

# Rapid methods to monitor nutrients in sustainable healthy diets of collective catering systems

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## Background

The WHO and FAO in "The Sustainable Healthy Diet, guiding principles" underline the evidence between synergies among foods, nutrients present in dietary patterns and their bioavailability, degree of food processing and the influence on its physical and chemical characteristics and subsequent health impact, even on non communicable disease, reported in target 3.4.1 of Sustainable Development Goals, and consistent with key elements of Global Burden of Disease Study findings. In Italy almost one in 10 people eat a meal in collective catering (CC) every day. In accordance with The Sustainable Healthy Diet, the Italian Ministry of Health (MH) in the national guidelines for CC indicate, in annex 8 "Qualitative elements", activating procedures for the conservation of nutritional qualities of micronutrients and bioactive substances, reduction of the decay of nutrients and healthy components of the finished product. The central purchasing bodies of the Autonomous Region of Friuli Venezia Giulia, as recommended by the State Regions Agreement 222/2016, have applied these criteria introducing the process of critical control points of nutrient analysis (NACCP) in the Public Procurement for the school catering of 26 municipalities and for all 18 regional hospital CCs with more than 3 million meals per year served. 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

As part of the collaboration agreement between the Local Health Agency of Trieste and the Laboratory of Commodities Science of Trieste University, 89 samples of vegetables (n=65), meat (n=16), fish (n=7), egg (n=1) with different degrees of processing were taken from the collective catering services. Each single sample consisted of 2 or 4 aliquots of the same food, a total of 246 samples were taken (34 samples consisting of 4 aliquots and 55 samples consisting of 2 aliquots). One aliquot consisted of raw material (fresh or frozen), the other aliquots consisted of cooked and kept either at 80°C for 60 and / or 120 minutes and then cooled to 4°C. For the samples analysis, both conventional techniques (chemical and chromatographic) and optical colorimetric techniques, 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 can be correlated with conventional techniques. More than 600 analyzes were performed and the outcomes were compared with the food composition database by the UT and the Agency of the Ministry of Agriculture. Using conventional techniques, the samples analyses concerned the determination of the oxidation state and the content of some characterizing molecules such as polyphenols, histamine, total compounds of the Maillard reaction (MPRT) and some group B vitamins. The data obtained were then correlated with the DRA measurements. In this poster the results relating to the vegetable component have been reported.

## Results

The results showed a good correlation between the two analytical systems, in particular as regards the colour measurements and the Maillard compounds and between the colour measurements and the oxidation state. The colorimetric measurements are less correlated with the content of total polyphenols; this may be related to the low chromophore capacity of these compounds, which are not detectable by the spectroscopic system. The data obtained showed:

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 in long-term conditions who are repeatedly exposed and in prolonged way to the meals served. As can be seen from figure 1., over time the value of IC 50 tends to increase on average, thus highlighting a loss of antioxidant power as a greater quantity of food will be needed to obtain the antioxidant effect of TO.

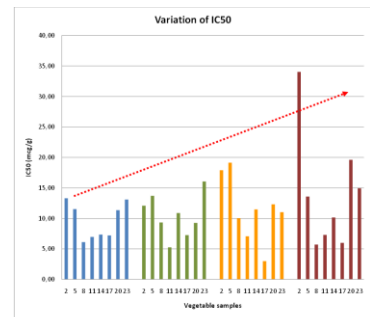


Figure 1. IC50 values measured in vegetable samples

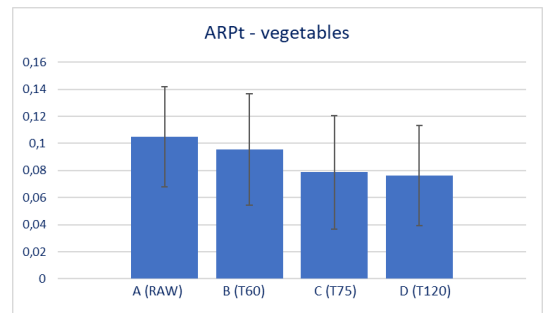


Figure 2. ARPt: evaluation of the anti-radical activity of vegetable samples grouped by sampling time

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 coloring and the phenolic content, therefore the monitoring of the color 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 color is useful for evaluating the quality of the cooking process and the repeatability of the preparation.

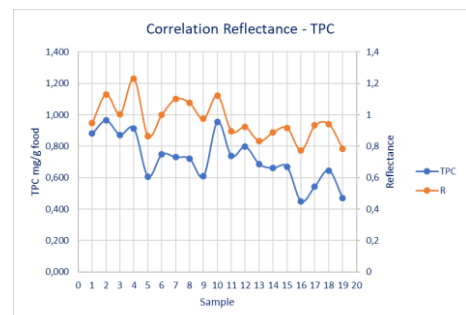


Figure 3. DRA: Comparison of the total polyphenol content (TPC) with the average reflectance value measured on vegetable samples, subjected to different thermal stress1

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

## Conclusions

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. In this vision, the next phase of research will focus on a new project for portable systems with immediate analytical responses to develop in collective catering workplace settings and in the process to evaluation for food donation including assessment of remaining shelf-life.