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Folate in Red Rhapsody Strawberry—Content and Storage Stability †

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Abstract: Folate (Vitamin B9) is critical for a range of biological functions in adults and children, including DNA, protein and neurotransmitter synthesis. It is also essential for the healthy development of the fetus in early pregnancy and for the prevention of neural tube defects, such as spina bifida. Strawberries are considered a tasty and healthy fruit consumed all over the world and may potentially be an important dietary source of natural folates. However, the relative importance of strawberry as a dietary source will depend on the total folate concentration, vitamer profile, storage stability and bioavailability to humans. Red Rhapsody, an important commercial strawberry cultivar in Australia, was screened for its folate content and storage stability by stable isotope dilution assay (SIDA). Total folate content ranged from 90–118 μg/100 g fresh weight (fw), which was well above the value in the Australian Food Composition Database (39 μg/100 g fw). 5-Methyltetrahydrofolate, the biologically active form in humans, was the principal vitamer present. Furthermore, folate remained relatively stable during refrigerated (4 °C) storage (loss of only 28% after 14 days of storage). This information is relevant for consumers since the inherent perishability of strawberry fruit makes refrigerated storage common practice in Australian households.

Keywords: folate; strawberry; vitamer profile; storage stability; food; nutrition

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1. Introduction

Folates, a generic term for a specific group of B vitamins, play an essential role in different metabolic pathways. More specifically, tetrahydrofolate (H4folate) polyglutamates are acceptors and donors of one-carbons in a network of biosynthetic and catabolic reactions among primarily three different cellular compartments. The one-carbon metabolism in the cytoplasm catalyzes nucleotide biosynthesis as well as the re-methylation of homocysteine to methionine. Secondly, folates are involved in the mitochondrial one-carbon metabolism generating amino acids, and thirdly in the nucleus for DNA replication and repair [1–3]. However, the human body is not able to synthesize these compounds. If not sufficiently provided with foods or supplements, a lack of folate is mainly correlated with neural tube defects in newborns [4], but can also result in decreased levels of methionine and increased levels of homocysteine. The latter is associated with cardiovascular diseases [5] and Alzheimer's disease [6–8]. Moreover, there seems to be a correlation between folate status and the risk of developing cancer, specifically colorectal cancer [9].

These essential metabolic functions and the evidence of deficiencies in societies without mandatory fortification emphasize the importance of an adequate folate supply.

Strawberries (*Fragaria* × *ananassa*) are considered a tasty and healthy fruit consumed all over the world and may potentially be an important dietary source of natural folates. However, the relative importance of strawberry as a dietary source of folate will depend on the total folate concentration, vitamer profile, folate storage stability and bioavailability to humans. Red Rhapsody, an important commercial strawberry cultivar in Australia, was screened for its folate content and storage stability.

2. Material and Methods

Red Rhapsody strawberries (7 kg) were sourced fresh from a commercial farm in Brisbane, Queensland, Australia. Individual folate vitamers in the strawberry samples (fresh and during a 14-day storage trial at 4 °C) were determined by stable isotope dilution assay (SIDA) [10].

3. Results and Discussion

Total folate content in Red Rhapsody strawberry ranged from 90–118 µg/100 g fresh weight (fw), which was well above the published value in the Australian Food Composition Database (AFCD; 39 µg/100 g fw). However, similar values have been reported by Tulipani et al. [11] (up to 96 µg/100 g fw) and Striegel et al. [10] (up to 153 µg/100 g fw), respectively. 5-Methyltetrahydrofolate, the biologically active form in humans, was the principal vitamer present. Furthermore, folate concentration remained relatively stable during refrigerated (4 °C) storage, with a loss of only 28% after 14 days of storage (Figure 1). The total folate content in Red Rhapsody after storage was still considerably higher than in the AFCD.

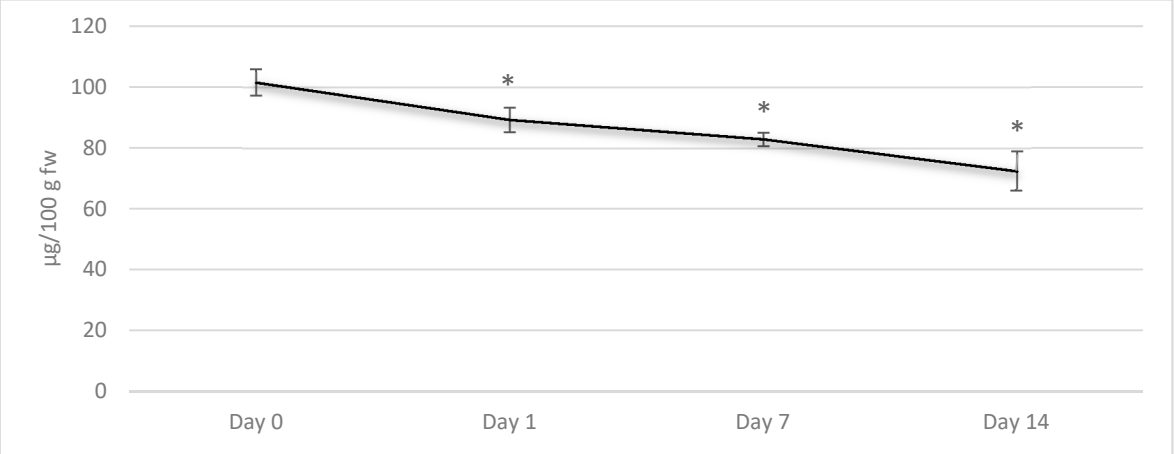

Figure 1. Total folate content in Red Rhapsody strawberries during a 14-day storage trial at 4 °C. Total folate content: 5-methyltetrahydrofolate (>90%), 5-formyltetrahydrofolate, tetrahydrofolate, pteroylglutamic acid and 10-formyl-pteroylglutamic acid. Strawberry samples were analyzed by stable isotope dilution assay (SIDA). Data are mean ± SD (n = 5); * $p < 0.05$ vs. day 0 (t-test).

4. Conclusions

The results of the present study are relevant for consumers since the inherent perishability of strawberry fruit makes refrigerated storage (approx. 4 °C) common practice in Australian households. Furthermore, Red Rhapsody strawberries with a total folate content of up to 118 µg/100 g fw when fresh, can also be regarded as an important dietary source of natural folates even when stored at 4 °C for 14 days.

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