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Prenatal Food Supplements on the Croatian and Polish Market

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Abstract

Aim: The purpose of the research was to compare the types and composition of dietary supplements (DS) for pregnant women available on the Polish (PL) and Croatian (CR) markets, comparing the content of selected ingredients with the recommended nutritional intakes for the European population, alongside analysing possible adverse effects.

Methodology: The product range offered on the Polish and Croatian markets was surveyed in July 2022 and the database was created based on which DS were sold online. The levels of ingredients

declared by the manufacturers on the labels were considered to evaluate and discuss the composition of dietary supplements (DS) intended for women planning pregnancy and/or those already pregnant were selected for the study.

Results: According to the research, 58 supplements were sold in Poland and 35 in Croatia. Women have a broad spectrum of supplements available on the market, but the legitimacy of their use is questionable. Supplements should complement the dietary intake of nutrients, certainly not exceeding the recommended doses and increasing the risk of adverse effects .

Implications and recommendations: The study demonstrated that consumers of both countries face similar problems. Products labelled “for pregnancy” do not guarantee that products fulfil the requirements of this group of consumers.

Originality/value: The prenatal supplement market is experiencing significant growth, DS should complement the dietary intake of nutrients, certainly not exceeding recommended doses and increasing the risk of adverse effects.

Keywords: food supplements, supplements labelling, prenatal food supplements

1. Introduction

The dietary habits and nutritional status of pregnant women do not differ from those of the general population, however pregnant women are more likely to use dietary supplements as a means to improve their diet and achieve beneficial effects for their newborn child. This is especially the case for older women, in particular those with higher education and income, women expecting their first child, and/or undergoing a medically assisted procedure.

Nutritional needs increase as the pregnancy progresses to its full term, but the only two nutrients for which diet alone is ineffective in reaching the required amounts are folic acid (pre-pregnancy and during the first trimester) and iron (especially through the second and third trimester). Other nutrients of interest are vitamin D, calcium, and iodine, due to the fact that their deficiencies are the most common ones (Milman et al., 2016).

The potentially excessive intake resulting from taking prenatal supplements is still not a source of safety concern, probably because nutritional deficiencies during pregnancy can have devastating long-term consequences (Gernand et al., 2016). In recent decades, pregnant women are almost universally recommended to take dietary supplements, yet more studies support the idea of targeted supplementation for pregnant women (Oh et al., 2020), which is considered to be far more effective and safer (Brown & Wright, 2020; Santander Ballestín et al., 2021).

The prenatal supplement market is currently experiencing significant growth. According to Industry Research, the market size was estimated globally at USD 1182.50 million in 2021 and is projected to reach USD 1849.70 million by 2028, exhibiting a CAGR of 6.60% during the forecast period (Market Research Future, 2021), with Europe being the fastest growing market.

Based on the Dietary Supplement Label Database (DSLD) analysis, prescription and nonprescription prenatal supplements in the US vary greatly in composition. Most of them contain folic acid, vitamin D (96% P, 92% NP), and iron (95% P, 88% NP), while iodine, calcium, DHA, and other nutrients are available in a smaller number of the products (Saldanha et al., 2017), however many exceeded nutrient recommendations for pregnant women (Saldanha et al., 2017). In 2019 Wierzejska (2021) analysed 33 products from the Polish market (Wierzejska, 2021). All the products contained folic acid, 97% vitamin D, and iodine, 73% DHA, and 82% iron, but the doses varied significantly, and many prenatal supplements did not reach the recommendations set by the Polish Society of Gynecologists and Obstetricians (Zimmer et al., 2020; Skrypnik et al., 2021).

Current recommendations say that pregnant women should take 600 µg of folic acid and 16 mg of iron a day (The DRV Finder, 2019). UTL for folic acid is set at 1 g/day, but new forms of folic acid used in supplements are readily absorbed and will not accumulate in the blood (Ferrazzi et al., 2020). For iron, no UTL is specified, but an intake of 50-60 mg in a single dose, especially if not taken during a meal, can cause gastrointestinal discomfort (EFSA, 2017). Gernand (2019) conducted an analysis of nutrient intake from foods (including fortified foods), water, and supplements during pregnancy and found that, according to the US and Canadian upper tolerable levels (UTL), the only concern exists for niacin and iron (Gernand, 2019), yet even health professionals often forget that in order to achieve their maximum potential, supplements should be taken pre-pregnancy (Milman et al., 2016). Therefore, the focus should be on family planning, but in today's society, many pregnancies are unplanned, especially in high-income countries (Bearak et al., 2022).

In the US, 64% of pregnant and 54% of lactating women take prenatal supplements (Jun et al., 2021). According to a face-to-face interview study on 572 pregnant women from China, even 94.8% used at least one supplement, and 29.8% used more than four supplements in the previous month (Xiang et al., 2022). Interestingly, besides regular channels of purchase (e.g. pharmacies), many (31.8%) turned to online sources (Xiang et al., 2022).Based on one longitudinal study on pregnant women from Eastern Croatia (*N* = 222), 81.1% used multicomponent prenatal supplements. The majority of them (59.9%) started with a folic acid supplement in the first trimester and continued using multicomponent one until the full term, while 21.2% only used prenatal supplements in the first trimester, predominantly folic acid (Banjari, 2012). However, based on a questionnaire study (*N* = 794), 15.9% of the general population of reproductive-age women from Croatia use supplements in comparison to all women undergoing medically assisted pregnancy (Marija et al., 2021).

In Poland, questionnaire studies found that around 70% of pregnant women used supplements (Dereń et al., 2017; Grzelak et al., 2016), however the rate of women using supplements during pregnancy was higher than during pregnancy planning (Dereń et al., 2017; Hamułka et al., 2010), whilst 63% used supplements containing omega-3 fatty acids (Dereń et al., 2017), or folic acid (Grzelak et al., 2016). Both countries demonstrate a growing interest in prenatal supplementation, making them interesting cases for comparison. Analysing the differences and similarities in the approaches to supplementation provides valuable insights into consumer needs in Central and Eastern Europe. Poland represents one of the larger markets within the European Union, while Croatia, a more recent EU member (since 2013), offers a contrasting perspective. Comparing these two countries enables a better understanding of how varying stages of EU integration impact the prenatal supplements market.

2. Methodology

The range of products offered on the Polish and Croatian markets was surveyed in July 2022, and a database was created based on which DS was sold online (e.g.www.apteka-melissa.pl/, www.doz.pl, www.gemini.pl, www.ljekarna.hr, www.mojaljekarna.hr, www.tvojaljekarna.com/webshop). The levels of ingredients declared by the manufacturers on the labels were examined to evaluate and discuss the composition of dietary supplements (DS) intended for women planning pregnancy or those already pregnant were selected for the study, excluding products containing only folic acid as an active ingredient (no other product exclusions were applied). Supplements that were readily available in online pharmacies to ensure accessibility and relevance to consumers were chosen. At the time of research, 58 supplements were sold in Poland and 34 in Croatia, with only four products available in both countries. The range of prices was very wide and varied, between 3.82 to 59.00 euros (median 8.36 euros) for Poland, and from 6.20 to 64.88 euros (median 18.58 euros) for Croatia.

3. Results and Discussion

The female population in Poland is almost 10 times larger than in Croatia (Table 1), however the number of children born per woman was higher in Croatia than in Poland 1.47 vs 1.44 (Table 1), and the number of households with 3 or more children being higher in Croatia than in Poland, the highest among the EU countries. This indicates that despite the difference in general population, the number of potential consumers in Croatia exceeds that in Poland, this should be reflected in the market.

Table 1. The overview of Polish and Croatian populations in 2021

	Poland	Croatia
Total population	38 162 224	3 888 529
Women	19 715 26 (51.66%*)	2 013 963 (51.79%*)
Number of births	331 000	3 6508

*percentage of total population

Source: (GUS, 2022).

As expected, the number of supplements available in Croatia was smaller (Table 2), but only 1.7 times fewer supplements than in Poland, moreover the prices of these products were higher in Croatia – the median being 18.58 vs. 8.36 euros. The Croatian market was dominated by imported products (6 domestic/28 imported), while in Poland, half of all supplements were made by domestic manufacturers (50%), which may explain their lower prices. The observed price differences between the two countries may indeed reflect disparities in purchasing power, influencing consumer behaviour and accessibility. Next, dietary habits, such as higher fish consumption in Croatia, may partly explain the differences in iodine supplementation between the countries. In general, differences in how healthcare professionals guide supplementation decisions could further shape market characteristics.

Table 2. The overview of Polish and Croatian dietary supplements − intended use

	Poland	Croatia	Total
Pregnancy planning (PP)	16 (including 2 products only for pregnancy planning)	14 (including 2 products only for pregnancy planning)	30
Pregnancy (P)	51 (including 9 products only for pregnancy)	29 (including 9 products only for pregnancy)	80
Lactation (L)	42 (including 4 products only for lactation)	20 (including 2 products only for lactation)	62
Total*	58	36	

*the total number in not a sum of PP, P and L because some products are labelled as suitable for more than one category (group of consumers)

Source: own study.

More products available on the Croatian market (11 vs. 7) were labelled as suitable for pregnancy planning, pregnancy and lactation, whilst six products from Croatia and 30 from Poland were intended for pregnancy, and lactation. Two products from Croatia and three from Poland were meant for pregnancy planning, whereas three products from Croatia and four from Poland were to be used only during lactation (Table 2). Given the importance of folic acid, iron and calcium during pregnancy, the nutritional composition of available products in relation to the recommended intake for the European population was analysed (EFSA, 2017).

One of the most commonly used supplements prior to and during pregnancy is folic acid (FA), a practice based on the unquestionably proven role of FA on the foetus (Argyridis, 2019; Garrett & Bailey 2018). However, the study found seven products that do not contain FA (Tables 3 and 4). Considering that female consumers show a different level of knowledge and awareness about the need to supplement their diet with FA and do not always read the supplement's label carefully, the question is whether this information should be clearly communicated on the package.

Table 3. Comparison of dietary supplements composition with EFSA PRI recommendations (Poland)

Nb	Folic acid [µg]	Folic and methylofolate	Folic acid EFSA %	Vit D [µg]	Vit D EFSA	Iron [mg]	Fe EFSA (%)	Calcium [mg]	Ca EFSA %
1	400	400	66.67	10	66.67	28	175	200	21.05
2	400	400	66.67	10	66.67	28	175	200	21.05
3	60	60	10.00		0.00		0		0.00
4	400	400	66.67	2.5	16.67	14	87.5		0.00
5	400	800	133.33	50	333.33	27	168.75		0.00
6	400	800	133.33		0.00		0		0.00
7	600	600	100.00	5	33.33	15	93.75	200	21.05
8	400	400	66.67	50	333.33	26	162.5		0.00
9	400	800	133.33	50	333.33	30	187.5		0.00
10	0	0	0.00	0	0.00	0	0.00	0	0.00
11	400	400	66.67	5	33.33	20	125	240	25.26
12	400	800	133.33	20	133.33		0		0.00
13	400	800	133.33	20	133.33	10	62.5		0.00
14	400	400	66.67	20	133.33	14	87.5		0.00
15	400	400	66.67	10	66.67	27	168.75		0.00
16	100	100	16.67		0.00	30	187.5		0.00
17	800	800	133.33	50	333.33	18	112.5		0.00
18	600	600	100.00		0.00	16	100		0.00
19	200	400	66.67	25	166.67		0		0.00
20	200	400	66.67	50	333.33		0		0.00
21	400	400	66.67	7.5	50.00	9	56.25		0.00
22	294	294	49.00	25	166.67	9	56.25		0.00
23	294	294	49.00	25	166.67	9	56.25		0.00
24	540	540	90.00	5.6	37.33	16	100	584	61.47
25	400	400	66.67	5	33.33		0		0.00
26			0.00		0.00		0		0.00
27	200	200	33.33		0.00		0		0.00
28	400	400	66.67	20	133.33	28	175	120	12.63
29	400	400	66.67	5	33.33	14	87.5	100	10.53
30	400	800	133.33	50	333.33	30	187.5		0.00
31	400	800	133.33	50	333.33	30	187.5		0.00
32	400	800	133.33	50	333.33		0		0.00
33	500	500	83.33	5	33.33	5	31.25	400	42.11
34	400	800	133.33	50	333.33		0		0.00
35	400	600	100.00	50	333.33	27	168.75		0.00
36	400	600	100.00	50	333.33		0		0.00
37	400	400	66.67	5	33.33		0		0.00
38	200	616	102.67	10	66.67	19	118.75		0.00
39	0	0	0.00	0	0.00	0	0.00	0	0.00
40	0	0	0.00	0	0.00	0	0.00	0	0.00
41	400	400	66.67	50	333.33	30	187.5		0.00
42	400	800	133.33	50	333.33	60	375		0.00
43	400	800	133.33	50	333.33	30	187.5		0.00
44	400	400	66.67	10	66.67	15	93.75		0.00
45	300	612	102.00	50	333.33		0		0.00
46	400	800	133.33	50	333.33		0		0.00
47	400	400	66.67	5	33.33	14	87.5	652	68.63
48	400	400	66.67	50	333.33	27	168.75		0.00
49	400	400	66.67	11.5	76.67	20	125		0.00
50	400	400	66.67	10	66.67	20	125		0.00
51	200	200	33.33		0.00	14	87.5		0.00

Source: own study.

Table 4. Comparison of dietary supplements composition with EFSA PRI recommendations (Croatia)

Nb	Folic acid [µg]	Folic and methylofolate	Folic acid EFSA %	Vit D [µg]	Vit D EFSA	Iron [mg]	Fe EFSA (%)	Calcium [mg]	Ca EFSA %
1	200	800	133.33	15	100.00	14	87.5		0.00
2	400	800	133.33	5	33.33		0	125	13.16
3	200	400	66.67	5	33.33	14	87.5		0.00
4	0	400	66.67	5	33.33	25	156.25	30	3.16
5	400	400	66.67	5	33.33	14	87.5	652	68.63
6	400	400	66.67	5	33.33	10	62.5	200	21.05
7	400	400	66.67	7.5	50.00	12.5	78.125		0.00
8	400	400	66.67	5	33.33	14	87.5	150	15.79
9	500	500	83.33	5	33.33	12.5	78.125	500	52.63
10	400	400	66.67	10	66.67	17	106.25		0.00
11	400	400	66.67	10	66.67	17	106.25	500	52.63
12	400	400	66.67	10	66.67	17	106.25		0.00
13		400	66.67	5	33.33	14	87.5		0.00
14	400	400	66.67	10	66.67	15	93.75	200	21.05
15	400	400	66.67	7.5	50.00	17	106.25		0.00
16	800	800	133.33	10	66.67	28	175	200	21.05
17	800	800	133.33	20	133.33	40	250	125	13.16
18	400	400	66.67	10	66.67	4	25	325	34.21
19	1000	1000	166.67	15	100.00	27	168.75	200	21.05
20	1000	1000	166.67	15	100.00	27	168.75	200	21.05
21	400	400	66.67	5	33.33	28	175		0.00
22	500	500	83.33	15	100.00	5	31.25	400	42.11
23	400	400	66.67	5	33.33	7	43.75		0.00
24	100	100	16.67		0.00	14	87.5		0.00
25	800	800	133.33	12.5	83.33	1.6	10		0.00
26	400	400	66.67	10	66.67	21	131.25		0.00
27		0	0.00		0.00		0		0.00
28		0	0.00		0.00	15	93.75		0.00
29		0	0.00	5	33.33		0		0.00
30	400	400	66.67		0.00	28	175		0.00

Source: own study.

The content of FA in all the analysed products showed a wide range of concentrations. Two products had 1 g of FA (both from Croatia), six had 800 µg (four from Croatia), two had 600 µg (both from Poland), one 540 µg (Poland), four had 500 µg (three from Croatia), 49 had 400 µg of FA, and 12 products less than 400 µg. The basic form of FA was found in 62 products (31 from Poland and 31 from Croatia), but additional metapholates were found in 19 products from Poland and four from Croatia (Tables 3 and 4). Methylfolate (L-methylfolate) is the biologically active form of folate, which unlike folic acid, does not require enzymatic reduction by methylenetetrahydrofolate reductase (MTHFR) (Argyridis, 2019). The history of the methylfolates use in supplement production is relatively recent. Due to its improved bioavailability, it can be expected that more producers will incorporate this form of FA in their supplements.

The importance of the appropriate folic acid intake before and during pregnancy is indisputable. Czarnowska-Kujawska et al. (2022) raised the question of the quality and authenticity of such products sold in Poland. Their analysis revealed that almost all the tested supplements (29 out of 30 samples) contained less FA than declared. The difference reached 99.1% and related to products for pregnant women. Their results raised great concern about the quality of products available on the Polish market (Czarnowska-Kujawska et al., 2022).

Iron is another essential mineral for pregnancy, yet women often enter pregnancy as iron deficient. Therefore, its close monitoring prior to and during pregnancy is of utmost importance. Iron requirements increase during the second and third trimester of pregnancy, primarily as a result of physiological changes and the increased needs of a growing foetus, and as a result, iron is often integrated into various supplements for pregnant women. However, excessive iron can induce oxidative stress and lead to serious consequences (e.g. iron overload in the liver), so its dosage needs close monitoring (Lönnerdal, 2017). A total of 18 products (one from Croatia, and 17 from Poland) had no iron in the composition. The contents of iron of up to 100% of PRI were found in 33 products (19 from Croatia and 14 from Poland). Doses higher than 100% of PRI were found in 34 supplements (13 in Croatia and 21 in Poland) (Tables 3 and 4). Out of all the analysed products, only one product (indicated use for pregnancy planning) contains more iron than the recommended value, or 375% of the EFSA population reference intake (PRI), which indicates the potential risk of iron overdose. Products intended solely for lactation contained iron in the form of Iron(III) pyrophosphate in the range of 0-100% of EFSA PRI. The highest iron content variability (0-375% of EFSA PRI) was found in supplements intended for pregnancy. Forms of iron found in supplements include iron gluconate, iron fumarate, iron sulphate, iron pyrophosphate, and iron diglycinate. The research results clearly showed that iron content in some of the products may pose a risk of excessive iron intake, especially when combined with a diet abundant with fresh fruits (i.e. diet with a high vitamin C content, which is the best promotor of iron absorption).

Calcium is another mineral of special interest among pregnant women, whose absorption is promoted by vitamin D. The primary source of this mineral is a diet rich in dairy products. Insufficient intake of calcium may negatively impact the development of the foetus, which may result in restricted intrauterine growth, low birth weight, poor bone mineralisation, and preterm birth. At the same time, health risks for the mother increase as well, primarily manifested as hypertension and preeclampsia (Hofmeyr et al., 2018; Willemse et al., 2020). The calcium content in the supplements analysed was declared in 52.9 % of Polish and 58.6 % of Croatian products intended for pregnant women, with a median equal to 200 mg/daily dose.

Vitamin D was declared in the composition of most products available on the Croatian and Polish markets (86.2% and 90.2% of products intended for pregnancy, respectively), ranging from 5 to 50 ug per daily dose. The form of vitamin D found in the majority of products was cholecalciferol incorporated in oil capsules and tablets. A systematic review of the bioavailability of vitamin D supplements found that oil-soluble substances increased serum 25(OH)D more than powdered supplements. Positive correlations between the status of vitamin D and negative pregnancy outcomes such as small-for-gestation age, gestation diabetes, and preterm birth were demonstrated in the meta-analysis of observational studies (Wei, 2014).

The main reason for iodine supplementation during pregnancy is to prevent maternal and foetal hypothyroidism and to support the foetus's neurological development (Zimmermann, 2016). The presence of this mineral was declared in 90.2% of Polish and 72.4 % of Croatian products intended for pregnancy, with a median equal to 200 ug/daily dose for Polish and 150 ug/daily dose for Croatian products. Since the recommended intake of iodine during pregnancy is 200 ug/day (AI EFSA), the daily dose of supplements provides up to 110% of this nutrient (for Polish products). While table salt in both countries is fortified with iodine, the difference in iodine content in supplements can be observed through other dietary characteristics, possibly fish consumption. The average consumption of fish and seafood, which is the primary source of iodine in a diet, is higher among Croatians than Polish (20.82 kg/person/year in Croatia and 13.11 kg/person/year in Poland in 2019) (EUMOFA, 2021).

One of the ways that may be used to encourage consumers to make a purchase is to indicate the rich composition of the preparation. The word ‘rich’ is used here to mean the content of many vitamins and minerals in the product. The situation is not different in the case of dietary supplements intended for pregnant women. Moreover, the analysed products contained additional nutrients, including B complex vitamins, vitamins E, C, and D, and the minerals selenium, manganese, magnesium, copper,

chromium, and zinc. Nutritional needs change during pregnancy, however the need for supplementation with a complete set of vitamins and minerals is highly debatable. Pregnant women can experience debilitating nausea and vomiting; according to the research, 50% and 80%, respectively, report experiencing such problems (Body & Christie, 2016). They could experience frequent bouts of sickness and struggle to consume meals and liquids, and this may result in an insufficient supply of some nutrients, and comprehensive supplementation may be one of the solutions.

When comparing the declared content of vitamins in supplements with the recommendations of the EFSA, one can notice that 90% of Polish and Croatian supplements are complex. Secondly, according to the manufacturers' declarations, individual ingredients were added in amounts exceeding 100% PRI EFSA (supplementary file). The chemical form in which a given ingredient is added to a dietary supplement is not without significance, e.g. magnesium, which can be found as magnesium oxide, magnesium lactate or magnesium citrate (supplementary file). Magnesium oxide is commonly used as a source of magnesium in many products. However, it is considered to be one of the least absorbable forms of this element (Uysal et al., 2019). It has been proven that the body absorbs a mineral in chelate formation at a higher rate. Organic salts such as magnesium lactate or magnesium citrate appear to be easier for the body to absorb and are not dependent on the amount but rather on the chemical form (Blancquaert et al., 2019). When minerals enter the body, they chemically combine with organic molecules or ligands to convert them into chelates, an organic form that the body can absorb and use. There are several things that can inhibit or interfere with absorption, e.g. dietary fibre intake. Additionally, another problem occurs for very complex dietary supplements, where the selected ionised minerals compete for the same carrier (to form a chelate formation) and thus block each other's absorption (zinc prevents copper absorption, and calcium can interfere with zinc). Thus the final absorption can be lower than expected, yet these differences and interactions are not to be known by the average consumer, who should put their trust in manufacturers and professionals working with supplements.

Probiotic products for pregnant women may become a new significant market branch. In general, products containing a minimum daily dose of microorganisms may bring specific health benefits i.e. boosting the immune system, increasing the bioavailability of nutrients, reducing the symptoms of lactose intolerance, suppressing the growth of pathogenic bacteria, decreasing the number of toxins produced by said bacteria and reduce the risk of certain types of cancer by, for example, indicating the carcinogenic properties in chemoprevention of the large intestine (Parvez et al., 2006). Moreover, it seems that probiotics during pregnancy can act protectively against preeclampsia, gestational diabetes mellitus, and allergic diseases in children (Baldassarre et al., 2018; Parvez et al., 2006). However, a systematic review and meta-analysis from 2018, which included 49 publications covering 27 studies, found no evidence to support the beneficial effect of probiotics on preterm delivery, birth weight, or gestational diabetes (Jarde et al., 2018). The presence of probiotic strains was indicated in the composition of only a few supplements (supplementary materials). It is worth mentioning that in most cases, the producers specified the bacterial strain and not merely the genus and species. It is believed that the properties of probiotics are strain-dependent, therefore to use probiotics rationally, it is necessary to know the properties of a specific probiotic strain (Hwang et al., 2015; Szajewska, 2010). The consumption of strains used in the analysed supplements may prevent intestinal infections (*Lactococcus lactis* W58, *Bifidobacterium bifidum* W23) (Campana et al., 2017). It had been proven that orally administered LAB could influence vaginal microbiota. The study conducted by Ho et al. (2016) showed that the intake of LAB GR-1 and RC-14 strains reduces vaginal and rectal colonization by group B streptococci (GBS).

The presence of plant extracts or parts of plants, e.g. fruit, was indicated in the composition of some supplements (Table 5). The plant ingredient most often used in the production of the analysed group of supplements is cranberry or its extracts. Pregnant women may reduce their risk of urinary tract infections (UTIs) caused by asymptomatic bacteriuria (ASB) by means of incorporating cranberry juice into their diets. The question remains whether the amount of extract or juice in the supplement dose is sufficient to obtain a protective effect.

Another ingredient that has gained in popularity is ginger (ginger extract), which has been used successfully to treat nausea, without adverse effects, hence pregnant women can treat their nausea symptoms by eating its natural form, i.e. ginger root (to chew or prepare a drink or a tea). Consequently, cranberry juice can be consumed to prevent urinary tract problems instead of taking it in a supplement. Botanical substances used in the production of dietary supplements are the main source of phyto-chemicals (which have anti-inflammatory, antiproliferative, antioxidant, cytoprotective, hypoglycaemic or lipid-lowering and other properties), vitamins (e.g. E, A, K, C), or minerals (Si, Mn) (Table 5). Thus, some botanical ingredients should be used with care due to their potential adverse effects.

Table 5. Examples of plant raw materials declared in the composition of the analysed supplements

No.	Plant raw material	Selected properties
1.	rosehip extract	source of vitamin C
2.	nettle leaf (*Urtica dioica*)	traditionally used in the control of cardiovascular disorders especially hypertension; reported to improve glucose homeostasis in vivo (Dhouibi et al., 2020)
3.	spinach leaves (*Spinacia oleracea*)	source of phytochemicals, such as carotenoids and phenolic compounds, vitamins (Roberts & Moreau, 2016)
4.	fennel fruit (*Foeniculum vulgare*)	source of phytochemicals and essential oils, increase milk secretion, facilitate birth (Rather et al., 2016)
5.	milk thistle extract	side effects
6.	dry extract of ginger rhizome (*Zingiber officinale Rosc*.)	in cases of pregnancy-induced nausea and vomiting (Giacosa et al., 2015)
7.	elderberry (*Sambucus nigra*) fruit extract DER 25:1	contains polyphenols
8.	acerola fruit extract (*Malpighia punicifolia L*.)	contains vitamin C
9.	raspberry (*Rubus idaeus*) fruit extract DER 4:1	contains vitamin C and polyphenols (Radočaj et al., 2014)
10.	rose wild fruit extract	contains vitamin C
11.	sea buckthorn dry extract	source of bioactive phenolic constituents having antioxidant, cytoprotective and antibacterial properties (Seglina et al., 2021)
12.	carrot concentrate (*Ducus sativus*)	contains vitamin A
13.	orange concentrate (*Citrus sinensis*)	contains vitamin C
14.	broccoli concentrate (*Brassica Oleracea Ver. Italica*)	contains folic acid (Mahn & Reyes, 2012)
15.	chamomile flower (*Matricaria chamomilla L*.)	enhance breastfeeding; contains active constituents including volatile oils and antioxidants (Singh et al., 2011)
16.	head cabbage concentrate (*Barassica Oleracea L*.)	contains vitamin K
17.	leaf and dandelion root (*Taraxacum officinale*)	source of vitamins (A, C, E, K, and B) and minerals (iron and silicium), Dandelion leaves are also a rich source of potassium and selected phytochemicals of dandelion are presented (Kania-Dobrowolska & Baraniak, 2022)
18.	cranberry (*Oxycoccus macrocarpus*)	prevent urinary tract infections
19.	brown rice concentrate (*oryza sativa*)	contains vitamin E

Source: own study.

According to the law, gynaecologists in Poland cannot recommend a specific dietary supplement – they can only inform the patient about the need for dietary supplementation. Women, therefore, are responsible for choosing the right product, or they must rely on the advice of a pharmacist. To make a reliable assessment of which product will provide the right amount of ingredients, she must have knowledge in this field. It is undoubtedly necessary to educate society about the effects of deficiency and the oversupply of individual nutrients or minerals.

Several of the analysed products were labelled "for vegans". The number of vegetarians and vegans in many European countries is growing (Buchholz, 2022). A group of products that may be particularly

desirable by vegans are those with unsaturated fatty acids. In the analysed group, such products contained Schizochytrium microalgae oil containing DHA (docosahexaenoic acid). The capsules were made of hydroxypropyl methylcellulose (HPMC) – four products from Poland.

Problems concerning the quality of supplements and their advertising are known to the Polish legislative bodies. Several years after the publication of reports indicating irregularities in the dietary supplements market, in January 2023 many changes were proposed to the Food and Nutrition Act. The proposals for these changes, which have now been discussed and consulted with the industry, would include, among others: the mandatory placement of a message during the presentation and/or advertising of a dietary supplement, i.e. “a dietary supplement is a food whose purpose is to supplement a normal diet. The dietary supplement has no medicinal properties.”; prohibition of using in advertisements the image of authorities and experts in the field of medical sciences and health sciences, including in particular persons practising medical professions; prohibition of using objects in advertisements that may be associated with the performance of occupations applicable in health care; a ban on presenting activities that may be related to the performance of these professions; introduction of restrictions on advertising in terms of the target group, as well as possible associations with devices or medicinal products; separation of medicinal products and dietary supplements offered in pharmacies, pharmacy outlets or out-of-pharmacy outlets.

In general, the labelling of dietary supplements in Poland and Croatia is governed by EU regulations, as both countries are EU member states and the EU regulations for dietary supplement labelling ensure clear, accurate, and legible information, mandating the listing of ingredients, allergens, and nutritional values as per Regulation (EU) No 1169/2011. Directive 2002/46/EC sets rules for permitted vitamins, minerals, and substances, requiring detailed labelling with nutrient quantities and RDAs. Health Claims Regulation (EC) No 1924/2006 strictly prohibits unauthorised health claims, allowing only those approved by the EFSA.

4. Conclusions

During pregnancy planning, pregnancy, and breastfeeding, proper nutrition is one of the most critical factors affecting both the mother's and her infant's health. Women have a broad spectrum of supplements available on the market, but while some supplements may be beneficial, others may be unnecessary or potentially harmful, depending on individual needs and their composition. Supplements should complement the dietary intake of nutrients, certainly not exceeding the recommended doses and increasing the risk of adverse effects. However, sometimes less is more, as one can see from the analysis, and complex supplements are rarely necessary. The analysis also revealed notable discrepancies between the Polish and Croatian prenatal supplement markets. Firstly, the pricing of supplements was significantly higher in Croatia, with a median price of 18.58 euros compared to 8.36 euros in Poland. This disparity likely reflects the differences in the origin of products, as the Croatian market is dominated by imported supplements (82.3%), whereas in Poland, domestic manufacturers account for 50% of the market. The reliance on imported products in Croatia could impact both accessibility and affordability for consumers, especially those in lower-income groups.

Secondly, variations in nutrient composition were observed. For instance, despite the proven importance of folic acid (FA) during pregnancy, seven products across both markets lacked this essential nutrient. Additionally, discrepancies in the inclusion of other critical ingredients such as iron, calcium, and vitamin D suggest a lack of standardisation in meeting the EFSA recommendations. These inconsistencies highlight the need for clearer regulatory guidelines to ensure that supplements labelled "for pregnancy" adequately support prenatal health.

Thirdly, labelling practices differ in their clarity and comprehensiveness. While some products provide detailed nutrient profiles, others lack transparency or fail to highlight the absence of key nutrients such as folic acid. This raises concerns about misleading labelling and its potential to impact consumer

decision-making negatively, for example, the label "for pregnancy" might mislead consumers into believing the product contains all essential nutrients when it does not.

Selecting the right product can be challenging when supplementation is needed. This challenge can be managed by better informing the general public, but manufacturers and professionals should also share the burden and return/strengthen the trust consumers place in them when choosing what is best for them. Manufacturers could include clear, evidence-based advisory messages on their packaging, such as *read the current prenatal recommendations before use and consult your healthcare provider to determine whether this product is appropriate for you.*

These messages would encourage informed decision-making and emphasise the importance of professional guidance, whilst public campaigns could focus on educating prospective parents about prenatal nutrition and the role of supplements, helping them distinguish between necessary supplementation and marketing-driven choices. Finally, training programmes for doctors, midwives, and pharmacists could ensure consistent, accurate advice is given to consumers, reinforcing the guidance provided on the product labels.

The label "for pregnancy" can suggest that a given product contains a set of essential ingredients that women need – ss was shown, that labelling can be misleading. Considering the importance of folic acid, a few questions remain of whether the product that does not contain folic acid should be labelled "for pregnancy". Secondly, should it be labelled "does not contain folic acid", and thirdly, "ask a dietician or a doctor before consumption," as this guidance can help prevent interactions between herbal ingredients, avoid overdoses of certain elements, and/or simply provide valuable information.

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Suplementy diety dla kobiet w ciąży: rynek polski i chorwacki

Streszczenie

Cel: Celem badania było porównanie rodzajów i składu suplementów diety (SD) dostępnych na rynku polskim (PL) i chorwackim (CR) dla kobiet w ciąży, z uwzględnieniem zawartości wybranych składników w odniesieniu do zalecanych norm żywieniowych dla populacji europejskiej, oraz analiza potencjalnych skutków ubocznych.

Metodologia: Oferta rynków polskiego i chorwackiego została zbadana w lipcu 2022 roku. Utworzono bazę danych na podstawie suplementów diety sprzedawanych online. Przy ocenie i omówieniu składu suplementów brano pod uwagę poziomy składników deklarowane przez producentów na etykietach. Do ewaluacji wybrano suplementy diety przeznaczone dla kobiet planujących ciążę lub będących już w ciąży.

Wyniki: Zgodnie z badaniem w Polsce sprzedawano 58 suplementów, a w Chorwacji 35. Zatem kobiety mają szeroki wybór suplementów na rynku, jednak zasadność ich stosowania jest wątpliwa. Suplementy powinny uzupełniać dietę w składniki odżywcze, nie przekraczając zalecanych dawek i nie zwiększając ryzyka skutków ubocznych.

Implikacje i rekomendacje: Badanie wskazuje na podobieństwa i różnice w ofercie suplementów diety na chorwackim i polskim rynku. Konsumenci obu krajów borykają się z podobnymi problemami. Produkty oznaczone „dla kobiet w ciąży" nie gwarantują, że spełniają wymagania tej grupy konsumentów.

Oryginalność/wartość: Suplementy powinny uzupełniać dietę w składniki odżywcze, nie przekraczając zalecanych dawek i nie zwiększając ryzyka skutków ubocznych. Przyjmowanie złożonych suplementów rzadko jest konieczne, a wybór odpowiedniego produktu może być wyzwaniem, gdy suplementacja jest potrzebna.

Słowa kluczowe: suplementy diety, etykietowanie suplementów, suplementy prenatalne