DEVELOPMENT OF MEAT PRODUCTS WITH LUTEIN FOR EYE HEALTH

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Introduction

Lutein is an oxygenated derivative of carotenoids called xantophylls. It is a yellow pigment present in the macular region of the eye retina. Lutein is not produced in the human body, it is obtained from the diet. Patients with age related macular degeneration have lower levels of lutein in the macula compared to healthy individuals. Consumption of both lutein supplements and foods rich in lutein (green vegetables, fruits, egg yolk) are associated with lower risk of age related macular degeneration (Granado *et al.*, 2003).

The recommended daily allowance for lutein is 6mg. However the average lutein intake in Hungary is only 1.3 mg/day and even less in the elderly. The reason for this is the insufficient consumption of vegetables and fruits, especially those (spinach, sorrel, parsley, dill) high in lutein. The aim of the present study was 1) to measure the lutein content of Hungarian vegetables and meat raw materials; 2) to determine the effects of meat processing operations on lutein content of added vegetables and added lutein preparations; 3) to develop meat products with lutein content of at least one third of the RDA in one single portion, *i.e.* 900μg/50g. Meat products were chosen because: they are consumed every day or every two days also by old people; meat is a rich source of zinc and selenium which also protect eye health; and the fat in meat products enhances absorption of lutein.

Materials and Methods

Green vegetables (spinach, sorrel, mangold, parsley, Brussels sprout, broccoli, green of celery, dill, lettuce, cabbage) were obtained from the local market or from a stockyard garden. The edible parts of the vegetables were chopped by hand and analysed freshly or after frozen storage at -20°C for one or two months. Frozen and dried vegetables were purchased in supermarkets. Pork (loin, butt, leg), pork fat, chicken and turkey breast, pork and chicken liver were chopped and frozen at -20°C until use.

Comminuted pork products and liver pate were manufactured in the laboratory and in a meat processing plant with 0.5-1% dried parsley and various amounts of lutein preparation (FS20 Lutein, Roche).

For the extraction of lutein, chopped sample and solid magnesium carbonate were homogenised with extractant (hexane-acetone-methanol-toluene with BHT). The resulting suspension was filtered through Macherey-Nagel filter papers. The residue was re-extracted twice. The filtrate was transferred into a separating funnel. The lower phase was separated and washed twice with hexane. The upper layers were combined and dried for at least two hours over anhydrous sodium sulphate. The volume of lutein extract was measured. In case lutein-esters were present, the extract was saponified with methanolic potassium hydroxide solution at room temperature overnight followed by neutralisation with some drops of acetic acid. Duplicates of 1.5 ml extract were evaporated to dryness. The residues were dissolved in eluent (acetonitrile-methanol-dichloromethane-*n*-heptane), agitated and centrifuged. From the supernatant 20μl was injected into a reverse-phase HPLC (Shimadzu LC-10AD with 3PD-M10A diode array detector) employing a C_{18} column in isocratic mode.

Meat products were tested by a sensory panel. Colour was measured with Minolta CR-300.

Results and Discussion

Lutein content of fresh Hungarian vegetables (Table 1) is in the range presented in the literature (Granado *et al.*, 1992; Mangels *et al.*, 1993; Souci *et al.*, 1994). Of the vegetables dried leaves have the highest lutein content and seem most suitable for addition to meat products. No lutein was detected in meat and fat samples, while in pork liver 79μg/100g, in chicken liver 80.5μg/100g lutein were found.

Recovery of lutein from heat-treated meat-vegetable mixtures is above 100%. This finding was also reported by Updike and Schwartz (2003) and explained by increased extractability of lutein from a heat-denatured protein matrix. On the contrary, recovery of free lutein being sensitive to light and oxygen is only 35-42% (Table 2).

Preliminary sensory tests showed that the amount of dried parsley that can be added to meat products is 0.5-1.0%. This ratio is much higher than commonly used and it was necessary to strengthen the taste by adding triple the amount of dried onion and allspice. Addition of 0.5-1.0% dried parsley, however, does not result in the targeted lutein content in the meat products therefore lutein preparation also has to be added. Lutein preparation gave yellow colour to the product (Table 3) which was partly balanced with carmine acid. The yellow shade of the liver pate was more accepted by the sensory panel than that of the comminuted meat product.

Table 1: Lutein content of vegetables (μg/100g).

Vegetable	Fresh	Frozen	Dried
spinach	2674	682	-
parsley	11980	3929	18997
sorrel	5958	980	-
mangold	5543	968	-
light leaves	3768	-	-
dark leaves	7844	-	-
cabbage	26	-	-
Brussels sprouts	168	118	-
broccoli	290	30	-
lettuce	374	-	-
green of celery	6520	-	12190
dill	7156	-	23001

Table 2: Recovery of lutein from heat treated mixtures.

Mixture	Heat treatment	Recovery of lutein (%)
Pork butt+ free lutein	75°C, 1 hour	42.4
	75°C, 2 hour	38.4
	85°C, 1 hour	34.8
Pork liver+free lutein	75°C, 1 hour	37.2
	75°C, 2 hour	35.9
	85°C, 1 hour	37.4

Table 3: Instrumental colour of meat products with parsley and lutein.

Colour parameter	Comminuted meat product with parsley	Comminuted meat product with parsley and lutein	Liver pate with parsley	Liver pate with parsley and lutein
L*	63.2±9.0	60.4±1.8	56.4±1.5	5.2±1.0
a*	3.1±1.1	5.5±0.9	6.6±1.3	6.6±0.6
b*	11.5±0,5	22.0±1.0	12.9±0.1	21.0±0.4

Conclusions

Comminuted meat products and liver pate of good sensory characteristics and of targeted lutein content (900 μg/50g) can be produced by adding dried vegetables and lutein preparation. Introduction of meat products with lutein to the market calls for an intensive promotion to inform consumers of the advantages of lutein for eye health.

References

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