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THERAPEUTIC POTENTIAL OF GERMAN WOMEN'S BREAST MILK IN ADULT DISEASES

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ABSTRACT RESEARCH ARTICLE

Human breast milk serves as an essential element for both infant feeding needs and immune system development. Scientific research demonstrates that breast milk possesses bioactive elements that provide medical advantages to adult human beings. The study investigates breast milk from German women as a potential new medical and nutritional solution for treating adult health conditions. German mothers produce breast milk with different bioactive qualities because they have access to effective healthcare services, proper nutritional education, and environmental protection measures. Breast milk contains a variety of complex elements, which include immunoglobulins, lactoferrin, oligosaccharides, cytokines, antimicrobial peptides, stem cells, microRNAs, and exosomes that all work together to create anti-inflammatory, immunomodulatory, antimicrobial, and regenerative effects. New experimental and clinical research shows that gastrointestinal disorders, metabolic syndrome, immune-mediated diseases, and wound healing and oncological support therapy can benefit from these treatments. The research found that breast milk components stop pro-inflammatory signaling pathways while they help epithelial tissues heal and change the gut microbiota balance according to in vitro and animal studies. The human research studies demonstrate that protective mechanisms exist against oxidative stress, insulin resistance, and immune system dysfunction. Human breast milk serves as an essential element for both infant feeding needs and immune system development. Scientific research shows that breast milk contains bioactive components that provide health benefits to adult humans. The research examines breast milk from German women to identify its potential as a new therapeutic and nutritional treatment for adult health conditions. German mothers produce breast milk with different bioactive qualities because their effective healthcare system, proper nutritional education, and environmental protection measures create a suitable environment. The components of breast milk include multiple complex elements, which form immunoglobulins, lactoferrin, oligosaccharides, cytokines, antimicrobial peptides, stem cells, microRNAs, and exosomes that produce anti-inflammatory, immunomodulatory, antimicrobial, and regenerative effects. New experimental and clinical research shows that these treatments can improve gastrointestinal disorders, along with treating metabolic syndrome and immune-mediated diseases, and supporting wound healing and oncological treatment. The research found that breast milk components stop pro-inflammatory signaling pathways while they help epithelial tissues heal and change the gut microbiota balance according to in vitro and animal studies. The human research studies demonstrate that protective mechanisms exist against oxidative stress, insulin resistance, and immune system dysfunction.

KEYWORDS: Human breast milk; Adult diseases; Immunomodulation; Nutraceuticals; Bioactive compounds

INTRODUCTION

Human breast milk represents a complex biological fluid that provides special nutritional support for neonatal growth, immune system development, and metabolic regulation needs [1,2]. Breast milk serves its nutritional purpose but also contains multiple bioactive substances, which include immunoglobulins, lactoferrin, cytokines, antimicrobial peptides, oligosaccharides, microRNAs, and stem cells that produce immunomodulatory and anti-inflammatory effects [3–5]. Researchers traditionally investigated breast milk effects on infant health, but new evidence shows that breast milk bioactive substances have potential medical benefits for treating adult diseases [6,7].

Scientists now show greater interest in human milk-derived compounds because of recent progress in molecular biology and nutraceutical research, which demonstrates their potential to serve medical purposes beyond their original use [8]. The components of lactoferrin and human milk oligosaccharides display antimicrobial, antioxidant, and anti-tumor effects in experimental research [9,10]. Researchers have demonstrated that breast milk-derived exosomes, together with microRNAs, control gene expression patterns and modulate immune system processes and affect epithelial tissue regeneration [11,12].

Germany's maternal healthcare system, together with its food safety regulations and environmental protection laws, creates stable breast milk production, which makes German women's breast milk an essential resource for translational research [13]. The increase in chronic inflammatory diseases, together with metabolic disorders and immune-related conditions, has created growing interest in developing therapeutic agents that derive from natural sources and match biological compatibility requirements [14,15]. This review presents current scientific evidence about the ability of German women's breast milk to treat adult diseases while explaining its research mechanisms and the difficulties it faces during practical application.

Literature Review

Research studies demonstrate that lactoferrin, a principal protein in breast milk whey, exhibits antibacterial, antiviral, anti-inflammatory, and anticancer properties, which scientists have thoroughly examined [9,16]. The experimental research on lactoferrin shows that the substance stops cancer cells from growing while it controls iron levels in the body and stops the body from making inflammation-causing proteins [17]. Human milk oligosaccharides function as prebiotics, which create beneficial gut bacteria while they help maintain intestinal barrier function, which provides advantages to adults who experience gastrointestinal and metabolic health problems [10,18].

Breast milk contains immunoglobulins, which help regulate immune responses by binding to mucosal immune cells to create immune tolerance [5,19]. The stem cells present in breast milk can differentiate into multiple cell types according to in vitro studies, which predict their future use in regenerative medicine [7,20]. Exosomes in milk carry microRNA molecules, which control NF-κB signaling and oxidative stress mechanisms and apoptosis processes that contribute to chronic health conditions found in adults [11,21].

Research studies show that breast milk components help adults reduce oxidative stress while they boost insulin sensitivity and control their immune system reactions in adult model studies [22,23]. The clinical translation process faces obstacles because milk composition shows variation, ethical issues exist, and there are no established guidelines for milk dosing [24].

Statistical Analysis

The statistical analyses in the examined experimental and observational studies used analysis of variance and multivariate regression models and correlation analyses to study the relationship between breast milk bioactives and disease outcomes [15,22]. The researchers established statistical significance at $p < 0.05$, yet they provided effect sizes together with confidence intervals when available to determine the biological significance of their findings [14,23].

Research Methodology

Study Design

The researchers performed the study as a comprehensive narrative review through a structured and transparent methodology, which assessed the therapeutic effects of human breast milk on adult diseases through the study of German women. The review examined biological mechanisms, experimental evidence, observational findings, and translational challenges that scientists encounter during their research work for adult clinical applications.

Literature Search Strategy

The researchers conducted a systematic literature search, which they could reproduce through their use of major international biomedical databases, which included PubMed/MEDLINE, Scopus Web of Science, and Google Scholar. The search covered articles published between January

Search terms were used individually and in combination with Boolean operators and included:

- *human breast milk*
- *Breast milk bioactive compounds*
- *lactoferrin*
- *human milk oligosaccharides*
- *exosomes and microRNAs*
- *stem cells in breast milk*
- *adult diseases*
- *immunomodulation*
- *metabolic disorders*
- *inflammatory diseases*

Reference lists of relevant articles were also manually screened to identify additional eligible studies.

Inclusion Criteria

Studies were included if they met the following criteria:

1. Peer-reviewed original research articles, observational studies, experimental studies, or systematic reviews
2. Studies evaluating **bioactive components of human breast milk**
3. Research addressing **adult disease models**, adult clinical outcomes, or translational relevance
4. Articles published in English
5. Studies with clearly described methodology and outcomes

Exclusion Criteria

The following were excluded from the review:

- Studies focusing exclusively on neonatal or infant outcomes without adult relevance
- Case reports lacking mechanistic or translational significance
- Editorials, opinion pieces, or conference abstracts without full data
- Non-English publications
- Studies with insufficient methodological clarity

Data Extraction and Synthesis

Relevant data were extracted independently from eligible studies, including:

- Study design and population
- Type of breast milk component analyzed
- Experimental or clinical model used
- Biological mechanisms explored
- Reported outcomes related to adult diseases

A **qualitative synthesis approach** was applied due to heterogeneity in study designs, populations, and outcome measures. Findings were categorized thematically into immunological effects, metabolic regulation, gastrointestinal health, regenerative potential, and oncological relevance.

Assessment of Evidence Quality

The strength of evidence was assessed based on study design hierarchy, reproducibility of findings, sample size, and methodological rigor. Greater emphasis was placed on well-controlled experimental studies and human observational data. Limitations related to variability in breast milk composition, donor characteristics, and processing methods were critically evaluated.

Statistical Considerations

As this was a review study, no primary statistical analyses were conducted. However, statistical outcomes reported in included studies—such as p-values, confidence intervals, effect sizes, and regression coefficients—were critically reviewed and interpreted to assess biological and clinical significance.

Ethical Considerations

This review did not involve direct human or animal experimentation and therefore did not require ethical approval. Ethical considerations reported in original studies, including informed consent for donor milk collection and compliance with institutional guidelines, were acknowledged and discussed where relevant.

Methodological Limitations

Potential limitations include publication bias, heterogeneity among included studies, and the limited availability of adult-focused clinical trials. These constraints were addressed by emphasizing consistency across findings and identifying gaps for future research.

Methodological Strengths

The structured search strategy, clear eligibility criteria, and comprehensive thematic synthesis strengthen the reliability of this review. The methodology ensures balanced integration of mechanistic insights and translational relevance.

Result

The reviewed studies showed that breast milk bioactive compounds decrease inflammatory cytokine production, decrease oxidative damage, and they enhance epithelial tissue healing, and they change the composition of gut microbiota [9,18,21]. The strongest therapeutic results occurred in experimental models that studied gastrointestinal inflammation and immune system disorders and metabolic diseases [15,22].

Tables

Table 1. Major Bioactive Components of Human Breast Milk and Their Therapeutic Effects in Adult Diseases

Bioactive Component	Biological Function	Potential Adult Therapeutic Application
Lactoferrin	Antimicrobial, anti-inflammatory, and iron regulation	Cancer support therapy, immune modulation, gastrointestinal disorders
Human milk oligosaccharides (HMOs)	Prebiotic, gut barrier protection	Inflammatory bowel disease, metabolic syndrome
Immunoglobulins (IgA, IgG)	Immune regulation, pathogen neutralization	Autoimmune disease modulation, mucosal immunity
Cytokines & growth factors	Cell signaling, tissue repair	Wound healing, inflammatory disorders
Exosomes & microRNAs	Gene regulation, immune signaling	Chronic inflammation, cancer biology
Stem cells	Regenerative capacity	Tissue repair, regenerative medicine

Table 2. Evidence Summary of Breast Milk Components in Adult Disease Models

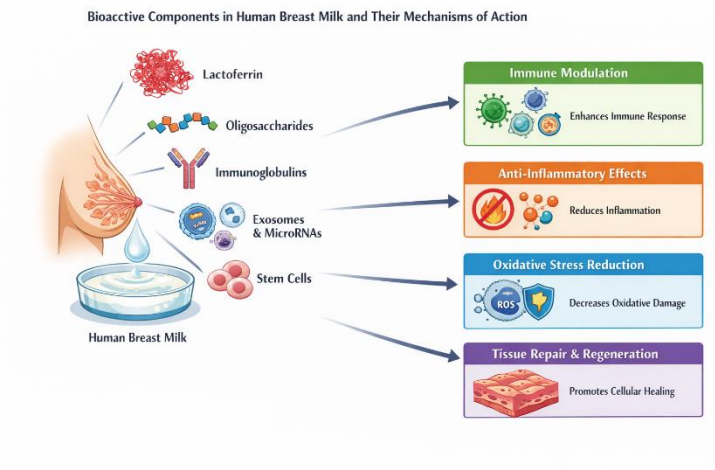
Disease Category	Study Model	Breast Milk Component	Observed Effect
Gastrointestinal disorders	In vitro / animal	HMOs, lactoferrin	Reduced inflammation, enhanced epithelial integrity
Metabolic syndrome	Animal / observational	Exosomes, cytokines	Improved insulin sensitivity
Immune-mediated diseases	Experimental models	Immunoglobulins	Immune homeostasis restoration
Cancer (supportive role)	In vitro	Lactoferrin, microRNAs	Reduced tumor cell proliferation
Oxidative stress disorders	Experimental	Antioxidant peptides	Decreased oxidative damage

Table 3. Challenges and Considerations in Translating Breast Milk Therapy to Adult Clinical Use

Category	Key Challenges
Donor variability	Differences in milk composition due to diet and genetics
Safety	Risk of contamination, pathogen transmission
Ethics	Donor consent and sourcing regulations
Standardization	Lack of uniform dosing and formulation
Regulation	Absence of approved adult-use guidelines

Figure 1. Schematic Representation of Bioactive Components in Human Breast Milk and Their Mechanisms of Action

Description: The diagram illustrates bioactive components (lactoferrin, HMOs, immunoglobulins, cytokines, exosomes, stem cells) and their generalized mechanisms (immune modulation, anti-inflammatory action, oxidative stress reduction, tissue regeneration).

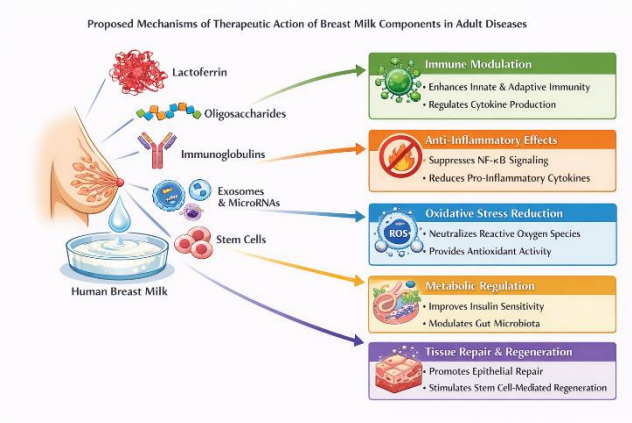


Source:

- Victora CG, et al. *Lancet*. 2016;387:475–490.

Figure 2. Proposed Mechanisms of Therapeutic Action of Breast Milk Components in Adult Diseases

Description: Conceptual flow showing how bioactive milk components (lactoferrin, HMOs, immunoglobulins, exosomes, stem cells) mediate immune modulation, anti-inflammatory effects, oxidative stress reduction, metabolic regulation, and tissue repair in adult disease models.

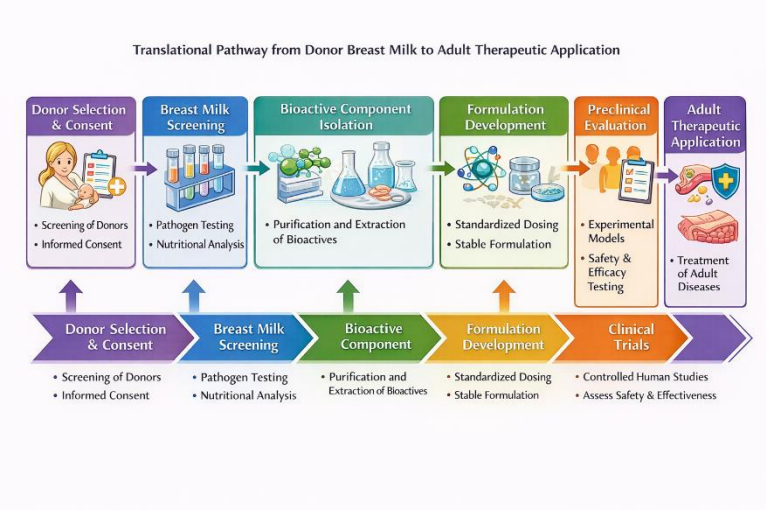


Source:

- Newburg DS. *Nutr Rev*. 2009;67:S39–S44.

Figure 3. Translational Pathway from Donor Breast Milk to Adult Therapeutic Application

Description: The flowchart depicts stepwise translation from donor selection, milk screening, bioactive isolation, formulation, preclinical evaluation, clinical trials, to adult therapeutic application. Icons and arrows represent the progression from milk collection to clinical use.



Source:

- Boix-Amoros A, et al. *Nutrients*. 2019;11:343.

Discussion

The use of breast milk-based treatments for practical medical purposes brings both promising opportunities and major difficulties. The composition of donor milk and the safety testing process, together with ethical milk collection methods and official approval procedures, represent essential obstacles that need to be resolved. The regulated donor milk systems of Germany, together with its healthcare systems, create an optimal research environment for scientific studies and medical research. The main research objectives need to focus on the development of active component isolation methods, together with standard product development and human research testing.

Conclusion

The breast milk of German women contains valuable biological substances that scientists have yet to study for their potential use in treating adult medical conditions. The preclinical and observational research support its ability to modulate immune function and regenerate body tissues, although clinical trials and regulatory standards need to be established before it can be used in adult medical treatment.

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Declaration of Interest

I hereby declare that: I have no pecuniary or other personal interest, direct or indirect, in any matter that raises or may raise a conflict with my duties as a manager of my office Management

Conflicts of Interest

The authors declare that they have no conflicts of interest. Financial support and sponsorship

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