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# Genetic Improvement of *Solanum tuberosum* for Sustainable Space Agriculture: A Review †

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**Introduction**: During long-duration space missions, astronauts face several physiological challenges due to microgravity, radiation, isolation, and confinement, which can lead to neuroinflammation, cognitive impairments, and other long-term effects. In this context, nutrition plays a critical role in maintaining homeostasis. One proposed solution to the degradation of micronutrients in stored space food is the cultivation of fresh crops in space farms. **Methodology**: Based on a literature review, this study explores the WBEEP (Whole-Body Edible and Elite Plant) strategy, which aims to develop crops with higher nutritional value, increased edible biomass, and improved efficiency in nutrient use under controlled environmental conditions. **Results**: Potato (*Solanum tuberosum* L.) is a promising candidate for space agriculture due to its high energy yield, ease of cultivation, and stress tolerance. However, it faces limitations such as the accumulation of solanine—a toxic compound—in its aerial parts and its relatively low nutritional content. Genetic strategies such as silencing or mutating genes (GAME4, DPS, GAME9) involved in solanine biosynthesis, or introducing tomato genes that convert solanine into non-toxic compounds, may allow the whole plant to become edible. Additionally, biofortification techniques—such as overexpression of key enzymes, pathway modulation, and transcription factor regulation—can enhance protein, vitamin, and phytonutrient content. **Conclusions**: With proper genetic engineering approaches, potatoes can be transformed into a nutritionally complete and fully edible crop, contributing significantly to sustainable food production in long-term space missions.

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