Journal of Food Composition and Analysis 67 (2018) 191–200

Contents lists available at ScienceDirect

Journal of Food Composition and Analysis

journal homepage: www.elsevier.com/locate/jfca

Variation in tuber proximate composition, sugars, fatty acids and amino acids of eight *Oromo dinich* (*Plectranthus edulis*) landraces experimentally grown in Ethiopia

Abera Geleta Gifty[a,b], Bruno De Meulenaer[a,*], Temesgen Magule Olango[b]

[a] Ghent University, Faculty of Bioscience Engineering, Department of Food Safety and Food Quality, Research Group Food Chemistry and Human Nutrition, Belgium
[b] School of Plant and Horticultural Science, Faculty of Agriculture, Hawassa University, P.O. Box 05, Awassa, Ethiopia

ARTICLE INFO

Chemical compounds studied in this article:
L-Arginine (PubChem CID: 6322)
L-Asparagine (PubChem CID: 6267)
L-Serine (PubChem CID: 5951)
L-Histidine (PubChem CID: 6274)
L-Leucine (PubChem CID: 6106)
I-Isoleucine (PubChem CID: 6306)
L-Citrulline (PubChem CID: 9750)
D-(−)-Fructose (PubChem CID: 5984)
D-Glucose (PubChem CID: 5793)
Maltose (PubChem CID: 439186)

Keywords:
Plectranthus edulis
Amino acids
Reducing sugars
Food composition
Oromo dinich
Underutilized tubers
Arginine
Fatty acids
Protein-quality
Food analysis

ABSTRACT

Plectranthus edulis is one of the underutilized tubers indigenous to Ethiopia grown for its edible tuber. However, data on their variation on proximate, sugar, amino acids and fatty acids composition is largely unknown. Therefore, eight landrace, grown under identical conditions, were characterized. Considerable variation in the composition of the various landraces was observed. In general, the dry matter content of the tubers was lower compared to other edible tubers making the *Oromo* potato as it called locally, less suitable for frying and roasting. Also their higher reducing sugar (3.67–7.26% on dry matter basis) content compared to potatoes; restrict their application for frying purposes. Tubers were generally rich in minerals (4.47–7.03% on dry matter basis) and arginine content (up to 4.68% on dry matter basis). Remarkably, the extracted lipids contained typically 50% fatty acids, suggesting the presence of essential oils as well. The observed variation in nutrients composition exhibited the tuber's promising potentials in human nutrition, food supplement and genetic engineering.

1. Introduction

Plectranthus edulis (Vatke) Agnew (syn. *Coleus edulis*) is one of the important tuber producing plants whose potential has not been fully investigated and realized. It is an indigenous crop to Ethiopia (Engels and Hawkes, 1991) and known by several local names in different parts of Ethiopia (*Oromo dinich*, in Oromia region, *Welayta donuwa* in Wolayta zone, *Agew dinch* in Awi zone) (EBI, 2012). However, since it is largely consumed in Oromia regional state, which covers the largest part of Ethiopia, the name *Oromo dinich* was used throughout this article, which means in fact *Oromo* potato when directly translated to English.

The habit of the tuber formation is similar to Irish potato. It is however neither a potato nor related to it. It is also not related to sweet potato, yam, or cassava (National Research Council (U.S.) Development Security and Cooperation, 2006). It is a member of the mint family *Laminaceae,* subfamily *Nepetoideae* (Abdel-Mogib et al., 2002).

P. edulis has a long growing period from 9 to 12 months after planting. Traditionally it is grown in dry conditions, without adding inorganic fertilizer, where most cereals fail. It is cultivated at an altitude of 1300 to 2600 m above sea level (EBI, 2012). The yield varies from 45000 kg to 49000 kg/ha (Taye et al., 2013) which is three times higher than the yield of potato in Ethiopia (13684.7 kg/ha) (FAOSTAT Crop Statistics, 2016). Currently, there are more than 30 Landraces

* Corresponding author at: Faculty of Bioscience Engineering, Department of Food Safety and Food Quality, Research Group Food Chemistry and Human Nutrition, Coupure Links 653, B-9000 Ghent, Belgium.
E-mail address: Bruno.DeMeulenaer@UGent.be (B. De Meulenaer).

https://doi.org/10.1016/j.jfca.2018.01.015
Received 6 July 2017; Received in revised form 15 January 2018; Accepted 17 January 2018
Available online 31 January 2018
0889-1575/

maintained by the Ethiopian Biodiversity Institute (EBI, 2012). For some of the landraces, physiological diversity, tuber morphological characteristics, agronomy and the potential for micro-propagation were studied (Garedew et al., 2013; Taye et al., 2013; Tsegaw and Feyissa, 2014).

The plant is herbaceous and bushy growing up to 1.5 m of height. It produces finger like slender stem tubers up on swelling of the tip or middle part of stolon's. Tubers have several deep eyes and are easily broken and irregular in shape (Engels and Hawkes, 1991), 20–25 cm long, weighing 1090 g (Taye, 2008). The color of the tubers varies from white-purple, brown, red-deep and purple based on the landraces.

Mature tubers are consumed as staple food as vegetable after boiling with skin or without, contributing to the diet and household food security. Hence, the crop could have a great potential to alleviate hunger directly, through increasing food production and enhancing the nutrition of diets of the poor. Moreover, similar to other *Plectranthus* species, *P. edulis* is a plant of economic and medicinal interest (Abdel-Mogib et al., 2002; Rijo et al., 2013).

Despite its contribution to the diet and food security of the community, little research attention is given to better understand the tubers diversity in nutrient composition. It does not even appear as such in the national research programs (EBI, 2012). The chemical composition of *P. edulis* tubers has not been well studied, except for the report of Abdel and others for the presence of thirty-seven types of diterpenoids which are of medicinal interest (Abdel-Mogib et al., 2002). General data on the tubers proximate composition and contents of few vitamins and minerals are available only from the Ethiopian Health and Nutrition Research Institute (EHNRI, 1997). However, for promoting a sustainable diet in the rural community and understand the contribution of food biodiversity to nutritional adequacy, identification and monitoring of nutrition indicators for biodiversity is critical (Charrondière et al., 2013). Hence, studying the diversity in nutrient composition among different landraces of *Oromo dinich* is the first step to understand its contribution to the human diet, its potential for further value addition and prompt its potential commercial use. This paper thus presents the variation in proximate composition, sugars, fatty acids, total and free amino acids contents of mature tubers among eight *Oromo dinich* (*P. edulis*) landraces experimentally grown under similar conditions at Hawassa in Ethiopia. The compositional data will be published in FAO/INFOODS food composition database for biodiversity after the reviewed paper is published.

2. Materials and methods

All the chemicals used in the experiment were of standard quality.

2.1. Planting material collection

Nine landraces of *Oromo dinich* (*P. edulis*) tubers were collected from farmer's fields and local markets in potentially growing areas. The tubers were collected from four *Kebeles* in Oromia region and one *Kebele* from Southern Nations and Nationalities People's region (SNNPR) (Table 1). The identity of the tubers was confirmed by the experts from Ethiopian Biodiversity Institute (EBI) on basis of their morphology.

The local names of the landraces were used and codes were given for each landraces by the collector as indicated in Table 1.

2.2. Design of the experiment

The nine landraces were planted in three replications using a completely randomized block design (RCBD) with 9 landraces and 3 blocks layout. The experimental field was located at 7.05°S latitude, 38.49°E longitude, and 1708 m above sea level. The soil was sandy loam with a pH of 6.6. The average air temperature during the growing period varied between min. 9.4 to 15.6 °C; max. 24.3.0 to 31.4 °C, total precipitation during the growing period was 3.1 mm (ENMA, 2015).

2.3. Planting

To avoid the impact of growing season and regions on the tubers chemical composition, the collected seed tubers (planting materials) were grown at one season under similar conditions at the Hawassa University research field from Dec 2012 to Dec 2013.

Seed tubers were cut in to pieces before planting. Two cut pieces with minimum of two eyes were placed in a hole with 5 cm depth and spacing of 90 cm between plants and 70 cm between ridges. Plants were irrigated every three days until the ridges were half flooded.

Coco peat an organic fertilizer was used as a replacement for the traditional peat used by the farmers. Two times a shovel full of coco peat per plant was applied to the soil at the same day before flowering. Throughout the growing period, plots were kept weed free, plants grown vigorously in their vegetative growth and no pest occurrence and disease symptoms were observed. Tubers were harvested when physiologically mature (80–100% of the above ground part dried) between 9–12 months after planting. Accession *DHSew* failed to produce tubers at Hawassa environmental condition. Hence, chemical composition was analyzed only for tubers harvested from eight landraces (Fig. 1).

2.4. Sample preparation and nutrient analysis

A kilo gram of tubers of each accession was harvested from each plot three times. Tubers from three middle rows of each plot were mixed to make a composite sample per plot for each accession. Tubers with visual defects and disease were sorted out from the composite sample. Ten healthy and uniform weight (approximately 25–50 g) tubers were taken from each sorted composite samples. Tubers were washed with tap water to remove soil and dried with a kitchen towel before peeling.

All the tubers were hand-peeled by scratching the surface with a sharp knife and re-washed with tap water. Five peeled tubers were chopped, mixed and dry matter and ash were determined. The remaining chopped tubers were further partially dried in an oven at 60 °C for 72 h. The dried chopped tubers were ground using a cyclone mill (FOSS 1093 Cyclone sample mill) with a 2 mm screen. The flour was

Table 1
Local names of the landraces of *Oromo dinich* (*Plectranthus edulis)* tubers and areas of collection.

Ser no	Local names of the landraces	Accession code	Zone/district/*kebele*/region	Elevation (m above sea level)	Collection
1	*Dinnichaa – Oromo – Su*	*DOSu*	*Horo guduro wollega/Jarte Jardga/Suteketali/Oromia*	2388	Farmers' field
2	*Dinnichaa – habesha* – red- *Se*	*DHSer*	*Jimma/mama/Sembo mana/Oromia*	2059	Farmers' field
3	*Inuka – Wolayta donuwa-Sh*	*IWsh*	*Wolayta/Damot gale/Shahsha-gale/SNNPR**	2219	Farmers' field
4	*Lofua – Wolayta donuwa – Sh*	*LWsh*	*Wolayta/Damot gale/Shahsha-gale/SNNPR**	2219	Farmers' field
5	*Chenqo – Wolayta donuwa – Sh*	*CWsh*	*Wolayta/Damot gale/Shahsha-gale/SNNPR**	2219	Farmers' field
6	*Dinnichaa – gurracha* – red-*Ar*	*DGArr*	East *Wollega/Jimma Arjo/Arjo/Oromia*	2506	Market
7	*Dinnichaa – Oromo* – white – *Ji*	*DOJiw*	East *Wollega/Diga/Jirata/Oromia*	2506	Farmers' field
8	*Dinnichaa – gurracha* – white – *Ar*	*DGArw*	East *Wollega/Jimma Arjo/Arjo/Oromia*	2506	Market
9	*Dinnichaa – habesha* – white – *Se*	*DHSew*	*Jimma/mama/Sembo mana/Oromia*	2059	Farmers' field