

Jojari River Pollution and Its Health Repercussions: Dermatological, Respiratory and Reproductive Implications

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ABSTRACT

The pollution of the Jojari River in Rajasthan has become a pressing environmental and public health issue, primarily due to continuous discharge of untreated industrial effluents from textile and chemical units of Jodhpur, along with domestic sewage. This contamination has severely deteriorated water quality, posing risks for communities dependent on the river for daily use. Dermatological complications such as rashes, eczema, skin infections, and persistent itching are commonly observed among residents who come into direct contact with polluted water. In addition, respiratory disorders including chronic cough, asthma, wheezing, and bronchial irritation are increasingly reported, particularly among children and the elderly, owing to constant exposure to airborne toxins and foul odors released by industrial waste. Equally concerning are the reproductive health effects linked to long-term exposure to heavy metals and endocrine-disrupting chemicals. Documented problems include menstrual irregularities, reduced fertility, miscarriages, and congenital defects, which are associated with bio-accumulation of hazardous substances through contaminated water and food. These outcomes reflect not only poor waste management and weak regulatory enforcement but also highlight a critical gap in health monitoring and policy implementation. Addressing these challenges requires urgent interventions such as effective wastewater treatment, strict monitoring of industrial discharge, community-level health awareness, and regular medical surveillance. Integrated approaches are essential to mitigate health deterioration, restore ecological balance, and safeguard the well-being of affected populations.

Keywords: Jojari River, Industrial Effluents, Pollution, Dermatological Issues, Respiratory Health, Reproductive Outcomes.

Introduction

Water pollution remains one of the most pressing environmental challenges in India, especially in arid and semi-arid regions where water scarcity is already a major issue. Among the lesser-discussed yet critically affected rivers is the Jojari River in Rajasthan. Originating from the hills near Jodhpur, this seasonal tributary of the Luni River once played an essential role in supporting agriculture and meeting domestic water needs of surrounding communities. However, over the past two decades, the Jojari has transformed into a heavily polluted drainage channel, primarily due to unchecked industrial discharge, rapid urbanization, and the absence of effective wastewater management systems.

The most significant contributor to the river's pollution is the textile and dyeing industry in Jodhpur. These industries release large volumes of untreated or partially treated effluents directly into the river, containing hazardous substances such as azo dyes, chromium, lead, cadmium, arsenic, and other chemical solvents. Additionally, untreated domestic sewage, solid waste dumping, and agricultural runoff

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further degrade the river's water quality. Seasonal flow means pollutants remain stagnant for long periods, intensifying their concentration and impact on surrounding ecosystems and human health.

The communities residing along the banks of the Jojari River, many of whom belong to economically weaker sections, are continuously exposed to this toxic environment. Direct use of polluted river water for bathing, washing clothes, irrigation, and even drinking in some areas has been linked to a significant rise in health problems. Dermatological conditions, including chronic skin irritation, eczema, fungal infections, and allergic reactions, are increasingly common, especially among children and women. Prolonged exposure to contaminated air and water also contributes to respiratory illnesses such as asthma, bronchitis, and persistent coughing — conditions that are exacerbated during dry months when toxic dust and vapors become airborne.

Of even greater concern are the long-term reproductive health impacts, which are often under-reported or insufficiently studied. Women in the region have reported increasing cases of menstrual irregularities, reduced fertility, miscarriages, and birth defects, potentially due to the presence of endocrine-disrupting chemicals in the polluted water. These compounds can interfere with hormonal functions, posing a threat not just to individuals but also to future generations.

Despite these alarming developments, systematic health studies and policy responses remain limited. There is a critical need to investigate the interconnections between environmental degradation and public health, particularly in the context of vulnerable rural populations. This review aims to explore the dermatological, respiratory, and reproductive health consequences of Jojari River pollution based on available scientific literature, field data, and comparative case studies. It also seeks to highlight the urgent requirement for policy reforms, industrial accountability, community health monitoring, and sustainable river management practices to safeguard both environmental and human health in the region.

Access to clean and safe water is fundamental to human health, yet in many parts of India, particularly in semi-arid regions like western Rajasthan, water bodies have become heavily contaminated due to rapid industrialization and unregulated waste disposal. One such severely affected water body is the Jojari River, a tributary of the Luni River, which flows through the industrial hub of Jodhpur. Once a seasonal river that supported agriculture and local livelihoods, the Jojari has now deteriorated into a highly polluted stream, primarily functioning as a drainage for industrial effluents, untreated sewage, and solid waste. The contamination has reached alarming levels, with textile dyeing units, chemical industries, and domestic discharges being the primary contributors.

The degradation of the Jojari River is not just an environmental concern—it poses serious public health risks for the communities living along its banks. Residents, many of whom belong to economically and socially vulnerable groups, are routinely exposed to the river's polluted water and air through daily activities such as bathing, washing, and farming. Over time, this continuous exposure has been associated with a significant increase in dermatological disorders, including chronic itching, rashes, dermatitis, and fungal infections. The presence of heavy metals, toxic dyes, and irritant chemicals in the water directly impacts skin health, particularly among children and women.

In addition to skin-related issues, the respiratory health of the population has also been compromised. The stagnant and decomposing pollutants emit foul-smelling gases and airborne toxins, leading to respiratory conditions such as asthma, bronchitis, coughing, and other pulmonary irritations. These problems are exacerbated during dry months when airborne chemical residues and dust particles increase, especially in communities lacking access to cleaner alternatives.

Perhaps most concerning are the reproductive health risks emerging in the region. There is growing evidence—both scientific and anecdotal—pointing to increased cases of menstrual irregularities, infertility, miscarriages, and congenital abnormalities, likely linked to endocrine-disrupting chemicals present in the river. These substances can interfere with hormonal functions, posing long-term health threats not just to individuals but also to future generations.

Despite the evident health impacts, there is a lack of systematic data and public health surveillance related to Jojari River pollution. This review paper aims to synthesize existing knowledge and highlight the critical links between river pollution and specific health outcomes—focusing on dermatological, respiratory, and reproductive risks. It further emphasizes the urgent need for environmental regulation, community health interventions, and sustainable river management practices to prevent irreversible damage to both human health and the environment.

Literature Review

The intersection of environmental pollution and public health has been extensively studied globally, with numerous reports linking polluted water bodies to a range of health disorders. In India, several rivers such as the Ganga, Yamuna, Sabarmati, and Luni have been studied in this context, yet relatively little scholarly attention has been given to smaller yet critically polluted rivers like the Jojari River in Rajasthan. This section reviews existing literature related to the Jojari River's pollution profile and its health impacts, while also drawing parallels from similar case studies across India and other developing countries.

Multiple studies and environmental monitoring reports have highlighted the deteriorating water quality of the Jojari River. According to regional surveys, the river receives an estimated 50–60 million liters per day of untreated effluents, primarily from textile dyeing and chemical processing industries in Jodhpur. The effluents contain heavy metals (such as lead, cadmium, and chromium), azo dyes, and high chemical oxygen demand (COD) values—indicators of severe organic and inorganic contamination. Research by local NGOs and state pollution control boards confirms that biological oxygen demand (BOD) levels frequently exceed safe limits, making the water unfit for both human and agricultural use.

Dermatological impacts are among the most immediately visible consequences of polluted water exposure. A study by Sharma et al. (2018) on communities near industrial rivers in India reported high prevalence of eczema, skin rashes, and bacterial infections, especially among individuals who frequently bathe or work in contaminated water. Although no large-scale clinical study has been conducted exclusively on Jojari basin residents, field observations and health camp data suggest similar patterns. Local residents often report itchiness, discoloration, and long-term skin damage, suspected to be caused by prolonged contact with chemical residues and pathogens in the river.

The Jojari River basin's poor air quality, especially in summer months, has been linked to respiratory illnesses. Inhalation of toxic vapors and fine particulate matter from stagnant and decaying pollutants can lead to asthma, chronic bronchitis, and allergic rhinitis. A comparative study on river-adjacent settlements in Tamil Nadu (Patel et al., 2019) demonstrated a strong correlation between polluted waterways and increased respiratory morbidity. Given similar industrial activity in Jodhpur, it is reasonable to infer comparable outcomes, particularly as the population lacks access to clean indoor air and protective measures.

Emerging evidence connects long-term exposure to endocrine-disrupting chemicals (EDCs)—commonly found in industrial effluents—to reproductive health issues. Substances like phthalates, nonylphenols, and heavy metals have been identified in water samples from several polluted rivers. These compounds can interfere with hormonal balance, potentially leading to infertility, miscarriages, menstrual disorders, and developmental problems in newborns. While direct studies on reproductive health outcomes along the Jojari River are limited, anecdotal reports from local health workers and gynecologists suggest a rising trend of such conditions in women from affected areas.

Despite the apparent severity of the issue, scientific research specific to Jojari River's public health impact is scarce. Most available data are either environmental assessments or short-term health surveys conducted by NGOs and district health authorities. There is a significant need for interdisciplinary research combining environmental science, toxicology, public health, and community medicine to produce robust, evidence-based insights. Such research would be crucial for informing public policy and targeted intervention programs in the region.

The degradation of the Jojari River is the result of multiple anthropogenic inputs, largely driven by rapid industrialization, unregulated urban expansion, and inadequate environmental governance. These pollution sources have significantly altered the chemical and biological profile of the river, turning it from a seasonal watercourse into a toxic channel. This section examines the three primary contributors to the river's contamination: industrial discharges, domestic waste, and agricultural runoff, compounded by seasonal stagnation due to the region's arid climate.

The most significant contributor to the pollution load in the Jojari River is the textile dyeing and chemical industry, concentrated in and around Jodhpur. These industries discharge large volumes of untreated or partially treated wastewater directly into the river. According to a study by Kumar et al. (2017), the effluents from these units contain a variety of toxic compounds, including azo dyes, heavy metals (such as chromium, cadmium, and lead), phenols, and organic solvents.

These substances are known for their high chemical oxygen demand (COD) and biological oxygen demand (BOD), indicating a significant depletion of dissolved oxygen in the river, thereby threatening aquatic life and making the water unsuitable for human use. Yadav and Bhatnagar (2020) found that chromium concentrations in Jojari River water samples exceeded WHO permissible limits by over 300%, suggesting long-term ecological and health risks. Furthermore, many of these dyes and solvents are carcinogenic and resistant to natural degradation, leading to their persistent presence in the riverbed.

In addition to industrial pollutants, the river is heavily burdened by domestic sewage and municipal solid waste. Unplanned urban settlements and insufficient sanitation infrastructure contribute to the direct discharge of untreated household waste into the river. Sharma and Singh (2018) observed that approximately 80% of domestic sewage generated in peri-urban Jodhpur areas is released into open drains that eventually flow into the Jojari River.

The municipal waste includes not only organic matter but also plastics, detergents, and pharmaceutical residues, all of which further degrade water quality. The absence of centralized wastewater treatment plants (WWTPs) in the Jojari catchment area exacerbates the issue. As per Gupta et al. (2019), the lack of pre-treatment facilities means that both blackwater and greywater from residential areas enter the river untreated, increasing bacterial contamination and contributing to the spread of waterborne diseases.

Agricultural practices in the Jojari basin also contribute to the river's pollution, especially during the monsoon and post-monsoon seasons. Excessive use of chemical fertilizers, pesticides, and herbicides in nearby farmlands leads to surface runoff into the river system. A study by Verma et al. (2020) reported elevated levels of nitrates and phosphates in the river after rainfall events, which can cause eutrophication, leading to algal blooms and further oxygen depletion.

Additionally, the arid and semi-arid climate of western Rajasthan, characterized by low rainfall and high evaporation rates, results in seasonal stagnation of the Jojari River. During non-monsoon months, the limited flow fails to dilute pollutants, concentrating the contaminants in stagnant water pools. This stagnation fosters anaerobic microbial activity, releasing toxic gases such as hydrogen sulfide and methane, further degrading air and water quality. Chopra and Meena (2021) highlighted that such stagnant stretches act as localized "pollution hotspots," posing serious health hazards to communities residing nearby.

Dermatological Health Risks

- **Skin Diseases in Local Populations**

Communities residing along the Jojari River frequently experience a high prevalence of skin-related ailments, attributable to continuous exposure to polluted river water. Common dermatological conditions reported include eczema, persistent rashes, contact dermatitis, and various fungal infections. Field surveys and health camps conducted by local NGOs and healthcare workers reveal that these afflictions disproportionately affect vulnerable groups, such as children, women, and daily laborers who rely on the river for bathing, washing clothes, and irrigation.

Regular contact with contaminated water during routine activities increases the likelihood of skin barrier disruption, which facilitates secondary infections. Studies in comparable industrial riverine environments (Sharma et al., 2018; Patel & Kumar, 2019) have similarly documented elevated incidences of chronic skin irritation and hypersensitivity reactions in populations exposed to toxic effluents, emphasizing the public health implications for communities along Jojari.

- **Toxicological Basis**

The underlying toxicological mechanisms of these skin diseases are primarily linked to the presence of heavy metals (such as chromium, cadmium, lead), synthetic dyes, solvents, and other chemical irritants in the river water. Heavy metals can penetrate the skin either through direct contact or microabrasions, causing cytotoxicity and oxidative stress at the cellular level (Lal et al., 2020). These substances also act as allergens or sensitizers, triggering immune-mediated inflammatory responses that manifest as dermatitis or eczema.

Chronic exposure can compromise skin integrity, reducing its natural defense against pathogens and environmental insults. Experimental studies (Gupta & Mehta, 2019) have shown that certain textile dyes and industrial chemicals can induce photo-sensitivity, pigmentation changes, and carcinogenic

alterations in epidermal tissues. Moreover, bioaccumulation of heavy metals in skin cells may lead to long-term health effects, underscoring the necessity of mitigating exposure.

Respiratory Health Risks

- **Respiratory Symptoms and Community Reports**

Communities living along the Jojari River frequently report a range of respiratory problems, with chronic coughing, bronchitis, and asthma being among the most prevalent conditions. These health issues are exacerbated by the poor air quality in the river basin, especially in areas where effluent stagnation leads to the release of harmful chemical vapors. Local health surveys (Patel & Singh, 2020) indicate that seasonal spikes in respiratory illnesses often coincide with periods of low wind and high temperatures, which trap airborne pollutants near ground level.

Residents engaging in daily activities close to the river—such as washing clothes or agricultural work—are particularly vulnerable to inhaling these irritants. The combination of industrial emissions and drying river sediments contributes to the persistence of airborne toxins, thereby posing ongoing respiratory risks to exposed populations.

- **Inhalation of Toxic Fumes and Particulates**

A major contributor to respiratory morbidity is the inhalation of volatile organic compounds (VOCs) and fine particulate matter (PM_{2.5} and PM₁₀) emanating from the polluted river and adjoining industrial zones. VOCs, including benzene, toluene, and formaldehyde, originate from textile dyeing processes and chemical industries, and are known respiratory irritants that can trigger asthma exacerbations and chronic bronchitis (Sharma et al., 2019).

Fine particulates arise from dried sludge and sediments deposited along the riverbanks, which become airborne during windy conditions, particularly in the hot, dry months characteristic of western Rajasthan. These particulates can penetrate deep into the lungs, causing inflammation and reduced lung function. Seasonal variations significantly influence pollutant concentrations, with the pre-monsoon and summer months identified as high-risk periods for respiratory exposure (Kumar & Verma, 2021).

Reproductive and Endocrine Health Risks

- **Reproductive Issues in Affected Communities**

Communities residing near the Jojari River have reported elevated incidences of reproductive health problems, including infertility, miscarriages, low birth weight in newborns, and various hormonal imbalances. Epidemiological studies from similarly polluted river basins in India (Singh et al., 2020; Verma & Gupta, 2019) indicate that chronic exposure to contaminated water and soil can disrupt normal reproductive functioning. In the Jojari region, anecdotal and clinical data suggest a correlation between exposure to industrial and agricultural pollutants and adverse pregnancy outcomes among local women.

Such reproductive challenges not only affect individual families but also pose broader social and economic burdens on communities, making it imperative to understand and mitigate the underlying environmental causes.

- **Endocrine-Disrupting Chemicals (EDCs)**

The reproductive health risks are largely attributed to the presence of endocrine-disrupting chemicals (EDCs) in the river's effluents. These chemicals—such as phthalates, bisphenol A (BPA), heavy metals like lead and cadmium, and certain pesticides—interfere with the body's hormonal signaling pathways, leading to altered development, fertility problems, and metabolic disorders (Kumar & Lal, 2021).

EDCs can bioaccumulate in the human body through ingestion of contaminated water, food crops irrigated with polluted water, and dermal absorption. Their mechanism of action involves mimicking or blocking natural hormones, disrupting the synthesis, transport, and metabolism of endogenous hormones, thereby causing long-term health effects that may span generations (Meena & Sharma, 2020). Chronic exposure to low doses of these chemicals is particularly concerning, as subtle endocrine disturbances can manifest in significant reproductive morbidity over time.

Public Health Implications and Social Impact

The pollution of the Jojari River imposes a substantial burden on rural healthcare systems, which are often ill-equipped to manage the increasing incidence of waterborne and pollution-related diseases. Frequent outbreaks of dermatological, respiratory, and reproductive ailments strain limited

medical resources, reducing the capacity to provide timely and effective care. This systemic pressure exacerbates existing health disparities in the region (Singh & Joshi, 2021).

Among the most vulnerable populations are women, children, and marginalized communities, who face disproportionate exposure and health risks. Women, often responsible for household water use, experience greater contact with contaminated water, elevating their risk of skin diseases and reproductive complications. Children's developing immune and respiratory systems make them more susceptible to pollutants, while socioeconomically disadvantaged groups frequently lack access to clean water and adequate healthcare, deepening the cycle of vulnerability (Kaur et al., 2019).

Beyond physical health, chronic illness and environmental degradation exact a profound psychosocial toll. The loss of livelihood due to pollution-affected agriculture, coupled with persistent health problems, leads to stress, anxiety, and social marginalization. Communities face stigma and diminished quality of life, impacting mental well-being and social cohesion (Mehta & Sharma, 2020). This intersection of environmental and social determinants highlights the urgent need for integrated interventions addressing both ecological restoration and social support.

Recommendations and Future Directions

- **Implementation of Effective Wastewater Treatment**

To mitigate the ongoing pollution of the Jojari River, the establishment and strict enforcement of advanced wastewater treatment facilities is critical. Industries, particularly textile and chemical plants, must comply with stringent effluent quality standards, utilizing modern technologies such as membrane filtration, advanced oxidation, and bio-treatment. Upgrading and regularly maintaining Common Effluent Treatment Plants (CETPs) will reduce the discharge of toxic substances into the river ecosystem, thereby lowering public health risks (Sharma et al., 2022).

- **Regular Medical Screening and Health Data Collection**

Proactive health monitoring programs targeting populations in affected areas are essential. Periodic medical screenings focusing on dermatological, respiratory, and reproductive health can facilitate early diagnosis and intervention. Establishing a comprehensive health surveillance system will generate valuable data for tracking disease patterns, evaluating intervention outcomes, and guiding resource allocation (Kumar & Singh, 2023).

- **Community Education and Awareness Programs**

Raising awareness about the health hazards associated with Jojari River pollution and promoting safe hygiene practices is vital for empowering local communities. Tailored education programs can address behavioral changes, such as avoiding direct contact with contaminated water and advocating for the use of protective measures during domestic and agricultural activities. Collaboration with local leaders and NGOs will ensure culturally sensitive and sustainable outreach efforts (Patel & Meena, 2021).

- **Strengthening Environmental and Health Governance**

Robust policy frameworks and enforcement mechanisms are indispensable to curb industrial pollution and protect public health. Strengthening coordination between environmental agencies, public health departments, and local governments will improve regulatory oversight. Introducing community participation in monitoring and decision-making can enhance transparency and accountability. Additionally, integrating health impact assessments into industrial licensing processes will ensure that health considerations remain central to environmental governance (Joshi et al., 2022).

Conclusion

This review highlights the severe public health consequences arising from the pollution of the Jojari River, emphasizing dermatological, respiratory, and reproductive health risks faced by local populations. Industrial discharges, domestic waste, and agricultural runoff contribute complex mixtures of heavy metals, chemical irritants, and endocrine-disrupting compounds that compromise both environmental and human health.

The findings underscore the urgent need for integrated, multi-sectoral action involving effective wastewater treatment, health monitoring, community education, and strengthened governance. Addressing these challenges requires not only technological and regulatory interventions but also a deep understanding of the social and ecological context.

Interdisciplinary research plays a pivotal role in unraveling the complex interactions between pollution sources, toxicological pathways, and health outcomes. Collaborative efforts across environmental science, public health, toxicology, and social sciences are essential to design sustainable solutions that protect both the river ecosystem and the well-being of vulnerable communities.

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