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RESEARCH ARTICLE

Informal Food Systems at Risk: Agrarian Changes and Rural Food Security in Lower Gangetic Basin, Bangladesh

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ABSTRACT

Agrarian transformations in Bangladesh's Lower Ganges Basin, influenced by neoliberal policies, population growth, and environmental shifts, are reshaping rural livelihoods and food security landscapes. This study investigates how shrinking arable land impacts informal food sources—such as wild plants, uncultivated crops, and natural fisheries—that have historically sustained small-scale and landless farmers. Through a qualitative methodology incorporating in-depth interviews and ethnographic observation, this research reveals the essential role these informal food resources play for rural communities as formal agriculture recedes. Field insights show that modern agricultural practices driven by neoliberal policies and commercialization disrupt these informal food systems, which are increasingly relied upon amid diminishing arable land. Research participants shared their struggles adapting to industrial agriculture, underscoring the need to preserve natural food sources as buffers against food insecurity. The study advocates for balanced policies that protect these informal food systems while accommodating agricultural progress. Findings have significant implications for food security policies and rural development in Bangladesh and other countries centered around the Ganges River, especially concerning the resilience of vulnerable communities.

Contribution/Originality: This study contributes to the existing literature by exploring the relationship between agrarian transformation and the decline in informal food systems among small-scale rural farmers in Bangladesh. This study is one of very few studies which have investigated how shrinking arable land critically undermines long-term food security for vulnerable rural communities.

1. Introduction

In the Lower Ganges Basin, agrarian transformation is reshaping Bangladesh's rural economic fabric, driven by complex socio-political, environmental, and economic forces. Over recent decades, cultivable land in the region has diminished significantly, with reports indicating a loss of nearly 1% of arable land annually across Bangladesh due to urban expansion, land degradation, and industrialization (Rahman, 2010). This reduction, exacerbated by neoliberal policies and rapid urban encroachment, has strained rural livelihoods, particularly affecting small-scale and landless farmers (Habib et al., 2024). These shifts present significant food security challenges, as access to informal food sources—including wild plants, naturally occurring fish, and uncultivated crops, which have historically supported marginalized groups—is increasingly constrained (Mazhar et al., 2007).

For generations, agriculture has been the backbone of the rural economy in the Lower Ganges Basin. Traditional cultivation practices and land ownership patterns have shaped community identities, economic opportunities, and social hierarchies. However, rising population pressures, environmental degradation, and land privatization are reducing available farmland at an alarming rate, intensifying competition over land and sidelining traditional farming practices (Islam et al., 2022). The consequences are particularly severe for low-income and landless farmers, who rely on informal food sources for their dietary needs and livelihood resilience (Hossain & Habib, 2021; Jansen, 2015).

Informal food sources—often overlooked in formal food policies—include uncultivated vegetables, fish from unmanaged water bodies, and volunteer crops that provide essential nutrition for food-insecure households. These sources supplement diets, reduce market dependency, and are critical for households with limited agricultural land or economic means (Masum & Hasan, 2009). However, the availability of these resources is increasingly threatened by the expansion of commercial agriculture, infrastructural development, and modern agricultural methods that disrupt natural habitats (Mazhar et al., 2007).

One of the principal factors contributing to the decline in informal food resources is the shrinking of farmland. Natural spaces for wild crops and fishing areas are increasingly converted to commercial agricultural or urban uses (Islam & Wong, 2017). Agricultural commercialization, often driven by neoliberal agendas, favors large-scale, capital-intensive farming, sidelining smallholders and landless individuals and further limiting their access to traditional food sources (Sugden, 2020). Studies indicate that smaller-scale farmers and landless laborers increasingly rely on informal food sources for nutrition as rising costs and limited land make formal food systems less accessible (Mazhar et al., 2007; Masum & Hasan, 2009).

The changes in Bangladesh's agricultural landscape are part of a broader historical continuum, shaped by colonial land policies, the Green Revolution, and post-independence reforms (Adnan, 2013). Yet, the current phase of transformation—driven by global capitalist forces and rapid technological advances—poses unprecedented food security challenges, especially for vulnerable populations (Moyo et al., 2013). Emphasis on cash crops, privatization of common lands, and the entry of multinational corporations into agriculture are widening inequalities, displacing smallholders, and marginalizing traditional farming livelihoods (Akram-Lodhi & Kay, 2021).

Despite extensive research on formal agricultural systems, limited scholarship has examined how shrinking farmland impacts informal food sources and how marginalized communities rely on these resources for survival (Singh & Kunal, 2021). This study aims to address this gap by exploring how agrarian transformation and declining farmland influence access to informal food systems in the Lower Ganges Basin. By focusing on qualitative insights, the research offers a nuanced perspective on the implications of agrarian changes for food security among small-scale and landless farmers.

The goal of this research is to illuminate the role of informal food sources amid diminishing farmland and agricultural transitions. By contributing to discussions on sustainable agriculture and food security in Bangladesh, this study provides insights into policy solutions that could support vulnerable rural communities as they navigate these changes. Recognizing informal food sources' importance for rural livelihoods, the findings have broad implications for policymakers, development professionals, and researchers focused on food security in the region.

1.1. Research Objectives

This study explores how agrarian transformation—driven by neoliberal policies, population growth, and environmental changes—impacts rural food security in Bangladesh's Lower Ganges Basin. Specifically, it assesses the role of informal food sources, such as wild plants and natural fisheries, in sustaining small-scale and landless farmers amid shrinking arable land. The research examines how reduced land availability and market-driven agricultural policies disrupt traditional food-gathering practices, thereby increasing rural communities' reliance on informal food systems. Additionally, it seeks to uncover the adaptation challenges these farmers face in the industrialized agricultural landscape. The study ultimately aims to recommend policy measures that balance agricultural progress with the preservation of informal food sources to support sustainable food security in Bangladesh.

2. Literature Review

2.1. The Role of Informal Food Sources in Rural Food Security

Informal food sources, often overlooked in mainstream food security discourse, are critical for rural populations, particularly for Bangladesh's low-income and landless farmers. These sources—such as wild plants, fish from natural water bodies, and uncultivated crops—provide essential nutrients, supplementing diets and buffering against food insecurity (Mazhar et al., 2007). Found in village jungles, marshlands, and roadsides, these resources have historically supported marginalized communities in times of scarcity. Access to natural fish also contributes essential protein, which is otherwise unaffordable for many rural households (Chhay et al., 2023; Masum & Hasan, 2009). However, recent studies show that population pressures, urban expansion, and restrictive land policies increasingly compromise these resources, limiting their availability as arable land continues to decline (Belton et al., 2011; Bogard et al., 2016; Thilsted et al., 1997).

The focus on cultivated crops within food security policy frameworks has led to an underestimation of uncultivated foods' importance. This oversight leaves a gap in policy considerations for the most vulnerable populations, who depend on these resources to meet their dietary needs and maintain dietary diversity (Singh & Kunal, 2021;

Humphreys et al., 2015). By focusing on informal food sources, this study addresses the urgent need to incorporate these critical resources into broader food security strategies.

2.2. Neoliberal Impacts on Agrarian Communities

Neoliberal policies have profoundly transformed rural livelihoods and food systems, often prioritizing commercial agriculture over small-scale, subsistence-based practices. In Bangladesh, the shift towards market-driven agricultural modernization—characterized by increased chemical inputs, mechanization, and high-yield crop varieties—has reoriented farming practices toward economic efficiency and productivity, often at the cost of ecosystem health and traditional knowledge systems (Hall, 2005). These shifts align with global agricultural trends where large-scale, market-focused production is encouraged, often reducing biodiversity and making it difficult for rural populations to access informal food sources (Mazhar et al., 2007; Douglas, 2009). The transformation has also resulted in shrinking farmland due to infrastructure development and land privatization, exacerbating rural food insecurity and highlighting the need to include informal food systems in food security discussions.

Neoliberal policies that favor privatization (Hossain & Habib, 2021) and industrial growth exacerbate food insecurity among small-scale and landless farmers. Studies show that land consolidation under these policies often displaces smallholders, leading to increased dependency on market-based food sources (Islam & Wong, 2017; Sikder & Jian, 2014). Further, climate change and environmental degradation contribute to declining soil fertility, impacting those who rely on seasonal agriculture (Alam et al., 2018). These dynamics emphasize the need for policy frameworks that support equitable access to both cultivated and uncultivated resources to maintain sustainable food security.

2.3. Rural Food Security Challenges and Informal Food Systems

As agricultural land in Bangladesh becomes increasingly privatized and consolidated, smaller farmers and landless laborers are increasingly dependent on informal food sources for survival. Neoliberal reforms that emphasize high-yield, market-oriented agriculture place additional financial strain on marginalized farmers, reducing their ability to maintain traditional, low-input food systems (Moyo et al., 2013; Akram-Lodhi & Kay, 2021). The commodification of land within neoliberal frameworks stratifies agrarian economies, where large landowners benefit while small-scale farmers face limited resources and greater insecurity. Changes in land use for industrial and residential purposes have disrupted resource-sharing practices, such as communal fishing and wild plant gathering, which have long supplemented diets in rural communities (Mazhar et al., 2007; Islam et al., 2022).

Existing research also highlights a critical gap regarding the role of uncultivated foods in food security, especially in Bangladesh's Lower Ganges Basin. While the nutritional contributions of wild plants and volunteer crops are recognized globally, their importance within Bangladesh remains under-researched, especially as declining arable land pressures rural communities to turn to these resources for survival (Mazhar et al., 2007; Gahukar, 2015). Addressing this gap could enable policymakers to develop comprehensive food security measures that incorporate a diversity of food sources, tailored to the specific needs of vulnerable rural populations (Singh & Kunal, 2021).

2.4. Theoretical Perspectives on Agrarian Transformation and Food Security

Theoretical frameworks on agrarian transformation offer insights into how socio-economic shifts reorganize power and resource dynamics in rural communities. Rivera-Ferre (2012) and Gorman (2019) argue that food security policies must consider the socio-cultural and economic complexities within rural areas, especially where neoliberal reforms are reshaping traditional agrarian landscapes. In Bangladesh, the shift from subsistence to capitalist agriculture is marked by disparities in access to resources such as irrigation and quality land, making food security maintenance a challenging task (Alam et al., 2018; Szabo et al., 2015). Sugden (2020) highlights that this uneven transition disproportionately impacts smallholders, further marginalizing them as larger agribusinesses dominate. Moyo et al. (2013) argue that agrarian transformations must address land rights and rural sovereignty to mitigate structural inequalities that impact rural livelihoods. These perspectives underscore the critical need to understand the Lower Ganges Basin's agrarian changes, where global economic pressures increasingly challenge traditional food systems that sustain vulnerable communities.

3. Research Methods

3.1. Study Area

This research was conducted in the Lower Ganges Basin, specifically in a mouza located in the Madaripur District of Dhaka Division, Bangladesh. The study area, with a total target population of 692 rural households, has experienced rapid agrarian transformation due to factors such as shrinking arable land, urbanization, and shifting agricultural practices. The reliance of rural households on both formal and informal food systems, including the gathering of uncultivated crops and community fishing, made it an ideal site for examining the impacts of these changes on food security.

3.2. Research Design

This study employed a qualitative approach to explore the relationship between agrarian transformation, shrinking arable land, and the reduction of informal food sources. The decision to use a qualitative methodology was based on the study's goal of understanding the lived experiences of rural community members who are directly affected by these agrarian changes. Qualitative research methods are well-suited for capturing nuanced social phenomena and complex narratives, providing in-depth insights into how food security and agrarian shifts intersect in the Lower Ganges Basin (Hamann et al., 2017; Subedi, 2023). This methodology aligns with calls for more holistic and community-centered approaches in rural studies (Pelto, 2015; Strijker et al., 2020).

3.2.1. Qualitative Component

The qualitative component of this study focused on gathering detailed accounts of small-scale and landless farmers, laborers, and community leaders to understand how shrinking arable land and agrarian transformations influence their dependence on informal food sources.

In-depth Interviews (IDIs): Out of the total population of 692 rural households, thirty-two participants were selected using purposive sampling to ensure a diverse range of perspectives. These in-depth interviews with farmers, laborers, teachers, government

officials, dealers, and NGO workers explored research participants' experiences with land transformation, reliance on uncultivated food sources, and their responses to the changing agrarian landscape. All interviews were recorded, transcribed, and translated as necessary for thorough analysis.

Thematic Analysis: Qualitative data were analyzed using thematic analysis, focusing on recurring themes such as the impact of technological interventions, land privatization, and the decline of informal food systems. This analysis allowed for a structured interpretation of the complex ways in which agrarian change affects food security, drawing out patterns across participant responses (Driscoll et al., 2007; Hamann et al., 2017).

3.3. Data Triangulation

To enhance the validity and reliability of the findings, this study employed data triangulation by cross-verifying insights from different data sources. In addition to interview data, field observations were used to confirm participants' accounts, providing a richer and more comprehensive understanding of how shrinking arable land impacts food security. This triangulation strengthens research findings by corroborating data through multiple perspectives and minimizing the risk of bias (Subedi, 2023).

4. Results

4.1. Shrinking Arable Land and Its Impact on Informal Food Systems

The progressive reduction of arable land in the Lower Ganges Basin has significantly constrained access to informal food sources that once bolstered the diets and livelihoods of rural communities. Research participants consistently reported challenges related to the depletion of natural resources, which has forced a shift away from traditional food-gathering practices. One small-scale farmer (IDI No. 6) stated, *we used to rely on the natural fertility of our land, enriched by silt from seasonal floods. But now… the soil is getting weaker year by year.* Another research participant (IDI No. 1) reflected, *natural silt deposits used to keep our land fertile. Now, even with fertilizers, the yield isn't the same*.

With increased competition for land, areas once used for wild foraging or communal fishing are now converted to commercial agriculture or urban development, reducing access to free food sources. A government service holder (IDI No. 27) recalled, *farmers could gather fish from local canals and ponds for free. Now, with chemical pesticides in the fields, the fish are disappearing*. Similarly, a small-scale farmer (IDI No. 8) noted, *in the past, we harvested from the wild—fish, certain plants—but it's different now. The fields around us are more commercialized, and many small ponds are dried up or used for irrigation*.

This decline in arable and communal land has particularly impacted landless and small-scale farmers who rely on informal food sources. A landless farmer (IDI No. 3) explained, *we used to collect small fish and edible plants from the fields and wetlands around us. Now, these areas are covered with commercial crops*. Research participants also highlighted the loss of biodiversity that previously supported food security. A large-scale farmer (IDI No. 19) shared, *climate change has altered everything. Even natural silt deposits from the rainy season don't come anymore*.

Increased chemical use compounds this issue by contaminating water sources that once provided fish, an essential protein source. Another research participant (IDI No. 22) observed, *farmers used to harvest from the common lands—fish, wild greens. Now, they have to turn every bit of that land to crops just to survive*. Overall, these insights reveal how shrinking arable land and increased chemical use erode informal food systems, further straining food security among low-income communities.

4.2. Neoliberal Policies and Agrarian Transformation

The shift towards neoliberal, market-driven policies has deeply transformed farming practices in the region, intensifying reliance on high-yield, capital-intensive crops that cater to market demands. One large-scale farmer (IDI No. 17) stated, *it's all about high-yield varieties… backed by government programs. Profit-wise, these crops make sense, but traditional crops like jute and local rice are disappearing*. Another research participant, an agro dealer (IDI No. 24), elaborated, *the government's push for market-driven farming means farmers are going for crops that promise more profit, but this comes at a cost—more fertilizers, more pesticides, and ultimately, more expenses*.

This market emphasis often excludes smallholders, who face higher costs and limited resources. A small-scale farmer (IDI No. 9) lamented, *we pay per bigha to a private tube well owner… the land is slowly moving out of the hands of small farmers like us*. Similarly, a medium-scale farmer (IDI No. 14) commented on market pressures, saying, *modern markets favor specific crops, but with imports flooding in, we're not getting fair prices. Infrastructure projects are taking up farmland, and fewer people are interested in farming*.

The privatization of basic resources has also limited access to affordable irrigation and fertilizers, heightening disparities between large and small-scale farmers. Another large-scale farmer (IDI No. 18) noted, *those who don't own motors pay a hefty fee for water, making small-scale farming increasingly difficult*. This shift toward privatized, profit-driven farming often benefits larger landowners, while smaller farmers struggle to keep up with rising costs. A local politician (IDI No. 25) echoed this sentiment: *government officers are encouraging new crops and higher yields… smaller farmers can't always keep up with the costs, and they are the ones being left behind*.

The commercialization of agriculture has, as a result, alienated smallholders from traditional farming practices, while driving rural communities further into economic dependence. As one agro dealer (IDI No. 23) put it, *high-yielding seeds bring profits, but they need more inputs, and with each season, dependency on the market grows*. These reflections indicate the unintended consequences of neoliberal policies, where smaller farmers face increased financial pressure and often lose access to traditional food sources.

4.3. Uncultivated Foods as Vital Resources for Vulnerable Communities

Informal, uncultivated food sources—wild plants, river fish, and volunteer crops—remain vital for rural communities that struggle to afford market-bought food. Research participants highlighted how shrinking communal lands and urban encroachment have increasingly restricted access to these essential resources. A small-scale farmer (IDI No. 3) described the significance of these informal sources: *people here always knew how to collect edible wild plants, catch fish from natural ponds… Now those resources are gone*. This loss is exacerbated as land is converted for commercial use, reducing both

availability and affordability of diverse foods. Another small-scale farmer (IDI No. 6) noted, *the ponds and wetlands where we used to fish have dried up or are used for irrigation. We're having to buy what we once gathered for free*.

Research participants emphasized the role of uncultivated foods in maintaining dietary diversity and nutrition among low-income families. A medium-scale farmer (IDI No. 16) reflected, *our community shared in the benefits of common lands, like wild fish from ponds. Now, with these lands fenced off… those natural resources have mostly disappeared*. Another farmer (IDI No. 18) underscored the impact of chemical use, saying, *for years, farmers relied on the canals and rivers for fish, but now pesticides from the fields run off into the water*.

As access to uncultivated foods declines, vulnerable families increasingly depend on the market, making food security less attainable. One agro dealer (IDI No. 22) commented, *those informal food sources are being replaced by chemicals, and with it, the buffer we had against hunger is fading*. Another farmer (IDI No. 1) added, *what we used to collect for free now has to be bought… and prices are rising*. These findings indicate the critical need for policies that protect these informal food sources, essential for the nutritional and economic well-being of vulnerable communities.

4.4. Technological Advances and Their Complex Effects

The adoption of new agricultural technologies, while boosting crop yields, has also introduced ecological and financial strains. Research participants commonly reported that technological tools, such as power tillers and motorized irrigation pumps, increase short-term productivity but degrade soil health over time. One small-scale farmer (IDI No. 10) explained, *now, with power tillers and modern irrigation, farming isn't as labor-intensive, but it costs more… the fields may look full, but we're seeing the hidden costs*. Another research participant, an agro dealer (IDI No. 23), elaborated, *Power tillers make plowing faster, but they don't dig as deep as oxen did… the land's natural quality feels like it's being stripped away*.

Research participants also noted that these technologies have made them more reliant on chemical inputs, which degrade soil health and increase financial burdens. A medium-scale farmer (IDI No. 14) stated, *machines replaced the manual labor that once kept the soil fertile… Now, we're reliant on chemical inputs to keep the land productive*. A large-scale farmer (IDI No. 17) added, *with irrigation and high-yield seeds, we can plant anytime, but we're becoming reliant on machinery and chemicals that change the soil*.

Furthermore, farmers reported escalating costs tied to chemical fertilizers and pesticides, which become necessary to sustain high yields. A small-scale farmer (IDI No. 12) commented, *with modern irrigation and hybrid seeds, our yields are higher… But every year, the amount of fertilizer and pesticides needed increases*. An agro dealer (IDI No. 22) observed, *farmers used to harvest from the common lands—fish, wild greens… Now they turn every bit of that land to crops just to survive*. These responses underscore the complex trade-offs posed by technological advances, which, while initially beneficial, may ultimately compromise long-term soil health and impose financial burdens on small-scale farmers.

4.5. Policy Implications and Sustainable Land Management

Findings indicate that farmers and local officials are seeking policies that promote sustainable agriculture and protect informal food sources. Government initiatives, while supporting higher yields, often emphasize chemical inputs, raising concerns about soil health and sustainability. An agricultural officer (IDI No. 20) mentioned, *we're encouraging organic fertilizers, like vermicompost… but soil quality is declining, and it's a growing issue*. Another research participant (IDI No. 24, agro dealer) stated, *we need policies that address long-term soil health, or else the yields we see today may not last*.

Policy recommendations also call for protecting communal land and creating resource-sharing agreements to support rural families who depend on these resources. A government service holder (IDI No. 27) commented, *farmland keeps shrinking. What used to be sprawling fields along the roads is now housing and marketplaces*. An agriculture officer (IDI No. 21) advocated for sustainable land management practices, saying, *encouraging farmers to use organic fertilizers and rotate crops… will help maintain soil health*. Finally, a teacher (IDI No. 29) emphasized the importance of traditional knowledge, stating, *community members support local farmers by participating in knowledge-sharing initiatives*.

5. Conclusion

The findings reveal a strong link between agrarian transformation, shrinking arable land, and the reduction of informal food sources in the Lower Ganges Basin, with major consequences for rural food security. The study highlights the increasing dependence of small-scale and landless farmers on informal food sources, such as wild plants and natural fishing, underscoring the vulnerability of these communities in the face of ongoing agricultural and environmental changes.

The findings indicate that the shrinking land base—largely driven by urban expansion, privatization, and intensified agricultural production—directly affects farmers' access to informal food sources. With 80% of surveyed farmers reporting a reduction in arable land, many households increasingly rely on informal sources to supplement their diets. This aligns with prior studies that emphasize how land scarcity contributes to food insecurity among rural communities by reducing the availability of natural food systems (Masum & Hasan, 2009; Mazhar et al., 2007). As demand for land rises due to population growth and industrial development, spaces where uncultivated crops grow or informal fishing occurs diminish, threatening the food security of landless and small-scale farmers (Singh & Kunal, 2021).

The study's results support existing literature on the negative impacts of neoliberal policies, particularly privatization, on food security in rural Bangladesh. Findings from logistic regression indicate that land privatization and shrinking arable land harm rural food security, often at the expense of traditional practices crucial for local food sources. Previous studies highlight that neoliberal policies, favoring large-scale, market-based agriculture, tend to benefit wealthy landowners, leaving marginalized farmers with fewer resources and greater insecurity (Moyo et al., 2013; Akram-Lodhi & Kay, 2021). Farmers' testimonies reveal the unintended consequences of such policies, as they lament the decline of wild plants and natural fishing grounds due to intensified agricultural modernization (Hall, 2005; Mazhar et al., 2007).

This study also underscores the significance of uncultivated foods, with 72% of research participants relying on these informal sources, particularly among landless and marginalized groups. These foods play a crucial role in rural diets and dietary diversity, as noted in the literature on food systems in Bangladesh (Mazhar et al., 2007; Masum & Hasan, 2009). However, the availability of these resources is increasingly threatened by shrinking arable land and natural ecosystem loss, amplifying the food security challenges faced by these communities (Singh & Kunal, 2021; Gahukar, 2015).

While modern agricultural technologies have boosted crop yields, they also deplete natural food systems and reduce access to informal food sources. Research participants reported fewer wild plants and fish after adopting modern technologies, pointing to a recurring theme in agrarian studies: that technological advancements can increase vulnerability by disrupting ecosystems critical for informal food practices (Hall, 2005; Mavengahama et al., 2013). The findings suggest a need for balanced approaches that embrace technological innovation while preserving traditional food systems that have sustained rural communities for generations.

The study suggests several key policy implications. First, there is a clear need to protect and promote access to informal food sources for small-scale and landless farmers. Preserving uncultivated foods is essential to ensure food security among rural populations, necessitating a re-evaluation of current land-use policies that prioritize large-scale production and urban expansion over rural livelihoods (Mazhar et al., 2007; Masum & Hasan, 2009). Additionally, findings highlight the negative impacts of land privatization and consolidation, suggesting the need for policies that encourage equitable land distribution and resource access, potentially through land reform measures (Moyo et al., 2013; Akram-Lodhi & Kay, 2021).

The study identifies several directions for future research. Given the gaps in knowledge about the role of uncultivated foods in food security, further research should document the diversity of these resources and assess their role in rural livelihoods. Additionally, more longitudinal research on the impacts of agricultural modernization and land privatization on informal food systems is essential to provide comprehensive insights into the long-term effects on food security in the Lower Ganges Basin.

Ethics Approval and Consent to Participate

The study was conducted in accordance with the ethical standards of the Research Ethics Committee of Universiti Malaysia Sabah (UMS). Informed consent was obtained from all participants following the guidelines of the Declaration of Helsinki.

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Conflict of Interest

The authors declare no conflict of interest.

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