Maria da Graça Dias

Affiliation
Food and Nutrition Department
National Institute of Health Doutor Ricardo Jorge, IP
Lisbon, Portugal, www.insa.pt

Expertise
Analytical Chemistry
Food Composition Tables

Field of Interest
Carotenoids and lipossolubles vitamins analysis by HPLC
Carotenoids bioaccessibility
Data quality evaluation
Nutrients/contaminants exposure assessment
Food sampling plans for data to FCT
Data compilation and Databases
Infrastructure

INSA

What is it?

• Centenary Public Institute - 1899
• State Laboratory in the Health Sector
• National Reference Laboratory
• National Health Observatory
• Dedicated to Public Health Gains
European network to advance carotenoid research and applications in agro-food and health

Infraestructure
Food and Nutrition Department

Accredited assays: 82
Microbiology: 52
Chemistry: 30

Monitoring and Surveillance

Welcome to PortFIR
your portuguese food information resource

The PortFIR is a program of implementing Portuguese networks of excellence in nutrition and food safety, which also aims to the future establishment of a platform that will be equally recognized by Food Composition, Food Contamination and Food Consumption. The portal, as well as the surveillance activities, communicates with national and non-communicable health observatory instruments in the context of information systems, such as monitoring production and dissemination of Public Health statistics.

Reference
Accredited assays: 82
Microbiology: 52
Chemistry: 30

Proximates
Vitamins
Minerals
Micronutrients
Mycotoxins
Additives

Research & Development

HPLC-DAD-UV/Vis/Fluorescence
UPLC-DAD-UV/Vis/Fluorescence
HPLC-MS/MS
UPLC-MS/MS
Gas chromatography
ICP-MS/MS
Spectrophotometers
....food analysis

www.eurocaroten.eu / info@eurocaroten.eu / EUROCAROTEN CA15136
Research Questions Addressed

Carotenoids

Food analysis

Why?

❖ Health

❖ Possible risk reduction of cancer, cardiovascular diseases, eye degeneration

❖ Population groups depending on carotenoids to obtain vitamin A

❖ Chemical analysis

❖ Data reliability and completeness need improvement

❖ Controversial results from bioavailability studies and food processing

Contribution to the phytochemical characterization of Portuguese Fruits and Vegetables

❖ Method for Food Chemical Analysis for carotenoids determination by a HPLC-RP – DAD/UV-Vis method with quantification using external standards and an internal standard

Method validation

Uncertainties evaluation

❖ Study of different fruits and vegetables, including the natural variability among species/varieties/cultivars

❖ Retention factors and yields for cooked food

❖ Accredited by ISO 17025 for α-carotene, β-carotene, β-cryptoxanthin, lycopene, lutein, zeaxanthin
Research Questions Addressed

Carotenoids/vitamin A

Evaluation of ingestion by Portuguese Population

Total Diet Studies Exposure: 2012-2016 (FP7, GA nº 289108)

• Food items selected from the consumption survey.

• Sampling started on April 2014 and finished in March 2016.

• Samples were collected in 4 campaigns (spring, summer, autumn, winter). Each composite sample (total 169) is composed by 12 sub-samples prepared as eaten (total 2018 samples purchased).

• At least 48 shops were visited all in the Great Lisbon area. Besides, all food items were prepared/cooked as ingested.
Results 1

**Fig. 1 - Carotenoids in PDO/PGI Portuguese Fruits**

Different Places
Same Region, Variety, Harvest Time

**Fig. 1.1 - Carotenoids in Lane Late Orange produced in different places in Algarve Region**

Different Varieties
Same Region, Place, Harvest Time

**Fig. 1.2 - Carotenoids in six Apple varieties from Alcobaça**

Different Places
Same Region, Variety, Harvest Time

### Results 1

**Fig. 1 - Carotenoids in PDO/PGI Portuguese Fruits**

- M.Carnival Peach
- Lane Late Orange
- De Saco Cherry
- Apple "mean"
- Longal Chestnut
- Rocha Pear

### Results 1.1 - Carotenoids in Lane Late Orange produced in different places in Algarve Region

- Silves
- Faro
- Algoz
- Tavira

### Results 1.2 - Carotenoids in six Apple varieties from Alcobaça

- Royal Gala
- Bravo esmolfe
- Jonagold
- Reineta pardes
- Golden
- Starking

**Carotenoids content (mg/100 g)**

- α-carotene
- β-carotene
- β-cryptoxanthin
- Lutein
- Lycopene
- Zeaxanthin
Results 2

Fig. 2 - Carotenoids in Portuguese Traditional Vegetables

Fig. 2.2 - Carotenoids in Galega Kale by harvest month, grown at the same vegetable-garden (Tagus River Valley - Mouriscas)

Different Harvest Time
Same Region, Place, Variety, Plants

Different Regions
Same Variety, Harvest Time
Results 3

Total uncertainty components (analytical and sampling)

- Local
- Region
- Country
- Harvest time

Total uncertainty components include analytical and sampling components.
Conclusions

- Portuguese traditional leafy vegetables are a very good source of lutein (1.9 to 7.2 mg/100 g) and β-carotene (1.6 to 6.4 mg/100 g); fruits (consumed in larger quantities than vegetables), despite having lower carotenoid content, contain other carotenoids as β-cryptoxanthin.
- Fruits and vegetables carotenoid content may differ considerably depending on species, varieties, geographical site of production (region, place) and time of harvest, which should be taken in account in sampling plans.
- Studied samples and standard solutions appear to be stable for at least 6 months, when stored at -70 °C.
- The great majority of food items showed results with measurement relative uncertainties between 0.050 and 0.15, but relative uncertainties of 0.50 may occur near quantification limits.
- Cooking vegetables in water did not conduct to (E)/(Z) carotenoid isomerisation, and for the great majority of matrices 80-90% carotenoid retentions were obtained.
- High carotenoid content of traditional green vegetables and carotenoid physiological activities may contribute to the health effects of the Mediterranean diet.
Additional Notes
Needs…Interests….Carotenoids

- **Improvement** of the analytical **methods** - faster, **environment friendly** and more **accurate** when **saponification** step is necessary.
- **Proficiency/interlaboratory** tests.
- Adequate **reference materials**.
- More **studies** about **bioaccessibility/bioavailability**.
- More studies addressing **variability among varieties** for the same species.
- Data production about **yields** and **retention factors** during cooking.
- Promotion of the inclusion of the **nutritional value** of food as a factor to consider in plants improvement.
European network to advance carotenoid research and applications in agro-food and health
www.eurocaroten.eu / info@eurocaroten.eu
EUROCAROTEN CA15136

Thank you for your Attention