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ADDITION OF PLANT MATERIALS RICH IN PHENOLIC COMPOUNDS IN WHEAT BREAD IN TERMS OF FUNCTIONAL FOOD ASPECTS

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Abstract. Recently, the consumers awareness of the need to eat superior quality and healthy foods known as functional foods, that is, foods that contain ingredients that provide additional health benefits beyond the basic nutritional requirements, has increased. Functional foods represent one of the most interesting areas of research and innovation in the food industry (Annunziata and Vecchio, 2011). The natural antioxidants present in food have received considerable interest because of their safety and potential nutritional and therapeutic effects. Generally, wheat bread is considered to be a good source of energy and irreplaceable nutrients for the human body at the same time bread made with white flour is a food with a low antioxidant capacity. (Dariusz et al. 2014). This review is focused on enriching the wheat bread with natural raw materials rich in phenolic antioxidants such as spices, herbs and parts of green plants. These raw materials are often cheap and a very good source of phenolic antioxidants. Beside this, the information about changes in antioxidant activity during the bread making process were also discussed.
Keywords*: functional food, green plants, bread, antioxidant, sensory value.*

Introduction

General attitudes concerning functional foods have an important role in human nutrition, which is a modern global trend in in the food industry. Researchers are involved in optimizing bakery products, making technology to improve the quality, taste, functionality and bioavailability of food products (Annunziata and Vecchio 2011; Jones &Jew, 2007; Siro, Kapolna, Kapolna, & Lugasi, 2008).

In view of the wider consumption of bakery products, they could be good choice for the delivery of functionality. These data support the idea that bread is an important staple food (Altunkaya, Hedegaard et al. 2013), which are considered to be the best vehicle for functional supplements (developed humanity provide more than 50% of the total energy intake) (Akhtar, Anjum, & Anjum, 2011).

This review is focused on enriching the bakery products with natural raw materials (medicinal plant and spices) (Balestra, Cocci, Pinnavaia, & Romani, 2011), rich in phenolic antioxidants such as dry onion (*Allium cepa* L.) (Gawlik-Dziki, Swieca et al. 2013), garlic (Raba et al. (2007), turmeric (*Curcuma longa* L.*)* (Lim, Park et al. 2011), coriander (*Coriandrum sativum* L.) (S. Bahat et al. 2014), shatavari (*Asparagus racemosus*) (Singh, Jha et al. 2012), green coffee (Glei, Kirmse et al. 2006), green tea (Seidel, Boehm et al. 2007), (Olejnik, Olkowicz et al. 2016), ginger (Balestra et al. 2011), oregano (Seidel et al. (2007), pomegranate peel (Altunkaya, Hedegaard et al. 2013)

For this reason, new baking ingredients formulations are developed to enhance the content of phenolic antioxidative components. The incorporation of vegetable plants increases the antioxidant properties of bakery products from natural sources (Sivam, Sun-Waterhouse, Perera, & Waterhouse, 2012), without giving rise to quality defects (Liu, R. H. 2003). There are many studies supporting the idea that the beneficial effects of polyphenols is their bioavailability and metabolic fate (Saura-Calixto, Serrano, & Goni, 2007), have also been reported to possess diverse beneficial bioactivities, including antiallergic, and antimutagenic properties (Penget al., 2010).

Therefore, a conventional food could be transformed into a functional food with high nutritional characteristics, but with changed sensory attributes (Delgado-Andrade et al. 2010). A systematic plan to enhancement of bioactive compounds to bakery products could be similar way to following terms: functional products for gut health, functional products for antiaging or foods to combat stress.

Enrichment of bakery products with natural sources of phenolic antioxidants from medicinal plant, spices or waste plant materials

Effect of Green Tea *(Camellia sinensis)* on quality parameters of bread

Recently, large attention has been dedicated on medicinal phytochemicals that retard diseases caused by oxidative processes. On overview of green tea tag that is a superfood. According to (Ashraf A. Abd El-Megeid, Inas Z.A. AbdAllah et al. 2009) that the fortification of bread

with dried green tea leaves is certainly a new functional bread. The work was approved out to study the potential use of pounded dried green tea leaves for enriching bread and estimate the sensory characteristics and the nutritional value of fortified bread. In a similar manner, the results presented that the greatest level of fortification which had the highest scores was recorded for 2% Green Tea - enriching bread followed by 4% GT- enriching bread. Because of kidney function, liver function and lipid parameters performs to be improved considerably cause utilization of green tea fortified bread consumption.(Ashraf A. Abd El-Megeid, Inas Z.A. AbdAllah et al. 2009)

Effect of Shatavari (*Asparagus racemosus*) on quality parameters of bread

Nowadays consumers are becoming increasingly aware of the relationship between Shatavari (*Asparagus racemosus*) and health benefits. A popular Indian herb, Shatavari (*Asparagus racemosus*), combine into the bread added fiber and functional benefits, enhanced nutritional role. In 2012 have demonstrated that presence of Shatavari root powder incorporated of samples bread affected major sensory attributes (Singh, Jha et al. 2012). Thus, the changes in the textural characteristics of bread are increasing its crumb chewiness, hardness, adhesiveness, cohesiveness and decreasing the springiness. These data support the idea that a Shatavari herb realized a dilution of wheat gluten, change in nature of starch (Abdelghafor et al. 2011). For Shatavari incorporated in bread was found acceptable the range of 3 to 3.5 %, of optimum sensory and functional aspects. Following the qualitative and chromatographically analysis, all the native bioactive compounds of Shatavari root, except the flavonoids, were found present in the new bread enriched of Shatavari (Singh, Jha et al. 2012).

Effect of Turmeric (Curcuma longa L.) on quality parameters of bread

However nutriments rich in antioxidants play an essential role in the prevention of problems caused by cell and cutaneous aging (Fan, Zhang et al. 2007).

The study of (Lim, Park et al. 2011) are observed that breads containing turmeric powder render higher functional components and antioxidant properties. Korean turmeric *(Curcuma longa L.*) is a medicinal plant widely proved the antifung, immunomodulatory, antioxidative activities (Durrani et al. 2006). The addition of turmeric powder in a bread formulation significant increased crumb color, hardness curcumin content and total phenolic contents of breads. Also bread prepared with different

levels of substitution of wheat flour with turmeric indicated good antioxidant activity as tested by the b-carotene-linoleate bleaching assay (79.8 ± 0.6% antioxidant activity). The data on recommended dosage of turmeric powder is up to 4% could be included in a bread with the sensory acceptability.

The characteristic that turmeric curcuminoids have better stability and heating and does not affect the levels of individual curcuminoids, turmeric is one of the most functional food components such as curcumin (Lim, Park et al. 2011).

Effect of pomegranate peel *(Punica granatum* L.*)* on quality parameters of bread

Natural antioxidants at high levels, present in fruits and vegetables, offer health benefits. The application of such functional food lead to application of economy ingredients containing antioxidants. The bread with addition of pomegranate peel powder at different percentages (0% to 10%), indicated the highest antioxidative activity and the lowest value of L* regarding the crumb color (Altunkaya, Hedegaard et al. 2013). Nevertheless, 2.5% *Punica granatum* L adds had a good acceptance in a sensory test of aroma, texture, color.

Effect of dry onion (*Allium cepa* L.) on quality parameters of bread

The food product processing industries generate significant numbers of phenolic-rich by-products, which could be appreciated natural sources of antioxidants to be employed as ingredient.

Onion skin constitutes an appreciated supplement of high levels of flavonoid, remain unused after onion industrialization. These waste material (onion skin is cheaper, safer for consumers), purpose improving the antioxidant potential of bread by increasing its bio accessible quercetin content. The levels 2–3% dry onion addition caused significant improvement of antioxidant abilities, enhanced functional properties (Gawlik-Dziki, Swieca et al. 2013)

Effect of Green coffee on quality parameters of bread

Antioxidant activities of normal bread is not efficiently of good body health. Supplementation of bread with green coffee resulted in enhanced chemo preventive in vitro properties in contrast with normal bread. (Glei, Kirmse et al. 2006). Is likely to contain green coffee on bread, apply antioxidant activity, check growth of tumor cells, and prevent DNA damage. These properties of supplemented bread of green coffee were associated

with a better resistance of colon and liver cells against H_2O_2, an important mechanism of chemo protection (Sakihama et al. 2002)

CONCLUSION

The presence of a large number of bioactive compounds of aromatic herbs certainly gives full grain wheat bread great potential in relations of health benefits to humans, particularly in preventive terms.

Table 1.

The types of added different raw materials to enrich wheat bread and their effect on the antioxidant properties of bread and bread quality.

Mass fraction of added substance	**The sensory evaluation**	**Antioxidant assay**	**Effect**	**Reference**
Mixture of green tea powder (0.5%), oregano (0.75%) and tomato paste (0.75%)	Yes	FRAP	increase the ferric reducing ability of plasma but decreased sensory properties	(Seidel et al. 2007)
'Green Tea (*Camellia sinensis)*' 2%, 4%, 6%	Yes	-	increase in serum total cholesterol (TC), triglycerides (TG), low-density lipoprotein cholesterol (LDL-C), Aspartate Amino Transferase (AST)	(Ashraf A. Abd El-Megeid, Inas Z.A. AbdAllah et al. 2009)
Ginger powder (3; 4.5 and 6%)	Yes	DPPH	increase radical scavenging activity, but decrease sensory properties	Balestra et al. (2011)
Coriander leaf powder 1.0, 3.0, 5.0, and 7.0%	Yes	FRAP, DPPH	linear increase antioxidant activity, 3% and 5% addition improved bread quality Ground dried green tea leaves (2, 4 and 6%)	Das et al. (2012)

'Turmeric (*Curcuma longa L.)*' 2%, 4%, 6% and 8%	yes	b-carotene-linoleate bleaching	increased the curcumin, total phenolic contents and antioxidant activities of bread.	(Lim, Park et al. 2011)
'Pomegranate peel' *(Punica granatum L.)* ' 0-10%	no	ABTS	highest capacity of scavenging of radicals	(Altunkaya, Hedegaard et al. 2013)
'Dry onion (*Allium cepa* L.) ' skin 0-5%	yes	ABTS	bio accessible lipid oxidation preventers and compounds with reducing and chelating abilities	(Gawlik-Dziki, Swieca et al. 2013)
'Green Coffee' 0-5 %	no	FRAP, ABTS	enhanced chemo-preventive in vitro properties i	(Glei, Kirmse et al. 2006)

* DPPH (di(phenyl)-(2,4,6-trinitrophenyl)iminoazanium) radicals scavenging activity, FRAP e ferric reducing power, ABTS e 2,20-azino-bis(3-ethylbenzthiazoline-6-sulphonic acid) radicals scavenging activity. **(**Dariusz, Dzikia et al. 2014)

From the literature data, a compromise between nutritional value and sensorial quality is generally achieved via the enrichment of wheat flour by up to 5% of functional components (eg. onion skin, green coffee, etc).

The added antioxidants of plant material, specially a medicinal plant or spics, enhanced the sensory quality and total antioxidant capacity of bread. The protective effects of diet, explicitly higher consumption of bakery products are likely to be explained by a supplementary of such number of aromatic herbs, lifestyle choices and life-stage (Angioloni et al. 2009). The high antioxidant capacity and phenolic content of new fortification matrix products (bakery products), could be obtain healthy baked goods.

The substitution of wheat flour by plant active or resulted in the enrichment of fiber content in the composites. From the upstairs study it can be established that although the breads with higher level of addition gave better fiber content results, but received lower scores in the sensory tests (Dalgetty et al. 2006).

From the consumer point of view it could be concluded that, one of the important factors is the sensory value of bread, because taste, smell and flavor significantly influence consumer preferences towards cereal products.

REFERENCES

1. Azzurra Annunziata, Riccardo Vecchio (2011) Functional foods development in the European market: A consumer perspective, 3:223–228;
2. Angioloni, A. and Collar, C. (2009) Significance of Structuring/Prebiotic Blends on Bread Dough Thermo-Mechanical Profile. European Food Research and Technology, 229:603-610;
3. Ashraf A. Abd El-Megeid, et al. (2009) "The Protective Effect of the Fortified Bread with Green Tea Against Chronic Renal Failure;
4. Annunziata, A. and R. Vecchio (2011). "Functional foods development in the European market: A consumer perspective." Journal of Functional Foods, 3(3):223-228;
5. Akhtar, S., Anjum, F. M., & Anjum, M. A. A. (2011). Micronutrient fortification of wheat flour: recent development and strategies.Food Research International, 44:652-659;
6. Altunkaya, A., et al. (2013). "Antioxidant capacity versus chemical safety of wheat bread enriched with pomegranate peel powder." Food Funct**,** 4(5): 722-727;
7. Dariusz Dzikia, Renata Rozilo Urszula Gawlik-Dzikic and, Micha Swieca (2014) Current trends in the enhancement of antioxidant activity of wheat bread by the addition of plant materials rich in phenolic compounds, Trends in Food Science & Technology 40 (2014):48-61;
8. Dalgetty, D. and Baik, B. (2006) Fortification of Bread with Hulls and Cotyledon Fibers Isolated from Peas, Lentils and Chickpeas. Cereal Chemistry, 83:269-274;
9. Delgado-Andrade, C., Conde-Aguilera, J. A., Haro, A., Pastoriza de la Cueva, S., & Rufian-Henares, J. A. A. (2010). Combined procedure to evaluate the global antioxidant response of bread. Journal of Cereal Science, 52:239-246;
10. Durrani, F.R., Ismial, M. Sultan, A. Shhail, S. M. Chand, N. Durrani, Z. (2006). Effect of different levels of feed added turmeric (*Curcuma longa*) on the performance of broiler chicks. Journal of Agricultural and Biological Science, 1(2):9–11;

11. Gawlik-Dziki, U., et al. (2013). "Quality and antioxidant properties of breads enriched with dry onion (Allium cepa L.) skin." Food Chem 138(2-3):1621-1628;
12. Jones, P. J., & Jew, S. (2007). Functional food development: Concept to reality. Trends in Food Science and Technology, 18:387–390;
13. Olejnik, A., et al. (2016). "Gastrointestinal digested Sambucus nigra L. fruit extract protects in vitro cultured human colon cells against oxidative stress." Food Chem 197(A): 648-657;
14. Raba, D. N., Moigradean, D., Poiana, M. A., Popa, M., & Jianu, I. (2007). Antioxidant capacity and polyphenols content for garlic and basil flavored bread. Journal of Agroalimentary Processes and Technologies, 13:163-168;
15. Siro, I., Kapolna, E., Kapolna, B., & Lugasi, A. (2008). Functional food. Product development, marketing and consumer acceptance—A review. Appetite, 51:456–467;
16. S. Bhat, P. Kaushal, M. Kaur, H.K. Sharma Coriander (Coriandrum sativum L.): processing, nutritional and functional aspects Afr J Plant Sci, 8(1):25–33;
17. Sivam, A. S., Sun-Waterhouse, D. X., Waterhouse, G. I. N., Quek, S., & Perera, C. O. (2011). Physicochemical properties of bread dough and finished bread with added pectin fiber and phenolic antioxidants. Journal of Food Science, 76:97-107;
18. Saura-Calixto, F., Serrano, J., & Goni, I. (2007). Intake and bioaccessibility of total polyphenols in a whole diet. Food Chemistry, 101:492–501;
19. Sakihama Y, Cohen MF, Grace SC, and Yamasaki H: Plant phenolic antioxidant and prooxidant activities: phenolics-induced oxidative damage mediated by metals in plants. Toxicology 177:67–80;