RESEARCH ARTICLE   **ARAŞTIRMA MAKALESİ**

Evaluating the socio-economic conditions of fishers and sustainability of small-scale fisheries in the Kalni River, Bangladesh

Bangladeş Kalni Nehri'ndeki balıkçıların sosyo-ekonomik koşullarının değerlendirilmesi ve küçük ölçekli balıkçılığın sürdürülebilirliği

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Abstract: Small-scale fisheries play a vital role in the economy of Bangladesh, especially in providing livelihood to fishers and foreign exchange. A study on the socio-economic assessment of small-scale fishing and fish availability in the Kalni River in Habiganj district was conducted for four months from May to August 2023. A total of 58 fishers were randomly selected and interviewed for information gathering and pre-checklisting in focus group discussions (FGDs). Of these, 93% were male and the mean age was 36.89 ± 6.43 years. The results showed that the monthly income of fishers ranged from 10,000-20,000 BDT, 20,000-30,000 BDT, and less than 10,000 BDT. The study collected information on various aspects including the type of fishing gear used and the availability of small indigenous fish (SIS). The main fishing method, 'Ber jal' gear, accounted for 80% of the catch, while 'Dhormo jal' gear accounted for the remaining 20%. During this period, 1-3 types of Puti (*Puntius* sp.) and (*Nandus nandus*) Gobiidae family is the most abundant species. Various SISs were caught in the river; some rare species were also identified. Community-based management approach and management of fish sanctuaries, as well as public awareness of fishery resources, could be effective in minimizing anthropogenic impacts on fishers' livelihood.

Keywords: Bangladesh, *Puntius* spp., small indigenous species, socio-economic, small scale fisheries

Öz: Küçük ölçekli balıkçılık, özellikle balıkçılara geçim kaynağı ve döviz sağlaması açısından Bangladeş ekonomisinde hayati bir rol oynamaktadır. Habiganj bölgesindeki Kalni Nehri'nde küçük ölçekli balıkçılığın ve balık mevcudiyetinin sosyo-ekonomik değerlendirmesi üzerine olan bu çalışma, Mayıs-Ağustos 2023 tarihleri arasında dört ay boyunca yürütülmüştür. Toplam 58 balıkçı rastgele seçilmiş ve bu balıkçılarla odak grup tartışmalarında (FGD'ler) bilgi toplama ve ön kontrol listesi oluşturmak için görüşülmüştür. Bunların %93'ü erkek ve yaş ortalaması 36,89 ± 6,43 yıldır. Sonuçlar, balıkçıların aylık gelirinin 10.000-20.000 BDT, 20.000-30.000 BDT ve 10.000 BDT'den az arasında değiştiğini göstermiştir. Çalışmada, kullanılan balıkçılık araçlarının türü ve küçük yerli balıkların (SIS) mevcudiyeti de dahil olmak üzere çeşitli yönler hakkında bilgi toplanmıştır. Ana balıkçılık yöntemi olan 'Ber jal' avcılık yöntemi, avın %80'ini oluştururken, 'Dhormo jal' yöntemi kalan %20'yi oluşturmuştur. Bu dönemde, 1-3 tür Puti (*Puntius* spp.), meni (*Nandus nandus*) ve Gobiidae familyası türü en bol bulunan balıklardır. Nehirde çeşitli SIS'ler yakalandı; ayrıca bazı nadir türler de belirlendi. Topluluk temelli yönetim yaklaşımı ve balık koruma alanlarının yönetimi ile balıkçılık kaynaklarına ilişkin kamuoyunun farkındalığı, balıkçıların geçim kaynakları üzerindeki antropojenik etkileri en aza indirmede etkili olabilir.

Anahtar kelimeler: Bangladeş, *Puntius* spp., küçük yerli türler, sosyo-ekonomik, küçük ölçekli balıkçılık

INTRODUCTION

Fish and fisheries have long dominated the lives and livelihoods of Bangladeshis people. According to "Maache-Bhate Bangali," which translates to "Fish and rice make a Bengali," the majority of Bangladeshis consume fish in their diets (Alam and Thomson, 2001; Rashed-Un-Nabi et al., 2011). Initially, viewed primarily as a means of subsistence, the fisheries industry has developed into a significant contributor to the national GDP, job creation, and foreign exchange earnings (Njaya, 2007; Mozumder et al., 2023). Bangladesh contains a wide variety of fishery assets, enveloping many local and outlandish sea-going species. As

the fourth-largest producer of inland fisheries worldwide, Bangladesh's freshwater bodies are home to 260 native fish species, 12 exotic fish species, and 24 prawn species (DoF, 2018; Das et al., 2024). The fisheries sector is crucial to the nation's economy because it provides food, employment, and earnings in foreign exchange. It has a significant impact on the supply of animal protein, the GDP of the nation (3.52%), export revenue (1.39%), and so on (DoF, 2020). Aquaculture will be worth approximately 264 billion US dollars in 2022, accounting for 49.2% of global fish production (Sidiq et al., 2024). In addition, this amount is 87.5 million tons of fish

(Shamsuzzaman et al., 2020). Bangladesh is the third-largest producer of inland open-water capture water, making it one of the top aquaculture producers worldwide (Azad et al., 2023). Small-scale fisheries are traditional fishing methods that use limited resources such as capital and energy (Gunakar and Bhatta, 2023). Moreover, small-scale fisheries frequently self-regulate to safeguard nearby assets by enforcing closed seasons, restricting fishing gear, and controlling fishing access (Mozumder et al., 2023). These methods could be as straightforward as those used in less developed nations or as sophisticated as larger vessels such as trawlers and long liners in more developed regions. Small-scale fisheries are an essential component of global fishing activities and are a vital source of income for millions of people worldwide in developed as well as developing nations (Mohsin and Emdadul Haque, 2009). As Bangladesh's fisheries area has a high potential to contribute to the country's financial turn of events, these issues can be addressed by mindful and cost-effective fisheries executives (Murshed-e-Jahan et al., 2009).

Bangladesh, which is also a developing nation, has a similar percentage of small-scale fishing. This industry provides numerous advantages, including national employment, food security, and economic expansion (Islam et al., 2017a). This is especially true for the Sylhet region, which is in the country's northeastern region and contains a large area of natural water bodies and low-income fisher groups. The potential of small-scale fisheries to alleviate poverty has been largely overlooked despite their crucial role in supporting a significant portion of the population (Islam et al., 2017b). Small-scale fishermen lack protection from a wide range of crises, which eventually leads to poor socioeconomic conditions (Islam and Chuenpagdee, 2013). Floods and market issues pose particular difficulties for those living in the Sylhet region (Mawa et al., 2023), as does a lack of hospitals, sanitary living conditions, and waterborne diseases such as dysentery and diarrhea (Ashbolt, 2004; Hridoy et al., 2025). Inadequate collaboration between specialists and neighborhood partners is primarily to blame for the unfortunate outcomes brought about by the devaluation of fisheries assets, which necessitates adequate support from Bangladeshi educators for those affected (Emdad and Salim, 2013).

Fishermen have a high rate of illiteracy due to a lack of access to education, which is exacerbated by a lack of schools and inadequate transportation and communication infrastructure (Khanum, 2013). The Sunamganj region faces challenges as a result of high population pressure and an increase in the number of households with landless fishermen. Because the government does not have a sufficient understanding of the small-scale fisheries (SSF) industry, it is ill-equipped to address the potential effects on society and the environment. The lives of small-scale fishermen in floodplain areas are ignored in the material that is currently being published, highlighting the urgent need for additional research. According to a study that examined the factors that influence these fishermen's income, it is evident

how important it is to increase their income to develop policies that will improve their well-being (Anna et al., 2019). To achieve social-ecological sustainability and ensure future livelihoods, novel methods are required to comprehend fisheries in their environments and create efficient policies (Andrew et al., 2007). The National Fisheries Policy (1998) is a crucial framework that prioritizes sustainable fisheries management, the advancement of aquaculture, and the reduction of poverty. Furthermore, Co-Management Policies are designed to enhance collaboration among government bodies, non-governmental organizations (NGOs), and fishers. These policies seek to promote shared responsibilities and inclusive decision-making, ensuring a balanced strategy for resource management and active community participation. The present study seeks to offer insights into the diversity, availability, current status, population trends, threats, and household circumstances of SISs in the northern part of the Kalni River region in Bangladesh. The study also considered the socioeconomic conditions of stakeholders to assess the future potential of SSFs.

MATERIALS AND METHODS

The research utilized a mixed-method approach, integrating both qualitative and quantitative techniques. This strategy facilitates a thorough analysis by merging numerical data with detailed contextual insights, providing a well-rounded understanding of the research subject.

Study area

This research was carried out in the designated area of the Kalni River (24°25'36"N 91°12'08" E) in the Habiganj district of Bangladesh to evaluate the livelihoods of local fishermen (Figure 1). The banks of the Kushiyara-Kalni River in the Ajmiriganj upazila of the Habiganj district have been eroding over time. The Kalni River is a tributary of the Surma River, which originates from the Manipur state in India.
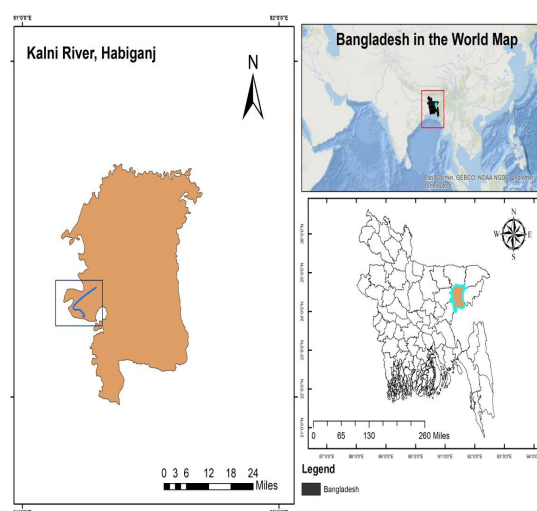

Figure 1. Geographical Representation of the Kalni River in Habiganj, Bangladesh, and Its Global and National Context: Developed Using ArcGIS 10.8

Data collection process

Primary data were collected and used for this study. The data collection period was conducted for four months from May to August 2023. The data were collected through the administration of questionnaires. This data collection process by a research team focused on 58 small-scale fishers and women who had life-led many problems in their household assessments. A previous check was made via focus group discussion (FGD). The illiterate respondents did not understand English, so the questionnaire was explained in the Bangla language; thus, they answered properly and were notified. Face-to-face questionnaire interviews were conducted with the chosen fishers; the sample size was established at 60 (Rahman et al., 2018). On the other hand, a total of 50 fishers were randomly selected from three villages, Mohonganj upazila, in the Netrokona district (Alam et al., 2023). In their study, 70 households were identified as being particularly susceptible to riverbank erosion (Ali and Khan, 2023).

Data analysis

The data were examined using the R programming language (R Studio 4.3.2) for data cleaning and analysis preparation, after which the frequency distribution, percentage, mean, and standard deviation (SD) were determined using descriptive statistics.

RESULTS

The data were collected for close examination of the respondents' livelihood; personal, communicational, socioeconomic, and situational characteristics; and other factors.

Gender distribution across different age groups

The review showed that 93% of the males and 7% of the females were aged between 27 and 50 (36.89±6.43) years (Figure 2), which demonstrated that the angler networks were ruled by the middle-aged bunch. Their exercises are fish-related, and some additional work includes family.
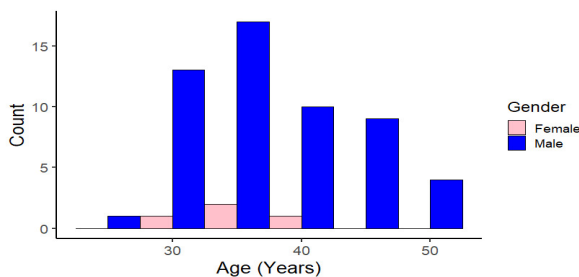
Figure 2. Age-related performance across different genders

Main occupation related to monthly income

The month-to-month pay of anglers was ordered into three gatherings under 10000, 10,000-20,000 and 20,000-30,000 BDT. A greater percentage of the respondents (41.51% under 10,000) (13.21% are 20,000-30,000) had a high BMI of 10,000-20,000 (45.28%) (Figure 3).
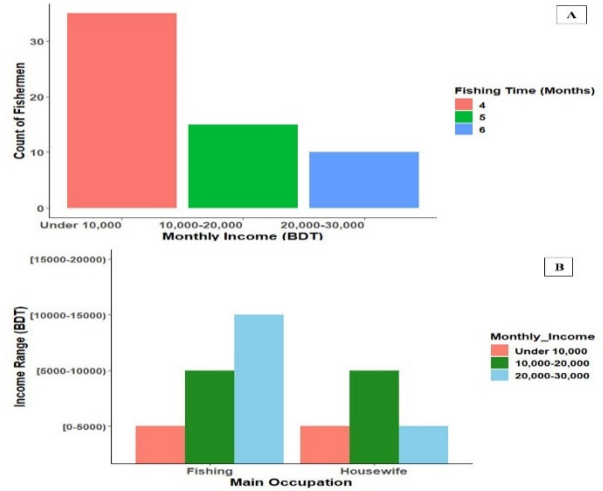
Figure 3. Presents bar charts illustrating: A. The relationship between monthly income and fishing time, and B. The association between monthly income and occupation

Relationship between daily engagement in fishing and monthly income

According to the study intensity map, there is a relationship between month-to-month pay and fishing length within a 24-hour time frame. The information reveals that anglers invest in shifting measures of energy fishing: 1-6 hours, 6-7 hours, 7-8 hours, 8-9 hours, and more than 10 hours. The most widely recognized fishing term is between 8 and 9 hours, representing 25% of the commitment, followed by 7 and 8 hours, which represents 23.75% of the commitment (Figure 4).

The peak season of fishing generates monthly income

In this study, the pinnacle fishing season for little fish occurred from December to February, during which anglers acquired the most noteworthy extent of their month-to-month pay, totaling 67.19%. In particular, December to January contributes 23.44%, and November to February contributes 9.38% to the general pay. Anglers procuring between 10,000 and 20,000 normally experience this pinnacle from November through February.
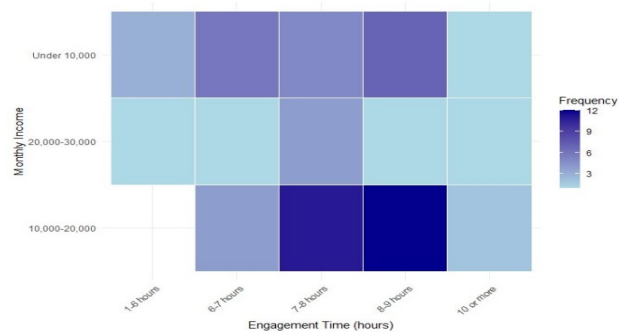
Figure 4. Amount of time spent fishing and relate to their monthly income

Types of gear use and amount of fish caught

This study on the different fishing strategies utilized to catch Puti fish. The essential strategy, the "Ber jal" gear, represented 80% of the catch, while the "Dhormo jal" gear contributed more than 20% of the total (Figure 5).
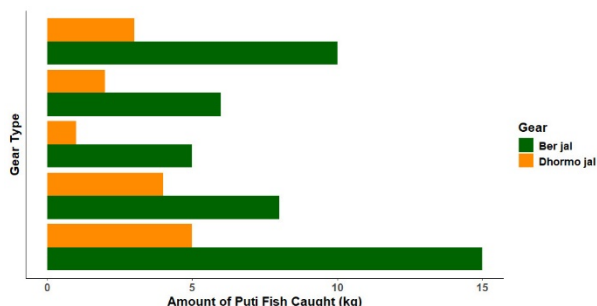

Figure 5. The utilization of gear for catching Puti (*Puntius* spp.) was measured per kilogram

Types of Puti fish

The pie chart provides the division of answers with regard to the range of Puti species they were familiar with. The majority (50%) were familiar with 2-3 species, reinforcing the fact that this was the most prevalent range known to them. An approximate 33.3% were familiar with 1-2 species, revealing very low awareness when it comes to species diversity. A very minimal percentage (1.9%) were familiar with 3-4 species, reinforcing the fact that exposure to more diversified Punti species is negligible (Figure 6).
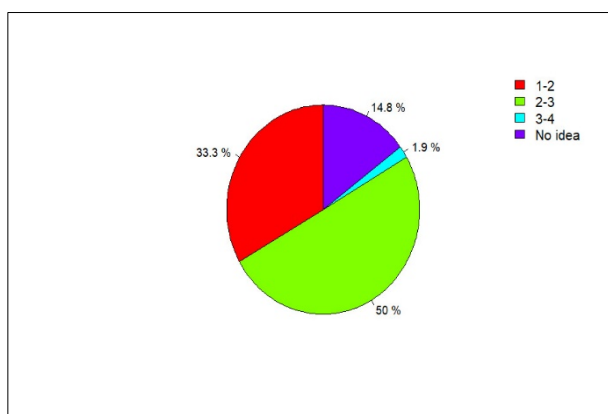

Figure 6. Distribution of respondents based on the number of puti fish species identified

Availability of small indigenous species (SIS)

This study looks at the limited scale fisheries working along the Kalni Waterway, zeroing in on the variety of fish species present. Among the species reviewed, Meni (*Nandus nandus)* was the most common, accounting for 17% of the complete fish populace. Less habitually experienced species include Baim (*Mastacembelus armatus*), Shol (*Channa striata*), Chapila (*Gudusia chapra*), and Gutom (*Lepidocephalichthys guntea*). Despite these overflow varieties, the review highlights the assorted scope of fish

species inhabiting the Kalni Waterway ecosystem. Three percent of the Anguillidae family contains freshwater eels. Meni, from the Gobiidae family, is the most common species, accounting for 17%. Shoal from the Channidae family was associated with the most unbountiful species (1%), and Rani, which is from the Cyprinidae family, was associated with 14% of the unbountiful species (Figure 7). Additionally, the occasional overflows of Kholisha (*Trichogaster fasciata*) and Kakila (*Xenentodon cancila*) are accessible in this riverside neighborhood market (Figure 8).
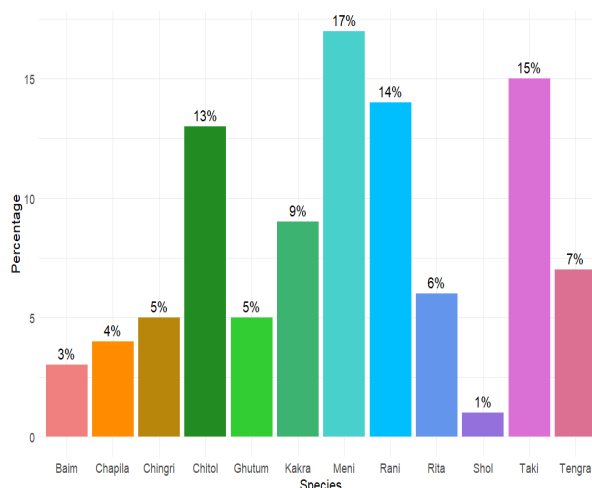

Figure 7. Percentage distribution of respondents' knowledge on different fish species

Figure 8. Some fish species in the Kalni River, Bangladesh

DISCUSSION

The demographics and socio-economics of fishing communities in South Asia are heterogeneous. In Barpeta, Assam, most anglers (49.3%) were aged 31–40 years and 23.91% were from the 41–50 age group (Kalita et al., 2015). In Tamil Nadu's Kanyakumari district, 46% of mussel fishers were between the ages of 40–50 years, followed by 24% who were aged between 50 and 60 years, 18% between the ages of 30 and 40 years old, 8 under 30 years old, and 4 over 60 years old (Mary et al., 2015). About three-fifths of the total fishing labor force in Karnataka comprised small-scale fishers, 36% with ages between 21–30 years, followed by 25% each in the age brackets of 31–40 and 41–50 years, while another

9% of fishers were under the age of twenty and only again just five percent above fifty (Islam et al., 2016). In a different study, the 31-40 age group comprised about 52% (Sidiq et al., 2024).

Earning power among fishers is another indicator of inequality in the economy. In Bangladesh, a four-month study found that most fishers earned below 10,000 BDT ($125) per month. 72%, 16% and only 12% of them annually earned in the group categories:15,000–25,000 BDT; the medium income (25,001–35,000 BDT) and between 35,001–50,000BDT respectively (Rashed-Un-Nabi et al., 2011). While 68.8% sold their catch in local markets, they were largely caught using traditional fishing gears which contributed to the total catch (80 and 20% of Ber jal and Dhormo jal catches, respectively) (Afrad et al., 2019).

On the Shari-Goyain Waterway in Sylhet, fishers used different gears such as gill nets, seine nets, lift nets, cast nets, and hauled nets (Ahmed, 2008; Das et al., 2022). Mono-fiber gill nets, traps (139.48 kg), line nets (66.37 kg), and seine nets (31,130 kg) were the most -preferred with high catches (Njaya, 2007). *Puntius* spp. is another important freshwater cyprinid inhabiting the region with high nutritional values (Gupta, 2015). Nevertheless, environmental hazards threaten species such as *Puntius sarana* which is critically endangered in the lower Ganges region (Sarkar et al., 2012).

Aquatic ecosystems are a prominent highlight of biodiversity studies across Bangladesh. For example, 36% of fish from the Cyclinidae family were recorded from the Bhairab River along with other families namely Bagridae, Channidae, and Mastacembelidae. In Sylhet, other surveys recorded a total of 79 fish species, while the specific Kusiara River has been reported to yield as many as 74 species in one sampling survey and generic sub-basins such as Sylhet-Mymensingh have yielded over 92 species in total across sites within land-use types (Hossain et al., 2009). Nevertheless, these values often are dependent on habitat conditions and the scope of research.

This diversity, the fishing sector in Bangladesh is one of the most affected by issues such as labor shortages, pollution, and habitat destruction due to flooding (Mustafi et al., 2022; Kawsar et al., 2023). These issues should be addressed as awareness raising, skill development, and creation of access to credit programs offered through government offices, and microcredit organizations in northeastern Bangladesh (Hridoy et al., 2021; Sunny et al., 2021; Dey and Ghosh, 2022). Furthermore, there is a lack of comprehensive research on the long-term impacts of habitat destruction and pollution on fish diversity and fisher livelihoods. Addressing this gap requires integrating ecological studies with socio-economic assessments to develop sustainable fisheries management strategies.

Challenges faced by the fishing industry

Insufficient protein intake among fishermen can result in the sale of their catch in local markets to earn a living, with additional income sometimes coming from the sale of two pieces of Snell, Clams, or Oysters for 1.00 Tk. Poor sanitation systems can also negatively impact people's livelihoods. These issues are significant concerns for river stakeholders and can sometimes involve local businesses and vendors. However, the fishermen's passion for fishing not only properly utilizes their time but also engages them in fishing for 4-6 hours daily. Unfortunately, many of their family members lack education due to the difficulties in maintaining their families' needs. Other fishermen have noted that rivers are becoming increasingly polluted, which is affecting their livelihoods and leading to the spread of waterborne diseases (Hridoy et al., 2025). Fisher women often process small, unsold fish to create semifermented fish products, which can serve as an additional source of income. However, they also face challenges related to the local fisheries syndicate, which can limit their ability to harvest open-water fish. In addition, their gear is not always protected, which can result in damage and hinder their ability to fish effectively. Furthermore, the use of chemicals in agricultural lands can lead to the accumulation of toxic sediments in waterways, which can negatively impact fish populations and the livelihoods of fishermen.

CONCLUSION

This study presents important insights into the socio-economic conditions and fish diversity in the Kalni River, underscoring the reliance of small-scale fisheries on traditional methods. The research found that middle-aged male fishers constitute the main workforce, utilizing gear like "Ber jal" to catch small indigenous species such as *Puntius* spp. and *Nandus nandus*. Although these species are commonly found, fish diversity is severely threatened by overfishing, environmental degradation, and inadequate management practices. The socio-economic assessment indicated that fishers encounter several challenges, including low income, seasonal fluctuations in fish availability, and restricted access to modern fishing technologies. These issues have a profound effect on their livelihoods and food security. To tackle these challenges, it is essential to implement collaborative management strategies, which may include the creation of fish sanctuaries, as well as providing financial and technical assistance to fishers. Policymakers must focus on sustainable fishing practices and community-led conservation efforts to safeguard the fish diversity of the Kalni River and enhance the welfare of its fishing communities.

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AUTHORSHIP CONTRIBUTIONS

Md. Abdullah Al Mamun Hridoy**:** Conceptualization, Methodology, Data Analysis. Md. Abdullah Al Mamun Hridoy, Shuvo Saha, Tanvir Ahmed Chowdhury**:** Data Curation, Writing - Original Draft Preparation. Md. Abdullah Al Mamun Hridoy, Puspendu Biswas Paul**:** Visualization, Investigation. Md. Thashin Rahman, Md. Abdullah Al Mamun Hridoy**:** Software, Validation. Kazi Shiam, Md. Mahedee Hasan, Rafi-Ul-Islam, Mohammad Fahim, Abdullah Al Mizan, Tanvin Yeasin Tanay**:** Data Collection, Writing - Reviewing and Editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known financial or personal conflicts that could have influenced this research.

ETHICS APPROVAL

All human-animal care and experimental procedures were conducted following guidelines set by the Sylhet Agricultural University Ethical Committee Board, which were strictly followed (protocol no. APR2023004).

DATA AVAILABILITY

For any questions regarding the datasets used in this study, please get in touch with the corresponding author.

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