



MEASURING BIOACTIVITY OF BLACK SEA AREA TRADITIONAL FOODS

Francesca Danesi ¹ ✉, Federica Pasini ¹, Mariia Mudryk ², Bike Kocaoglu ³, Dmitry Karpenko ⁴, Leonid Kapreliants ⁵, Marjam Jorjadze ⁶, Alexandru Stroia ⁷, Iordanka Alexieva ⁸, Maria Fiorenza Caboni ², Luigi Filippo D'Antuono ⁹, Alessandra Bordonì ¹



✉ francesca.danesi@uniibo.it

¹Department of Food Science - University of Bologna (Italy); ²Uzhhorod National University (Ukraine); ³Yeditepe University, Istanbul (Turkey); ⁴Moscow State University of Food Production (Russian Federation); ⁵Odessa National Academy of Food Technologies (Ukraine); ⁶"Elkana", Biological Farming Association, Tbilisi (Georgia); ⁷Bucharest University of Economics (Romania); ⁸University of Food Technologies, Plovdiv (Bulgaria); ⁹Department of Agroenvironmental Science and Technology - University of Bologna (Italy)

INTRODUCTION. In order to explore new potential sources of natural dietary antioxidants, a large number of **vegetable traditional foods of the Black Sea Area (BSA)** were analysed for **antioxidant capacity** and **total phenolic content**. The present work is part of the 7FP BASEFOOD, which aims to revalue traditional BSA foods, representing a potential under-utilised source of putative health promoting dietary components, still neglected by scientific literature.

METHODS. **39 foods** (Table 1), belonging to different groups (cereals, vegetables, fruits, oilseeds, herbs and spices, fermented products), were analysed. Traditional dishes were prepared, according to the seasonal availability of ingredients, freeze-dried and sent to the University of Bologna by local Partners of Bulgaria, Georgia, Romania, Russia, Turkey, and Ukraine. Samples were extracted in water/ethanol [1], and the extracts were analysed for their antioxidant capacity and total phenolic content (TPC).

The **total antioxidant capacity (TAC)** was measured using **ABTS** [2] and **DPPH** methods [3]. Values obtained for both the TAC methods

were compared to the concentration-response curve of a standard Trolox solution and expressed as micromoles of Trolox equivalent (TE). The **total phenolic compounds (TPC)** were determined at 750 nm using the Folin-Ciocalteu spectrophotometric method according to the guidelines of Singleton *et al.* [4]. TPC was assessed through a gallic acid calibration curve.

As the moisture content significantly varied among different samples, the bioactivity was calculated on the basis of **fresh weight** of the original sample.

Table 1. Analyzed BSA foods and Countries of origin.

Group	Country
Cereals Group	
Sour rye bread	Ukraine
Buckwheat porridge crumby	Russia
Cornmeal mush (Mamaliga)	Romania
Bread baked with tsiteli doli wheat flour	Georgia
Tikvenik	Bulgaria
Bulgur pilaf	Turkey
Vegetables Group	
Ukrainian borsch	Ukraine
Transcarpathian green borsch	Ukraine
Vegetable okroshka (soup)	Russia
Nettle soup (ciorba)	Romania
Nettles with walnut sauce	Georgia
Bean soup with Rodopian dried beans (Rodopski fasul)	Bulgaria
Kale soup	Turkey
Fruits Group	
Compote (Uzvar)	Ukraine
Blueberry	Ukraine
Watermelon juice	Russia
Plums jam (Magiun)	Romania
Churchkela	Georgia
Rose jam	Bulgaria
Fruit of the evergreen cherry laurel	Turkey
Oilseeds Group	
Roasted sunflower seeds	Ukraine
Mustard oil	Russia
Flax oil	Georgia
Sunflower seeds	Bulgaria
Herbs and Spices Group	
Dill	Ukraine
Nettle	Ukraine
Parsley	Ukraine
Sorrel	Ukraine
Pomazanka	Ukraine
Herbal dish	Romania
Wild plum sauce (tkemali)	Georgia
Mursal tea (Sideritis scardica)	Bulgaria
Black tea	Turkey
Fermented Products Group	
Sauerkraut	Ukraine
Kvass southern	Russia
Elderberry soft drink (socata)	Romania
Boza	Bulgaria
Sautéed pickled green beans	Turkey

RESULTS. On fresh weight basis, some BSA traditional foods showed a considerably strong antioxidant response and contained high concentrations of phenolic compounds (Figure 1). The antioxidant capacity was therefore compared to TPC. The relations between the two characters have been critically examined for the whole pool of foods.

The TPC and ABTS antioxidant capacity showed a significant and high correlation (Figure 2), whereas the relation between TPC and DPPH assay (Figure 3) reported some outliers: raw and roasted sunflower seeds, sunflower seeds, nettle, and churchkela. The sunflower seeds had the highest phenolic content but a free radical scavenging activity (DPPH assay) lower than nettle, blueberry and churchkela. The low TPC of these last three foods was in contrast with their antioxidant capacity, probably due to the present of other compounds with antioxidant proprieties.

Figure 1. Antioxidant capacity investigated by ABTS and DPPH methods and total phenolic content (TPC) of BSA foods related to their individual categories.

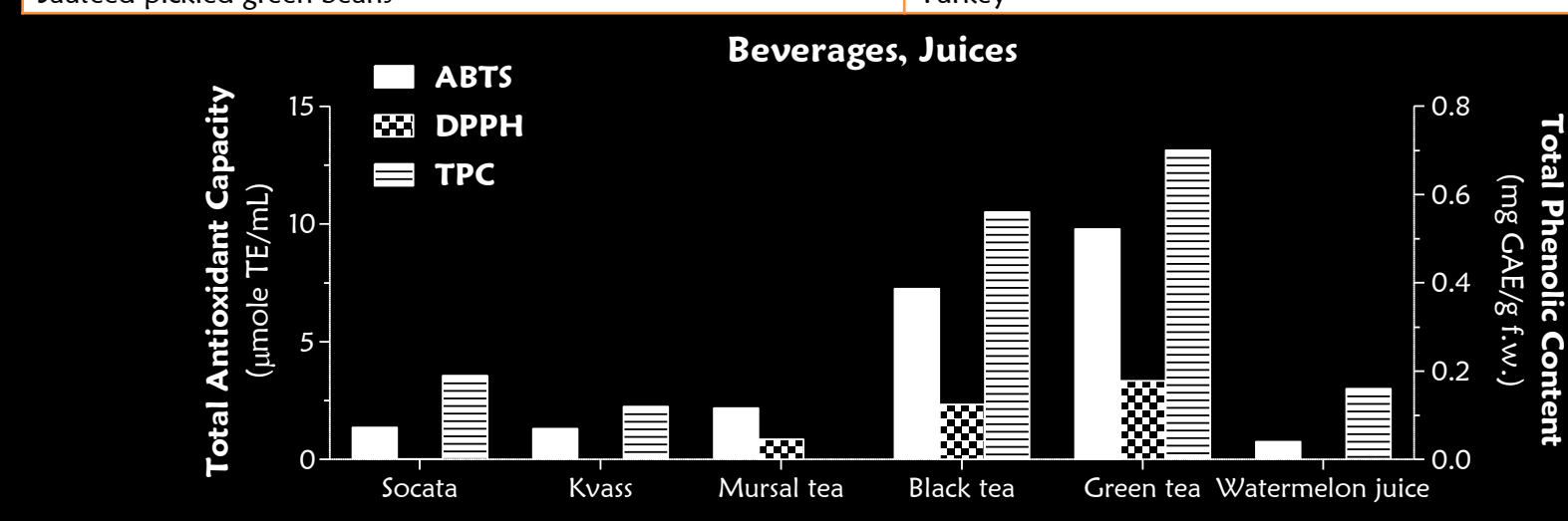
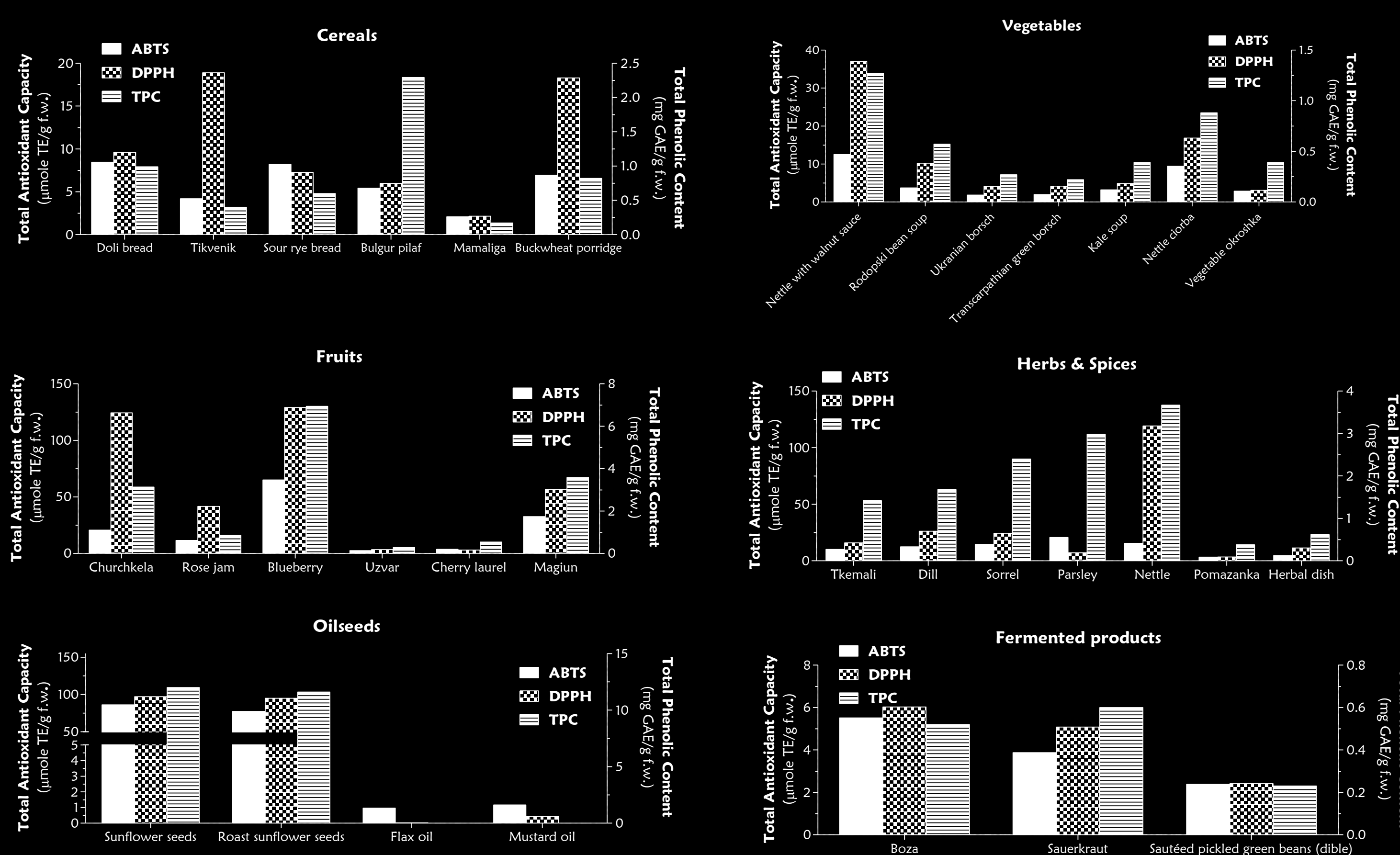
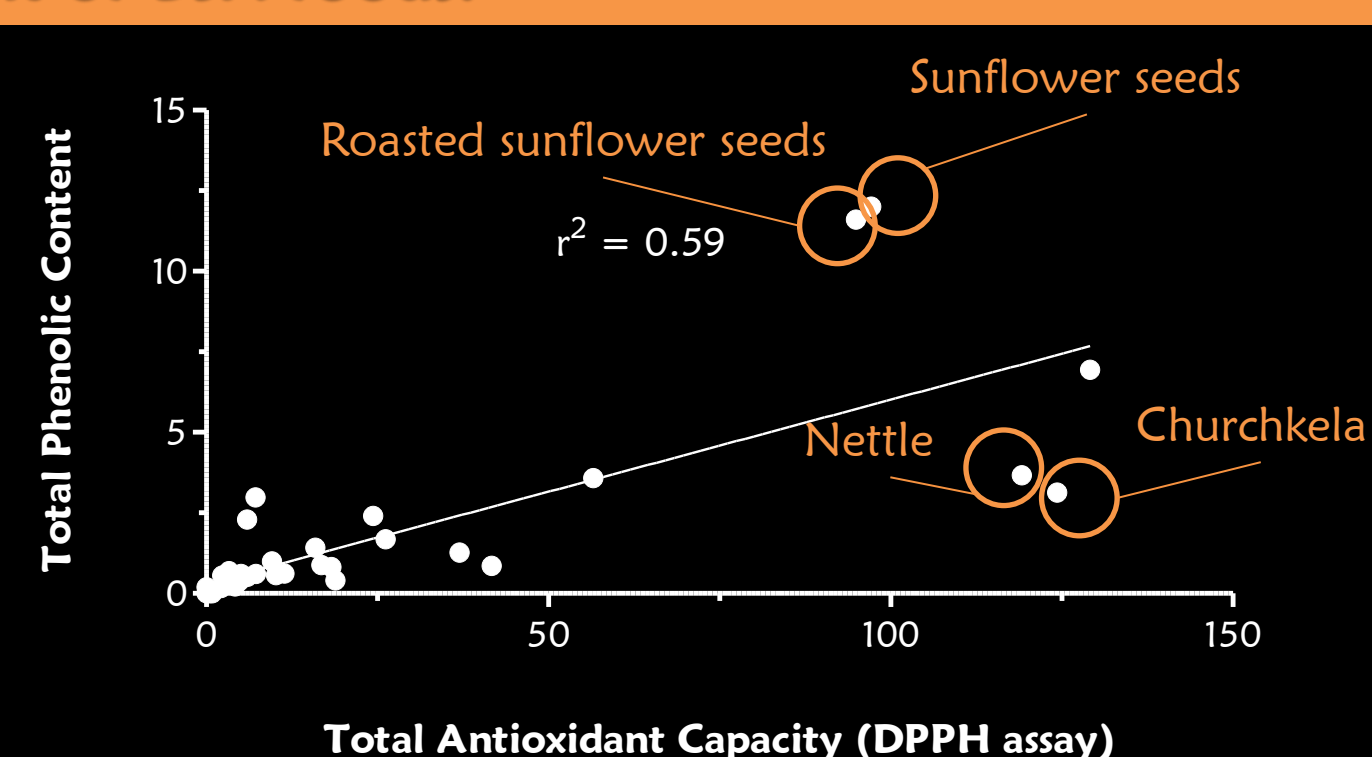


Figure 2. Correlation between antioxidant activity investigated by ABTS method and total phenolic content of BSA foods.

Figure 3. Correlation between antioxidant activity investigated by DPPH method and total phenolic content of BSA foods.



DISCUSSION. This characterization of traditional foods of BSA may enhance the appeal and knowledge of these foods also outside the areas of origin, and contribute to both their on-site preservation and the opening of update commercial opportunities for some of them.

Acknowledgements. This study was funded by project **BASEFOOD** "Sustainable exploitation of bioactive components from the Black Sea Area traditional foods" (EC Contract no: FP7-KBBE-227118).

1. Pellegrini, N., et al., Total antioxidant capacity of spices, dried fruits, nuts, pulses, cereals and sweets consumed in Italy assessed by three different *in vitro* assays. *Mol Nutr Food Res*, 2006, **50**(11): p. 1030-8.
2. Re, R., et al., Antioxidant activity applying an improved ABTS radical cation decolorization assay. *Free Radic Biol Med*, 1999, **26**(9-10): p. 1231-1237.

3. Brand-Williams, W., M.E. Cuvelier, and C. Berset, Use of a free radical method to evaluate antioxidant activity. *LWT - Food Science and Technology*, 1995, **28**(1): p. 25-30.
4. Singleton, V.L. and J.A. Rossi, Jr., Colorimetry of total phenolics with phosphomolybdic-phosphotungstic acid reagents. *Am J Enol Vitic*, 1965, **16**(3): p. 144-158.

