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Effect of n-3 long-chain polyunsaturated fatty acid intake during pregnancy and lactation on infant health outcomes

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Background: The incidence of inflammatory and allergic diseases in the developed countries has increased significantly over the past two decades. One of the possible explanations of the observed increase involves the concurrent change in Western diet from a relative balance between anti-inflammatory omega-3 long chain poliunsaturated fatty acids (n-3 LC PUFA) and pro-inflammatory omega-6 LC PUFA, to a diet in which n-6 PUFA are in vast majority predominant. Maternal supplementation with omega-3 LC PUFA may modulate immune responses and incidence of morbidity in neonates and children.

Objective: to assess whether supplementation of omega-3 fatty acids during pregnancy and lactation reduces the incidence of respiratory illnesses, functional intestinal disorders and allergic reactions in infants.

Methods: In this paper was conducted a retrospective servey of women whose children were at the age of one year at the time. Elaborated questionnaires were filled in by pediatricians throughout their daily working hours while attending the patients. The assessment of morbidity (acute respiratory diseases, functional intestinal disorders and atopic reactins) was carried out. Laboratory tests of infant immunity (content of IgA, IgG and IgM by immunological methods) and fatty acid methabolism detection of omega-3 poliunsaturated fatty acids — docosahexaenic acid (DHA), eicosapentaenic acids (EPA) and omega-6 poliunsaturated fatty acid — arachidonic acid (AA) by gas chromatographic analysis in blood serum of children were done. The outcomes of the study were analysed and processed using statistical methods.

Results: Results of findings indicate on higher incidence of acute respiratory tract and atopic diseases as well as functional disorders of the gastrointestinal tract in infants whose mothers did not use seafood (omega-3 poliunsaturated fatty acids) in their diets during the pregnancy and breastfeeding. The research of immunity of infants showed no difference in concentration of IgG and IgM ($p>0,05$), but significant difference for IgA concentrations in blood serum. In infants whose mothers consumed omega-3 poliunsaturated fatty acids during pregnancy and postnatally the concentration of IgA was higher compared to opposite group. The fatty acid composition of the blood serum showed changes in the content of the main representatives of omega-3 poliunsaturated fatty acids and omega-6 poliunsaturated fatty acids. The concentrations of both DHA and EPA were higer while the content of AA was lower in the group of infants whose mothers intake seafood during pregnancy and postnatally. Significant differences were observed for DHA and AA ($p<0,05$).

Conclusions: This study demonstrated advantages of consumption of omega-3 poliunsaturated fatty acids by women during pregnancy and breastfeeding in preventing the morbidity as well as the influence health status and development of their children in early life.

Key words: infants, polyunsaturated fatty acids, seafood, immunity, morbidity.

Introduction

Epidemiological human and animal studies show that apart from genetic factors, environmental exposures early in life are important determinants of health and disease in later life. Since the effects of the early exposures to risk factors can be long-lasting, this phenomenon has been termed as «early life programming». Nutrition among others was identified as one source of early exposures that might influence early development and later health status. It is recognized that substantial immune development in human subjects takes place prenatally and in the period after birth, and it is possible that such development can be influenced by nutritional factors having potential role in triggering pathologic status and diseases. In this direction the main goal of studies should be directed to identify the role of nutritional factors in development of pathologic disorders in order to elaborate some effective strategy of their prevention, and more important to perform these studies in early childhood.

It is currently well known that the regulation of tolerance and immune system activation is crucial to health, and failure in the regulation of these responses can lead to recurrent infections, inflammatory diseases, and allergic reactions. Many allergic and inflammatory processes in adulthood are originated from fetal and neonatal periods; therefore these periods are crucial to immune system development. Different studies also showed that immune abnormalities precede the development of inflammatory and allergic diseases.

The infants in neonatal period have several immunological immaturities: priming interactions of antigen-presenting cells, cytotoxic T-cell responses to infection, complement activity, and antibody responses to antigen exposure, in addition to Th2-phenotype polarization [15]. Th1 cytokines are involved in inflammatory reactions and their actions are directed against infections, whereas Th2 cytokines are involved in antibody production, particularly IgE, and are commonly associated with allergic reactions. Th1 and Th2 cytokines have mutually inhibitory functions [13]. Immunological status of placenta characterised by Th2 phenotype which is necessary to reduce harmful effects of Th1 response against the fetus. At the same time, this placental immunological milieu needs to be redirected towards appropriate Th1 response that allows protection against infection.

The immature immune system is highly susceptible to immunomodulatory environmental risk factors with immunomodulatory effects, particularly in the prenatal and postnatal periods. In this connection was elaborated hypothesis that maternal diet may influence the maturation of the immune system, response to infections, and development of atopic diseases in neonates and infants. Specifically, maternal intake of омега-3 PUFA during pregnancy and lactation can modulate immune responses, and consequently reduce morbidity rate in neonates and children. Certain animal and human studies support this hypothesis indicating that omega-3 LC PUFA suppress cell-mediated immune responses [22].

The increased interest in omega-3 long chain polyunsaturated fatty acids (LC PUFA) originated on the basis of data showing a link between current (Western) diet and an increased incidence of allergic and inflammatory diseases. Nowadays, consumption of omega-3 LC PUFA is typically low compared to increased consumption of omega-6 LC PUFA resulting in an imbalance omega-6/omega-3 ratio which now estimated at 15–50/1 in modern dietary habits of population. It should be noted that linolenic acid (LA) is the main representative and precursor of omega-6 LC PUFA in current diets and its consumption has dramatically increased throughout last two centuries [14, 17].

Allergic diseases are typically diagnosed in early infancy and causative events take place in prenatally or during the neonatal period. Speculations take place in regard of the predisposition to allergic disease which may result from insufficiently balanced T helper cell type 1 and 2 (Th1 and Th2) pathways during fetal life. It has been proposed that high concentrations of dietary n-6 PUFA favour a Th2 differentiation of the immune system. One mechanism whereby omega-3 LC PUFA may alter the T helper cell balance is through suppression of interleukins expression, those interleukins related to allergic diseases through their role in inducing immunoglobulin E (IgE) synthesis in cells and Th2 type differentiation in T cells [11].

The LC PUFA of interest include the omega-3 LC PUFA docosahexaenoic acid (DHA, 22:6n-3) and eicosapentaenoic acid (EPA, 20:5n-3) and the omega-6 LCPUFA arachidonic acid (ARA, 20:4n-6). These fatty acids are synthesized from their precursor α-LA (18:3n-3) and linoleic acid (LA, 18:2n-6) through a series of elongation and desaturation steps common to the omega-3 and omega-6 pathways [5]. It should be noted than the conversion, particularly from α-LA to EPA and DHA, is inefficient in early life, hence endogenous production of these fatty acids does not meet the requirements of neonate and infants which is necessary during rapid tissue growth and development [2]. Besides, DHA and EPA serve as important cell membrane components as well as precursors for an extensive network of biologic mediators with many effects in the body, including numerous roles in immune function and inflammation [20].

It is extremely important that high quality nutrition, including LC PUFA, be supplied to the fetus, infant and young child to ensure that all essential nutrient needs are met. Omega-3 LC PUFA are essential components in uniquely high concentrations in brain gray matter and retina, and their accumulation take place during the second half of pregnancy and remains high during the first year of life with continued growth for the next several years. During this time many developmental milestones are reached in terms of cognitive, visual, and motor development [16]. In this regard, physiological importance of omega-3 LC PUFA, particularly DHA, is supported by its active and preferential maternal-fetal placental transfer, which is mediated by specific fatty acid transfer proteins and membrane binding proteins that favor placental transport of DHA over other fatty acids.

The association between sufficient intake of omega-3 LC PUFA from fish or fish oil supplements and risk of diseases was studied and evaluated in a systematic reviews [3,8]. But the benefits of omega-3 LC PUFA intake in pregnancy and during breastfeeding, their protective effect on health and development of pathologic disorders are less clear, particularly in children in early life .

The objective of our study was to assess whether supplementation of omega-3 long chain polyunsaturated fatty acids during pregnancy and lactation reduces the incidence of respiratory illnesses, functional intestinal disorders and allergic reactions in infants as well as influence immune status and fatty acids metabolism.

Patients and methods

A retrospective analysis was carried out using interview method in 250 women, whose children reached the age of one year at the time of assessment. Women with their infants were enrolled into the study at the primary health care units in urban area. In order to assess the influence of consumption of omega-3 LC PUFAs during pregnancy and breastfeeding on physical development and health of infants at the age of one year was elaborated questionnaires. After analysis of the questionnaires, were selected two groups: 1st group of respondents were 100 women who used to eat seafood not less than twice a week (one portion of sea food was equal to 100–150 g of sea fish) during pregnancy and breastfeeding; 2nd group of respondents were 150 women whose diets did not contain seafood.

In according with the recommendations and practice guidelines for health care providers supported by the World Association of Perinatal Medicine, the Early Nutrition Academy, and the Child Health Foundation, pregnant and lactating women should aim to achieve an average daily intake of at least 200 mg DHA and women of childbearing age can meet the recommended intake of DHA by consuming one to two portions of sea fish per week, including fatty fish, which is a good source of omega-3 LC PUFA. Consumption of this amount of fish does not generally exceed the tolerable intake levels of environmental contaminants. Other sources of omega-3 LC-PUFA include enriched foods and dietary supplements. Dietary α-LA, the precursor to DHA, is much less effective in promoting optimal DHA status than consumption of preformed DHA and is insufficient to promote desirable levels of DHA deposition in the fetal brain [4, 21].

Assessment of incidence of common diseases and disorders like respiratory tract diseases, functional intestinal disorders and allergic reactions was conducted. The outcomes of the study were analyzed and processed using statistical methods. Apart from clinical evaluation, in our study we investigated immunity of infants assessing the content of IgA, IgG and IgM by immunological methods. For detection of DHA, EPA (omega-3 LC PUFA) and AA (omega-6 LC PUFA) was used gas-chromatographic analysis.

Data were presented as means and standard deviation. A 2-tailed Student t test was used to examine differences between supplementation groups for continuous variables. Pearson's chi-squared or χ^2 test was used for categorical values as well as statistical analysis of odds ratios (OR) using a two-by-two frequency table and confidence intervals (CI). A $p<0,05$ was considered significant. Statistical software package of Microsoft Excel was used for calculations.

Results

A total of 250 women and their children at the age of one year were enrolled into study. Among children 135 were male and 115 were female. All children were term born, in early neonatal period — healthy, without somatic diseases or neurologic disorders. The weight in both groups at the time of birth was 3240,0±46,4 g, height — 51,7±3,2 cm. Most of children were born after physiologic birth (92,0%). Child anthropometric measurements showed no differences in both groups. At 3 months of age the weight was on average 5896,5±34,6 g, at 6 months — 7822,5±28,7 g, at the aged of 1 year — 10650,6±64,8 g. This means that physical development was consistent with the age-based indicators.

Analysis of feeding showed that all infants were on breastfeeding at birth, but duration and exclusively breastfeeding was different in groups. At the age of 6 months in the 1st group 45,0% of children were exclusively breastfed and in the 2nd group only 4,0%. The average of duration of breastfeeding in the 1st group was 7,0±0,6 months while in 2nd group — 4,8±0,2 months, which was significantly different ($p<0,01$). Thus, consumption of seafood with a predominant content of omega-3 LC PUFA during pregnancy and after birth has beneficial effect on lactation and breastfeeding duration.

Our studies showed that frequency of respiratory and atopic diseases as well as functional disorders of the gastrointestinal tract in infants was different in observed groups. Retrospective clinical findings indicated on higher incidence of mentioned pathological conditions in children whose mothers did not use seafood in their diets during the pregnancy and breastfeeding (table 1)

Table 1

Morbidity in infants throughout the first year of life, abs (%)

Indicator	1st group (n=100)	2nd group (n=150)	OR (95 % CI)	p
Acute respiratory diseases	63 (63,0)	129 (86,0)	0,73 (0,61–0,85)	=0,003
Acute bronchitis	4 (4,0)	19 (12,7)	0,27 (0,10–0,85)	=0,036
Regurgitation	22 (22,0)	83 (55,3)	0,23 (0,13–0,41)	=0,000
Constipation	20 (20,0)	60 (40,0)	0,38 (0,21–0,68)	=0,001
Diarrhea	12 (12,0)	50 (33,3)	0,27 (0,14–0,55)	=0,000
Intestinal cramps	35 (35,0)	84 (56,0)	0,42 (0,25–0,79)	=0,002
Atopic reactions	30 (30,0)	72 (48.0)	0,46 (0,27–0,79)	=0,001

In regard to acute respiratory diseases in infants throughout the first year of life, it should be noted that in 2nd group of infants the frequency of acute respiratory diseases was significantly higher compared to its frequency in children in the 1st group (OR 0,73 95 % 0,61–0,85, p<0,003). The frequency of acute obstructive bronchitis showed the same trend, i.e. was significantly higher in the 2nd group of children (OR 0,27 95 % CI 0,10–0,85, p<0,0036).

Functional intestinal disorders like regurgitation, constipation, diarrhea and intestinal cramps are common digestive conditions in early childhood. Our analysis generally concluded that in the 1st group the incidence of functional intestinal disorders was less common than in the 2nd group and statistic data confirmed that statement. Calculation of odds ratios for regurgitation stated OD 0,23 95% CI 0,23 0,13–0,41 (p<0,003) for constipation — OD 0,38 95% CI 0,21–0,68 (p<0,001), for diarrhea — OD 0,27 95% CI 0,14–0,55 (p<0,001) and intestinal cramps — OD 0,42 95% CI 0,25–0,71(p<0,002).

Currently epidemiological studies investigating the effects of fish intake during pregnancy, infancy and childhood on development of atopic outcomes in children are inconsistent, although the majority of the studies showed protective effects of fish consumption. Therefore, in our research we analyzed the incidence of atopic diseases in infants who were under observation. The results showed significant differences in frequency of atopic diseases (OD 0,46 95% CI 0,27–0,79, p<0,001) which was more common in the 2nd group of infants.

In our investigation we studied some indicators of immune status in infants comparing those in both groups. The level of immunoglobulins relatively indicates on degree of development of immune defense and indirectly reflects the changes which are occurred in infant body depending on its metabolic and immunological disorders and influence of some environmental factors, including dietary factors.

In our study we investigated the effect of omega-3 LC PUFA supplementation in pregnant women and postnatally while breastfeeding on infant immunoglobulin's concentration in blood serum (figure 1). No difference was found in the level of IgG and IgM in plasma (p>0,05). At the same time IgA concentrations in serum of observed children was different, in infants of the 2nd group IgA concentration was lower compared to the 1st group (p<0,05).

Another part of our study consist of the investigation of PUFA level in blood, particularly, concentration of DHA, EPA (omega-3 LC PUFA) and AA (omega-6 LC PUFA) (figure 2). Our analysis showed changes in the content of the these fatty acids. The concentration of both DHA and EPA were lower while the content of AA was higher in the 2nd group compared to the 1st group. Significant differences were observed for DHA and AA (p<0,05).

Discussion

Exceptionally rapid growth and development of the fetus occurs during pregnancy and for the young child during the first several years of life. Brain growth accelerates during the second half of pregnancy and remains high during the first year of life with continued growth for the next several years [19]. During this time many developmental milestones are reached in terms of cognitive, visual, and motor development. In this regard it should be noted that maternal diet, nutritional status during pregnancy and in the period of lactation significantly influence the development and immunological adaptation of infants. Fetal and neonatal periods are key periods for immunological adaptation, and many of disorders and diseases later in the life are likely to originate during these crucial periods. However, relatively little attention has been devoted to the matter, namely, potential for early life programming by dietary factors. Among micronutrients considerable attention has been paid to the effect of LC PUFA. There are two principal families of PUFA, the omega-6 LC PUFA and the omega-3 LC PUFA.

Humans can synthesize saturated and monounsaturated fatty acids, but they cannot synthesize the omega-3 and the

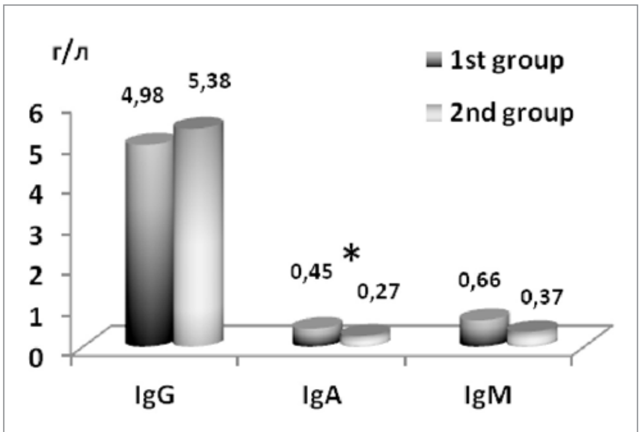

Fig. 1. Immunoglobulin concentration in blood serum in infants

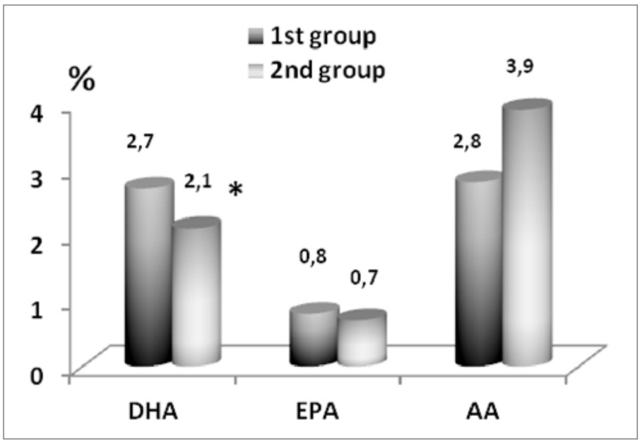

Fig. 2. Concentration of DHA, EPA and AA in blood serum in infants

omega-6 families of PUFA. The parent fatty acids of these families, α-linolenic acid (α-LA) and linoleic acid (LA) are essential fatty acids and must be present in the diet. At the same time LA and α-LA can be metabolised to other fatty acids. LA can be converted to arachidonic acid (AA). α-LA can be converted to eicosapentaenic (EPA) giving rise to docosahexaenic DHA. DHA is a critical component of cell membranes, especially in the brain and the retina. AA is both a membrane component and a precursor to potent signaling molecules, the prostaglandins and leukotrienes. The chain elongation/desaturation enzymes are shared by both ovega-3 and omega-6 PUFAs with competition between substrates for these enzymes [1,7].

Tissue accumulation of DHA in infant body starts in *utero*, with quantitatively marked deposition in the second half of gestation [9]. Further DHA accumulation in the body, especially in brain and retina continues after birth until four years of age. It is well known that fetus depends on the PUFA status in women and enzyme systems, which participate in conversion of PUFA from maternal body to fetus, provide an active transport of LC PUFAs across the placenta and do it in favor to the fetus so that the level of PUFA in the fetus more higher than in maternal blood [10].

Contemporary diets of Ukrainian population content significant quantities of LA (omega-6 PUFA) in vegetable oils extracted from corn, sunflower and soybean. The main representative of omega-3 PUFA α-LA is found in green plant tissues, in some common vegetable oils, including soybean and rapeseed oils, in some nuts, and in flaxseed (also known as linseed) and flaxseed oil. Between them, LA and α-LA contribute over 95%, and perhaps as much as 98% of dietary PUFA intake in most Western diets with LA intake being in excess of that of α-LA [18]. The intake of LA in Western countries increased greatly over the second half of the 20th century, following the introduction and marketing of cooking oils and margarines. α-LA intake probably changed little over this time. Typical intakes of both essential fatty acids are in excess of requirements. However, the changed pattern of consumption of LA has resulted in a marked increase in the ratio of ovega-6 to omega-3 PUFA in the diet. This ratio is currently 25–50/1 in most Western populations compared to original 1:1 ratio of humans in the past [6]. It proves the importance of the provision of a balanced dietary intake for pregnant and breastfeeding women and this should include a regular supply of omega-3 LC PUFAs, DHA and EPA.

In this way, imbalance of omega-6 and omega-3 LC PUFA in women has its consequences resulting in lipid disorders in infants. Apart from insufficient supply of fetus, due to reduction in the consumption of omega-3 LC PUFAs, the same occurs with the content of these acids in breast milk. Given the involvement of omega-6 and omega-3 LC PUFAs and their respective balance in disease processes and maintaining good health, our goal was to study relationship between omega-3 LC PUFAs intakes during pregnancy and breastfeeding and morbidity of infants in early life.

Conclusion

Our studies indicate the benefits of omega-3 PUFAs consumption during pregnancy and early childhood and demonstrate the potential protective role of omega-3 PUFAs in allergic and respiratory diseases as well as functional bowel disorders via several mechanisms which include the modulation of immune function and the influence regulatory processes through different systems in infant's body. We received statistically confirmed data of favorable impact of omega-3 LC PUFAs on incidence of acute respiratory, atopic diseases and functional bowel disorders which had less common frequency in children whose mothers consumed seafood. Resuming all above, this cross-sectional study demonstrated favorable role of availability of omega-3 LC PUFAs in infants and their long-term effects in preventing the immune mediated diseases as well as the intestinal functional disorders and health status during early growth and development.

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Влияние потребления омега-3 длинноцепочечных полиненасыщенных жирных кислот женщинами во время беременности и в период лактации на состяние здоровья и заболеваемость их детей на первом году жизни

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Вступление: Частота воспалительных и аллергических заболеваний в развитых странах значительно увеличилась за последние два десятилетия. Одним из возможных объяснений наблюдаемого увеличения заболеваемости является изменение качествнного состава рационов питания, при этом отмечается изменение баланса между потреблением полиненасыщенных жирных кислот. В современной диете преобладает потребление омега-6 полиненасыщенных жирних кисот и достаточно низкое потребление омега-3 полиненасыщенных жирных кислот. Такой дисбаланс оказывает неблагоприятное влияние на состояние здоровья и заболеваемость детей, особенно раннего возраста. Потребление продуктов, содержащих омега-3 полиненасыщенные жирные кислоты, может модулировать иммунные реакции и способствовать снижению заболеваемости новорожденных и детей на первом году жизни.

Цель: изучить влияние потребления омега-3 полиненасыщенных жирных кислот женщинами во время беременности и в период лактации на частоту острых респираторных заболеваний, функциональные нарушения кишечника и аллергические реакций у их детей на первом году жизни.

Методы: В данной работе были проведены ретроспективные исследования методом анкетированя 250 женщин, чьи дети на момент обследования достигли возраста одного года. Специально разработанные анкеты заполнялись педиатрами во время посещения пациентами поликлиники. Проводилась оценка частоты заболеваний, таких как функциональные нарушения кишечника, респираторные заболевания и атопические реакции. Проводился анализ иммуного статуса детей путем определения содержания IgA, IgG и IgM, исследовались концентрации докозагексаеновой, эйкозапентаеновой кислот (омега-3 полиненасыщенные жирные кислоты) и арахидоновой кислоты (омега-6 ПНЖК) с помощью газохроматографического анализа в сыворотке крови детей. Результаты исследований были проанализированы и обработаны с использованием статистических методов.

Результаты: Проведенные исследования указывают на более високий уровень заболеваний верхних дыхательных путей, функциональных нарушений ЖКТ, а также атопических реакций у детей, чьи матери не использовали в своих рационах питания морепродукты (омега-3 ПНЖК) во время беременности и в период кормления грудью. Исследование иммунного статуса путем определения уровня иммуноглобулинов в сыворотке крови у детей не показал никакой разницы в содержании IgG и IgM ($p > 0,05$), в то же время, отмечено статистически достоверное уменьшение содержания IgA в сыворотке крови детей, матери которых не употребляли пре- и постнатально продукты, содержащие омега-3 ПНЖК. Изучение профиля жирных кислот в сыворотке крови показало изменения в содержании основных представителей ПНЖК. Содержание докозагексаеновой и эйкозапентаеновой кислот (омега-3 ПНЖК) было статистически достоверно выше, а арахидоновой кислоты (омега-6 ПНЖК) было ниже в группе детей, чьи матери использовали в своих рационах морепродукты во время беременности и в послеродовом периоде.

Выводы: данные исследования показали, что достаточное обеспечение организма детей раннего возраста омега-3 ПНЖК способствует снижению заболеваемостий детей на первом году жизни, оказывает положительное влияние на развитие и состояние здоровья детей в раннем возрасте.

Ключевые слова: дети, полиненасыщенные жирные кислоты, морепродукты, иммунитет, заболеваемость.

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Вплив споживання омега-3 довголанцюгових поліненасичених жирних кислот жінками в період вагітності та лактації на стан здоров'я і захворюваність їх дітей на першому році життя

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Вступ: Частота запальних та алергічних захворювань в розвинених країнах значно збільшилася за останні два десятиліття. Одним з можливих пояснень спостережуваного збільшення захворюваності є зміна якісного складу раціонів харчування, при цьому відзначається зміна балансу між споживанням поліненасичених жирних кислот. У сучасній дієті переважає споживання омега-6 поліненасичених жирних кісот і досить низьке споживання омега-3 поліненасичених жирних кислот. Такий дисбаланс справляє негативний вплив на стан здоров'я і захворюваність дітей, особливо раннього віку. Споживання продуктів, що містять омега-3 поліненасичені жирні кислоти, може модулювати імунні реакції і сприяти зниженню захворюваності новонароджених і дітей на першому році життя.

Мета: вивчити вплив споживання омега-3 поліненасичених жирних кислот жінками під час вагітності та в період лактації на частоту гострих респіраторних захворювань, функціональні порушення кишечника і алергічні реакцій у їх дітей на першому році життя.

Методи: В даній роботі були проведені ретроспективні дослідження методом анкетування 250 жінок, чиї діти на момент обстеження досягли віку одного року. Спеціально розроблені анкети заповнювалися педіатрами під час відвідування пацієнтами поліклініки. Проводилась оцінка частоти захворювань, таких як функціональні порушення кишечника, респіраторні захворювання і атопічні реакції. Проводився аналіз імунного статусу дітей шляхом визначення вмісту IgA, IgG і IgM, досліджувалися концентрації докозагексаєнової, ейкозапентаєнової кислот (омега-3 поліненасичені жирні кислоти) і арахідонової кислоти (омега-6 ПНЖК) за допомогою газохроматографічного аналізу в сироватці крові дітей. Результати досліджень були проаналізовані та оброблені з використанням статистичних методів.

Результати: Проведені дослідження вказують на більш високий рівень захворювань верхніх дихальних шляхів, функціональних порушень ШКТ, а також атопічних реакцій у дітей, чиї матері не використовували у своїх раціонах харчування морепродукти (омега-3 ПНЖК) під час вагітності та в період годування груддю. Дослідження імунного статусу шляхом визначення рівня імуноглобулінів в сироватці крові у дітей не показав ніякої різниці у змісті IgG і IgM ($p > 0,05$), в той же час, відзначено статистично достовірне зменшення вмісту IgA в сироватці крові дітей, матері яких не вживали пре — і постнатально продукти, що містять омега-3 ПНЖК. Вивчення профілю жирних кислот у сироватці крові показало зміни у змісті основних представників ПНЖК. Зміст докозагексаєнової і ейкозапентаєнової кислот (омега-3 ПНЖК) було статистично достовірно вище, а арахідонової кислоти (омега-6 ПНЖК) було нижче в групі дітей, чиї матері використовували в своїх раціонах морепродукти під час вагітності та в післяпологовому періоді.

Висновки: дані дослідження показали, що достатнє забезпечення організму дітей раннього віку омега-3 ПНЖК сприяє зниженню захворюваності дітей на першому році життя, позитивно впливає на розвиток і стан здоров'я дітей в ранньому віці.

Ключові слова: діти, поліненасичені жирні кислоти, морепродукти, імунітет, захворюваність.

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