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SHORT COMMUNICATION



Preservation of vitamins content in Cuccìa using an innovative method of processing

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ABSTRACT

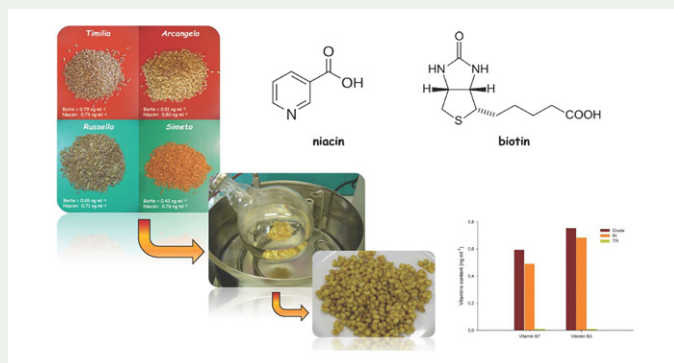
Cuccìa is a traditional Sicilian food prepared by boiling whole durum wheat kernels, in water, for many hours. This process destroys the vitamins E and B contents of crude kernels. It was rated a method to prepare the Cuccìa, preserving the vitamin content. Four varieties of durum wheat were processed comparing the traditional cooking method (TR-boiling for 5/6 hours), and an innovative one (IN-grains scarification, germination, and cooking at 50 °C for 2 hours). On soups obtained the content of biotin, niacin and α -amylase activity were determined. ANOVA showed the cooking method influences biotin and niacin content having values from 0.56 and 0.72 ng ml⁻¹ (raw grain) and values close to 0 (TR), while only a 10% decrease (IN) respectively for both vitamins. On the contrary, α -amylase activity was reduced with IN method. The IN method combined with ancient grains, produces the soup with a good vitamin B amount.

ARTICLE HISTORY

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KEYWORDS

Cuccìa processing; durum wheat; old varieties; vitamins



1. Introduction

In the early 1960s, in Greece and southern Italy, adult life expectancy was among the highest in the world and rates of coronary heart disease, certain cancers, and other

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diet-related chronic diseases were among the lowest. This was attributed to the particular diet adopted in those regions and today known as Mediterranean diet, characterized by the consumption of numerous plant foods (vegetables, breads, other forms of cereals, potatoes, beans, nuts, and seeds), fresh fruit, fish, cheese, olive oil and wine. This diet is able to provide all of the known essential micronutrients (i.e., vitamins and minerals), fiber, and other plant food substances believed to promote health (Corsaro et al. 2015), fighting also obesity (Metro et al. 2018).

Among the plant food of the Mediterranean tradition, we focused our attention on cereals, because of their agronomic and economic importance in Sicily and their importance on human health, due to the presence of many phytochemical compounds, with benefits for health, including dietary fibre, a number of phenolic compounds, lignans, vitamins and minerals and other bioactive components.

The whole kernel of durum wheat is considered to be a good source of B vitamins (thiamine, riboflavin, niacin, pyridoxine and folic acid) and vitamin E. On the other hand, the wheat kernel has low contents of the other lipid soluble vitamins, which are only present in significant amounts in the embryo (Shewry and Hey 2015).

Thanks to the fibre content, and the presence of micro-elements and vitamins, the whole kernel dishes of the tradition, can be considered as functional foods, because of the biological effects in preventing cardiovascular diseases (Santini et al. 2017). Moreover using old varieties of durum wheat, characterized by low amount of gluten, and zero contamination of mycotoxins could enhance the nutraceutical characteristics (Santini et al. 2009; Gallo et al. 2010; Williams 2014). Among these, Cuccia is a traditional Sicilian food prepared by boiling whole durum wheat kernels in water and dressing them with salt and vinegar. It requires that the whole kernel wheat is soaked for at least one night before the kernels are cooked normally from 2 to 8 hours on a low flame (Muratore et al. 2006; Bognanni and Spagna 2008). The traditional method of processing, however, leads to a nutritional impoverishment of the raw material used. In this work we develop a new processing method to preserve water-soluble vitamins, conferring to the soup the adjective “functional”, monitoring two vitamins of the B complex, on biotin (Vitamin B7) and niacin (Vitamin B3), the most abundant among vitamin of the B complex in wheat, during the preparation of the typical Sicilian soup.

2. Results and discussion

2.1. Optimal cooking time, vitamins content and α -amylase activity

The optimal cooking times for the four varieties studied were determined. The cv *Timilia* with OCT of $12 \times 10^5 \text{ s}^2$ differs from all the others ($18 \times 10^5 \text{ s}^2$).

From the ANOVA analyses performed (Table S1), comparing kernels uncooked, cooked on flame and cooked under vacuum, the decreasing in vitamins B7 and B3 and the α -amylase activity resulted mainly distributed for “cooking type” effect, with MS values of 0.809 (Vitamin B7), 1.38 (Vitamin B3) and 100184 (α -amylase activity).

Moreover in the process used as control, the high temperatures destroyed the content in vitamins and inactivate the α -amylase activity in all the accessions, all the values resulted zero; these data were missed and for the ANOVA analyses of chemical characterization of Cuccia and the “genotype X cooked/uncooked kernel” effects are

Table 1. Vitamins content (ng ml^{-1}) and α amylase activity (s) in the old and modern accessions. The different letters among rows within the same column indicate significant differences at $P < 0.05$ between old and modern accessions.

Treatment	Accessions	Vitamin B7	Vitamin B3	α -amylase activity
Uncooked	Old	0.61 a	0.75 a	191 b
	Modern	0.58 b	0.76 a	208 a
	Means	0.595 a	0.755 a	199.5 a
Cooked	Old	0.59 a	0.72 a	183 b
	Modern	0.40 b	0.66 b	190 a
	Means	0.492 b	0.685 b	186.5 b
	General means	0.545	0.722	193

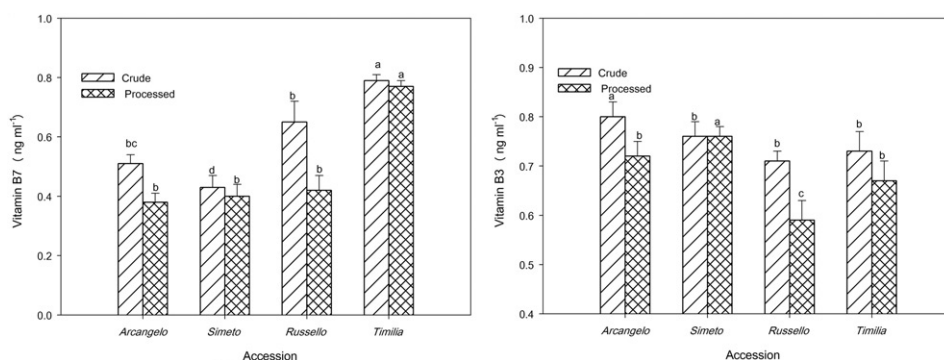


Figure 1. Vitamin B7 and Vitamin B3 (ng ml^{-1}) degradation in the Cuccia prepared using the new process. The different letters among genotypes within the same treatments indicate significant differences at $P < 0.05$.

considered. Row data concerning the vitamin B7 and B3 degradation of the kernel in relation to “accession X cooked/uncooked kernel” are reported in Figure 1.

The data reported in Table 1, took into account the type of accession (old or modern). In particular, the Bartlett's test performed in cooked and uncooked kernels showed the content in vitamin B7 is statistically different between old and modern accessions, with value of 0.597 (old accessions) and 0.490 ng ml^{-1} (modern accessions). The same behaviour has been observed for vitamin B7 with values of 0.730 and 0.705 ng ml^{-1} for old and modern accessions, respectively. On the contrary the α -amylase activity resulted higher in the modern varieties (199.5 minutes) than the old ones (187.5 minutes). On average of accessions, the vitamin B7 content resulted 0.595 ng ml^{-1} in uncooked kernels, with a decreasing of 17.2% in cooked kernels. The accession “Timilia” showed a very low degradation passing from 0.790 (uncooked) to 0.770 ng ml^{-1} (cooked kernel). Vitamin B3 resulted, averaged for genotypes 0.750 ng ml^{-1} in uncooked kernels and 0.685 ng ml^{-1} in cooked kernels. Any degradation was observed in the accession “Simeto”. α -amylase enzyme is broken down between 70 and 80 °C. The more soft cooking process developed here (50 °C) does not alter the α -amylase activity (Table 1).

2.2. Sensory evaluation

Cuccia, prepared from the four wheat accessions, using both the traditional method and the new one, was assessed by a panel of appositely trained judges, who did not

find significant differences in sensory evaluation between the two procedures (Global quality score 6.5).

The global evaluation does not show significant differences between the kernel varieties. Of these, it should be noted that *Cuccia* prepared from *Timilia* presents an intense colour, which might be important for the marketable point of view, given that this characteristic was valued by the judges (Figure S1).

3. Conclusions

In conclusion, uncooked kernels of durum wheat used as the primary ingredient of soups, can represent a good source of B complex vitamins, allowing *Cuccia* to be considered as functional food. Cooking the kernel according to the traditional Sicilian method breaks down of all the vitamins and enzymes contained in the wheat caryopsides. Cooking at reduced pressure made it possible to reduce the cooking times and, above all, to preserve the vitamins and enzymes most sensitive to high temperatures. The reduction in vitamins and enzyme contents in the *Cuccia* obtained by the new cooking method resulted quite low, above all if we compare the values with traditional *Cuccia*.

The effect of accession resulted significant. “*Timilia*” kernels presented a cooking time of $12\text{ s} \times 10^2$, the highest degree of acceptance by consumers for color, the highest content in Vitamin B7 and good levels of Vitamin B3, both in uncooked kernels and *Cuccia*.

The more soft method of preparation proposed here represents an important step for the re-evaluation of a traditional dish such as *Cuccia* in order to include it among the *functional foods* on the basis of the vitamins and enzymes that it contains.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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