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LUTEIN CONTENT OF SELECTED POLISH FOODS AND ESTIMATION OF ITS INTAKE

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In the present study, lutein content of vegetables and vegetable products, fruits as well as eggs available on the Polish market was estimated with the use of high performance liquid chromatography (HPLC). The highest concentration of lutein was found in green leafy vegetables: spinach (8.95 mg/100 g), cabbage Savoy (6.89 mg/100 g), lettuce (1.65 mg/100 g), celery leaves (1.68 mg/100 g) as well as in yellow and green vegetables: pumpkin (2.82 mg/100 g), zucchini (1.14 mg/100 g), broccoli (1.97 mg/100 g), and green peas (2.23 mg/100 g), whereas its lowest concentration was observed in fruits (<0.60 mg/100 g). The mean content of lutein in eggs was found to reach 0.62 mg/100 g and depend on the method of breeding. The average estimated intake of lutein was 1.78 mg/person/day, the main source of this carotenoid being vegetables and vegetable products (70.8%), potatoes (12.3%), eggs (10.1%), and fruits (5.9%).

INTRODUCTION

Besides chlorophylls and anthocyanins, carotenoids belong to the most important and most frequent pigments found in nature, the main sources being yellow, orange, and red fruits and vegetables as well as green leafy vegetables. Approximately 500 carotenoids have been identified, but only a few of them can be concerted to vitamin A. The others, which do not possess vitamin A activity, are referred to as "inactive carotenoids". However, results of several studies have shown that they have strong antioxidant properties [Granado *et al.*, 2003; Handelman, 2001; Krinsky, 2001; Mares-Perlman *et al.*, 2002]. Besides zeaxanthin, lutein is one of the carotenoids, a basic fundamental pigment present in central region of the retina, known as the yellow pigment [Bone & Landrum, 2001; Krinsky, 2002]. In humans, lutein has two functions, namely (1) it is an antioxidant, and (2) it is a yellow filter absorbing UV light that is disastrous to the eyes. As an antioxidant, together with zeaxanthin, it scavenges reactive oxygen species in the eyes, therefore protecting them from diseases such as age-related macula degeneration, pigmented degeneration of the retina, and cataract [Handelman, 2001; Krinsky *et al.*, 2003; Mares-Perlman *et al.*, 2002]. The antioxidant activities of lutein are due to the presence of 9 conjugated double bonds in the carbon chain as well as 2-OH groups in the β-ionone rings [Bone & Landrum, 2001; Krinsky, 2002].

Taking into consideration the protective action of lutein in humans as well as the fact that data about lutein content of foods available on the Polish market have not been published, it seems purposeful to carry out studies on lutein content of vegetables, fruits, and eggs as well as the intake of the carotenoid by the Polish population.

MATERIALS AND METHODS

Materials for the assessment of lutein content of foods available on the Polish market included potatoes and selected vegetable products (green peas, sweet corn, haricot bean as well as tomato concentrates) produced in Poland and originating from 8 companies. Lutein was also estimated in farm eggs, bought in the retail market as well as village eggs purchased directly from individual farmers. Fruits and vegetables investigated were bought from 6 shops. Due to great differences in variety, apples and potatoes were acquired from 18 shops. Vegetable products were purchased in the retail market from different places, 4 packages for each. The estimation of the amount of lutein in the selected foods available on the Polish market was carried out in the years 2002–2003.

Lutein was determined for each of the foods by high-performance liquid chromatography (HPLC) method with the use of an apparatus by the Gilson Company with UV-VIS detector and chromatographic column C18 RP, as well as guard, all from Vydac Company. Lutein content was determined only in the edible parts of vegetables, fruits and vegetable products. Products were weighed in the amount of 1.0 g and homogenized with 20 mL methanol, but in the case of eggs, a mixture of chloroform:methanol was applied as well as 0.2 mL of 5% BHT in alcohol solution was added. Following this, extraction was done with methanol at ambient temperature. The methanol extracts collected were fil-

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tered and then concentrated under nitrogen. The dried residue was immediately dissolved in hexane and after filtration with microfilters (pore diameter of 0.45 μm) it was injected into the chromatographic column. The determination of lutein content was carried out spectrophotometrically at a wave length of 446 nm, using the mixture of methanol:hexane:water at the ratio of 88:10:2 (v/v/v) as a mobile phase and a flow rate of 1.0 mL/min. Results obtained were compared with the standard curve performed with lutein standard obtained from Sigma. Sample analysis was carried out in triplicate for each of the purchased samples. Recovery trial using this method was 96%.

Data from lutein estimation in the present study were used for the assessment of its daily intake by the Polish population based on balance sheet data (household budget) from the year 2002, obtained at the Central Office of Statistics.

RESULTS AND DISCUSSION

Lutein is found in yellow and orange fruit and vegetables as well as green leafy vegetables, the content being often masked by the green pigment chlorophyll. Lutein content of vegetables is characterized by a wide span: from 0.012–0.016 mg/100 g of onion, radish and cauliflower to 12–18 mg/100 g of spinach, dill, green parsley, corn-salad, and even 39 mg/100 g in some kale varieties [Hart & Scott, 1995; Holden *et al.*, 1999; Mangels *et al.*, 1993; Murkovic *et al.*, 2000; Müller, 1996; O'Neill *et al.*, 2001]. In the present study, the highest concentration of lutein was also found in green vegetables, *i.e.* spinach with mean content of 8.95 mg/100 g, celery leaves – 1.68 mg/100 g, and cabbage Savoy – 6.89 mg/100 g (Table 1). The other types of cabbages, *i.e.* white cabbage and Brussels sprouts, were characterised by a lower content of lutein which accounted for 0.22 and 0.51 mg/100 g, respectively. A great variation was found in lutein content of different lettuce varieties. For example, lutein content of lettuce butterhead was 4 times higher than that of lettuce iceberg, *i.e.* 1.65 and 0.41 mg/100 g, respectively. Data available in the scientific literature about lutein of different vegetables vary and depend on the location and type of cultivation, season of the year, variety, degree of ripeness, type of leaf (inner-outer) as well as the intensity of leaf pigment [Hart & Scott, 1995; Heinonen *et al.*, 1989; Holden *et al.*, 1999; Humphries & Khachik, 2003; Müller, 1996; Pelz *et al.*, 1998].

The highest concentration of lutein among vegetables with leaf or flower as the edible part was found in pumpkin (2.82 mg/100 g) followed by broccoli and zucchini (1.97 mg and 1.14 mg/100 g, respectively). The content of lutein in pumpkins reported in other papers ranged from 1.33 to 2.40 mg/100 g [Humphries & Khachik, 2003; Murkovic *et al.*, 2000; Müller, 1997]. The amount of lutein in broccoli also differed greatly and ranged from 0.80 mg/100 g [Murkovic *et al.*, 2000; Müller, 1997; Pelz *et al.*, 1998] to 2.40–2.80 mg [Holden *et al.*, 1999; Khachik *et al.*, 1992]. The concentration of lutein in cucumbers ranged from 0.44 to 0.66 mg/100 g (mean content being 0.51 mg), which is in agreement with the results of studies conducted by many authors who demonstrated that the amount of lutein in this product varies from 0.47 mg/100 g [Heinonen *et al.*, 1989] to 0.67 mg/100 g [Hart & Scott, 1995] and even 0.84 mg/100 g [O'Neill *et al.*, 2001]. Lutein content of green and yellow paprika was 0.71 mg and 0.67 mg/100 g, respectively; red paprika was characterized by the lowest content amounting to 0.35 mg/100 g (Table 1), with β-cryptoxanthin as the predominant pigment [Granado *et al.*, 1992; Holden *et al.*, 1999; Müller, 1997; O'Neill *et al.*, 2001]. Data for paprika in the present study are consistent with those obtained by other authors [Hart & Scott, 1995; Heinonen *et al.*, 1989; O'Neill *et al.*, 2001]. The mean lutein content of yellow tomatoes was higher by 18% than that of red tomatoes. Generally, lutein contents of red tomatoes have been reported to range from 0.044 mg/100 g to 0.210 mg/100 g, depending on the variety, degree of ripeness, season of the year, type of cultivation and climatic conditions [Granado *et al.*, 1992; Hart & Scott, 1995; Heinonen *et al.*, 1989; Leth *et al.*, 2000; Murkovic *et al.*, 2000; Müller, 1997; O'Neill *et al.*, 2001; Pelz *et al.*, 1998].

The mean lutein content of sugar beet and carrots did not differ and was 0.27 and 0.30 mg/100 g, respectively (Table 1). Potatoes do not contain ample amounts of lutein,

TABLE 1. Lutein content (mg/100 g) of vegetables available on the Polish market.

Vegetables	Mean ± SD	Range
	Fresh vegetables	
Leaves and stems		
Brussels	0.51±0.05	0.45–0.59
Chicory	0.33±0.03	0.29–0.38
White cabbage	0.22±0.13	0.08–0.44
Cabbage Savoy	6.89±1.65	4.60–9.44
Lettuce iceberg	0.41±0.06	0.31–0.49
Lettuce butterhead	1.65±0.33	1.13–2.12
Celery-leaves	1.68±0.20	1.43–1.98
Spinach	8.95±2.63	5.86–12.95
Flowers and fruits		
Broccoli	1.97±0.54	1.19–2.74
Zucchini	1.14±0.27	0.67–1.40
Pumpkin	2.82±0.68	1.88–3.62
Cucumber	0.51±0.10	0.41–0.66
Paprika, red	0.35±0.08	0.23–0.43
Paprika, orange	0.58±0.10	0.45–0.72
Paprika, green	0.71±0.06	0.64–0.82
Paprika, yellow	0.67±0.11	0.47–0.77
Tomato red	0.09±0.03	0.06–0.12
Tomato yellow	0.11±0.02	0.08–0.13
Roots and tubers		
Beetroot	0.27±0.04	0.19–0.31
Carrot	0.30±0.06	0.22–0.41
Potato	0.08±0.03	0.03–0.12
	Frozen vegetables	
Broccoli	1.89±0.33	1.45–2.42
Brussels	0.47±0.05	0.40–0.56
Haricot bean	0.29±0.06	0.22–0.39
Carrot	0.28±0.05	0.23–0.38
Tomato	0.08±0.01	0.06–0.11
Spinach	8.80±1.95	6.62–12.23
Legumes:		
Pea, yellow, dried	0.98±0.10	0.81–1.13
Bean, white, dried	<0.02	

SD – standard deviation

but they are a good source of this carotenoid, since their consumption stands at a higher level in Poland. The mean lutein content of potatoes was found to be 0.08 mg/100 g, but it varied from 0.03 to 0.12 mg/100 g, depending on the variety and season of the year. Several authors have recorded similar values in their studies [Heinonen *et al.*, 1989; Lu *et al.*, 2001; Müller, 1996; 1997; O'Neill *et al.*, 2001].

Besides fresh vegetables, other good sources of dietary lutein are frozen vegetables, vegetable products, which are available throughout the year. Furthermore, technological processes, such as mincing, marinating, freezing or mild heating increase the degree of carotenoid release and absorption [Granado *et al.*, 1992; Hart & Scott, 1995; Khachik *et al.*, 1992; O'Neill *et al.*, 2001].

Lutein contents of the selected frozen and fresh vegetables were similar (Table 1). The highest values were found in green vegetables, spinach (8.80 mg/100 g) as well as broccoli (1.89 mg/100). The concentration of lutein in the other vegetables (brussels sprouts, haricot bean, carrot, tomato) was below 0.50 mg/100 g. These results were similar to those obtained by other authors [Hart & Scott, 1995; Holden *et al.*, 1999], but values for brussels sprouts and haricot bean were on average 26% lower than the values found in other countries.

Table 1 presents the mean lutein content of legumes too. Values for peas ranged from 0.81 mg to 1.13 mg/100 g, with the average content being 0.98 mg/100 g. The amount of lutein in beans was lower, *i.e.* 0.02 mg/100 g. Several authors demonstrated lutein content of peas to range from 0.64 mg to 1.63 mg/100 g [Hart & Scott, 1995; Holden *et al.*, 1999; Humphries & Khachik, 2003].

TABLE 2. Lutein content (mg/100 g) of vegetable products available on the Polish market.

Vegetable products	Mean ± SD	Range
Sweet corn		
I	0.67±0.04	0.61–0.72
II	0.51±0.04	0.47–0.56
III	0.36±0.03	0.31–0.38
IV	0.30±0.02	0.27–0.32
V	0.23±0.02	0.21–0.26
x	0.41±0.16	0.21–0.72
Green peas		
III	2.39±0.21	2.12–2.64
I	2.26±0.17	2.06–2.48
V	2.24±0.18	1.97–2.44
II	2.21±0.19	1.97–2.42
IV	2.06±0.20	1.79–2.32
x	2.23±0.22	1.79–2.64
Haricot bean		
I	0.22±0.03	0.18–0.25
VI	0.21±0.02	0.17–0.24
V	0.20±0.02	0.17–0.22
x	0.21±0.02	0.17–0.25
Concentrated tomato pastes		
VII	0.30±0.04	0.25–0.34
II	0.29±0.03	0.24–0.33
VIII	0.27±0.03	0.23–0.31
x	0.29±0.03	0.23–0.34

SD – standard deviation, I–VIII – company codes for vegetable products

The highest content of lutein in the group of vegetable products was found in preserved green peas, mean content being 2.23 mg/100 g (2.06 to 2.39 mg); this was followed by preserved sweet corn where lutein content accounted for 0.41 mg/100 g (Table 2). Differences were found for vegetable products between companies, 14% variability for green peas and 3-fold difference for sweet corn, which probably depended on their degree of ripeness, variety and period of harvest. The amounts of lutein haricot bean and tomato pastes from different companies were similar or differed slightly. The mean lutein content of beans was 0.21 mg/100 g and ranged from 0.17 to 0.25 mg/100 g; the average concentration of lutein for tomato pastes was 0.29 mg/100 g, varying between 0.23 to 0.34 mg/100 g.

Generally, lutein content of fruits is lower that that of vegetables and usually this amount does not exceed 1.0 mg/100 g, which has been confirmed in the present study (Table 3). The highest values of lutein were recorded in both fresh and frozen blackberries (0.54 and 0.50 mg/100 g, respectively). The second group of fruits included blueberries, bilberries, Mirabelle, plums, raspberries and aronia, in which lutein content varied between 0.11 mg for aronia and 0.29 mg for blueberries. Values below 0.1 mg/100 g were reported for cherries, plums, apples, oranges and watermelon. The lowest lutein concentrations were found in tangerines, *i.e.* below 0.02 mg/100 g. Lutein content of frozen fruits was similar to that of fresh fruits with a non-significant difference at the level of 3–10%. Data from the present study are in agreement with the results reported by other scientists [Heinonen *et al.*, 1989; Humphries & Khachik, 2003; Mangels *et al.*, 1993; Müller, 1996; 1997; O'Neill *et al.*, 2001], but differ between each other, depending on the place and type of cultivation, degree of ripeness and period of harvest.

TABLE 3. Lutein content (mg/100 g) of fruit available on the Polish market.

Fruit	Mean ± SD	Range
Fresh:		
Aronia	0.11±0.02	0.09–0.14
Blueberry	0.29±0.04	0.23–0.35
Bilberry	0.20±0.03	0.16–0.24
Apple	0.05±0.02	0.02–0.09
Blackberry	0.54±0.07	0.47–0.67
Raspberry	0.12±0.04	0.08–0.18
Melon	0.03±0.01	0.02–0.05
Tangerine	< 0.02	
Orange	0.05±0.02	0.03–0.08
Mirabelle	0.13±0.03	0.09–0.20
Plum	0.08±0.02	0.06–0.12
Cherry	0.08±0.02	0.05–0.11
Frozen:		
Aronia	0.11±0.02	0.09–0.12
Blueberry	0.28±0.02	0.24–0.32
Bilberry	0.19±0.02	0.17–0.23
Blackberry	0.50±0.04	0.44–0.55
Raspberry	0.12±0.02	0.09–0.14
Mirabelle	0.13±0.02	0.10–0.16
Plum	0.08±0.02	0.06–0.10
Cherry	0.07±0.02	0.05–0.10

SD – standard deviation

Lutein is also present in some food products of animal origin, such as egg yolk, which is due to the presence of yellow pigment (rich in lutein) in plants used for feeding hens [Bailey & Chen, 1989; Ollilainen *et al.*, 1989]. The lutein content of eggs in the present study ranged from 0.27 to 1.07 mg/100 g and depended on the method of hen breeding (Table 4). The lutein content of eggs from hens bred in the rural areas was almost 50% higher than that of battery hens. The mean lutein content of egg yolk was 1.58 mg/100 g and ranged from 0.71 to 2.82 mg/100 g. The results of the present study are consistent with those of other authors [Leth *et al.*, 2000; Ollilainen *et al.*, 1989; O'Neill *et al.*, 2001]. Studies carried out in Denmark showed that egg yolks from the so-called "organic farms" had more than twofold higher amount of lutein compared to yolks from battery hens and threefold higher in relation to yolks from free – living hens (1320, 527 and 384 g/100 g, respectively) [Leth *et al.*, 2000]. In a study conducted in Finland, however, lutein content of whole egg was shown to be 619.5±52.6 μg/100 g and that of egg yolk to be 1575.8±34 μg/100 g [Ollilainen *et al.*, 1989].

TABLE 4. Lutein content (mg/100 g) of eggs available on the Polish market.

Eggs		Mean ± SD	Range
Battery hens	Eggs whole	0.42±0.09	0.27–0.54
	Egg yolk	1.07±0.24	0.71–1.40
Village hens	Eggs whole	0.82±0.18	0.58–1.07
	Egg yolk	2.08±0.47	1.48–2.82
x	Eggs whole	0.62±0.25	0.27–1.07
	Egg yolk	1.58±0.64	0.71–2.82

SD – standard deviation

Taking into consideration the results of the present study on lutein content of selected foods available on the Polish market as well as data concerning the consumption of foods, made available by the Central Office of Statistics, it was estimated that the daily dietary intake of lutein was 1.78 mg/person/day.

Studies carried out in the former Western Germany in the years 1985–1989 and involving 23 000 subjects revealed that the average intake of lutein/zeaxanthin was higher in men – 1.95 mg/day than in women – 1.87 mg/day [Pelz *et al.*, 1998]. Studies performed by Müller [1996] in 39 subjects showed that the average lutein intake was 0.97 mg/day. The total carotenoid intake in participants accounted for 5.30 mg/day, but the consumption of provitamin A carotenoids was 3.51 mg and that of non-precursors of vitamin A carotenoids – 1.79 mg. In studies of the Finnish population conducted among 10 000 participants, it was demonstrated that the average intake of lutein reached 1.05 mg/day in women and 1.12 mg/day in men [Järvinen, 1995]. However, studies conducted in Ireland in 118 subjects from 2 age groups (24–45 years and ≥65 years) demonstrated higher lutein and zeaxanthin intakes in the younger group, independent of gender, the values being 2.37 mg/day and 2.10 mg/day for women and men, respectively [Carroll *et al.*, 1999].

Studies conducted simultaneously in 5 European countries, *i.e.* in Spain (Madrid), France (Grenoble), Holland (Zeist), Great Britain (Coleraine) and Ireland (Cork), showed that the population of Southern Europe (Spain and France) consumed the highest amount of lutein/zeaxanthin, 3.25 and 2.50 mg/person/day, respectively. The lowest values were reported for Great Britain (1.59 mg/day) and Ireland (1.56 mg/day). Lutein intake in Holland ranged from 1.42 to 3.04 mg/day. It is worth mentioning that these studies were carried out in single cities in a smaller number of population not exceeding 76 persons aged 25–45 years [O'Neill *et al.*, 2001].

Studies performed in the USA in the years 1987 as well as 1992 among 16 000 healthy adult participants showed that the mean lutein intake was 2.15 mg/day for women and 1.86 mg/day for men [Nebeling *et al.*, 1997]. Curran-Celentano *et al.* [2001] carried out studies in 278 healthy adults, aged 18–50, and found that the mean lutein intake was 1.10 mg/100 g. However, data from investigations among US women, aged 19–50, showed that the average consumption of lutein reached 1.30 mg/day [Chug-Ahuja *et al.*, 1993].

The lutein intake by 1721 Canadians in a nutrition survey (24-h food record) carried out in the years 1997–1998 was 1.33 mg/day, but values were higher for women and increased with age [Johnson-Down *et al.*, 2002].

The main sources of lutein in the present studies were vegetables and vegetable products representing 70.8% (1.26 mg), where vegetables alone amounted to 63.8%. Potatoes supplied 12.2 (0.22 mg) and eggs 10.1% (0.18 mg) of the total lutein intake. The consumption of fruits yielded only 0.11 mg, which is just 6.1% of the total lutein intake; legumes, mainly peas and beans contributed below 1% of the dietary lutein.

Similar values were also reported by other authors. The main sources of lutein were vegetables, especially green ones (spinach, lettuce, broccoli, chicory), which contributed 56% to 78% of the dietary lutein [Goldbohm *et al.*, 1998; Granado *et al.*, 2003; O'Neill *et al.*, 2001; Pelz *et al.*, 1998]. The results of the present study as well as data from Dutch investigations showed that eggs supplied 0.10 mg and fruits 0.11 mg of lutein, which constitutes each about 4% of the dietary lutein, at the total intake of 2.51 mg/day [Goldbohm *et al.*, 1998]. Pelz *et al.* [1998] carried out nutrition studies (24-h food record x 7) in 23 000 respondents and reported that the main sources of lutein/zeaxanthin were vegetables, constituting 70% of the dietary intake of these carotenoids. The contribution of various foods to the dietary intake of lutein was as follows: leafy vegetables (30%), spinach (20%), kale (8%), eggs (8%), peas (6%), potatoes, fruits, fruit juices as well as vegetable products contributed each about 5%. Studies carried out simultaneously in 5 European countries showed that the main sources of lutein depended on nutritional habits prevailing in a given country. In Spain and France, spinach and lettuce contributed most of the dietary lutein, 34 and 31 as well as 16 and 8%, respectively. In Great Britain and Ireland, peas, broccoli and eggs contributed 36 and 19; 8 and 16% as well as 8 and 10% of dietary lutein, respectively. However, in Holland, spinach supplied 30%, broccoli 10% and peas 9% of the dietary lutein [Granado *et al.*, 2003; O'Neill *et al.*, 2001]. The low contribution of fruits to the dietary lutein is due to the low concentration of this carotenoid in this class of products. In Spain, oranges contributed 7–8% of the total dietary lutein, which was due to high consumption of this product.

The main sources of lutein in studies conducted in Canada were vegetables, especially lettuce (20.5%), spinach (15.2%), sweet corn (13.8%), and broccoli (13.2%). High

consumption of oranges contributed 11.1% of lutein, which was higher than the values obtained in the present study [Johnson-Down *et al.*, 2002].

CONCLUSIONS

1. The highest lutein content of the products investigated was found in leafy vegetables: spinach, cabbage Savoy, lettuce, celery-leaves as well as yellow-green vegetables: pumpkin, zucchini, broccoli, green peas; whereas the lowest lutein concentration was observed in fruits.

2. The average content of lutein in eggs was 0.62 mg/100 g and was found to depend on the type of hen breeding.

3. The average lutein intake was 1.78 mg/person/day, the main sources being vegetables and vegetable products, which contributed 70.8% of the dietary carotenoid; this was followed by potatoes (12.3%) and eggs (10.1%).

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OCENA ZAWARTOŚCI LUTEINY W WYBRANYCH PRODUKTACH KRAJOWYCH ORAZ OSZACOWANIE JEJ SPOŻYCIA

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W pracy przy użyciu wysokosprawnej chromatografii cieczowej (HPLC) oznaczono zawartość luteiny w warzywach, owocach, przetworach warzywnych oraz w jajach dostępnych na polskim rynku, a będących głównym źródłem ww. karotenoidu w diecie. Ponadto na podstawie uzyskanych wyników oraz danych GUS dotyczących spożycia żywności, oszacowano średnie spożycie luteiny z dietą oraz główne jej źródła. Najwyższe zawartości luteiny w badanych produktach odnotowano w zielonych liściach warzyw: szpinaku (8,95 mg/100 g), kapuście włoskiej (6,89 mg/100 g), sałacie (1,65 mg/100 g), selerze naciowym (1,68 mg/100 g) oraz żółtych i zielonych warzywach: dyni (2,82 mg/100 g), cukini (1,14 mg/100 g), brokułach (1,97 mg/100 g), zielonym groszku (2,23 mg/100 g), zaś stosunkowo najniższe w badanych owocach (<0,60 mg/100 g) (tab. 1–3). Średnia zawartość luteiny w jajach wynosiła 0,62 mg/100 g i była uzależniona od sposobu hodowli kur (tab. 4). Średnie spożycie luteiny oszacowano na 1,78 mg/dzień/osobę, przy czym głównym źródłem ww. związku były warzywa i przetwory warzywne (70,8%), a następnie ziemniaki (12,3%), jaja (10,1%) oraz owoce (5,9%).