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Journal of Food Composition and Analysis 21 (2008) 93–106

JOURNAL OF FOOD COMPOSITION AND ANALYSIS

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Original Article

Carotenoid and mineral content of Micronesian giant swamp taro (*Cyrtosperma*) cultivars

Lois Englberger[a,*], Joseph Schierle[b], Klaus Kraemer[b], William Aalbersberg[c], Usaia Dolodolotawake[c], Julia Humphries[d], Robin Graham[e], Anne P. Reid[f], Adelino Lorens[a,g], Kiped Albert[a,g], Amy Levendusky[a], Eliaser Johnson[h], Yumiko Paul[h], Fernando Sengebau[i]

[a]*Island Food Community of Pohnpei, Kolonia, Pohnpei, Federated States of Micronesia*
[b]*DSM Nutritional Products Ltd, Kaiseraugst, Switzerland*
[c]*Institute of Applied Science, University of the South Pacific, Suva, Fiji*
[d]*School of Pharmacology, Flinders Medical Centre, Bedford Park, South Australia, Australia*
[e]*University of Adelaide, Faculty of Sciences, School of Agriculture and Wine, Glen Osmond, Australia*
[f]*Atlanta Center of Nutrient Analysis, Food and Drug Administration, Atlanta, Georgia, USA*
[g]*Pohnpei Agriculture of the Office of Economic Affairs, Kolonia, Pohnpei, Federated States of Micronesia*
[h]*Pohnpei Department of Health, Kolonia, Pohnpei, Federated States of Micronesia*
[i]*Department of Agriculture, Koror, Republic of Palau, Palau*

Received 24 July 2007; received in revised form 21 September 2007; accepted 21 September 2007

Abstract

Dietary change in Micronesia has led to serious problems of vitamin A deficiency and other nutritionally-related health problems. It is essential to identify nutrient-rich indigenous foods that may be promoted for health improvements. Giant swamp taro (*Cyrtosperma merkusii*) is important for food and culture on atoll and mountainous islands of Micronesia. There are many *Cyrtosperma* cultivars, but few have been analyzed for nutrient content. Samples were collected in the Federated States of Micronesia (Pohnpei, Chuuk and Yap) and the Republic of Palau, assessed for corm flesh color and other attributes, and analyzed for carotenoids (β- and α-carotene, β-cryptoxanthin, lutein, zeaxanthin, and lycopene) and minerals (including iron, zinc, and calcium). Of 34 cultivars analyzed, β-carotene concentrations varied from 50 to 4486 μg/100 g. Yellow-fleshed cultivars generally contained higher carotenoid concentrations. Of the ten cultivars analyzed for mineral content (wet weight basis), substantial concentrations of zinc (5.4–46.1 mg/100 g), iron (0.3–0.8 mg/100 g) and calcium (121–305 mg/100 g) were found. All cultivars were acceptable for taste and production factors. These carotenoid- and mineral-rich cultivars should be considered for promotion in Micronesia and other areas for potential health benefits.

Keywords: Carotenoid; Vitamin A; Mineral; Chronic disease; Micronesia; Indigenous food; Dietary change; Giant swamp taro; *Cyrtosperma merkusii*; Taro cultivars

1. Introduction

Assessing the nutrient composition of indigenous foods and cultivars is essential in order to identify locally grown foods to alleviate micronutrient deficiency and other nutritionally-related diseases; establish locally relevant dietary guidelines; assess dietary intake and determine relationships between diet, disease, and health; provide information for agriculture and trade development; and present data needed for protecting biodiversity and traditional food systems of indigenous peoples (Greenfield and Southgate, 2003; Kuhnlein, 2000).

*Corresponding author. P.O. Box 2299, Kolonia, Pohnpei, 96941, Federated States of Micronesia. Tel.: +691 320 8639; fax: +691 320 2127.
E-mail address: nutrition@mail.fm (L. Englberger).

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doi:10.1016/j.jfca.2007.09.007

Giant swamp taro (*Cyrtosperma merkusii*)[1] is the most important staple food on Pacific atoll islands[2] (Murai et al., 1958; Mahoney, 1960a, b; Sivan, 1990) and is a major staple food on volcanic islands of Micronesia (Bradbury and Holloway, 1988; Falanruw, 1995; Malolo et al., 1999). This includes the Federated States of Micronesia (FSM) (consisting of Pohnpei, Chuuk, Yap, and Kosrae) (population 107,008) (FSM Division of Statistics, 2002) and the Republic of Palau (population 20,579) (CIA, 2006), both independent island nations, located in the Western Pacific Ocean.

Following dietary and other lifestyle changes, serious problems of vitamin A deficiency have developed in all four FSM states (Elymore et al., 1989; Centers for Disease Control and Prevention, 2001; Kim 2002; Yamamura et al., 2004) with over half of under-5-year old FSM children afflicted with this problem. In addition, chronic disease problems, including diabetes, heart disease and cancer, have occurred at epidemic proportions in FSM and Palau and other parts of Micronesia and the Pacific (Coyne, 2000).

Cyrtosperma was named among the four most important food crops for Pohnpei and Chuuk (Fischer and Fischer, 1957) and as the most important local staple food for Yap (Falanruw, 1995; Egan, 1998). Because of its importance, people on the Pohnpei atoll of Pingelap speak of *Cyrtosperma* with "reverence and affection" (Sacks, 1996). Another writer explained how people of Pingelap, Mwoakilloa, and Ngatik (other Pohnpei atolls) "pride themselves on their knowledge of its [*Cyrtosperma*] cultivation. And they should … it is the mainstay of their diet, their life's blood" (Mahoney, 1960b).

Agricultural resources are limited on atolls due to the low rainfall, sandy soils, and high salinity, but *Cyrtosperma* thrives well under such conditions, can be harvested at any time of the year, withstands typhoons and storms, and can be stored in the ground up to 10 or even 30 years and still be edible (Bentzen, 1949; Mahoney, 1960b; Pollock, 1992). Due to the remoteness of many atolls, *Cyrtosperma* is particularly important for food security.

Cyrtosperma is an aroid (*Araceae* family), as are the other taro types: *Colocasia esculenta*, (true or dry-land taro); *Alocasia macrorriza* (giant taro) and *Xanthosoma sagittifolium* (Hawaiian, American or New World taro) (Lewis, 2000; Pollock, 1992). However, *Cyrtosperma* is grown in fresh water marshes and swampy areas (other taros are grown on drier areas) and is large in size, growing to heights of 15–20 feet (*Colocasia* growing to about two feet) (Bascom, 1965). It has huge arrow-shaped leaves (Fig. 1), and corms (Fig. 2) that usually weigh two to ten pounds, but they may weigh as much as 50 pounds (Mahoney, 1960a; Pollock, 1992) or more: one corm (10 years old) was documented at 160 pounds (Merlin and Juvik, 1996). *Cyrtosperma* requires a long time before harvesting, usually 3 years, depending on the variety, whereas *Colocasia* matures after 9–14 months (Pollock, 1992) and must be then harvested. Like many root crops,

Fig. 1. A giant swamp taro plantation in the Mortlock Islands, Chuuk State, Federated States of Micronesia, showing a harvested plant with corm.

Fig. 2. Corms of *Pwiliet* cultivar of giant swamp taro at the 2004 World Food Day exhibition in Kolonia, Pohnpei, Federated States of Micronesia.

[1] In English, different terms have been used to refer to giant swamp taro, such as giant taro, swamp taro, wetland taro, and hard taro. This paper will use the term *Cyrtosperma* for clarity purposes.

[2] An atoll is a ring-shaped low-lying coral island or group of islands often consisting of only a narrow strip of land with seawater on both sides, circling a lagoon.