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Q6(a)

What is acclimatization? Discuss adaptive responses to high altitude and cold climate

UPSC Civil Services Mains 2021 · Anthropology GS 1 · 20 marks · Concepts and methods of Ecological Anthropology: Bio-cultural Adaptations

9.7 Concepts and methods of Ecological Anthropology: Bio-cultural Adaptations-Genetic and Non-genetic factors. Man's physiological responses to environmental stresses: hot desert, cold, high altitude climate.

Core demand of the question

- What is acclimatization? Discuss adaptive responses to high altitude and cold
- Write about 250 words for 20 marks

Revision summary

Acclimatization is reversible adjustment within a lifetime.

It is not the same as genetic adaptation, though they combine.

Altitude responses are ventilation, heart rate, and later haematology.

Tibetans and Andeans solve hypoxia by different mixes of physiology and genes.

Cold responses are shivering, vasoconstriction, diet, and Arctic clothing.

Introduction

Acclimatization is a reversible, physiological adjustment to an environment within an individual's life. It is not a genetic adaptation of a population, though the two can work together.

Body

Acclimatization defined

- **Short-term change:** sweating in heat, hyperventilation on a climb, vasoconstriction in wind.
- It differs from **habituation** (less notice of a stimulus) and from **genetic adaptation** (allele change across generations).
- Developmental acclimatization, as in chest growth at altitude, sits between a holiday trip and a gene.

High altitude

- Hypoxia is the stress. Immediate responses include raised ventilation and heart rate. Later, more red cells and 2,3-DPG shift oxygen delivery.
- **Andean** populations often show high haemoglobin. **Tibetan plateau** people more often raise ventilation and use different haemoglobin-oxygen patterns, with EPAS1 and related alleles as genetic partners of the same stress.
- **Limits:** chronic mountain sickness, low birth weight, and the need for slow ascent. Culture adds coca, tea, pacing, and pastoral mobility.

Cold

- **Immediate:** shivering, vasoconstriction, and a rise in metabolic heat.
- **Inuit** and other Arctic peoples show well-studied combinations of insulation (fat, clothing), high-calorie fat diets, and circulatory patterns in hands that reduce frostbite in some tests.
- **Lewis** hunting reaction (cyclic rewarming of fingers) is a short-term acclimatization. Bergmann and Allen rules are population-shape correlations, not the same as one person's acclimatization.
- **Technology is part of the adaptive response:** parkas, igloos, and night fires are as real as brown fat.

Bio-cultural point

- **High altitude and cold are textbooks of the hallmark in 01d:** body, gene, and practice in one loop.

Flow diagram

Acclimatization -> High altitude hypoxia
Acclimatization -> Cold
High altitude hypoxia -> Tibetan ventilation alleles
Cold -> Inuit insulation diet gear

Conclusion

Acclimatization is reversible physiology. At altitude it is ventilation and blood; in cold it is heat, vessels, and clothing. **Tibetan** and **Inuit** cases show genes and gear beside the same stresses.

Facts & figures

Tibetan plateau

High-altitude adaptation with relatively lower haemoglobin than Andes and distinctive EPAS1 haplotypes.

Andean

Classic high-haemoglobin, barrel-chest teaching case of altitude physiology.

Inuit

Arctic cold and marine-fat diet; clothing and shelter are central adaptive responses.

Lewis reaction

Alternating constriction and dilation in cooled fingers, a short-term cold response.