Vegetarian dietary patterns alone do not establish that an individual has vitamin B12 deficiency.

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8. Potential Symptoms and Health Consequences

Category	Possible Manifestations
Haematological	Megaloblastic anaemia, weakness and fatigue.
Neurological	Tingling, numbness and balance difficulties.
Cognitive	Possible difficulties with concentration and memory.
Oral Health	Glossitis or inflammation of the tongue.
Developmental	Potential adverse effects on normal growth and development.

These manifestations are not specific to vitamin B12 deficiency. Appropriate clinical evaluation is necessary to distinguish nutritional deficiencies from other medical conditions. Neurological manifestations can occur even without anaemia.

9. Difference Between Iron, Vitamin B12 and Folate Deficiency

Parameter	Iron Deficiency	Vitamin B12 Deficiency	Folate Deficiency
Typical Anaemia	Microcytic anaemia	Megaloblastic anaemia	Megaloblastic anaemia
Red Blood Cell Size	Usually smaller	Often larger	Often larger
Major Biological Role	Haemoglobin formation	DNA synthesis and neurological function	DNA synthesis and cell division
Neurological Effects	Not the characteristic B12-related pattern	May cause characteristic neurological complications	Generally lacks the characteristic B12-related neurological pattern

Important UPSC Concept

All cases of anaemia are not caused by iron deficiency. Vitamin B12 deficiency, folate deficiency, infections, chronic diseases and inherited blood disorders can also contribute to anaemia.

Combined deficiencies may alter the typical laboratory patterns described above.

10. Food Fortification, Supplementation and Dietary Diversification

Strategy	Meaning	Example
Food Fortification	Adding essential micronutrients to food products.	Vitamin B12-fortified food products.
Supplementation	Providing specific nutrients through suitable preparations.	Professionally recommended vitamin supplements.

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Strategy	Meaning	Example
Dietary Diversification	Increasing the variety and nutritional quality of foods consumed.	Balanced meals containing diverse nutrient-rich foods.
Biofortification	Increasing the nutrient content of crops through breeding, agronomic or biotechnology approaches.	Iron-rich or zinc-rich crop varieties.

These strategies are complementary but not interchangeable. Their effectiveness depends on the nutrient concerned, population requirements, scientific evidence and implementation quality.

11. Major Government Initiatives for Nutrition and Adolescent Health

Government Initiative	Major Objective
POSHAN Abhiyaan	Improve nutritional outcomes through convergence, monitoring and community participation.
Mission Saksham Anganwadi and POSHAN 2.0	Strengthen nutrition services and Anganwadi infrastructure for eligible beneficiaries.
PM POSHAN	Provide nutritious meals to eligible schoolchildren and support educational participation.
Anaemia Mukt Bharat	Reduce anaemia through preventive and therapeutic interventions.
Rashtriya Kishor Swasthya Karyakram	Address adolescent health requirements, including nutrition and mental health.
Weekly Iron and Folic Acid Supplementation	Address iron and folic acid requirements among eligible adolescents.
National Health Mission	Strengthen accessible and equitable healthcare delivery.
School Health and Wellness Programme	Promote health awareness and healthy behaviour among schoolchildren.

These programmes provide broader nutrition and public health infrastructure. Their inclusion does not imply that every programme specifically provides vitamin B12 supplementation or screening.

12. Anaemia Mukt Bharat and the 6×6×6 Strategy

Anaemia Mukt Bharat was launched in 2018 to strengthen India's response to anaemia among vulnerable population groups.

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Major Interventions

- Prophylactic iron and folic acid supplementation.
- Periodic deworming.
- Behaviour change communication.
- Testing and treatment of anaemia.
- Provision of iron and folic acid-fortified foods through relevant public programmes.
- Addressing non-nutritional causes of anaemia in endemic areas.

Critical Policy Perspective

Iron and folic acid interventions cannot automatically correct vitamin B12 deficiency. A comprehensive approach to anaemia requires identification of its underlying causes and appropriate treatment.

13. Constitutional Provisions Related to Nutrition and Health

Constitutional Provision	Relevance
Article 21	Right to life, judicially interpreted to encompass important aspects of health and dignity.
Article 39(e)	Protection of the health and strength of workers and the tender age of children.
Article 39(f)	Opportunities for children to develop in a healthy manner and with dignity.
Article 41	Public assistance in specified circumstances, subject to the State's economic capacity and development.
Article 45	Early childhood care and education for children below six years.
Article 47	Duty of the State to raise nutritional levels, improve living standards and improve public health.
State List Entry 6	Public health and sanitation, hospitals and dispensaries.

UPSC Prelims Fact

Article 47 belongs to Part IV of the Constitution, which contains the Directive Principles of State Policy.

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14. Nutritional Security and Sustainable Development Goals

SDG	Objective	Relevance to Nutrition
SDG 1	No Poverty	Improves household access to nutritious food.
SDG 2	Zero Hunger	Addresses hunger, food insecurity and malnutrition.
SDG 3	Good Health and Well-being	Promotes healthy lives and healthcare access.
SDG 4	Quality Education	Healthy nutrition supports learning and educational participation.
SDG 5	Gender Equality	Addresses gender-related inequalities in food and healthcare access.
SDG 10	Reduced Inequalities	Promotes equitable access to nutrition and health services.

15. Economic and Social Consequences of Adolescent Malnutrition

Human Capital Development

Nutritional deficiencies may adversely affect physical development, educational participation and future workforce capabilities.

Healthcare Expenditure

Delayed diagnosis and management of nutritional disorders can increase healthcare requirements and household expenditure.

Educational Outcomes

Poor health and persistent fatigue may interfere with school attendance, concentration and participation in learning activities.

Demographic Dividend

India's ability to benefit from its young population depends partly on investments in nutrition, health, education and skills.

Intergenerational Malnutrition

Poor adolescent nutrition may contribute to future health vulnerabilities, making early intervention important for breaking intergenerational cycles of disadvantage.

> **Human Development Linkage**
> Better Nutrition ? Improved Health ? Stronger Educational Participation ? Human Capital Development ? Higher Economic Potential

16. Major Governance Challenges

- Limited availability of representative micronutrient deficiency data.
- Variation in laboratory thresholds and diagnostic methodologies.
- Inadequate access to screening and diagnostic facilities.
- Insufficient dietary diversity among vulnerable households.

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- Unequal access to healthcare and nutrition services.
- Difficulty reaching adolescents outside the formal school system.
- Weak coordination between education, health and nutrition departments.
- Limited public awareness regarding hidden hunger.
- Overemphasis on calorie availability without adequate attention to micronutrients.

17. Way Forward: Strengthening India's Adolescent Nutrition Strategy

Evidence-Based Nutritional Surveillance

Develop reliable and representative nutritional datasets with age-wise, sex-wise and regional classifications. Publish laboratory thresholds and survey methodologies transparently.

Strengthen School Nutrition Programmes

Improve dietary diversity, nutritional quality and health education through appropriate school-based interventions.

Targeted Screening and Clinical Assessment

Train primary healthcare professionals to identify nutritional risk factors, distinguish different causes of anaemia and refer adolescents for appropriate evaluation.

Evidence-Based Food Fortification

Evaluate suitable fortified foods based on nutritional requirements, affordability, safety, quality standards and scientific evidence.

Nutrition Education and Behavioural Change

Promote awareness regarding balanced diets, reliable micronutrient sources and healthy food choices without stigmatising cultural or dietary preferences.

Interdepartmental Convergence

Strengthen coordination among health departments, educational institutions, local governments and nutrition-related agencies.

Equitable Access

Ensure that vulnerable adolescents, including those outside formal schooling, can access appropriate nutritional information and healthcare services.

18. UPSC Prelims Quick Revision Capsule

Keyword	Remember
Vitamin B12	Cobalamin
Vitamin B12 Classification	Water-soluble vitamin
Mineral in Cobalamin	Cobalt
Intrinsic Factor	Supports vitamin B12 absorption

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Keyword	Remember
Terminal Ileum	Principal absorption site for vitamin B12
Megaloblastic Anaemia	May result from vitamin B12 or folate deficiency
Hidden Hunger	Micronutrient deficiency
Adolescence	10–19 years
Article 47	Nutrition, standard of living and public health
POSHAN Abhiyaan	Improvement of nutritional outcomes
Anaemia Mukt Bharat	6×6×6 strategy
RKSK	Adolescent health
SDG 2	Zero Hunger
SDG 3	Good Health and Well-being

19. UPSC Prelims Practice MCQ

Question 1

With reference to vitamin B12, consider the following statements:

1. It is a water-soluble vitamin.
2. It plays an important role in DNA synthesis.
3. Its deficiency may cause neurological complications.

Which of the statements given above are correct?

A. 1 and 2 only

B. 2 and 3 only

C. 1 and 3 only

D. 1, 2 and 3

Reveal Answer and Explanation

Correct Answer: D – All three statements

Vitamin B12 is water-soluble and supports DNA synthesis, red blood cell formation and neurological functioning.

Question 2

Which Article of the Indian Constitution specifically directs the State to improve nutritional levels and public health?

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A. Article 32

B. Article 44

C. Article 47

D. Article 51

Reveal Answer and Explanation

Correct Answer: C – Article 47

Article 47 is a Directive Principle of State Policy dealing with nutrition, living standards and public health.

Question 3

Consider the following pairs:

1. Vitamin B12 – Cobalamin.
2. Vitamin C – Ascorbic acid.
3. Vitamin B1 – Thiamine.
4. Vitamin B2 – Riboflavin.

How many of the above pairs are correctly matched?

A. Only one

B. Only two

C. Only three

D. All four

Reveal Answer and Explanation

Correct Answer: D – All four

All four vitamins are correctly matched with their scientific names.

Question 4

The term hidden hunger primarily refers to:

A. Inadequate micronutrient intake or availability.

B. Complete absence of food consumption.

C. Excessive protein consumption.

D. Increase in agricultural productivity.

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Reveal Answer and Explanation

Correct Answer: A

Hidden hunger refers to deficiencies of essential vitamins and minerals, which may occur even when calorie intake is sufficient.

Question 5

Consider the following statements:

1. Vitamin B12 deficiency can cause megaloblastic anaemia.
2. All cases of anaemia are caused by iron deficiency.
3. Food fortification involves adding essential nutrients to food products.

Which of the statements given above are correct?

A. 1 and 2 only

B. 1 and 3 only

C. 2 and 3 only

D. 1, 2 and 3

Reveal Answer and Explanation

Correct Answer: B – 1 and 3 only

Anaemia has multiple possible causes, including iron, vitamin B12 and folate deficiencies. Therefore, statement 2 is incorrect.

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20. UPSC Mains Practice Question

GS Paper II – Health, Social Justice and Human Development

Question: Micronutrient deficiencies among adolescents represent a significant challenge to India's human capital development. Examine the causes and consequences of hidden hunger and suggest measures to strengthen adolescent nutritional security.

Marks: 15 | **Word Limit:** 250 words

Reveal Model Answer

Introduction

Hidden hunger refers to deficiencies of essential vitamins and minerals despite potentially adequate calorie consumption. Reports of widespread vitamin B12 deficiency among Indian adolescents highlight the need for a comprehensive nutritional security strategy.

Major Causes

- Inadequate dietary diversity and micronutrient intake.
- Poverty and unequal access to nutritious foods.
- Absorption disorders and underlying health conditions.
- Limited nutritional awareness and diagnostic facilities.
- Implementation gaps in adolescent health programmes.

Consequences

- Increased risk of nutritional anaemia and neurological complications.
- Adverse effects on educational participation and development.
- Higher healthcare requirements and household expenditure.
- Reduced human capital potential.
- Possible intergenerational health disadvantages.

Way Forward

- Strengthen representative nutritional surveillance.
- Promote dietary diversification and appropriate food fortification.
- Improve targeted screening and professional nutritional guidance.
- Strengthen school nutrition and adolescent health programmes.
- Ensure convergence between health, education and nutrition departments.
- Improve access for economically and socially vulnerable adolescents.

Conclusion

Addressing hidden hunger is essential for achieving Article 47's nutritional objectives and Sustainable Development Goals 2 and 3. An evidence-based, equitable and multisectoral approach can strengthen India's demographic dividend and promote sustainable human development.

21. UPSC Syllabus Mapping

UPSC Paper	Relevant Topic
Prelims GS Paper I	General science, vitamins, nutrition and human physiology.

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UPSC Paper	Relevant Topic
Mains GS Paper I	Population, poverty and social development.
Mains GS Paper II	Health, education, hunger, poverty and social sector development.
Mains GS Paper III	Food security, human capital and inclusive growth.
Mains GS Paper IV	Equity, public welfare, accountability and ethical healthcare governance.
Essay	Nutrition, demographic dividend and sustainable human development.
Interview	Public health policy, nutritional inequality and adolescent welfare.

22. Frequently Asked Questions

What is the scientific name of vitamin B12?

Vitamin B12 is known as cobalamin.

Is vitamin B12 water-soluble or fat-soluble?

Vitamin B12 is a water-soluble vitamin.

What type of anaemia is associated with vitamin B12 deficiency?

Vitamin B12 deficiency can cause megaloblastic anaemia and may also produce neurological complications.

Do two-thirds of all Indian adolescents have vitamin B12 deficiency?

A recent newspaper report suggested such an estimate. However, the original study methodology and population coverage must be verified before treating it as a nationwide prevalence figure.

Can vegetarian individuals obtain vitamin B12?

Yes. Dairy products, appropriately fortified foods and professionally recommended supplements can contribute to adequate vitamin B12 intake.

Does every vegetarian individual have vitamin B12 deficiency?

No. Nutritional status depends on actual intake, absorption, health conditions and other individual factors.

What is hidden hunger?

Hidden hunger refers to deficiencies of essential vitamins and minerals that may occur even when calorie intake is adequate.

Which constitutional provision deals with nutrition and public health?

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Article 47 of the Indian Constitution.

What is the difference between fortification and supplementation?

Fortification adds nutrients to food products, whereas supplementation provides nutrients through specific preparations.

Can iron supplementation alone treat vitamin B12 deficiency?

No. Vitamin B12 deficiency requires appropriate assessment and management addressing the specific deficiency and its underlying cause.

Which Sustainable Development Goals are directly related to nutrition and health?

SDG 2, Zero Hunger, and SDG 3, Good Health and Well-being.

Why is adolescent nutrition important for UPSC?

It connects public health, constitutional obligations, social justice, food security, demographic dividend and human development.

23. Conclusion

Vitamin B12 deficiency among adolescents highlights the importance of moving beyond calorie-based food security towards comprehensive nutritional security.

India's nutrition strategy must address micronutrient deficiencies through reliable scientific evidence, dietary diversity, appropriate healthcare services, nutritional education and equitable access to public welfare programmes.

Investing in adolescent nutrition is not merely a healthcare intervention. It is also an investment in human capital, educational development, economic productivity and India's long-term demographic potential.

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