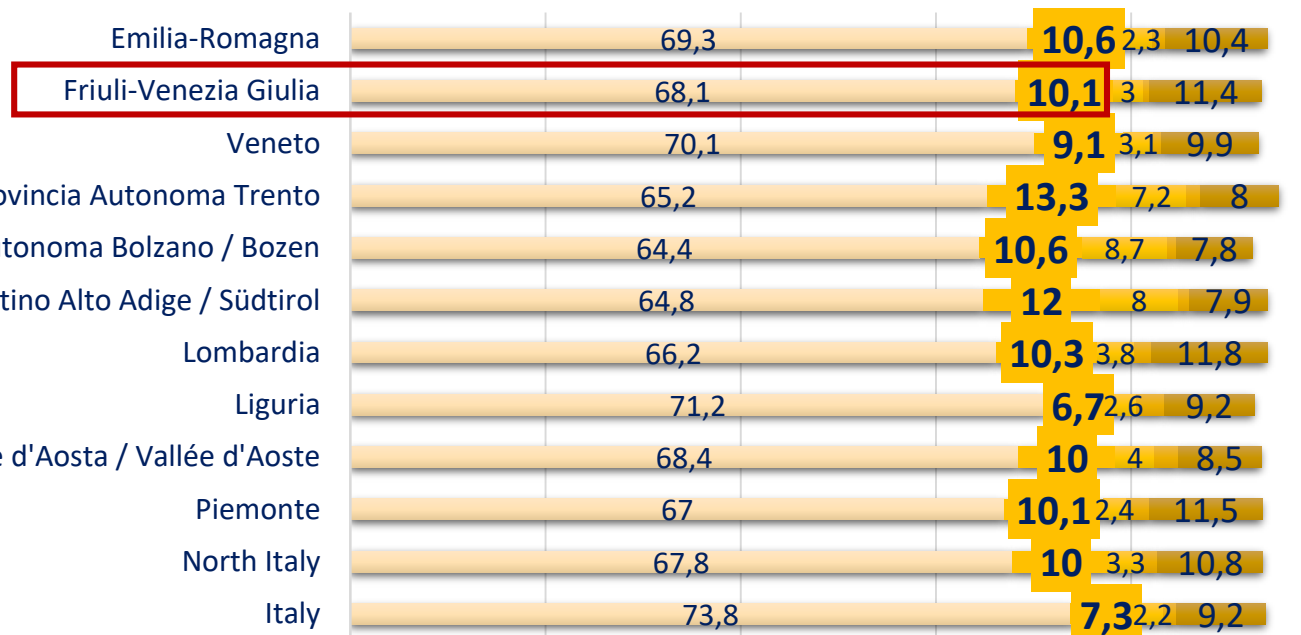


# Development of rapid methods to monitor nutritional standards of sustainable food systems in catering services

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People aged 3 and over, lunch consumption in north Italy Regions %



- home
- canteen**
- restaurant
- bar
- workplace



The aim of the project was to develop rapid and cheap methods for monitoring the nutritional quality of meals by applying the NACCP process.

# methods

In the first phase, 89 samples of vegetables, meat, fish, pasta and milk, with different degrees of processing, were taken from **workplace catering services**. Each individual sample consisted of 2 or 4 aliquots of the same food, a **total of 246 samples** were taken. One aliquot consisted of raw produce (fresh or frozen), the other aliquots consisted of cooked produce kept either at **80°C for 30 and, in many cases, 90 or 120 minutes** and then cooled to 4°C.

In a second phase, 78 samples were taken from 10 **nursery catering services**. Subsequently, 16 samples of formula milk and 18 samples of dry pasta were added. Overall, more than **1300 analyses were performed**.

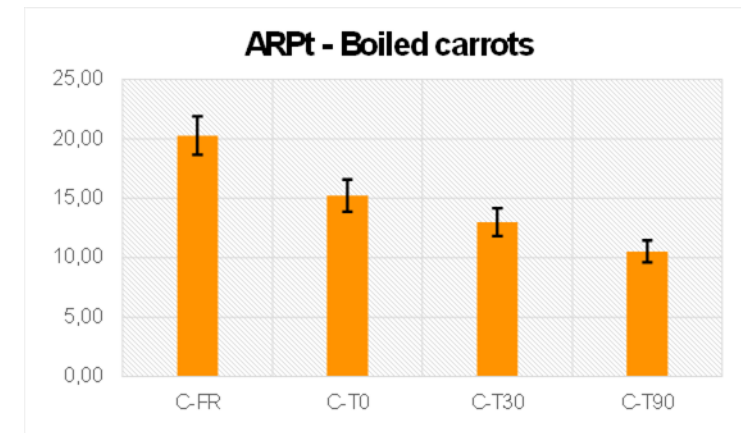
For the samples analysis, both conventional techniques (chemical and chromatographic) and optical colorimetric techniques of the spectrophotometric type, applying the **Diffuse Reflectance Accessories (DRA)**, were used.

The comparison with optical techniques was developed to evaluate the possibility of carrying out rapid analyzes that could be correlated with conventional techniques. Using conventional techniques, the samples analyses concerned the determination of the oxidation state and the content of some characterizing molecules such as total polyphenols, flavonoids, tannins, histamine, total compounds of the Maillard reaction (MPRt) and some group B antioxidant vitamins.

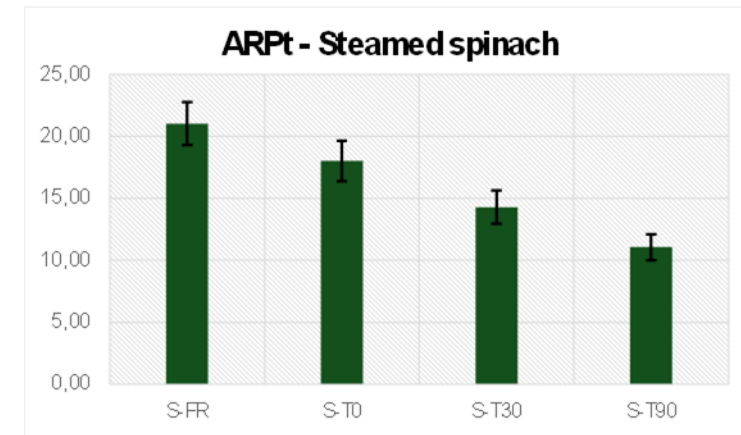
These outcomes were compared with the food composition database by the UT and the Agency of the Ministry of Agriculture. The data obtained were then correlated with the DRA measurements.

# results

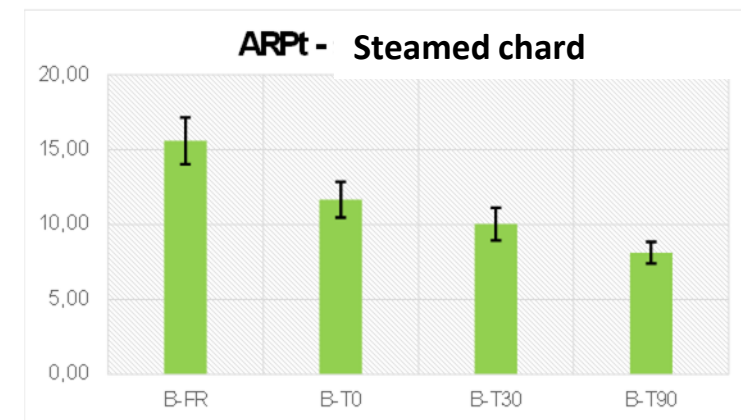
Graph 1



Graph 2

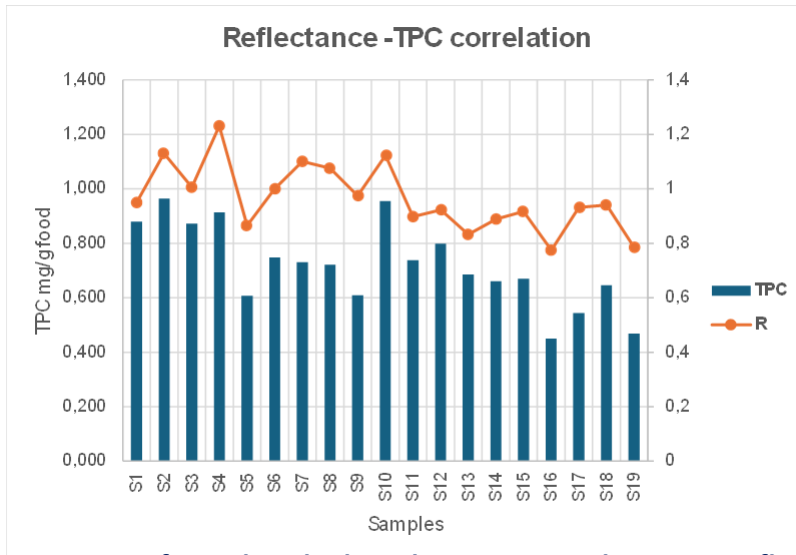


Graph 3

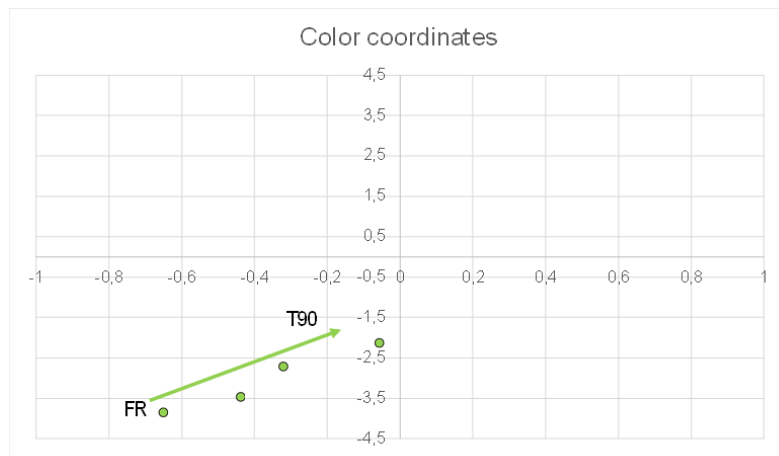


Variation of total antioxidant capacity in relation to storage time at 80°C

# results



Graph 4 Comparison of total polyphenol content with mean reflectance value measured on fresh spinach leaf samples subjected to different thermal stress



Graph 5 Moving from point FR to point T90, in the colour sphere, there is a transition from white (maximum reflectance) to black (minimum reflectance)

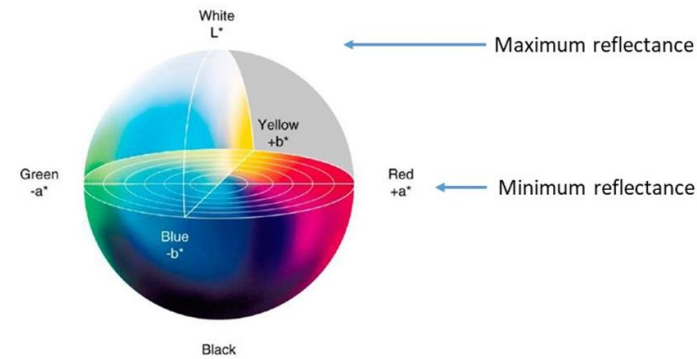


Figure 1 The LAB colour space is determined by three coordinates:

- L\* indicates brightness,
- a\* and b\* are coordinates that allow the sample to be placed within a chromaticity diagram.

The results showed a good correlation between the two analytical systems, and the colour measurements and the polyphenols content graph 4. In fact, high values of polyphenol content correspond to an increase in reflectance, whose L\* value tends towards **white**, while a reduction in phenolic content results in a reduction in reflectance that tends towards **black**.

The data obtained shows:

It is possible to maintain a high concentration of polyphenols by reducing the time between food preparation and administration, which has positive effects for those who eat such meals, in particular frail subjects with long-term health conditions who are repeatedly exposed for prolonged periods to the meals served.

With regard to the measurement of colour, it can be observed that, in the case of vegetable matrices, **there is a correlation between the intensity of the colouring and the phenolic content**, therefore the monitoring of the colour would make it possible to evaluate the trend over time of the antioxidant markers. In the case of complex matrices, on the other hand, measuring the colour is useful for evaluating the quality of the cooking process and the repeatability of the preparation.

# conclusions

Possessing a knowledge of the type of correlation that binds marker molecules and relative coloration can be placed at the foundation of the creation of new methodologies of particular speed and efficiency.

Project findings can be applied in the NACCP process to rapidly cost-effectively monitor the nutritional quality of collective catering meals, and adhere to WHO and FAO “ The Sustainable Healthy Diet, guiding principles ” and Ministry of Health guidelines for collective catering.

The results represent an innovative contribution capable of contributing to the promotion of the culture of food and nutritional security.

Furthermore, a new project could focus on the development of portable systems with immediate analytical responses to develop in collective catering workplace settings.

FOODIS

Interreg  
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The next research step will focus on the pilot action of the Interreg FOODIS project – **Cross-border ecosystem for innovation and sustainability in food sector value chains** (ITAT-11-001).

The pilot project, as indicated by FAO and the EU Platform on Food Losses and Food Waste, Food Donation Subgroup, involves the creation of a number of tools dedicated to Redistribution Organizations and Charity Organizations in the solidarity food donation sector.

In particular rapid methods to monitor nutritional standards will be applied for the development of the integrated manual for food safety and nutritional security, aimed at providing an update of the procedures relating to risk management in the field of food safety, in order to identify the nutritional security procedures, with the adoption of the NACCP process, as recommended by the State Regions Agreement 222/2016.

Thank You

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