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EFFECTS OF LONG-TERM HYPOBARIA AND HYPOXIA ON THE GROWTH AND NUTRITION  
OF LETTUCE

**Abstract**

The objectives of this research were to grow plants under long-term hypobaric and hypoxic conditions, and to investigate how hypobaria and hypoxia affect the growth and the nutrition of plants. 25-day old lettuce (*Lactuca sativa* L. Rome) seedlings were transplanted into nutrient solution and grown for 20 days under two levels of total atmospheric pressure (101 and 30 kPa) and three levels of oxygen partial pressure (21, 6 and 2 kPa). Compared with 21 kPa oxygen partial pressure, hypoxia (6 or 2 kPa) not only significantly inhibited the growth of lettuce plants by decreasing biomass, leaf area, the ratio of root and shoot, water content, the contents of minerals and organic compounds (vitamin C, crude protein and crude fat) under two levels of total pressure, but also decreased the thylakoid in chloroplast and the content of carotenoid, and changed the shape of mitochondrion and increased the starch grain and the content of chlorophyll in mesophyll. In addition, enzymatic activities (catalase and total superoxide dismutase), the content of glutathione and total antioxidant capacity significantly reduced by hypoxia, but the contents of malondialdehyde and total phenol increased markedly. Under the same oxygen partial pressure (21, 6 or 2 kPa), hypobaria (30kPa) did not markedly enhance the biomass of lettuce plants, but increased leaf area, the ratio of root and shoot, water content of the lettuce plants. Hypobaria also decreased the contents of malondialdehyde and total phenol and protected the ultrastructure of mitochondrion and chloroplast of lettuce leaves under hypoxic condition (6 or 2 kPa). Furthermore, enzymatic activities (catalase and total superoxide dismutase), the contents of minerals and organic compounds enhanced markedly in hypobaria. This research shows that hypobaria (30 kPa) can not markedly enhance the growth of lettuce plants, but can improve the ability of anti-adversity and plants nutrition in hypoxia (6 or 2 kPa).

Key words: long-term, hypobaria, hypoxia, lettuce, growth