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# Effect of intakes of N-3 long chain polyunsaturated fatty acids during pregnancy and early childhood on development, morbidity and immunity of infants in first year of life: cross-sectional study

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***Background:*** *At present, there are considered the efficient mechanisms existed by which diets high in n-3 LC PUFAs during pregnancy and early childhood may modulate the development of innative immune disorders and promote the adequate formation of immune system both on general and local levels. Early availability of n-3 LC PUFA could contribute to the normal growth and development, decrease risk factors of diseases or pathological disorders in infants.*

***Goals:*** *to assess the relationship between n-3 LCPUFAs intakes during pregnancy and postnatally and development, morbidity and immunity of infants in first year of life.*

***Methods:*** *A retrospective study was conducted using interview method of 300 women, whose children reached the age of one year. Elaborated questionnaires were filled in by pediatricians throughout their daily working hours while attending the patients. Was conducted assessment of frequency of common diseases and disorders like respiratory diseases, functional intestinal disorders and atopic diseases. Were investigated immunity of infants assessing the content of IgA, IgG and IgM by immunological methods and detected DHA, EPA (n-3 LC PUFAs) and AA (n-6 LC PUFAs) by gas chromatographic analysis in blood serum of children. The outcomes of the study were analysed and processed using statistical methods.*

***Results:*** *Retrospective clinical 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 in their diets during the pregnancy and in the lactating period. The research of immunity of children showed no difference in concentration of IgG and IgM in blood serum ($p>0,05$) but significant difference for IgA concentrations in plasma. In infants of n-3 LC PUFAs group IgA concentration was higher compared to opposite group. The fatty acid composition of the blood serum showed changes in the content of the main representatives of n-3 (DHA, EPA) and n-6 (AA) LC PUFAs. 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 postnataly. Significant differences were observed for DHA and AA ($p<0,05$).*

***Conclusions:*** *This cross-sectoinal study demonstrated favorable role of avalaibility of n-3 LC PUFAs, 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 of infants.*

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

## Introduction

Both intrauterine and early infancy are periods of rapid growth and development during which insufficient supply of energy and nutrients undoubtedly influences the infant health. Inadequate nutrition modulates early life outcomes and increases the risk of different pathological states and diseases later in life. Therefore, effective preventive measures are required in order to reduce the dietary risk factors and their consequences which act during critical life periods.

There is a speculation that the change in dietary fatty acid balance may be linked to the increased prevalence of diseases, particularly in early childhood. The prevalence of nutritional tract diseases in Ukraine and other industrialized countries has increased over the past two decades which can be explained as a result of genetic changes in the population. The main cause of that is likely to be related to environmental changes. In this context, it is of interest to observe that the increase in childhood diseases has coincided with a substantial shift in dietary intake of fatty acids to favor n-6 long-chain polyunsaturated fatty acids (LC PUFAs) over n-3 LC PUFAs. It is known that diets rich in n-6 LC PUFAs, which observed throughout last years, due to increased consumption of vegetable oils rich in linoleic acid (18:2 n-6), lead to a predominance of arachidonic acid (AA, 20:4n-6) in tissues. The latter gives rise to eicosanoids, predominantly pro-inflammatory, which stimulate and enhance the expression of pro-inflammatory cytokines, thus affecting the immunological status [14]. On the contrary, the use of diets which are high in n-3 LC PUFAs (fish oil), contributes to displacement of arachidonic acid by representatives of n-3 LC PUFAs in cellular phospholipids, primarily in cell membrane and cell structures. The main represented LC PUFAs in fish oil are docosahexaenoic acid (DHA, 22:6 n-3) and eicosapentaenoic acid (EPA, 20:5 n-3).

The result of fatty acid's imbalance leads to a range of biochemical and immunological changes which include alteration of receptor expression and activity, and reduction of pro-inflammatory cytokine responses. Thus, it can be emphasized that efficient mechanisms exist by which diets high in n-3 LC PUFAs may modulate the development of innative immune disorders and promote the adequate formation of immune system both on general and local levels. From the other hand, this contributes to the normal growth and development of infants, decrease risk factors of diseases or pathological disorders in early childhood.

Above mentioned justify that at present among essential micronutrients n-3 LC PUFAs play an important role in health of infants. There are strong data from experimental and clinical studies showing that n-3 LC PUFAs alter immune cell function and could influence the immune system of infants. The n-3 LC PUFAs may influence the number and/or activity of certain subpopulations of cells, which could affect subse-

quent maturation and polarization of the immune system [3].

The effects of n-3 LC PUFAs supplementation during the perinatal period on neurobehavioral development or visual acuity, infant growth as well as safety monitoring outcomes has been addressed by a number of clinical trials mainly in preterm infant populations [17]. At the same time the majority of the studies tested the effect of maternal omega-3 LC PUFAs supplementation during pregnancy on early childhood cognitive and visual development [4]. It was shown that the application of n-3 LC PUFAs during infancy can be for prevention of infection and allergy [13,15].

Moreover, it is known the regulatory influence of n-3 LC PUFAs on nervous system, their neurophysiological functions. DHA and EPA have critical role in the membrane phospholipids and are structural and functional components of cell membranes. These fatty acids are indispensable for cell membrane synthesis. Together with n-6 PUFAs, they are not only involved in the development and maturation of neuronal structures, but essential throughout the entire life span for maintaining normal brain and nervous system function. [16]. Deficiency and imbalance of these nutrients, especially during development phase may influence the regulatory functions of nervous system, and thus, leads to different functional disorders, primarily in digestive tract.

Concluding the above, supplementation of the maternal diet in pregnancy and early childhood with n-3 PUFA may provide a noninvasive intervention with significant potential to prevent the development of immune-mediated diseases and functional disorders of digestive tract. However the data available has limited reports elucidating the influence of early availability of n-3 LC PUFAs on frequency of sickness and development of infants during first year of life and their immunity.

***The objective*** of our study was to assess the relationship between n-3 LCPUFAs intakes during pregnancy, early childhood and development, morbidity and immunological status of infants in first year of life.

## Patients and methods

A retrospective study was conducted using interview method in 300 women, whose children reached the age of one year. Women with their infants were enrolled into the study at the primary health infant unit (polyclinic) in the Kiev area. In order to assess the impact of consumption of n-3 LC PUFAs during pregnancy and breast-feeding period on physical development and health of infants over the first year of life was elaborated questionnaire at the SI «Institute of pediatrics, obstetrics and gynecology of National Academy of Medical Science of Ukraine». Further researches were conducted at the polyclinic, where information was received from the women via questionnaires filled in by pediatricians throughout their daily working hours while attending the patients.

After analysis of the questionnaires, 50 were excluded having insufficient data. 250 questionnaires were selected and respondents were divided in two groups:

1st group of respondents were 100 women who used to eat seafood not less than twice a week;

2nd group of respondents were 150 women whose diets did not contain seafood.

The analysis of questionnaires showed that all reviewed women consumed in their diets sunflower and corn oil in which the level of linoleic fatty acid (n-6 fatty acid) was in the range from 42,0 to 74,0 g/100ml, while the concentration of α-linolenic fatty acid (n-3 fatty acid) was between 0,2 and 0,3 g/100ml. At the same time, the women of the 1st group during pregnancy and postnataly in their diets had seafood (fatty marine fish) not less than twice a week. One portion was equal to 100–150 g of sea fish.

According to the recommendations of the World Association of Perinatal Medicine, consumption of two portions of sea fish twice a week is equal to the consumption of 200 mg docosahexaenoic fatty acid (DHA), which is regarded as the optimal intake of n-3 LC PUFAs. This contributes to favorable course of pregnancy and reduces the risk of complications of childbirth, promotes the optimal development of the fetus, newborn and children yeary in the life. Consumption of this amount of fish does not generally exceed the tolerable intake levels of environmental contaminants [18].

Assessment of frequency of common diseases and disorders like respiratory diseases, functional intestinal disorders and atopic diseases was conducted. The outcomes of the study were analysed 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 (n-3 LC PUFAs) and AA (n-6 LC PUFAs) was used gaschromatographic analysis.

Data are 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 $\chi^2$ 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 value <0,05 was considered significant. Statistical software package of Microsoft Excel was used for calculations.

## Results

A total of 250 children in the age of one year were enrolled into analysis, among them 135 male and 115 female. All children were term born, healthy, without somatic and neurologic pathology. The weight in both group at the time of birth was 3340,0±16,4 g, height — 52,4±1,2 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±1,7 g, at 6 months — 7822,5±2,3 g, at the aged of 1 year — 10650,6±4,5 g, means that physical development was consistent with the age regulations.

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 1&&st group 45,0% of children were exclusively breastfed and in 2nd group only 4,0%. The average of duration of breastfeeding in 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 n-3 LC PUFA during pregnancy and after birth has beneficial effect on lactation and breastfeeding duration.

The frequency of the diseases during first year of life in infants, who were under observation, was analyzed by using nonparametric statistical methods. Were performed estimates of **odds ratios (OR) using a two-by-two frequency table** (contingency or 2x2 table) and shi-square test or $\chi^2$ criteria. 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 indicate on higher incidence of mentioned pathological conditions in children whose mothers did not use seafood in their diets during the pregnancy and in the lactating period (Table 1).

*Table 1*

**Frequency of morbidity in infants throughout the first year of life (abs/%)**

| Morbidity of infants | 1st group (n=100) | 2nd group (n=150) | OR (95% CI) | p |
|---|---|---|---|---|
| ARD | | | | |
| – once a year | 49 (49,0) | 89 (59,3) | 0,66 (0,39–1,09) | 0,139 |
| – recurrent | 14 (14,0) | 40 (26,7) | 0,45 (0,23–0,88) | 0,026 |
| 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 (0,25–0,71) | 0,002 |
| Atopic diseases | 30 (30,0) | 72 (48,0) | 0,46 (0,27–0,79) | 0,001 |

In regard to acute respiratory diseases (ARD) in infants throughout the first year of life, it should be noted that in 2nd group of infants the frequency of ARD recurrences was significantly higher compared to its frequency in children in 1st group ($p<0,05$). Estimate of frequency of acute and obstructive bronchitis showed the same trend which was as well significantly higher in 2nd group of children. As presented in the table 1, the analysis comparing frequency of ARD and acute bronchitis in infants of 1st group versus 2nd group showed OR 0,45 95% CI 0,23–0,88 ($p<0,05$) and OR 0,27 95% CI 0,10–0,85 ($p<0,05$) respectively which indicates a statistically significant difference between groups.

Functional intestinal disorders (FID) like regurgitation, constipation, diarrhea and intestinal cramps are common digestive conditions in early childhood. Based on the current evidence, events that take place early in life predispose to the development of FID. Based on the fact that dietary factors play predominant role and contribute to formation of intestinal pathology, we studied influence of n-3 LC PUFA consumption during pregnancy and in lactating period on the frequency of FID in observed infants. Our analysis generally concluded that in 1st group clinical findings are more favourable as the frequency of FID occured significantly less likely compared to the same in 2nd group.

Statistic alanalysis of received data showed significant differences in frequency of FID in infants during first year of life. Calculation of odds ratios for regurgitation states OD 95% CI 0,23 0,13–0,41, for constipation — OD 95% CI 0,38 0,21–0,68, for diarrhea — OD 95% CI 0,27 0,14–0,55 and intestinal cramps — OD 95% CI 0,42 0,25–0,71. In all these ivents the study of shi-square test showed p value less than 0,05.

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 a protective effect of fish. Therefore in our research we analysed the incidence of atopic diseases in infants who were under observation. The results showed significant differences in frequency of atopic diseases, OD 95% CI 0,46 0,27–0,79 ($p<0,05$).

In our investigation we studed some indicators of immune status in infants who reached one year of life comparing them in both groups. The level of immunoglobulins relatively indicates on degree of development of immune defence and indirectly reflects the changes which are occurred in infant body depending on metabolic and immunological disorders due to influence of some factors of environment, including dietary factors.

The effect of n-3 LC PUFA supplementation by women on infant immunoglobilins concentration in blood serum are presented in figure 1. No difference was found in concentration of IgG and IgM in plasma ($p>0,05$). A significant difference for IgA concentrations in plasma was observed in infants of 2nd group, IgA concentration in this group was lower compared with 2nd group ($p<0,05$).

As we mentioned before there were differences in dietary intake of nutrients between observed groups. This refers to consumption of seasfood by mothers. In this regard it was of interest to investigate the effect of n-3 LC PUFA consumption during pregnancy and postnately on concentration DHA, EPA (n-3 LC PUFA) and AA (n-6 LC PUFA). The analysis of the fatty acid composition in plasma is illustrated in fig.2.

The fatty acid composition of the blood serum showed changes in the content of the main representatives of n-3 (DHA, EPA) and n-6 (AA) LC PUFAs. The concentration of both DHA and EPA were lower while the content of AA was higher in 2nd group compared to 1st group. Significant differences were observed for DHA and AA ($p<0,05$).

## Discussion

A number of studies suggest that besides genetic factors, environmental exposures early in life are important determinants of health and disease later in life. The effect of long-lasting early exposures refers to the phenomenon which has been termed as «early life programming» [6,9]. Nutrition has been identified as one source of early exposures that might influence early development and later phenotype [7]. Along with this, 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 dis-

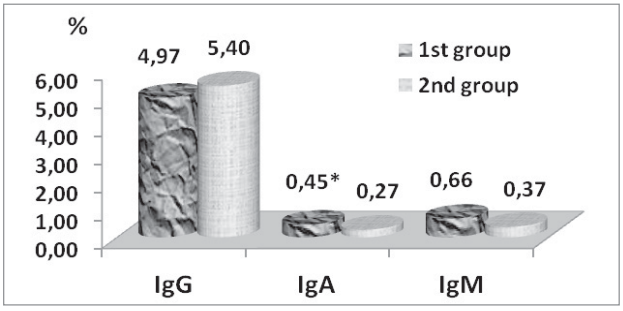


***Fig. 1.*** Concentration of immunoglobulins in blood serum in infants at the age of one year

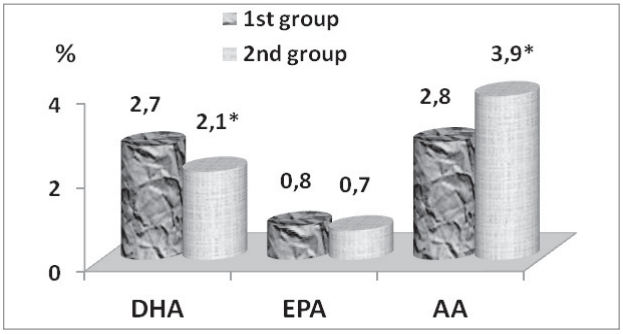


***Fig. 2.*** Concentration of DHA, EPA and AA in blood serum in infants at the age of one year

eases 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 long-chain polyunsaturated fatty acids (LC PUFA). There are two principal families of PUFA, the n-6 and the n-3 families. The simplest members of each family, linoleic acid (LA; 18:2n-6) and a-linolenic acid (ALA; 18:3n-3), cannot be synthesised by mammals. At the same time LA and ALA can be metabolised to other fatty acids. LA can be converted to arachidonic acid (AA; 20:4n-6). ALA can be converted to EPA (20:5n-3) giving rise to DHA (22:6n-3).

LA is found in significant quantities in many vegetable oils, including corn, sunflower and soyabean oils, and in products made from such oils. ALA is found in green plant tissues, in some common vegetable oils, including soyabean and rapeseed oils, in some nuts, and in flaxseed (also known as linseed) and flaxseed oil. Between them, LA and ALA 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 ALA [12]. 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. ALA 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 n-6 to n-3 PUFA in the diet. This ratio is currently between 10 and 50 in most Western populations compared to original 1:1 ratio of humans in the past [2].

These data should be presented and interpreted in the direction of impact on the status of lipids in children, since maternal LC PUFA status during pregnancy is critical for the essential fatty acid status in the newborn. It is known that in the fetus long-chain PUFAs are accumulated during the last trimester of pregnancy and the first months of life [1]. Enzyme systems which participate in convertion of PUFA in the human fetal liver seem to be immature and unable to supply sufficient long-chain PUFAs to meet the requirements until 16 weeks after birth [8]. Furthermore, the capacity of the placenta to synthesize long-chain PUFAs from essential fatty acids is very limited, but there is an active transport of long-chain PUFAs across the placenta, as shown by a maternal-fetal concentration gradient of long-chain PUFAs in favor of the fetus [10].

In this way, imbalance of n-6 and n-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 n-3 LC PUFAs, the same occurs with the content of these acids in breast milk. Given the involvement of n-6 and n-3 LC PUFAs and their respective balance in disease processes and maintaining good health, our goal was to study relationship between n-3 LC PUFAs intakes during pregnancy and postnataly and development, morbidity and immunity of infants in first year of life.

Analysis of the development of infants showed no differences in antropometric indexes thoughout the first year of life. We did not detect any effect of maternal dietary supplementation with n-3 long chain polyunsaturated fatty acids on gestational length or birth weight. As well there were no differences in height and weight indexes at the age of one year. This indicates on adequate development of children in observed groups.

As expected, fatty acid pattern in blood serum was greatly influenced by the supplementation given to the mothers during pregnancy and lactation period. In accordance with our study, there was increase in the level of DHA and EPA (the family of n-3 LC PUFAs) and decrease of AA (n-6 LC PUFAs) concentration. These changed were significantly different ($p<0,05$) and our results are consistent with other data [5].

While there were no changes in the indexes of physical development, we found dietary implication on immune functioning. Early intervention with n-3 LC PUFAs during the fetal and neonatal period has impact on immunoglobulin profile. In our study we detected only difereces in concentration of IgA. In children whose mothers consumed seafood there were significantly higher level of IgA compared to the group without such dietary intervention ($p<0,05$).

IgA and its secretory form is the main immunoglobulin which is produced in mucosal linings than all other types of antibody combined. SIgA influences the composition of the intestinal microbiota, downregulates proinflammatory responses normally associated with the uptake of highly pathogenic bacteria and potentially allergenic antigens, and promotes the retro-transport of antigens across the intestinal epithelium to dentric cell subsets in GALTs [11].

Low concentration of IgA reflects its transient immunodeficiency as in infancy the innate and acquired immune systems are present but at reduced activities. The main knowledge is that infants can be considered as immunocompetent but immunologically @@*nalve*@@ [15]. Several events occur during the first months of life that allow the immune system to become both competent and functional. It is likely that n-3 LC PUFAs promote the improvement of immunological mechanisms in synthesis and production of immunoglobulins, particularly IgA and its secretory form, and thus, contribute to adequate developement of immunity in infants.

Our studies actually 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 finctional intestinal disorders via several mechanisms which include the modulation of immune function and the influence on the regulatory processes of nervous system. We received statistically confirmed data of favorable impact of n-3 LC PUFAs on incidence of acute respiratory, atopic diseases and finctional disorders of intestinal tract which were less frequent in children whose mothers consumed seafood.

Resuming all above, this cross-sectoinal study demonstrated favorable role of avalaibility of n-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.

Further well designed trials, however, with higher patient numbers may be justified to confirm results of current cross-sectional study and future research may allow elucidating the mechanisms underlying the actions of LC PUFAs.

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**Ефективність використання омега-3 довголанцюгових жирних кислот під час вагітності та в постнатальному періоді на розвиток, захворюваність та імунний статус дітей раннього віку: перехресне дослідження**

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В даний час розглядаються ефективні механізми, які можуть модулювати порушення іннативного імунітету і надавати позитивний вплив на формування як імунної системи в цілому, так і на локальному рівні, засновані на використанні раціонів з додатковим споживанням омега-3 поліненасичених довголанцюжкових жирних кислот (омега-3 ДЦ ПНЖК ) у період вагітності та постнатальному періоді. Достатній вміст омега-3 ДЦ ПНЖК в організмі дітей першого року життя може сприяти їх нормальному росту і розвитку, зменшує ризик розвитку захворювань або патологічних станів.

**Метою** цієї роботи було оцінити вплив споживання жінками омега-3 ДЦ ПНЖК під час вагітності і після народження на розвиток, захворюваність і імунний статус дітей першого року життя.

**Методи:** ретроспективні дослідження були проведені у 300 жінок, чиї діти досягли віку одного року, з використанням анкетно-опитувального методу (інтерв'ю). Спеціально розроблені анкети заповнювалися педіатрами під час відвідування пацієнтами поліклініки. Проводилась оцінка частоти захворювань, таких як респіраторні, атопічні захворювання, функціональні порушення кишечника. Проводився аналіз іммуного статусу дітей шляхом визначення вмісту IgA, IgG та IgM, досліджувалися концентрації докозагексаєнової ( ДГК), ейкозапентаєнової (ЕПК) кислот (омега-3 ДЦ ПНЖК) та арахідонової (АК) кислоти (омега-6 ДЦ 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 високу частоту гострих захворювань дихальних шляхів, атопічних захворювань, а також функціональних розладів шлунково-кишкового тракту у дітей, чиї матері не використовували в своїх раціонах морепродукти протягом вагітності і в період лактації. Дослідження імунного статусу не виявило відмінностей в концентрації IgG і IgM в плазмі крові ($p>0,05$ ), проте виявило істотну різницю в концентрації IgA в плазмі у дітей, матері яких споживали омега- 3 ДЦ ПНЖК, концентрація IgA була вищою порівняно з групою порівняння. Вивчення профілю жирних кислот в сироватці крові показало зміну вмісту основних представників омега-3 і омега-6 ДЦ ПНЖК. Концентрації ДГК і ЕПК були вище, а вміст АА був нижчим в групі дітей, чиї матері споживали морепродукти під час вагітності та в постнатальному періоді. Значні відмінності спостерігалися відносно ДГК і АК ($p<0,05$).

**Висновки:** Дані дослідження показали, що достатнє забезпечення організму дітей раннього віку омега-3 ДЦ ПНЖК сприяє успішному запобіганню імунно-опосередкованих захворювань, а також функціональних порушень ШКТ, здійснює позитивний вплив на розвиток і стан здоров'я дітей в ранньому віці.

**Ключові слова:** діти раннього віку, поліненасичені жирні кислоти, імунний статус, захворюваність.

**Эффективность потребления омега-3 длинноцепочечных жирных кислот во время беременности и в постнатальном периоде на развитие, заболеваемость и иммуный статус детей раннего возраста: перекрестное исследование**

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В настоящее время рассматриваются эффективные механизмы, которые могут модулировать нарушения иннативного иммунитета и оказывать положительное влияние на формирование как иммунной системы в целом, так и на локальном уровне, основанные на использовании диет с дополнительным потреблением омега-3 полиненасыщенных длинноцепочечных жирных кислот (омега-3 ДЦ ПНЖК) в период беременности и постнатальном периоде. Достаточное содержание омега-3 ДЦ ПНЖК в организме детей первого года жизни может способствовать их нормальному росту и развитию, уменьшать риск развития заболеваний или патологических состояний.

**Целью** настоящей работы было оценить влияние потребления женщинами омега-3 ДЦ ПНЖК во время беременности и после рождения на fразвитие, заболеваемость и иммунологический статус детей первого года жизни.

**Методы:** ретроспективные исследования были проведены у 300 женщин, чьи дети достигли возраста одного года, с использованием анкетно-опросного метода (интервью). Специально разработанные анкеты заполнялись педиатрами во время посещения пациентами поликлиники. Проводилась оценка частоты заболеваний, таких как респираторные, атопические заболевания, функциональные нарушения кишечника. Проводился анализ ммунологического статуса детей путем определения содержания IgA, IgG и IgM, исследовалась концентрация докозагексаеновой (ДГК), эйкозапентаеновой (ЭПК) кислот (омега -3 ДЦ ПНЖК) и арахидоновой (АК) кислоты (омега-6 ДЦ 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 высокую частоту острых заболеваний дыхательных путей, атопических заболеваний, а также функциональных расстройств желудочно-кишечного тракта у детей, чьи матери не использовали в своих рационах морепродукты в течение беременности и в период лактации. Исследование иммунного статуса не выявило различий в концентрации IgG и IgM в плазме крови ($p>0,05$), однако выявило существенную разницу в концентрации IgA в плазме. У детей, матери которых потребляли омега-3 ДЦ ПНЖК, концентрация IgA была выше по сравнению с группой сравнения. Изучение профиля жирных кислот в сыворотке крови показало изменение содержания основных представителей омега-3 и омега-6 ДЦ ПНЖК. Концентрации ДГК и ЭПК были выше, а содержание АА было ниже в группе детей, чьи матери потребляли морепродукты во время беременности и в постнатальном периоде. Значительные различия наблюдались в отношении ДГК и АК ($p<0,05$).

**Выводы:** Данные исследования показали, что достаточное обеспечение организма детей раннего возраста омега-3 ДЦ ПНЖК способствует успешному предотвращению иммунно-опосредованных заболеваний, а также функциональных нарушений ЖКТ, оказывает благоприятное влияние на развитие и состояние здоровья детей в раннем возрасте.

**Ключевые слова:** дети раннего возраста, полиненасыщенные жирные кислоты, иммунный статус, заболеваемость.

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