

## NUTRITION OF LACTATING WOMEN IN SLOVENIA

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### ABSTRACT

The dietary intake during lactation plays an important role. Till now 40 lactating Slovenian women at 1–3.5 month post partum participated in the study. Dietary intakes were assessed by 7-day weighted protocols and evaluated by Prodi 4.5 expert plus computer programme. The preliminary results were compared with the central European reference values for nutrient intakes (D-A-CH, 2000). We observed a too low average daily carbohydrate intake by 31 % and a too low average daily protein and fat intake by 24 %. This reflected in a relatively low daily energy intake, which was by 27 % below the recommended Central European referential values. Intakes of Mg (88 %), Fe (67 %), I (52 %), F (41 %), Vit.A (48 %), D (53 %), E (88 %), B<sub>1</sub> (78 %), C (75 %) and folic acid (42 %) were below the D-A-CH recommended values. The ratio between SFA, MUFA and PUFA was 2.5 : 2.1 : 1. The energy intake was too low; whereas the proportion between macronutrients was adequate. The absolute and proportional intake of dietary fibre, Mg, Fe, I, F, vitamins A, D, E, B<sub>1</sub>, C and folic acid was too low, whereas the intake of saturated fatty acids was too high. Our preliminary results suggest that the diet of lactating women in Slovenia needs further attention and should be studied in more detail.

Key words: human nutrition / lactating women / lactation / breast-feeding / dietary intake / recommendations / infant health

## PREHRANA DOJEČIH MATER V SLOVENIJI

### IZVLEČEK

Prehrana v času nosečnosti ima pomembno vlogo. V študiji je sodelovalo 40 zdravih doječih mater 1–3,5 mesece po porodu. Njihov dnevni prehranski vnos smo spremljali s 7-dnevnim prehranskim protokolom. Preliminarne rezultate smo ovrednotili z računalniškim programom Prodi 4,5 expert plus. Dobljene vrednosti smo primerjali s srednjeevropskimi referenčnimi vrednostmi za vnos hranil (D-A-CH, 2000). Ugotovili smo za 31 % prenizek povprečni dnevni vnos ogljikovih hidratov in za 24 % prenizek povprečni dnevni vnos proteinov in maščob, kar se odraža tudi na relativno nizki energetski vrednosti dnevno zaužitih obrokov, ki je bila za 27 % pod priporočenimi srednjeevropskimi referenčnimi vrednostmi. V primerjavi s srednjeevropskimi D-A-CH-ovimi priporočili so imele slovenske matere prenizek prehranski vnos Fe (67 %), I (52 %), F (41 %), Vit. A (48 %), D (53 %), E (88 %), B<sub>1</sub> (78 %), C (75 %) in folne kisline

(42 %). Razmerje med nasičenimi (SFA), mononenasičenimi (MUFA) in polinenasičenimi (PUFA) maščobnimi kislinami je bilo 2.5 : 2.2 : 1. Razmerje makronutrientov je bilo primerno. Vnos vlaknin, nekaterih mineralov (Mg, Fe, I in F) in vitaminov (A, D, E, folna kislina and vit. C) je bil pod priporočeno vrednostjo. Vnos nasičenih maščobnih kislin je bil previsok. Preliminarni rezultati naše študije kažejo na precejšnja odstopanja prehrane doječih mater v Sloveniji od srednjeevropskih priporočil, zato je smiselno spremljati in proučevati prehrano doječih mater v Sloveniji tudi v prihodnosti.

Ključne besede: prehrana ljudi / doječe matere / laktacija / dojenje / prehranski vnos / priporočila / dojenčki / zdravje

## INTRODUCTION

Lactation confers marked benefits to infants, mothers, families and the society. Health care of nursing mothers and their infants is an important priority of primary preventive care (Mullerova *et al.*, 1998). Human milk from healthy, well-nourished mothers is the preferred form of feeding for healthy newborn infants (Koletzko *et al.*, 2001). Nutritional inadequacies during lactation may affect the well-being of both mothers and their infants. The mother's diet and life style during lactation period plays an important role.

In Slovenia, mothers are stimulated to breastfeed their infants. At the time of leaving maternity hospital, usually the third day after delivery, on average 95 % of women are breast-feeding (Kraševc, 2001). Breast-feeding rates among Slovenian mothers are increasing and the average duration is approaching 6 months (Hoyer and Pokorn, 1998). In this pilot study we investigated the adequacy of nutrient intake of healthy lactating Slovenian women in comparison with the central European reference values for nutrient intakes (D-A-CH, 2000).

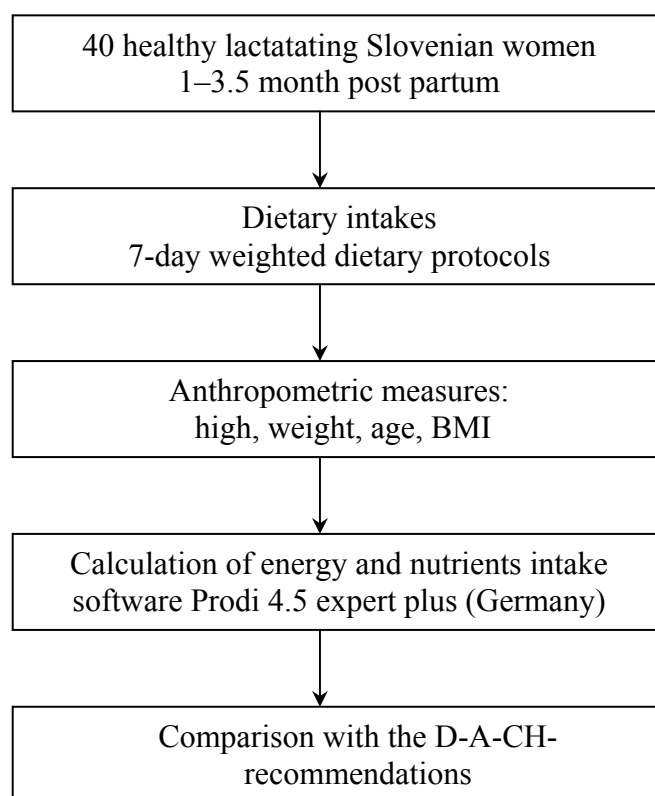
## SUBJECTS AND METHODS

### Subjects

The study population comprised 40 healthy lactating Slovenian women at 1 to 3.5 months postpartum. All women gave birth to a single, full-term, healthy infant and were enrolled into the study during their visit of the University Children's Hospital in Ljubljana. The study protocol was approved by the Ethical Committee of the Medical Faculty of the University of Ljubljana, Slovenia. After a careful explanation of the study, a written informed consent was obtained from all participating women.

### Study design

All women consumed a habitual omnivorous diet. Diets were assessed by prospective 7-day weighted dietary protocols. Each woman was carefully instructed to record the exact amount of all foods and drinks consumed (quantity in g, ml or household measures) and the corresponding brands. Energy and nutrients intakes were calculated from dietary records with the nutrition database software Prodi version 4.5, expert plus, using the nutrient databases Bundeslebensmittelschlüssel, II.3 and Souci, Fachmann, Kraut Nährwerttabellen (Kluthe, 2000). These databases contain 11 500 food items with the composition for 330 nutrients. The German databases were chosen, because there is no appropriate Slovenian database, suited for the research work. The values for iodine in table salt and fluorine in water were checked and accommodated to Slovenian values.



### Statistical analysis

Statgraphics Plus for Windows (version 4.0: 1994–1996) was performed for statistical analyses. The test for normal distribution of data was performed.

## RESULTS AND DISCUSSION

Table 1. Anthropometric measures of Slovenian lactating women (mean±SD)

	Lactating Slovenian women
Age, years	27.5 ± 4.8
Height, cm	166.3 ± 26.1
Weight, kg	64.5 ± 13.8
BMI, kg m <sup>-2</sup>	23.4 ± 4.3
wrist circumference, cm	15.4 ± 2.5
r – construction	10.8 ± 0.8
Percentage of muscle	15.8 ± 6.2
Muscle index*	5.8 ± 3.1

r = (high /wrist circumference): above 10.9 = gentle; 10.9–9.9 = medium; under 9.9 = strong construction

\* = Muscle index: under 5 = gracile; 5–12 = normally formed; above 12 = strongly formed musculature

### Energy

The lactating Slovenian women included in our study reported a rather low energy intake (73 % of D-A-CH). In view of the normal BMI, some degree of underreporting cannot be excluded. However lactating women are at risk of energy and nutrient inadequacies.

Table 2. Average dietary daily intake of selected nutrients by the participating Slovenian women at 1 to 3.5 months postpartum and the D-A-CH reference (D-A-CH, 2000) recommendations

	Lactating Slovenian women (mean $\pm$ SD)	D-A-CH reference 2000
Energy intake, kJ day <sup>-1</sup>	9 169 $\pm$ 2 392	12 490 *
Protein, g day <sup>-1</sup>	85 $\pm$ 20	112
Carbohydrate, g day <sup>-1</sup>	270 $\pm$ 84	392
Fat, g day <sup>-1</sup>	82 $\pm$ 23	108
P : CH : F Ratio, %	16 : 50 : 34	15 : 53 : 32
Water, ml day <sup>-1</sup>	2 800 $\pm$ 800	2 710
Dietary fibre, g day <sup>-1</sup>	22.0 $\pm$ 6.5	37
SFA : MUFA : PUFA Ratio	2.5 : 2.1 : 1	1 : 1 : 1

\* = 12 490 kJ day<sup>-1</sup> (total energy need) = 9 790 kJ day<sup>-1</sup> (basic energy need) + 2 700 kJ day<sup>-1</sup> (net increment for the lactation); P : CH : F Ratio = ratio between proteins : carbohydrates : fats; SFA : MUFA : PUFA Ratio = ratio between saturated, monounsaturated and polyunsaturated fatty acids

The recommended total daily energy consumption of lactating women until 4 months post partum is 12 490 kJ day<sup>-1</sup> (2 985 kcal day<sup>-1</sup>). Due to lactation, this recommendation considers the net increment need of 2 700 kJ day<sup>-1</sup> (635 kcal day<sup>-1</sup>; see text under table 2) (D-A-CH, 2000). Studies of dietary intake of lactating women in other countries similarly report energy intakes below the recommendations, i. e. 8 978 kJ day<sup>-1</sup> in Ontario, Canada (Doran and Evers, 1997), 8 511 kJ day<sup>-1</sup> in South Africa (Kesa *et al.*, 2001) and 8 700 kJ day<sup>-1</sup> in the Czech republic (Mullerova *et al.*, 1998).

### Macronutrients

The proportion between macronutrients obtained in our study was adequate. The daily absolute water intake was sufficient as well. The absolute and proportional intakes of dietary fibre were too low.

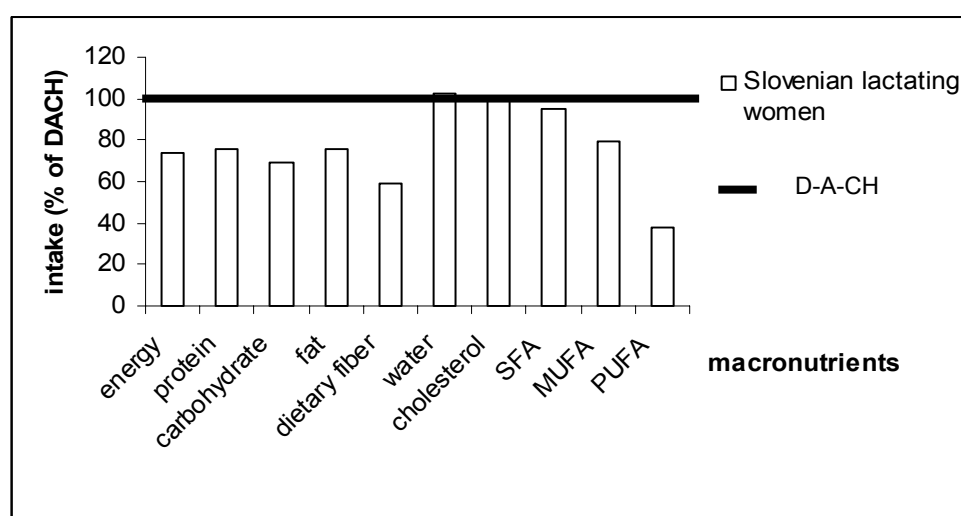


Figure 1. An average daily intake of macronutrients consumed by lactating Slovenian women at 1 to 3.5 months postpartum compared to D-A-CH reference values 2000 (D-A-CH, 2000) (% of recommendations).

### Ratio between fatty acids

The ratio between saturated, monounsaturated and polyunsaturated fatty acids in the diet of lactating Slovenian women studied was 2.5: 2.1: 1, whereas the recommended ratio is 1:1:1 (D-A-CH). This indicates an inappropriate ratio of the ingested fatty acids, with a too high proportion of saturated fatty acids (44 % vs. recommended  $\leq 33$  % total fat intake), see fig. 2), which were mainly of animal origin (milk, milk products, meat and meat products) and there was a considerably too low intake of polyunsaturated fats (18 % vs. recommended 23–33 % total fat intake, see fig. 2) that are mainly found in plant oils and sea fish.

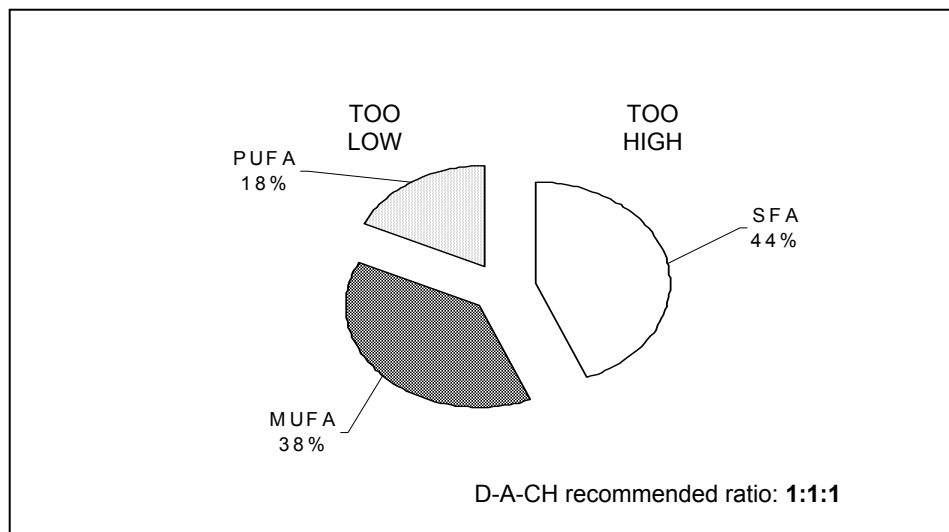


Figure 2. Proportion of average daily intake of saturated (SFA), monounsaturated (MUFA) and polyunsaturated (PUFA) fatty acids ingested by lactating Slovenian women at 1 to 3.5 months postpartum.

An inappropriate composition of ingested fat, characterised by too high saturated fat intake and too low polyunsaturated fat intake, reported in our study for lactating women is in agreement with previously reported results for a sample of Slovenian population (Koch, 1997) as well as recent dietary survey by CINDI (Mavčec-Zakotnik, 2000). Too low intake of polyunsaturated fats is associated with insufficient intake of docosahexaenoic acid (DHA). According to literature data amount of DHA in human milk is influenced by maternal diet (Fidler, 2000).

### Vitamins and minerals:

D-A-CH reference values contain recommendations for the intake of 12 vitamins (vit. A, D, E, B<sub>1</sub>, B<sub>2</sub>, niacin, B<sub>6</sub>, folic acid, panthothenic acid, biotin, vit. B<sub>12</sub> and vit. C) and 12 minerals (Na, K, Cl, Ca, Mg, P, Fe, I, F, Zn, Cu, Mn) during the lactation period.

In our study the evaluation of these vitamins and minerals showed low absolute and proportional intakes for six vitamins A (48 % of D-A-CH), D (53 %), E (88 %), B<sub>1</sub> (78 %), folic acid (42 %) and C (75 %); and four minerals Mg (88 % of D-A-CH), Fe (66 %), I (53 %) and F (41 %). A low intake of vitamin D and calcium was also reported for lactating women in Austria. That indicates a high risk for the development of disorders of bone metabolism (Koenig and Elmadfa, 2000). Too low intake of some vitamins and minerals (Vit. E, B<sub>1</sub>, Vit. C and Mg) can be associated with low energy intake. Figure 3 and 4 show the dietary intake of Slovenian lactating women compared to D-A-CH recommendations.

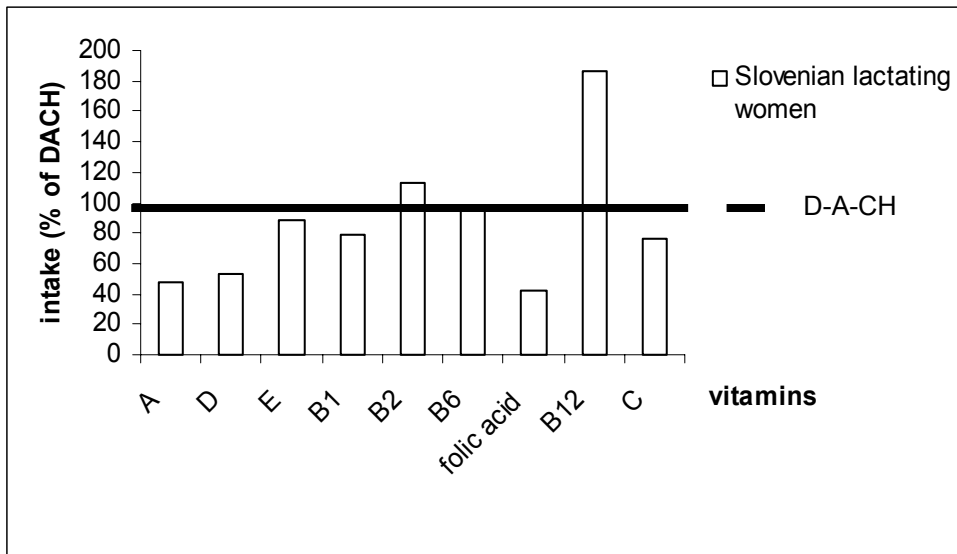


Figure 3. An average daily intake of vitamins consumed by lactating Slovenian women at 1 to 3.5 months postpartum compared to D-A-CH reference values 2000 (D-A-CH, 2000) (% of recommendations).

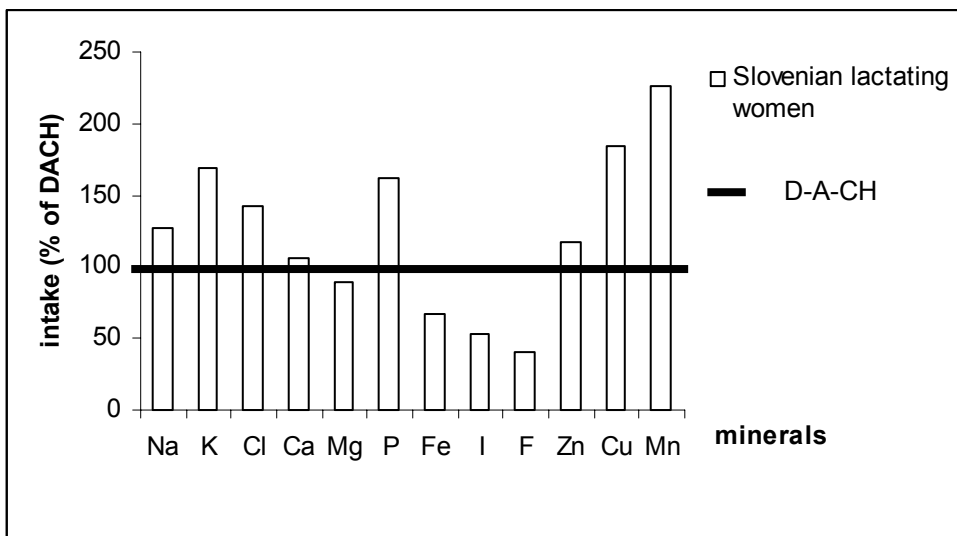


Figure 4. An average daily intake of minerals consumed by lactating Slovenian women at 1 to 3.5 months postpartum compared to D-A-CH reference values 2000 (D-A-CH, 2000) (% of recommendations).

In many researches low intake of iron (Dewey, 2001, Kesa *et al.*, 2001), vitamin A and vitamin E was reported (Muslimatum *et al.*, 2001, Olafsdottir *et al.*, 2001). Low iron intake in breastfeeding women is critical, because iron is one of the most limiting minerals in the diet of breastfed infants (Dewey, 2001). Iron deficiency is widespread among females of reproductive age. It is partly induced by plant-based diets containing low levels of poorly bio-available food. The most effective technological approaches to combat iron deficiency include food fortification and dietary strategy (Kesa *et al.*, 2001). Many pregnant and lactating women in developing countries are anaemic and vitamin A deficient. Vitamin A also plays an important role in iron metabolism (Muslimatum *et al.*, 2001). There is a relationship between the content of vitamins A

and E in human milk and the maternal diet. The recommended intake of fat-soluble vitamins for lactating women can easily be met with a cod liver oil supplementation, rather than with diet alone (Olafsdottir *et al.*, 2001). For Slovenian lactating women we could suggest appropriate oil supplements to achieve the recommended intake of fat-soluble vitamins.

## CONCLUSIONS

Nutrition of the lactating mother plays a very important role. The mammary gland exhibits metabolic priority for nutrients, often at the expense of maternal reserves (Picciano, 1998). Nutrient deficiencies, which can arise during this vulnerable period of the life cycle, may impact both mother and her infant.

The diet of lactating women in Slovenia needs further attention and should be studied in more detail. An adequate nutritional education should be directed to lactating women to help them achieve the recommended nutrient intake. The programs to promote breastfeeding in Slovenia should also include strategies to assure an adequate diet during lactation.

## ACKNOWLEDGEMENT

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## POVZETEK

Pravilna prehrana matere in zdrav način življenja v obdobju dojenja imata pomembno vlogo tako za dojenčke, matere, družine in družbo v celoti (Mullerova *et al.*, 1998). Humano mleko zdravih mater predstavlja dojenčku v prvih mesecih življenja najboljšo hrano (Koletzko *et al.*, 2001). V Sloveniji spodbujamo dojenje mater in traja povprečno 6 mesecev (Hoyer and Pokorn, 1998). V našem delu smo ugotovili povprečen dnevni vnos energije in hranil zdravih doječih mater v Sloveniji in naredili primerjavo z evropskimi priporočili (D-A-CH). V študijo smo vključili 40 zdravih doječih mater, v času med 1–3,5 mesecem po porodu. Vse matere so rodile zdravega donošenega dojenčka in so uživale mešano prehrano. Prehranjevalne navade smo spremljali s 7-dnevnim tehtanim prehranskim protokolom. Prehranske protokole smo ovrednotili s pomočjo računalniškega programa Prodi 4,5 expert plus z nemškimi prehranskimi tabelami, ki smo jih dopolnili s hranilnimi vrednostmi za nekatera slovenska živila, zlasti tista pri katerih lahko hranilne vrednosti bistveno odstopajo od srednjeevropskih (kot na primer jod v kuhinjski soli ali fluor v pitni vodi). Rezultate analize smo primerjali z evropskimi prehranskimi priporočili za doječe matere (D-A-CH, 2000). Podatke smo statistično obdelali s testom za normalno porazdelitev s računalniškim programom "Statgraphics Plus". Povprečna starost mater v naši raziskavi je bila  $27,5 \pm 4,8$  let z normalnim indeksom telesne mase  $23,5 \pm 2,7$  kg m<sup>-2</sup> (mean  $\pm$  SD), nežno telesno konstrukcijo in normalno formirano muskulaturo. Rezultati analize kažejo na to, da je prehrana doječih mater v Sloveniji hipokalorična, dosegajo samo 75 % priporočljivega kaloričnega vnosa. Glede na normalen indeks telesne mase ne moremo izključiti možnosti pomankljivega beleženja zaužite hrane v prehranskem dnevniku.

Razmerje med posameznimi makrohranili je primerno, vnos dietnih vlaknin pa je nižji od priporočil. Razmerje med nasičenim, enkratnenasičenimi in večkratnenasičenimi maščobami je 2.5 : 2.1 : 1. Kar kaže na nepravilno razmerje zaužitih maščobnih kislin, s prevelikim deležem zaužitih nasičenih maščobnih kislin in prenizkim deležem večkratnenasičenih maščobnih kislin. Iz natančno izpolnjenih 7-dnevnih tehtanih prehranskih protokolov smo razbrali, da doječe matere zaužijejo preveč nasičenih maščobnih kislin v obliki mleka, mlečnih izdelkov, mesa in

mesnih izdelkov, in premalo večkrat nenasičenih maščobnih kislin, ki se nahajajo pretežno v morskih ribah, mikroalgah in rastlinskih oljih (zlasti v repičnem in sončničnem olju).

V primerjavi s srednjeevropski D-A-CH-ovimi priporočili slovenske matere z obroki zaužijejo premalo vitaminov Vit. A (48 %), D (53 %), E (88 %), B<sub>1</sub> (78 %), C (75 %) in folne kisline (42 %), kot tudi premalo mineralov Mg (88 %), Fe (67 %), I (52 %), F (41 %). Vzrok za prenizek prehranski vnos nekaterih vitaminov in mineralov (Vit. E, B<sub>1</sub>, Vit. C and mineral Mg) lahko iščemo tudi v prenizkem kaloričnem vnosu. Najbolj zaskrbljujoča je nizka vsebnost železa pri doječih materah, saj je železo pri dojenem dojenčku tudi eden od najbolj limitirajočih mineralov. Prehranski primankljaj, ki lahko med dojenjem pri materi še narašča, lahko vpliva na zdravje tako matere kot dojenčka. Prehrana doječih mater v Sloveniji kaže na precejšnja odstopanja od priporočil za doječe matere, zato bi bilo v prihodnosti slovenskim doječim materam smiselno zagotoviti potrebne informacije, da bo njihova prehrana v času dojenja v skladu s priporočili.

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