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Features of lactation in puerperal women with obesity

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The objective: **to determine the features of lactation in obese puerperas, depending on the body mass index and the therapeutic and preventive measures.**
Materials and methods**. The analysis and evaluation of quantitative and qualitative indicators (lactose, casein, total protein, lipids, lactoferrin, transferrin, ceruloplasmin, vitamins C and E, immunoglobulins of G, A, M classes) of maternal milk in the dynamics of the postpartum period in 386 puerperas was conducted. The main group consisted of 115 women with obesity, the management of the preconception period, pregnancy and the postpartum period was carried out according to the proposed by us program, including non-drug and drug methods. The comparison group included 103 puerperas with obesity, the management of which was carried out in accordance with the Order No. 417 of the Ministry of health of Ukraine dated 15.07.2011. The control group consisted of 53 primiparous with normal body weight.**
Results. Analysis of the state of lactation revealed hypogalactia and pathological changes in the qualitative composition of breast milk, manifested in women with obesity and lower levels of lactose and lactoferrin by 1,6 times, total protein, ceruloplasmin by 2,2 times, lipids by 2,1 times, transferrin by 1,4 times, casein by 1,5 times, vitamin C by 1,8 times and E by 1,5 times, and the content of IgG by 2,1 times, IgM by 1,9 times, IgA by 2,2 times. The stage of hypogalactia severity and pathological changes in the quality of breast milk increase due to the body mass index growth.
Conclusion. The proposed pathogenetically justified program of therapeutic and preventive measures contributed to the increase in the volume of breast milk and its quality improve.
Key words: *postpartum period, lactation, obesity.*

Особливості лактації у породіль із ожирінням
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Мета дослідження: визначення особливостей лактації у породіль із ожирінням залежно від індексу маси тіла та проведених лікувально-профілактичних заходів.
Матеріали та методи. Проведено аналіз і оцінювання кількості та якісних показників (лактози, казеїну, загального білка, ліпідів, лактоферину, трансферину, церулоплазміну, вітамінів С і Е, імуноглобулінів класів G, A, M) материнського молока у динаміці післяпологового періоду у 386 породіль. До основної групи увійшли 115 жінок із ожирінням, ведення прегравідарного періоду, вагітності та післяпологового періоду яких здійснювали за запропонованою нами програмою, що включала немедикаментозні та медикаментозні методи. До групи порівняння увійшли 103 породіллі з ожирінням, менеджмент ведення яких проводили згідно з Наказом № 417 МОЗ України від 15.07.2011 р. До контрольної групи включені 53 першороділлі з нормальною масою тіла.
Результати. Аналіз стану лактації виявив гіпогалактію та патологічні зміни якісного складу грудного молока, що характеризувались у жінок із ожирінням зниженням рівня лактози і лактоферину у 1,6 разу, загального білка, церулоплазміну – у 2,2 разу, ліпідів – у 2,1 разу, трансферину – в 1,4 разу, казеїну – в 1,5 разу, вітаміну С – в 1,8 разу та Е – в 1,5 разу, а також вмісту IgG – у 2,1 разу, IgM – в 1,9 разу, IgA – у 2,2 разу. Ступінь тяжкості гіпогалактії і кількість патологічних змін якісних показників материнського молока зростають у міру підвищення індексу маси тіла.
Заключення. Запропонована нами патогенетично обґрунтована програма лікувально-профілактичних заходів сприяла збільшенню кількості грудного молока і покращенню його якісного складу.
Ключові слова: *післяпологовий період, лактація, ожиріння.*

Особенности лактации у родильниц с ожирением
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Цель исследования: определение особенностей лактации у родильниц с ожирением в зависимости от индекса массы тела и проведенных лечебно-профилактических мероприятий.
Материалы и методы. Проведены анализ и оценка количества и качественных показателей (лактозы, казеина, общего белка, липидов, лактоферрина, трансферрина, церулоплазмина, витаминов С и Е, иммуноглобулинов классов G, A, M) материнского молока в динамике послеродового периода у 386 родильниц. В основную группу вошли 115 женщин с ожирением, ведение прегравидарного периода, беременности и послеродового периода которых проводили по предложенной нами программе, включающей немедикаментозные и медикаментозные методы. В группу сравнения вошли 103 родильницы с ожирением, менеджмент ведення которых проводили согласно Приказу № 417 МЗ Украины от 15.07.2011 г. В контрольную группу вошли 53 первородящие с нормальной массой тела.
Результаты. Анализ состояния лактации виявил гипогалактию и патологические изменения качественного состава грудного молока, проявляющиеся у женщин с ожирением снижением уровня лактозы и лактоферрина в 1,6 раза, общего белка, церулоплазмина – в 2,2 раза, липидов – в 2,1 раза, трансферрина – в 1,4 раза, казеина – в 1,5 раза, витамина С – в 1,8 раза и Е – в 1,5 раза, а также содержания IgG – в 2,1 раза, IgM – в 1,9 раза, IgA – в 2,2 раза. Степень тяжести гипогалактии и количество патологических изменений качественных показателей материнского молока возрастают по мере повышения индекса массы тела.
Заключение. Предложенная нами патогенетически обоснованная программа лечебно-профилактических мероприятий способствовала увеличению объема грудного молока и улучшению его качественного состава.
Ключевые слова: *послеродовой период, лактация, ожирение.*

Considering difficult demographic situation in Ukraine over the past 10-15 years, the problem of preserving the reproductive potential and health of the future generation by reducing maternal and fetal losses, goes beyond the medical industry and becomes of national importance. Extragenital pathology adversely affects the condition of women during pregnancy, childbirth and the postpartum period. The maternal mortality rate due to extragenital complications reaches 12–20% and perinatal morbidity and loss reach about 40% explaining the growing interest of the obstetric community in this problem and requires further in-depth study. So far, obesity occupies a special place in the structure of extragenital pathology. Its frequency reaches to 29,7–35,5% among the female population and 35–38% among pregnant women [17, 18, 20]. Recently, in most countries of Western Europe, obesity affects 10–25% of the population, in the USA – about 40%. In Ukraine, according to the state statistics service (2018), obesity is registered in 19–27% of the population [5, 8, 16, 21].

The course of pregnancy in women with obesity is complicated by the threatening abortions, miscarriage, placental dysfunction, preeclampsia, fetal distress, gestational diabetes mellitus, abnormalities of labor activity, macrosomia, maternity trauma of mother and newborn, bleeding during deliveries and in the early postpartum period, early and late hypogalactia [2, 6, 19].

Breastfeeding is an integral part of the reproductive process for women of all peoples and cultures. It physiologically ensures adequate nutrition and survival for infants. Lactotrophic nutrition is the postnatal equivalent of hemotrophic nutrition of the fetus. After birth there is a transformation of «mother-placenta-fetus» system in its postnatal counterpart «mother-breast-native milk-child» preserving the genetic relationship that was formed during gestational development. Breast milk contains a large number of components. Most of them are identified but still the role of others is still unknown. The extreme variety of biologically active and protective factors of milk provides the formation of the adaptive potential of the child affects the physical, mental and intellectual development and forms behavioral reactions. One of the main factors that directly affect the quantitative and qualitative composition of breast milk is the women's health. It is believed that obesity before pregnancy, as well as excessive weight gain during pregnancy, is associated with an increased risk of insufficient lactation and a decrease in the lactation period. Mechanisms of lactation inhibition development in obese women have not been sufficiently studied. But there is an assumption that they are developing in connection with hypothalamic dysfunction and violation of Prolactin production in the first week after birth [1, 12, 13, 14].

Taking into account the numerous problems that arise in women with obesity during pregnancy, childbirth and the postpartum period, it is undoubtedly urgent to form a step-by-step comprehensive system of a differentiated approach to the diagnosis, prevention and targeted drug correction of obstetric and perinatal complications, in particular hypogalactia and improving the quality of maternal milk.

The objective: to determine the features of lactation in obese puerperal women, depending on the body mass index and therapeutic and preventive measures.

MATERIALS AND METHODS

In order to study the condition of lactation, we determined the quantitative and qualitative indicators of breast milk in the dynamics of the postpartum period (1st, 3rd, 7th and 14th days) in 386 puerperal women who had been randomized by groups. The main group consisted of 115 women with obesity, which used the proposed treatment and prevention program, the distinctive features of which were: individual and step-by-step approach depending on the presence of complications of the pre-conception period, the course of pregnancy, childbirth, and postpartum period.

Periconceptional preparation of women with obesity consisted in body weight reduce by 5–10% during 4–6 months, improve of respiratory function and lipid profile, reduce of hypercholesterolemia degree and insulin resistance as well as normalization of blood pressure, progesterone support of the second phase of the menstrual cycle in the presence of luteal phase insufficiency (micronized progesterone vaginally from 16 to 25 days of the cycle for 4–6 menstrual cycles). In a case of hypothyroidismus detection, women obtained replacement therapy after the consult of an endocrinologist (to exclude subclinically current hypothyroidism or diabetes), as well as plasmapheresis twice a week, 4–6 sessions overall. In the case of pregnancy before 12 weeks we recommended reduce low-calorie diet. After 12th week and before the onset of labor we recommended including fasting days, drinking regime in the amount of 35–40 ml/kg body weight, breathing exercises, dosed physical activity under normal or controlled blood pressure.

Management of the I trimester of pregnancy was supplemented by the use of a vaginal form of micronized progesterone for 16 weeks without determining the level of progesterone in the blood, magnesium preparations for 1–2 months, L-arginine for 3 weeks, acetylsalicylic acid up to 36 weeks of gestation, in a case of severe early gestosis – plasmapheresis twice a week, 4–6 sessions overall. After the 12th week of pregnancy, it was recommended to extend therapy with polyunsaturated fatty acids and essential phospholipids. After 28 weeks and before delivery it was recommended to use anticoagulant sulodexide and drugs that improve the functioning of the digestive tract. Before the onset of delivery the elastic compression of the lower extremities was proposed, depending on varicose disease absence or presence. In the case of planned delivery by cesarean section we applied preoperative showering with a local antiseptic for a week. Before preventive treatment after delivery we used low-molecular heparin in an average preventive dose for 7 days together with early activation, respiratory gymnastics, drinking regimen of 35–40 ml/kg body weight and drugs that increase the contractility of the uterus.

Non-drug complex consisted of diet therapy, psychoprophylaxis, physical therapy, the effect of which is mainly aimed at increasing the adaptive capacity of the woman's body. In addition, the undeniable advantage of these methods is their wide availability, efficiency, safety for mother and fetus. Diet therapy and physical therapy were carried out in a continuous mode, while psychoprophylaxis and drug therapy courses were conducted if it was necessary. To ensure optimal body weight in pregnant women, the calculation of the energy needs of the body, adjusted for motor activity, pregnancy factor and pathological factors was conducted.

Calculation of the Main Energy Exchange (MEE) was carried out according to the formula of I.E. Khoroshilova = 655 + (9,6 × body weight) + (1,8 × height) – (4,7 × age), where body weight was measured by kg, height by cm and age by years. Definition of Actual Energy Expenditure (AEE) was carried out according to the following formula: AEE = MEE × FA × FP × PF, where FA – physical activity: at work – 1,3; at home – 1,2; FP – factor in pregnancy: antepartum – 1,3; postpartum – 1.4; PF – pathologic factors were absent – 1,0; body temperature 38 °C – 1,1; body temperature 39 °C – 1,2; cesarean section – 1.3; peritonitis – 1.4; sepsis – 1,5 [3, 4, 7, 11].

The need of pregnant women in proteins, fats and carbohydrates was calculated on the actual body weight taking into account the pregnancy period, the presence of obesity and excessive weight gain during pregnancy. We recommended to this contingent of pregnant women to reduce the ingestion of fat and, especially, carbohydrate calories at steady consumption of proteins. The composition of the daily diet was recorded in the individual food diary of a pregnant woman. The last meal was carried out no later than one and a half to two hours before bedtime. Fluid retention and increase in of circulating blood

Table 1

Breast milk volume in women in the comparison group, ml

Day of research	Groups of women			
	Control group, n=53	Comparison group		
		I class obesity, n=49	II class obesity, n=32	III class obesity, n=22
1	83,4±6,2	82,7±5,2	60,4±3,2*	40,4±2,8**
3	242,6±10,2	241,8±9,2	201,8±8,3*	141,7±9,4**
7	461,9±18,3	459,5±17,6	324,7±14,3*	241,7±19,5**
14	662,5±24,9	661,9±28,3	481,5±28,2*	372,8±26,3**

Notes: * – the difference is significant for the control group (p<0,05); ** – the difference is significant for the control group (p<0,01).

Table 2

Breast milk volume in women of the main group, ml

Day of research	Groups of women			
	Control group, n=53	The Main Group		
		I class obesity, n=52	II class obesity, n=35	III class obesity, n=28
1	83,4±6,2	80,4±3,2	72,5±4,3	62,4±4,4*
3	242,6±10,2	241,8±8,3	211,9±8,7*	209,9±8,7*
7	461,9±18,3	452,8±14,3	455,4±14,3	354,8±14,3*
14	662,5±24,9	681,5±28,2	683,5±26,2	583,6±27,3*

Note: * – the difference is significant for the control group (p<0,05).

volume lead to additional stress on the cardiovascular system and kidneys. In a case of pathological weight gain and the presence of edema, pregnant women were transferred to a low-sodium diet, where the amount of salt consumed was 3–4 g per day.

In order to achieve this goal, we considered it appropriate to include common or individual psychoprophylaxis as preventive measures. The duration of the course was 8–12 sessions. Pregnant women and their husbands were taught to manage their emotions and explained the anatomical and physiological features of the birth process. After completing the course of psychoprophylaxis, all pregnant women noted a significant improvement in mood and stabilization of their emotional state. The programme of psychological prevention had a positive influence on psychogenic risk factors for impaired lactation and characterological features of the person. The inclusion in the program of relaxing gymnastics, breathing exercises and water procedures contributed to the normalization of vascular tone, the level of blood platelets restoration and reduction of their aggregation ability, normalization of sugar levels and improvement of general hemodynamics.

The comparison group included 103 women with obesity, whose management was carried out according to the Order No. 417 of the Ministry of Health of Ukraine dated 15.07.2011. Women of the main and the comparison groups were divided into three subgroups depending on the body mass index: class I obesity (BMI 30,0–34,9 kg/m2), class II obesity (BMI 35,0–39,9 kg/m2), class III obesity (BMI ≤ 40,0 kg/m2). The control group consisted of 53 primiparous with normal body weight.

The volume of milk was determined by weighing newborns before and after feeding. Along with the amount of expressed milk was determined. The determination of milk sugar (lactose) was carried out by iodometric method which based on the interaction between the aldehyde group of milk sugar and iodine in an alkaline environment, where iodine is an oxidant. The method of casein determination in milk was based on the fact that it is acidic. The difference between the amount of alkali used for the neutralization of the whole milk and the amount spent on the neutralization of milk whey (after precipitation of casein), represents the amount of alkali spent for the neutralization of the whole casein. The study of total protein and lipid content was carried out according to the generally accepted method.

Determination of vitamins C and E in milk was carried out by spectrophotometric method. Concentrations of immunoglobulins of G, A, M classes in milk were determined by enzyme immunoassay using commercial reagent kits «Enzyme immunoassay test system to determine the amount of IgG, IgA, IgM in Human serum» and «Enzyme immunoassay system to determine the amount of sIgA in saliva» («Microflora») according to the Protocol of the analysis. In view of the fact that the concentration of IgG and IgM in milk is much lower than in serum, we used different dilutions of samples of native milk than recommended for the blood serum, namely 1:700 for the detection of IgG and 1:800 for determination of IgM. To determine the IgA and sIgA dilutions recommended in the protocols were used. The results of enzyme immunoassay were determined by a photometer «Multiscan» (LKB, Finland) at a wavelength of 492 nm. The calculation of the results was carried out in a computer program «Tetrasoft». Concentrations of lactoferrin, transferrin and ceruloplasmin were determined by radial immunodifusion in gel. Antichain serum was used against lactoferine («Microflora»), the final dilution of antiserum in the agar was 1:40. The results of the reaction were calculated by measuring the diameter of the precipitation rings and calculated in a computer program «Tetrasoft» [9].

Statistical processing of the data was performed in «Excel 2003» tables, statistical program Statistica for WINDOWS V. 8.0.550 (StatSoft, USA). Reliability between indicators was determined by Student's t-test and Fisher's method [10, 15].

RESULTS AND DISCUSSION

The obtained data indicate that there are no significant differences between the volume of breast milk in women with I class obesity of comparison group and the control one within 14 days of observation (p>0,05). In puerperas with II and III class obesity there is a decrease in the amount of breast milk in 1,4 (p<0,05) and 2,1 (p<0,01) times for the 1st day; 1,2 (p<0,05) and 1,7 (p<0,01) times for the 3rd; 1,4 (p<0,05) and 1,9 (p<0,01) times for 7thday; 1,4 (p<0,05) and 1,8 (p<0,01) times for the 14th day, compared with the same indicator of women in the control group that indicates a negative impact of II class obesity and III class obesity, especially, on the quantitative indicator of lactation (table 1).

Table 3

Qualitative breast milk content of the comparison group women, M±m

Indicator, g/l	Day of research	Groups of women			
		Control group, n=53	Comparison group		
			I class obesity, n=49	II class obesity, n=32	III class obesity, n=22
Lactose	1	63,47±2,32	62,78±2,29	53,17±2,32*	42,27±2,25**
	3	63,66±2,38	62,67±2,27	53,42±2,19*	42,12±2,28**
	7	68,65±2,23	69,42±2,13	56,32±2,13*	42,01±2,02**
	14	68,16±2,02	69,47±2,35	56,43±3,53*	42,25±2,27**
Lactoferrin	1	3,02±0,31	3,08±0,27	2,01±0,22*	2,06±0,25*
	3	3,74±0,34	3,62±0,36	2,23±0,27*	2,18±0,23*
	7	3,69±0,37	3,64±0,32	2,25±0,24*	2,19±0,28*
	14	3,67±0,35	3,59±0,28	2,33±0,21*	2,28±0,27*
Caeruloplasmin	1	0,32±0,02	0,34±0,04	0,31±0,03	0,18±0,02*
	3	0,41±0,03	0,38±0,02	0,37±0,04	0,17±0,01*
	7	0,37±0,04	0,36±0,03	0,41±0,05	0,16±0,02*
	14	0,42±0,01	0,39±0,04	0,43±0,04	0,17±0,03*
Transferrin	1	3,02±0,31	3,05±0,33	2,98±0,27	1,45±0,12*
	3	2,89±0,28	3,09±0,28	3,01±0,32	1,39±0,14*
	7	3,22±0,33	3,09±0,33	2,79±0,36	1,44±0,17*
	14	3,19±0,30	3,12±0,32	3,09±0,32	1,39±0,12*
Total Protein	1	25,23±2,14	24,83±2,16	17,38±1,65*	12,13±1,02**
	3	22,75±1,82	23,25±2,12	16,25±1,42*	10,28±0,89**
	7	14,53±1,32	15,23±1,14	9,16±0,82*	6,47±0,53**
	14	12,15±1,03	13,21±1,11	8,14±0,75*	5,26±0,42**
Casein	1	1,12±0,11	1,10±0,12	1,08±0,11	1,07±0,10
	3	1,67±0,12	1,72±0,15	1,63±0,15	1,08±0,11*
	7	1,81±0,15	1,82±0,18	1,69±0,19	1,07±0,12*
	14	1,77±0,12	1,72±0,15	1,68±0,17	1,08±0,14*
Lipids	1	33,23±3,07	32,82±3,17	20,46±1,22*	15,27±1,43**
	3	34,21±2,89	35,14±2,97	21,23±1,46*	17,18±1,61**
	7	37,18±3,21	36,22±3,12	23,88±2,12*	16,87±1,59**
	14	44,25±2,83	43,29±3,09	31,85±2,47*	21,25±2,13**

Notes: * – the difference is significant for the control group (p<0,05); ** – the difference is significant for the control group (p<0,01).

Assessing changes in the breast milk volume in the main group of puerperal women, we also noted no significant differences between the control group and women with I class obesity (p>0,05). A positive trend, in relation to the comparison group, we revealed in women with II class obesity, which was observed on the 1st, 3rd, 7th and 14th day of the postpartum period. It was manifested by an increase in the volume of breast milk to the level of the control group (p>0,05). From the 1st day of the postpartum period in puerperal women with III class obesity an increase in the volume of breast milk was also noted. For women of the comparison group this figure remained significantly lower in relation to the control one (p<0,05) (table 2).

Among the indicators of the qualitative composition of breast milk, lactose content deserves special attention. Based on the data obtained, we observed a decrease in this indicator in puerparas in the comparison group with II and III class obesity during 14 day-follow-up (p<0,05 and p<0,01, respectively to the obesity class). The content of lactoferin in breast milk of this group of women did not significantly change in the presence of I class obesity, and in the case of II and III class obesity, was 1,6 times lower than in the control group (p<0,05). The presented data on the content of ceruloplasmin indicate the absence of significant differences between the control group and puerparas with I and II class obesity (p>0,05).

However, in women with III class obesity, we observed a 2,2-fold decrease in this indicator during the entire follow-up period in relation to the control group of puerparas (p<0,05). A similar pattern was observed in the assessment of transferrin content in women with III class obesity of the comparison group, which is 2,2 times lower than the same indicator in the control group of puerperal women (p<0,05) and did not depend on the day of the postpartum period (table 3).

The content of total protein in breast milk during the postpartum period in puerperal women with normal body weight on the 7th and 14th day is physiologically lower by 1,7 and 2,1 times than on the 1st and the 3rd day. At the same time, in women of the comparison group with II and III class obesity, we found a decrease in this indicator on the 1st day in 1,5 (p<0,05) and 2,1 times (p<0,01), on the 3rd day – in 1,4 (p<0,05) and 2,2 times (p<0,01), on the 7th day in 1,6 (p<0,05) and 2,2 times (p<0,01), on the 14th day in 1,5 (p<0,05). and 2,3 times (p<0,01), respectively, the obesity class.

Such an important component of breast milk as casein in both puerparas with I and II class obesity and women of control group increased in the dynamics of the postpartum period. However, it was reduced by 1,6 times with III class obesity, starting from the 3rd day of the postpartum period, remaining consistently low till the 14th day. Of course, one of the most informative indicators of the lactation quality is the lipid content in breast milk. The obtained results in puerperal women of the comparison group indicate a decrease in this parameter from the 1st day of postpartum period in 1,6 (p<0,05) and 2,2 times (p<0,01) with

Table 4

Qualitative breast milk composition of the main group women, M±m

Indicator, g/l	Day of research	Groups of women			
		Control group, n=53	The Main Group		
			I class obesity, n=52	II class obesity, n=35	III class obesity, n=28
Lactose	1	63,47±2,32	63,24±2,36	56,38±2,32*	54,37±2,13*
	3	63,66±2,38	63,49±2,11	58,29±2,11	56,47±2,12*
	7	68,65±2,23	67,38±2,12	64,32±2,18	52,34±2,16*
	14	68,16±2,02	65,51±3,41	63,43±3,56	53,45±3,55*
Lactoferrin	1	3,02±0,31	3,01±0,19	2,42±0,18	2,11±0,19*
	3	3,74±0,34	3,63±0,17	2,89±0,21*	2,39±0,25*
	7	3,69±0,37	3,65±0,25	2,78±0,22*	2,65±0,24*
	14	3,67±0,35	3,54±0,26	3,43±0,17	2,44±0,22*
Caeruloplasmin	1	0,32±0,02	0,30±0,01	0,29±0,01	0,23±0,02*
	3	0,41±0,03	0,39±0,01	0,37±0,03	0,26±0,02*
	7	0,37±0,04	0,41±0,04	0,40±0,04	0,27±0,02*
	14	0,42±0,01	0,43±0,01	0,41±0,02	0,26±0,03*
Transferrin	1	3,02±0,31	2,98±0,22	2,96±0,24	2,19±0,21*
	3	2,89±0,28	2,91±0,29	2,96±0,31	2,05±0,25*
	7	3,22±0,33	2,89±0,31	2,98±0,35	2,08±0,22
	14	3,19±0,30	3,09±0,32	3,12±0,31	2,12±0,24
Total Protein	1	25,23±2,14	24,12±1,48	20,36±1,64	18,38±1,62
	3	22,75±1,82	22,46±1,54	19,15±1,35	17,25±1,42*
	7	14,53±1,32	14,96±0,34	15,04±0,76	15,11±0,81
	14	12,15±1,03	12,64±0,45	12,75±0,15	13,12±0,78
Casein	1	1,12±0,11	1,09±0,11	1,09±0,12	1,09±0,13
	3	1,67±0,12	1,64±0,16	1,64±0,12	1,05±0,15*
	7	1,81±0,15	1,71±0,19	1,75±0,15	1,06±0,17*
	14	1,77±0,12	1,68±0,17	1,63±0,16	1,03±0,15*
Lipids	1	33,23±3,07	31,14±1,24	26,32±1,52*	23,41±1,24*
	3	34,21±2,89	32,13±1,47	27,21±1,36*	24,22±1,31*
	7	37,18±3,21	34,18±2,22	28,58±2,62*	24,78±2,92*
	14	44,25±2,83	44,55±2,45	41,84±2,46	24,85±2,45*

Note: * – the difference is significant for the control group (p<0.05).

II and III class obesity; in 1,6 (p<0,05) and 2,0 times (p<0,01) on the 3rd day; in 1,6 (p<0,05) and 2,2 times (p<0,01) on the 7thday and in 1,4 (p<0,05) and 2,1 times (p<0,01) on the 14th day.

In women of the main group with I class obesity the lactose content had no significant differences (p>0,05) in the dynamics of the studies. It should be noted that in the application of our proposed program of treatment and prevention in women with II class obesity, the level of this indicator increased from the 7th day of the postpartum period, remaining within the norm also on the 14th day. In case of III class obesity, it remained low during all 14 days of follow-up (p<0,05), (table 4).

Analyzing the lactoferin indicator it was found that it became similar to the level of control group values from 14th days of the postpartum period in the case of II class obesity. Still, it was reduced by 1,5 times in puerperas with III class obesity during 14 days (p<0,05). The content of ceruloplasmin in women of the main group with I and II class obesity did not differ from the level of the control group (p>0,05). In III class obesity puerperas it was almost 1,5 times lower than in the control group women (p<0,05).

The level of transferrin remained low and stable in case of III class obesity (p<0,05). However, the content of transferrin in peurperas with II class obesity increased to the level of reference values under our proposed program application. The level of total protein also remained low in puerperas with II and III class obesity on the 1st (p<0,05) and 3rd day of follow-up (p<0,05). It was stabilizing to the indicators of puerperal women of the control group only on the 7th and 14th day. The casein content in the breast milk of women with I and II class obesity in the main group was within the reference values, remaining consistently low at III class obesity during the entire follow-up period (p<0,05). The application of the proposed program allowed us to increase significantly the lipid content in breast milk to 14th days after delivery in women with II class obesity. However, this figure remained at a low level for all 14 days of postpartum period in III class obesity women (p<0,05).

Table 5

The content of vitamins in breast milk of the comparison group women, M±m

Indicator, mcmol/l	Day of research	Groups of women			
		Control group, n=53	Comparison group		
			I class obesity, n=49	II class obesity, n=32	III class obesity, n=22
Vitamin C	1	20,25±1,23	19,78±1,32	18,96±1,16	18,32±1,34
	3	98,62±6,47	97,52±5,87	72,44±5,42*	50,45±4,14**
	7	82,45±5,43	83,07±6,34	68,46±3,14*	49,57±3,25**
	14	68,49±5,25	70,45±6,71	42,45±3,18*	30,67±2,43**
Vitamin E	1	1,67±0,14	1,62±0,15	1,59±0,14	1,61±0,13
	3	2,53±0,24	2,48±0,21	2,43±0,22	1,78±0,12*
	7	3,02±0,31	3,11±0,29	2,89±0,27	1,82±0,13*
	14	3,11±0,32	3,03±0,28	2,91±0,28	1,84±0,14*

Notes: * – the difference is significant for the control group (p<0,05); ** – the difference is significant for the control group (p<0,01).

Table 6

The content of vitamins in breast milk of the main group women, M±m

Indicator, mcmol/l	Day of research	Groups of women			
		Control group, n=53	Main Group		
			I class obesity, n=52	II class obesity, n=35	III class obesity, n=28
Vitamin C	1	20,25±1,23	20,06±1,54	19,96±1,74	17,73±1,72
	3	98,62±6,47	96,13±5,37	94,12±5,13	76,24±5,26*
	7	82,45±5,43	82,42±4,31	82,56±4,24	80,16±4,12
	14	68,49±5,25	69,16±3,14	69,48±3,21	68,22±3,12
Vitamin E	1	1,67±0,14	1,64±0,13	1,59±0,11	1,58±0,12
	3	2,53±0,24	2,46±0,22	2,41±0,25	1,80±0,15*
	7	3,02±0,31	2,89±0,27	2,95±0,23	2,93±0,26
	14	3,11±0,32	3,01±0,25	2,97±0,25	2,86±0,24

Note: * – the difference is significant for the control group (p<0,05).

Analyzing the vitamin content of breast milk, it should be noted that the content of vitamin C in women of the control group tends to increase rapidly, starting from the 3rd day of the postpartum period. However, on the 3rd day the content of vitamin C in breast milk of puerperas with II and III class obesity of the comparison group decreased by 1,4 (p<0,05) and 2,0 times (p<0,01). The tendency continued and by 7th day it was 1,2 (p<0,05) and 1,7 times (p<0,01), by 14th day became 1,6 (p<0,05) and 2,2 times (p<0,01), compared with the indicators of women in the control group. Assessing the content of vitamin E, we found that its level decreased in women with III class obesity, starting from 3rd day of the postpartum period, compared with the same indicator of the control group puerperas (p<0,05) (table 5).

In women of the main group with III class obesity, vitamin C content in breast milk remained low on the 3rd day after delivery (p<0,05). In all other puerperas in the main group, vitamin C levels were within reference values for all 14 days of the postpartum period. The content of vitamin E were not significantly different between treatment control and treatment groups with I and II class obesity (p>0,05). In the case of the III class obesity the content of this vitamin on the 7th and 14th day after delivery entered the level of performance of women in the control group, which is quite positive comparing with the comparison group (table 6).

The content of immunoglobulins is of great importance for the qualitative evaluation of breast milk. Thus, puerperal women with III class obesity of the comparison group, the level of IgG was 2 times lower (p<0,01) than the same indicator in the control group women during 14 days of puerperium (table 7).

The content of IgA in the case of I class obesity did not differ from the same indicator of the control group women (p>0,05). However, in puerperas with II class obesity we noted the decrease in this parameter (p<0,05) starting from the 3rd days of the postpartum period. In III class obesity women this pattern was noted from the 1st day, and from the 3rd days – with a more likely degree of reliability (p<0,01). Changes in the content of IgM indicate that there are no significant differences between the control group and puerperal women with I and II class obesity. At the same time, in women with grade III class obesity from the 1st day after delivery, there was a decrease in this indicator (p<0,05), which took place up to the 14th days of observation (p<0,01), compared with the indicator of the control group women.

Analyzing the content of IgG using the proposed program, attention is paid to the increase in the values of this indicator in puerperas with III class obesity by 1,5 times (p<0,05), relative to the comparison group women. A similar pattern took place in the evaluation of the content of IgA in breast milk of the main group women. In particular, its level during the period of observation in the case of I and II class obesity did not go beyond the control values. It is worth noting that in puerperas with III class obesity, the indicators of this immunoglobulin were lower than in the control group, by 1,6 times (p<0,05). In women of the main group with III class obesity, the level of

Table 7

The content of immunoglobulins in breast milk of the comparison group women, M±m

Indicator, g/l	Day of research	Groups of women			
		Control group, n=53	Comparison group		
			I class obesity, n=49	II class obesity, n=32	III class obesity, n=22
IgG	1	0,71±0,02	0,73±0,04	0,69±0,05	0,32±0,01**
	3	0,34±0,01	0,36±0,01	0,33±0,01	0,17±0,01**
	7	0,33±0,01	0,35±0,01	0,36±0,01	0,16±0,01**
	14	0,41±0,02	0,43±0,01	0,39±0,02	0,19±0,01*
IgA	1	3,33±0,21	3,28±0,24	3,27±0,25	2,15±0,20*
	3	1,63±0,17	1,59±0,13	0,89±0,05*	0,53±0,04**
	7	2,32±0,16	2,36±0,13	1,24±0,11*	0,71±0,05**
	14	1,33±0,11	1,31±0,12	0,91±0,04*	0,45±0,01**
IgM	1	0,41±0,01	0,42±0,02	0,43±0,03	0,29±0,01*
	3	0,51±0,01	0,49±0,03	0,48±0,02	0,22±0,01**
	7	0,45±0,01	0,44±0,02	0,43±0,03	0,21±0,01**
	14	0,43±0,01	0,45±0,04	0,44±0,03	0,22±0,01**

Notes: * – the difference is significant for the control group (p<0,05); ** – the difference is significant for the control group (p<0,01)

Table 8

The content of immunoglobulins in breast milk of the main group women, M±m

Indicator, g/l	Day of research	Groups of women			
		Control group, n=53	Main Group		
			I class obesity, n=52	II class obesity, n=35	III class obesity, n=28
IgG	1	0,71±0,02	0,69±0,11	0,68±0,06	0,48±0,04*
	3	0,34±0,01	0,33±0,03	0,32±0,02	0,25±0,02*
	7	0,33±0,01	0,35±0,03	0,31±0,01	0,24±0,02*
	14	0,41±0,02	0,39±0,01	0,40±0,02	0,31±0,03*
IgA	1	3,33±0,21	3,27±0,23	3,22±0,24	2,48±0,06*
	3	1,63±0,17	1,60±0,06	1,61±0,07	0,85±0,02*
	7	2,32±0,16	2,21±0,15	2,04±0,13	1,24±0,02*
	14	1,33±0,11	1,30±0,03	1,31±0,02	0,71±0,03*
IgM	1	0,41±0,01	0,43±0,03	0,42±0,02	0,31±0,06
	3	0,51±0,01	0,49±0,03	0,48±0,04	0,39±0,02*
	7	0,45±0,01	0,46±0,01	0,41±0,03	0,36±0,02*
	14	0,43±0,01	0,44±0,03	0,42±0,04	0,32±0,03*

Note: * – the difference is significant for the control group (p<0,05).

IgM was 1,4 times lower (p<0,05) in comparison to the control group. But as for women of the comparison group, it was almost 1,5 times higher (table 8).

Thus, the results of the study of lactation function in obese puerperas indicate the absence of significant changes in almost all qualitative and quantitative parameters of breast milk with a body mass index of 30,0–34,9 kg/m2. In the case of body mass index increase of more than 35,0 kg/m2 there is a state of hypogalactia and pathological changes in the quality of breast milk, which are manifested by a decrease in the level of lactose, lactoferin, ceruloplasmin, transferrin, casein, total protein, lipids, vitamin C, E, IgA, IgM, IgG. The lack of effectiveness of «traditional monitoring» dictated the need to develop and implement a program of therapeutic and preventive measures for this contingent of women.

The application of our developed program made it possible to reduce the frequency of pathological qualitative and quantitative changes in breast milk in women with obesity and gives grounds to recommend it for wide use in health care practice.

CONCLUSIONS

1. Assessment of lactation in postpartum women with obesity found the condition of hypogalactia and pathological changes in the qualitative breast milk content, which is indicated by the decrease in the level of lactose and lactoferrin by 1,6 times (p<0,05), total protein, ceruloplasmin by 2,2 times (p<0,01), lipids by 2,1 times (p<0,01), transferrin by 1,4 times (p<0,05), casein by 1,5 times (p<0,05), vitamin C by 1,8 times (p<0,01) and E by 1,5 times (p<0,05) as well as IgG by 2,1 times (p<0,01), IgM by 1,9 times (p<0,01), IgA by 2,2 times (p<0,01).

2. The severity of hypogalactia and pathological changes in the breast milk quality increase with increasing of body mass index.

3. A pathogenetically justified program of therapeutic and preventive measures promoted to increase of the breast milk volume by 1,5 times (p<0,05) and its quality improve. This fact is confirmed by increase of lactose and lactoferin content by 1,2 times, ceruloplasmin, transferrin, casein and total protein by 1,5 times, lipids content by 1,3 times as well as vitamin C and E by content 1,4 times, IgG and IgM by 1,5 times and IgA by 1,4 times (p<0,05).

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