

Abstract

Lactic Fermentation Increases Antioxidant Capacity and Phenolic Compounds in White and Red Varieties of Quinoa [†]

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Abstract: Quinoa (*Chenopodium quinoa* Willd.) is a pseudocereal originally grown in the Andean region of South America. Due to its nutritional and functional properties, as well as its tolerance to harsh environments, quinoa has garnered increased attention in recent decades, with its production expanding to Europe and Asia. Polyphenols are secondary by-products of plants, exhibit positive impacts on health, including anti-mutagenic and antioxidant activities, which protect against oxidative-induced stress. This study focused on investigating changes in antioxidant capacity and phenolic compounds in white and red quinoa varieties during lactic acid fermentation with *Lactobacillus plantarum* 299v[®]. Throughout fermentation, pH and lactic acid formation were monitored every two hours until the pH dropped below 4.6. Samples before and after fermentation were analyzed for antioxidant capacities using 2,2-diphenyl-1-picrylhydrazyl (DPPH) and ferric ion-reducing antioxidant power assay (FRAP). The total polyphenol content (TPC) was measured using the Folin–Ciocalteu method, and the polyphenol profile was identified and quantified by UPLC-MS-UV. The findings revealed that fermentation led to a significant increase ($p < 0.001$) in TPC from 4.03 to 7.68 mgGAE/100 g and from 4.35 to 7.96 mgGAE/100 g for the white and red quinoa varieties respectively. Fermentation showed a significantly positive impact on the iron-reducing antioxidant capacity of quinoa ($p < 0.05$). Red quinoa had higher antioxidant levels than the white variety, with a similar trend observed in the DPPH assay. After fermentation, the antioxidant capacity in white and red quinoa increased from 7.90 ± 0.03 to 10.48 ± 0.11 (mgTE/100 g) and from 8.78 ± 0.06 to 11.75 ± 0.10 (mgTE/100 g), respectively. Furthermore, fermentation significantly ($p < 0.001$) increased the content of polyphenols with high antioxidant power such as epi-catechin, catechin, 4-Hydroxybenzoic acid, vanillic acid, chlorogenic acid, rutin and quercetin in both red and white varieties. In conclusion, lactic fermentation proved to be effective for increasing the phenolic content and antioxidant capacities of both quinoa varieties.

Keywords: fermentation; polyphenols; quinoa; antioxidant capacity



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