Vitamin A and Lutein Levels in Dried Leaves of *Moringa Oleifera*

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Abstract

Leaves of Moringa oleifera, a tropical plant used in Burundi as food against malnutrition, is high in lutein and vitamin A. The leaves are consumed as dry powder that people store in their home at room temperature. As such, content in vitamin A and lutein may decrease over time and affect the amonts that are ingested. In order to assess such a decrease, we performed HPLC quantification of lutein and vitamin A in powdered dry leaves of *Moringa oleifera* over a six month period, in both young and mature leaves. Young and mature leaves were also harvested in July and August. The results show that levels in lutein and in β-carotene were generally higher in leaves harvested in July compared to those harvested in August, whereas no differences were observed for *cis*-β-carotene. Levels in lutein (0.66 mg/g +/- 0.29, on average) and in *cis*-β-carotene (0.033 mg/g +/- 0.020, on average) decreased rapidly over the first month, with values near 0 after this period. Content in β-carotene (0.17 mg/g +/- 0.01, on average) showed a 50% decrease during the first month, and reached nearly 0 after two months. In conclusion, dried leaves of *Moringa oleifera* should be consumed within the first month after they have been harvested and dried, in order to benefit from their content in lutein and in β- and *cis*-β-carotenes.

Introduction

Moringa oleifera

Moringa oleifera, is an exceptionally nutritious vegetable tree with a variety of potential uses. The leaves of Moringa oleifera are highly nutritious, being a significant source of beta-carotene, Vitamin C, protein, iron, and potassium.[5] In addition to being used fresh as a substitute for spinach, its leaves are commonly dried and crushed into a powder, and used in soups and sauces.

Carotenoids

Carotenoids belong to the category of diterpenoids and are in the form of a polyene chain which is sometimes terminated by rings. Carotenoids composed only of carbon and hydrogen such as α-carotene, β-carotene and lycopene, are known as carotenes. Carotenoids containing oxygen, such as lutein and zeaxanthin, are known as xanthophylls. The polyene chain of carotenoids is susceptible to oxidative degradation by light or heat and is chemically unstable in acids.

Metabolic functions

Vitamin A plays a role in a variety of functions throughout the body, such as vision, gene transcription, immune function, embryonic development and reproduction, bone metabolism, haematopoiesis, skin and cellular health. In particular, vitamin A is a vitamin that is needed by the retina of the eye in the form of retinal, that is absolutely necessary for both low-light and color vision. Vitamin A deficiency is estimated to affect approximately one third of children under the age of five around the world.[20] It is estimated to claim the lives of 670,000 children under five annually.[21] Approximately 250,000–500,000 children in developing countries become blind each year owing to vitamin A deficiency.[22]

Lutein is employed by organisms as an antioxidant and for blue light absorption. It was found to be concentrated in the macula, a small area of the retina responsible for central vision. The hypothesis for the natural concentration is that lutein helps keep the eyes safe from oxidative stress and the high-energy photons of blue light.[4][5][6][7][8][9][10]

Vitamin A and Lutein in Foods

Vitamin A is found at different levels in many plants and at very high levels in animal livers. Vitamin A can be found in two principal forms in foods: The carotenes alpha-carotene, beta-carotene, gamma-carotene; and the xanthophyll beta-cryptoxanthin. Lutein is found in green leafy vegetables Lutein is also found in egg yolks, animal fats, and the retina.[3]

Materials and Methods

Moringa oleifera Leaves

Young and mature leaves of Moringa oleifera were harvested from trees growing at the ISABU experimental station, in the Kumoso area, Burundi, both in July and August. Sampling was performed on four different parts of the field, according to natural lighting conditions: (1) East; (2) Centre East; (3) Centre West; (4) West. Leaves were dried at 45˚C for 48h (10% humidity), crushed into powder and packaged in sealed plastic bags, under vacuum.

Extraction and Analysis

Samples of dried leaves were further crushed in a mortar, in liquid nitrogen, and extracted using a mixture of hexane-ethanol-acetone (2:1:1) under ultrasonic conditions in a temperature controled bath (40˚C) for 30 min.

Carotenoids analysis was performed by RP-HPLC (Agilent) on a YMC C30 stationary phase column (250 x 4.6 mm, 5 µm particule size), using gradient elution. The A and B mixtures were composed of methanol/MTBE/Water (81:15:4) and methanol/MTBE (9:91), respectively. A linear gradient was used, starting with A mixture (100%) and ending with a 50:50 ratio of A and B mixtures, over a 45 min period.

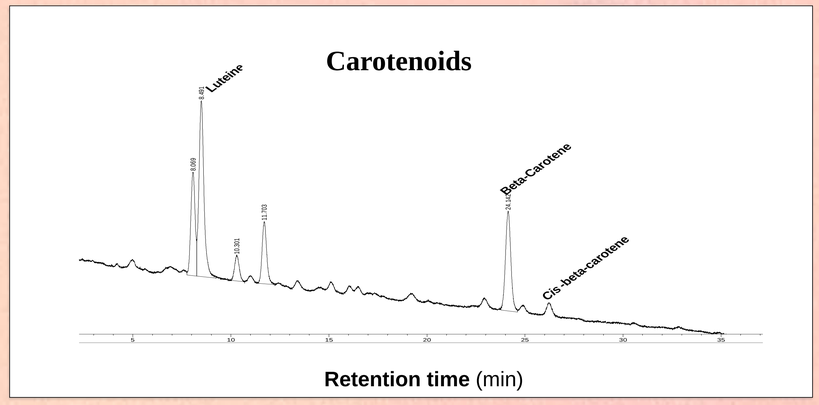

Fig 1. Chromatograms of carotenoids of Moringa oleifera extracts by RP-HPLC

Results and Discussion

Table 1. Carotenoid content of Moringa oleifera leaves, harvested in July and August

Compound	Month	Young leaves (mg/20g)	Mature Leaves (mg/20g)	Average (mg/20 g)
B-Caroten	July	3.35 +/- 0.62	5.34 +/- 0.98	
	August	2.31 +/- 0.67	2.60 +/- 0.52	3.40 +/- 0.69
Cis-β-caroten	July	0.63 +/- 0.37	0.89 +/- 0.53	
	August	0.49 +/- 0.29	0.63 +/- 0.36	0.66 +/- 0.39
Lutein	July	16.83 +/- 9.73	19.40 +/- 11.05	
	August	7.074 +/- .43	9.83 +/- 6.35	13.28 +/- 7.89

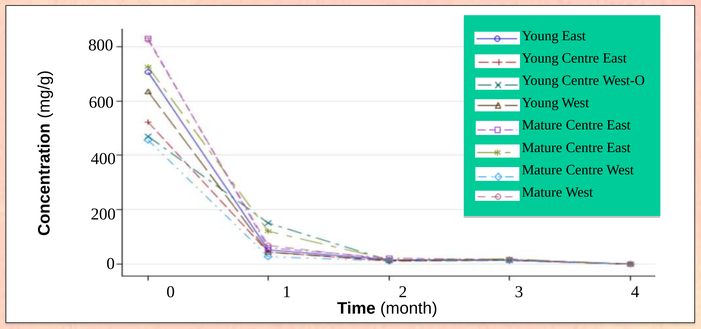

Fig. 2. Lutein content in dry powder of Moringa oleifera leaves

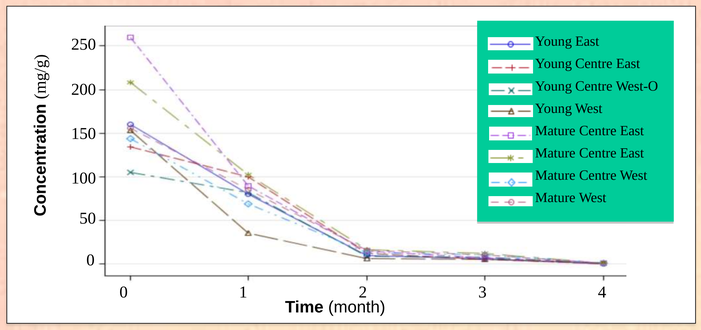

Fig. 3. β-Carotène content in dry powder of Moringa oleifera leaves

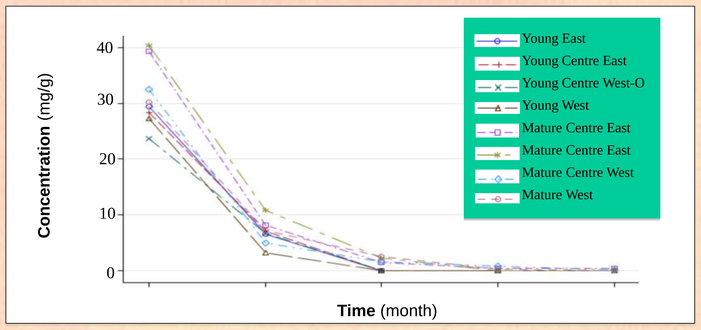

Fig. 4. *cis*-β-Carotène content in dry powder of Moringa oleifera leaves

Conclusion

Lutein and in β-carotene contents were generally higher in leaves harvested in July compared to those harvested in August, whereas no differences were observed for *cis*-β-carotene. Levels in lutein (0.66 mg/g +/- 0.29, on average) and in *cis*-β-carotene (0.033 mg/g +/- 0.020, on average) decreased rapidly over the first month, with values near 0 after this period. Content in β-carotene (0.17 mg/g +/- 0.01, on average) showed a 50% decrease during the first month, and reached nearly 0 after two months. Dried leaves of *Moringa oleifera* should be consumed within the first month after they have been harvested and dried, in order to benefit from their content in lutein and in β- and *cis*-β-carotenes.

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