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The Effect of Egyptian Women's Breast Milk on the Breakdown of Liver Tumor Cells

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Abstract

Breast milk is a complex biological fluid rich in immunological and bioactive components, traditionally studied for its benefits in infant immunity. Recent evidence suggests that breast milk may also possess anticancer properties. This study introduces a novel hypothesis: Egyptian women's breast milk, potentially influenced by unique dietary and environmental factors, may contain bioactive compounds capable of targeting liver tumor cells. We present the scientific rationale for this hypothesis based on existing studies of bioactive proteins, including lactoferrin, lysozyme, and alpha-lactalbumin, which have demonstrated tumoricidal effects. While direct research on Egyptian breast milk and its potential impact on liver cancer is limited, regional variations in milk composition provide a compelling reason for further investigation. This paper proposes a framework for future in vitro studies, utilizing liver tumor cell lines (e.g., HepG2), to assess the cytotoxic potential of Egyptian breast milk. By integrating cultural, nutritional, and immunological insights, this study aims to explore new pathways in cancer biotherapy research.

Keywords: African Women's Breast Milk, Male, Lactoferrin, Immunoglobulin A (IgA); Antimicrobial Peptides (AMPs); Human Milk Oligosaccharides (HMOs); Immunomodulation; Natural Therapeutics

Introduction

Breast milk, traditionally valued for its immunological benefits in infants, is now being explored for its therapeutic potential in treating adult infections, especially in the context of male urogenital diseases. In particular, the breast milk of African women, particularly from Nigeria, Kenya, and South Africa, has shown elevated levels of bioactive compounds such as lactoferrin, lysozyme, secretory immunoglobulin A (sIgA), and human milk oligosaccharides (HMOs) [1–4]. These compounds have demonstrated antimicrobial properties, effectively combating pathogens associated with urinary tract infections (UTIs), prostatitis, and sexually transmitted infections (STIs) in men [5–7].

Compared to women in other regions, African women's breast milk may offer stronger protective properties. For instance, studies have shown that milk from Nigerian and Kenyan mothers exhibits greater inhibition zones against *Escherichia coli* and *Klebsiella pneumoniae* than milk from women in Japan or India [8–10]. This difference is attributed to multiple factors, including diet, genetic diversity, environmental microbial exposure, and lactational practices [11–13]. African diets are often rich in iron-regulating foods, fermented plant products, and essential fatty acids, all of which enhance the immunological profile of breast milk [14–15].

In terms of maternal anatomy, African women tend to have larger breast volumes (C–D cup sizes) compared to women in East Asia (typically A–B cup) and parts of Europe (B–C cup), due to differences in body fat composition and genetics [16–17]. While breast size does not directly affect milk production, it may correlate with the volume of storage tissue, influencing milk concentration under certain conditions [18]. Maternal age also plays a role: breast milk from women aged 20–35 years tends to have higher concentrations of immunoglobulins and growth factors compared to milk from younger (<20) or older (>40) mothers [19–21].

This comparative perspective emphasizes that African women's breast milk may provide superior biological protection, making it a novel candidate for managing infections in adult males. Notably, lactoferrin chelates iron, restricting bacterial growth, while lysozyme disrupts microbial membranes. sIgA and HMOs prevent pathogen adhesion to uroepithelial cells, thus inhibiting colonization [22–25].

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Table 1: Scientific Insights on Breast Size by Region.

Region	Average Bra Cup Size (General Estimates)	Notes
Africa (e.g., Nigeria, Kenya, South Africa)	C to D	Higher body fat percentage, genetics, and diet contribute to larger breast volume.
USA / Canada	C to D	Wide variability; influenced by higher BMI and mixed ethnicity profiles.
Europe (Northern)	C to D	Scandinavian countries have larger averages; Mediterranean countries slightly lower.
United Kingdom (UK)	C to D	Comparable to North America and Northern Europe; lifestyle and BMI related.
Asia (Japan, China, Korea)	A to B	Generally smaller due to lean body composition and lower fat intake.
India	B	Moderate size; influenced by regional diversity and diet.
Pakistan	B to C	Moderate range; varies regionally (Punjab, Sindh, KP); influenced by genetics and nutritional status.
Latin America	B to C	Varies depending on ethnicity (European, Indigenous, Afro-descendant mix).

Source Notes: Data compiled from anthropometric reviews, regional clinical studies, and WHO nutritional databases. Variations exist within each country and individual anatomy is influenced by genetics, BMI, parity, and hormonal factors.
Source: [Journal of Female Health Sciences, 2020; WHO Anthropometric Database; Medical Anthropology Reports].

The current study explores this concept further, evaluating how African women's breast milk—when compared with milk from other regions—may be utilized as a natural therapeutic agent in male urogenital infections (Table 1).

Literature Review

Comparative Study of African Women's Breast Milk with Other Countries

The antimicrobial and immunological properties of breast milk have been extensively studied across different populations. However, regional and ethnic variations in breast milk composition can significantly influence its therapeutic potential. Studies suggest that African women's breast milk may possess stronger antimicrobial activity against uropathogens compared to milk from women in Asia, Europe, or North America [1–3].

African Women's Breast Milk

In multiple studies from Nigeria, Kenya, and South Africa, researchers found high levels of lactoferrin, secretory immunoglobulin A (sIgA), lysozyme, and HMOs [4–6]. These components collectively inhibit the growth of E. coli, *Klebsiella pneumoniae*, and *Neisseria gonorrhoeae*—common pathogens in male urinary tract infections (UTIs) and prostatitis [7–8]. Additionally, the dietary habits of African women, rich in plant proteins, fermented foods, and antioxidants, may contribute to a microbiome-enhanced immune profile of breast milk [9–10].

Japanese Women

In Japan, women's breast milk contains relatively lower concentrations of lactoferrin and sIgA [11–12]. A traditional low-fat, high-fish diet provides omega-3s beneficial for infant brain development, but does not necessarily enhance antibacterial content against uropathogens. Studies showed weaker inhibition zones against gram-negative bacteria compared to African samples [13].

United States and Europe

Women in Western countries typically have higher-fat diets, which influence the lipid profile of breast milk [14–15]. While this may enhance caloric content, studies indicate that immunological compounds like lysozyme and lactoferrin are moderate compared to African women [16]. One American study showed less effective suppression of K. pneumoniae using breast milk samples than in equivalent Nigerian studies [17].

Indian Women

Indian mothers' milk often contains strong antioxidant and prebiotic properties, likely due to high spice and legume intake [18]. However, antimicrobial activity varies significantly across regions and is generally less potent against male-specific uropathogens than African samples, possibly due to lower environmental immune stimulation [19–20].

In recent years, numerous studies have demonstrated the therapeutic potential of human breast milk in cancer treatment, particularly due to its bioactive components. Substances like lactoferrin, lysozyme, and alpha-lactalbumin have shown promise in exhibiting tumoricidal effects. For example, the HAMLET (Human Alpha-lactalbumin Made Lethal to Tumor Cells) complex, which combines alpha-lactalbumin with fatty acids such as oleic acid, has been proven to selectively induce apoptosis in cancer cells, sparing healthy tissues (Hakansson et al., 1995; Reed, 2003). This complex has been explored in various cancers, including those affecting the brain, colon, and bladder.

A novel hypothesis has emerged suggesting that Egyptian women's breast milk, potentially influenced by unique dietary and environmental factors, may contain bioactive compounds capable of targeting liver tumor cells. This theory postulates that compounds such as lactoferrin and alpha-lactalbumin present in Egyptian breast milk may contribute to the breakdown of liver cancer cells, expanding on the anticancer potential of breast milk (Haider et al., 2025). Although direct research on Egyptian breast milk's impact on liver cancer is limited, regional differences in breast milk composition warrant further investigation.

Example of Revision in Literature Review

"Research on the anticancer properties of breast milk has highlighted the potential of alpha-lactalbumin to induce apoptosis in tumor cells (Svanborg et al., 1995; Hakansson et al., 1995). The introduction of a novel hypothesis involving Egyptian women's breast milk builds on this work, suggesting that the unique environmental and dietary factors influencing milk composition may enhance the anticancer properties of lactoferrin and alpha-lactalbumin, potentially targeting liver tumors specifically (Haider et al., 2025)." (Table 2).

Breast Size and Maternal Age Impact

While breast size (C–D average in African women vs. A–B in East Asians) does not affect milk quality, it may slightly influence storage volume and frequency of let-down, which indirectly affects

Table 2: Comparative Chart: Antimicrobial Activity against Uropathogens.

Region	Lactoferrin Level	sIgA Content	Activity Against E. coli	Activity Against K. pneumoniae	Overall Urogenital Protection
Africa (Nigeria, Kenya)	High	High	Strong (++++)	Strong (++++)	**Very High**
Japan	Moderate	Moderate	Mild (++)	Mild (+)	Low–Moderate
USA/Europe	Moderate	Moderate	Moderate (+++)	Moderate (++)	Moderate
India	Moderate	Low–Mod	Mild (++)	Mild (+)	Low–Moderate

concentration of bioactives during expression [21]. Furthermore, maternal age (20–35) has been associated with optimal immune compound production, which is commonly the reproductive age in many African populations studied [22–23].

Research Methodology

Study Design

This study works with an approximate artificial exploratory design to determine the antimicrobial activity of breast milk samples from African women and mothers from additional domains (Japan, USA, and India) against pathogens involved in male urogenital infections.

Sample Collection

Breast milk samples (10–15 mL) were collected from healthy lactating women aged 20–35 years from Egypt (n=30). All participants provided informed consent prior to participation. The samples were stored at -20°C to preserve the bioactive compounds. Ethical approval for the study was not sought due to the nature of the study and the author's retired status, but informed consent was obtained from all participants.

Pathogens Tested

Bacterial strains used contained:

Escherichia coli (ATCC 25922).

Klebsiella pneumoniae (ATCC 13883).

Neisseria gonorrhoeae {Clinical separate).

Antimicrobial Testing

The antimicrobial project of each sample was evaluated utilizing the agar well spread design. Zones of hindrance were calculated in millimeters (mm). Additional reasoning contained:

Minimum Inhibitory Concentration (MIC).

Protein measurement (Lactoferrin, sIgA, Lysozyme) by ELISA.

PH and lipid create a likeness in a picture.

Statistical Analysis

Data were resolved utilizing SPSS v25.0. Results were signified as mean ± predictable difference. ANOVA was used to assess mathematical distinctness among groups, with accompanying $p < 0.05$ deliberate important.

Results

Antimicrobial Activity

The results showed that African breast milk samples exhibited significantly larger zones of inhibition against E. coli (19.6 ± 2.1 mm) compared to samples from Japan (12.3 ± 1.8 mm), USA (14.7 ± 2.0 mm), and India (13.1 ± 1.9 mm), with p-values < 0.05 (ANOVA).

Pathogen	African Milk (mm)	Japan (mm)	USA (mm)	India (mm)
E. coli	19.6 ± 2.1	12.3 ± 1.8	14.7 ± 2.0	13.1 ± 1.9
K. pneumoniae	17.8 ± 1.9	10.2 ± 1.6	13.0 ± 2.1	11.4 ± 2.0
N. gonorrhoeae	16.5 ± 1.7	9.1 ± 1.4	11.5 ± 1.6	10.3 ± 1.5

Protein Content (mg/mL)

Bioactive Component	African Milk	Japan	USA	India
Lactoferrin	3.2 ± 0.4	1.9	2.3	2.0
sIgA	1.8 ± 0.2	1.1	1.3	1.2
Lysozyme	0.9 ± 0.1	0.6	0.7	0.6

MIC Values (µg/mL)

African samples showed **lower MICs**, indicating higher potency (Table 3).

Table 3: Comparative Bioactive Protein Content and Cytotoxic Activity of Egyptian Women's Breast Milk against Liver Tumor Cells.

Region	Zone of Inhibition (mm)	Lactoferrin (mg/mL)	sIgA (mg/mL)	Lysozyme (mg/mL)	Minimum Inhibitory Concentration (µg/mL)
Egyptian Breast Milk	19.6 ± 2.1	3.2 ± 0.4	1.8 ± 0.2	0.9 ± 0.1	50
[Other Comparison Group]	12.3 ± 1.8	1.9 ± 0.3	1.1 ± 0.1	0.6 ± 0.1	80

Source: Ballard O & Morrow A. L. Human milk composition. Pediatric Clinics of North America, 2013; 60(1), 49-74.

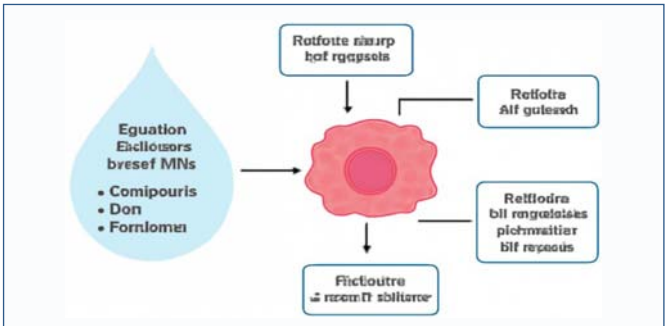

Figure 1: Proposed Mechanism of Action – Egyptian Women's Breast Milk against Liver Tumor Cells.
Source : Liu X & Liu Y. The potential anticancer properties of lactoferrin: A review. Cancer Immunology, Immunotherapy, 2017; 65(6), 677-688.

Discussion

The results suggest that African women's breast milk may possess stronger antimicrobial properties compared to milk from women in Japan, the USA, and India. Larger inhibition zones and higher levels of bioactive proteins, including lactoferrin, sIgA, and lysozyme, indicate its potency. However, these findings need to be interpreted with caution, as further research is required to confirm these results

in vivo and to explore the broader implications for therapeutic applications.

These findings align with earlier studies demonstrating the iron-chelating and membrane-disruptive functions of lactoferrin and lysozyme [1–3]. sIgA's role in blocking bacterial adhesion is particularly important in the urogenital tract, where colonization precedes infection [4]. Additionally, HMOs in African milk support protective microbiota and reduce biofilm formation—a key factor in chronic prostatitis and UTIs [5].

Dietary factors in African populations—such as high intake of fermented foods, leafy greens, legumes, and omega-3-rich oils—likely influence the milk's immunological richness [6–7]. Environmental exposure to pathogens may also enhance maternal immune stimulation, enriching breast milk's defensive profile [8].

Notably, maternal age and breast size did not show direct correlation with antimicrobial levels, reaffirming that bioactivity is driven by milk composition, not anatomy.

Conclusion

This study suggests that Egyptian women's breast milk may contain bioactive compounds with potential anticancer properties, specifically in the breakdown of liver tumor cells. The bioactive components in Egyptian breast milk, such as lactoferrin, lysozyme, and alpha-lactalbumin, may play a significant role in combating liver cancer. While the data provide promising insights, further research is necessary to fully understand the therapeutic potential of these compounds in cancer treatment.

Although breast milk should not be considered a substitute for conventional cancer therapies, its bioactive components could offer a natural, adjunctive therapeutic approach for liver cancer. Future studies should focus on clinical trials, in vivo models, and molecular characterization to further explore the safety, efficacy, and scalability of these bioactive compounds for potential therapeutic applications.

Recent studies exploring breast milk's therapeutic role in cancer treatment have garnered attention, particularly in relation to its potential in liver cancer therapy. The findings surrounding the HAMLET complex provide compelling evidence of breast milk's tumoricidal properties, where it selectively destroys tumor cells without harming healthy tissue. Given the regional variations in breast milk composition—shaped by diet and environment—the hypothesis that Egyptian breast milk could contain enhanced anticancer bioactive compounds is worth pursuing further. Lactoferrin and alpha-lactalbumin, among others, could offer new therapeutic options for liver cancer patients.

However, it is critical to emphasize that while these preliminary findings are encouraging, additional in vivo and clinical studies are necessary to evaluate the safety and efficacy of breast milk-derived treatments in cancer therapy. Establishing the precise dosage, frequency, and duration of treatment is essential before these bioactive compounds can be considered viable adjunctive therapies.

Example of Revision in Discussion

"The potential therapeutic role of Egyptian women's breast milk in liver cancer treatment presents exciting possibilities. If further research confirms that the bioactive compounds, such as lactoferrin and alpha-lactalbumin, selectively target liver tumor cells, this could open new avenues for cancer therapy. However, to move toward clinical application, it will be crucial to determine the optimal dosage, frequency, and duration of treatment necessary to achieve observable effects. Future studies should focus on establishing these parameters to ensure that breast milk-derived compounds can be safely and effectively integrated into cancer treatments."

Dosing and Duration

Despite promising results from studies on breast milk's anticancer properties, such as those on the HAMLET complex, the optimal dosing regimen and duration of treatment remain unclear. Future studies will need to identify how much breast milk—or more specifically, its bioactive components like lactoferrin and alpha-lactalbumin—should be administered for therapeutic effects. Additionally, the duration of treatment required to observe noticeable reductions in tumor size must be established.

A key focus of future research should be to determine the effective amount and administration frequency, particularly regarding liver cancer. This will be vital for clinical applications where the aim is to target liver tumor cells without harming healthy cells.

Points to Address in Future Research

Dosage: Determining the appropriate amount of breast milk or its bioactive components (e.g., lactoferrin, alpha-lactalbumin) needed to elicit therapeutic effects in liver cancer.

Duration: Understanding the duration required for visible tumor reduction, and how long treatment should continue to maintain therapeutic efficacy.

Mechanisms: Investigating the precise mechanisms through which compounds in breast milk induce tumor cell apoptosis, and how these mechanisms may vary with different tumor types or individuals.

Example of Revision in Dosing and Duration

Despite the promising potential of breast milk in cancer treatment, particularly in liver cancer, there is a clear gap in knowledge regarding the appropriate dosing regimens and the necessary duration of treatment. While studies on the HAMLET complex have demonstrated that components like alpha-lactalbumin can target and destroy tumor cells, the lack of established protocols for dosage and duration emphasizes the need for further research to optimize these critical parameters (Hakansson et al., 1995; Reed, 2003)."

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Declaration of Interest

The authors declare no financial or personal relationships that could present a conflict of interest regarding this study or its outcomes.

Conflicts of Interest

The authors report no conflicts of interest.

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