Uniwersytet Medyczny im. Piastów Śląskich we Wrocławiu
Wydział Lekarski

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„Analiza doświadczeń i wiedzy Polskich matek oraz personelu medycznego w zakresie laktacji i jej wybranych aspektów.”

"Analysis of the experiences and knowledge of Polish mothers and medical staff in the field of lactation and its selected aspects."

Praca doktorska została wykonana w Katedrze i Klinice Neonatologii
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Promotor:
prof. dr. hab. n. med. Barbara Królak - Olejnik

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Podziękowania

Pragnę w szczególny sposób podziękować
Pani prof. dr hab. n. med. Barbarze Królak-Olejnik,
promotor mojej pracy doktorskiej,
za pomoc, motywację, cenne wskazówki udzielone w trakcie realizacji pracy,
a także za okazywaną życzliwość oraz dzielenie się wiedzą i naukowym doświadczeniem.

Serdecznie dziękuję moim Rodzicom
za nieustanne wsparcie i pomoc.

SPIS TREŚCI.

WYKAZ SKRÓTÓW.

AAP - Amerykańska Akademia Pediatrii (ang. American Academy of Pediatrics)

ACOG - Amerykańskie Kolegium Ginekologów i Położników (ang. American College of Obstetricians and Gynecologists)

C_{kor} – skorygowany współczynnik korelacji

DHA - kwas dokozaheksaenowy

EPA – kwas eikozapentaenowy

ESPGHAN - Europejskie Towarzystwo Gastroenterologii Dziecięcej Hepatologia i Żywienia (ang. European Society for Paediatric Gastroenterology Hepatology and Nutrition)

USK – Uniwersytecki Szpital Kliniczny

WHO - Światowa Organizacja Zdrowia (ang, World Health Organization)

1. PUBLIKACJE ZAWARTE W ROZPRAWIE DOKTORSKIEJ.

Rozprawa doktorska powstała w oparciu o monotematyczny cykl pięciu artykułów opublikowanych w międzynarodowych czasopismach naukowych indeksowanych w bazie PubMed i / lub uwzględnionych na liście Journal Citation Reports, znajdujących się w wykazie czasopism naukowych Ministerstwa Nauki i Szkolnictwa Wyższego (MNiSW), oraz w polskim czasopiśmie naukowym spoza listy MNiSW.

Pierwszą pracą spośród cyklu jest przegląd systematyczny piśmiennictwa dotyczącego wpływu diety wegetariańskiej, w tym wegańskiej na skład mleka kobiecego. Pracę opublikowano w wersji elektronicznej w 2020 r., wydano drukiem w 2021 r. w czasopiśmie *Critical Reviews in Food Science and Nutrition*. W pracy przedstawiono aktualny stan wiedzy na temat zależności między nawykami żywieniowymi matki w okresie laktacji a składem jej mleka.

Kolejne dwie prace wchodzące w skład cyklu prezentują wyniki badania przekrojowego, dotyczącego wiedzy i opinii związanych z tematyką diety matki w okresie laktacji. Badanie przeprowadzono w 2019 r. z wykorzystaniem elektronicznych kwestionariuszy ankietowych w grupie 1159 respondentów: polskich matek, które urodziły dzieci w terminie porodu i karmiły je własnym mlekiem oraz personelu medycznego niezależnie od płci i dzietności.

W czwartej pracy przedstawiono wyniki badania przekrojowego dotyczącego wiedzy i opinii matek w okresie laktacji w zakresie możliwości stosowania własnego mleka w celach pozażywieniowych oraz doświadczeń w stosowaniu własnego mleka jako “domowego środka leczniczego”. W publikacji omówiono dane dotyczące stosowania mleka kobiecego w profilaktyce i leczeniu schorzeń błon śluzowych. Badanie przeprowadzono w 2018 r. z wykorzystaniem elektronicznych kwestionariuszy ankietowych w grupie 1187 kobiet karmiących piersią, niezależnie od czasu trwania laktacji.

Ostatnia praca opublikowana w Standardach Medycznych, które są źródłem wiedzy dla pediatrów i lekarzy rodzinnych, stanowi syntezę niepublikowanych lub opublikowanych w ograniczonym zakresie danych z wyżej wymienionych dwóch badań przekrojowych.

Na rozprawę doktorską składają się następujące artykuły:

1. Karcz K, Królak-Olejnik B. Vegan or vegetarian diet and breast milk composition - a systematic review. Crit Rev Food Sci Nutr. 2021; 61(7):1081-1098. doi:10.1080/10408398.2020.1753650 Epub 2020 Apr 22 (IF: 11,176 MNiSW: 200 punktów).

2. Karcz K, Lehman I, Królak-Olejnik B. Foods to Avoid While Breastfeeding? Experiences and Opinions of Polish Mothers and Healthcare Providers. Nutrients. 2020; 12(6):1644. doi:10.3390/nu12061644 (IF: 5,717 MNiSW: 140 punktów).
3. Karcz K, Lehman I, Królak-Olejnik B. The link between knowledge of the maternal diet and breastfeeding practices in mothers and health workers in Poland. Int Breastfeed J. 2021; 16(1):58. doi:10.1186/s13006-021-00406-z (IF: 3,461 MNiSW: 100 punktów).
4. Karcz K, Walkowiak M, Makuch J, Olejnik I, Królak-Olejnik B. Non-Nutritional Use of Human Milk Part 1: A Survey of the Use of Breast Milk as a Therapy for Mucosal Infections of Various Types in Poland. Int J Environ Res Public Health. 2019; 16(10):1715. doi:10.3390/ijerph16101715 (IF: 2,849 MNiSW: 140 punktów).
5. Karcz K, Królak-Olejnik B. Wiedza personelu medycznego i matek karmiących piersią dotyczące wybranych aspektów laktacji - "diety" i pozażywieniowego zastosowania mleka. (Medical personnel and breastfeeding mothers knowledge of selected aspects of lactation - "diet" and non-nutritional use of breast milk). Stand Med Pediatr. 2021; 18(3):377-385. (MNiSW: 5 punktów).

Łączna wartość współczynnika oddziaływania (IF) według Impact Factor List dla wymienionego cyklu wynosi 23,203 oraz 585 punktów według wykazu czasopism naukowych Ministerstwa Nauki i Szkolnictwa Wyższego (Komunikat Ministra Edukacji i Nauki z dnia 21 grudnia 2021 r. w sprawie wykazu czasopism naukowych i recenzowanych materiałów z konferencji międzynarodowych).

Wszystkie artykuły zostały zamieszczone w wersji opublikowanej przez czasopisma.

2. OMÓWIENIE.

2.1. Wstęp.

Karmienie piersią jest preferowanym sposobem żywienia niemowląt na całym świecie [1 - 5]. Skład mleka kobiecego, z uwagi na zrównoważone i dostosowane do potrzeb dziecka proporcje składników odżywczych (głównie białka i tłuszczu) oraz liczne substancje bioaktywne (immunoglobuliny, prebiotyki, probiotyki i postbiotyki, cytokiny, komponenty układu dopełniacza, enzymy), umożliwia optymalny wzrost i rozwój niemowlęcia, w tym dojrzewane jego układu immunologicznego [6, 7]. Ponadto, zmniejsza ryzyko wystąpienia chorób autoimmunologicznych, chorób atopowych, alergii i nietolerancji pokarmowych, infekcji układu oddechowego i pokarmowego, rozwoju otyłości i zespołu metabolicznego, a także wpływa pozytywnie na zdolności poznawcze, rozwój siatkówki oka i mielinizację układu nerwowego [1, 2]. Karmienie piersią zapewnia liczne korzyści zdrowotne nie tylko dla niemowląt, ale także matek - zmniejsza ryzyko rozwoju nowotworów piersi, jajników i macicy, redukuje ryzyko zachorowania na cukrzycę typu 2, nadciśnienie tętnicze i osteoporozę [1, 2]. Karmienie piersią zostało uznane za kliniczny złoty standard żywienia niemowląt a organizacje światowe, m.in. Światowa Organizacja Zdrowia (WHO) [1, 2], Amerykańska Akademia Pediatrii (AAP) [3], Amerykańskie Kolegium Ginekologów i Położników (ACOG) [4], Europejskie Towarzystwo Gastroenterologii Dziecięcej Hepatologia i Żywienia (ESPGHAN) [5] zalecają wyłączne karmienie naturalne przez pierwszych 6. miesięcy życia dziecka, z jego kontynuacją w czasie wprowadzania pokarmów uzupełniających, do 12. [3] lub 24. [1, 2] miesiąca życia dziecka, lub dłużej.

W 2017 r. w Polsce odnotowano wysoki odsetek kobiet rozpoczynających piersią po porodzie (97%), ale niestety szybko następuje obniżanie wskaźnika wyłącznego karmienia piersią w kolejnych miesiącach życia dziecka - 43,5% w 2. miesiącu, 28,9% w 4. miesiącu i 4% w 6 miesiącu. Co więcej, dokarmianie mieszanką mleczną dla niemowląt zwykle ma początek już w pierwszych dniach po porodzie [8]. Jednym z uznanych czynników, które mają znaczący wpływ na inicjację i rozwój laktacji jest skuteczne wsparcie laktacyjne udzielone w okresie okołoporodowym. Zależy ono nie tylko od wiedzy personelu medycznego sprawującego opiekę nad matką i noworodkiem, a także umiejętności udzielenia wsparcia, instruktażu, efektywnej komunikacji, a przede wszystkim właściwej edukacji. W Polsce szkolenia specjalistyczne w zakresie karmienia piersią odbywają się w formie dobrowolnych kursów podyplomowych, podczas gdy program studiów wyższych dla np. położnych i lekarzy

nie uwzględnia tematyki laktacji i jej praktycznych aspektów w wystarczającym zakresie [9]. W latach 2009 - 2011 i 2017 - 2018 wykazano, że polski personel medyczny nie jest odpowiednio przygotowany do zapewnienia wykwalifikowanego wsparcia laktacyjnego [9 - 12]. Natomiast, wiedza matek o karmieniu piersią, żywieniu dzieci oraz zasadach odżywiania się w okresie laktacji w dużym stopniu zależy od jakości otrzymanego wsparcia laktacyjnego i informacji przekazanych przez personel medyczny [8, 10 - 13]. Zatem, poprawa jakości opieki zdrowotnej nad matką i niemowlęciem i wzrost wskaźników karmienia piersią zostały uwzględnione wśród celów operacyjnych Narodowego Programu Zdrowia na lata 2016 - 2020 [14]. Do działań niezbędnych do zapewnienia powodzenia karmienia piersią zaliczono m.in. identyfikację czynników ryzyka wczesnego zaprzestania karmienia piersią, wczesne rozpoznanie potencjalnych problemów z karmieniem piersią oraz edukację żywieniową [14].

Niestety mity dotyczące laktacji i diety matki karmiącej piersią zostały dość mocno zakorzenione w społeczeństwie polskim – są one powielane nie tylko przez matki, ale także personel medyczny [11]. Przede wszystkim błędne opinie dotyczą produktów dozwolonych i zabronionych w diecie matki karmiącej piersią, wpływu diety na skład jakościowy i ilościowy mleka kobiecego (zwłaszcza w aspekcie „niepełnowartościowego" mleka matek wegetarianek i weganek), związku między spożywaniem określonych produktów a stanem zdrowia dziecka i korzyści z „profilaktycznej" eliminacji produktów potencjalnie alergizujących z diety matki [10 - 12, 15].

Laktacja jest stanem fizjologicznym, zatem zgodnie z aktualną wiedzą medyczną, dieta matki karmiącej piersią powinna być dietą zbilansowaną, zróżnicowaną, opartą na piramidzie żywienia, celem pokrycia dobowego zapotrzebowania na poszczególne składniki odżywcze i energię [16, 17]. Eliminacja wybranych grup produktów pokarmowych jest wskazana wyłącznie w przypadku stwierdzenia objawów ich nietolerancji u matki lub dziecka, natomiast nie jest rekomendowana w celach profilaktycznych - nie tylko nie wykazano wpływu na zmniejszenie częstości występowania alergii, kolki lub innych zaburzeń funkcji przewodu pokarmowego u niemowląt, ale stwierdzono zwiększone ryzyko rozwoju alergii u dzieci w późniejszym wieku (z uwagi na ograniczoną ekspozycję na alergeny w mleku matki) [16 - 19]. Należy pamiętać, że w przypadku każdej diety eliminacyjnej wzrasta ryzyko niedoborów pokarmowych u matki. Niemniej jednak kobiety, których podstawę żywienia stanowi dieta wegetariańska, w tym wegańska, mogą karmić piersią. Dieta wykluczająca produkty pochodzenia zwierzęcego wiąże się ze zwiększonym ryzykiem niedoboru żelaza, witaminy B12, wapnia, kwasu DHA, dlatego należy zwrócić szczególną uwagę na właściwe

zbilansowanie codziennego jadłospisu oraz odpowiednią suplementację mikroelementów, aby pokryć dzienne zapotrzebowanie na składniki odżywcze [20].

Presja wywierana na matki z uwagi na ich sposób odżywiania, nadrozpoznawalność alergii na białka mleka krowiego u niemowląt, zalecanie profilaktycznej diety eliminacyjnej matkom oraz przypisywanie obserwowanych u niemowląt karmionych pokarmem kobiecym dolegliwości (kolki, częsty płacz, zmiany skórne) "błędom dietetycznym" matki mogą przyczyniać się do skrócenia czasu karmienia piersią wskutek częstszego karmienia mlekiem modyfikowanym i rezygnacji z karmienia naturalnego [10]. Brak adekwatnego wsparcia laktacyjnego ze strony personelu medycznego może skłaniać matki do samodzielnego poszukiwania wiedzy i korzystania z poradnictwa z innych, często niezweryfikowanych źródeł. Korzystanie z internetu stanowi niestety wśród Polaków popularną metodę pozyskiwania informacji dotyczących zdrowia [21]. Ponadto, wiedza o właściwościach immunomodulujących mleka kobiecego i błędne przekonanie o jego wysokiej czystości biologicznej, skłania pacjentki do wykorzystywania własnego mleka w celach pozażywieniowych, w tym "leczniczych", mimo braku jednoznacznych i silnych dowodów naukowych potwierdzających zasadność tych praktyk [22].

2.2. Cel badań, problemy badawcze.

Głównym celem badań była ocena wiedzy polskich matek i personelu medycznego w zakresie wybranych aspektów laktacji oraz analiza związanych z nimi doświadczeń. Szczegółowa analiza dotyczyła:

- rozpowszechnienia poglądów na temat "diety matki karmiącej", produktów dozwolonych lub niedozwolonych do spożycia w okresie laktacji, zasadności stosowania profilaktycznych diet eliminacyjnych oraz wpływu sposobu odżywiania matki na skład mleka i stan zdrowia jej dziecka;
- porównania wiedzy personelu medycznego oraz matek niewykonujących zawodów medycznych w zakresie żywienia w okresie laktacji;
- wpływu wiedzy o "diecie matki karmiącej" i doświadczeń własnych matek w tym temacie na przebieg okresu laktacji;
- w przypadku personelu medycznego, także wpływu wiedzy o "diecie matki karmiącej" i doświadczeń własnych w tym temacie na poradnictwo laktacyjne udzielane pacjentkom;

- wiedzy, nastawienia i praktyk związanych ze stosowaniem mleka kobiecego w celach pozażywieniowych przez matki w okresie laktacji.

2.3. Materiał.

2.3.1. Materiał (dotyczy artykułów nr 2, 3, 5).

Pierwsze badanie przekrojowe dotyczyło wiedzy i opinii związanych z dietą matki w okresie laktacji, w tym: zaleceń dotyczących spożywania poszczególnych produktów, wpływu sposobu odżywiania matki na skład mleka kobiecego i jego właściwości, związku między dietą matki a objawami i dolegliwościami obserwowanymi u niemowląt. Badanie to było skierowane do polskich matek, które urodziły zdrowe dzieci w terminie porodu i karmiły je piersią lub własnym mlekiem nie bezpośrednio z piersi, oraz do personelu medycznego niezależnie od płci i dzietności. Otrzymano 1180 wypełnionych kwestionariuszy, z których 1159 zakwalifikowano do dalszej analizy.

Kryteria włączenia:
- zgoda na udział w badaniu;
- matki, które urodziły zdrowe dzieci w terminie porodu i karmiły je własnym mlekiem niezależnie od metody i czasu trwania karmienia;
- personel medyczny (lekarze, pielęgniarki, położne), niezależnie od wieku, płci i dzietności, który w swojej praktyce zawodowej sprawuje opiekę nad kobietami w okresie laktacji i/lub ich dziećmi.

Kryteria wyłączenia:
- brak zgody na udział w badaniu;
- mężczyźni nie będący przedstawicielami personelu medycznego;
- kobiety nie będące przedstawicielami personelu medycznego, które urodziły dziecko przedwcześnie;
- kobiety nie będące przedstawicielami personelu medycznego, które nie karmiły swojego dziecka własnym pokarmem;
- kobiety nie będące przedstawicielami personelu medycznego, które nie urodziły żadnego dziecka.

2.3.2. Materiał (dotyczy artykułów nr 4, 5).

Drugie badanie przekrojowe dotyczyło wiedzy i opinii matek w okresie laktacji w zakresie możliwości stosowania własnego mleka w celach pozażywieniowych oraz doświadczeń w stosowaniu własnego mleka jako "domowego środka leczniczego". Otrzymano 1218 wypełnionych kwestionariuszy, z których 1187 zakwalifikowano do dalszej analizy.

Kryteria włączenia:
- zgoda na udział w badaniu;
- kobiety w okresie laktacji, niezależnie od czasu jej trwania.

Kryteria wyłączenia:
- brak zgody na udział w badaniu;
- kobiety nie karmiące dziecka własnym mlekiem / kobiety poza aktualnie trwającym okresem laktacji.

2.4. Metody.

2.4.1. Metody (dotyczy artykułów nr 2, 3, 5).

Badanie przeprowadzono z wykorzystaniem kwestionariusza ankietowego udostępnionego w formie elektronicznej. Kwestionariusz został przygotowany w języku polskim i składał się z 3 części: 1) pytań zamkniętych jednokrotnego wyboru ("Tak" / "Nie") sprawdzających czy w opinii respondentów matka karmiąca piersią może spożywać poszczególne produkty; 2) pytań zamkniętych jednokrotnego wyboru ("Prawda" / "Fałsz"), w których respondenci zostali poproszeni o ocenę prawdziwości stwierdzeń dotyczących diety matki w okresie laktacji, związku między sposobem odżywiania się matki a dolegliwościami obserwowanymi u niemowlęcia karmionego jej mlekiem, oraz zależności między dietą a składem mleka kobiecego; 3) pytań jednokrotnego wyboru spośród listy odpowiedzi dotyczących danych demograficznych i informacji pomocniczych, na podstawie których oceniono, czy respondent spełnił kryteria włączenia do badania. Listy produktów i stwierdzeń, uwzględnione w kwestionariuszu, zostały przygotowane na podstawie informacji rozpowszechnionych w internecie, głównie na stronach internetowych poświęconych tematyce rodzicielstwa, blogach i forach dyskusyjnych dla rodziców, a także pozyskanych bezpośrednio

od matek, których dzieci były hospitalizowane bądź konsultowane w Klinice Neonatologii USK we Wrocławiu.

Przed rozpoczęciem właściwego badania, przeprowadzono badanie testowe wśród losowo wybranych 10 kobiet, których dzieci były hospitalizowane w Klinice - uzyskano pozytywne opinie odnośnie budowy kwestionariusza i pełnego zrozumienia zawartych w nim pytań.

Właściwe badanie przeprowadzono w miesiącach styczeń - luty 2019 r. Celem uzyskania danych dotyczących jak najliczniejszej i najbardziej różnorodnej populacji respondentów, informacja o projekcie została zamieszczona w mediach społecznościowych, na forach dyskusyjnych i stronach internetowych dotyczących tematyki rodzicielstwa i laktacji. Uzyskane odpowiedzi były automatycznie kodowane celem anonimizacji, a następnie zostały zbiorczo poddane analizie statystycznej.

2.4.2. Metody (dotyczy artykułów nr 4, 5).

Badanie przeprowadzono w miesiącach listopad - grudzień 2018 r., z wykorzystaniem elektronicznego kwestionariusza ankietowego. Kwestionariusz został przygotowany wyłącznie w języku polskim i składał się z 2 części: 1) pytań dotyczących danych demograficznych - w formie jednokrotnego wyboru lub krótkiej odpowiedzi; 2) pytań zamkniętych jedno- lub wielokrotnego wyboru oceniających czy respondentki kiedykolwiek miały styczność z informacjami na temat możliwości stosowania własnego mleka w celach pozażywieniowych oraz odnoszących się do źródeł pochodzenia powyższych informacji, doświadczeń z wykorzystywaniem ich w praktyce i deklaracji odnośnie chęci wypróbowania kolejnych z wymienionych metod w przyszłości. Lista potencjalnych zastosowań mleka kobiecego, uwzględniona w kwestionariuszu, została przygotowana na podstawie informacji rozpowszechnionych w internecie, głównie na stronach internetowych poświęconych tematyce rodzicielstwa, blogach i forach dyskusyjnych dla rodziców, a także pozyskanych bezpośrednio od matek, których dzieci były hospitalizowane bądź konsultowane w Klinice Neonatologii USK we Wrocławiu.

Podobnie jak w przypadku poprzedniego badania, informacja o projekcie uwzględniająca opis docelowej grupy respondentów oraz link do kwestionariusza ankietowego zostały rozpowszechnione drogą elektroniczną, głównie za pośrednictwem mediów społecznościowych. Dane zgromadzono w formie zanonimizowanej, a następnie przeprowadzono ich analizę statystyczną.

2.5. Etyka.

Przed rozpoczęciem badań, każdy z projektów został pozytywnie zaopiniowany przez Komisję Bioetyczną Uniwersytetu Medycznego we Wrocławiu, Nr KB 519/2019 i Nr KB 703/2018. Udział w badaniach był w pełni dobrowolny, a respondenci nie otrzymali gratyfikacji za wypełnienie kwestionariuszy. Uczestnicy zostali poinformowani o anonimizacji gromadzonych danych, a w przypadku badania dotyczącego stosowania mleka kobiecego w celach pozażywieniowych - o nieedukacyjnym charakterze kwestionariusza i braku dowodów naukowych na zasadność wykorzystywania w praktyce wymienionych potencjalnych zastosowań pokarmu matczynego.

2.6. Podsumowanie wyników.

Krótko omówiono artykuły 1 - 5, stanowiące podstawę rozprawy doktorskiej.

2.6.1. Artykuł nr 1 pt.: "Vegan or vegetarian diet and breast milk composition - a systematic review".

Artykuł stanowi przegląd systematyczny dostępnych publikacji światowych w zakresie wpływu diety roślinnej (wegetariańskiej lub wegańskiej) matki na skład produkowanego przez nią mleka, przede wszystkim w zakresie makroskładników: białka, tłuszczu całkowitego i rodzaju kwasów tłuszczowych, laktozy jako głównego cukru mlecznego, a także wybranych mikroskładników: witaminy B12, kwasu foliowego i składników mineralnych (m.in. selenu, żelaza, miedzi, cynku, wapnia, magnezu, potasu i sodu). W artykule podsumowano również aktualną wiedzę dotyczącą zależności między nawykami żywieniowymi kobiet, stanem ich odżywienia, a składem mleka kobiecego. Na podstawie analizy piśmiennictwa potwierdzono, że niezależnie od wyborów żywieniowych, stan odżywienia i stan zdrowia kobiet oraz właściwie zbilansowana dieta mają istotny wpływ na skład mleka kobiecego. W związku z powyższym, zarówno matki odżywiające się w sposób tradycyjny, jak i wegetarianki czy weganki produkują mleko matki o porównywalnej wartości odżywczej, z niewielkimi różnicami w zakresie profilu kwasów tłuszczowych (w tym DHA i EPA) i niektórych mikroskładników, przede wszystkim witaminy B12. Zatem, niezbędna jest ich odpowiednia suplementacja rekompensująca potrzeby żywieniowe matki karmiącej.

2.6.2. Artykuł nr 2 pt.: "Foods to Avoid While Breastfeeding? Experiences and Opinions of Polish Mothers and Healthcare Providers."

W publikacji przedstawiono wyniki badania wiedzy i opinii matek (reprezentujących ogół społeczeństwa) oraz personelu medycznego w zakresie problematyki żywienia w okresie laktacji - w aspekcie możliwości spożywania poszczególnych produktów przez kobiety karmiące piersią. Lista artykułów spożywczych, w stosunku do których powstało wiele sprzecznych opinii i mitów związanych z włączaniem ich do codziennej diety matek karmiących, została przygotowana na podstawie informacji znalezionych w Internecie, zawartych w rozpowszechnianych ulotkach dla pacjentów lub otrzymanych bezpośrednio od kobiet w okresie laktacji i personelu medycznego. W rezultacie, respondenci zostali zapytani, czy matka karmiąca piersią może spożywać kolejno wymienionych 17 produktów: tatar, sushi, miód, grzyby, ser (w tym ser pleśniowy), kapustę, rośliny strączkowe, czekoladę, napoje gazowane (w tym wodę gazowaną), kawę, cytrusy, owoce pestkowe, orzechy, nabiał, czosnek, cebulę i pikantne potrawy.

Ankietę wypełniło 407 (35%) osób personelu medycznego i 752 (65%) matek wykonujących zawody niemedyczne. Łącznie badanie dotyczyło 1074 matek, które kiedykolwiek karmiły dziecko piersią. Częstość udzielenia poprawnych odpowiedzi wśród wszystkich badanych wynosiła od 68,94% do 99,14%. W odniesieniu do 12 z 17 pozycji (70,59%) poprawnych odpowiedzi udzieliło ponad 90% respondentów. Dla żadnego z 17 produktów nie wykazano statystycznie istotnej różnicy w odsetku poprawnych odpowiedzi otrzymanych od matek i personelu medycznego zajmującego się opieką poporodową ($p > 0,05$ w teście U Manna-Whitneya).

Na podstawie analizy regresji, typ wykonywanego zawodu (medyczny / niemedyczny) nie miał istotnego wpływu na udzielone przez respondentów odpowiedzi ($p > 0,05$). Nie wykazano również istotnego związku między poprawnością odpowiedzi a karmieniem dziecka mieszanką mleczną wskutek stosowania zaleconej diety eliminacyjnej w czasie karmienia piersią ($p > 0,05$). Co więcej, w przypadku czynników takich jak: dieta eliminacyjna w czasie karmienia piersią pierwszego dziecka i przestrzeganie diety eliminacyjnej z powodu zaleceń lekarza wykazano negatywny wpływ na częstość udzielenia poprawnej odpowiedzi przez respondentów ($p < 0,05$). Jednakże, w odniesieniu do drugiego z wyżej wymienionych, odsetek poprawnych odpowiedzi był wyższy. Jedyną zmienną, wobec której wykazano słabą pozytywną zależność z odsetkiem poprawnych odpowiedzi był czas karmienia piersią pierwszego dziecka ($p < 0,05$).

Spośród wszystkich ankietowanych matek, blisko 30% podało, że rozpoczęło dietę eliminacyjną w czasie laktacji - w ponad 70% decyzja o wykluczeniu z codziennego jadłospisu wybranych produktów wynikała z zaleceń lekarskich, w pozostałych przypadkach głównie z presji rodziny i znajomych. Około 17% matek z powodu restrykcji żywieniowych zdecydowało o zakończeniu karmienia naturalnego i karmieniu dziecka mieszanką mleczną. Wśród przedstawicieli personelu medycznego, 15% przyznało, że rekomendowało swoim pacjentkom profilaktyczną dietę eliminacyjną w okresie laktacji.

Mimo że respondenci prezentowali dobry poziom wiedzy w zakresie dopuszczalności spożywania wybranych grup produktów w okresie laktacji, część badanych tj. ok. 10 – 30% w zależności od produktu, kwestionowała uwzględnienie niektórych pokarmów w codziennej diecie podczas karmienia piersią. Co więcej, matki, które stosowały dietę eliminacyjną w czasie laktacji częściej udzielały niepoprawnych odpowiedzi, co może wynikać z jakości i rzetelności przekazanej im wiedzy oraz świadczyć o przekonaniu matek o zasadności stosowania profilaktycznej diety hipoalergicznej.

Poza prezentacją wyników przeprowadzonego badania przekrojowego dotyczącego "diety matki karmiącej", w artykule podsumowano aktualne rekomendacje dietetyczne dla kobiet w okresie laktacji.

2.6.3. Artykuł nr 3 pt.: "The link between knowledge of the maternal diet and breastfeeding practices in mothers and health workers in Poland."

W publikacji przedstawiono problem rozpowszechnionych w Polsce mitów dotyczących żywienia matek karmiących piersią. Mity odnoszą się głównie do związku między sposobem odżywiania matki a stanem dziecka karmionego jej mlekiem, w tym bezpieczeństwa spożywania poszczególnych artykułów spożywczych przez matkę i jej dziecko oraz występowania niepożądanych objawów u niemowląt (m.in. kolki, alergie, nasilony płacz). Dotyczą one również składu mleka kobiecego i jego związku z żywieniem matki oraz wpływu spożywania poszczególnych produktów na objętość mleka i przebieg laktacji. Ostatecznie w pracy zaprezentowano wyniki dotyczące 23 twierdzeń.

Wykazano, że wiedza respondentów dotycząca zależności między dietą matki a składem jej mleka (białka, tłuszcze, mikroskładniki) jest stosunkowo niska - odsetek prawidłowych odpowiedzi na pytania wynosił 42 - 61%. Większość respondentów poprawnie wskazała, że niektóre substancje, w tym smaki, zapachy, aromaty, mogą przenikać do mleka matki (80,5%), jednakże tylko 57% wiedziało, że na smak mleka mogą wpływać pikantne

potrawy. Analiza regresji wykazała, że do czynników, które istotnie wpłynęły na odsetek poprawnych odpowiedzi wśród uczestników badania należały: wykonywanie zawodu medycznego, czas trwania karmienia piersią i dzietność ($p < 0,05$).

W pytaniach dotyczących wiedzy ogólnej o żywieniu w okresie laktacji respondenci wykazali dobry poziom wiedzy - w przypadku 5 z 7 zagadnień odsetek poprawnych odpowiedzi wynosił powyżej 90%. Mimo, iż zdecydowana większość respondentów (93,2%) poprawnie wskazała, że dieta w okresie laktacji powinna być zbilansowana, podobnie jak dla każdej innej osoby dorosłej, tylko 73,7% wszystkich uczestników wiedziało, że nie ma konkretnych zaleceń żywieniowych dla matek karmiących poza pokryciem zwiększonego zapotrzebowania na poszczególne składniki odżywcze. Również ponad 90% ankietowanych była świadoma, że dietę eliminacyjną należy rozpocząć tylko w przypadku odpowiednich wskazań medycznych, a profilaktyczne wykluczanie wybranych grup artykułów spożywczych z codziennego jadłospisu nie uchroni dziecka przed rozwojem alergii, wystąpieniem kolki niemowlęcej, czy innych zaburzeń czynnościowych przewodu pokarmowego. Nie mniej jednak, blisko 16% ankietowanych uważało, że w okresie karmienia piersią nie należy spożywać produktów smażonych i ciężkostrawnych. Analiza regresji wykazała, że do czynników, które istotnie wpłynęły na odsetek poprawnych odpowiedzi wśród respondentów, należały: wykonywanie zawodu medycznego, stosowanie diety eliminacyjnej w czasie karmienia piersią i stosowanie diety eliminacyjnej z powodu zaleceń lekarza ($p < 0,05$).

W pytaniach dotyczących wpływu diety matki na przebieg procesu laktacji i dobrostan dziecka, respondenci wykazali bardzo dobry poziom wiedzy w przypadku 7 twierdzeń odnoszących się do m.in. spożywania kawy, nasion strączkowych, produktów potencjalnie alergizujących, kolki niemowlęcej, przerywanego snu dziecka i jego płaczu, oraz galaktogennych właściwości herbaty bawarki - ponad 85% poprawnych odpowiedzi. Nieco mniej, gdyż 78,3% respondentów właściwie uznało, że zmiany skórne zlokalizowane na twarzy dziecka nie zawsze wskazują na alergię na białka mleka. Najmniej, odpowiednio tylko 29,2% i 39,9% ankietowanych zakwestionowało przydatność picia piwa lub dużych ilości wody celem zwiększenia produkcji mleka. Analiza regresji wykazała, że do czynników, które istotnie wpłynęły na odsetek poprawnych odpowiedzi wśród respondentów, należały: czas karmienia piersią pierwszego dziecka, wykonywanie zawodu medycznego, stosowanie diety eliminacyjnej w czasie karmienia piersią i stosowanie diety eliminacyjnej z powodu zaleceń lekarza ($p < 0,05$).

Ponadto, w odniesieniu do rekomendowania profilaktycznych restrykcji dietetycznych pacjentkom karmiącym piersią przez personel medyczny, stwierdzono że praktyki te w istotny

sposób zależały od dzietności ($p < 0,001$) i samostosowania diety eliminacyjnej w okresie laktacji ($p < 0,001$). Wśród wszystkich matek, wykazano istotną dodatnią korelację między podjęciem ograniczeń dietetycznych w okresie karmienia piersią i stosowaniem mieszanki mlecznej dla niemowląt ($p < 0,001$).

Wyniki badania sugerują, że doświadczenie wprowadzenia diety eliminacyjnej podczas karmienia piersią istotnie kształtuje opinię matek na temat wpływu żywienia na jakość mleka kobiecego oraz dobrostan dziecka karmionego mlekiem matki. Stwierdzenie to dotyczy również kobiet, wykonujących zawody medyczne. Ponadto, porównując dane uzyskane wśród personelu medycznego i pozostałych matek, proporcje poprawnych odpowiedzi były porównywalne w obu grupach respondentów. Z jednej strony może to świadczyć o rosnącej świadomości w zakresie podstawowej wiedzy laktacyjnej i prowadzić do redukcji przywiązania do powszechnych mitów, z drugiej, niewystarczająca wiedza w zakresie wybranych aspektów laktacji wśród personelu medycznego może prowadzić do nieadekwatnego poradnictwa laktacyjnego, a zatem wpływać na dalsze decyzje związane z wyborami żywieniowymi matek, w tym dotyczące żywienia niemowląt.

2.6.4. Artykuł nr 4 pt.: "Non-Nutritional Use of Human Milk Part 1: A Survey of the Use of Breast Milk as a Therapy for Mucosal Infections of Various Types in Poland."

Artykuł odnosi się do badania przekrojowego dotyczącego stosowania mleka kobiecego w celach pozażywieniowych - zaprezentowano wyniki w zakresie aplikacji mleka na błony śluzowe (m.in. oka, nosa, gardła, przewodu słuchowego). Przeanalizowano odpowiedzi 1187 matek, spośród których 768 przyznało, że kiedykolwiek miało styczność z informacjami o zastosowaniach mleka kobiecego w profilaktyce i leczeniu schorzeń błon śluzowych, a 404 wypróbowało przynajmniej jedno z zastosowań w praktyce, co świadczy o dość dużym zainteresowaniu matek możliwością używania własnego mleka jako środka leczniczego. Najczęściej znane zastosowania obejmowały: leczenie przeziębienia, w tym kataru (jako krople do nosa) ($n = 604$), leczenie zapalenia spojówek ($n = 410$) oraz leczenie zatkanego kanalika łzowego (jako krople do oczu) ($n = 308$). Wymienione zastosowania były również najczęściej wykorzystywane przez respondentki (kolejno $n = 281$, $n = 99$, $n = 115$). Stwierdzono, że znajomość potencjalnych właściwości leczniczych mleka kobiecego korelowała z czasem trwania laktacji ($C_{kor} = 0,286$ $p < 0,001$). Natomiast, dodatni wywiad w kierunku ich praktycznego wykorzystania zależał od długości karmienia piersią ($C_{kor} = 0,248$ $p < 0,001$) i dzietności ($C_{kor} = 0,186$ $p < 0,005$). Ponadto, większość matek zadeklarowała chęć

korzystania z wybranych pozażywieniowych zastosowań mleka w przyszłości - 19 z 23 przykładowych metod zyskało poparcie ponad 50% matek, wypróbowanie pozostałych 4, w tym m.in. do pielęgnacji soczewek kontaktowych, zadeklarowało 20-50% ankietowanych.

Zgromadzone dane wskazują na duże zainteresowanie społeczeństwa możliwościami stosowania mleka kobiecego jako domowego, naturalnego "środka leczniczego" - prawdopodobnie ze względu na jego łatwą dostępność, znane właściwości prozdrowotne i przekonanie o wyłącznie dobroczynnym działaniu, bez ryzyka działań niepożądanych. Niemniej jednak, wiedza matek najczęściej pochodzi z niezweryfikowanych źródeł - głównie stron internetowych i blogów o tematyce rodzicielstwa (zadeklarowanych przez 67% respondentów) i forum dyskusyjnych dla rodziców (zadeklarowanych przez 43,5% respondentów). Z drugiej strony, ok. 37% ankietowanych matek otrzymało informacje o możliwości stosowania mleka w celach pozażywieniowych od położnej lub pielęgniarki. Z uwagi na brak jednoznacznych dowodów naukowych dotyczących stosowania pokarmu kobiecego w leczeniu i profilaktyce schorzeń błon śluzowych i ich wątpliwe bezpieczeństwo, w artykule podsumowano wyniki dostępnych badań odnoszących się do poszczególnych zastosowań uwzględnionych w ankiecie.

2.6.5. Artykuł nr 5 pt.: "Wiedza personelu medycznego i matek karmiących piersią dotyczące wybranych aspektów laktacji - "diety" i pozażywieniowego zastosowania mleka. (Medical personnel and breastfeeding mothers knowledge of selected aspects of lactation - "diet" and non-nutritional use of breast milk).

Publikacja stanowi odniesienie do wybranych problemów i aspektów laktacji, których znaczenie kliniczne i społeczne może mieć istotny wpływ na aktualne wskaźniki karmienia piersią w Polsce, a także na jakość poradnictwa laktacyjnego udzielanego matkom. W artykule przedstawiono wybrane dane pozyskane z przeprowadzonych badań przekrojowych, uprzednio niepublikowane lub opublikowanych w ograniczonym zakresie.

W pracy podkreślono, że niezależnie od wykonywanego zawodu, wiedza respondentów o wpływie żywienia na skład mleka kobiecego pozostaje na dość niskim poziomie. Z uwagi na rosnącą popularność alternatywnych form odżywiania – głównie w aspekcie diet wegetariańskich, o różnym stopniu eliminacji produktów pochodzenia zwierzęcego - ważne by personel medyczny potrafił rzetelnie ocenić ryzyko wystąpienia niedoborów pokarmowych u matek, a także ich dzieci. Niedostateczny poziom wiedzy może skutkować nieadekwatnym poradnictwem żywieniowym udzielanym matkom lub jego całkowitym brakiem. Respondenci

prawidłowo uznali, że mleko produkowane przez matki na diecie bezmięsnej może być w pełni wartościowe odżywczo, ale w większości nie znali zależności między podażą składników odżywczych a składem mleka. W przypadku kobiet, które w znacznym stopniu lub całkowicie wykluczyły z jadłospisu produkty pochodzenia zwierzęcego, niezmiernie ważna jest właściwa suplementacja m.in. witaminy B12 i kwasu DHA. Niedobór tych mikroelementów u matki przekłada się także na zwiększone ryzyko niedoboru u niemowląt, a w efekcie na nieprawidłowy ich rozwój, o czym wiedziała prawie połowa uczestników badania.

W zależności od wykonywanego zawodu, 17 - 25% procent ankietowanych uważało, że zmiany skórne na twarzy dziecka jednoznacznie wskazują na alergię na białka mleka krowiego, co jest stwierdzeniem fałszywym - wyższy odsetek poprawnych odpowiedzi stwierdzono wśród personelu medycznego. Częściej poprawnej odpowiedzi udzielili medycy, którzy nigdy nie zalecili matkom karmiącym profilaktycznej diety eliminacyjnej. Blisko połowa (44%) spośród matek wykonujących zawód medyczny, które rekomendują swoim pacjentkom eliminację wybranych produktów z codziennego jadłospisu na czas laktacji, podała stosowanie restrykcji żywieniowych w czasie karmienia piersią własnego dziecka. Nie mniej jednak, podejrzenie alergii na białka mleka krowiego u dziecka stanowiło główne wskazanie medyczne do rozpoczęcia diety eliminacyjnej u matki (ponad 95% przypadków). Średni czas trwania laktacji wśród kobiet, które rozpoczęły restrykcje żywieniowe zgodnie z zaleceniem lekarza (niezależnie od przyczyny i wskazania) wynosił 17,2 miesięcy. W przypadku kobiet, które doświadczyły presji rodziny, znajomych lub niepokoju o wpływ ich sposobu odżywiania się na jakość mleka, bądź zdrowie dziecka, średni czas trwania laktacji wynosił 13,4 miesięcy. Wykazano, że różnica długości karmienia naturalnego w obu grupach była istotna statystycznie ($p < 0,05$).

Na podstawie uzyskanych danych wykazano, że długość karmienia pierwszego dziecka i doświadczenia matki w okresie laktacji wpływają na długość karmienia piersią kolejnych dzieci.

Niemniej stwierdzono, że dłuższy czas trwania laktacji, zwłaszcza wśród pierworódek wiązał się także z większym zainteresowaniem wykorzystywania mleka w celach pozażywieniowych na podstawie informacji pozyskanych z niezweryfikowanych źródeł, często także “własnej intuicji”. Wyniki te potwierdzają, że matki znacznie częściej poszukują wiedzy o laktacji w mediach społecznościowych, a także sugerują się doświadczeniem i opiniami osób bez wykształcenia medycznego. Niestety nie zawsze zwracają się o pomoc do lekarza, położnej, czy doradcy laktacyjnego.

2.7. Wnioski.

1. Wiedza ogólna o żywieniu w okresie laktacji jest na dość dobrym poziomie, zarówno wśród personelu medycznego, jak i matek nieposiadających wykształcenia medycznego. Wymaga jednak doskonalenia, zwłaszcza w aspekcie wpływu diety na skład jakościowy i ilościowy mleka kobiecego.
2. Mimo braku dowodów naukowych, profilaktyczne restrykcje żywieniowe w czasie karmienia piersią, przypisywanie licznych objawów obserwowanych u niemowląt „błędom dietetycznym" popełnianym przez matki, rozpowszechnianie błędnych opinii o jakości mleka ludzkiego w wybranych sytuacjach klinicznych, stanowią powszechne praktyki oraz przyczyniają się do wcześniejszego zakończenia laktacji.
3. Do głównych czynników determinujących wiedzę o laktacji należą czas jej trwania i dzietność.
4. Stosowanie mleka kobiecego w celach pozażywieniowych wynika z niepopartych badaniami naukowymi, zaleceń dostępnych w niemedycznych źródłach, ale przekazywanych również przez personel medyczny.
5. Konieczne jest podniesienie kompetencji personelu medycznego sprawującego opiekę nad matką i dzieckiem w zakresie poradnictwa laktacyjnego i żywieniowego.
6. Wyniki przeprowadzonych badań mogą być przydatne w podkreśleniu roli edukacji żywieniowej w poradnictwie laktacyjnym, podniesieniu jego jakości w ramach podstawowej opieki zdrowotnej i aktualizacji programów promocji karmienia naturalnego w Polsce.

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4. STRESZCZENIE PRACY W JĘZYKU POLSKIM.

Wstęp: Karmienie piersią jest uznanym standardem żywienia niemowląt i małych dzieci. Udokumentowano zalety żywienia enteralnego mlekiem kobiecym, brakuje natomiast jednoznacznych danych wskazujących na korzyści z jego stosowania w celach pozażywieniowych, stąd praktyki te nie są rekomendowane.
Wyłączne karmienie mlekiem kobiecym jest zalecane przez pierwszych 6 miesięcy życia dziecka, z jego kontynuacją w czasie wprowadzania pokarmów uzupełniających. W Polsce odsetek dzieci karmionych naturalnie w 6. miesiącu życia wynosi zaledwie 4%. Szczególną rolę w promocji karmienia piersią i edukacji żywieniowej pełni personel medyczny sprawujący opiekę nad matką i niemowlęciem.
Laktacja jest stanem fizjologicznym, a dieta matki karmiącej powinna być zbilansowana i różnorodna, z uwzględnieniem zwiększonego zapotrzebowania na wybrane składniki odżywcze (białko, witaminy, mikroelementy). W przypadku matek, których podstawę żywienia stanowi dieta wegetariańska, w tym wegańska, należy zwrócić szczególną uwagę na odpowiednią suplementację poszczególnych mikroelementów, zwłaszcza witaminy B12 i DHA. Zmiana nawyków żywieniowych, w tym eliminacja z diety produktów o dużym potencjale alergizującym, nie jest zalecana.

Cel pracy: Celem pracy była ocena wiedzy polskich matek i personelu medycznego w zakresie wybranych aspektów laktacji oraz analiza związanych z nimi doświadczeń.

Materiał i metody: Przeprowadzono dwa badania przekrojowe z wykorzystaniem elektronicznych kwestionariuszy ankietowych: pierwsze, wśród 1159 respondentów, dotyczyło wiedzy, opinii i doświadczeń związanych z dietą matki w okresie laktacji; drugie, wśród 1187 respondentów, odnosiło się do wiedzy, opinii i doświadczeń matek w okresie laktacji w zakresie możliwości stosowania własnego mleka w celach pozażywieniowych.

Wyniki: Nie stwierdzono istotnych różnic między matkami a personelem medycznym w zakresie wiedzy dotyczącej problematyki diety kobiet w okresie laktacji ($p > 0,05$). Respondenci prezentowali dobry poziom wiedzy w zakresie dopuszczalności spożywania wybranych grup produktów przez matki karmiące piersią, ogólnych zasad żywienia podczas laktacji oraz wpływu diety matki na dobrostan dziecka (70 - 90% poprawnych odpowiedzi). W pytaniach dotyczących wpływu żywienia na skład mleka kobiecego odsetek poprawnych

odpowiedzi był znacznie niższy i wynosił 42 - 61%. Głównym czynnikiem determinującym wiedzę respondentów był czas trwania laktacji ($p < 0,05$). Blisko 30% matek z obu grup badanych stosowało dietę eliminacyjną w czasie laktacji, co miało wpływ na czas trwania karmienia piersią i opinie dotyczące odżywiania w tym okresie. Wykazano duże zainteresowanie Polek alternatywnymi zastosowaniami mleka kobiecego – blisko 75% respondentek posiadało informacje w tym zakresie, a 84% z nich wykorzystało je w praktyce. Podstawowe źródło wiedzy o właściwościach mleka kobiecego stanowi internet i media społecznościowe.

Wnioski:

1. Wiedza ogólna o żywieniu w okresie laktacji jest na dość dobrym poziomie, zarówno wśród personelu medycznego, jak i matek nieposiadających wykształcenia medycznego. Wymaga jednak doskonalenia, zwłaszcza w aspekcie wpływu diety na skład jakościowy i ilościowy mleka kobiecego.

2. Profilaktyczne restrykcje żywieniowe w czasie karmienia piersią, przypisywanie licznych objawów obserwowanych u niemowląt „błędom dietetycznym" popełnianym przez matki, rozpowszechnianie błędnych opinii o jakości mleka ludzkiego w wybranych sytuacjach klinicznych, stanowią powszechne praktyki oraz przyczyniają się do wcześniejszego zakończenia laktacji.

3. Stosowanie mleka kobiecego w celach pozażywieniowych wynika z niepopartych badaniami naukowymi, zaleceń dostępnych w niemedycznych źródłach, przekazywanych również przez personel medyczny.

4. Konieczne jest podniesienie kompetencji personelu medycznego sprawującego opiekę nad matką i dzieckiem w zakresie poradnictwa laktacyjnego i żywieniowego.

5. Wyniki przeprowadzonych badań mogą być przydatne w podkreśleniu roli edukacji żywieniowej w poradnictwie laktacyjnym, podniesieniu jego jakości w ramach podstawowej opieki zdrowotnej i aktualizacji programów promocji karmienia naturalnego w Polsce.

5. STRESZCZENIE PRACY W JĘZYKU ANGIELSKIM.

Introduction: Breastfeeding is a recognized standard in the nutrition of infants and young children. The advantages of enteral feeding with human milk have been documented, but there is no clear data indicating the benefits of its use for non-nutritional purposes, hence these practices are not recommended.

Exclusive breastfeeding is recommended for the first 6 months of a child's life, with its continuation during the introduction of complementary foods. In Poland, the percentage of naturally fed infants at 6 months of age is only 4%. The medical staff caring for the mother and the infant play a special role in the promotion of breastfeeding and nutritional education.

Lactation is a physiological state, and the diet of a breastfeeding mother should be balanced and varied, taking into account the increased demand for selected nutrients (protein, vitamins, microelements). In the case of mothers whose nutrition is based on a vegetarian, including vegan diet, special attention should be given to the appropriate supplementation of individual micronutrients, particularly vitamin B12 and DHA. Changing eating habits, including the elimination of foods with high allergenic potential from the diet, is not recommended.

Aim of the study: The aim of the study was to assess the knowledge of polish mothers and medical staff in the field of selected aspects of lactation and to analyze the related experiences.

Material and methods: Two cross-sectional studies were carried out using electronic questionnaires: the first, among 1,159 respondents, concerned the knowledge, opinions and experiences related to the diet of the lactating mother; the second, among 1,187 respondents, referred to the knowledge, opinions and experiences of lactating mothers regarding the possibility of using their own milk for non-nutritional purposes.

Results: There were no significant differences between mothers and medical staff in the knowledge of the dietary issues of lactating women ($p > 0.05$). The respondents presented a good level of knowledge on the acceptability of consumption of selected groups of products by breastfeeding mothers, the general principles of nutrition during lactation and the impact of the mother's diet on the child's well-being (70 - 90% of correct answers). In the questions concerning the influence of nutrition on the composition of breast milk, the percentage of correct answers was much lower and amounted to 42 - 61%. The main factor determining the respondents' knowledge was the duration of lactation ($p < 0.05$). Almost 30% of mothers from

both study groups followed an elimination diet during lactation, which had an impact on the duration of breastfeeding and the opinions on nutrition during this period. A great interest of Polish women in alternative uses of human milk was shown - nearly 75% of the respondents had information in this regard, and 84% of them used it in practice. The main source of knowledge about the properties of breast milk is the Internet and social media.

Conclusions:

1. General knowledge about nutrition during lactation is quite good, both among medical personnel and mothers without medical education. However, it requires improvement, especially in terms of the impact of the diet on the qualitative and quantitative composition of breast milk.

2. Prophylactic dietary restrictions during breastfeeding, attributing numerous symptoms observed in infants to "dietary mistakes" made by mothers, disseminating erroneous opinions about the quality of human milk in selected clinical situations, are common practices and contribute to early termination of lactation.

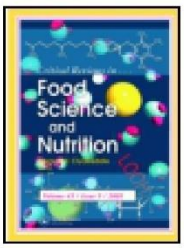
3. The use of breast milk for non-nutritional purposes results from recommendations not supported by scientific research, available in non-medical sources, but is also provided by medical personnel.

4. It is necessary to raise the competences of the medical personnel taking care of the mother and child in the field of lactation and nutritional counseling.

5. The results of the conducted research might be useful in emphasizing the role of nutritional education in lactation counseling, improving its quality in primary health care and updating programs for the promotion of natural feeding in Poland.

6. PUBLIKACJE.

6.1. Artykuł nr 1.



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Vegan or vegetarian diet and breast milk composition – a systematic review

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REVIEW

Vegan or vegetarian diet and breast milk composition – a systematic review

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ABSTRACT

It is known that nutritional composition of breast milk is, to a certain extent, related to maternal diet. The question of nutritional adequacy of mothers' milk is often raised whenever a vegetarian or vegan diet during the lactation process is concerned. For this reason, in some countries, the recruitment of vegan lactating women as milk donors is excluded by milk banks. The purpose of this systematic review is to summarize existing knowledge on variability of specific nutrients in breastmilk of mothers adhering to a plant-based diet. The databases, including MEDLINE (Pubmed) and Scopus, were used to identify relevant publications. Data extraction and analysis were conducted following a PRISMA protocol. Thirteen publications concerning the impact of dietary pattern and levels of animal-origin food intake on breast milk composition were included. The systematic review has shown that all non-vegetarian, vegetarian and vegan mothers produce breast milk of comparable nutritional value. Several differences are primarily attributed to fatty acids and some micro-components, primarily vitamin B12. Regardless of dietary choices, nourishment and adequate nutrition have a significant impact on human milk composition – on the basis of the current evidence, vegetarian and vegan mothers are capable of producing nutritionally valuable milk for their infants, as far as the appropriate supplementation compensating for breastfeeding mother's nutritional requirements is provided. Dietary choices should not be a permanent exclusion criterion for donor candidates in human milk banks.

KEYWORDS

Lactation; human milk; nutrients; plant-based diet; milk banks

Introduction

Breast milk is the basis of infants nutrition. According to current knowledge, human milk consists not only of nutrients, but immunologically active compounds, which provides both short- and long-term health benefits for infants (Agostoni et al. 2009). Therefore, the World Health Organization (WHO) recommends exclusive breastfeeding for 6 months of life along with its continuation during the introduction of complementary foods, up to 2 years or longer (World Health Organization 2017). The American Academy of Pediatrics (AAP) adopted a similar approach, recommending exclusive breastfeeding for 6 months of life and its continuation until 1 year along with the weaning period, in accordance with the needs of the mother and the child (American Academy of Pediatrics 2012).

As far as the nutritional adequacy of mother's milk is concerned, breast milk is usually sufficient to support infant growth and its composition is believed to be remarkably unaltered in case of limited energy and nutrient intake in mother's diet. However, persistent dietary restrictions during the lactation period can result in depletion of maternal body reserves and negatively affect both breast milk volume and its content of specific nutrients (Institute of Medicine 1991). In addition, some of these critical nutrient concentrations are potentially of significant importance for child's growth and development in their first months of life – proteins providing amino acids, polyunsaturated fatty acids (with impact on omega-3 fatty acids), vitamin D, vitamins of group B (especially B12), iron and iodine (Kleinman 2009). Thus, nutritional counseling for breastfeeding mothers should include careful examination of maternal dietary habits.

The issue of adequate nutrient intake is often raised in the aspect of following vegetarian, especially vegan, diet during the lactation period. The vegetarians' eating patterns may vary considerably, depending on the extent to which animal products are excluded. First of all, vegetarians do not consume any kind of meat – both red and white, and fish as well. The most common types of vegetarianism include: lacto-ovo-vegetarianism – eliminates meat and fish but allows consumption of eggs and dairy products; lacto-vegetarianism – allows dairy products, but eliminates eggs; ovo-vegetarianism – allows eggs but eliminates dairy products; veganism – exclude consumption of any animal products, vegans do not use honey or beeswax, gelatin and other animal-derived ingredients (Melina, Craig, and Levin 2016; Craig and Mangels 2009). The more restrictive the vegetarian diet, the risk of dietary inadequacy is greater. Nutrition specialists state that vegetarian, including vegan, diets can provide sustainable development and cover all dietary needs; however, they warn about the risk of nutritional deficiencies and their consequences. Generally, it is assumed that a vegan diet should meet specific, higher than average,

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nutritional requirements while breastfeeding, with a particular emphasis on bioavailability and intake of micronutrients – for instance: vitamin B12, calcium, selenium, zinc, iodine and omega-3 fatty acids including docosahexaenoic acid (DHA) (Federal Commission for Nutrition (FCN) 2018). Vegan diets can be adequate for people at all ages, including pregnant or lactating women, provided that meal plans are well-balanced or sufficient supplementation is provided (Melina, Craig, and Levin 2016; Craig and Mangels 2009; Federal Commission for Nutrition (FCN) 2018; Agnoli et al. 2017).

It is already known that not only the nutritional status of the mother appears to influence the composition of breast milk, but also her dietary habits – the issue of maternal diet and content of particular nutrients in human milk have been already analyzed (Bravi et al. 2016; Andreas, Kampmann, and Mehring Le-Doare 2015; Emmett and Rogers 1997; Ballard and Morrow 2013; Lönnerdal 1986; Innis 2014). According to the American Academy of Nutrition and Dietetics, breast milk of vegan mothers is similar in its composition to that of non-vegetarians, except for fatty acids concentration, and an appropriately planned plant-based diet can contribute to sustainable growth of the infants (Melina, Craig, and Levin 2016; Craig and Mangels 2009; Mangels and Messina 2001). On the contrary, the Swiss Federal Commission for Nutrition (FCN) (Federal Commission for Nutrition 2018) and the German Nutrition Society (DGE) (Richter et al. 2016) state that a vegan diet cannot be recommended for general population, particularly not for pregnant and lactating women, infants, children and elderly people. Both organizations emphasize the importance of supplementation and nutrition counseling in aforementioned groups. Comparably, the European Society of Pediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) (Fewtrell et al. 2017) draws attention to the risk of nutrient deficiencies in infants of vegan mothers, as the intense process of growth and development, especially in the first year of life when milk, optimally breast milk, is a basis of nutrition, requires adequate supply of nutrients (Fewtrell et al. 2017; Van Winckel et al. 2011). To ensure a proper maintenance of nervous system, the regular supplementation of vitamin B12 is strongly recommended in both vegan mothers and their infants, even if the mother do not present any symptoms of deficiency. It might be also advised in lacto-vegetarians, as well as other groups, whenever the dietary intake of reliable sources of cobalamin is low (Fewtrell et al. 2017; Van Winckel et al. 2011; Van Winckel 2017).

On the basis of the aforementioned stance, most of worldwide milk banks recruit vegan mothers as donors, on condition that they regularly supplement vitamin B12 as well as other micronutrients if necessary. According to European Milk Bank Association (EMBA) Guidelines, mothers who follow a vegan diet without supplementation with Vitamin B12 should not donate their milk, but there is no recommendation to disqualify all vegan mothers without any other premise apart from the way of nutrition (Weaver et al. 2019). The similar position was supported by PATH organization (PATH 2019), as well as adopted by Human Milk Banking Association of South Africa (HMBASA) (HMBASA Milk Banks Guidelines 2014). Vegan donors might be recruited conditionally – provided the mother is in good health condition, the diet is well-composed according to the medical and dietary advice, and the supplementation of an additional dose of vitamins and other micronutrients is regular. Nevertheless, national guidelines might vary in particular countries, ex. human milk banks in Switzerland, Germany and Austria do not accept donations from vegans (The European Foundation for the Care of Newborn Infants (EFCNI) 2018; Frischknecht et al. 2010). Similarly, in Poland, vegan diet is an absolute and constant exclusion criterion for breast milk donation – on the basis of official recommendations for human milk banks, breast milk of vegan mothers is not considered as wholesome due to the restrictive diet (Wesołowska et al. 2018).

In this paper, we aimed to analyze existing research on the effects of vegetarian, including vegan, diet on maternal breast milk composition.

Methods

Literature search strategy

The full search for published literature was performed twice: on 12th December 2018 and on 20th May 2019. The databases including MEDLINE (PubMed) and Scopus were used to find relevant papers. There was no language restrictions, neither date limits. As the process of writing the article had prolonged, an additional search was conducted on 20th January 2020, concentrating on studies published from May to the current date. The searches were conducted by using various word combinations, such as: "vegetarian," "vegan," "vegetarianism," "human milk," "breast milk," "lactation," "breastfeeding," "breastfed," "breast fed," "diet," "nutrition," "intake," "status," "composition," "fat," "fatty acids," "protein," "amino acids," "carbohydrates," "glucose," "fructose," "galactose," "micronutrients," "vitamins," "iron," "choline," "calcium," "zinc," "selenium," "iodine," "infant," "newborn," "neonate," "pregnancy outcome," "delivery," "deficiency." Each term search involved a wide range of synonyms and keyword connections to ensure maximum access to relevant papers. Studies were based on the assumption that search keywords were present in either the title, or abstract, or keywords, provided by authors of the manuscript.

Studies selection and data extraction

The papers found in initial search were removed of duplicates and they were searched for titles and abstracts in accordance with the eligibility criteria. The inclusion criteria were stated as follows:

1. primary studies;
2. studies on humans;
3. papers written in Polish, English or German;

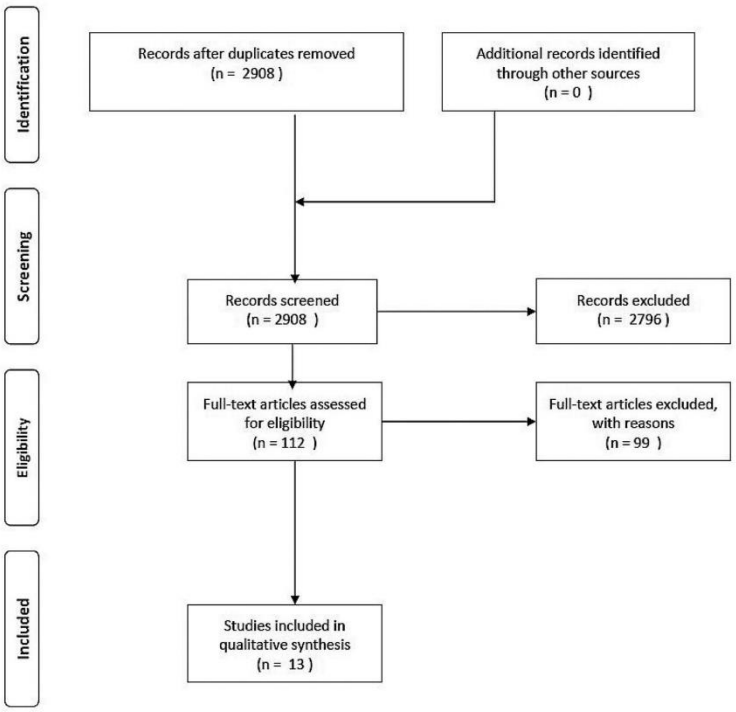

Figure 1. Procedure of publication selection – The PRISMA flow chart.

4. references concerning the influence of dietary pattern on breast milk composition
5. categorization due to dietary habits along with consideration given to the levels of animal-origin food intake;
6. inclusion of vegetarians or vegans in a study group;
7. inclusion of breastfeeding mothers in the study group;
8. references concerning the exposure to various nutrients or a type of diet and its impact on maternal or neonatal status and breast milk composition

The following exclusion criteria were applied

1. secondary studies;
2. case reports;
3. studies on animals;
4. full text access unavailable;
5. insufficient data on mothers' diet, lactation, nutritional status;
6. no dietary assessment/categorization;
7. lack of control group;
8. non-assessed impact of dietary patterns on breast milk composition;
9. no animal-derived food exclusion in any participating group or non-detailed data on eating pattern.

Overall, the selection process aimed at identifying any original studies determining the associations between breast milk composition and mother's adherence to plant-based diet. Extracted data included details on methodology, study group characteristics, and main findings of the original study. If the abstract did not provide sufficient data, the paper was qualified for further full-text analysis. Each time a literature review was found, we checked its reference list to ensure our search results include all relevant publications. No additional articles were found. Then, if available, full texts of selected papers were retrieved. The articles were checked for inclusion twice at an interval of 6 months – the corresponding lists of selected studies were consistent. After reviewing the full texts, the rejected articles ($n = 99$) were divided into groups, on the basis of such categories as: (1) no animal source foods excluded or no detailed information on dietary pattern provided ($n = 60$); (2) insufficient information on the impact of diet on maternal status, including mother's breast milk composition ($n = 17$); (3) no dietary assessment ($n = 7$); (4) focus on poor condition of a breastfed child, without any assessment of breast milk composition ($n = 3$); (5) insufficient data on lactation or breast milk quality ($n = 12$).

The literature search and the reviewing process were conducted according to the PRISMA guidelines (Figure 1) (Moher et al. 2009).

All eligible studies were formally evaluated using the Quality Assessment Tool, provided by the National Heart, Lung and Blood Institute (National Heart, Lung and Blood

Institute 2018). This tool refers to 13 elements of quality assessment. Each component was rated using descriptive score: "yes", "no", "not applicable"/"not reported"/"cannot determine". For summary purposes, we derived a numeric score for the final grade assigned to each study by counting the number of 'yes' answers obtained. For overall assessment, the following criteria were applied: 0–3 points "very poor", 4–5 points "poor", 6–8 points "fair", 9–10 points "good", 11–13 points "very good".

The first author (KK) designed the methodology, established the criteria of data extraction, performed the process of records screening and identification of the literature, under the constant supervision of the second author (BK-O). Both two authors (KK and BK-O) reviewed all of the articles consecutively and performed the study selection independently, according to the inclusion and exclusion criteria. Any disagreements at each stage of the verification process were resolved by consensus.

Results

Literature search

The selection process using the PRISMA flow diagram is depicted in Figure 1. After removing duplicates, the search yielded 2908 articles, including all search results. Having read title and abstract, 112 papers, with an access to full text, were identified. After considering the full-text, further 99 publications were excluded. A total of 13 independent studies met the inclusion criteria and were included in this systematic review. On search conducted in November 2019, 8 additional publications were found and all of them (4 systematic reviews, 2 papers in Spanish or Chinese, 2 irrelevant observational studies) were rejected.

Study characteristics – summary

The characteristics of formally evaluated studies are presented in a chronological order in Table 1.

None of 13 included papers received a full score in quality assessment. Not every study provided a clear description of study population, nor the detailed criteria of the recruitment process (Bijur and Desai 1985; Finley et al. 1985a, 1985b; Sanders and Reddy 1992). In addition, the sample size justification and power calculations were missing. In some papers, the exposure measures were not always clearly defined, including the details on the exposure time frame (Bijur and Desai 1985; Finley et al. 1985a, 1985b; Debski et al. 1989; Sanders and Reddy 1992; Liao et al. 2011), the level of exposure (Sanders, Ellis, and Dickerson 1978; Bijur and Desai 1985; Specker et al. 1990; Liao et al. 2011), multiple evaluation of exposures (Sanders, Ellis, and Dickerson 1978; Bijur and Desai 1985; Rana and Sanders 1986; Specker et al. 1990; Patel and Lovelady 1998; Perrin et al. 2019, as far as the impact of mother's nutrition on breast milk composition was concerned.

Mostly, the level of exposure was not blinded to the assessors. In some studies, all missing details were said to be provided in another papers (Rana and Sanders 1986; Debski et al. 1989); however, the full texts of those publications were unavailable. For these reasons, in evaluation studies they obtained from 4 to 9 points – most of the analyzed studies (76.9%) got a score of 7 points or more, which was assessed as "fair" or "good" due to the adopted scale (Sanders, Ellis, and Dickerson 1978; Finley et al. 1985a, 1985b; Rana and Sanders 1986; Debski et al. 1989Sanders and Reddy, 1992; Patel and Lovelady 1998; Pawlak et al. 2018; Perrin et al. 2019).

The studies included were published between 1978 and 2018. Only 3 articles were published after 2000 (Liao et al. 2011; Pawlak et al. 2018; Perrin et al. 2019). The remaining papers were published in 1970s ($n = 1$) (Sanders, Ellis, and Dickerson 1978), 1980s ($n = 5$) (Bijur and Desai 1985; Finley et al. 1985a, 1985b; Rana and Sanders 1986; Debski et al. 1989) and 1990s ($n = 4$) (Specker et al. 1990; Sanders and Reddy 1992; Kim et al. 1996; Patel and Lovelady 1998). The studies were conducted mainly in the USA ($n = 7$) (Finley et al. 1985a, 1985b; Debski et al. 1989; Specker et al. 1990; Patel and Lovelady 1998; Pawlak et al. 2018; Perrin et al. 2019). The other ones were carried out in the UK ($n = 3$) (Sanders, Ellis, and Dickerson 1978; Rana and Sanders 1986; Sanders and Reddy 1992) and in Asian countries: India ($n = 1$) (Bijur and Desai 1985), Taiwan ($n = 1$) (Liao et al. 2011), Korea ($n = 1$) (Kim et al. 1996). Seven publications considered data on ethnicity of the participants and 3 of them included Hindu (Bijur and Desai 1985; Patel and Lovelady 1998) and Indian (Sanders and Reddy 1992) women in a study group (Table 2). All the studies included women in reproductive age, mostly aged from 18 to 40 years, however, the authors of 6 papers did not refer to the age of breastfeeding mothers (Sanders, Ellis, and Dickerson 1978; Rana and Sanders 1986; Sanders and Reddy 1992; Liao et al. 2011).

As far as the inclusion criteria are considered, detailed eligibility criteria for participants are provided in 5 studies (Sanders, Ellis, and Dickerson 1978; Rana and Sanders 1986; Patel and Lovelady 1998; Pawlak et al. 2018; Perrin et al. 2019), whereas the remaining articles include only characteristics essential for recruitment to study and control groups (Bijur and Desai 1985; Finley et al. 1985a, 1985b; Debski et al. 1989; Specker et al. 1990; Sanders and Reddy 1992; Kim et al. 1996; Liao et al. 2011).

Study and control group characteristics

The size of study and control groups varied among publications. In general, the study samples were small with fewer than 100 participants. The number of participants ranged from 19 to 74. However, it should be also mentioned that in one of the studies, specimens of breast milk were involved in the analysis from previous research (Rana and Sanders 1986), whereas in another study, breastfeeding mothers constituted a minor part of all participants, thus the breast milk analysis was not the major concern of that research (Sanders, Ellis, and Dickerson 1978).

Table 1. Characteristics of evaluated studies.

First author, year (ref)	Location	Quality score	Study participants	Maternal dietary assessment	Breast milk samples	Components measured in breast milk	Results
Sanders 1978 (Sanders, Ellis, and Dickerson 1978)	UK	8	22 vegans and 22 omnivore controls, of whom 4 vegans and 4 omnivore controls were breastfeeding mothers.	Not specified; Interview regarding inclusion criteria for vegans: diet does not include any products of animal origin; Supplementation of vitamin B12 was noted.	20 ml of breast milk were obtained from each mother at the start of morning feed; 2ml of breast milk were obtained from the same breast in the middle and the final part of the feed.	Fatty acids.	Wilcoxon's test: Significantly lower amount of C16:0, C16:1, C18:0 and C20:4ω3 and higher amount of C18:2ω6, C18:3ω3, C20:2ω6 in vegans' breast milk ($p < 0.05$). Tendency to lower proportions of C20:5ω3 and C22:6ω3 in vegans' breast milk.
Bijur, 1985 (Bijur and Desai 1985)	India	5	50 women from Bombay: 18 non-vegetarian frequent meat eaters, 16 non-vegetarian occasional meat eaters, 16 lacto-vegetarians.	Not described.	Morning samples of manually expressed breast milk were collected before feeding the baby.	Total protein, free amino acids (FAA), vitamin B12.	Low levels of vitamin B12 in breast milk were found among mothers who had low serum B12 level – lower level were found, both in serum and breast milk ($p < 0.01$), in lacto-vegetarian mothers in comparison with non-vegetarian mothers. Contents of total protein and FAA were similar in all groups.
Finley 1985 (Finley et al. 1985a)	USA	7	57 women: 30 vegetarians, 8 semi-vegetarians (fish-eaters), 29 omnivores.	24-h dietary recall including supplements at the initial interview; 2-day diet record every month.	Morning samples of breast milk were collected on the day after dietary record. Women expressed all of the milk in the breast..	Total fat, fatty acids.	Student-*t* test: No significant difference in total breast milk fat content between vegetarians and non-vegetarians was found. Breast milk from vegetarians contained less C16:0, C16:1ω9, C18:0, C18:1ω9 and more C18:2ω6 fatty acids. Higher level of C10:0 and C12:0 in milk of vegetarians correlated with lower fat intake.
Finley 1985 (Finley et al. 1985b)	USA	7	68 women: vegetarians, semi-vegetarians, omnivores.	24-h dietary recall and 2-day diet record including supplements obtained at monthly intervals	Portion of all of the milk from one breast expressed at the time of second breastfeeding of the day	Protein, lactose, lipid, minerals, trace elements	Student-t test: No significant influence of the diet on breast milk composition was found – all women were well-nourished. Milk from vegetarians and non-vegetarians differed in concentration of some fatty acids, due to maternal diet and daily intake. Correlation analysis: level of milk lipid remained constant during 6 months of lactation and increased during next 14 months ($r = +0.29$); level of milk lactose remained constant during 20 months of lactation; level of milk protein decreased during 6 months of lactation ($r = -0.43$) and remained constant during next 14 months (vegetarians at 7–20 months of lactation had lower levels of milk protein than non-vegetarians).
Rana 1985 (Rana and Sanders 1986)	UK	9	For milk analysis 14 vegan and 14 omnivore mothers included - analysis included samples from previous study.	Food intake record of seven consecutive days (including weight); collection of duplicate meals from 3 days.	Frozen mid-stream milk samples collected 4–6 weeks post-partum.	Taurine.	Student-t test ($p < 0.01$): mean taurine concentration in the vegan breast milk (35 mg/dl) was significantly lower than in the breast milk of omnivores (53 mg/dl).

(*continued*)

Table 1. Continued.

First author, year (ref)	Location	Quality score	Study participants	Maternal dietary assessment	Breast milk samples	Components measured in breast milk	Results
Dębski 1989 (Debski et al. 1989)	USA	7	45 milk samples from 38 lactating women: 26 vegetarians and 12 nonvegetarians.	2 – day diet record at monthly intervals for 4–6th month of lactation.	Milk samples collected by hand expression or with breast pump.	Selenium (Se); Gluthatione peroxidase (GSH-Px) activity.	The quantity of Se in milk from vegetarian women was 132 % of that from non-vegetarian women (22.2 ± 0.8 ng/ml vs 16.8 ± 1.3 ng/ml). Protein content in milk was similar in both groups. Milk Se concentration was linearly correlated with GSH-Px activity ($r = 0.76$, $p < 0.0001$). Significant relationship ($r = 0.68$, $p = 0.0001$) between milk GSH-Px activity and linoleic acid content was found. Milk Se and linoleic acid content were not correlated ($r = 0.30$, $p = 0.09$).
Specker 1990 (Specker et al. 1990)	USA	5	19 women: 13 vegetarians, 6 omnivores.	Interview – not specified: exclusion of dairy products and eggs from vegetarian diet; none of vegetarians and 5 omnivores took commercial supplements.	Sample of breast milk form the first morning feeding – all milk of the breast was expressed.	Vitamin B12.	Vitamin B12 concentration in vegetarian mothers' milk was lower than in omnivores' milk ($p = 0.007$). In strict vegetarians, an inverse correlation between milk vitamin B12 concentrations and length of time on a vegetarian diet was found ($r = -0.605$, $p = 0.03$). Milk vitamin B12 concentrations were inversely related to maternal urinary MMA concentrations ($r = -0.830$, $p < 0.001$) and associated with maternal serum vitamin B12 content ($r = 0.787$, $p < 0.001$).
Sanders 1992 (Sanders and Reddy 1992)	UK	7	45 women: 19 vegans, 5 vegetarians, 21 omnivores.	3-day weighed food intake inventory in lactating women; 7-day weighed food intake inventory in non-lactating women; analysis of 3-day duplicate meals.	Midstream breast milk samples obtained 6 weeks postpartum (10 ml).	Fatty acids (FA).	In comparison to omnivores' breast milk, vegans' breast milk contained higher proportions of short chain FA (C10–C14) and lower proportions of medium chain FA (C16–C18) ($p < 0.01$). The proportions of dihomogammalinolenic acid (20:3ω6) and arachidonic acid (20:4ω6) were comparable in all groups. The proportion of breast milk DHA (22:6ω3) was lower in vegans than in omnivores and vegetarians ($p < 0.01$). The ω6 / ω3 FA ratio was higher in the vegans than in the other groups.
Kim 1996 (Kim et al. 1996)	Korea	7	22 non-vegetarian women from Seoul, 23 lacto-ovo-vegetarian women from Seoul and its suburban areas.	Mothers' food intake measured by the weighing method - not specified. Infants' taurine intake was calculated by multiplying taurine concentrations by human milk intakes.	Sample of 30–50 ml of initial milk expressed manually from 10–12 a.m. at 3, 5, 15, 30, 60, 90, 120, 150 days postpartum.	Taurine	Taurine concentrations of human milk decreased significantly during the course of lactation among all participants ($p < 0.05$). After 90 days postpartum, the decline in taurine concentrations in breast milk was more remarkable in lacto-ovo-vegetarians than in non-vegetarians ($p < 0.05$). Non - vegetarians had higher energy intakes than lacto-ovo-vegetarians at 30, 120 and 150 days postpartum, however the overall protein intake was higher among lacto-ovo-vegetarians.

Patel 1998 (Patel and Lovelady 1998)	USA	8	8 East Indian women: 5 lacto-vegetarians, 3 lacto-ovo-vegetarians. 11 omnivores: 5 East Indian women, 6 Caucasians.	Food frequency questionnaire; supplements intake was recorded.	Samples of all the breast milk from one breast expressed at the first feeding, collected at least 4 weeks postpartum.	Vitamin B12	No significant correlation between the number of servings of diary products consumed daily and milk vitamin B12 concentrations among all participants was found. Vitamin B12 concentrations were significantly lower in the vegetarian group than in the omnivore group ($p < 0.05$). The mean breast milk vitamin B12 co centrations decreased significantly with the duration of lactation ($p = 0.04$), and were lower in vegetarians than in omnivores ($p = 0.006$).
Liao 2010 (Liao et al. 2011)	Taiwan	4	24 women from Taiwan; 8 vegetarians among participants.	Not described.	Sample of 30 ml of breast milk categorized due to lactation stages: first week postpartum, first month postpartum, second month postpartum, third to ninth month postpartum.	Free nucleotides and nucleosides	Total free nucleotide concentration in breast milk was significantly higher in vegetarians than in non-vegetarians ($p = 0.037$), but there was no significant difference in nucleoside concentration. Cytidine diphosphate was found to be the predominant nucleotide in human milk, indifferent to the stage of lactation, diet and place of residence.
Pawlak 2018 (Pawlak et al. 2018)	USA	9	74 lactating women: 26 vegans, 22 vegetarians, 26 non-vegetarians.	Diet type was self-reported by participants (survey); vitamins supplementation was recorded.	Samples of milk collected during the first or second feeding and over 2 h since the previous feeding; complete expression of 1 breast content.	Vitamin B12.	No difference in vitamin B12 concentrations in breast milk was found between diet groups. Use of individual vitamin B12 supplements had a significantly positive impact on milk B12 concentrations ($p = 0.024$). No relation with vitamins B-complex nor prenatal vitamins was found.
Perrin 2019 (Perrin et al. 2019)	USA	9	74 lactating women: 26 vegans, 22 vegetarians, 26 omnivores.	Diet survey; vitamins supplementation was recorded.	Samples of milk collected during the first or second feeding and over 2 h since the previous feeding; complete expression of 1 breast content.	Total fat, fatty acids (FA), brain-derived neurotrophic factor (BDNF).	The breast milk composition of saturated fat, unsaturated fat, and trans fat differed significantly by diet ($p \leq 0.001$). A significant difference in total omega-3 fatty acids was observed between diet groups, with higher percentages of ALA ($p \leq 0.001$). No difference in the prevalence of low milk DHA between diet groups was found. BDNF was not detectable in collected samples.

Table 2. Material and methods – characteristics of the study groups.

First author, year (ref)	Age of breastfeeding participants	Socioeconomic status	Ethnicity	Duration of meatless diet	Duration of lactation	Anthropometrics	Inclusion criteria	Additional exclusion criteria
Sanders 1978 (Sanders, Ellis, and Dickerson 1978)	Not specified.	Predominantly professional and middle classes.	Caucasians.	Range 3–12 years, average 7 years (vegan mothers).	Minimum of 3 months.	Not specified regarding mothers, however vegans proved to have lower body weight and lower sum of skinfold measurements.	Study group: Diet should not contain any food of animal origin. Diet should last at least 1 year. Control group: Healthy, not taking any special diet volunteers. Omnivores matching the vegans regarding the sex, age, height, ethnic origin and socioeconomic background.	–
Bijur, 1985 (Bijur and Desai 1985)	Range 18–38 years.	Low class.	80 % Hindus, 20 % not specified.	Not specified.	Not specified.	Mean weight of the mothers 45.42 kg (range of 36.4–57.6 kg). Mean weight of the infant 2.57 kg (range of 1.1–4.1 kg).	Not specified. 50 mothers admitted to the hospitals in Bombay - they were representative for the majority of population.	–
Finley 1985 (Finley et al., 1985a)	Range 22–37 years, average 29 years.	Not specified.	Not specified; Women living in northern Canada.	Not specified.	Range 2–31 months.	Maternal pre-pregnancy body weight (% ideal weight for height): mean 103 %, range 82–137 %.	Not specified.	–
Finley, 1985 (Finley et al. 1985b)	Mean 20 years.	Low median household income.	Not specified.	Not specified.	Minimum 3–4 weeks postpartum.	Maternal pre-pregnancy body weight (% ideal weight for height): mean 103 %.	Not specified; study included well-nourished women living in industrialized society.	Breastfeeding women before the stabilisation of lactation - exclusion of colostrum.
Rana, 1985 (Rana and Sanders 1986)	Range 18–40 years; age of breastfeeding women not specified.	Not specified.	Not specified; both study and control group were recruited in England.	Vegans: Average of 6 years (range 1–15 years); previously followed vegetarian diet average of 4 years (0–14 years).	Not specified; the study included breast milk samples from another research.	Quetelet index (weight : height): vegan women 21; omnivore women 21 – no details regarding lactating mothers.	Study group: Following vegan diet for at least 1 year; Taking no medications other than oral contraceptives. Control group: volunteers matching the vegan subjects for age, sex, similar height, similar body built.	–
Dębski 1989 (Debski et al. 1989)	Mean 29 years.	Not specified, but reported elsewhere -full text unavaliable.	Not specified, but reported elsewhere -full text unavaliable.	Not specified, but reported elsewhere -full text unavaliable.	Not specified, but reported elsewhere -full text unavaliable.	Not specified, but reported elsewhere -full text unavaliable.	Healthy lactating women - vegetarians and omnivores.	–
Specker 1990 (Specker et al. 1990)	Mean 31 years, range 22–40 years.	Not specified.	Not specified.	Range 14–137 months (median 72 months).	Vegetarian infants: mean 7.3 months (range 2–13.9 months); Omnivorous infants: mean 7.8 months (5.0–11.9 months).	Not specified.	Lactating women and their infants – omnivores and mothers following macrobiotic diet.	Inadequate volume of breast milk or infant's urine or maternal serum samples obtained.

Sanders 1992 (Sanders and Reddy 1992)	Not specified.	Not specified.	White vegetarians and vegans; Indian vegetarians; white omnivores.	Not specified.	14 weeks.	Mean birth weight of infants born: to Hindu vegetarian women 3.18 kg (range 3.04–3.33 kg), to white omnivores 3.48 kg (3.35–3.62 kg), white vegan 3.31 kg (3.08 -–3.35 kg).	Not specified; vegan, vegetarian and omnivore subject of white and Hindu ethnicity, matched for gestational age, parity, maternal age, sex of the infant.	–
Kim 1996 (Kim et al. 1996)	Not specified.	Not specified.	Mothers living in Seoul; Seventh Day Adventist Church members.	Not specified.	3, 5, 15, 30, 60, 90, 120, 150 days postpartum.	Not specified.	Study group: lacto-ovo-vegetarians Control: non-vegetarians.	–
Patel, 1998 (Patel and Lovelady 1998)	Not specified.	Not specified.	Study group: East Indian women (mostly Hindu); Control: East Indian and Caucasian women.	Not specified.	Minimum 4 weeks.	Not specified.	Lactating women, free of any illness, not smoking, who gave birth to healthy full-term infants. Infants at least 4 weeks old, exclusively breastfed.	–
Liao 2010 (Liao et al. 2011)	Not specified.	Not specified.	Asian, Taiwanese.	Not specified.	Range 1 week–9 months postpartum.	Not specified.	Taiwanese women, vegetarians and omnivores.	–
Pawlak 2018 (Pawlak et al. 2018)	Mean age (± SD): vegans 32.7 (± 5.2); vegetarians 32.2 (± 4.6); non-vegetarians 31.0 (± 4.7) years.	Not specified, participants categorized by education.	Black; Asian; Hispanic; White; Mixed/ Other.	Mean length (± SD): vegans 6.2 (± 5.5) years - range 0.5–23 years, median 4.3 years; vegetarians 7.5 (± 5.5) years - range 1 month – 20 years, median 6 years; non-vegetarians 25.8 (± 11.5) years.	Mean length (± SD): vegans 36.6 (± 27.7) months; vegetarians 54.6 (± 46.0) months; non-vegetarians 27.5 (± 19.8) months.	Mean BMI (± SD) of mothers: vegans 22.8 kg/m^2 (± 5.1), vegetarians 23.9 kg/m^2 (± 3.8), non-vegetarians 25.8 kg/m^2 (± 4.5).	Living in the United States; maternal age 18–46 years; giving birth to a healthy term infant; current age of infant at least 2 weeks; willingness to donate milk and complete diet survey.	Diagnosis of MTHFR gene mutation; health conditions affecting B12 status (intrinsic factor deficiency, bariatric surgery in the past; celiac disease; inflammatory bowel disease); hypothyroidism; hyperthyroidism; myeloproliferative disorders; advanced liver disease; pregnancy.
Perrin, 2019 (Perrin et al. 2019)	Mean age (± SD): vegans 32.7 (± 5.2); vegetarians 32.2 (± 4.6); non-vegetarians 31.0 (± 4.7) years.	Not specified, participants categorized by education.	Asian; Hispanic; White; Mixed / Other.	Mean length (± SD): vegans 6.2 (± 5.5); vegetarians 7.5 (± 5.55) years; non-vegetarians 25.8 (± 11.5) years.	Mean length (± SD): vegans 36.6 (± 27.7) months; vegetarians 54.6 (± 46.0) months; non-vegetarians 27.5 (± 19.8) months.	Mean BMI (± SD) of mothers: vegans 22.8 kg/m2 (± 5.1), vegetarians 23.9 kg/m2 (± 3.8), non-vegetarians 25.8 kg/m2 (± 4.5).	Living in the United States; mothers at age of 18–46 years; giving birth to a healthy term infant; currently, infant at age of at least 2 weeks; mothers willing to complete the diet survey and donate their milk.	Diagnosis of MTHFR gene mutation; health conditions affecting B12 status (intrinsic factor deficiency, bariatric surgery in the past; celiac disease; inflammatory bowel disease); hypothyro-idism; hyperthyro-idism; myeloproli-ferative disorders; advanced liver disease; pregnancy.

The authors of only three papers referred to the socio-economic status of the participants – one study included representatives of middle class (Sanders, Ellis, and Dickerson 1978), two studies were carried out among lower class (Bijur and Desai 1985; Finley et al. 1985b). In 2 papers, the study groups were categorized by level of education (Pawlak et al. 2018; Perrin et al. 2019). The remaining papers do not provide any data on the socio-economic status of lactating mothers (Rana and Sanders 1986; Debski et al. 1989; Specker et al. 1990; Sanders and Reddy 1992; Kim et al. 1996; Patel and Lovelady 1998; Liao et al. 2011).

The characteristics of participants, who took part in evaluated studies, are presented in a chronological order in Tables 1 and 2.

Maternal nutrition

The study groups of all studies included women following meatless diet, with various extent in exclusion of products of animal-origin, and omnivore control groups. In 3 studies, participants were classified as vegans, vegetarians and non-vegetarians (Sanders and Reddy 1992; Pawlak et al. 2018; Perrin et al. 2019), in 2 studies: vegans and omnivores (Sanders, Ellis, and Dickerson 1978; Rana and Sanders 1986), while in 8 studies: vegetarians and omnivores (Bijur and Desai 1985; Finley et al. 1985a, 1985b; Debski et al. 1989; Specker et al. 1990; Kim et al. 1996; Liao et al. 2011) (2 of which additionally distinguished a semi-vegetarian group) (Finley et al. 1985a, 1985b).

The type of maternal diet was defined by mothers themselves. Furthermore, for more precise definition of dietary habits, the authors used such methods as: dietary recall ($n = 2$) (Finley et al. 1985a, 1985b), food record ($n = 4$) (Finley et al. 1985a, 1985b;Rana and Sanders 1986; Debski et al. 1989), dietary survey or food frequency questionnaire ($n = 3$) (Patel and Lovelady 1998; Pawlak et al. 2018; Perrin et al. 2019), interview ($n = 3$) (Sanders, Ellis, and Dickerson 1978; Finley et al. 1985a; Specker et al. 1990), duplicate diet method ($n = 1$) (Rana and Sanders 1986), weighing method ($n = 2$) (Sanders and Reddy 1992; Kim et al. 1996) and non-specified one ($n = 2$) (Bijur and Desai 1985; Liao et al. 2011). The supplement intake was reported in 7 papers (Sanders, Ellis, and Dickerson 1978; Finley et al. 1985a, 1985b; Rana and Sanders 1986; Patel and Lovelady 1998; Pawlak et al. 2018; Perrin et al. 2019).

Since time might be a key predictor of how dietary habits affect breast milk composition and maternal body reserves, the duration of meatless diet was reported in 5 studies (Sanders, Ellis, and Dickerson 1978; Rana and Sanders 1986; Specker et al. 1990; Pawlak et al. 2018; Perrin et al. 2019). In most cases, the mean duration of vegan or vegetarian diet was 6–7 years.

Another factor affecting human milk composition is undernutrition. As far as the authors provided information on mothers' anthropometry, including weight and Body Mass Index (BMI), the women who participated in the study group were within normal range (accepted in authors' country). Physical measures were the only reported indicators of nutritional status.

All the factors described above are summarized in Table 2.

Breast milk samples collection

The detailed information on breast milk samples collection is presented in Table 1.

It is known that the composition of breast milk varies during the lactation period. Of the all studies included in this systematic review, 8 papers concerned mature breast milk (Sanders, Ellis, and Dickerson 1978; Finley et al. 1985a, 1985b; Specker et al. 1990; Sanders and Reddy 1992; Patel and Lovelady 1998; Pawlak et al. 2018; Perrin et al. 2019), 2 – colostrum or transitional milk (Kim et al. 1996; Liao et al. 2011). Authors of 3 papers did not provide any information on the stage of lactation while collecting samples (Bijur and Desai 1985; Rana and Sanders 1986; Debski et al. 1989). Furthermore, in one study the breast milk specimens were collected from the same mother several times in ongoing lactation period (Kim et al. 1996). In another study, the human milk specimens were classified into to 4 stages of lactation (Liao et al. 2011) (Tables 1 and Tables 2).

The way of collecting mother's milk varied in those studies as well. Hand expression was a predominant method, but in 3 studies milk was allowed to be collected using a breast pump (Finley et al. 1985a, 1985b; Pawlak et al. 2018). In 9 papers, the analyzed breast milk was collected in the morning: before feeding the baby ($n = 1$) (Bijur and Desai 1985), from the 1st feeding ($n = 2$) (Specker et al. 1990; Patel and Lovelady 1998), from the 1st or 2nd feeding ($n = 2$) (Pawlak et al. 2018; Perrin et al. 2019), from the 2nd feeding ($n = 2$) (Finley et al. 1985a, 1985b), at 10–12 am ($n = 1$) (Kim et al. 1996), at non-specified time ($n = 1$) (Sanders, Ellis, and Dickerson 1978) (Table 1).

In 4 papers, authors did not provide the details regarding the part of a day for sample collection (Rana and Sanders 1986; Debski et al. 1989; Sanders and Reddy 1992; Liao et al. 2011).

In 6 studies, mothers were asked to express whole content of one breast (Finley et al. 1985a, 1985b; Specker et al. 1990; Patel and Lovelady 1998; Pawlak et al. 2018; Perrin et al. 2019). Another 2 studies carried out an analysis of a midstream sample of breast milk (Rana and Sanders 1986; Sanders and Reddy 1992). In another paper, the milk specimens contained initial part of milk (Kim et al. 1996). One study, however, included smaller samples – taken in the middle and at the end of the same feeding (Sanders, Ellis, and Dickerson 1978) (Table 1).

The majority of articles (76.9%) specified that milk was frozen after collecting the samples and stored in cold. In one study, mothers froze breast milk just after expressing it, at a temperature about −4 °C (Liao et al. 2011). The milk was later kept frozen in laboratories. The storage temperature was −20 °C (Finley et al. 1985a, 1985b; Rana and Sanders 1986; Sanders and Reddy 1992; Patel and Lovelady 1998; Pawlak et al. 2018; Perrin et al. 2019) or −70 °C

(Debski et al. 1989; Liao et al. 2011). In one of the studies there was no information given regarding the freezing temperature (Specker et al. 1990).

Breast milk composition – assessment

The researchers' interest concentrated on various human milk components. The authors of analyzed publications examined the content of: vitamin B12 ($n=4$) (Bijur and Desai 1985; Specker et al. 1990; Patel and Lovelady 1998; Pawlak et al. 2018), folic acid activity ($n=1$) (Bijur and Desai 1985), fatty acid ($n=4$) (Sanders, Ellis, and Dickerson 1978; Finley et al. 1985a; Sanders and Reddy 1992; Perrin et al. 2019), total fat ($n=3$) (Finley et al. 1985a, 1985b; Perrin et al. 2019), amino acids and total protein ($n=3$) (Bijur and Desai 1985; Finley et al. 1985b; Debski et al. 1989), taurine (n = 2) (Rana and Sanders 1986; Kim et al. 1996), selenium ($n=1$) (Debski et al. 1989), minerals ($n=1$) (Finley et al. 1985b), free nucleotides and nucleosides ($n=1$) (Liao et al. 2011), lactose ($n=1$) (Finley et al. 1985b). In addition, in one study breast milk was analyzed for brain-derived neurotrophic factor (BDNF) in correlation with omega-3 fatty acids content (Perrin et al. 2019); in another paper, because of the examination of selenium content, the glutathione peroxidase (GSH-Px) activity was determined (Debski et al. 1989).

Breast milk composition – main results

Total fat

The total breast milk fat was measured in 3 papers (Finley et al. 1985a, 1985b; Perrin et al. 2019). Perrin et al. observed a significant difference in dietary groups ($p=0.041$) – mean concentrations of total milk fat were 3.0 (± 1.7) g/dl for vegans, 4.0 (± 2.9) g/dl for vegetarians and 4.0 (± 2.9) g/dl for omnivores. The total fat content in breast milk seemed to be affected by maternal age ($\beta=0.1$, $R=0.047$; $p=0.036$), with no significant relationship to the stage of lactation and maternal BMI, although the maternal BMI in mothers following a meatless diet was significantly lower ($p=0.021$) than in omnivores. When it comes to trans-fat, the mean breast milk trans-fat concentrations were relatively low – below 1.1% in all study groups, with the lowest levels in vegans (Perrin et al. 2019).

Finley et al. found that the milk fat maintained at a constant level in the first 6 months of lactation and increased in subsequent 14 months ($r = +0.29$). As all the study participants were well-nourished, the dietary fat intake did not significantly affect the breast milk composition (correlation coefficient: 0.03), even though the vegetarians consumed less fat than non-vegetarians (Finley et al. 1985b).

Finley et al. continued the analysis of breast milk fat content in another study. Since the participants were well-nourished, both vegetarians and non-vegetarians had similar dietary fat intake, which constituted 36% of energy intake – with no significant impact on fat content in breast milk samples. The mean percentage of fat in breast milk samples was 3.21 ± 1.78% for vegetarians and 3.23 ± 2.13% for non-vegetarians. In further analysis, maternal parity and nursing intervals were negatively correlated with a milk fat percentage ($r = -0.38$ and $r = -0.28$, respectively), with no significant correlation between a part of a day and expressing milk (Finley et al. 1985a).

Regardless of meat consumption patterns, the participants were divided into groups of low animal-fat intake (LAF) – less than 35 g daily, and high animal-fat intake (HAF) – more than 35 g daily (the fat intake was estimated on the basis of two-day records made prior to the milk samples collection). For LAF group the milk fat percentage was positively correlated with the amount of animal-fat consumption ($r = +0.35$, $p \leq 0.001$). However, there was no significant correlation in HAF group ($r = 0.06$, $p \leq 0.10$). Neither the total fat intake nor vegetable fat intake affected significantly the milk fat percentage in any of dietary groups (Finley et al. 1985a).

Free fatty acids

A detailed analysis of particular fatty acids was conducted in 4 studies. When it comes to polyunsaturated fatty acids, the main $\omega 3$ acids include: α-linolenic acid (ALA; 18:3ω3), DHA, EPA, and docosapentaenoic acid (DPA; 22:5ω3) and $\omega 6$ acids: linoleic acid (LA; 18:2ω6) and arachidonic acid (AA; 20:4ω6).

In both studies, Finley et al. found some differences in fatty acid composition of breast milk, based on the maternal dietary habits. In general, fourteen fatty acids were identified in human milk. In comparison to non-vegetarians, the vegetarians' breast milk contained less C16:0 (23.96 ± 2.92% vs 22.50 ± 3.63%), C16:1ω9 (3.23 ± 0.79% vs 2.81 ± 0.68%), C18:0 (8.70 ± 1.31% vs 7.44 ± 1.53%) and C181ω9 (32.98 ± 3.51% vs 30.74 ± 4.13%) fatty acids and was more rich in 18:2ω6 fatty acids (14.65 ± 4.24% vs 18.38 ± 4.67%). The results seemed to reflect the difference in dietary intake of fatty acids – vegetarians consumed less oleic acid (C18:1ω9) than non-vegetarians (mean 30 ± 13 g vs 34 ± 12 g), and more linoleic acid (C18:2ω6) (mean 14 ± 9 g vs 12 ± 8 g). As vegetarians consumed less fat, their milk proved to have a higher level of C10:0, C12:0, C14:0 fatty acids. All in all, vegetarians' breast milk contained a reduced level of saturated long-chain fatty acids and a higher level of polyunsaturated fatty acids (Finley et al. 1985a, 1985b).

The analysis of fatty acids in relation to the animal-fat intake (low animal-fat intake – LAF, high animal-fat intake – HAF) has revealed no correlation between fatty acid pattern and total fat in milk in LAF group, whereas in HAF group a significant relationship was found: C10:0 ($r = +0.38$), C12:0 ($r = +0.31$), C18:3 ($r = +0.26$), C20:2ω6 ($r = +0.31$), C16:0 ($r = -0.29$), C18:0 ($r = -0.28$). Considering de novo synthesis of fatty acids in mammary glands, no significant difference in breast milk composition, including fat content, was found between vegetarians and non-vegetarians (Finley et al. 1985a).

Perrin et al. discovered that breast milk samples were predominantly rich in long-chain fatty acids, counting more than 15 carbons. No significant difference in distribution of total long-chain ($p=0.906$) or total medium-chain ($p=0.879$) fatty acids by the dietary group was observed. Of

the predominant fatty acids, the dietary patterns proved to affect the content of C16:0, C16:1cis, C18:0, C18:1cis, C18:3cis $\omega 3$ fatty acids ($p \leq 0001$) in milk significantly. Furthermore, in particular dietary groups ($p \leq 0.001$), a dietary pattern had an impact on the content of saturated, unsaturated and trans fat in breast milk (Perrin et al. 2019).

The authors conducted further analysis of polyunsaturated fatty acids in milk samples: omega-3 and omega-6 fatty acids. As regards omega-3 fatty acids, a statistically significant difference was found in dietary groups due to a higher percentage of ALA in vegan milk ($p < 0.001$) – the mean percentage of ALA in breast milk samples was 2.09% for vegans, 1.55% for vegetarians and 1.19% for omnivores. There was no statistically significant difference in DHA concentration in any dietary group ($p = 0.543$). Moreover, the majority of participants had breast milk DHA concentration below 0.3% and no significant correlation was found among them ($p = 0.555$). In the analysis of total omega-6 fatty acids concentrations, there was no statistically significant difference in any dietary group ($p = 0.492$). However, omnivores had more gamma linolenic acid (0.08%; $p < 0.001$). 13.5% of participants supplemented DHA/EPA – taking supplements proved to be a positive predictor of ALA ($\beta = 0.62$, $p = 0.002$), DHA ($\beta = 0.10$, $p = 0.017$), total omega-3 fatty acids ($\beta = 0.71$, $p < 0.001$) and a decreased concentration ratio of omega-6, omega-3 fatty acids in breast milk ($\beta = -2.84$, $p = 0.005$) (Perrin et al. 2019).

Sanders et al. assessed human milk samples with regard to fatty acid composition. As a result, the difference in the fatty acid profile was significant ($p < 0.001$) due to dietary groups, apart from arachidonic acid (AA 20:4$\omega 6$) and dihomo-gamma-linolenic acid (20:3$\omega 6$). The amount of short-chain fatty acids, i.e. with 10–14 carbon atoms, transpired to be higher in vegans than in vegetarians and omnivores; similar results were found for linoleic acid and α-linolenic acid. As far as fatty acids with 16–18 carbon atoms were concerned, their ratio was higher in omnivores than in vegetarians and vegans. In comparison to other dietary groups, the proportion of DHA in milk of vegans tended to be lower. In addition, vegans had lower ratio of LA/ALA in breast milk, however the omega-6 and omega-3 ratio was higher than in other groups. The results of milk analysis seemed to be parallel to the analysis of dietary habits – the intake of linoleic acid (18:2$\omega 6$) was greater in vegans than in other groups and the intake of α-linolenic acid (18:3$\omega 3$) turned out to be higher in vegans and white vegetarians than in Hindu vegetarians and omnivores (Sanders, Ellis, and Dickerson 1978).

In another study by Sanders et al. analyzing fatty acid composition, breast milk of vegan mothers tended to have the lower proportion of C16:0, C16:1, C18:0, C20:4$\omega 3$ ($p < 0.05$) fatty acids and the higher proportion of C18:2$\omega 6$, C18:3$\omega 3$ and 20:2$\omega 6$ ($p < 0.05$) fatty acids than omnivores (Sanders and Reddy 1992).

Proteins

The total protein content was estimated in 3 studies (Bijur and Desai 1985; Finley et al. 1985b; Debski et al. 1989). Both Bijur et al. and Debski et al. observed no significant differences in particular dietary groups with regard to total protein concentrations in breast milk (Bijur and Desai 1985; Debski et al. 1989). According to Bijur et al. mean values constituted 1.122 (± 0.072) gm/dl for lacto-vegetarians, 1.221 (± 0.064) gm/dl for occasional meat eaters and 1.216 (± 0.049) gm/dl for frequent meat eaters. On the basis of the data available from authors, the estimated protein intake, including animal protein intake in non-vegetarians, transpired to be lower than in western countries (Bijur and Desai 1985). According to Debski et al. mean protein concentration in vegetarians' milk was 10.2 (± 1.4) g/100 ml and 9.9 (± 1.1) g/100 ml in non-vegetarians' milk (Debski et al. 1989).

Finley et al. discovered that the protein levels in milk from mothers in particular dietary groups were different because of the course of lactation. After 7–20 months of lactation, milk samples from vegetarian mothers had lower content of proteins (0.44 ± 0.46%, $n = 52$ samples from 11 women) than those from non-vegetarian ones (1.83 ± 0.48%, $n = 21$ samples from 16 women). As far as the dietary protein intake is concerned, even though vegetarians consumed less total proteins than non-vegetarians, both group covered 100% of the Recommended Dietary Allowance. However, in both groups the levels of milk proteins were unrelated to dietary protein intake (correlation coefficient = 0.06). Similarly, neither a part of a day of milk expression, nor month of lactation, nor an interval between milk expressions (partial correlation coefficient = 0.02) are related. In both groups, the level of milk proteins decreased in the first 6 months of lactation ($r = -0.43$) and did not change significantly in subsequent 14 months of lactation (Finley et al. 1985b).

Taurine

The analysis of taurine concentration in breast milk samples with regard to the dietary preferences was conducted in 2 studies (Rana and Sanders 1986; Kim et al. 1996). Rana et al. compared the group of omnivores with the group of vegans, both living in Seoul, in terms of taurine dietary intake, plasma concentration, urinary excretion and breast milk concentration. The breast milk samples analyzed in the study included also samples taken from another research. The authors found significantly lower (than in omnivore samples) mean taurine concentrations in vegan milk samples ($p < 0.01$). Further analysis revealed that, when compared with omnivores, vegans consumed significantly less protein and their meals contained no preformed dietary taurine. Furthermore, the urinary excretion of taurine was significantly higher in omnivores, whereas the plasma mean concentrations were similar in both groups (Rana and Sanders 1986).

Kim et al. analyzed the taurine concentrations in human milk in several stages of lactation, comparing samples from lacto-ovo-vegetarians and omnivores. In both groups, the longer the course of lactation was, the less taurine the breast milk contained ($p < 0.05$). With regard to the dietary group, lacto-ovo-vegetarians had significantly lower milk taurine

concentrations after 90 days postpartum than omnivores. The taurine intake in breastfed infants was estimated by calculations – multiplying mean taurine concentrations in several stages of lactation by an average breast milk intake, measured by weighing method. Until 120 days postpartum, taurine intake was similar among infants of non-vegetarian mothers. After 30 days postpartum, a gradually decreasing taurine intake was observed in infants of vegetarian mothers. After 60 days postpartum, there was a significant difference in comparison to the control group – $p < 0.05$ (Kim et al. 1996).

Vitamin B12

Vitamin B12 was analyzed in 4 articles (Bijur and Desai 1985; Specker et al. 1990; Patel and Lovelady 1998; Pawlak et al. 2018). Two studies incorporated Indian vegetarian women to the study groups (Bijur and Desai 1985; Patel and Lovelady 1998). The results of both studies revealed that mean serum and vitamin B12 levels were lower in milk from vegetarian women than from the non-vegetarian control groups (Bijur and Desai 1985; Patel and Lovelady 1998). Bijur et al. found those differences between dietary groups as statistically insignificant ($p > 0.05$) (Bijur and Desai 1985), whereas Patel et al. – statistically significant ($p < 0.05$) (Patel and Lovelady 1998). As far as the vitamin B12 concentrations in milk are concerned, in both studies vegetarian mothers proved to have lower levels, with a statistically significant difference according to Patel et al. ($p = 0.006$) (Patel and Lovelady 1998). However, according to Patel et al. the number of daily servings of dietary cobalamin sources consumed did not significantly correlate with vitamin B12 concentrations in milk, although the mean dietary intake was significantly lower in the vegetarian group. In addition, among the control groups, Indian women proved to have lower vitamin B12 concentrations in breast milk and comparable levels in serum ($p = 0.06$) (Patel and Lovelady 1998).

Pawlak et al. and Specker et al. also found lower vitamin B12 concentrations in milk from mothers following meatless diet, than in omnivore control groups (Specker et al. 1990; Pawlak et al. 2018). Nevertheless, according to Pawlak et al. the measured values of breast milk vitamin B12 did not differ significantly by dietary pattern. It should be mentioned, that 78.4% of all participants used multivitamins containing vitamin B12, whereas 25.7% of them used individual vitamin B12 supplemets (Pawlak et al. 2018).

In all 3 studies, where serum and milk vitamin B12 concentrations were assessed concomitantly, the positive correlation between measured values was found (Bijur and Desai 1985; Specker et al. 1990; Patel and Lovelady 1998). Moreover, Patel et al. has proved that the duration of lactation negatively affects the content of vitamin B12 in breast milk ($p = 0.04$) (Patel and Lovelady 1998), whereas neither Pawlak et al. nor Specker et al. did not consider the duration of lactation as a factor affecting vitamin B12 levels in milk ($p > 0.05$) (Specker et al. 1990; Pawlak et al. 2018).

In 3 papers, the supplementation was taken into consideration during analyses. According to Pawlak et al. taking vitamin B12 supplements proved to be a positive predictor of breast milk vitamin B12 concentration ($p = 0.028$), whereas taking multivitamins did not affect milk vitamin B12 content significantly (Pawlak et al. 2018). On the contrary – Patel et al. did not find any significant correlation with regard to that issue (Patel and Lovelady 1998). None of the participants of Specker et al.'s study was administered commercial supplements.

According to Specker et al. the length of any type of vegetarian diet is a factor inversely correlated with breast milk vitamin B12 concentration ($p = 0.03$) (Specker et al. 1990).

Minerals

Finley at al. analyzed milk samples for iron, copper, zinc, calcium, magnesium, potassium and sodium concentrations. As both vegetarian and non-vegetarian women were well-nourished, there was no statistically significant difference in breast milk's inorganic constituent composition. Moreover, some differences in dietary mineral intake did not affect milk composition significantly. Longitudinal changes in concentration of inorganic constituents in milk have revealed to be similar in both groups. During the first 6 months of lactation, there was a decreasing trend in the concentrations of zinc ($r = -0.7$) copper ($r = -0.69$), sodium ($r = -0.56$), potassium ($r = -0.56$), iron ($r = -0.43$), whereas the level of magnesium increased ($r = +0.31$). Within subsequent 14 months the level of calcium decreased ($r = -0.41$), whereas the level of zinc increased ($r = +0.39$). Between the 9th and 20th month of lactation, there was an increase in sodium level ($r = +0.39$). Between the 7th and 20th month of lactation, the concentrations of sodium and potassium remained stable, without any significant fluctuations (Finley et al. 1985b).

Selenium

In undialysed milk samples, the selenium concentration was significantly higher in the case of vegetarian mothers in comparison to non-vegetarian ones (22.2 ± 0.8 ng/ml vs 16.8 ± 1.3 ng/ml), whereas there was less significant difference between both study groups in dialyzed milk samples (10.9 ± 0.7 ng/ml vs 10.6 ± 0.6 ng/ml). Both groups of mothers had comparable dietary intake of selenium (vegetarian women: 101 ± 6 ng; non-vegetarian women: 106 ± 5 ng) during the 4-6 months of lactation. According to Debski et al. a variance in concentrations of undialysed milk samples was unlikely to result from the dietary habits (Debski et al. 1989).

Selenium was also found as a fraction associated with proteins, mainly of high molecular weights. However, the increase in vegetarian milk selenium content was not associated with a proportional increase in selenoprotein concentrations (Debski et al. 1989).

Lactose

The lactose concentration in breast milk samples from vegetarian mothers was found to be similar to the lactose levels

in samples from non-vegetarian mothers. Furthermore, the lactose concentration remained stable during the course of lactation among all participants. The dietary intake of carbohydrates did not affect the lactose concentration in breast milk significantly (Pearson correlation coefficient: 0.04) (Finley et al. 1985b).

Folic acid activity

The folic acid content in human milk was assessed using microbiological method of folic acid activity evaluation by Bijur et al. No statistically significant difference between vegetarians and omnivores was found (Bijur and Desai 1985).

Non-nutritive components

Brain derived neurotrophic factor (BDNF)

BDNF was not detected in any of breast milk samples. The analysis was proceeded on two groups of samples - prior to the analysis, one group was prepared according to the instruction of commercial ELISA kit, another group was centrifuged with higher speed prior to improve BDNF capacity (Perrin et al. 2019).

Free nucleotides and nucleosides

Liao, et al. provided data on mean concentrations of nucleosides and nucleotides among all mothers. The mean total nucleotides and nucleosides concentrations constituted 213.15 (SD ± 73.26) µmol/l and 16.38 µmol/l. The concentrations of both nucleotides and nucleotides decreased during the course of lactation. Cytidine diphosphate was found to be the prevalent nucleotide in breast milk, regardless of the stage of lactation and dietary habits of the mothers. In comparison to the omnivore group (*U* Mann Whitney test, $\alpha = 0.05$), vegetarian mothers had high free nucleotide concentration in breast milk ($p = 0.037$), with no statistical difference in free nucleoside concentration ($p = 0.076$) (Liao et al. 2011).

Glutathione peroxidase activity

The analysis of breast milk samples has revealed a high activity of GSH-Px in milk of vegetarian women when compared to non-vegetarian women. A linear correlation between Se concentration and GSH-Px activity was found ($r = 0.76$, $p < 0.001$) along with a correlation coefficient equal to 0.72 in vegetarian women's milk and 0.60 in omnivore women's milk. In addition, a relationship between milk GSH-Px activity and linoleic acid content was revealed ($r = 0.68$, $p = 0.0001$). However, on the basis of other studies, the authors suggested that GSH-Px activity partially resulted from the presence of GSH-Px isozymes in human milk – their biological function is to protect lipids from oxidative stress. Overall, the GSH-Px activity in vegetarian and non-vegetarian women's milk accounted, respectively, for 37% and 23% of total peroxidase activity. The total peroxidase activity in milk samples from both groups remained without any statistically significant difference (Debski et al. 1989).

Discussion

Over the past few decades the attempts to investigate the relationship between such maternal factors as the nutritional status and dietary habits, including the intake of particular nutrients, and the composition of human milk have been made (Bravi et al. 2016; Innis 2014; Butte et al. 1984; Brown et al. 1986). The impact on particular milk components is related to not only current mother's dietary intake, nutrients reserves and nutrients utilization, but depends on genetic determinants, effectiveness of metabolic pathways, comorbidities, environmental conditions, infant's gender, gestational age at birth and postnatal age, as well nutrients digestibility and bioavailability – all of the aforementioned factors might result in positive, neutral or negative change in the concentrations of the breast milk compounds (Institute of Medicine 1991; Bravi et al. 2016). In general, milk production and milk quality is not significantly affected by mild or moderate variations in maternal nutrition (Dewey 1998; Lovelady 2004; Keikha et al. 2017). Longer periods of dietary restrictions, both quantitative and qualitative, do not have any pronounced effect on human milk, provided that the mobilization of maternal body reserves is sufficient for milk synthesis (Institute of Medicine 1991; Butte et al. 1984; Dewey 1998; Lovelady 2004). As the energy demands to exceed normal metabolic needs during the lactation process, the nutrient needs of breastfeeding mothers increase to compensate for the daily nutrient output into breast milk (Institute of Medicine 1991; Butte et al. 1984). Studies conducted on overweight lactating women revealed that neither physical activity, nor dietary restrictions affect the quantity and composition of breast milk, as well as the infant's growth – but the lactation should be stabilized (Lovelady 2011). On the contrary, the composition of some nutrients in human milk can be significantly affected by prolonged nutritional deprivation and insufficient mother's tissue stores (Institute of Medicine 1991; Brown et al. 1986). Due to e.g. low socioeconomic status, temporary periods of fasting preceded by insufficient daily provision of nutrients, might affect both mother's nutritional status and micronutrients concentrations of breast milk (Rakicioglu et al. 2006).

As the mother's nutritional status is considered to have impact on the quality and quantity of breast milk, several studies investigated the association of maternal anthropometric measurements with breast milk composition. In the recent studies, the milk protein concentrations were positively correlated with bioelectrically estimated maternal body composition: muscle, fat and fat-free mass. The milk fat concentrations and milk caloric value depended on body weight and body mass index (BMI) (Bzikowska-Jura et al. 2018; Bzikowska et al. 2018).

The studies included in this systematic review were conducted on women whose anthropometric measures were within normal range, what was adopted for indicator of

nutritional status (data from 46.15% studies) – regardless of their socio-economic status and educational background. Even though a tendency to lower body weight was found among vegans, their anthropometry remained within normal range. Nevertheless, the physical measures (e.g. weight, BMI, skinfold thickness) do not constitute a reliable tool for the assessment of nutritional status. Apart from the risk of errors arising out of inadequate training of personnel, improper technique of measurements, difficulties in measurement of certain anthropometric characteristics such as skinfolds, the reference data should be representative of the investigated community. Moreover, anthropometry is insensitive to detect changes in nutritional status following inadequacy of food over short periods of time, nor unable to distinguish specific nutrients deficiencies as a cause of undernutrition.

The results of the reviewed studies did not present any significant impact of body weight on breast milk components. However, the detailed data concerning participants' nutritional status and anthropometric measures was limited, since further investigation is needed to verify whether body composition differs due to the diet and intake of animal-origin products, and whether it affects breast milk components.

In addition, regardless of the methods of analyses as well as the preparation and storage of the collected human milk samples, the results of investigations were comparable.

As far as the impact of mother's diet on human milk nutritional components is concerned, the macronutrient content seems to be less affected by dietary habits and changes during the course of lactation as a result of the infant's needs. According to current knowledge, maternal dietary intake do not affect the breast milk proteins and lactose composition (Bravi et al. 2016; Schanler 2011). Similar conclusions have been reported in the analyzed studies – regardless of other factors, the breast milk composition was not significantly different between mothers following a meatless diet and omnivores. In fact, a properly planned and well-balanced vegan diet can fully cover nutritional needs for proteins. However, as the digestibility of plant-derived proteins can be limited, the daily intake of protein should be increased by 10% during lactation (Agnoli et al. 2017; Baroni et al. 2019). Considering amino acids profile, the difference in taurine concentrations was found, as omnivores' milk was significantly more rich in this amino acid, what might have been attributable to dietary intake (Kim et al. 1996). Taurine is considered as a factor regulating the development of fetal and neonatal nervous system. This amino acid is provided by mother via placenta or with breast milk. According to existing knowledge, both maternal obesity and maternal malnutrition can adversely influence the transfer of taurine from mothers to fetuses or infants and probably impair the neural development (Tochitani 2017). Further research with consideration given to other factors, e.g. maternal nutritional status, comorbidities, stage of lactation are needed to assess whether dietary habits have a significant impact on taurine concentration in breast milk.

On the contrary, maternal dietary fat intake, regardless of the type of the diet, has an impact on the quality of fat in breast milk, with insignificant effect on its quantity. Mothers on a low-fat diet produce breast milk with a slightly higher fraction of medium-chain fatty acids when compared with mothers following a high-fat diet (Lönnerdal 1986; Innis 2014; Kelishadi et al. 2012).. As plant-based diet is generally rich in linoleic acid and omega-6 polyunsaturated fatty acids and deficient in good sources of omega-3 fatty acids and monounsaturated oils, the tissue fatty acids profile in vegetarians and vegans is thought to have higher proportions of omega-6 fatty acids and lower proportions of omega-3 fatty acids, compared to omnivores (Melina, Craig, and Levin 2016; Craig and Mangels 2009; Agnoli et al. 2017; Sanders 1999). Similar findings were reported in the reviewed studies (Sanders, Ellis, and Dickerson 1978; Finley et al. 1985a; Sanders and Reddy 1992). Nevertheless, fatty acids occur in milk not only as a result of dietary intake, but also as mobilization from body fat reserves and endogenous synthesis by the mammary glands. For this reason, even if maternal diet is deficient in some fatty acids, they are still present in human milk (Institute of Medicine 1991; Neville and Picciano 1997).

The impact of maternal dietary habits on the fatty acid composition of milk concerns mainly fluctuations in the content of essential polyunsaturated fatty acids, with a special interest on DHA and EPA (Sanders 1999). Vegans consume quite big amounts of omega-6 but marginal amounts of omega-3 fatty acids, which is mainly ALA (Melina, Craig, and Levin 2016; Craig and Mangels 2009; Van Winckel et al. 2011). In the periods of pregnancy and lactation, the metabolites of ALA, DHA and EPA, are indispensable for the development of the retina and central nervous system (Agostoni et al. 2009; Van Winckel et al. 2011; Sanders 1999). The daily intake of DHA and EPA is very low among vegans, as these omega-3 fatty acids might be found only in algae or fortified products, mainly plant-based beverages (Melina, Craig, and Levin 2016; Craig and Mangels 2009; Baroni et al. 2019). It is assumed, that DHA and EPA can be synthesized from ALA, which requires sufficient amounts of ALA, optimal omega-6/omega-3 ratio of fatty acids daily intake, but also proteins, pyridoxine, biotin, calcium, copper, magnesium, and zinc involved in DHA production. However, the process of endogenous conversion to DHA is highly inefficient and do not cover daily requirements. Serum levels of DHA and EPA were found to be lower in vegan and vegetarians compared to non-vegetarians. Similar results were obtained in studies investigating omega-3 fatty acids content in breast milk, cord blood, and erythrocytes lipid membrane (Van Winckel et al. 2011; Baroni et al. 2019). All these conclusions have been reflected in the results of analyzed studies – breast milk of vegan mothers is deficient in DHA, since the supplementation of preformed forms of DHA is essential. As an alternative for vegan mothers, algal-derived DHA, accepted by FDA, is available (Baroni et al. 2019).

The longitudinal changes in human milk during the course of lactation appears to be identical in all mothers, regardless of their dietary habits. If lactating women are exposed to the micronutrient deficiency or daily

requirements to cover both mother's and infant's needs exceed the dietary intake, the depletion of maternal reserves affects the breast milk composition. During lactation, mothers should provide proper amounts of calcium, vitamin D, iron, iodine, as well as zinc, magnesium, vitamin B6, folate (Institute of Medicine 1991; Bravi et al. 2016). Furthermore, vegetarians, and especially vegans, should pay attention to adequate vitamin B12 intake (Melina, Craig, and Levin 2016; Agnoli et al. 2017; Baroni et al. 2019) The biggest risk of developing vitamin B12 deficiency is attributed to the vegan diet. Since cobalamin is essential for DNA creation and maintenance of nervous system, deprivation or insufficiency of its body reserves can lead to irreversible cognitive impairment and other neurological disorders, hematologic complications and even death due to qualitative malnutrition. For this reason, supplementation of vitamin B12 is strongly recommended for all vegans and advisable for vegetarians, especially for breastfeeding mothers and children – an emphasis is put on reliable additional source of cobalamin for breastfed infants whose mothers do not supplement this vitamin (Van Winckel 2017; Van Winckel et al. 2011; Sebastiani et al. 2019). In this systematic review, the time of following a plant-based diet, the duration of lactation, supplementation of vitamin B12 by mothers as well as serum level of vitamin B12 in mothers have been found as main determinants of vitamin B12 concentrations in breast milk. Proper preparation of meals, with consideration given to the digestibility and assimilation of nutrients, should not be omitted (Melina, Craig, and Levin 2016; Craig and Mangels 2009; Federal Commission for Nutrition (FCN) 2018; Agnoli et al. 2017; Baroni et al. 2019).

The purpose of this study was to collect evidence on the relationships between maternal plant-based diet and breast-milk composition, including the comparison with healthy mothers following a typical omnivore diet. The subject of breast milk composition, concentrated on particular compounds, has been already well studied. According to the current knowledge, the nutritional profile of breast milk depends not only on dietary habits, but also nutritional status, comorbidities, genetics, stage of lactation, gestational age at labor, and other environmental factors (Institute of Medicine 1991; Kleinman 2009; Keikha et al. 2017; Sanders 1999; Tochitani 2017; Miliku et al. 2019). Due to the aforementioned factors, nutritional requirements vary among individuals. As far as the nutritional adequacy of the diet is concerned, a dietary pattern that provides sufficient intake of essential nutrients and prevent depletion of the nutrients from the body ensuring its proper function can be called "well-balanced". If the nutritional requirements exceed the daily dietary intake, especially for micronutrients, the proper supplementation should be considered.

As it was already mentioned, the official statements of professional dietetic societies and organizations regarding the impact of vegetarianism on both mothers and infants' health condition are inconsistent. Although, AND (Melina, Craig, and Levin 2016; Craig and Mangels 2009) supported the thesis that well-balanced meatless diet is safe and support sustainable growth and development in all age groups, the FCN (Federal Commission for Nutrition (FCN) 2018), the DGE (Richter et al. 2016) and ESPGHAN (Fewtrell et al. 2017) indicates the risk of nutritional deficiencies and their irreversible consequences, thus do not recommend a vegan diet as a way of nutrition during pregnancy, lactation, infancy and childhood. Moreover, the issue of restricting animal-derived nutrients during pregnancy and lactation still arises doubt of healthcare providers managing donations of human milk.

Our study included papers published in vast period of time. The results have shown that the breast milk composition in women following plant-based and traditional diet is similar, with few differences in fatty acids profile, including strong emphasis on low DHA and EPA concentrations in milk of vegans. Moreover, among differences in micronutrient content, a significant consideration should be given to the low levels of vitamin B12 and the need of proper supplementation, optimally under the medical supervision. Regardless of a laboratory method used and the time of publication, the conclusions were consistent. However, the antrophometric measurements were the only indicators of participants' nutritional status. Future studies on the current topic are therefore recommended.

Conclusions

The question whether vegan diet disqualifies mother from breast milk donation to the milk banks is debatable. Due to the solid evidence, breast milk provides basic alimentation for preterm infants. Mother's milk is the first choice, but when its amount is insufficient, the donor's milk is an alternative (Agostoni et al. 2009; Wesołowska et al. 2018; Arslanoglu et al. 2019). With regard to human milk banking, the Neonatal Intensive Care Units require recruiting donors and donor profiles, including the data on nutritional status, dietary habits and health history, because these all factors have an impact on individual composition of breast milk (PATH, 2019; HMBASA Milk Banks Guidelines 2014; The European Foundation for the Care of Newborn Infants (EFCNI) 2018; Frischknecht et al. 2010; Wesołowska et al. 2018; Moher et al. 2009; National Heart, Lung and Blood Institute 2018; Sanders, Ellis, and Dickerson 1978; Bijur and Desai 1985; Finley et al. 1985a, 1985b; Rana and Sanders 1986; Debski et al. 1989; Specker et al. 1990; Sanders and Reddy 1992; Kim et al. 1996). The individual high needs of premature infants for nutrients – mainly proteins, calcium and phosphorus, require improving breast milk quality with fortified breast milk (Wesołowska et al. 2018; Arslanoglu et al. 2019). Provided that nourishment is satisfactory, the diet covers nutritional requirements, and the obligatory supplementation of at least DHA and vitamin B12 is provided, vegans are likely to produce as nutritionally valuable milk as omnivores. For this reason, dietary choices, if rational, should not permanently forbid breast milk donation. Each donor candidate should be assessed individually, with evaluation of health condition, nutritional assistance, medical supervision and lactational support.

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6.2. Artykuł nr 2.

nutrients

MDPI

Article

Foods to Avoid While Breastfeeding? Experiences and Opinions of Polish Mothers and Healthcare Providers

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Abstract: Popular beliefs regarding a mother's diet during lactation have a significant impact on breastfeeding practices among mothers, as well on breastfeeding counseling among healthcare providers worldwide. The objective of this study was to assess mothers' and medical professionals' knowledge and opinions on the "lactating mother's diet". An electronic survey, prepared in Polish, was administered to healthcare providers, as well as mothers who have breastfed a child. The chi-square test, logistic regression, and Mann Whitney U test were used for statistical calculations. Out of a total of 1180 responses received, 1159 were analyzed, and 21 were excluded because they did not meet the inclusion criteria. The survey was completed by 407 (35%) medical healthcare providers and 752 (65%) lactating mothers in non-medical professions. In total, the study included 1074 mothers who have breastfed a child, and 29.14% of them reported that they eliminated certain foods from their diet when breastfeeding. There was no statistically significant difference in the responses received from mothers and medical staff providing maternal care (for each of 17 products, e.g., steak tartare, sushi, legumes, dairy products, $p > 0.05$ by the Mann-Whitney test). However, a logistic regression revealed some significant correlations with other variables (e.g., duration of lactation). The respondents revealed an appropriate level of knowledge on nutrition during lactation and the majority of participants neither adhered to nor recommended a prophylactic elimination diet. Among other evaluated factors, the experience of following an elimination diet affected respondents' knowledge of nutrition during breastfeeding. Both mothers and healthcare providers require good nutritional education.

Keywords: breastfeeding; diet; health care surveys

1. Introduction

Human milk provides optimal nutrition for infants. Thus, it constitutes a first choice for feeding [1,2]. On the basis of numerous short- and long-term benefits for both mothers and infants, multiple organizations, such as the American Academy of Pediatrics (AAP) [3], the American College of Obstetricians and Gynecologists (ACOG) [4], and the World Health Organization (WHO) [5], support the recommendation of exclusive breastfeeding for at least the first 6 months of life, with its continuation alongside weaning. As far as the impact on several health conditions is concerned, according to the current state of knowledge, exclusive breastfeeding for 3 to 4 months reduces the risk of atopic diseases, including eczema and asthma. Moreover, feeding with human milk while introducing complementary foods might decrease the incidence of food allergies [6].

On the other hand, exclusively breastfed infants might present symptoms suggesting manifestations of allergic reactions to food components. The concentration of antigens or endogenous allergenic proteins in breast milk can be high enough to trigger an allergic reaction. Nevertheless, the diagnosis of food allergy in exclusively breastfed infants is challenging and requires conscientious

consideration, as well as the exclusion of other conditions [7]. In fact, the first treatment of food allergy is the cessation of allergen exposure, which in practice means an elimination diet in lactating mothers. However, there is no evidence that excluding some products from the diet of pregnant or lactating mothers as a preventive measure can protect her offspring from developing a sensitization to allergens or any atopic disease [6,8].

Despite the scientific evidence, the popular beliefs regarding the mother's diet during lactation have a significant impact on breastfeeding practices in society, as well breastfeeding counseling among healthcare providers worldwide. Mothers are constantly reinforced in their conviction that their breast milk can be harmful for infants unless they change their dietary habits and stop consuming certain products when breastfeeding. The authors of this work have often experienced lactating women consulting their clinic to ask whether dietary restrictions are required and what they should eat. The most common misconceptions concern not only the prevention of atopic diseases, but also human milk quality and quantity, the effectiveness of lactation, milk-borne diseases and infants' general condition and development, all of which are attributable to the consumption of certain products [9–11].

The period of lactation imposes the need for an additional energetic and nutrient supply for mothers [12]. The dietary restrictions not only might affect the effectiveness of breastfeeding, but they can be detrimental for mothers' nutritional status and well-being. Constant anxiety about infants' health and the further elimination of potentially "harmful" products from the diet are factors which contribute to the decision to stop breastfeeding [13].

2. Aim of the Study

The objective of this study was to assess mothers' (representing the general public), and medical professionals' knowledge and opinions related to the issue of diet during lactation and the consumption of particular products.

3. Materials and Methods

The electronic survey was conducted in January and February 2019 in Poland among native inhabitants of Poland. The target group of the study included: (1) mothers who have breastfed a child (generally healthy and born full-term), regardless of the duration of lactation, including expressed breast milk with bottle feeding, for example, as representatives of Polish society; and (2) healthcare providers, regardless of age, sex, and parity. The questionnaire (Supplementary Materials File S1) used in the study was prepared by the authors, in a Polish language version only. It consisted of three parts: (1) questions regarding whether a lactating mother can eat or drink certain foods; (2) questions concerning popular myths related to nutrition when breastfeeding a child and referring to the knowledge of breast milk composition; and (3) demographic data and respondents' experience with an elimination diet. In this study, the first part of the results is presented, referring to the opinions regarding the consumption of particular products during lactation. The list of foods included in the study was compiled from information found online (e.g., discussion groups and forums, parenting blogs) or received directly from lactating mothers consulting the authors' clinic.

The survey was distributed in an electronic form, mainly using randomly selected internet discussion groups and forums: (1) related to the topics of parenthood, or breastfeeding, available mainly on Facebook; or (2) established for medical professionals (doctors, midwives, nurses, lactation consultants, etc.). To ensure participants' comprehension of the questionnaire, face-to-face interviews with a convenient sample (n = 10) were conducted prior to the start of the study. Provided that the respondents agreed to participate in the study through direct contact, they were provided with a link to the questionnaire. The participation in the study was fully voluntary. The responses were collected anonymously and were coded automatically.

Prior to the study's commencement, formal permission was obtained from the Bioethics Committee at the Medical University in Wroclaw (No. KB 519/19).

Formal analysis of the results was performed using the chi-square test (to test for differences in the correct answer rate categorized by the place of residence), logistic regression (to assess a relationship between predictor variables and respondent's answers, categorized as correct and incorrect) and the Mann-Whitney U test (to compare answers between study groups). Calculations were made in Microsoft Excel for Office 365 (Microsoft, Redmond, WA, USA), STATISTICA 13.3 (StatSoft, Inc., Tulsa, OK, USA) and R version 3.6.2 (R Core Team, 2013. R Foundation for Statistical Computing, Vienna, Austria. http://www.R-project.org/).

4. Results

4.1. Data

Questionnaire data were provided by 1180 respondents, all of whom were native Polish speakers. As 21 respondents did not meet the basic criteria of participation, as neither a medical professional, nor a mother who had ever fed a baby with her own breast milk, for the purpose of the formal analysis, 1159 questionnaires were included (Figure 1).

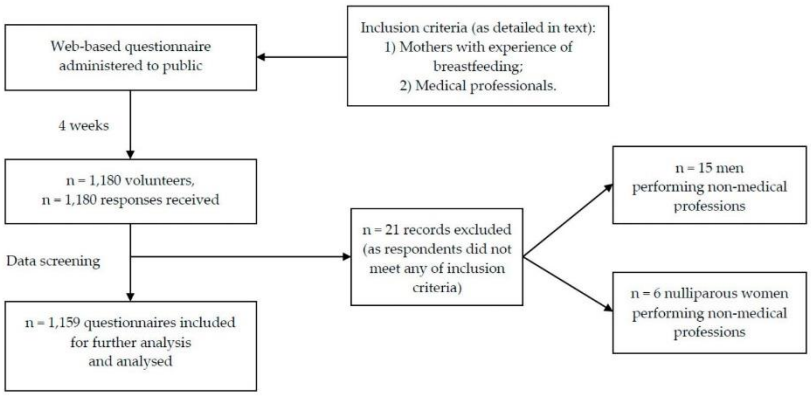

Figure 1. Flowchart on study group recruitment steps.

4.2. Characteristics of the Study Group

The group of respondents comprised: (1) 407 individuals carrying out a medical profession, 10 men and 397 women, including 322 mothers who delivered their babies at term and reported a history of breastfeeding; (2) mothers with any experience in breastfeeding, pursuing professions outside the healthcare sector (n = 752). The respondents differed in terms of age, level of education, place of residence, parity, history of breastfeeding and experience in practicing an elimination diet during lactation. The detailed characteristics of the study group are provided in Table 1.

Table 1. Characteristics of respondents (n = 1159).

Variable	Number of Respondents (%)
Age in years	
<20	3 (0.26%)
20–29	490 (42.28%)
30–39	581 (50.13%)
≥40	85 (7.33%)
Gender	
Female	1149 (99.14%)
Male	10 (0.86%)
Place of residence	
Village	213 (18.38%)
Cities < 100,000 residents	301 (25.97%)
Cities > 100,000 residents	645 (55.65%)
Profession	
Medical	407 (35.12%)
Non-medical	752 (64.88%)
Parity	
0	77 (6.64%)
1	586 (50.56%)
2	426 (36.76%)
3	67 (5.78%)
4 or more	3 (0.26%)
Duration of first child's breastfeeding (months)	
0–3	172 (14.84%)
4–5	94 (8.11%)
6–12	327 (28.21%)
13–24	363 (31.32%)
More than 24	118 (10.18%)
n/a	85 (7.33%)

Abbreviations: n/a—non applicable.

4.3. Foods to Avoid While Breastfeeding

The questions regarding whether the consumption of certain products is allowed in the lactation period referred to the most confusing food, as there are a variety of contrary opinions and various myths related to including them in the daily diet of lactating mothers. The list of products commonly advised to be avoided, as a preventive measure, was based on information found on the internet, leaflets for patients or provided directly by mothers and medical personnel. It included 17 items: steak tartare, sushi, honey, mushrooms, cheese (including blue cheese), cabbage, legumes, chocolate, sparkling beverages (including sparkling water), coffee, citrus fruits, stone fruits, nuts, dairy products, garlic, onion, and spicy food. The incidence of correct answers among all the respondents ranged from 68.94% to 99.14% and was higher than 90% in 12 of 17 items (70.59%) (Figure 2). The rate of correct answers differed by place of residence only for two products: honey ($\chi 2$ (2, N = 1159) = 8.138, p = 0.017) and spicy food ($\chi 2$ (2, N = 1159) = 6.833, p = 0.033). No statistically significant difference in answers was found between healthcare professionals and mothers performing non-medical professions (for each of the 17 products, $p > 0.05$ by Mann-Whitney test).

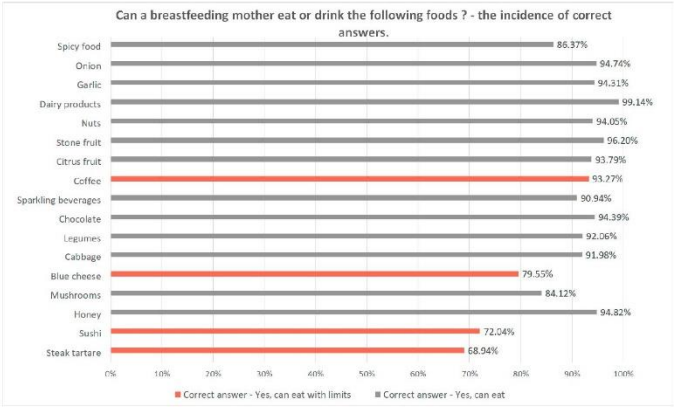

Figure 2. Can a lactating mother eat or drink the following products: incidence of correct answers for each of the 17 products included in the questionnaire. The bars on the chart referring to foods that can be eaten with limits are colored orange, and the bars referring to foods that do not need any prophylactic restriction are colored gray.

In further analysis, the respondents' answers referring to each of the 17 products were correlated with the following variables: parity, gender, duration of breastfeeding the first child, following the elimination diet when breastfeeding the child, feeding the infant with commercial formula instead of breastfeeding because of an elimination diet, pursuing a medical profession, and following an elimination diet due to a doctor's advice. Logistic regression calculations revealed no correlations with feeding the infant with commercial formula instead of breastfeeding because of an elimination diet, nor pursuing a medical profession. Only with regard to "dairy products" did answers differ depending on respondents' gender. The answers concerning the following 16 products were correlated with the other variables to a different extent. The results are summarized in Table 2.

Table 2. Statistically significant factors with an influence on the opinions regarding whether a mother is allowed to consume particular foods while breastfeeding. Multiple regression analysis, $p < 0.05$.

Item	Variables						
	Parity	Gender	Duration of Breastfeeding the 1st Child	Following the Elimination Diet When Breastfeeding the Child	Feeding the Infant with Commercial Formula Instead of Breastfeeding for the Reason of Elimination Diet	Practicing a Medical Profession	Following an Elimination Diet Due to a Doctor's Advice
	B; OR (95% CI)	B; OR (95% CI)	B; OR (95% CI)	B; OR (95% CI)	B; OR (95% CI)	B; OR (95% CI)	B; OR (95% CI)
Steak tartare	−0.246; 0.78 (0.66, 0.93)	n/s	0.026; 1.03 (1.01, 1.04)	0.700; 0.5 (0.38, 0.65)	n/s	n/s	−0.416; 0.66 (0.49, 0.89)
Sushi	−0.213; 0.81 (0.68, 0.97)	n/s	0.031; 1.03 (1.02, 1.05)	−0.691; 0.5 (0.38, 0.66)	n/s	n/s	−0.335; 0.72 (0.52, 0.98)
Honey	n/s	n/s	0.036; 1.04 (1, 1.07)	−0.916; 0.4 (0.24, 0.68)	n/s	n/s	n/s
Mushrooms	−0.311; 0.73 (0.59, 0.91)	n/s	0.0304; 1.03 (1.01, 1.05)	−1.034; 0.36 (0.26, 0.49)	n/s	n/s	n/s
Cheese	−0.252; 0.78 (0.64, 0.95)	n/s	0.040; 1.04 (1.02, 1.06)	−0.911; 0.4 (0.3, 0.54)	n/s	n/s	−0.426; 0.65 (0.46, 0.92)
Cabbage	n/s	n/s	0.051; 1.05 (1.02, 1.08)	−1.561; 0.21 (0.14, 0.33)	n/s	n/s	−0.477; 0.62 (0.38, 1.01)
Legumes	n/s	n/s	0.043; 1.04 (1.01, 1.07)	−1.692; 0.18 (0.12, 0.29)	n/s	n/s	−0.55; 0.57 (0.36, 0.93)

Table 2. *Cont.*

Item	Variables						
	Parity	Gender	Duration of Breastfeeding the 1st Child	Following the Elimination Diet When Breastfeeding the Child	Feeding the Infant with Commercial Formula Instead of Breastfeeding for the Reason of Elimination Diet	Practicing a Medical Profession	Following an Elimination Diet Due to a Doctor's Advice
	B; OR (95% CI)	B; OR (95% CI)	B; OR (95% CI)	B; OR (95% CI)	B; OR (95% CI)	B; OR (95% CI)	B; OR (95% CI)
Chocolate	n/s	n/s	0.053; 1.05 (1.02, 1.09)	−1.433; 0.24 (0.14, 0.4)	n/s	n/s	n/s
Sparkling beverages	−0.389; 0.68 (0.51, 0.89)	n/s	0.047; 1.05 (1.02, 1.08)	−0.919; 0.4 (0.27, 0.6)	n/s	n/s	n/s
Coffee	n/s	n/s	0.044; 1.04 (1.01, 1.08)	−1.193; 0.3 (0.19, 0.48)	n/s	n/s	−0.744; 0.48 (0.29, 0.78)
Citrus fruits	n/s	n/s	0.066; 1.07 (1.03, 1.11)	−1.693; 0.18 (0.11, 0.3)	n/s	n/s	n/s
Stone fruits	−0.461; 0.63 (0.42, 0.95)	n/s	0.045; 1.05 (1.01, 1.09)	−1.733; 0.18 (0.09, 0.33)	n/s	n/s	n/s
Nuts	n/s	n/s	0.043; 1.04 (1.01, 1.08)	−1.819; 0.16 (0.1, 0.27)	n/s	n/s	−0.939; 0.39 (0.23, 0.65)
Dairy products	n/s	2.644; 14.07 (1.61, 122.97)	n/s	n/s	n/s	n/s	n/s
Garlic	n/s	n/s	0.107; 1.11 (1.07, 1.16)	−1.813; 0.16 (0.1, 0.28)	n/s	n/s	−0.566; 0.57 (0.33, 0.99)
Onion	n/s	n/s	0.084; 1.09 (1.04, 1.13)	−1.99; 0.14 (0.08, 0.24)	n/s	n/s	n/s
Spicy food	n/s	n/s	0.061; 1.06 (1.04, 1.09)	−1.187; 0.31 (0.22, 0.43)	n/s	n/s	n/s

Abbreviations: B—estimate coefficient; OR—odds ratio; CI—confidence interval; n/s—non-significant.

4.4. Elimination Diet According to Experience of Mothers and Medical Professionals

Among the respondents, 29.14% of all mothers indicated that they had ever followed an elimination diet while breastfeeding their children. In the most cases, this practice resulted from following a doctor's advice (71.25%, $n = 223$), peer pressure—e.g., received from family, friends (20.77%, $n = 65$), or other reasons (7.99%, $n = 25$), including the mother's anxiety that her diet might have negatively affected her milk and the breastfed child. Within the aforementioned group, 95.52% ($n = 217$) of mothers were advised to eliminate dairy products due to the suspicion of an allergy to milk proteins in the infant. Among the respondents, 16.93% ($n = 53$) of mothers decided to stop breastfeeding and start feeding their infants with commercial milk formula because of dietary restrictions. As far as an elimination diet being considered as a preventive measure, 61 out of 407 (~15%) healthcare professionals admitted that they had recommended this practice to their breastfeeding patients.

5. Discussion

Our experience from clinical practice indicates that the myths concerning the "lactating mother's diet" and conviction regarding the advantages of prophylactic dietary restrictions are still widely present in Polish society. Even though the respondents presented a good level of knowledge on the allowance of consumption of several products during lactation, a portion of the respondents, i.e., about 10–30% depending on the product, contested the possibility of including some foods in a daily diet when breastfeeding. The results of the survey revealed that multiparas and mothers who had the possibility to breastfeed their first child were more likely to give correct answers. Mothers who followed an elimination diet more often answered incorrectly. However, the results and correct answers rate improved when a dietary restriction was started due to a doctor's advice.

The reasons for dietary restrictions and planning a "lactating mother's diet" varied depending on factors including the conviction of their role in the prophylaxis of allergies, peer pressure, cultural background, or the attempt to manage or clarify symptoms observed in infants. With regard to the aforementioned issues, we will refer to the available literature.

As has been already mentioned, a mother's "diet mistakes" are believed to be a main cause of infant colic. In fact, this condition improves over time, regardless of intervention. On the basis

of the authors' previous clinical practice, most often, mothers believe that bloating or colic pain in their offspring might be caused by the consumption of legumes, cabbage, onion, garlic or sparkling beverages, as the gas molecules transfer to the breast milk and irritate the infant's digestive tract. The results of the available studies remain divergent: some literature indicates the essential role of particular dietary restrictions while breastfeeding in reducing the manifestation of colic symptoms in infants, at the same time, a number of papers underline the ineffectiveness of any modification in the mother's or infant's nutrition [14,15]. For this reason, no recommendation on dietary modifications in the treatment of infant colic has been made [15].

As far as the prevention of atopy and other allergies is concerned, the available data remain ambiguous. On the basis of current evidence, there is no premise to support prophylactic maternal dietary restrictions during the lactation period, or in pregnancy. Nevertheless, the identification and elimination of allergens from the diet might be supportive for the treatment of children who have developed atopic diseases [6,8,13].

Unfortunately, a number of mothers worldwide still attribute their infant's fussiness and gastrointestinal symptoms to feeding and "diet mistakes", leading to further dietary restrictions as a preventive measure. The list of the most commonly suspected products includes coffee, sparkling beverages, legumes, citrus fruits, dairy products, chocolate, cabbage, garlic, onion and spicy food [16]. This belief is often supported by family and friends in the mother's surroundings [10,16], which has been reflected in the results of our study, and this might have a cultural background [11]. This issue is consistent with observations from the authors' clinical experience. For example, an insufficient quantity of human milk is attributable to various "diet mistakes", for example, mothers are often told they should drink large portions of still water or Bavarian tea to increase milk supply. Moreover, it is believed that milk stasis in the lactiferous duct or low milk secretion result from the consumption of stone fruits, as the stone can cause an occlusion of the lactiferous ducts. It is important to emphasize that, taking peer pressure into consideration, the conviction that dietary habits need to be changed as a preventive measure and restrictions on food may not only cause stress and disturb successful breastfeeding, resulting in its short duration, but may adversely affect a mother's health condition and her micronutrient body reserves [17].

Another controversial practice is the consumption of raw meat and fish, for example, steak tartare, sushi, and unpasteurized milk or cheese, including blue cheese. During pregnancy, the consumption of these products is contraindicated, but during lactation the limitations are less strict. Provided that the meat is fresh and comes from a verified supplier, it can be eaten raw, with the exception of poultry and venison. Sushi should be prepared with fresh fish and it is recommended to choose species which are less likely to accumulate mercury, such as the small and non-predatory varieties, as well as the other seafood. The same rules concern unpasteurized products, they should be fresh, purchased from a verified supplier and should not exceed the best-before date. Reasonable choices are essential, as the consumption of the aforementioned products is connected with the risk of food-borne infections in mothers. However, apart from rare cases of septicemia, they do not pose a significant threat to the breastfed infant [10,17,18].

In addition, breastfeeding is considered to be an essential factor contributing to the promotion of a healthy diet, it has a leading role in modulating the development of flavor preferences. Infants exposed to various scents and flavors in breast milk, which stem from their mothers' diets, are more likely to accept them during complementary feeding and in later childhood. Moreover, children who were breastfed in infancy are believed to be more willing to eat vegetables than formula-fed infants [19,20].

The issue of nutrition during the lactation period, including dietary choices and apprehension about consuming particular foods, seems to be a relevant matter worldwide. Based on the available literature, opinions on the link between mother's nutrition and infants' behavior have already been investigated in Canada [16], Asia [10,11,21], Mexico [22], and the USA [23]. Misinformation related to mainly animal-source foods or fruits and vegetables lead to women feeling obliged to deal with dietary restrictions, believing this practice to bring health benefits for their offspring [10,11,16,21,22,24,25].

Nevertheless, different degrees of elimination of various products from the diet make mothers vulnerable to qualitative malnutrition, resulting especially from deprivation of micronutrients [18,21]. As a result of nutritional stress, the quality of life is diminished. Additionally, following an elimination diet is a factor affecting the length of breastfeeding [1,23,24]. In fact, knowledge gaps, commitment to tradition, and peer pressure make lactating mothers follow the practice of myths and taboos and to consequently develop learned and observed habits [10,11,16,24,25]. In this paper, our aim was to assess the knowledge on nutrition of breastfeeding mothers in Polish society, with a special focus on the comparison between healthcare providers and patients and emphasis on the presence of particular products in daily diets. In similar publications of Polish authors, the general knowledge of lactation, including popular myths and nutrition, was investigated among mothers [24] and healthcare providers [25]. The results of the aforementioned studies are comparable to the results of this survey, thus, further education in the area of lactation is needed, and knowledge of nutrition and reliable counseling are crucial for long and successful breastfeeding.

Recommendations

Breastfeeding is a fully physiological condition, therefore, a "healthy breastfeeding mother's diet" should be prepared in accordance with the current recommendations included in the nutrition pyramid and include a variety of products. This is essential as it might allow the lactating mothers to cover their increased daily requirements for nutrients, vitamins, and microelements [12,26].

General rules of nutrition during lactation should be followed:

1. Routine elimination diets, e.g., to prevent allergies in a child, are not recommended [7,8,13–15].
2. The choice of natural, low-processed products of good quality is recommended [18,26].
3. Foods containing preservatives, artificial additives, and trans fatty acids should be avoided [26].
4. The consumption of products with a high sugar content, such as sweets or large amounts of fruit juice, is not recommended [26].
5. Energy demands during the first 6 months of lactation increase by approximately 500 kcal per day, therefore, a breastfeeding mother should consume several meals daily [26,27].
6. Overeating or eating "for two" is not advised, it is enough to satisfy hunger [26].
7. Breastfeeding mothers should supply an additional 21 g of proteins per day in the initial period of lactation and 14 g in the next months of breastfeeding [12,18,26].
8. The daily supplementation of 100–200 mg of docosahexaenoic acid (DHA) or regular consumption of two servings of fish per week enables an adequate DHA content in breast milk to be reached and provides the infant with a proper amount of polyunsaturated fatty acids [3,18,28].
9. Breastfeeding requires the provision of iron at doses of 11 mg per day in the first months of lactation, and 18 mg per day after the resumption of menstruation [18,29].
10. Adequate iodine intake (200 µg daily) ensures an adequate iodine content in breast milk (approximately 100–150 µg/100 mL) [30].
11. As the amount of calcium secreted in breast milk is 150–300 mg per day and depends on mother's bone mineralization and urinary calcium excretion, the recommended daily calcium intake in the mother's diet is 1000 mg [18,31]. The main dietary sources of calcium include milk and dairy products, followed by cereals and vegetables [12,18,26].
12. Supplementation of folic acid at a dose of 500 ug per day, as well as the consumption of natural sources of folates (e.g., green leafy vegetables, oranges, cereals, and offal), is recommended [12,32].
13. Vitamin D should be administered under the control of 25(OH)-D serum levels, with an optimal range of 30–50 ng/mL. If it is not possible to determine the concentration of 25(OH)-D, 2000 IU of vitamin D should be administered daily throughout lactation. High amounts of vitamin D are contained in cod liver oil and fatty fish, such as herring and salmon [18,33].

6. Limitations

The foremost limitation of the survey is its reliance on answers self-provided by respondents. There is no possibility of verifying the accuracy of the data, nor the identity of the respondent. To minimize the risk of ineligibility, the questionnaire provided questions referring to the basic inclusion criteria, e.g., category of practiced profession (medical or non-medical), gender, and parity. Based on the received answers, questionnaires completed by 21 respondents were excluded from further analysis.

Another limitation is that a truly random sample of participants was impossible to obtain, the survey was responded to mostly by mothers and medical professionals who were active on randomly selected discussion groups and forums. For this reason, the study group should not be considered as fully representative of the Polish population.

7. Conclusions

The nutrition of women during lactation is a controversial topic. In the past, mother's nutrition was attributed to all adverse symptoms in the infant, however, our knowledge is changing, meaning that some theories are being scientifically confirmed while others are refuted. The lack of current knowledge causes the reproduction of many harmful myths.

The topic of the "lactating mother's diet" is still an important issue worldwide, as the traditional beliefs concerning the nutrition of breastfeeding women, its impact on infant's health and need of dietary restrictions affect the practice of breastfeeding. This seems to be confirmed by the results of the survey: almost 30% of mothers were advised to start dietary restrictions, not only for medical reasons, leading over 16% of them to stop breastfeeding. In addition, among other evaluated factors, the experience of following elimination diet affected mothers' knowledge of nutrition during breastfeeding. However, the majority of respondents correctly recognized the questioned foods as generally permitted when lactating.

Although the level of knowledge is improving and adherence to taboos is diminishing, both mothers and healthcare providers require good nutritional education. Responsible nutrition should be based on reasonable choices, whenever dietary restrictions need to be introduced due to medical indications, the mother's diet should be well-planned and cover all nutritional demands.

Supplementary Materials: The following are available online at http://www.mdpi.com/2072-6643/12/6/1644/s1, File S1: Questionnaire.

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6.3. Artykuł nr 3.

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RESEARCH Open Access

The link between knowledge of the maternal diet and breastfeeding practices in mothers and health workers in Poland

Karolina Karcz*, Izabela Lehman and Barbara Królak-Olejnik

Abstract

Background: There are multiple misconceptions concerning the breastfeeding mother's diet and its adverse impact on breast milk composition and the breastfed child's health, which might lead to breastfeeding cessation. Although prophylactic maternal dietary restrictions are not recommended, mothers all over the world are often recommended to avoid certain foods, due to cultural beliefs, social pressure and even outdated or ambiguous medical recommendations. In Poland, there is no systematic approach to breastfeeding education in the form of nationwide educational programs for particular social groups. It was estimated that in 2017 only 3–4% of Polish infants were exclusively breastfed at 6 months of age. The aim of this study was to recognize the scale of common dietary misconceptions among lactating mothers in Poland and to compare knowledge and opinions between medical staff and mothers who have ever breastfed a child. In addition, the paper is an attempt to identify factors contributing to the still current practice of recommending prophylactic dietary restrictions to breastfeeding mothers by medical staff.

Methods: The study was conducted in Poland, in January – February 2019. The study used a diagnostic poll method and was conducted mainly in an electronic form. A total of 1159 completed questionnaires data were analyzed: 35.1% completed by medical staff and 64.9% by mothers in non-medical professions. Statistical calculations were conducted with Chi-square test, logistic regression and U Mann Whitney test (level of significance set at 0.05).

Results: The respondents presented a good level of knowledge and predominantly assessed the questioned statements correctly. Duration of breastfeeding was found to be the main factor determining respondents' knowledge ($p < 0.05$). Concerning medical staff, the parity ($p < 0.001$) and applying an elimination diet when themselves breastfeeding ($p < 0.001$) had a significant impact on recommendation of prophylactic dietetic restrictions to the lactating women.

Conclusions: Regardless of a resonably good level of knowledge on maternal nutrition in the lactation period, both breastfeeding mothers and medical staff are still convinced of the beneficial effect of preventive dietary restrictions, which affects further lactational counselling and lactational performance.

Keywords: Breastfeeding, Lactation, Diet, Healthcare surveys

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Background

From the early stages of life, appropriate nutrition is essential to provide good physical and mental development and long-term health. Since mother's milk composition is usually adjusted to the infant's needs and is sufficient to ensure sustainable growth and development, breastfeeding is a standard nutrition for all infants (ESPG HAN) [1].

To compensate for both infant's and mother's demands, the process of lactation requires a greater need for nutrients. Maternal nutritional status and dietary intake mainly influence milk concentrations of vitamins (A, D, B12, thiamin, riboflavin, pyridoxine), iodine, selenium and fatty acids profiles, whereas the milk content of proteins, carbohydrates and other minerals remains unaltered, unless the mother is extremely undernourished or depleted in body stores (WHO, IOM) [2–4].

Exclusive breastfeeding, is recommended for 6 months, and when practiced for at least 3 to 4 months, is proven to reduce the incidence of atopic disease in infants (AAP) [5]. On the contrary, the concentrations of allergens in breast milk might be high enough to mediate the process of sensitization to antigens, therefore resulting in development of symptoms such as fussiness, hives, eczema, regurgitations, stool changes and other gastrointestinal disorders. However, the presence of these symptoms can be attributed to other reasons, not associated with hypersensitivity to food allergens (AAP) [5, 6]. Unfortunately, all these infantile ailments are sometimes considered to result from breastfeeding and the impact of maternal nutrition on breast milk quality [7]. Plenty of misconceptions have been present in societies and are often disseminated to consecutive generations, despite the changing state of scientific knowledge. As the issue of lactating women's nutrition is overgrown with myths, mothers might receive contrary and ambiguous recommendations, as well as being urged to avoid certain foods because of cultural beliefs [8–11]. In many settings, mothers are constantly being informed that their breast milk can have adverse effects on infants, unless they change their dietary habits and follow a prophylactic elimination diet during breastfeeding. However, this practice might have a negative impact on breastfeeding rates.

In Poland, there is no systematic approach to breastfeeding education in the form of nationwide educational programs for particular social groups. Lactational education for medical staff is organized mainly as postgraduate nonobligatory courses. In 1995, breastfeeding was included for the first time in the National Health Program. The National Health Program in Poland is implemented and modified every 5 years and its strategic goal is to improve the health of the population, including the promotion of proper nutrition for children. According to the National Health Program for 2016–2020 [12], all efforts should have been made to improve health care for the mother and infant, including improving nutritional status and breastfeeding rates. In this matter, the overarching aim was to take all appropriate measures to ensure the success of breastfeeding, including the identification of risk factors for early cessation of breastfeeding and the early identification of potential breastfeeding problems. The introduction of the Standard of Perinatal Care in 2012 [13] was supposed to be a breakthrough in the promotion of breastfeeding in Poland. Now all maternity hospitals are obliged to protect, promote and support breastfeeding. However, a nationwide study reported that at 2 months of age, only 43% of infants were still breastfed, and at 6 months of age, only 3–4% of infants were exclusively breastfed [14].

The available literature provides several studies conducted in different world regions, concerning the topic of myths attached to a mother's diet during lactation [7–11]. However, none of them compares the level of knowledge and opinions on nutrition in the lactation period between the groups of patients and healthcare providers. This paper presents an overview of both Polish medical personnel and Polish breastfeeding mothers' opinions regarding common misconceptions concerning lactation and nutrition. In addition, the impact of maternal experience with breastfeeding and dietary restrictions on both level of knowledge and further continuation of breastfeeding, as well as on applying personal experience in medical practice was indicated.

The aim of this study was to recognize the scale of common lactating mothers' dietary misconceptions, mainly concerning the composition of human milk and its relationship to mother's nutrition, adverse symptoms in infants, and popular misbeliefs regarding the consumption of particular products. A further objective of the survey was to assess and compare knowledge of respondents practicing medical and non-medical professions. In this context, the paper is an attempt to identify factors contributing to the still current practice of recommending prophylactic dietary restrictions to breastfeeding mothers by medical staff.

Methods

Study design

The study used the diagnostic poll method, and thus was based on a convenience sample, using a survey questionnaire previously compiled by the authors.

The study was designed only in the Polish language and conducted in Poland.

Prior to the start of the study, the comprehension of the questionnaire was tested during face-to-face interviews with 10 randomly selected multiparous mothers

who were hospitalized with their infants after delivery in the authors' clinic.

The questionnaire consisted of 3 parts: 1) questions regarding whether a breastfeeding mother can include particular products in her daily diet; 2) questions concerning popular myths regarding nutrition when breastfeeding and referring to the knowledge on breast milk composition; 3) demographic data and respondents' experience with dietary restrictions. The questionnaire included only close-ended questions. Parts 1) and 2) consisted of single-choice questions ('Yes / No' or 'True / False'). Part 3) included single-choice questions provided with a list of options. Answers to all questions were required.

In this paper, the results on the popularity of common myths, referring to the impact of mother's nutrition on the process of lactation and infant's health condition, are presented.

Myths and beliefs

Based on worldwide publications, the most popular convictions on breastfeeding and nutrition in the lactation period concern the following aspects: human milk composition, impact of maternal diet on breast milk composition, impact of consumption of particular products on the quantity of milk and progress of lactation, adverse effect of mother's diet on the infant's condition, safety of consumption of particular meals by mother and her breastfed child [7–11]. For the purpose of this study, 23 statements were included in the survey and for the analysis, they were categorized in 3 groups, as follows: 1) impact of mother's diet on breast milk composition; 2) general statements regarding mother's diet during lactation; 3) mother's diet - impact on the lactation process and infant's well-being.

Target group

The following groups were invited to participate in the study: 1) mothers pursuing professions outside the healthcare sector, who had any experience of breastfeeding, provided the child was delivered at term, regardless of the duration of lactation, including expressed breast milk feeding, representing society as a whole; 2) medical staff, regardless of age, sex and parity. The study did not differentiate exclusive breastfeeding from simultaneous feeding with both breast milk and infant formula.

Data collection

In January–February 2019, the questionnaire was distributed in electronic form, mainly in social networks on randomly selected discussion forums and groups, identified via Facebook and other publicly available websites. These discussion forums and groups: 1) concerned the topics of breastfeeding and parenthood – those were visited by parents, mainly mothers, who were sharing their experiences in e.g. breastfeeding, weaning, child rearing; 2) were associated with medical staff (e.g. physicians, nurses, midwives, lactation consultants) – those were visited by medical staff who were sharing their experiences in e.g.: work with the patients, specialization training, additional postgraduate training or were sharing their knowledge of their fields of interest.

Advertisements including information on the study were published in each of the selected groups and forums. To ensure the eligibility of respondents: 1) all persons interested in participation in the study were contacted directly by a private message and after a short interview (concerning the performed profession, parity and experience in breastfeeding) provided with a link to the questionnaire; 2) the questionnaire included questions about: sex of the respondent, profession, parity, duration of breastfeeding of each of the offspring. Based on the completed questionnaire, if the eligibility of the respondent was questionable or objectionable, the answers were excluded from the final analysis.

All the participants were enrolled voluntarily, did not receive any remuneration and fully agreed to complete the questionnaire. Starting and completing the survey confirmed the respondents' consent to participate in the study. The responses were coded and saved anonymously.

Data analysis

Formal analysis of the final results included the Chi square test, logistic regression and U Mann Whitney test. For calculations Microsoft Excel for Office 365 (Microsoft, Redmond, WA, USA), Statistica 13.3 (StatSoft, Inc., Tulsa, OK, USA) and R version 3.6.2 (R Core Team, 2013. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.) were used. In analysis, the level of respondents' knowledge was dependent on the percentage of correct answers.

Ethics

Prior to the study commencement, formal permission was obtained from the Bioethics Committee at the Medical University in Wroclaw (No. KB 519/19).

Results

Characteristics of the respondents

A total of 1180 completed questionnaires were received. As 15 records indicated male respondents performing non-medical professions and six records identified nulliparous women employed outside the healthcare field, these respondents were considered as ineligible to participate in the study and data from these records was excluded from further analysis. The final sample included 1159 respondents, 752 of whom were not health

professionals. Among the respondents working in the medical professions, 10 were men and 397 women, and with 81.1% mothers who have ever breastfed a child. More than a half of all respondents lived in cities with over 100,000 residents and were over 30 years old. Half of the participants had one child and more than 50% of all children were breastfed at least for 6 months. Detailed data on the respondents is provided in Table 1.

Impact of mother's diet on breast milk composition

In general, respondents presented a quite low level of knowledge of human milk composition and its dependence on the mother's nutrition. As far as the macronutrients are concerned, a total of 57.2% of all respondents answered correctly that dietary habits do not influence the concentration of breast milk proteins significantly, whereas 51% of all respondents had knowledge that the lipid profile of breast milk is influenced by the diet. In the case of micronutrients, only 51.6% of the study group knew the relationship between diet, maternal body stores and iodine concentration in human milk and barely 45.8% recognized an insufficient supply of vitamin B12 in mother's diet as a risk factor for its deficiency in the infant. Even though respondents knew quite well that some substances, including flavors might pass to the mother's milk (80.5%), only 57% indicated correctly that the taste of breastmilk can be affected by spicy food. The logistic regression analyses revealed several factors that were associated with correct answers among participants, with various directions of relationship, the most important being a medical professional, duration of breastfeeding and parity. These results are summarized in Table 2. Some differences in proportion providing correct answers were found between healthcare providers and breastfeeding mothers (Fig. 1).

General statements regarding mother's diet during lactation

The vast majority of respondents (93.2%) considered that the diet during lactation should be well-balanced, with general recommendations as for every other adult. However, 73.7% of all participants knew that there are no

Table 1 Basic characteristics of respondents ($n = 1159$)

Variable	Number of respondents (%)	
	Medical ($n = 407$; 35.12%)	Non-medical ($n = 752$; 64.88%)
Age in years		
< 20	0	2 (0.27%)
20–29	183 (44.96%)	308 (40.96%)
30–39	165 (40.54%)	416 (55.32%)
≥ 40	59 (14.50%)	26 (3.46%)
Sex		
Female	397 (97.53%)	752 (100%)
Male	10 (2.47%)	n/a
Place of residence		
Village	77 (18.92%)	136 (18.09%)
Cities < 100,000 residents	105 (25.80%)	196 (26.06%)
Cities > 100,000 residents	225 (55.28%)	420 (55.85%)
Parity		
0	77 (18.92%)	n/a
1	167 (41.03%)	419 (55.72%)
2	139 (34.15%)	287 (38.16%)
3	24 (5.90%)	43 (5.72%)
4 or more	0	3 (0.40%)
Duration of first child's breastfeeding (months)		
0–3	55 (13.51%)	117 (15.56%)
4–5	23 (5.65%)	71 (9.44%)
6–12	119 (29.24%)	208 (27.66%)
13–24	100 (24.57%)	263 (34.97%)
More than 24	25 (6.14%)	93 (12.37%)

n/a non applicable

Table 2 Factors influencing knowledge about the dietary impact on breast milk composition ($n = 1159$)

Variable	Univariate analysis		Multivariate analysis		Correct answer
	B; OR (95% CI)	*P*-value	B; OR (95% CI)	*P*-value	
The mother's diet has little influence on protein content in milk.					TRUE
Parity	0.115; 1.12 (0.95, 1.32)	0.168	n/a	n/a	
Duration of breastfeeding the first child	0.017; 1.02 (1.0, 1.03)	0.012[a]	0.018; 1.02 (1.0, 1.03)	0.007[a]	
Applied an elimination diet during breastfeeding	−0.25; 0.78 (0.6, 1.01)	0.061	n/a	n/a	
Used elimination diet and replaced breastfeeding with infant formula	−0.344; 0.71 (0.41, 1.23)	0.222	n/a	n/a	
Being a medical professional	0.299; 1.35 (1.05, 1.73)	0.017[a]	0.421; 1.52 (1.16, 2.0)	0.002[a]	
Applied an elimination diet according to a doctor's recommendations	−0.058; 0.94 (0.7, 1.27)	0.699	n/a	n/a	
The composition and quality of fats in mother's milk mainly depends on the diet.					TRUE
Parity	−0.156; 0.86 (0.73, 1.01)	0.06	n/a	n/a	
Duration of breastfeeding the first child	−0.001; 0.999 (0.99, 1.01)	0.825	n/a	n/a	
Applied an elimination diet during breastfeeding	0.007; 1.01 (0.78, 1.31)	0.958	n/a	n/a	
Used elimination diet and replaced breastfeeding with infant formula	0.4; 1.49 (0.85, 2.62)	0.164	n/a	n/a	
Being a medical professional	−0.190; 0.83 (0.65, 1.05)	0.123	n/a	n/a	
Applied an elimination diet according to a doctor's recommendations	−0.194; 0.82 (0.61, 1.1)	0.194	n/a	n/a	
The mother's diet affects the concentration of iodine in milk. This concentration depends on the iodine stores in the mother's body.					TRUE
Parity	−0.294; 0.75 (0.63, 0.88)	< 0.001[a]	−0.254; 0.78 (0.66, 0.92)	0.003[a]	
Duration of breastfeeding the first child	−0.007; 0.994 (0.98, 1.01)	0.304	n/a	n/a	
Applied an elimination diet during breastfeeding	−0.009; 0.991 (0.765, 1.29)	0.948	n/a	n/a	
Used elimination diet and replaced breastfeeding with infant formula	0.211; 1.24 (0.71, 2.15)	0.456	n/a	n/a	
Being a medical professional	0.474; 1.61 (1.26, 2.05)	< 0.001[a]	0.419; 1.52 (1.19, 1.95)	< 0.001[a]	
Applied an elimination diet according to a doctor's recommendations	0.021; 1.02 (0.76, 1.37)	0.888	n/a	n/a	
A deficiency of vitamin B12 in the mother's diet is a risk factor for the deficiency of this vitamin in an infant.					TRUE
Parity	−0.280; 0.76 (0.64, 0.89)	< 0.001[a]	− 0.276; 0.76 (0.62, 0.92)	0.006[a]	
Duration of breastfeeding the first child	−0.019; 0.98 (0.97, 0.99)	0.004[a]	−0.019; 0.98 (0.97, 0.99)	0.005[a]	
Applied an elimination diet during breastfeeding	0.099; 1.1 (0.85, 1.43)	0.457	n/a	n/a	
Used elimination diet and replaced breastfeeding with infant formula	−0.184; 0.83 (0.48, 1.46)	0.52	n/a	n/a	
Being a medical professional	0.404; 1.5 (1.18, 1.91)	0.001[a]	0.372; 1.45 (1.11, 1.89)	0.006[a]	
Applied an elimination diet according to a doctor's recommendations	−0.26; 0.97 (0.73, 1.31)	0.861	n/a	n/a	
Some flavors / aromas / other substances, e.g. proteins, pass into breast milk.					TRUE
Parity	0.01; 1.01 (0.82, 1.24)	0.922	n/a	n/a	
Duration of breastfeeding the first child	0.020; 1.02 (1.0, 1.04)	0.022[a]	0.020; 1.02 (1.0, 1.04)	0.021[a]	
Applied an elimination diet during breastfeeding	0.386; 1.47 (1.04, 2.09)	0.03[a]	0.242; 1.38 (0.97, 1.96)	0.418	

Table 2 Factors influencing knowledge about the dietary impact on breast milk composition ($n = 1159$) *(Continued)*

Variable	Univariate analysis		Multivariate analysis		Correct answer
	B; OR (95% CI)	*P*-value	B; OR (95% CI)	*P*-value	
Used elimination diet and replaced breastfeeding with infant formula	−0.309; 0.73 (0.39, 1.4)	0.346	n/a	n/a	
Being a medical professional	0.231; 1.26 (0.92, 1.72)	0.146	n/a	n/a	
Applied an elimination diet according to a doctor's recommendations	0.403; 1.5 (1.0, 2.24)	0.05[a]	0.126; 1.42 (0.95, 2.14)	0.713	
Spicy food changes the taste of mother's milk.					TRUE
Parity	−0.122; 0.89 (0.75, 1.04)	0.143	n/a	n/a	
Duration of breastfeeding the first child	0.005; 1.01 (0.99, 1.02)	0.427	n/a	n/a	
Applied an elimination diet during breastfeeding	0.677; 1.97 (1.5, 2.59)	< 0.001[a]	−1.08; 1.97 (1.5, 2.59)	< 0.001[a]	
Used elimination diet and replaced breastfeeding with infant formula	0.145; 1.16 (0.66, 2.03)	0.615	n/a	n/a	
Being a medical professional	0.06; 1.06 (0.83, 1.36)	0.63	n/a	n/a	
Applied an elimination diet according to a doctor's recommendations	0.438; 1.55 (1.14, 2.1)	0.005[a]	0.55; 1.55 (1.14, 2.1)	0.055	

B Coefficient, *OR* Odds Ratio, *CI* Confidence Interval, *n/a* non applicable
[a]statistically significant

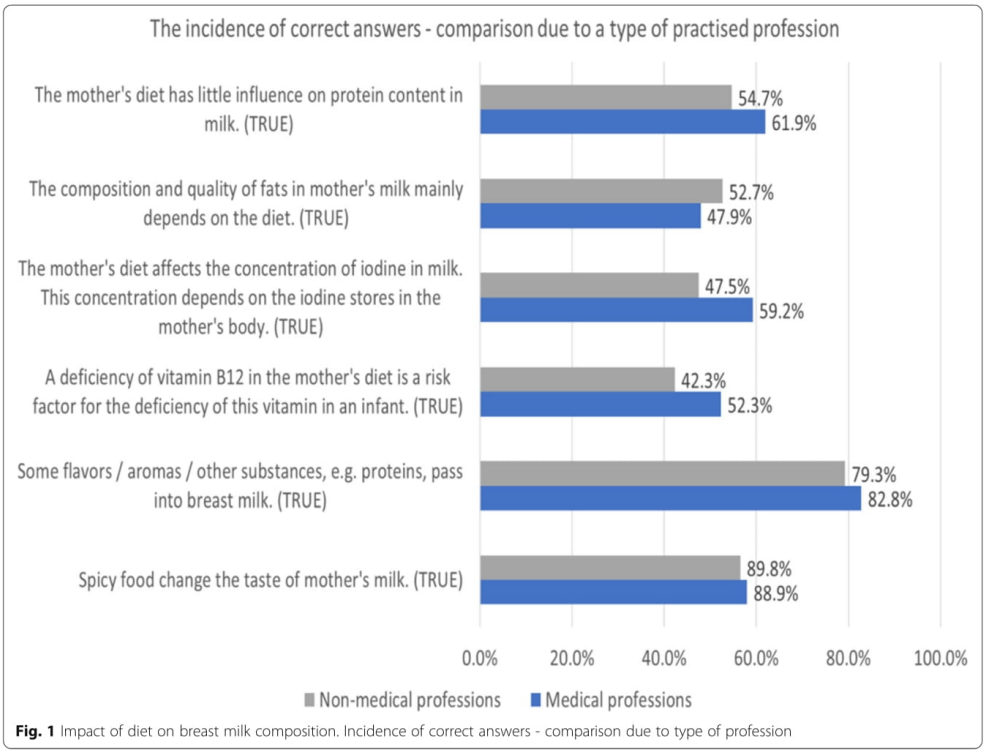

Fig. 1 Impact of diet on breast milk composition. Incidence of correct answers - comparison due to type of profession

specific dietary recommendations, apart from covering the higher needs for particular nutrients. Generally, the study group correctly supported the statement that only relevant medical indications are the basis for an elimination diet (94.2%) and that prophylactic dietary restrictions in a breastfeeding mother would not prevent their infants from developing food allergies or digestive tract disorders (92.4%). In general, respondents were aware that daily caloric and fluid demand increases during lactation (95.1%), but that the mother is not allowed to consume meals without any limits (92.9%). Nevertheless, there is no need to choose only light meals and to avoid fried nor hard to digest products (incidence of correct answers = 83.7%).

The main factors affecting significantly ($p < 0.05$) participants' opinions on whether the statements were true or false included: themselves having used an elimination diet during breastfeeding, applying an elimination diet due to their doctor's recommendations and practicing a medical profession. The impact of these factors was found to vary across the questioned items, in these terms, the specific factor affected the prevalence of correct answers positively or negatively. The results have been summarized in Table 3. A comparison of the proportions of correct answers between healthcare providers and mothers is presented in Fig. 2.

Mother's diet - impact on the lactation process and infant's well-being

Almost all, up to 95.9% of respondents were found to believe that the crying of a breastfed infant results from insufficient breast milk supply, even if the lactation is stabilized, with sufficient milk production. As far as the popular beliefs regarding household methods of stimulating breast milk production are concerned, 88.5% of respondents correctly rebutted the effectiveness of drinking Bavarian tea (tea with milk). However, respectively only 39.9 and 29.2% of respondents contested the usefulness of drinking large amounts of water and beer. Mainly, the opinions were dependent on the duration of the lactation period and the prevalence of correct answers increased with the duration of breastfeeding.

Improper mother's diet might be considered as another reason for crying of a breastfed infant. The great majority of respondents (96.3%) correctly considered this statement as false. Similarly, recognition of the belief that consuming spicy food or legumes by the mother might cause colic or bloating in a breastfed infant as untrue, was presented by 89.5 and 88.9% of respondents respectively. The logistic regression analysis revealed that the prevalence of correct answers was positively affected by the duration of the lactation period and negatively affected by applying an elimination diet while breastfeeding, regardless of reason for dietary restriction. About 95% of respondents correctly answered that drinking coffee during the lactation is allowed and it does not result in frequent infant waking at night.

Even though only 78.3% of respondents were aware that skin lesions located on a baby's face do not always indicate an allergy to milk proteins, 93.4% of answers correctly stated that a breastfeeding mother is allowed to eat potentially allergenic products. In both cases, opinions were affected by the duration of lactation (positive impact on the prevalence of correct answers) and following an elimination diet in the period of lactation (negative impact on the prevalence of correct answers). In the case of the second statement, the presence or absence of medical advice was of key importance. The answers to the first of the aforementioned statements were also influenced by the type of profession, with higher rate of correct answers among medical professionals.

The results of univariate and multivariate logistic regression analysis are summarized in Table 4. The comparison of prevalence of correct answers between healthcare providers and mothers has been presented in Fig. 3.

Dietary restriction during breastfeeding - practices and experience of respondents

During the course of lactation, 29.1% ($n = 313$) of all mothers followed an elimination diet, mostly due to medical recommendation ($n = 223$) and suspicion of allergy to cow's milk proteins in infants ($n = 212$). In 16.9% of the above-mentioned mothers, dietary restrictions resulted in the cessation of breastfeeding. A statistically significant positive correlation was found between dietary restrictions during breastfeeding and the use of infant formula ($p < 0.001$). Among the medical staff, 15% admitted to having ever recommended exclusion of certain products from maternal diet as a preventive measure for future development of allergies in an infant. The statistical analysis revealed that parity ($p < 0.001$) and self-compliance with the elimination diet during lactation ($p < 0.001$) had a significant impact on recommending preventive dietary restrictions to mothers. There was no significant correlation between following ($p = 0.237$) nor recommending ($p = 0.193$) elimination diet and place of residence.

Discussion

To the best of our knowledge, this is the first study which examines the beliefs of both medical staff and breastfeeding mothers in respect of rules of nutrition during lactation and on the effect of maternal diet in breast milk composition and infant's health. The results of the study confirm that convictions regarding the negative effects of routine dietary habits during breastfeeding and the possibility of harmfulness of breast milk,

Table 3 Factors influencing opinions on general statements regarding mother's diet during lactation ($n =$)

Variable	Univariate analysis		Multivariate analysis		Correct answer
	B; OR (95% CI)	*P*-value	B; OR (95% CI)	*P*-value	
The breastfeeding mother's diet should be a well-balanced diet, with general recommendations as for every other adult.					TRUE
Parity	−0.248; 0.78 (0.57, 1.07)	0.122	n/a	n/a	
Duration of breastfeeding the first child	0.009; 1.009 (0.98, 1.04)	0.524	n/a	n/a	
Applied an elimination diet during breastfeeding	−0.661; 0.52 (0.32, 0.83)	0.006[a]	n/a	n/a	
Used elimination diet and replaced breastfeeding with infant formula	−0.115; 0.89 (0.31, 2.54)	0.829	n/a	n/a	
Being a medical professional	0.167; 1.18 (0.72, 1.93)	0.504	n/a	n/a	
Applied an elimination diet according to a doctor's recommendations	−0.231; 0.79 (0.46, 1.37)	0.409	n/a	n/a	
When breastfeeding, you can eat for two, in any amount.					FALSE
Parity	−0.258; 0.77 (0.57, 1.05)	0.102	n/a	n/a	
Duration of breastfeeding the first child	0.014; 1.01 (0.99, 1.04)	0.279	n/a	n/a	
Applied an elimination diet during breastfeeding	0.452; 1.57 (0.9, 2.76)	0.116	n/a	n/a	
Used elimination diet and replaced breastfeeding with infant formula	−0.073; 0.93 (0.33, 2.64)	0.891	n/a	n/a	
Being a medical professional	1.119; 3.06 (1.67, 5.61)	< 0.001[a]	1.149; 3.15 (1.72, 5.78)	< 0.001[a]	
Applied an elimination diet according to a doctor's recommendations	0.699; 2.01 (0.99, 4.08)	0.053	0.763; 2.15 (1.05, 4.37)	0.035[a]	
The elimination diet of the breastfeeding mother should be started only with relevant medical indications.					TRUE
Parity	−0.079; 0.92 (0.66, 1.3)	0.652	n/a	n/a	
Duration of breastfeeding the first child	0.021; 1.02 (0.99, 1.05)	0.167	n/a	n/a	
Applied an elimination diet during breastfeeding	−0.576; 0.56 (0.34, 0.94)	0.027[a]	n/a	n/a	
Used elimination diet and replaced breastfeeding with infant formula	0.23; 1.02 (0.31, 3.37)	0.969	n/a	n/a	
Being a medical professional	0.41; 1.51 (0.87, 2.62)	0.147	n/a	n/a	
Applied an elimination diet according to a doctor's recommendations	0.323; (0.69, 2.75)	0.358	n/a	n/a	
The mother's elimination diet from the beginning of lactation will protect the infant from digestive tract disorders and allergies.					FALSE
Parity	−0.414; 0.66 (0.49, 0.89)	0.006[a]	−0.257; 0.66 (0.49, 0.89)	0.117	
Duration of breastfeeding the first child	0.013; 1.01 (0.99, 1.04)	0.285	n/a	n/a	
Applied an elimination diet during breastfeeding	−1.500; 0.22 (0.14, 0.35)	< 0.001[a]	−2.266; 0.11 (0.06, 0.2)	< 0.001[a]	
Used elimination diet and replaced breastfeeding with infant formula	−0.824; 0.44 (0.2, 0.96)	0.04[a]	−0.389; 0.44 (0.2, 0.96)	0.368	
Being a medical professional	0.275; 1.32 (0.82, 2.12)	0.256	n/a	n/a	
Applied an elimination diet according to a doctor's recommendations	− 0.559; 0.57 (0.35, 0.93)	0.025[a]	1.222; 3.55 (1.89, 6.68)	< 0.001[a]	
Breastfeeding mother's diet should be based on specific recommendations for lactating women.					FALSE
Parity	0.083; 1.09 (0.9, 1.31)	0.376	n/a	n/a	
Duration of breastfeeding the first child	0.138; 1.01 (1.0, 1.03)	0.066	n/a	n/a	
Applied an elimination diet during breastfeeding	−0.716; 0.49 (0.37, 0.65)	< 0.001[a]	−0.746; 0.47 (0.36, 0.63)	< 0.001[a]	
Used elimination diet and replaced breastfeeding with infant formula	0.099; 1.1 (0.58, 2.09)	0.762	n/a	n/a	
Being a medical professional	0.474; 0.62 (0.48, 0.81)	< 0.001[a]	−0.513; 0.6 (0.46, 0.79)	< 0.001[a]	
Applied an elimination diet according to a doctor's recommendations	−0.231; 0.79 (0.58, 1.1)	0.16	n/a	n/a	
The breastfeeding mother should not eat fried and indigestible products, only cooked and light meals are recommended.					FALSE
Parity	−0.01; 0.991 (0.79, 1.23)	0.932	n/a	n/a	
Duration of breastfeeding the first child	0.045; 1.05 (1.02, 1.07)	< 0.001[a]	0.044; 1.04 (1.02, 1.07)	< 0.001[a]	
Applied an elimination diet during breastfeeding	−0.951; 0.39 (0.28, 0.53)	< 0.001[a]	1.461; 0.24 (0.14, 0.39)	< 0.001[a]	
Used elimination diet and replaced breastfeeding with infant formula	−0.312; 0.73 (0.37, 1.45)	0.371	n/a	n/a	

Table 3 Factors influencing opinions on general statements regarding mother's diet during lactation ($n =$) *(Continued)*

Variable	Univariate analysis		Multivariate analysis		Correct answer
	B; OR (95% CI)	*P*-value	B; OR (95% CI)	*P*-value	
Being a medical professional	−0.314; 0.73 (0.53, 1.0)	0.053	n/a	n/a	
Applied an elimination diet according to a doctor's recommendations	−0.505; 0.6 (0.42, 0.87)	0.006[a]	0.678; 1.94 (1.12, 3.35)	0.017[a]	
Daily caloric and fluid demand increases during lactation.					TRUE
Parity	−0.616; 0.54 (0.38, 0.77)	< 0.001[a]	n/a	n/a	
Duration of breastfeeding the first child	0.021; 1.02 (0.99, 1.05)	0.181	n/a	n/a	
Applied an elimination diet during breastfeeding	0.134; 1.14 (0.62, 2.12)	0.67	n/a	n/a	
Used elimination diet and replaced breastfeeding with infant formula	−0.747; 0.47 (0.18, 1.24)	0.128	n/a	n/a	
Being a medical professional	0.436; 1.55 (0.85, 2.82)	0.156	n/a	n/a	
Applied an elimination diet according to a doctor's recommendations	0.555; 1.74 (0.78, 3.89)	0.177	n/a	n/a	

B Coefficient, *OR* Odds Ratio, *CI* Confidence Interval, *n/a* non applicable
[a]statistically significant

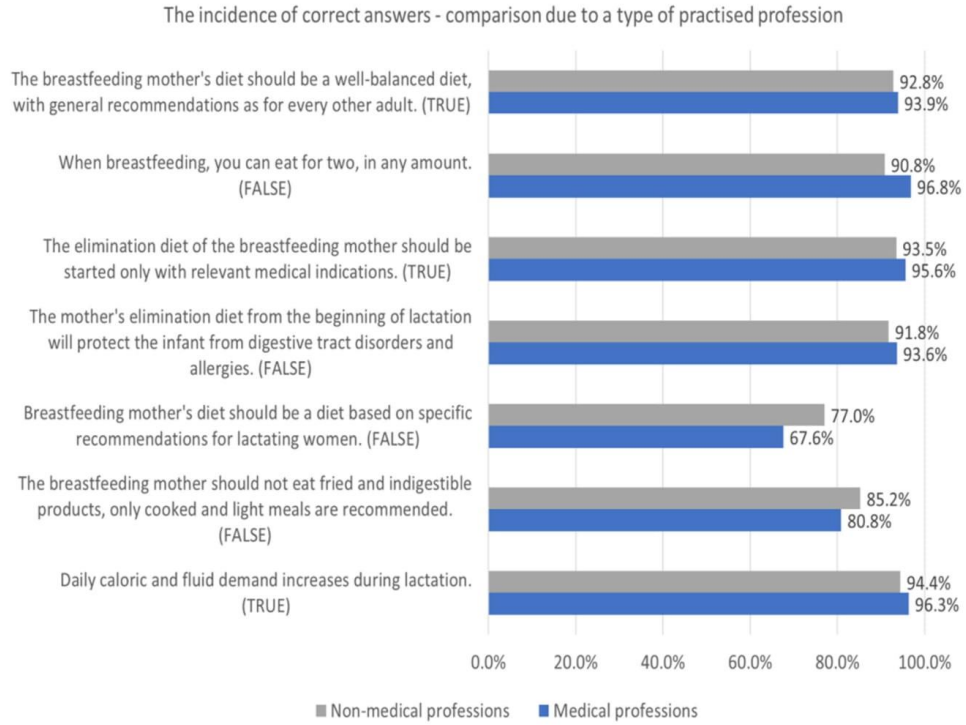

Fig. 2 General statements regarding mother's diet during lactation. Incidence of correct answers - comparison due to type of profession

Table 4 Factors influencing knowledge regarding the impact of mother's diet on the lactation process and infant's well-being ($n = 1159$)

Variable	Univariate analysis		Multivariate analysis		Correct answer
	B; OR (95% CI)	*P*-value	B; OR (95% CI)	*P*-value	
In general, a breastfed infant cries because is not getting enough mother's milk (the question concerns fully developed and stabilized lactation).					FALSE
Parity	0.059; 1.06 (0.71, 1.6)	0.776	n/a	n/a	
Duration of breastfeeding the first child	0.084; 1.09 (1.04, 1.14)	< 0.001[a]	0.084; 1.09 (1.04, 1.14)	< 0.001[a]	
Applied an elimination diet during breastfeeding	−0.507; 0.6 (0.33, 1.1)	0.098	n/a	n/a	
Used elimination diet and replaced breastfeeding with infant formula	− 1174; 0.31 (0.13, 0.76)	0.011[a]	− 0.823; 0.32 (0.13, 0.8)	0.081	
Being a medical professional	0.504; 1.66 (0.85, 3.22)	0.137	n/a	n/a	
Applied an elimination diet according to a doctor's recommendations	0.333; 1.03 (0.49, 2.17)	0.93	n/a	n/a	
Bavarian milk tea increases lactation.					FALSE
Parity	−0.158; 0.85 (0.66, 1.1)	0.218	n/a	n/a	
Duration of breastfeeding the first child	0.027; 1.03 (1.01, 1.05)	0.015[a]	0.029; 1.03 (1.01, 1.05)	0.009[a]	
Applied an elimination diet during breastfeeding	−0.251; 0.78 (0.53, 1.15)	0.208	n/a	n/a	
Used elimination diet and replaced breastfeeding with infant formula	−0.333; 0.72 (0.33, 1.56)	0.399	n/a	n/a	
Being a medical professional	0.738; 2.09 (1.36, 3.22)	< 0.001[a]	0.770; 2.16 (1.34, 3.47)	0.001[a]	
Applied an elimination diet according to a doctor's recommendations	0.147; 1.16 (0.72, 1.86)	0.545	n/a	n/a	
Drinking large amounts of water increases milk production.					FALSE
Parity	0.091; 1.1 (0.93, 1.29)	0.279	n/a	n/a	
Duration of breastfeeding the first child	0.043; 1.04 (1.03, 1.06)	< 0.001[a]	0.042; 1.04 (1.03, 1.06)	< 0.001[a]	
Applied an elimination diet during breastfeeding	−0.119; 0.82 (0.63, 1.07)	0.146	n/a	n/a	
Used elimination diet and replaced breastfeeding with infant formula	−0.743; 0.48 (0.25, 0.9)	0.022[a]	−0.563; 0.48 (0.25, 0.9)	0.091	
Being a medical professional	0.044; 1.04 (0.82, 1.34)	0.729	n/a	n/a	
Applied an elimination diet according to a doctor's recommendations	−0.114; 0.89 (0.66, 1.21)	0.457	n/a	n/a	
A breastfed child cries because of mother's improper diet.					FALSE
Parity	−0.266; 0.77 (0.5, 1.16)	0.211	n/a	n/a	
Duration of breastfeeding the first child	0.021; 1.02 (0.98, 1.06)	0.27	n/a	n/a	
Applied an elimination diet during breastfeeding	−1.589; 0.2 (0.11, 0.38)	< 0.001[a]	2.257; 0.1 (0.05, 0.22)	< 0.001[a]	
Used elimination diet and replaced breastfeeding with infant formula	−0.804; 0.45 (0.15, 1.3)	0.14	n/a	n/a	
Being a medical professional	−0.197; 0.82 (0.44, 1.53)	0.537	n/a	n/a	
Applied an elimination diet according to a doctor's recommendations	0.626; 0.53 (0.27, 1.04)	0.066[a]	1.091; 2.98 (1.34, 6.62)	0.007[a]	
Spicy food in mother's diet causes colic in a breastfed infant.					FALSE
Parity	0.032; 1.03 (0.79, 1.34)	0.81	n/a	n/a	
Duration of breastfeeding the first child	0.049; 1.05 (1.02, 1.08)	< 0.001[a]	0.047; 1.05 (1.02, 1.08)	< 0.001[a]	
Applied an elimination diet during breastfeeding	−1.327; 0.27 (0.18, 0.39)	< 0.001[a]	−2.112; 0.12 (0.07, 0.21)	< 0.001[a]	
Used elimination diet and replaced breastfeeding with infant formula	−0.271; 0.76 (0.34, 1.73)	0.516	n/a	n/a	
Being a medical professional	−0.086; 0.92 (0.62, 1.35)	0.665	n/a	n/a	
Applied an elimination diet according to a doctor's recommendations	−0.555; 0.58 (0.38, 0.88)	0.011[a]	1.031; 2.8 (1.57, 5.0)	< 0.001[a]	
Legumes, e.g. peas, in the mother's diet cause bloating in the infant.					FALSE
Parity	−0.173; 0.84 (0.65, 1.08)	0.18	n/a	n/a	
Duration of breastfeeding the first child	0.034; 1.03 (1.01, 1.06)	0.005[a]	0.030; 1.03 (1.01, 1.06)	0.017[a]	
Applied an elimination diet during breastfeeding	−1.383; 0.25 (0.17, 0.37)	< 0.001[a]	−2.392; 0.09 (0.05,0.15)	< 0.001[a]	
Used elimination diet and replaced breastfeeding with infant formula	−0.519; 0.59 (0.28, 1.25)	0.17	n/a	n/a	
Being a medical professional	−0.323; 0.72 (0.5, 1.05)	0.09	n/a	n/a	
Applied an elimination diet according to a doctor's recommendations	− 0.465; 0.63 (0.41, 0.96)	0.031[a]	1.336; 3.8 (2.15, 6.72)	< 0.001[a]	

Table 4 Factors influencing knowledge regarding the impact of mother's diet on the lactation process and infant's well-being ($n = 1159$) *(Continued)*

Variable	Univariate analysis		Multivariate analysis		Correct answer
	B; OR (95% CI)	*P*-value	B; OR (95% CI)	*P*-value	
Drinking coffee during lactation is allowed.					TRUE
Parity	0.094; 1.1 (0.76, 1.6)	0.62	n/a	n/a	
Duration of breastfeeding the first child	0.013; 1.01 (0.98, 1.04)	0.414	n/a	n/a	
Applied an elimination diet during breastfeeding	−0.685; 0.5 (0.29, 0.86)	0.013[a]	−0.665; 0.51 (0.3, 0.88)	0.016[a]	
Used elimination diet and replaced breastfeeding with infant formula	1.039; 2.83 (0.38, 20.8)	0.308	n/a	n/a	
Being a medical professional	0.657; 1.93 (1.03, 3.62)	0.041[a]	0.635; 1.89 (1.0, 3.55)	0.049[a]	
Applied an elimination diet according to a doctor's recommendations	−0.404; 0.67 (0.36, 1.22)	0.192	n/a	n/a	
Children of mothers who drink coffee during lactation often wake up at night.					FALSE
Parity	0.206; 1.23 (0.82, 1.85)	0.326	n/a	n/a	
Duration of breastfeeding the first child	0.005; 1.005 (0.97, 1.04)	0.783	n/a	n/a	
Applied an elimination diet during breastfeeding	−0.379; 0.68 (0.37, 1.25)	0.218	n/a	n/a	
Used elimination diet and replaced breastfeeding with infant formula	0.124; 1.13 (0.27, 4.79)	0.866	n/a	n/a	
Being a medical professional	−0.514; 0.6 (0.34, 1.06)	0.079	n/a	n/a	
Applied an elimination diet according to a doctor's recommendations	0.555; 1.74 (0.73, 4.14)	0.21	n/a	n/a	
Pimples and erythema on the baby's face always indicate an allergy to milk proteins - the mother must eliminate dairy from her diet.					FALSE
Parity	−0.163; 0.85 (0.7, 1.03)	0.1	n/a	n/a	
Duration of breastfeeding the first child	0.032; 1.03 (1.02, 1.05)	< 0.001[a]	0.035; 1.03 (1.02, 1.05)	< 0.001[a]	
Applied an elimination diet during breastfeeding	−0.906; 0.4 (0.3, 0.54)	< 0.001[a]	−0.895; 0.37 (0.23, 0.6)	< 0.001[a]	
Used elimination diet and replaced breastfeeding with infant formula	−0.916; 0.4 (0.23, 0.71)	0.002[a]	−0.385; 0.41 (0.23, 0.73)	0.225	
Being a medical professional	0.497; 1.64 (1.21, 2.24)	0.002[a]	0.564; 1.77 (1.25, 2.5)	0.001[a]	
Applied an elimination diet according to a doctor's recommendations	−0.729; 0.48 (0.35, 0.67)	< 0.001[a]	0.212; 0.51 (0.36, 0.7)	0.438	
During lactation, eating allergenic products, such as citrus, chocolate, nuts is forbidden.					FALSE
Parity	−0.170; 0.84 (0.61, 1.16)	0.297	n/a	n/a	
Duration of breastfeeding the first child	0.047; 1.05 (1.01, 1.08)	0.004[a]	0.044; 1.05 (1.01, 1.08)	0.009[a]	
Applied an elimination diet during breastfeeding	−1.511; 0.22 (0.14, 0.36)	< 0.001[a]	−2.102; 0.12 (0.06, 0.23)	< 0.001[a]	
Used elimination diet and replaced breastfeeding with infant formula	−0.403; 0.67 (0.26, 1.73)	0.407	n/a	n/a	
Being a medical professional	−0.058; 0.94 (0.58, 1.53)	0.812	n/a	n/a	
Applied an elimination diet according to a doctor's recommendations	−0.764; 0.47 (0.28, 0.77)	0.003[a]	0.810; 2.25 (1.16, 4.36)	0.016[a]	

B Coefficient, *OR* Odds Ratio, *CI* Confidence Interval, *n/a* non applicable
[a]statistically significant

affect maternal perception of nutrition and breastfeeding practices.

The main factor influencing respondents' knowledge in respect of questioned statements was the duration of lactation. The findings of the other worldwide studies indicated that knowledge towards breastfeeding was strongly correlated with the duration of exclusive breastfeeding [15, 16]. In addition, breastfeeding practices were influenced by the mother's knowledge of breastfeeding recommendations [16]. In the authors' opinion, there is a two-way dependence between the knowledge of breastfeeding and the duration of lactation. The higher is the general knowledge (e.g. recommendations, properties of breast milk, short- and long-term effects of breastfeeding for both mothers and infants), the longer is the breastfeeding period, with emphasis on exclusive breastfeeding. Consequently, the longer the duration of lactation, the higher is maternal knowledge of particular aspects of breastfeeding – e.g. breastfeeding techniques, solutions for nursing difficulties, as well as maternal nutrition during lactation.

Moreover, the results of the survey indicate that the experience of following an elimination diet when breastfeeding determines mothers' opinion regarding nutrition and its impact on breast milk quality as well as on the general condition of a breastfed child. It seems that there is a reciprocal relationship between dietary restrictions and the length of breastfeeding, and both of them might be influenced by other socioeconomic factors (e.g. breastfeeding support and acceptance, peer pressure, local customs or beliefs, attitudes towards breastfeeding, personal experience with breastfeeding a previous child,

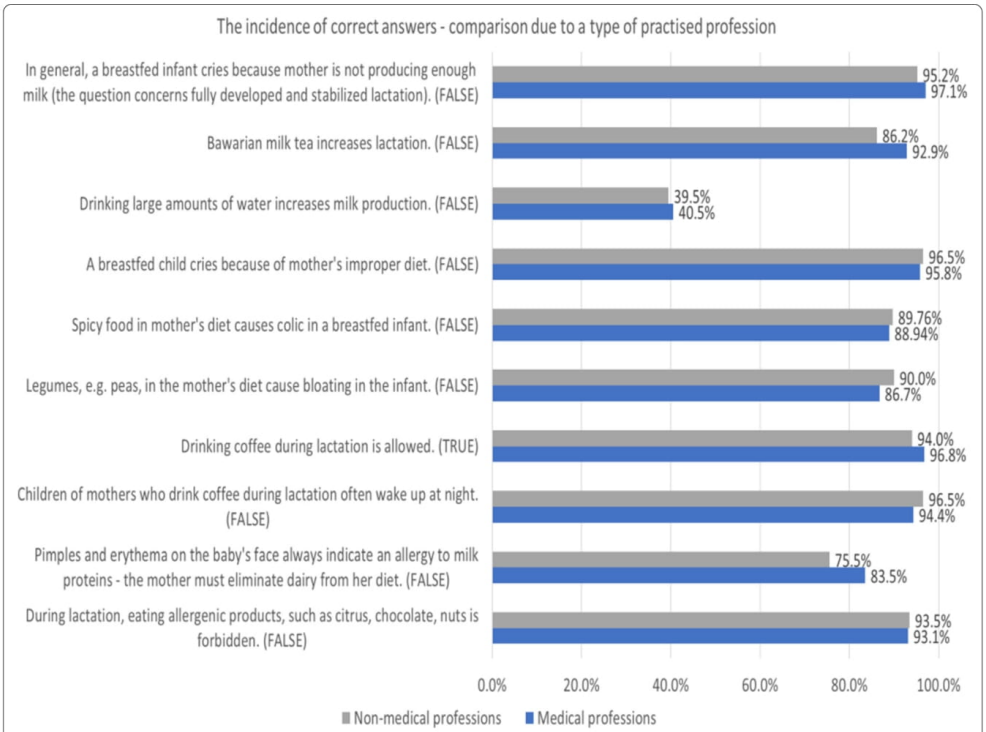

Fig. 3 General statements regarding mother's diet during lactation. Incidence of correct answers - comparison due to type of profession

parity, comorbidities, level of education, providing facilities for breastfeeding in the mother's place of employment – based on the survey results and the available worldwide literature [7–11, 15, 16]).

The proportions answering questions correctly were comparable between medical personnel and mothers practicing non-medical professions. This suggests that there may be a growing awareness and increase in nutritional and lactational knowledge among society, leading to a decreasing adherence to myths. Reduction of factors disturbing the process of lactation, especially peer pressure due to lactational misbeliefs, is likely to enhance the breastfeeding rates [7, 8, 11]. On the other hand, insufficient lactational knowledge among medical staff might lead to low-quality or lack of lactational counseling, thus might affect maternal knowledge of nutrition and lactation and further decisions related to infant feeding choices.

The relevance of adequate maternal nutrition and reasonable lactational support in promotion of breastfeeding has been emphasized worldwide [3, 5]. Furthermore, the crucial influence of hospital policy and medical staff assistance after delivery on breastfeeding rates has been reported. Moreover, the post-discharge surveillance by physicians, especially pediatricians should facilitate continuation of breastfeeding due to the current recommendation [5]. Psychosocial determinants, including breastfeeding attitudes, knowledge, and social support in breastfeeding were found to affect the initiation of breastfeeding and the duration of exclusive breastfeeding [15, 17].

Medical staff did not seem to have significantly better education than mothers in general. In addition, personal experience with breastfeeding had an influence on further counselling. Both groups of respondents were found with insufficient knowledge of relationships between maternal nutrients intake and resulting milk composition. Higher awareness of these relationships might have a positive effect on maternal dietary choices, adequate supplementation and high-quality nutritional counselling as a part of routine medical care. Also the practical knowledge of methods of how to enhance lactation and

establish a good milk supply should be improved. On the other hand, high proportions of respondents who provided correct answers and the comparable prevalence of correct answers between both study groups suggest popularization of evidence based knowledge in Poland, and thus similar awareness of the validity of common myths and beliefs. Further training and education on particular issues of breastfeeding management is needed - not only among practicing medical staff, but in medical schools. Special concern should be given to increasing the knowledge of nutrition, physiology of lactation and differentia diagnosis of allergy to cow's milk proteins.

Both mothers and medical professionals were found to have a moderately low level of knowledge of the impact of maternal nutrition on breast milk composition. Dietary habits do not seem to have a pronounced impact on particular components. In general, breast milk proteins and carbohydrates (mainly lactose) are the least affected by external variables and their concentrations depend primarily on the infant's gestational age at birth and on the duration of lactation with regard to the infant's postnatal age [3, 18]. According to the current knowledge, maternal dietary fat intake does not have any remarkable impact on total fat concentration in breast milk. However, it affects the breast milk fat quality, with significant alterations in the fatty acids profile [2, 3, 18]. The vitamin content of human milk is mainly dependent on maternal vitamin status and vitamin deficiency in the mother results in its low output to breast milk. What is more, the concentrations of vitamins are affected by dietary intake, and in a longer assessment, the higher supply, the higher concentration in breast milk [2, 18]. Similar correlations have been observed regarding selenium and iodine, but not e.g. iron, zinc, copper [2]. The results of the survey indicate that knowledge of these correlations should be improved. Nutritional counselling of breastfeeding mothers may be considered essential, and, as a further benefit, patient compliance may increase due to a better understanding of medical recommendations. This is especially significant in the medical care of vegetarians and vegans, who produce nutritionally adequate breast milk of similar composition to breast milk of mothers following a traditional diet, provided the obligatory supplementation of vitamin B12, omega-3 fatty acids and good adherence to dietary recommendations [19–21].

In general, there is no specific food to avoid when breastfeeding and no evidence in respect of a protective effect of a prophylactic maternal exclusion diet during pregnancy or during lactation on the occurrence of atopic diseases in infants [6]. General knowledge of this topic was reported by a high majority of respondents, which indicates growing awareness of current recommendations and diminishing prevalence of unscientific approaches to maternal diet while breastfeeding. When providing parental education and support, medical staff should also discuss the issue of the controversial impact of particular foods in maternal diet on breastfed infants' intestinal disorders or fuss-cry behaviours. There is no apparent evidence regarding the association of cow's milk, dairy products, chocolate, cruciferous vegetables and legumes with colic symptoms, and therefore mothers should not be advised to exclude these products prophylactically [22, 23]. In addition, parents should be informed that any type of facial rash in infants does not mean a straightforward diagnosis of allergy to cow's milk proteins and the study revealed that breastfeeding mothers more often than medical staff attributed infantile skin lesions to allergy. Basically, the diagnosis of cow's milk allergy might be considered if symptoms presented by a child cannot be explained with other conditions. Mild sensitization might be manifested with skin lesions, thus beside physical examination, a conscientious medical interview, including feeding history is essential for differential diagnosis [24, 25]. Allergy to cow's milk proteins develops in 2–3% of infants in their first year of life [26]. However, based on the results of the study, mothers were most often recommended to start an elimination diet due to the suspicion of allergy to cow's milk proteins in their infants, which suggest overdiagnosis of this ailment.

Based on the results of the study, drinking large amounts of water is believed to enhance lactation. In fact, there is no direct correlation between fluid intake and milk volume [8, 27]. As mothers might be worried about producing sufficient amounts of breastmilk for their infants, they need to receive adequate support and counselling, thus medical staff should be well-educated in the physiology of lactation and acquainted with indicators of successful breastfeeding.

Limitations

As the study group included mainly internauts active on randomly selected discussing groups, the results should not be fully generalized to the Polish population. Another limitation is reliance on data provided by respondents. The unsupervised conditions of completing the questionnaire gave a possibility that respondents might have used additional information sources. On the other hand, lack of a supervisor eliminated interviewer-related errors. Further research on this topic in different regions of the world and among larger study groups, especially among medical staff is needed. We believe it might be helpful in increasing the quality of lactational counselling, as well as in identification of the main breastfeeding management issues and applying strategic solutions to increase the local breastfeeding rates.

Conclusions

The conviction that preventive diet restrictions during lactation deliver beneficial effects is still present both among breastfeeding mothers and medical staff. Personal experience with dietary restrictions during the period of lactation affects further counselling to breastfeeding patients. In general, regardless of the practiced profession, the level of knowledge regarding maternal nutrition and its influence on lactation is quite good and comparable between breastfeeding mothers and medical staff. Growing awareness as well as nutritional and lactational knowledge within society might decrease adherence to myths. However, the awareness of the correlation between breast milk composition and dietary habits and the quality of diet should be improved. The quality of medical staff's knowledge may affect the mothers' knowledge in respect of nutrition and breastfeeding due to recommendations given while providing health care. Lack of reliable counselling, popularization of common lactational and nutritional misconceptions and insisting on dietary restriction without exact medical indications might be the factors limiting the duration of exclusive breastfeeding among Polish mothers, a topic that needs to be addressed by further research. There is the need to update the curricula and improve the competences of medical staff caring for pregnant and lactating women and their infants in order to promote medical staff as a reliable source of lactational knowledge.

Abbreviations

AAP: American Academy of Pediatrics; DHA: Docosahexaenoic acid; DGE: German Nutrition Society; EPA: Eicosapentaenoic acid; ESPGHAN: European Society for Paediatric Gastroenterology Hepatology and Nutrition; FCN: Swiss Federal Commission for Nutrition; IOM: Institute of Medicine; IU: International unit; WHO: World Health Organization

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Authors' contributions

KK and IL conceptualized the study. KK, IL and BK-O contributed to the methodology. KK and IL participated in data curation. KK contributed to formal analysis and prepared the original draft of the manuscript. KK, IL and BK-O revised the manuscript. BK-O supervised the study. All authors have read and agreed to the published version of the manuscript.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study obtained a positive approval of the Bioethics Committee at the Medical University in Wroclaw (No. KB 519/19). The potential participants were contaced directly and provided with detailed information on the purpose and regulations of the study (also attatched to the survey) – having agreed to participate in the study, they were provided with a link to the survey. Participation in the study was fully voluntary. The responses were collected anonymously and were coded automatically.

Consent for publication

Not required.

Competing interests

Authors declare no conflicts of interest.

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Publisher's Note

6.4. Artykuł nr 4.

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Article

Non-Nutritional Use of Human Milk Part 1: A Survey of the Use of Breast Milk as a Therapy for Mucosal Infections of Various Types in Poland

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Abstract: The use of home remedies for the treatment of moderately severe ailments is a common practice in the Polish population. Currently, the topic of the potential non-nutritional properties of human milk is attracting the attention of breastfeeding mothers. This study was aimed at understanding lactating women's knowledge, attitudes, and practices of non-nutritional breast milk on mucous membranes. The study was conducted among lactating women, who filled out a questionnaire consisting of questions about their knowledge and experiences with non-nutritional use of human milk. Statistical calculations were conducted with chi-square test and c-Pearson coefficient. A total of 1187 women were acted on, whereby 768 of respondents claimed to have knowledge of the non-nutritional use of human milk on mucous membranes, whilst 404 of them claimed that they had used at least one method. Among the most frequently used methods were the treatment of rhinorrhea, lacrimal canaliculi obstruction, and conjunctivitis. A correlation between length of breastfeeding ($p < 0.001$) and knowledge of non-nutritional human milk usage in prophylaxis and treatment of mucous membrane inflammation was found. Breastfeeding duration ($p < 0.001$) and parity ($p < 0.005$) were correlated with the application of those methods in practice. Due to a high propensity to testing those methods, parents' education in the field of possible risks and importance of medical consultations is necessary.

Keywords: breast milk; milk therapy; mucous membranes

1. Introduction

The use of home remedies to treat moderately severe health complaints, including mild infections, is presumed to be a common practice in the Polish population. The popularity of the methods used is primarily due to their easy availability, the opportunity to use substances of natural origin, and the belief that they are devoid of side effects. According to data collected by the Polish Center for Public Opinion Research (CBOS), Poles use the internet for purposes related to health and treatment; among respondents, 50% visit websites concerning health topics, 13% use forums and groups, 69% use the internet to look for information on how to manage their ailments, and 14% set their own treatment on the basis of information found on the internet, without consulting medical professionals [1].

In recent years, society presented a special interest in uses of human milk for non-nutritional purposes, including therapy. The first attempts to use breast milk as a home remedy appeared hundreds

of years ago, and opinions about its properties and treatment effects were passed down from generation to generation [2,3]. Currently, the topic of potential non-nutritional properties of human milk often attract the attention of breastfeeding mothers. The direct source of data supporting the foregoing theses were mothers who consulted the authors' Clinic of Neonatology on the safety of using their own breast milk in the treatment of rhinitis or conjunctivitis in their offspring. Widely available sources of knowledge, the press and social media, give numerous possibilities for the use of breast milk, especially in the aspect of alternative methods of treatment and prophylaxis. While in lay literature reports of anecdotal effectiveness of the proposed methods can be found, reliable scientific data developed in accordance with the principles of evidence-based medicine are scarce.

The composition of breast milk is optimally adapted to the needs of the newborn infant, in terms of both nutrients and biologically active constituents [4]. These affect the immune status of infants by not only providing protection, but also facilitating development of the immune system, tolerance of antigens, and stimulation of an adequate inflammatory response to contact with pathogens. The beneficial effects of breastfeeding include prevention of gastrointestinal and respiratory tract infections, and reduced risk of atopic dermatitis and the occurrence of autoimmune diseases, such as diabetes type 1, celiac disease, asthma, rheumatoid arthritis, or multiple sclerosis [5,6]. In addition, a mother's milk contains leukocytes and numerous antimicrobial compounds, including immunoglobulins, acute phase proteins, mediators of cellular communication, lysozyme, lactoferrin, lactoperoxidase, oligosaccharides, and prebiotics [7]. The presence of multiple bioactive components gives rise to the potential of the use of breast milk for therapeutic application.

According to the authors' knowledge, there are no statistical data on the use of human milk for non-nutritional purposes in Poland. The only identified paper was written in a Polish review of selected worldwide research articles concerning the use of the breast milk in the treatment of neonatal conjunctivitis, breast inflammation, atopic dermatitis, and diaper dermatitis, in the care of umbilical cord swab, and in anticancer therapy as a future perspective [8]. Therefore, the subject of the study was to explore the knowledge of, attitude to, and practices of non-nutritional breast milk use by women during lactation. The aim of this study was to assess the prevalence of the use of their own milk by mothers in the prevention and treatment of ear, ocular, pharyngeal, and nasal mucosa ailments. In this paper, the authors present the results of the survey and provide a brief summary of the representative studies to highlight findings that are considered important.

2. Materials and Methods

A cross-sectional study was conducted in November/December 2018 using an anonymous web questionnaire prepared in Polish. Lactating women were asked to complete the survey—both breastfeeding and expressed milk-feeding, regardless of lactation duration. The questions included in the questionnaire were related to contact with information on non-nutritional properties of human milk, their practical application, evaluation of results, and respondents' willingness to test potentially therapeutic uses of their own milk. The list of methods concerning the non-nutritional use of human milk was based on information found on web forums, blogs, social networks, and in lay literature.

It needs to be emphasized that, both prior to and after completing the questionnaire, respondents were informed of the non-educational purpose of the survey—the notice on the origin of listed non-nutritional breast milk usages and their scientifically unverified status was posted together with the link to the survey, as well as in its final part (Figure S1, Supplementary Materials).

The questionnaire was posted on Polish-language forums and groups discussing topics of parenthood and breastfeeding, mainly based on Facebook. The groups and online forums were randomly selected, found with a search engine using keywords in Polish such as "lactation", "breastfeeding", "mother", and "parenthood". The respondents answered anonymously and did not receive any reward. The responses were coded automatically due to the order of reception. The statistical correlation between the variable categories was assessed using the chi-square test. The c-Pearson coefficient was used to determine the relation between nominal variables. The statistical

significance level of findings was set at $p < 0.05$. For calculations, PQStat 1.6.6 (PQStat Software Tomasz Więckowski, Plewiska, Poland) and Microsoft Excel for Office 365 (Microsoft, Redmond, WA, USA) were used.

Participation in the survey was entirely voluntary, and, by filling in the questionnaire, women agreed to participation in the study. Prior to the start of the study, formal permission was obtained from the local ethics committee, the Bioethical Committee at the Medical University in Wroclaw (Nr KB 703/2018, 22 November 2018).

3. Results

The questionnaire was completed by 1218 mothers, of whom 31 were excluded due to the lack of current lactation during the period of research. The analysis included responses from 1187 women, whereby 890 (74.98%) of the respondents admitted that they had contact with information about non-nutritional uses of breast milk, of which 768 (86.29%) had heard about its therapeutic effect on mucous membranes (Table 1).

Table 1. Characteristics of the population of women who had contact with information about use of human milk for mucous membranes ("knowledge of") or used it in practice ("used").

Demographic Data	Knowledge of, *n* = 768 (86.29%)	Used, *n* = 404 (45.39%)
	Age in years (Mean ± SD)	
	30.18 ± 3.89	30.32 ± 4.01
	Place of residence (*n*)	
Rural	137 (17.84%)	81 (20.05%)
City < 100,000 residents	181 (23.57%)	101 (25.0%)
City > 100,000 residents	450 (58.59%)	222 (54.95%)
	Education (*n*)	
Primary education	1 (0.13%)	1 (0.25%)
Basic vocational education	7 (9.11%)	3 (0.74%)
General secondary education	108 (14.06%)	60 (14.85%)
Tertiary education	652 (84.9%)	340 (84.16%)
	Parity (*n*)	
1	476 (61.98%)	227 (56.19%)
2	240 (31.25%)	144 (35.64%)
3	49 (6.38%)	32 (7.92%)
≥4	3 (0.39%)	1 (0.25%)
	Number of currently breastfed children (*n*)	
1	745 (97.0%)	391 (96.78%)
2	22 (2.87%)	12 (2.97%)
3	1 (0.13%)	1 (0.25%)
≥4	0	0
	Duration of lactation in months (Mean ± SD)	
	11.2 ± 8.68	12.65 ± 9.56
	Gestational age in weeks (Mean ± SD)	
	39.18 ± 2.1	39.12 ± 2.13

A relationship between duration of lactation (chi-square test = 37.86; $p < 0.001$; c-Pearson adjusted coefficient = 0.286) and "knowledge" of the use of breast milk as a remedy in prophylaxis and treatment of mucosal ailments was found (Figure 1). No significant relationship in terms of place of residence, parity, or gestational age was found. Most often, mothers knew about the use of human milk in treatment of common cold ($n = 604$), conjunctivitis ($n = 410$), and blocked tear ducts ($n = 308$) (Figure 2).

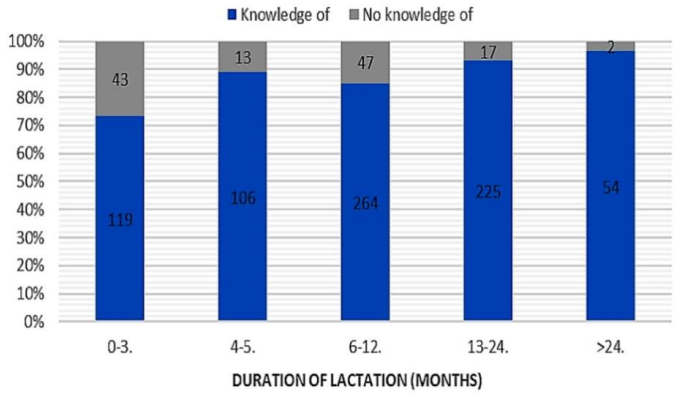

Figure 1. The duration of lactation and "knowledge" of the use of breast milk in prevention and treatment of mucosal ailments ("knowledge of" vs. "no knowledge of").

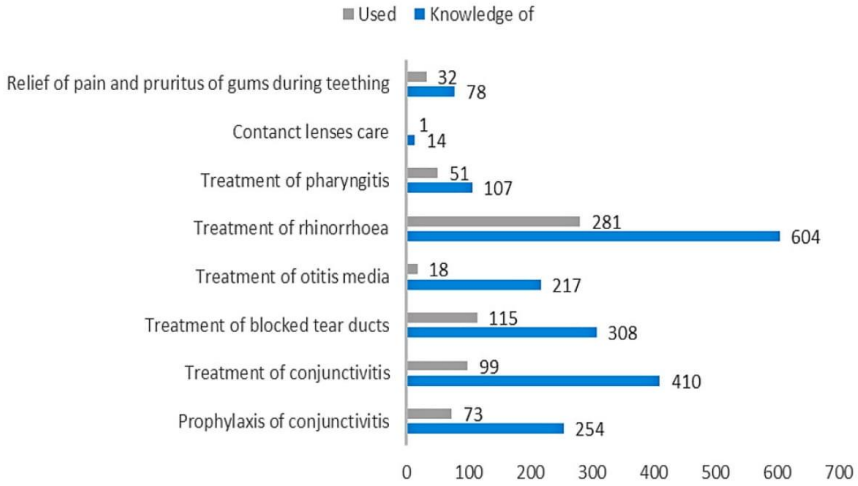

Figure 2. Comparison of the number of mothers who had "knowledge" of using human milk on mucous membranes ("knowledge of") and the number of mothers who tried it in practice ("used").

In total, 404 women implemented knowledge about the use of breast milk on mucous membranes in practice (Table 1). Respondents assessed the results of breast milk use on mucous membranes as positive (339 opinions), negative (34 opinions), or difficult to assess (41 opinions). Among mothers, the most popular applications of their own milk comprised treatment of cold (n = 281), blocked tear ducts (n = 115), and conjunctivitis (n = 99) (Figure 2). In the case of attempts to use breast milk as a home remedy for mucosal complaints, we found a relationship between breastfeeding duration (chi-square test = 24.36; $p < 0.001$; c-Pearson adjusted coefficient = 0.248) and parity (chi-square test = 13.495; $p < 0.005$; c-Pearson adjusted coefficient = 0.186) (Figures 3 and 4).

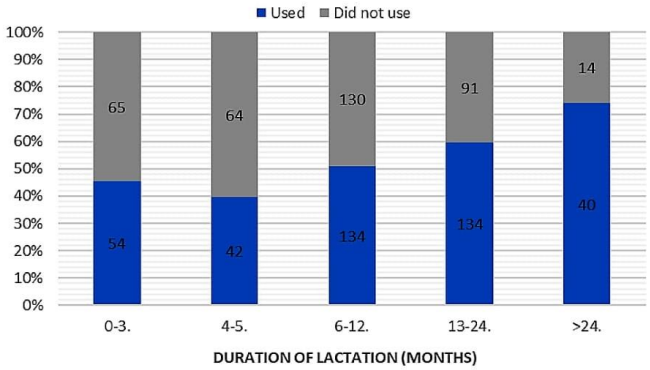

Figure 3. The duration of lactation and attempts to use breast milk in prevention and treatment of mucosal ailments ("used" vs. "did not use").

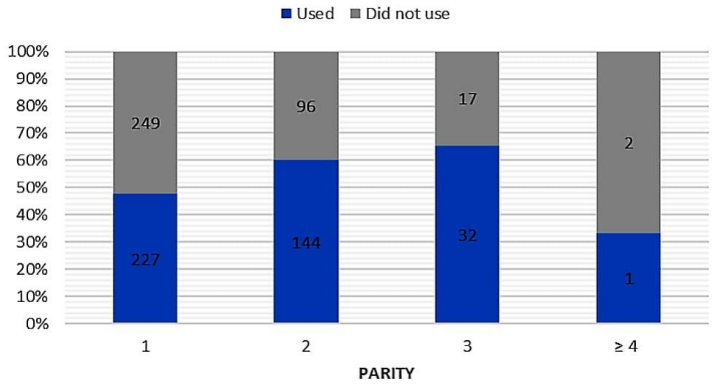

Figure 4. The parity and attempts to use breast milk in prevention and treatment of mucosal ailments ("used" vs. "did not use").

Among the respondents, 14 women discovered information concerning the possibility of cleaning contact lenses with women's milk. Only one of them decided to put this method into practice, with negative effect—pruritus and redness of the conjunctiva. Furthermore, 171 mothers expressed a willingness to use their own milk for contact lens care in the future (Figure 5).

Among all respondents who applied their milk for non-nutritional purposes (n = 751), 63 (8.4%) mothers used milk only on mucous membranes, 347 (46.2%) only on the skin, and 341 (45.4%) in both cases. These three groups were compared with regard to duration of pregnancy, breastfeeding, parity, education, place of residence, and age. A statistically significant relationship was found in terms of (successively increasing correlation) education (chi-square test = 12.77; $p < 0.05$; c-Pearson adjusted coefficient = 0.158), parity (chi-square test = 17.65; $p < 0.01$; c-Pearson adjusted coefficient = 0.186), and breastfeeding duration (chi-square test = 31.24; $p < 0.001$; c-Pearson adjusted coefficient = 0.245).

The basic sources of mothers' knowledge about the possibilities of non-nutritional use of their own milk were websites (67.06%), online discussing groups for parents (43.49%), and midwives or nurses (37.24%) (Figure 6).

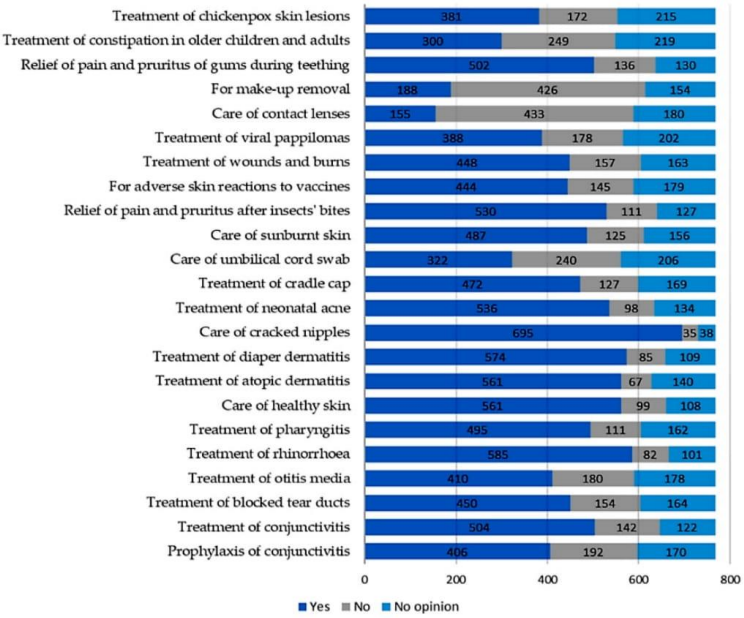

Figure 5. Declared willingness to use selected non-nutritional uses of breast milk in the future. The list of methods was based on information found on online discussing groups, blogs, social networks, and in lay literature. It was remarked that little or no scientific data are currently available regarding the efficacy and dangers of implementation of those usages.

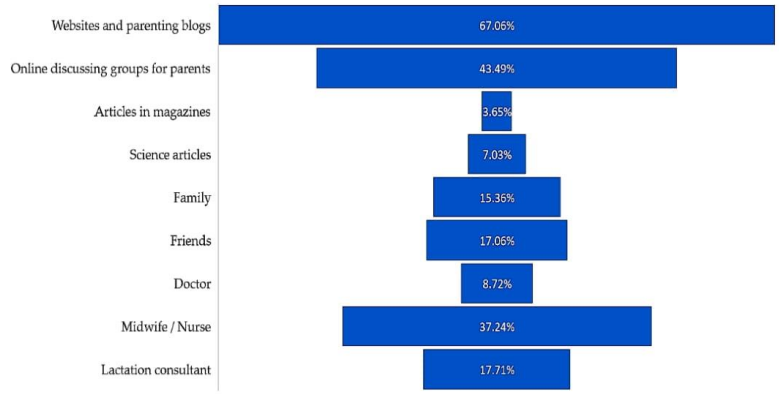

Figure 6. Source of mothers' knowledge about the possibilities of non-nutritional use of breast milk (multiple choice question).

4. Discussion

A mother's milk is an extremely complex fluid, which not only nourishes babies, but protects them from diseases [6,7,9]. Numerous antimicrobial and immunomodulating compounds, including human milk oligosaccharides, compensate for the functional immaturity of the infantile immune system. The bioactive agents which comprise human milk are capable of inhibiting inflammatory

processes, as well as increasing the production of specific antibodies, antioxidants, interleukins, growth factors, secretory leukocytes, and defensins. A mother's milk also contains factors that can mediate differentiation and development of B lymphocytes [10]. Due to the increasing knowledge of breast milk composition, the possibility of its use as a therapeutic agent is being investigated. Tests on animal models (New Zealand rabbits and infant rats) showed that the topical application of oligosaccharides contained in human milk hinders the adhesion of pathogens such as *Streptococcus pneumoniae* and *Haemophilus influenzae* to mucous membranes, thus reducing the risk of infection. It was also found that supply of oligosaccharides within 24 h after infection alleviates the symptoms of pneumonia [11]. Similar results were obtained in vitro—oligosaccharides contained in human milk limited adhesion of pathogens to conjunctival epithelium [12] and intestinal mucosa [13].

It appears that, due to easy accessibility, health-promoting properties, and belief in its harmlessness, women's milk is used as a remedy in "home medicine". Its use for non-nutritional purposes attracts great public interest, as confirmed in this study.

As mentioned in Section 1, Polish women are, thus, willing to use natural substances to test therapies with their own milk as an alternative to standard treatments. It should be emphasized that knowledge of this topic comes mainly from uncertain sources (websites and forums for parents). The use of methods recommended by other mothers takes place beyond the control of medical personnel. Our attention was given to greater willingness to try out potentially therapeutic milk properties on children than mothers themselves—for example, the readiness to use breast milk for prophylaxis or treatment of conjunctivitis was declared by 2.5 or three times more women than in the case of contact lens care. As we call into question the safety of the use of breast milk as a remedy for mucosal ailments, we provide below a brief summary of available research papers, with reference to each "human milk usage" included in the survey.

The most popular amongst the mothers surveyed was the use of their own milk in the treatment of rhinitis in infants. Women instilled milk from breast directly into children's nostrils in order to shorten the duration of infection and to improve nasal patency. In the opinion of 86.12% of mothers, the procedure brought a positive effect. No publications were found on the use of human milk as nose drops in the topical treatment of rhinitis. However, scientific publications reported the protective effect of breastfeeding on upper respiratory tract infections and the beneficial development of nasopharyngeal flora [14,15].

The use of human milk as drops is also recommended on social media for otitis media treatment. This method tested by 18 women was assessed positively; however, at the same time, mothers administered other medications. Previously published reviews of studies indicated an increased frequency of otitis media in children due to a short breastfeeding period and the introduction of milk formula before six months of age [16]. Extended breastfeeding seems to reduce the incidence of otitis media in childhood [17].

There is a lack of reliable scientific data verifying the usefulness of breast milk in the local treatment of pharyngitis. Potential benefits might result from the described anti-inflammatory properties of human milk and its protective effect against upper respiratory tract infections [14,18].

Putting drops of breast milk into purulent eyes is a remedy quite often recommended on parents' forums. Among the respondents, 254 mothers had heard about the use of milk in prevention of conjunctivitis, while 410 mothers had practical experience in its treatment, of which 29% and 24%, respectively, applied this method. The available scientific papers do not explicitly verify benefits of the abovementioned practices. The American Academy of Pediatrics recommends the use of 1% tetracycline ointment, 0.5% erythromycin ointment, or 0.5–1% silver nitrate solution for prophylaxis of anterior eye segment infections in newborns. The standard management of conjunctivitis consists of antibiotic therapy and antivirals; due to the underlying cause, however, conservative treatment is often sufficient [19].

In previous studies, the activity of colostrum against *Staphylococcus aureus* was demonstrated [20–22]. The impact of breast milk and antibiotics on bacteria growth was also compared in vitro; antibiotics

showed significantly greater efficacy for most strains, except for gonococci [23]. In the aspect of nasolacrimal duct obstruction, one retrospective study was published; the time it took for newborns' chronic lacrimation resolution was shorter after instilling eyes with milk [24]. Although the results of the studies seem promising, they should be considered carefully. When it comes to conjunctivitis and eye injuries, delay in ophthalmologic consultations and initiation of proper therapy can lead to serious complications—spread of infection to surrounding tissues (endophthalmitis, panophthalmitis), loss of sight, and even indication for eye enucleation [25].

As far as "milk therapy" is concerned, it is important to note that human milk was generally considered sterile; however, in recent years, it proved to be a permanent source of commensal, mutualist, and potentially probiotic bacteria colonizing the infant's intestines. The mammary gland contains its own microflora not only during lactation, but in the final stage of pregnancy. The composition of microbiota may vary depending on the duration of pregnancy, type of delivery, maternal weight, duration of lactation, maternal health, and inhabited latitude. Despite these factors, the core microbiota of human milk contains genera *Staphylococcus*, *Streptococcus*, *Serratia*, *Pseudomonas*, *Corynebacterium*, *Propionibacterium*, *Lactobacillus*, and to a lesser extent *Enterococcus* and *Bifidobacterium* [26]. Transitional flora is not without significance. Like any other human body secretion, milk can be a carrier of pathogens—viruses, e.g., HIV, HTLV-1, CMV, HBV, HCV, HSV, VZV; protozoa, e.g., *Toxoplasma*; fungi, e.g., *Candida spp.*; and bacteria, including *Listeria monocytogenes*, *Coxiella burnetii*, *Staphylococcus aureus*, and *Streptococcus B*; cases of milk-transferred infections in infants were also reported [27]. Therefore, safety of human milk application to mucous membranes should be carefully considered, especially in newborns and infants.

The newborn's microflora is highly dynamic and undergoes rapid changes during the first years of life, striving for a stable structure of distinct microbial communities with unique composition and functions in specific areas of the body. Early interactions between the developing microbiome, pathogenic bacteria, and their human host are responsible for maturation of the immune system in the postpartum period, which affects health in the future [28]. Although the influence of breastfeeding on intestinal microbiota development and upper respiratory tract bacterial flora is well known, it is not clearly defined whether topical application of human milk to mucous membranes, e.g., ocular or nasal, brings health benefits. It is generally recognized, however, that microbial dysbiosis in anatomical niches may lead ultimately to immune dysregulation [15–17]. From this standpoint, further research on the topic of "breast milk therapy" for mucosal infections is needed.

5. Strengths and Limitations

This paper is a part of the first study, to the authors' knowledge, on the subject of breast milk use for non-nutritional purposes in Poland. It provides preliminary data on the prevalence of using human milk as a home remedy in the treatment and prevention of mucous membrane complaints, and also includes patients' experiences. The survey was completed by women from various regions of Poland, differing in terms of age, parity rate, and education. However, as the study was limited mostly to mothers active on social networks, the study group cannot be considered as representative of the Polish population.

6. Conclusions

The following conclusions were drawn in this study:

1. A high interest in the non-nutritional applications of breast milk was demonstrated among breastfeeding Polish mothers. Due to the high levels of readiness to use in practice methods recommended on online forums, there is a need to educate parents about possible risks and to highlight the importance of medical consultation in order to initiate adequate treatment.

2. Anecdotal evidence, based on patients' personal experience, confirming the effectiveness of human milk in the prevention and treatment of mucous membranes ailments is a sufficient argument for mothers to use the methods found on the internet.

3. There is a need for reliable information verifying health benefits and risks associated with the use of breast milk for therapeutic purposes in mucous membranes. Further scientific research in this area should be carried out.

Supplementary Materials: The following are available online at http://www.mdpi.com/1660-4601/16/10/1715/s1. Figure S1: Introduction and conclusion of the online form used for the survey. A copy of the pre-filled form is available online: https://docs.google.com/forms/d/e/1FAIpQLSewcxKIW39bsUz46dBC6GNXfhXtmSNPowPDniNDpdKbRGq-jw/viewform.

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6.5. Artykuł nr 5.

Wiedza personelu medycznego i matek karmiących piersią dotycząca wybranych aspektów laktacji – „diety" i pozażywieniowego zastosowania mleka

Medical personnel and breastfeeding mothers' knowledge of selected aspects of lactation – „diet" and non-nutritional use of breast milk

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STRESZCZENIE

Mimo braku dowodów naukowych, profilaktyczna dieta eliminacyjna i stosowanie własnego mleka w celach pozażywieniowych to praktyki powszechne wśród polskich matek.

Cel: Celem artykułu jest prezentacja doświadczeń i wiedzy polskich matek oraz personelu medycznego w zakresie laktacji i jej wybranych aspektów na podstawie badań własnych autorów.

Materiał i metody: W latach 2018-2019 przeprowadzono 2 badania przekrojowe z wykorzystaniem elektronicznych kwestionariuszy ankietowych dotyczących: 1) stosowania mleka kobiecego w celach pozażywieniowych przez Polki, 2) diety matki karmiącej piersią i wiedzy o żywieniu w okresie laktacji. W pierwszym badaniu wzięło udział 1187 matek w okresie laktacji. W drugim badaniu wzięło udział 1159 osób, w tym polskie matki i personel medyczny. Analizę statystyczną zgromadzonych danych wykonano przy pomocy metod nieparametrycznych i regresji logistycznej.

Wyniki: Wiedza personelu medycznego była porównywalna do wiedzy pacjentek ($p > 0,05$). Niezależnie od rodzaju wykonywanego zawodu respondenci wykazali niską wiedzę w zakresie wpływu diety na makroskładniki mleka kobiecego. Wiedza i doświadczenia z zakresu laktacji istotnie determinują czas karmienia piersią ($p < 0,05$). Główne źródło wiedzy matek o właściwościach mleka kobiecego stanowią media społecznościowe.

Wnioski: Przeprowadzone badania wskazują na ciągłą potrzebę edukacji zarówno społeczeństwa, jak i personelu medycznego, szczególnie w zakresie poradnictwa żywieniowego i wiedzy o właściwościach mleka kobiecego. Konieczna jest poprawa i aktualizacja programów nauczania kadry medycznej sprawującej opiekę nad kobietami w okresie ciąży i laktacji oraz ich dziećmi – celem budowania i umacniania autorytetu personelu medycznego jako źródła aktualnej wiedzy medycznej o laktacji i mleku kobiecym.

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SŁOWA KLUCZOWE: ■ ZDROWIE ■ WIEDZA ■ POSTAWY ■ PRAKTYKA ■ KARMIENIE PIERSIĄ ■ DIETA ■ ŻYWNOŚĆ I ŻYWIENIE ■ TERAPIA MLEKIEM

ABSTRACT

Despite the lack of scientific evidence, prophylactic elimination diet and the use of own milk for non-nutritional purposes are common practices among Polish mothers.

Aim: The aim of the study was to present the experiences and knowledge of Polish mothers and medical staff in the field of lactation and its selected aspects, based on the authors' own research.

Material and methods: In the years 2018-2019, 2 cross-sectional studies using electronic questionnaires were carried out on: 1) the use of human milk for non-nutritional purposes by Polish women, 2) the diet of a breastfeeding mother and knowledge about nutrition during lactation. The first study involved 1,187 lactating mothers. 1,159 people took part in the second study, including Polish mothers and medical staff. The statistical analysis of the collected data was performed using non-parametric methods and logistic regression.

Results: The knowledge of medical personnel was comparable to that of the patients ($p > 0.05$). Regardless of the type of occupation, the respondents showed little knowledge of the impact of diet on the macronutrients of breast milk. Lactation knowledge and experience significantly determine the duration of breastfeeding ($p < 0.05$). The main source of knowledge of mothers about the properties of breast milk is social media.

Conclusions: The conducted research indicates a continuous need for education, both of the society and medical personnel, especially in the field of nutritional counseling and knowledge about the properties of breast milk.

It is necessary to improve and update the curricula of medical staff caring for pregnant and lactating women and their children in order to build and strengthen the authority of medical staff as a source of current medical knowledge about lactation and breast milk.

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KEY WORDS: ■ HEALTH ■ KNOWLEDGE ■ ATTITUDES ■ PRACTICE ■ BREASTFEEDING ■ DIET ■ FOOD AND NUTRITION ■ MILK THERAPY

GŁÓWNE TEZY

- Profilaktyczna eliminacja wybranych produktów z diety matki jest nadal uznawana za właściwe postępowanie dietetyczne w okresie laktacji, co może prowadzić do rezygnacji przez kobiety z karmienia piersią.
- Wiedza personelu medycznego o laktacji, żywieniu matki karmiącej piersią i mleku kobiecym wymaga doskonalenia i aktualizacji.
- Polskie matki wykazują zainteresowanie niekonwencjonalnymi metodami profilaktyki i leczenia powszechnych schorzeń wieku niemowlęcego, w tym metodami z wykorzystaniem własnego mleka. Stosowanie mleka kobiecego w celach „profilaktycznych" i „leczniczych" odbywa się bez konsultacji z lekarzem.

Wstęp

Temat odżywiania matki w okresie laktacji od lat pozostaje związany z wieloma mitami, dotyczącymi nie tylko tego, które produkty i grupy żywności są „dozwolone", ale także wpływu poszczególnych pokarmów na jakość mleka, efektywność karmienia piersią oraz stan zdrowia dziecka (w aspekcie krótko- i długoterminowym, np. kolka, nieutulony płacz, ryzyko rozwoju alergii). Często nieprawdziwe przekonania wynikają z braku aktualnej wiedzy medycznej bądź tradycji o podłożu kulturowym lub religijnym. Są one przekazywane między pokoleniami, a co więcej – powielają je nie tylko matki karmiące piersią, ale także personel medyczny[1-8]. Mimo braku dowodów naukowych profilaktyczna eliminacja produktów potencjalnie alergizujących z diety matki w okresie laktacji jest ciągle powszechną praktyką – nie wykazano skuteczności tych interwencji w zapobieganiu rozwojowi przewlekłych chorób alergicznych u dzieci. Należy jednak podkreślić, że profilaktyczna eliminacja produktów potencjalnie alergizujących z diety matki dotyczy wyłącznie działań rozpoczętych przed urodzeniem dziecka lub wraz z rozpoczęciem laktacji, bez istniejących wskazań medycznych; nie odnoszą się one do niemowląt, u których wkrótce po urodzeniu pojawiły się objawy choroby alergicznej, ponieważ interwencje dietetyczne podczas laktacji mogą wtedy stanowić leczenie, a nie profilaktykę pierwotną[9,10].

Wiedza o żywieniu w okresie laktacji wymaga także aktualizacji z uwagi na rosnącą popularność alternatywnych form odżywiania – głównie w aspekcie diet wegetariańskich, o różnym stopniu eliminacji produktów pochodzenia zwierzęcego. Powszechne jest błędne przekonanie o bezwarunkowo niedoborowej diecie i niepełnowartościowym mleku matek wegetarianek. Jednak z uwagi na ryzyko niedoborów pokarmowych (zwłaszcza witaminy B_{12}) przy nieprawidłowo zbilansowanej diecie konieczne jest odpowiednie wsparcie i poradnictwo żywieniowe zarówno dla matki w okresie laktacji, jak i jej dziecka[11-13].

Ograniczenia dietetyczne mogą wpływać negatywnie nie tylko na skuteczność karmienia piersią, ale także na stan odżywienia i samopoczucie matek. Ponadto – nieustanny niepokój o zdrowie dziecka w związku ze sposobem odżywiania matki, presja otoczenia lub dalsza eliminacja potencjalnie „szkodliwych" produktów z diety stanowią czynniki, które mogą przyczynić się do decyzji o zaprzestaniu karmienia piersią.

Standard Opieki Okołoporodowej w Polsce zawiera punkty dotyczące opieki nad matką w okresie ciąży i laktacji oraz noworodkiem, z uwzględnieniem wsparcia i edukacji matki w zakresie laktacji i problemów z nią oraz żywienia[14]. Ponadto – poprawa stanu odżywienia i sposobu żywienia społeczeństwa polskiego, z uwzględnieniem promocji karmienia piersią, wsparcia laktacyjnego matek karmiących piersią, edukacji w zakresie żywienia noworodka i kobiet w okresie laktacji oraz podnoszenia kompetencji personelu medycznego sprawującego opiekę nad matką i jej dzieckiem, stanowiła jeden z celów operacyjnych Narodowego Programu Zdrowia na lata 2016-2020[15]. Na istotną rolę edukacji i wsparcia matek oraz szkolenia personelu medycznego sprawującego opiekę nad matką i noworodkiem wskazuje również Światowa Organizacja Zdrowia (WHO)[16,17]. Działania te nabierają szczególnego znaczenia w świetle wskaźników karmienia naturalnego w Polsce (ok. 3-4% w 6. miesiącu życia dziecka) – jednych z najniższych spośród krajów Europy[18].

Cel

Celem artykułu jest:

1. prezentacja doświadczeń i wiedzy polskich matek oraz personelu medycznego w zakresie laktacji i jej wybranych aspektów na podstawie badań własnych autorów;
2. analiza wniosków z badań własnych autorów w aspekcie skutków o znaczeniu klinicznym i społecznościowym.

Materiał i metody

W latach 2018-2019 w ramach działalności naukowej Katedry i Kliniki Neonatologii Uniwersytetu Medycznego we Wrocławiu przeprowadzono 2 badania przekrojowe z wykorzystaniem elektronicznych kwestionariuszy ankietowych dotyczących wybranych aspektów laktacji. Jedno z badań poruszało problematykę diety matki karmiącej – produktów „dozwolonych" i „zabronionych" w okresie laktacji, wpływu sposobu odżywiania się kobiety na skład jej mleka oraz stan zdrowia dziecka karmionego mlekiem matki. Badanie przeprowadzono z udziałem 1159 respondentów – personelu medycznego i polskich matek. Opis metodyki uwzględniono w publikacji[19]. Kolejne badanie dotyczyło stosowania mleka kobiece-

go w celach pozażywieniowych przez Polki – zarówno w aspekcie wiedzy, jak i doświadczeń. Grupę badaną stanowiły matki będące aktualnie w okresie laktacji – przeanalizowano odpowiedzi 1187 kobiet. Metodykę badania opisano w publikacjach[20,21].

Analizę danych wykonano przy użyciu oprogramowania: Excel Microsoft Office 365 (Microsoft, Redmond, WA, USA), STATISTICA 13.3 (StatSoft, Inc., Tulsa, OK, USA) i R version 3.6.2 (R Core Team, 2013; R Foundation for Statistical Computing, Vienna, Austria; http://www.R-project.org/). W analizie wykorzystano test U Manna–Whitney'a do porównania grup o rozkładzie odbiegającym od rozkładu normalnego, test Chi-kwadrat (x^2) dla porównania zmiennych kategorycznych między grupami, test tau (τ) Kendalla dla określenia zależności między zmiennymi kategorycznymi i regresję logistyczną dla oceny związku między zmiennymi kategorycznymi a zmiennymi objaśniającymi. Poziom istotności statystycznej przyjęto dla p = 0,05.

Praca stanowi syntezę danych dotychczas niepublikowanych lub opublikowanych w ograniczonym zakresie.

Wyniki

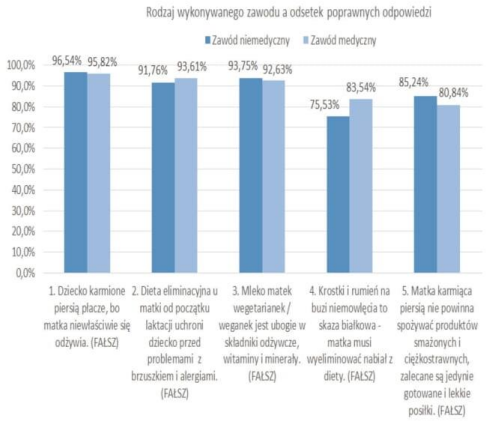
Wiedza o „diecie matki karmiącej" i mleku kobiecym

W badaniu przeprowadzonym na grupie 1159 osób wzięły udział 752 matki, które kiedykolwiek urodziły dziecko w terminie porodu i karmiły je własnym mlekiem (64,88%) oraz 407 osób wykonujących zawód medyczny (35,12%), w tym także 10 mężczyzn. Charakterystykę respondentów przedstawiono w **Tabeli 1**. Respondenci zostali poproszeni o ocenę stwierdzeń dotyczących laktacji i mleka kobiecego jako prawdziwe lub fałszywe – zgodnie ze swoją wiedzą. W niniejszej pracy prezentujemy wyniki dotyczące wybranych 5 stwierdzeń. Wiedza obu grup była porównywalna, z wyjątkiem stwierdzenia dotyczącego zmian skór-

Tabela 1. Charakterystyka respondentów (n = 1159)

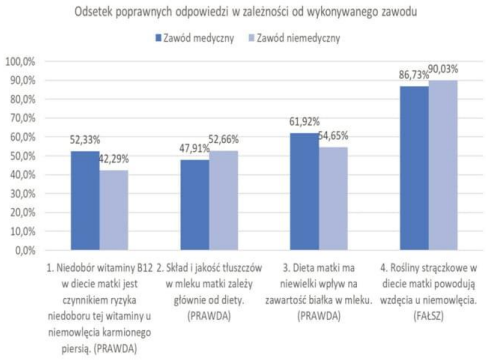
Zmienna	Liczba respondentów (%)		test Chi-kwadrat		
	Zawód medyczny (n = 407; 35,12%)	Zawód niemedyczny (n = 752; 64,88%)	χ^2	df	p
Wiek (w latach)					
< 20	0	2 (0,27%)	58,08	3	< 0,001*
20-29	183 (44,96%)	308 (40,96%)			
30-39	165 (40,54%)	416 (55,32%)			
≥ 40	59 (14,50%)	26 (3,46%)			
Płeć					
Żeńska	397 (97,53%)	752 (100%)	18,64	1	< 0,001*
Męska	10 (2,47%)	0			
Miejsce zamieszkania					
Wieś	77 (18,92%)	136 (18,09%)	0,122	2	0,941
Miasto < 100 000 mieszkańców	105 (25,80%)	196 (26,06%)			
Miasto > 100 000 mieszkańców	225 (55,28%)	420 (55,85%)			
Dzietność					
0	77 (18,92%)	0	156,33	4	< 0,001*
1	167 (41,03%)	419 (55,72%)			
2	139 (34,15%)	287 (38,16%)			
3	24 (5,90%)	43 (5,72%)			
4 lub więcej	0	3 (0,40%)			

* wynik istotny statystycznie (p < 0,05)



RYCINA 1. Porównanie odsetka poprawnych odpowiedzi między respondentami wykonującymi zawód medyczny a matkami wykonującymi zawód niemedyczny

Wyniki analizy Chi-kwadrat , kolejno:
1) χ^2 (1, N = 1159) = 0,383, p = 0,536; τ = -0,018, p > 0,05;
2) χ^2 (1, N = 1159) = 1,297, p = 0,255; τ = 0,033, p > 0,05;
3) χ^2 (1, N = 1159) = 0,535, p = 0,465; τ = -0,022, p > 0,05;
4) χ^2 (1, N = 1159) = 9,977, p = 0,002; τ = 0,093, p < 0,05;
5) χ^2 (1, N = 1159) = 3,753, p = 0,053; τ = -0,057, p > 0,05.



RYCINA 2. Porównanie odsetka poprawnych odpowiedzi między respondentami wykonującymi zawód medyczny a matkami wykonującymi zawód niemedyczny

Wyniki analizy Chi-kwadrat , kolejno:
1) χ^2 (1, N = 1159) = 10,74, p = 0,001; τ = 0,096, p < 0,05;
2) χ^2 (1, N = 1159) = 2,38, p = 0,123; τ = -0,045, p > 0,05;
3) χ^2 (1, N = 1159) = 5,69, p = 0,017; τ = 0,07, p < 0,05;
4) χ^2 (1, N = 1159) = 2,9, p = 0,089; τ = -0,05, p > 0,05.

nych na twarzy dziecka i ich związku z alergią na białka mleka krowiego – istotnie częściej matki wykonujące zawód niemedyczny błędnie wskazywały, że jest to zdanie prawdziwe. Co więcej – w przypadku tego stwierdzenia odnotowano niższy odsetek poprawnych odpowiedzi w obu grupach. Wyniki zaprezentowano na **Rycinie 1**.

Niezależnie od rodzaju wykonywanego zawodu, respondenci wykazali niską wiedzę w zakresie wpływu diety na makroskładniki mleka kobiecego (**Rycinie 2**). Wykazano pozytywną zależność między poprawną oceną stwierdzeń „Mleko matek wegetarianek/weganek jest ubogie w składniki odżywcze, witaminy i minerały" i „Rośliny strączkowe w diecie matki powodują wzdęcia u niemowlęcia" (OR = 4,73; 95% CI: 2,01-11,13; p < 0,001) oraz negatywną zależność z oceną stwierdzenia „Niedobór witaminy B_{12} w diecie matki jest czynnikiem ryzyka niedoboru tej witaminy u niemowlęcia karmionego piersią" (OR = 0,4; 95% CI: 0,17-0,96; p = 0,04).

Profilaktyczna dieta eliminacyjna matki w okresie laktacji

W badaniu na grupie 1159 osób (w tym 407 przedstawicieli ochrony zdrowia), 15% personelu medycznego (n = 61), w tym 59 kobiet i 2 mężczyzn przyznało, że zalecało pacjentkom karmiącym piersią profilaktyczną dietę eliminacyjną. Istotny wpływ na zalecenie profilaktycznych ograniczeń dietetycznych przez kobiety wykonujące zawód medyczny (n = 59) miały: dzietność (OR = 1,81; 95% CI: 1,28-2,57; p < 0,001) oraz przestrzeganie diety eliminacyjnej w okresie karmienia piersią własnego dziecka (OR = 2,81; 95% CI: 1,58-5; p < 0,001). Nie stwierdzono związku między miejscem zamieszkania a stosowaniem (OR = 0,84; 95% CI: 0,63-1,12; p = 0,237) ani zalecaniem (OR = 0,8; 95% CI: 0,57-1,12; p = 0,193) diety eliminacyjnej przez personel medyczny. Charakterystykę grupy personelu medycznego ze względu na zalecanie profilaktycznych ograniczeń dietetycznych pacjentkom karmiącym piersią (w zależności od płci, dzietności i stosowania diety eliminacyjnej w okresie laktacji) przedstawiono w **Tabeli 2**. Ponadto wykazano zależność między zalecaniem profilaktycznej diety eliminacyjnej a oceną prawdziwości stwierdzenia „Krostki i rumień na buzi niemowlęcia to skaza białkowa – matka musi wyeliminować nabiał z diety" (OR = 0,41; 95% CI: 0,22-0,78; p < 0,01) – zostało ono poprawnie ocenione jako fałszywe przez 85,80% osób, które nigdy nie zalecały ograniczeń dietetycznych oraz przez 71,2% osób, które ograniczały eliminację wybranych produktów z diety na czas karmienia piersią.

Wśród respondentów 29,14% wszystkich matek wskazało, że kiedykolwiek stosowały profilaktycz-

Tabela 2. Charakterystyka grupy respondentów wykonujących zawód medyczny w aspekcie zalecania profilaktycznej diety eliminacyjnej w okresie laktacji (n = 407)

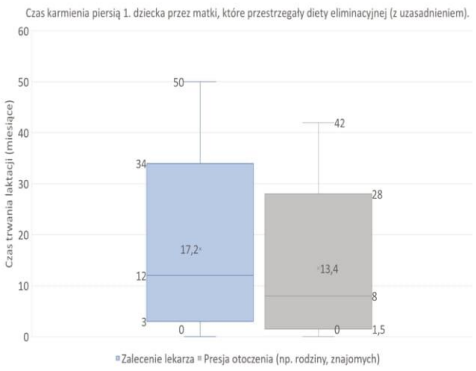
Zmienna	Czy kiedykolwiek zalecił Pan/zaleciła Pani matce w okresie laktacji prewencyjną dietę eliminacyjną?		test Chi-kwadrat		
	Tak (n = 61)	Nie (n = 346)	χ^2	df	p
Płeć					
Żeńska (n = 397)	59	338	0,202	1	0,653
Męska (n = 10)	2	8			
Dzietność					
0	5	72	11,81	3	0,008*
1	21	146			
2	28	111			
3	7	17			
≥ 4	0	0			
Czy w czasie laktacji stosowała Pani dietę eliminacyjną?**					
Tak (n = 100)	26	74	8,85	1	0,003*
Nie (n = 297)	33	264			

* wynik istotny statystycznie (p < 0,05)
** analiza dotyczy wyłącznie kobiet wykonujących zawód medyczny, które urodziły dziecko i karmiły je piersią

ną dietę eliminacyjną podczas karmienia piersią swoich dzieci. W większości przypadków ta praktyka wynikała z porady lekarza (71,25%, n = 223), presji otoczenia – np. rodziny, znajomych (20,77%, n = 65) lub innych powodów (7,99%, n = 25), w tym niepokoju matki, że jej dieta może mieć negatywny wpływ na skład i jakość jej mleka oraz zdrowie dziecka karmionego piersią. Ponadto w tej grupie 95,52% (n = 217) matkom zalecono wyeliminowanie produktów mlecznych z powodu podejrzenia alergii na białka mleka u niemowlęcia. Wśród wszystkich badanych – zarówno personelu medycznego, jak i matek wykonujących zawód niemedyczny – 16,93% (n = 53) matek zdecydowało się przerwać karmienie piersią i rozpocząć karmienie dziecka komercyjnymi mieszankami mlecznymi ze względu na ograniczenia dietetyczne.

Nie wykazano istotnego wpływu ograniczeń żywieniowych w okresie laktacji na czas karmienia piersią pierwszego dziecka (OR = 0,99; 95% CI: 0,98-1,01; p > 0,05), jednak miały istotny wpływ na stosowanie mieszanki mlecznej (OR = 10,48; 95% CI: 5,43-20,22; p < 0,001). Wśród matek, które stosowały dietę eliminacyjną, stwierdzono istotną różnicę w czasie trwania laktacji między grupami, które rozpoczęły restrykcje dietetyczne z powodu zalecenia lekarza, a tymi, które doświadczyły presji otoczenia – np. ze strony rodziny, znajomych (U = 5559,5; p < 0,01) (**Rycina 3**).

Czas karmienia piersią pierwszego dziecka istotnie wpłynął na czas karmienia kolejnego dziecka: co najmniej 6 miesięcy (OR = 1,03; 95% CI: 1,01-1,05; p < 0,05], co najmniej 12 miesięcy (OR = 1,03; 95% CI: 1,01-1,05; p = 0,001).



RYCINA 3. Porównanie czasu trwania laktacji między grupami kobiet, które przestrzegały diety eliminacyjnej pod wpływem zaleceń lekarskich lub presji otoczenia

Czas trwania laktacji a poszukiwanie alternatywnych zastosowań dla własnego mleka

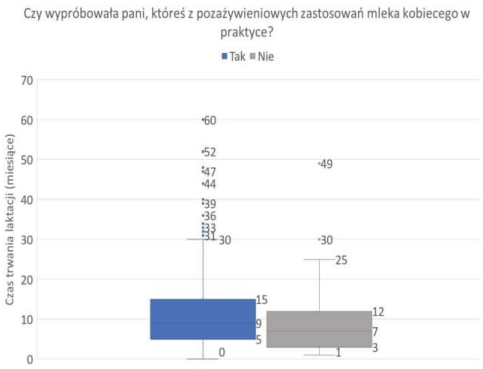
Spośród 1187 ankietowanych kobiet, 890 (74,98%) przyznało, że kiedykolwiek miało styczność z informacjami o możliwościach wykorzystania własnego pokarmu w celach pozażywieniowych, z czego w sumie 750 (84,27%) podjęło próbę zastosowania tej wiedzy w praktyce[18,19]. Istotne różnice znaleziono natomiast w zakresie czasu trwania laktacji – wśród kobiet wykazujących wiedzę lub także osobiste doświadczenia w pozażywieniowym stosowaniu własnego mleka stwierdzono istotnie dłuższy czas trwania laktacji ($p < 0,05$) (**Rycina 4** i **5**).

W badaniu wzięło udział 720 (60,66%) pierworódek i 467 wieloródek (39,34%). Większe zainteresowanie tematem pozażywieniowego stosowania mleka stwierdzono wśród pierworódek niż wieloródek [x^2 (3, N = 1187) = 9,87, p = 0,02; τ = -0,074, p < 0,05]; wśród kobiet, które potwierdziły, że kiedykolwiek otrzymały informacje w tym temacie (n = 890), pierworódki stanowiły 62,92% (77,78% spośród wszystkich ankietowanych pierworódek), natomiast wieloródki 37,08% (70,66% spośród wszystkich ankietowanych wieloródek).

Podstawowym źródłem wiedzy matek o pozażywieniowych właściwościach mleka kobiecego były media, w tym media społecznościowe: strony internetowe i blogi o tematyce rodzicielstwa – 64,72%, fora dla rodziców – 40,67%; w dalszej kolejności położna/pielęgniarka – 39,66% (**Rycina 6**).

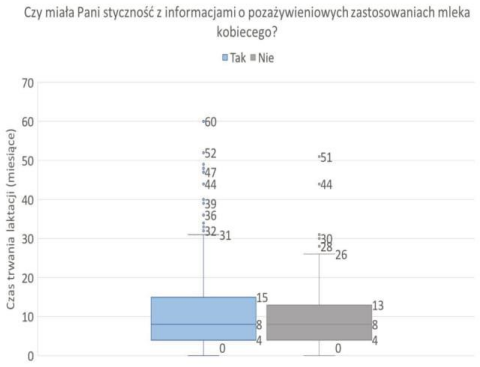
Kobiety, które podały jako źródło wiedzy m.in. pielęgniarkę/położną, najczęściej miały informacje o stosowaniu mleka z piersi w pielęgnacji popękanych brodawek sutkowych (n = 275), leczeniu kataru (n = 91), profilaktyce i leczeniu zapalenia spojówek (n = 83). Matki, które jako jedyne źródło wiedzy podały położną/pielęgniarkę (n = 88), najczęściej otrzymały informacje dotyczące stosowania mleka z piersi w pielęgnacji popękanych brodawek sutkowych (n = 73) oraz w profilaktyce i leczeniu zapalenia spojówek (n = 17).

Spośród 890 kobiet, które miały styczność z informacjami o pozażywieniowych zastosowaniach mleka kobiecego, 442 nie podały personelu medycznego ani doradcy laktacyjnego jako źródła wiedzy. Wiedzę pozyskiwały głównie ze stron internetowych i blogów (n = 317; 71,72%) oraz grup dyskusyjnych dla



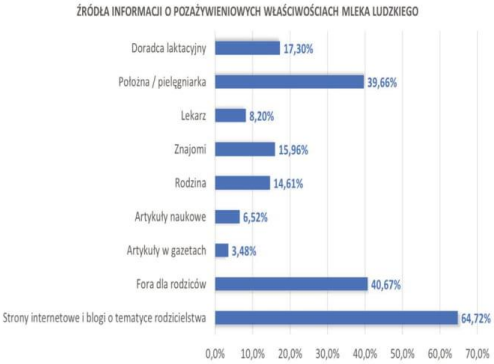
RYCINA 4. Porównanie czasu trwania laktacji między grupami kobiet, które stosowały własne mleko w celach pozażywieniowych i tymi, które nie wypróbowały żadnego z potencjalnych pozażywieniowych zastosowań w praktyce

Test Mann U Whitney: U = 42388,5, p = 0,00029



RYCINA 5. Porównanie czasu trwania laktacji między grupami kobiet, które miały wiedzę o potencjalnych pozażywieniowych zastosowaniach mleka kobiecego lub nigdy nie miały styczności z informacjami w tym temacie

Test Mann U Whitney U = 118105,5, p = 0,006



RYCINA 6. Źródła informacji o pozażywieniowych właściwościach mleka kobiecego (pytanie wielokrotnego wyboru)

rodziców (n = 223; 50,45%), w mniejszym stopniu od rodziny i znajomych (n = 131; 29,64%).
Dodatkowo matki kierowały się „intuicją" (odpowiedź podana przez matki jako inne źródło wiedzy) – zwłaszcza jeśli jedno z wypróbowanych zastosowań mleka oceniły pozytywnie, chętnie korzystały z kolejnych. Co więcej – część respondentek powoływała się na własne wykształcenie medyczne i wiedzę zdobytą w czasie studiów położniczych – kobiety te informowały o znajomości różnych potencjalnych zastosowań mleka kobiecego, nie tylko w pielęgnacji brodawek sutkowych.

Dyskusja

Mimo że karmienie piersią stanowi naturalną i optymalną formę żywienia niemowląt, wymaga ono ciągłego wsparcia, edukacji i promocji. Dotychczas wielokrotnie wykazano, że inicjacja i utrzymanie laktacji przez matkę w dużym stopniu zależy od:

1. pomocy uzyskanej od personelu medycznego oraz od prezentowanych przez ten personel postaw i wiedzy w zakresie laktacji[22-24];
2. wiedzy kobiet o karmieniu piersią i jego korzyściach zdrowotnych dla matki i jej dziecka[25,26].

Co więcej – zasugerowano, że wiedza o laktacji w przypadku matek karmiących piersią zależy od wiedzy personelu medycznego, który sprawuje opiekę nad tymi matkami[26]. Powyższe wnioski pozostają spójne z wynikami badań własnych autorów – ankietowane matki wykazywały porównywalną wiedzę do personelu medycznego. Wiedza ta jest na dość dobrym poziomie, zwłaszcza w aspekcie oceny prawdziwości popularnych mitów, ale wciąż wymaga doskonalenia – o czym świadczy nadmiernie częste przypisywanie zmian skórnych u niemowlęcia w pierwszej kolejności alergii na białka mleka krowiego oraz znacznie niższa wiedza w zakresie wpływu diety na skład mleka kobiecego.
Istotnym elementem edukacji w zakresie laktacji pozostaje edukacja żywieniowa. Laktacja jest stanem w pełni fizjologicznym, a sposób odżywiania się matki karmiącej nie różni się od zdrowego, prawidłowego odżywiania kobiety w podobnym wieku, z podobną masą ciała, wzrostem i poziomem aktywności fizycznej. Należy jedynie uwzględnić zwiększone zapotrzebowanie na niektóre składniki odżywcze (białko, witaminy, mikroelementy) oraz dodatkowe potrzeby energetyczne związane z wydzielaniem pokarmu, które wynoszą około 500 kcal/dobę, a u kobiet szczupłych 650 kcal/dobę. Głównym czynnikiem wpływającym na wydatek energetyczny jest czas i intensywność karmienia. Zwykle jakość mleka kobiecego wystarcza do zapewnienia adekwatnego wzrostu i rozwoju niemowlęcia, nawet jeżeli wartość energetyczna i odżywcza diety matki jest ograniczona. W przypadku niedoborów żywieniowych i braku możliwości pokrycia dziennego zapotrzebowania na składniki odżywcze poprzez dietę, wskazana jest ich odpowiednia suplementacja. Produkcja mleka jest zdeterminowana głównie przez zapotrzebowanie dziecka, natomiast skład mleka jest warunkowany zarówno czynnikami matczynymi, jak i niemowlęcymi[11,20,27]. W raporcie opublikowanym przez Centrum Nauki o Laktacji wykazano, że w opinii ok. 10% personelu medycznego karmienie mieszanką początkową dla niemowląt ma przewagę nad karmieniem piersią i jest uważane za bardziej wartościowe pod względem odżywczym[23].
Z badania przeprowadzonego przez autorów wynika, że mimo dość dobrej wiedzy ogólnej o żywieniu w okresie laktacji zarówno pacjentki, jak i personel medyczny wykazują zasadnicze braki wiedzy w zakresie wpływu żywienia na skład i jakość mleka kobiecego. Pod względem makroskładników – zawartość białka i węglowodanów w niewielkim stopniu zależy od nawyków żywieniowych matki; większy wpływ, zwłaszcza w aspekcie jakościowym, obserwuje się w przypadku tłuszczów – stąd np. mleko kobiet na diecie roślinnej zawiera więcej kwasów tłuszczowych długołańcuchowych i wielonienasyconych w porównaniu do mleka kobiet odżywiających się w sposób tradycyjny[13]. Należy jednak pamiętać o istotnym znaczeniu suplementacji przynajmniej witaminy B_{12} i kwasu DHA przez matki wegetarianki (witamina B_{12}: 250-500 µg/dobę lub 3 × 1000 µg/tydzień; kwas DHA 600 mg/dobę) i ich dzieci (witamina B_{12}: pod warunkiem regularnej suplementacji u matki, od 6. m.ż. 5-25 µg/dobę lub 3 × 200-300 µg/tydzień; kwas DHA: u dziecka karmionego piersią od 6. m.ż. 150 mg/dobę)[11-13].
Aktualnie uważa się, że w okresie laktacji nie należy eliminować poszczególnych grup produktów, w tym przede wszystkim produktów potencjalnie alergizujących z diety matki. Praktyki te mogą mieć negatywny wpływ na stan odżywienia matki i/lub płodu, jeśli dietę eliminacyjną wprowadzono w okresie ciąży. Ponadto istnieją wstępne dowody na to, że spożywanie pokarmów alergizujących podczas ciąży i laktacji może chronić przed rozwojem alergii pokarmowych i innych alergii u dzieci[9,10]. Jednak mity „diety matki karmiącej" i listy produktów „dozwolonych" i „zabronionych" w okresie laktacji są ciągle obecne i powielane przez polskie matki i personel medyczny. Podobne obserwacje dotyczą profilaktycznej diety eliminacyjnej w okresie laktacji. Z raportu opublikowanego przez Centrum Nauki o Laktacji wynika, że co druga matka otrzymała od personelu medycznego zalecenie profilaktycznego unikania wybranych grup produktów[24]. W badaniu przeprowadzonym przez autorów, 15% personelu medycznego potwierdziło, że rekomenduje takie postępo-

DO ZAPAMIĘTANIA

1. Dieta matki karmiącej piersią to dieta zdrowa, zbilansowana, uwzględniająca zwiększone zapotrzebowanie energetyczne oraz zwiększoną podaż białka i mikroelementów (np. wapń i żelazo).
2. Mleko matek na diecie roślinnej ma porównywalny skład do mleka matek odżywiających się w sposób tradycyjny, pod warunkiem prowadzenia zbilansowanej diety i regularnej suplementacji witaminy B_{12} oraz kwasu DHA. Suplementacja ta jest niezbędna zarówno u matki, jak i u jej dziecka!

Dawkowanie dla matki:

a) witamina B_{12}: 250-500 µg/dobę lub 3 × 1000 µg/tydzień;
b) kwas DHA: 600 mg/dobę.

Dawkowanie dla dziecka:

a) witamina B_{12} (pod warunkiem regularnej suplementacji u matki): od 6. m.ż. 5-25 µg/dobę lub 3 × 200-300 µg/tydzień;
b) kwas DHA (u dziecka karmionego piersią): od 6. m.ż. 150 mg/dobę.

3. Profilaktyczna dieta eliminacyjna u matki nie stanowi skutecznej profilaktyki pierwotnej alergii u dzieci i nie powinna być stosowana.

wanie – wśród personelu zidentyfikowano kobiety, które również profilaktycznie wprowadziły restrykcje żywieniowe w czasie karmienia piersią własnego dziecka. Ponadto $^1/_3$ matek stosowała profilaktyczną dietę eliminacyjną nie tylko w wyniku zaleceń medycznych, ale także z powodu presji otoczenia (np. rodziny, znajomych), co wpłynęło na całkowity czas karmienia naturalnego i częstość karmienia dziecka mieszanką początkową.

W kwestii edukacji matek i źródeł ich wiedzy o laktacji raporty Centrum Nauki o laktacji wskazują, że blisko połowa matek otrzymała od swoich położnych materiały informacyjne, wśród których często znajdowały się ulotki reklamujące mieszanki mlekozastępcze, porady dotyczące diety w okresie laktacji z listą produktów dozwolonych i zakazanych. Niektórym matkom polecano szukać informacji w internecie, głównie – czytać blogi. Ponadto matki wskazywały na braki w wiedzy personelu medycznego w zakresie nie tylko żywienia i problemów laktacyjnych, ale także właściwości mleka kobiecego. Co więcej – podawały, że często w aspekcie problemów i decyzji laktacyjnych kierowały się własną intuicją. Jednakże matki, które były edukowane w zakresie laktacji przez personel medyczny, jako źródło swojej wiedzy podały położne ze szkoły rodzenia[23,24].

W badaniu przeprowadzonym w 2013 r. we Wrocławiu stwierdzono, że głównym źródłem informacji dla kobiet, które urodziły dziecko siłami natury, są szkoły rodzenia, niezależnie od rodności. W przypadku pierworódek, niezależnie od drogi porodu – położne, a także rodzina i znajomi. Natomiast wieloródki, u których wykonano cięcie cesarskie, najczęściej czerpią wiedzę z Internetu[28].

Wyniki badań własnych autorów pozostają spójne z wyżej omówionymi wynikami badań przeprowadzonych w Polsce kilka lat wcześniej. Polskie matki nie otrzymują wystarczającego wsparcia od personelu medycznego, którego wiedza jest porównywalna do wiedzy pacjentek lub niższa. Z tego względu dostosowują się do nieaktualnych zaleceń lub powielanych mitów i niekiedy podejmują decyzję o zaprzestaniu karmienia naturalnego. Ponadto w poszukiwaniu wiedzy najczęściej korzystają z internetu, w tym z mediów społecznościowych, co wiąże się z rozpoczęciem ryzykownych praktyk, jak np. wykorzystywanie własnego mleka w celach „leczniczych" – m.in. w zapaleniu spojówek, w infekcjach górnych dróg oddechowych (jako krople do nosa, do ucha)[20,21].

Wnioski

Przeprowadzone przez autorów badania wskazują na ciągłą potrzebę edukacji, zarówno społeczeństwa, jak i personelu medycznego. Szczególnej uwagi i poprawy wymagają kompetencje personelu medycznego w zakresie poradnictwa żywieniowego i wiedzy o właściwościach mleka kobiecego. O ile ogólna wiedza personelu medycznego o „diecie" w okresie laktacji w przypadku matek odżywiających się w sposób tradycyjny jest dość dobra, choć wymagająca doskonalenia, o tyle wiedza o bilansowaniu diety roślinnej i wpływie diety na skład mleka kobiecego jest na dużo niższym poziomie – co ma istotne znaczenie w aspekcie rosnącego zainteresowania dietami wegetariańskimi. Mimo upływu lat i aktualizacji wiedzy o profilaktyce chorób alergicznych u niemowląt, nadal aktualna pozostaje praktyka zalecania matkom eliminacji wybranych produktów z codziennego jadłospisu. Wyniki przeprowadzonych przez autorów badania wskazują na:

1. potrzebę aktualizacji programów nauczania kadry medycznej opiekującej się kobietami w okresie ciąży i laktacji oraz ich dziećmi;
2. potrzebę budowania i umacniania autorytetu personelu medycznego jako źródła aktualnej wiedzy medycznej o laktacji, żywieniu i właściwościach mleka kobiecego;
3. potrzebę promocji karmienia piersią i zasad zdrowego, zbilansowanego odżywiania się jako najbardziej efektywnego sposobu zapobiegania schorzeniom cywilizacyjnym w przyszłości.

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Barbara Królak-Olejnik – merytoryczna recenzja artykułu, nadzór nad ostateczną wersją artykułu.

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20. Karcz K, Walkowiak M, Makuch J i wsp. Non-Nutritional Use of Human Milk Part 1: A Survey of the Use of Breast Milk as a Therapy for Mucosal Infections of Various Types in Poland. *Int J Environ Res Public Health* 2019;16:1715.
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6. OŚWIADCZENIA WSPÓŁAUTORÓW.

Wrocław, dnia 6.12.2021

prof. dr hab. n. med. Barbara Królak - Olejnik
/tytuł zawodowy, imię i nazwisko/

OŚWIADCZENIE

Jako współautor pracy pt. *„Vegan or vegetarian diet and breast milk composition - a systematic review." (Critical Reviews in Food Science and Nutrition. 2021; 61(7):1081-1098. doi: 10.1080/10408398.2020.1753650; published online 2020 April 22)* oświadczam, iż mój własny wkład merytoryczny w przygotowanie, przeprowadzenie i opracowanie badań oraz przedstawienie pracy w formie publikacji to:

pomoc w krytycznej ocenie piśmiennictwa, nadzór merytoryczny nad manuskryptem.

Jednocześnie wyrażam zgodę na przedłożenie w/w pracy przez lek. Karolinę Karcz jako część rozprawy doktorskiej w formie spójnego tematycznie zbioru artykułów naukowych opublikowanych w czasopismach naukowych.

Oświadczam, iż samodzielna i możliwa do wyodrębnienia część ww. pracy wykazuje indywidualny wkład lek. Karoliny Karcz przy opracowywaniu koncepcji artykułu, wykonaniu przeglądu piśmiennictwa, opracowaniu i interpretacji wyników oraz przygotowaniu manuskryptu.

.....
/podpis współautora/

Wrocław, dnia 09.12.2021

lek. Izabela Lehman
/tytuł zawodowy, imię i nazwisko/

OŚWIADCZENIE

Jako współautor pracy pt. *„Foods to avoid while breastfeeding? Experiences and opinions of Polish mothers and healthcare providers." (Nutrients. 2020 June 02; 12(6):1644. doi: 10.3390/nu12061644)* oświadczam, iż mój własny wkład merytoryczny w przygotowanie, przeprowadzenie i opracowanie badań oraz przedstawienie pracy w formie publikacji to:

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Izabela Lehman
.....
/podpis współautora/

Wrocław, dnia 6.12.2021

prof. dr hab. n. med. Barbara Królak - Olejnik
/tytuł zawodowy, imię i nazwisko/

OŚWIADCZENIE

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/podpis współautora/

Wrocław, dnia.....09.12.2021.....

lek. Izabela Lehman
/tytuł zawodowy, imię i nazwisko/

OŚWIADCZENIE

Jako współautor pracy pt. *„The link between knowledge of the maternal diet and breastfeedingpractices in mothers and health workers in Poland." (International Breastfeeding Journal. 2021 August 09; 16:58. doi: 10.1186/s13006-021-00406-z)* oświadczam, iż mój własny wkład merytoryczny w przygotowanie, przeprowadzenie i opracowanie badań oraz przedstawienie pracy w formie publikacji to:

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Izabela Lehman
.....
/podpis współautora/

Wrocław, dnia 6.12.2021

prof. dr hab. n. med. Barbara Królak - Olejnik
/tytuł zawodowy, imię i nazwisko/

OŚWIADCZENIE

Jako współautor pracy pt. *„The link between knowledge of the maternal diet and breastfeedingpractices in mothers and health workers in Poland." (International Breastfeeding Journal. 2021 August 09; 16:58. doi: 10.1186/s13006-021-00406-z)* oświadczam, iż mój własny wkład merytoryczny w przygotowanie, przeprowadzenie i opracowanie badań oraz przedstawienie pracy w formie publikacji to:

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.....

/podpis współautora/

Wrocław, dnia 6.12.2021

prof. dr hab. n. med. Barbara Królak - Olejnik
/tytuł zawodowy, imię i nazwisko/

OŚWIADCZENIE

Jako współautor pracy pt. „*Wiedza personelu medycznego i matek karmiących piersią dotycząca wybranych aspektów laktacji - "diety" i pozażywieniowego zastosowania mleka. (Medical personnel and breastfeeding mothers' knowledge of selected aspects of lactation - "diet" and non-nutritionaluse and breast milk). (Standardy Medyczne Pediatria. 2021; 18(3): 377-385.)* oświadczam, iż mój własny wkład merytoryczny w przygotowanie, przeprowadzenie
i opracowanie badań oraz przedstawienie pracy w formie publikacji to:

pomoc w przygotowaniu ostatecznej wersji manuskryptu, nadzór merytoryczny nad realizacją badania.

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.....
/podpis współautora/

Wrocław, dnia 25/06/2021r.

lek. Julia Makuch
/tytuł zawodowy, imię i nazwisko/

OŚWIADCZENIE

Jako współautor pracy pt. *„Non-Nutritional Use of Human Milk Part 1: A Survey of the Use of Breast Milk as a Therapy for Mucosal Infections of Various Types in Poland" (International Journal of Environmental Research and Public Health. 2019 May 16; 16(10):1715. doi: 10.3390/ijerph16101715)* oświadczam, iż mój własny wkład merytoryczny w przygotowanie, przeprowadzenie i opracowanie badań oraz przedstawienie pracy w formie publikacji to:

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Julia Makuch
/podpis współautora/

Wrocław, dnia..01.01.21.....

lek. Mateusz Walkowiak
/tytuł zawodowy, imię i nazwisko/

OŚWIADCZENIE

Jako współautor pracy pt. *„Non-Nutritional Use of Human Milk Part 1: A Survey of the Use of Breast Milk as a Therapy for Mucosal Infections of Various Types in Poland" (International Journal of Environmental Research and Public Health. 2019 May 16; 16(10):1715. doi: 10.3390/ijerph16101715)* oświadczam, iż mój własny wkład merytoryczny w przygotowanie, przeprowadzenie i opracowanie badań oraz przedstawienie pracy w formie publikacji to:

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.....
/podpis współautora/

Wrocław, dnia 6.12.2021

dr n. med. Igor Olejnik
/tytuł zawodowy, imię i nazwisko/

OŚWIADCZENIE

Jako współautor pracy pt. *„Non-Nutritional Use of Human Milk Part 1: A Survey of the Use of Breast Milk as a Therapy for Mucosal Infections of Various Types in Poland" (International Journal of Environmental Research and Public Health. 2019 May 16; 16(10):1715. doi: 10.3390/ijerph16101715)* oświadczam, iż mój własny wkład merytoryczny w przygotowanie, przeprowadzenie i opracowanie badań oraz przedstawienie pracy w formie publikacji to:

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I. Olejnik
.....
/podpis współautora/

Wrocław, dnia 6.12.2021

prof. dr hab. n. med. Barbara Królak - Olejnik
/tytuł zawodowy, imię i nazwisko/

OŚWIADCZENIE

Jako współautor pracy pt. *„Non-Nutritional Use of Human Milk Part 1: A Survey of the Use of Breast Milk as a Therapy for Mucosal Infections of Various Types in Poland" (International Journal of Environmental Research and Public Health. 2019 May 16; 16(10):1715. doi: 10.3390/ijerph16101715)* oświadczam, iż mój własny wkład merytoryczny w przygotowanie, przeprowadzenie i opracowanie badań oraz przedstawienie pracy w formie publikacji to:

pomoc w sformułowaniu hipotezy badawczej, pomoc w przygotowaniu ostatecznej wersji manuskryptu, nadzór merytoryczny nad realizacją badania.

Jednocześnie wyrażam zgodę na przedłożenie w/w pracy przez lek. Karolinę Karcz jako część rozprawy doktorskiej w formie spójnego tematycznie zbioru artykułów naukowych opublikowanych w czasopismach naukowych.

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.....
/podpis współautora/

8. OPNIE KOMISJI BIOETYCZNEJ.

KOMISJA BIOETYCZNA
przy
Uniwersytecie Medycznym
we Wrocławiu
ul. Pasteura 1; 50-367 WROCŁAW

OPINIA KOMISJI BIOETYCZNEJ Nr KB – 159/2019

Komisja Bioetyczna przy Uniwersytecie Medycznym we Wrocławiu, powołana zarządzeniem Rektora Uniwersytetu Medycznego we Wrocławiu nr 133/XV R/2017 z dnia 21 grudnia 2017 r. oraz działająca w trybie przewidzianym rozporządzeniem Ministra Zdrowia i Opieki Społecznej z dnia 11 maja 1999 r. (Dz.U. nr 47, poz. 480) na podstawie ustawy o zawodzie lekarza z dnia 5 grudnia 1996 r. (Dz.U. nr 28 z 1997 r. poz. 152 z późniejszymi zmianami) w składzie:

dr hab. Jacek Daroszewski, prof. nadzw. (endokrynologia, diabetologia)
prof. dr hab. Krzysztof Grabowski (chirurgia)
dr Henryk Kaczkowski (chirurgia szczękowa, chirurgia stomatologiczna)
mgr Irena Knabel-Krzyszowska (farmacja)
prof. dr hab. Jerzy Liebhart (choroby wewnętrzne, alergologia)
ks. dr hab. Piotr Mrzygłód, prof. nadzw. (duchowny)
mgr Luiza Műller (prawo)
dr hab. Sławomir Sidorowicz (psychiatria)
dr hab. Leszek Szenborn, prof. nadzw (pediatria, choroby zakaźne)
Danuta Tarkowska (pielęgniarstwo)
prof. dr hab. Anna Wiela-Hojeńska (farmakologia kliniczna)
dr hab. Andrzej Wojnar, prof. nadzw. (histopatologia, dermatologia) przedstawiciel Dolnośląskiej Izby Lekarskiej)
dr hab. Jacek Zieliński (filozofia)

pod przewodnictwem
prof. dr hab. Jana Kornafela (ginekologia i położnictwo, onkologia)

Przestrzegając w działalności zasad Good Clinical Practice oraz zasad Deklaracji Helsińskiej, po zapoznaniu się z projektem badawczym pt.

„Dieta matki karmiącej piersią – fakty czy mity?"

zgłoszonym przez **dr hab. Barbarę Królak-Olejnik, prof. nadzw.** zatrudnioną w Katedrze i Klinice Neonatologii Uniwersytetu Medycznego we Wrocławiu oraz złożonymi wraz z wnioskiem dokumentami, w tajnym głosowaniu postanowiła wyrazić zgodę na przeprowadzenie badania w Katedrze i Klinice Neonatologii Uniwersytetu Medycznego we Wrocławiu Uniwersytetu Medycznego we Wrocławiu oraz za pośrednictwem portali społecznościowych **pod warunkiem zachowania anonimowości uzyskanych danych**.

Uwaga: Badanie to zostało objęte ubezpieczeniem odpowiedzialności cywilnej Uniwersytetu Medycznego we Wrocławiu z tytułu prowadzonej działalności:

Pouczenie: W ciągu 14 dni od otrzymania decyzji wnioskodawcy przysługuje prawo odwołania do Komisji Odwoławczej za pośrednictwem Komisji Bioetycznej UM we Wrocławiu

Opinia powyższa dotyczy: projektów badawczych realizowanych poza działalnością statutową

Opinia jest ważna do dnia 1 marca 2021 r. (2 lata)

Wrocław, dnia 28 lutego 2019 r.
BW

Uniwersytet Medyczny we Wrocławiu
KOMISJA BIOETYCZNA
przewodniczący
prof. dr hab. Jan Kornafel

KOMISJA BIOETYCZNA
przy
Uniwersytecie Medycznym
we Wrocławiu
ul. Pasteura 1; 50-367 WROCŁAW

OPINIA KOMISJI BIOETYCZNEJ Nr KB – 703 /2018

Komisja Bioetyczna przy Uniwersytecie Medycznym we Wrocławiu, powołana zarządzeniem Rektora Uniwersytetu Medycznego we Wrocławiu nr 133/XV R/2017 z dnia 21 grudnia 2017 r. oraz działająca w trybie przewidzianym rozporządzeniem Ministra Zdrowia i Opieki Społecznej z dnia 11 maja 1999 r. (Dz.U. nr 47, poz. 480) na podstawie ustawy o zawodzie lekarza z dnia 5 grudnia 1996 r. (Dz.U. nr 28 z 1997 r. poz. 152 z późniejszymi zmianami) w składzie:

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mgr prawa Luiza Műller (prawo)
dr hab. Sławomir Sidorowicz (psychiatria)
dr hab. Leszek Szenborn (pediatria, choroby zakaźne)
Danuta Tarkowska (pielęgniarstwo)
prof. dr hab. Anna Wiela-Hojeńska (farmakologia kliniczna)
dr hab. Andrzej Wojnar (histopatologia, dermatologia) przedstawiciel Dolnośląskiej Izby Lekarskiej)
dr hab. Jacek Zieliński (filozofia)

pod przewodnictwem
prof. dr hab. Jana Kornafela (ginekologia i położnictwo, onkologia)

Przestrzegając w działalności zasad Good Clinical Practice oraz zasad Deklaracji Helsińskiej, po zapoznaniu się z projektem badawczym pt.:

„ Pozażywieniowe zastosowanie mleka kobiecego przez matki karmiące piersią"

zgłoszonym przez **lek. Karolinę Karcz** uczestnika studiów doktoranckich w Katedrze i Klinice Neonatologii Wydziału Lekarskiego Uniwersytetu Medycznego im. Piastów Śląskich we Wrocławiu oraz złożonymi wraz z wnioskiem dokumentami, w tajnym głosowaniu postanowiła **wyrazić zgodę** na przeprowadzenie badania w Klinice Neonatologii USK pod nadzorem dr Doroty Paluszyńskiej, Opiekuna Koła Naukowego **pod warunkiem zachowania anonimowości uzyskanych danych**.

Uwaga: Badanie to zostało objęte ubezpieczeniem odpowiedzialności cywilnej Uniwersytetu Medycznego we Wrocławiu z tytułu prowadzonej działalności.

Pouczenie: W ciągu 14 dni od otrzymania decyzji wnioskodawcy przysługuje prawo odwołania do Komisji Odwoławczej za pośrednictwem Komisji Bioetycznej UM we Wrocławiu.

Opinia powyższa dotyczy projektu badawczego realizowanego poza działalnością statutową.

Opinia jest ważna do dnia 31 grudnia 2019r.

Wrocław, dnia 22 listopada 2018 r.

Uniwersytet Medyczny we Wrocławiu
KOMISJA BIOETYCZNA
przewodniczący
prof. dr hab. Jan Kamiński