Indian J. Fish., 71 (1): 135-143, 2024 doi:10.21077/ijf.2024.71.1.141127-16

Available online at: epubs.icar.org.in/index.php/IJF

A comparative analysis of livelihood security among fish and dairy farmers in Tripura, India

Abhay Kumar Chandegara[1], Jitendra Kumar Chauhan[1], A. D. Upadhyay Upadhyay[1], Biswajit Lahiri[1] , Dileep K. Pandey[2*], Prasenjit Pal[1] and Halpati Reena[3]

[1]College of Fisheries, Central Agricultural University (Imphal), P. O. Lembucherra, Agartala - 799 210, West Tripura, Tripura, India
[2]College of Horticulture and Forestry, Central Agricultural University, Pasighat - 791 102, Arunachal Pradesh, India
[3]ICAR-Central Institute of Fisheries Education, Versova, Mumbai - 400 061, Maharashtra, India

Abstract

This comparative study in Tripura, conducted during 2021-2022, focuses on the livelihood security of tribal fish and dairy farming communities. Livelihood security encompasses essential aspects such as income, resources and basic needs like food, health, education, social integration and infrastructure. The study purposively selected West Tripura and Khowai districts based on their fish and milk production values. A sample of 160 farmers (80 fish farmers and 80 dairy farmers) were selected using stratified random sampling. Seven indicators were used to assess the livelihood security, and the Household Livelihood Security Index was calculated based on the mean values of these indicators. The cumulative square root method categorised the respondents into low, medium, and high livelihood security levels. The findings indicated that fish farmers generally scored higher in food security, economic security, health security, infrastructural security and institutional security. While, dairy farmers had higher levels of educational and social security. Most fisheries and dairy farming had medium to high livelihood security. The study underscores the significance of fisheries and dairy sectors in improving livelihoods and nutritional security among tribal communities in Tripura. Policymakers and stakeholders can use these findings to develop targeted interventions to enhance livelihood security for these communities.

*Correspondence e-mail:
dkpextension@gmail.com

Keywords:
Dairy farming, Fish farming, Livelihood security, Tripura

Received : 19.08.2023
Accepted : 04.03.2024

Introduction

Agriculture is the primary source of income for most of the rural households in India. It not only meets the food and nutritional needs of 1.3 billion Indians but also contributes considerably to production, employment, and demand generation (FAO, 2018; Kumar *et al.,* 2020; Sivamohan *et al.,* 2022). With the rapidly rising population and malnutrition, the agricultural sector faces limitations in delivering sufficient income and employment to people in developing nations like India (Noor *et al.,* 2018). Fish and dairy farming are expected to play an essential part in combating these difficulties by creating a sustainable livelihood system and nutritional security worldwide (Duarte *et al.,* 2009; Khan *et al.,* 2010). The Indian fisheries and dairy sectors play a crucial role in global food production, contributing significantly to nutritional security, rural livelihood support, and employment opportunities for over 18 million individuals. According to FAO, India is the second-largest aquaculture producer and ranks first in milk production (NFDB, 2018; Shree and Prabhu 2019; FAOSTAT, 2022).

Livelihood refers to the means, entitlements, activities and assets that individuals use to make a living, as well as an endeavour to satisfy the different fundamental and economic demands of life (Haan and Zoomers, 2002). "Livelihood Security" can be defined as adequate and sustainable access to income and resources to meet basic needs (including sufficient access to food, potable water, health facilities, educational opportunities, housing and time for community participation and social integration) (Frankenberger, 1996; Drinkwater and Rusinow, 1999).

Tripura, an Indian state known for its highest *per capita* fish consumption (29.29 kg per

annum), has witnessed remarkable growth in fisheries (DoF, 2023). However, livestock and dairy farming are significant secondary activities for agricultural households in Tripura (Paul *et al.,* 2016; Lahiri *et al.,* 2019). The Government of Tripura has taken many steps to ensure the food and nutritional security of the people, as fish and dairy are an essential component of the daily diet of more than 95% of the state's population (Acharjee and Ray, 2013; DoF, 2014; DAHDT, 2019). The concentration of tribal people in rural areas is substantially larger (97.4%), particularly in Tripura's mountain and forest zones (Deka, 2011; Deb *et al.,* 2021). Tribal culture and economics are heavily interconnected with the aquaculture and dairy sectors which provide food and livelihood for them.

Past studies suggest that most fish farmers also have minimal access to food. Further, fish farmers with higher monthly expenditure, higher education, smaller family size, better farm and off-farm work opportunities, and greater resource availability (land and water area) had a higher level of food security (Upadhyay *et al.,* 2012). In the context of dairy farmers, infrastructure, food, and educational security significantly improved farmers' total livelihood security and social security had the most negligible positive impact (Chauhan *et al.,* 2022). Furthermore, the people of Tripura face a variety of challenges, including geographical isolation, rugged terrain, slow infrastructure development, lack of significant industries, shrinking land availability, declining agricultural activity, high rural poverty, and a low representation of women in the workforce (Lahiri *et al.,* 2019). In addition, the traditional practices used in farming, along with a rise in population, resulted in a decrease in agricultural productivity and revenue for the tribal farmers. These issues work together to reduce livelihood prospects and drastically prolong poverty in the state (Ramanuja *et al.,* 2009). In this context, the present study aims at assessing the livelihood security of tribal fish and dairyfarming communities with the help of different indicators like occupation, income and education.

Materials and methods

The study was conducted using an ex-post-facto research design during 2021–2022 in the State of Tripura, located between latitude 22°57'N to 24°33'N and longitude 91°10'E to 92°20'E (ENVIS, 2013) (Fig. 1). Tripura's current annual fish production is around 77,227.69 t and *per capita* fish consumption is 29.29 kg, the highest among the inland states of the country (NFDB, 2019; DAHDT, 2020). In dairy farming, Tripura ranks third among India's north-eastern states, with a 1.045 million cattle population and an extra output of 1450 to 1500 t of milk annually. Furthermore, the *per capita* availability (PCA) of milk in Tirupura is 123 g which is remarkably lower than the national PCA of 427 g per year (Asish *et al.,* 2021). As a profession, farmers in the state have been producing animal and poultry products, including milk, meat and eggs (Kumar *et al.,* 2007). Out of eight districts in Tripura, two districts (West Tripura and Khowai) were purposively selected based on the above and below mean value of fish and milk production.

Primary data was collected using a semi-structured interview schedule. A pilot study on thirty farmers was conducted for rectifications and necessary changes in the interview schedule.

Fig. 1. Map of the Tripura State depicting the districts West Tripura and Khowai

Based on data from the Directorate of Fisheries and the Directorate of Animal Husbandry, Government of Tripura, a comprehensive list of fish and dairy farmers was compiled on a district-wise basis. Utilising stratified random sampling techniques, 80 fish farmers and 80 dairy farmers were proportionately selected from each of the designated districts.

Household's livelihood security index consisted of seven livelihood outcomes: Economic, Education, Health, Institutional, Food, Infrastructure and Social Security. These dimensions were measured based on accessibility, quality and status. Further, Household Livelihood Indices (HLI) for all the dimensions were obtained by aggregating the scores of indicators. Weightage was given to different indicators of livelihood security by taking the ranks from the judges (Scientists and Experts in Social Science). Further, the mean of these indicators was calculated and taken as a weightage of that specific indicator. The statements representing particular indicator of livelihood security was selected by sending the statements to the experts/judges for taking their responses. Based on the recommendations given by the experts, the final selection of statements for each indicator was made.To effectively combine the scores from various indicators, a normalisation process was carried out before the combination. In this research, standardised scores for each indicator were calculated using the formula:

$$\text{Uind j} = \frac{\text{Indicator ij - Min j}}{\text{Max j - Min j}}$$

where, Uindj = Unit score of the i^{th} respondent on j^{th} component

Max j and Min j = Maximum and minimum score on the j^{th} component

Then, the 'Household Livelihood Security Index' for each indicator of the entire household was calculated using the formula:

$$\text{HLSI} = \frac{\sum_{J=1}^{J} U_{ind\ j}}{J}$$

where, J = Number of indicators used in the index; ind j = The cumulative standardised score of all respondents for a specific indicator.

The approach outlined by Alfares and Duffuaa (2006), was adopted to assign weightage to the rank. The mean values of the sub-indicators were then calculated to determine their respective weightage, measured on a scale of 100 points. Among the seven sub-indicators of livelihood security, health security received the highest weightage (81.55), followed by food security (75.00), infrastructure security (71.46), educational security (61.93), institutional security (59.22), economic security (55.18) and social security (48.53). Classification of respondents into low, medium and high categories was done using the cumulative square root method based on their livelihood security and it was determined by analysing the total score.

Results and discussion

Socio-economic profile of fish and dairy farmers

Table 1 presents the socio-economic characteristics of fish and dairy farmers. The study reveals that a significant proportion of fish farmers (46.25%) fall within the middle age range (36-50 years), whereas a majority of dairy farmers (41.25%) belong to the young

Table 1. Socio-economic profile of fish and dairy farmers

Variable	Category	Frequency and Percentage (%) (n=80)	
		Fish farmers	Dairy farmers
Age	Young (<35)	26 (32.5)	33 (41.25)
	Middle aged (36-50)	37 (46.25)	32 (40)
	Old (>50)	17 (21.25)	15 (18.75)
Gender	Male	63 (78.75)	58 (72.5)
	Female	17 (21.25)	22 (27.5)
Education level	Illiterate	5 (6.25)	4 (5)
	Read and write	7 (8.75)	9 (11.25)
	Primary	16 (20)	16 (20)
	Secondary	27 (33.75)	21 (26.75)
	Higher secondary	17 (21.25)	20 (25)
	Graduate and above	8 (10)	10 (12.5)
Family size	Small	58 (72.5)	51 (63.75)
	Large	22 (27.5)	29 (36.25)
Land holdings	Marginal	75 (93.75)	47 (58.75)
	Small	5 (6.25)	33 (41.25)
Area of pond	Up to 0.5 ha	68 (85)	26 (32.5)
	Above 0.5 to 1 ha	12 (15)	4 (5)
Farming experience	Up to 3 years	6 (7.5)	9 (11.25)
	Above 3 to 10 years	17 (21.75)	22 (27.5)
	More than 10 years	57 (71.25)	49 (61.25)
Annual income	Above Rs.50,000 to ₹1 lakh	18 (22.5)	32 (40)
	Above Rs. 1 lakh to ₹1.50 lakh	52 (65)	38 (47.5)
	Above ₹1.50 lakh	10 (12.5)	10 (12.5)

age group (<35 years). This trend can be attributed to the higher enthusiasm and risk-taking propensity observed among young and middle-aged farmers towards both fish and dairy farming activities. Male farmers dominate in both sectors, constituting 78.75% of fish farmers and 72.50% of dairy farmers, as compared to female farmers. Regarding education, the majority of fish farmers (33.75%) have attained a secondary level of education, followed by those (21.25%) with a higher secondary education. Similarly, a significant portion of dairy farmers (26.75%) have completed secondary education, with 25% having higher secondary education. Family sizes among both fish farmers (72.50%) and dairy farmers (63.75%) tend to be small, with fewer than five individuals. Concerning land holdings, the majority of fish farmers (93.75%) possess marginal or smaller land holdings, while a notable portion of dairy farmers (58.75%) have marginal land holdings, and 41.25% have small land holdings. Most fish farmers (85%) operate ponds of up to 0.5 ha, with only 15% managing ponds ranging from above 0.5 to 1 ha. Conversely, only 5% of dairy farmers manage ponds of similar sizes. None of the respondents in either group reported pond areas exceeding 1 ha. Regarding farming experience, a large proportion of both fish farmers (71.25%) and dairy farmers (61.25%) have more than 10 years of experience. In terms of income, 65% of fish farmers earn annual incomes ranging from more than ₹1 lakh to 1.50 lakh, with 22.50% earning between ₹50,000 to 1 lakh. For dairy farmers, 47.50% reported annual incomes of more than ₹1 lakh to 1.50 lakh. None of the farmers surveyed reported annual incomes below ₹50,000.

Livelihood security of fish and dairy farmers

Food security

In this study, food security was assessed using various indicators, including "household dietary intake" or "household food consumption," which encompasses the diverse range of food groups consumed daily. Additionally, the study considered expenditure on food, measuring the proportion of income allocated to food expenses. These indicators collectively provided a comprehensive evaluation of food security, considering both the nutritional aspects of daily dietary intake and the economic dimension reflected in spending patterns on food.

The results presented in Table 1 revealed that 53.75% of fishery respondents reported a medium level of food security, while 31.25% reported a low level of food security. On the other hand, 50% of dairy respondents reported a medium level of food security, while 21.25% reported a low level of food security. It was significant to observe that about 28.75% of dairy respondents had a high level of security, which is lower than the fisheries respondents (15%). It indicated that food security was relatively better among the fish farmers than dairy farmers in the present study. It is mainly because more than 90% of the people of Tripura eat fish which is an essential source of protein (Debnath *et al.,* 2013). In developing countries, poor people with lower socio-economic conditions cannot get sufficient nutritional meals to maintain their well-being and health. The low incomce restricts them from taking meat or fresh fruits and vegetables. Fish and milk are less expensive for them and it meets people's dietary demands and daily protein requirement. The results are in agreement with the findings of Maurya and Kamalvanshi (2017).

Economic security

The present study selected economic security indicators like annual income, household assets, total expenditure and savings. The data in Table 2 show that 57.50% of the fish farmers had a medium economic security followed by low economic security (26.25%). In the case of dairy farmers, 45% had medium economic security, followed by low economic security (36.25%). Moreover, the average annual income of farmers was more under fish farming than in dairy farming. The result implies that the fish farmers' households are economically better and more secure than dairy farmers' households. Moreover, within the study area, fish and dairy farmers are involved in diverse livelihood activities to supplement their income. The primary sources of income reported by respondents include agriculture, livestock-rearing (such as cattle, poultry, piggery, duck and goat farming), non-agricultural pursuits (including government service, private work, and off-farm activities) and off-farm endeavours like labour and wood selling. However, several challenges persist, hindering the overall economic progress of farmers. These challenges encompass small and fragmented land holdings, reliance on monocropping, inadequate mechanisation and productivity levels, post-harvest losses, limited market linkages, subsistence farming practices, and slow adoption of advanced technologies (FAO, 2017). These results conforms the findings of Girish *et al.* (2020). The milk production of the north-eastern region is deficient compared to the national average. The productivity of indigenous breeds (such as Lakhimi, Bachaur, Purnea, Angatiri, Motu and Siri) is much lower than registered milk cattle breeds in India (*e.g.* Sahiwal, Gir, Red Sindhi, Tharparkar and Kankrej). As a result, there is an urgent need to improve the milk production situation in the north-eastern states to fulfil the milk requirement of the people and to improve the socio-economic condition of dairy farmers (Chandran *et al.,* 2014; Savalia*et al.,* 2019; Mandal *et al.,* 2020).

Health security

In this present research, health security among farmers was assessed using various indicators, including access to primary health care services, Body Mass Index (BMI, a measure of an individual's body weight in relation to their height, calculated as BMI = Weight/Height), and the availability of diverse health sanitation facilities. These indicators collectively provided a comprehensive evaluation of the health status and security of the farming population.

The results presented in Table 2 indicate reported that about 52.50% of fisheries respondents had a high health security followed by medium health security (36.25%) because most tribal people consumed processed fish like fermented and dried fish, which prevents obesity, diabetes and heart disease. Compared with fish farmers, about 46.25% of dairy farmers had high health security followed by medium level (37.50%). The present study confirmed that health security was significantly higher for fish farmers than dairy farmers in Tripura. In addition, both categories of farmers had good health security. The tribal diets are rich in milk, fruits, vegetables, pulses and flesh items like meat, fish and poultry. Milk and fish provide essential micronutrients and potential health benefits, including reduced blood pressure, regulated metabolism and prevention of cardiovascular diseases, ultimately improving human health (Mittal and Srivastava, 2006; Ruidavets *et al.*, 2007;

Table 2. Distribution of respondents according to different livelihood security indicators

Indicators	Categories based on HLSI*	Fish farmers (n=80)		Dairy farmers (n=80)	
		Frequency	%	Frequency	%
Food security	Low (<0.52)	12.00	15	17	21.25
	Medium (0.53 to 0.69)	43.00	53.75	40	50
	High (>0.69)	25.00	31.25	23	28.75
	Mean	0.65		0.54	
Economic security	Low (<0.35)	21	26.25	29	36.25
	Medium (0.36 to 0.48)	46	57.5	36	45
	High (>0.48)	13	16.25	15	18.75
	Mean	0.38		0.31	
Health security	Low (<0.55)	9	11.25	13	16.25
	Medium (0.56 to 0.71)	29	36.25	30	37.5
	High (>0.71)	42	52.5	37	46.25
	Mean	0.71		0.64	
Educational security	Low (<0.37)	11	13.75	7	8.75
	Medium (0.38 to 0.49)	42	52.5	40	58.75
	High (>0.49)	27	33.75	33	42.5
	Mean	0.44		0.47	
Social security	Low (<0.22)	31	38.75	23	28.75
	Medium (0.23 to 0.39)	33	41.25	40	50
	High (>0.39)	16	20	17	21.25
	Mean	0.29		0.35	
Institutional security	Low (<0.34)	35	43.75	39	48.75
	Medium (0.35 to 0.47)	27	33.75	28	35
	High (>0.47)	18	22.5	13	16.25
	Mean	0.41		0.35	
Infrastructure security	Low (<0.45)	22	27.5	13	16.25
	Medium (0.46 to 0.61)	29	36.25	45	56.25
	High (>0.61)	29	36.25	22	27.5
	Mean	0.6		0.53	

*HSLI=Household Livelihood Security Index

Ghosh-Jerat *et al.*, 2016). The number of health care infrastructure, health workers, health specialists and sub-centers like primary health centres (PHCs), community health centres (CHCs) and health and wellness centres (HWCs) in rural and urban areas that are operational is higher in Tripura than in other north-eastern states such as Arunachal Pradesh, Meghalaya, Manipur, Mizoram, Nagaland and Sikkim. Furthermore, the Tripura Government consistently prioritises health awareness and vaccination programmes for major diseases, exhibiting significant progress in its immunisation initiatives (IIPS, 2021; HFWDT, 2022). This proactive approach extends to both tribal and non-tribal communities, highlighting the state's commitment to ensuring comprehensive healthcare interventions for the people.

Educational security

Educational security was measured using the education level of the respondent, women's and children's literacy level in a household, availability of educational facilities and infrastructure in the area. The results presented in Table 1 indicate that about 52.50% of fisheries respondents had medium educational security, followed by a high level 33.75%. When compared with the fish farmers; about 58.75% of dairy respondents had a medium level of educational security, followed by a high level of 42.50%. Only 8.75% of dairy farmers had lower levels of educational security, which is lower compared to fish farmers (13.75%). Educational security was significantly average in both cases of dairy and fisheries tribal farmers. Many adolescents from tribal communities drop out due to financial challenges of their parents; their lack of interest in school and difficulties in getting higher education (Debbarma, 2022). To address these challenges, the Tripura Government has made improvements to the Integrated Child Development Scheme (ICDS) and implemented several programmes and policies that significantly reduced the dropout rate at the primary and upper primary levels as well as improved the educational security among tribal people (Saha and Roy, 2020; Ghosh *et al.*, 2021).This finding is consistent with the findings of Chauhan *et al.* (2022).

Social security

The ability of people to sustain and participate in social networks which enable them to achieve sustainable livelihoods by lowering risks, accessing resources and requiring understanding is referred to as social security. Social networks are the extent to which farmers participate in Panchayat, Co-operative, Self-Help Groups, and other organisations. The data in Table 2 shows that 41.25% of the fisheries respondents had a medium social security level followed by low social security (38.75%). In the context of dairy farmers, half of the

total dairy respondents had medium social security (50%), followed by low social security (28.75%). The present study confirmed that the social security was significantly higher for dairy farmers than fish farmers in Tripura; which might be due to the higher social status of dairy farmers compared with the fish farmers. In Tripura, over 592 primary dairy co-operative societies are functioning with a membership of around 32,000 dairy producers. The total number of co-operatives in the fisheries sector is 308, with 24000 fishers, which is lower than dairy farmers (ARD, 2020; FISHCOPFED, 2021). Additionally, the number of dairy-based SHGs (752) is also higher than the number of fishery-based SHGs (632) (MFAHD, 2019; DoF, 2021). The finding is in contrast to that of Pradhan *et al.* (2020).

Institutional security

Institutional security refers to a household's accessibility towards public and private institutions, including those that provide services to residents like health agents, rural extension personnel, local NGO staff, teachers and others, to receive funding, input, advice and suggestions. In this study, institutional security was measured with the help of different indicators like training attended by farmers, linkage with another institution and farmer's linkage with NGOs for getting help in terms of advice. The results presented in Table 1 revealed that 43.75% of fishery respondents reported a low institutional security level, while 33.75% reported a medium level. It was significant to observe that 22.50% of the fish farmers had a lower institutional security level. On the other hand, 48.75% of dairy respondents reported low institutional security, while only 16.25% of farmers reported high institutional security. The results indicated that institutional security was significantly higher for fish farmers than dairy farmers in Tripura because different fisheries institutions located in the study area regularly provide training and guidance about new farming practices and recent technologies to the fish farmers (Laheri*et al.,* 2019; Ghosh *et al.,* 2021; Debnath *et al.,* 2022). A large percentage of fish and dairy farmers have low institutional security, which suggests that there is a need to promote additional institutions and improve farmers' interactions with various institutions in their area to improve institutional security. Similar findings were also reported by Barela *et al.* (2018).

Infrastructure security

Infrastructure security is the basic safety offered by structural components necessary for a society to function. A society's critical infrastructure, such as roads, water supplies, sewage systems, electric utilities and telecommunications are included in this research.The data in Table 2 show that most fish farmers had medium and high infrastructure security. About 27.50% of fish farmers had a low level of infrastructure security. In the context of dairy farmers, 56.25% of the dairy respondents had medium Infrastructure security followed by a high level of Infrastructure security (27.50%). About 16.25% of dairy farmers had low infrastructure security. This finding is in line with the findings of Girish *et al.* (2020). The present study confirmed that the infrastructure security was significantly higher for fish farmers than dairy farmers in Tripura. Still, the average number of dairy farmers with medium infrastructure facilities is higher than that of fish farmers. Furthermore, the Government is working on creating an efficient supply chain that connects fish farmers to markets, providing necessary infrastructure such as all-weather roads, fish vehicles, and cold storage facilities and establishing quality standards for fish products (TWD, 2022). The Animal Husbandry Department has also taken several initiatives to improve the infrastructure, such as constructing milk collection centres, strengthening and expanding the cold storage facility for milk and milk products, and purchasing insulated and refrigerated transport vehicles for use in milk chilling and processing facilities, and provide subsidy for cattle shed and feed storage (SAIDP, 2019; Suchiradipta and Saravanan, 2018).

Overall livelihood security of fish and dairy farmers

An analysis of the distribution of fish and dairy respondents according to the overall Livelihood Security Index in Table 3 indicates that most fisheries and dairy respondents had medium to high levels of livelihood security. This could be attributed to the reliable income from dairy and fish farming. But in the case of dairy farmers, more percentages of farmers had low livelihood security (26.25%), because of lower milk production. This reduced milk output directly translates to a lower income potential for dairy farmers, impacting their overall economic stability. These study findings are consistent with Datta *et al.* (2014) and Chauhan *et al.* (2022). The large numbers of tribal fish and dairy farms have small and marginal soil fertility because of the hilly area. Moreover, all of them are entirely reliant on agricultural activities, which leads to less income. Therefore, the socio-economic status of farmers is low or medium and most of them fall into the low to medium livelihood security (Singh *et al.,* 2016; Das *et al.,* 2021).

Comparison of different livelihood security assets between fish and dairy farmers

According to the data of different livelihood assets (Fig. 2), the maximum livelihood indicator value for fish farmers was 0.63 and the minimum was 0.29. For dairy farmers, the maximum value of the livelihood indicator was 0.59 and the minimum was 0.31. The findings indicate that fish farmers had higher food security

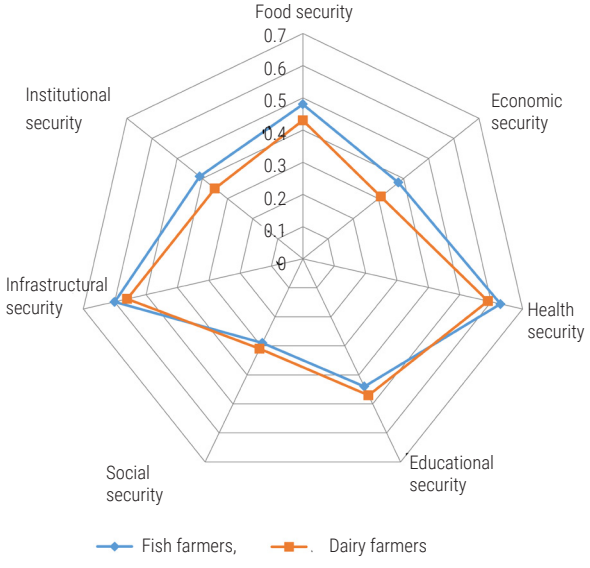

Fig. 2. Different livelihood security indicators of fish and dairy farmers

Table 3. Distribution of respondents according to overall Livelihood Security Index

Categories based on overall HLSI	Fish farmers (n=80)		Dairy farmers (n=80)	
	Frequency	%	Frequency	%
Very low (<0.31)	3	3.75	7	8.75
Low (0.32 to 0.40)	11	13.75	21	26.25
Medium level (0.41 to 0.53)	38	47.50	29	36.25
High level (0.54 to 0.63)	19	23.75	16	20.00
Very high (>0.63)	9	11.25	7	8.75
Total	80	100	80	100

(0.48), followed by economic (0.38), health (0.63), infrastructural (0.60) and institutional (0.41) security compared to dairy farmers. However, their educational (0.44) and social (0.29) security assets were relatively lower. On the other hand, dairy farmers exhibited greater educational (0.47) and social (0.31) security than fish farmers while experiencing low food (0.43), economic (0.31), health (0.59), infrastructural (0.56), and institutional (0.35) security (Fig. 1). These outcomes align with the research findings of Das *et al.* (2021).

The study highlights notable disparities in livelihood security levels between fish and dairy farmers. To enhance the overall livelihood security for both groups, it is crucial to address their common challenges, such as low income and limited access to resources. To achieve this, concerted efforts should focus on bolstering institutional support, promoting educational opportunities, and strengthening social networks. By implementing targeted interventions, we can ensure sustainable livelihoods for both fish and dairy farming communities. This calls for a holistic approach that recognises and leverages the unique strengths of each sector while addressing their specific vulnerabilities. By doing so, we can work towards bridging the gaps in livelihood security and fostering the well-being of these vital communities.

Acknowledgements

The authors sincerely acknowledge the cooperation of the tribal fish and dairy farmers of Tripura in gathering primary data. The authors are also thankful to the Central Agricultural University, Imphal, Manipur, India, for the necessary infrastructural support for conducting the study and the Directorate of Animal husbandry and Directorate of Fisheries, Government of Tripura, for providing necessary information.

References

Acharjee, M. K. and Ray, A. K. 2013. Research issues and priorities in the field of agriculture sector and dairy scenario of Tripura: A critical analysis. *Int. J. Eng. Res.,* 2(07): 49-55.

Alfares, H. K. and Duffuaa, S .O. 2008. Assigning cardinal weights in multi-criteria decision making based on ordinal ranking. *J. Multi-Criteria Decis. Anal.,* 15(5-6): 125-133. https://doi.org/10.1002/mcda.420.

ARD 2022. *Statistical, Animal Resources Development Department*, Tripura, India. https://ardd.tripura.gov.in/?q=stat. (Accessed 21 July 2023).

Asish, D., Koloi, S., Sarkar. D., Tripura, S., Debbarma, A. and Debbarma, K. 2021. Livestock and fodder production scenario of Tripura: An overview. *Int. J. Agric. Innov. Res.,*10: 18-20.

Barela, H. R., Jha, S. K., Rai, C. K. and Yadav, R. 2018. Assessment of livelihood security of tribal farmers: A case study from tribalarea of Madhya Pradesh, India. *Int. J. Curr. Microbiol. Appl. Sci.,* 7(3): 1135-1141. https://doi.org/10.20546/ijcmas.2018.703.135.

Chandra, K., Kosygin, L., Raghunathan, C. and Gupta, D. 2021. Faunal diversity of North-East Biogeographic Zone of India: An overview. *Faunal Diversity of Biogeographic Zones of India: North-East*, pp. 1-39.

Chandran, P. C., Dey, A., Babari, S. K., Kamal, R., Bhatt, B. P. and Prasad, R. E. 2014. Characteristics and performance of bachaur cattle in the gangetic plains of North Bihar: *Indian J. Anim. Sci.,* 84(8): 872-875. https://doi.org/10.56093/ijans.v84i8.43271.

Chauhan, J. K., Meena, B. S., Meena, H. R., Bhakat, C., Upadhyay, A. D., Lahiri, B., Pal, P., Tengli, M. B., Kumar, S., Chandegara, A. K. and Koreti, K. 2022. Assessment of livehood security and diversification of tribal diary farmers in NEH region of India. *Indian Res. J. Ext. Edu.,* 22(3): 182-187.

DAHDT 2020. *Department of Animal Husbandry and Dairying.* Govt. of Tripura, Tripura.

Das. A., Datta, D., Samajdar, T., Idapuganti. R. G., Islam, M., Choudhury, B. U. and Yadav, G. S. 2021. Livelihood security of small holder farmers in eastern Himalayas, India: Pond based integrated farming system a sustainable approach. *Curr. Res. Envr. Sustain.,* 3: 100076. https://doi.org/10.1016/j.crsust.2021.100076.

Datta, M. D. 2014. *Comparative study of socio-economic status of the farmers in adopted and non-adopted village.* Ph. D. Thesis, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India.

Deb, D., Jamatia, M., Debbarma, J., Ahirwal, J., Deb, S. and Sahoo, U. K. 2021. Evaluating the role of community-managed forest in carbon sequestration and climate change mitigation of Tripura, India. *Water Air. Soil Pollut.*, 232: 1-17.

Debbarma, N. 2022. Securing job by the educated tribal youths of Tripura: Issues and challenges. *J. Adv. Sch. Res. Allied Educ.,* 19(1): 190-194. https://doi.org/10.29070/JASRAE.

Debnath, C., Sahoo, L., Yadav, G. S., Datta, M. and Ngachan, S. V. 2013. Integrated fish farming. *Indian Farming*, 62(10):1 8-21.

Debnath, R., Ghosh, A., Lahiri, B., Singh, Y. J., Pal, P., Upadhyay, A. D. and Baidya, S. 2022. Advisories on fish farming in Tripura for coping with COVID 19: An Outlook. *Fishery Technol.,* 59: 303-310.

Deka, S. 2011. Health and nutritional status of the Indian tribes of Tripura and effects on education. *Inq. Journal,* 3(3): 1-5.

DoF 2014. *Ongoing development programmes: Dept of Fisheries,* Government of Tripura, India. https://fisheries.tripura.gov.in/program.htm.

DoF 2021. *Directorate of Fisheries,* Govt. of Tripura, India.

DoF 2023. *Annual report 2022-23.* Department of Fisheries, Govt. of Tripura, India. http://www.fisheries.tripura.gov.in.

Drinkwater, M. and Rusinow, T. 1999. Application of CARE's livehoods approach *Presentation for NRAC'99. CARE memo.* https://www.eldis.org/document/A40253.

Duarte, C. M., Holmer, M., Olsen, Y., Soto, D., Marba, N., Guiu, J. and Karakassis, I. 2009. Will the oceans help feed humanity?. *BioScience,* 59(11): 967-976. https://doi.org/10.1525/bio.2009.59.11.8.

FAO 2017. *The future of food and agriculture: Trends and challenge.* Food and Agriculture Organisation of the United Nations, Rome, Italy. www.fao.org/3/i6583e/i6583e.pdf.

FAO 2018. *India at a glance.* Food and Agriculture Organisation of the United Nations, Rome, Italy. https://www.fao.org/india/fao-in-india/india-at-a-glance/en/ (Accessed 20 November 2021).

FAOSTAT 2021. *Food and agriculture data.* Food and Agriculture Organisation of the United Nations, Rome, Italy. https://www.fao.org/faostat/en/ (Accessed 21 July 2023).

FISHCOPFED 2021. *National Federation of Fishermen's*. Govt. of Tripura, India.http://www.fishcopfed.in/ (Accessed 21 July 2023).

Frankenberger, T. 1996. Measuring household livelihood security: An approach for reducing absolute poverty. *Food Forum,* 34. Washington, USA, pp. 1-6.

Ghosh, A., Debnath, R., Lahiri, B., Debbarma, S., Shil, B. and Pandey, P. 2021. Fisheries education for tribal communities: A transect from Tripura. *J. Crop Weed,* 17(2): 183-188. https://doi.org/10.22271/09746315.2021.v17.i2.1469.

Ghosh, R. and Chaudhury, J. 2018. Health security among the tribal and non-tribal elderly persons in Tripura. *Int. Res. J. Manag. Sociol. Humanit.,* 9(6): 35-43.

Girish, C., Kadian, K., Meena, B. and Mandi, K. 2020. An assessment of livehood security of farmers practicing sericulture based dairy farming in Karnataka State. *Int. J. Livest. Res.,* 10(6): 43-50. http://dx.doi.org/10.5455/ijlr.20200410020955.

Haan, D. and Zoomers, A. 2002. Development geography at the crossroads of livelihood and globalisation. *Royal Dutch Geographical Society,* 9(4): 339-365. https://doi.org/10.1111/1467-9663.00262.

HFWDT 2022. *Health and Family Welfare Department,* Government of Tripura, India.

IIPS 2021. *National Family Health Survey (NFHS-5), Tripura*, *India:* International Institute for Population Science, Mumbai, India.

Khan, N., Afaq, F. and Mukhtar, H. 2010. Lifestyle as risk factor for cancer: Evidence from human studies. *Cancer Lett.,* 293(2): 133-143. https://doi.org/10.1016/j.canlet.2009.12.013.

Kumar, A., Patyal, A. and Panda, A. K. 2018. Sub-therapeutic use of antibiotics in animal feed and their potential impact on environmental and human health: A comprehensive review. *Anim. Feed Sci. Technol.,* 6: 25.

Kumar, M. D., Sivamohan, M. V. K. and Bassi, N. 2022. *Agrarian crisis in India: Status, dimensions and mitigation strategies*. SAGE Publishing, India.

Kumar, S., Singh, L., Singh, R., Thombare, P. and Devi, S. R. 2020. Agro ecological approaches for strengthening of Krishi Vigyan Kendras (KVKs) in India. *Andhra Agric. J.,* 67(Sp-II): 75-80.

Lahiri, B., Ghosh, A., Biswas, P., Mandal, S. C., Anurag, T. S. and Pandey, P. K. 2019. Development and deployment of mobile-based fishery advisory system in the north-eastern state of Tripura: Possibilities and scope. *Indian J. Ext. Educ.,* 55(3): 158-163.

Mandal, D. K., Mohammad, A., Rai, S. and Ghosh, M. K. 2020. *NDRI Policy Paper No: NDRI-ERS-1/2020.* ICAR-National Dairy Research Institute, Eastern Regional Station, A-12, Kalyani, Nadia, West Bengal, India, pp. 1-40.

Maurya, M. K., Kamalvanshi, V. 2017. Livelihood security of farmers in eastern Uttar Pradesh: An economic analysis. *J. Plant Dev. Sci.*, 9(12): 1095-1100.

MFAHD 2021. *Handbook on fisheries statistics.* Ministry of Fisheries, Animal Husbandry and Dairying, Government of India. https://dof.gov.in/sites/default/files/2021-02/Final_Book.pdf.

Mittal, P. C. and Srivastava, S. 2006. Diet, nutritional status and food related traditions of Oraon tribes of New Mal (West Bengal). *India Rural and Remote Health,* 6(1): 385.

NFDB 2019. *Annual report 2018-19. National Fisheries Development Board*, Department of Fisheries. Ministry of Fisheries, Animal Husbandry and Dairying, Government of India. http://nfdb.gov.in/about-indianfisheries.htm(Accessed 21 July 2023).

Noor, N., Zong, G., Seely, E. W., Weisskopf, M. and James-Todd, T. 2018. Urinary cadmium concentrations and metabolic syndrome in US adults: The National Health and Nutrition Examination Survey 2001–2014. *Environ. Int.*, 121: 349-356. https://doi.org/10.1016/j.envint.2018.08.029.

Pradhan, S., Naberia, S., Harikrishna, Y. V. and Jallaraph, V. 2020. Livelihood security of small farmers in Jabalpur District of Madhya Pradesh. *Indian J. Ext. Educ*., 56(4): 98-102.

Ramanuja, I., Rao, A., Selim, R. and Motukuri, B. 2009. *A pathway out of poverty: Bamboo incense sticks production as a livelihood option for rural women in Tripura, India.* Centre for Indian Bamboo Resource and Technology (CIBART), New Delhi, India.

Ruidavets, J. B., Bongard, V., Dallongeville, J., Arveiler, D., Ducimetière, P., Perret, B., Simon, C., Amouyel, P. and Ferrières, J. 2007. High consumptions of grain, fish, dairy products and combinations of these are associated with a low prevalence of metabolic syndrome. *J. Epidemiol. Community Health,* 61(9): 810-7. https://doi.org/10.1136/jech.2006.052126.

Saha, A. and Roy, M. 2020. Government policies and financial assistance for development of tribal education in Tripura. *Int. Multidiscip. Res. J.,* 6: 94-101.

SAIDP 2019. *State agriculture infrastructure development plan,* Department of Agriculture, Govt. of Tripura, India. https://rkvy.nic.in/static/SAIDP/TR/For%20this%20Period(2017-18%20to%202019-20)/SAIDP%20Tripura-%2021-03-2020%20(1).pdf (Accessed 21 July 2023).

Savalia, K. B., Ahlawat, A. R., Gamit, V. V., Parikh, S. S. and Verma, A. D. 2019. Recently recognized indigenous cattlebreeds of India: A Review. *Int. J. Curr. Microbiol. Appl. Sci.,* 8(12): 161-168. https://doi.org/10.20546/ijcmas.2019.812.024

Shil, B., Lahiri, B., Pal, P., Ghosh, A., Biswas, P. and Singh, Y. J. 2022. Determinants of adoption behaviour of the fish farmers of Pabda fish culture (*Ompok bimaculatus* Bloch, 1794) in Tripura, Northe-ast India. *Aquac. Int.,* 30(4): 2017-2041.

Shree, J. S. and Prabhu, M. 2019. An outlook on growth of dairy sector and its contribution to Indian economy. *Int. J. Livest. Res.,* 9(6): 240-247. . http://dx.doi.org/10.5455/ijlr.20190304061536.

Siddhnath, Ranjan, A., Mohanty, B. P., Saklani, P., Dora, K. C. and Chowdhury, S. 2022. Dry fish and its contribution towards food and nutritional security. *Food Rev. Int.,* 38(4): 508-536. https://doi.org/10.1080/87559129.2020.1737708.

Singh, A. K., Gohain, I. and Datta, M. 2016. Upscaling of agroforestry homestead gardens for economic and livelihood security in mid–tropical plain zone of India. *Agrofor. Syst.*, 90: 1103-1112. https://doi.org/10.1007/s10457-015-9886-7.

Suchiradipta, B. and Saravanan, R. 2018. Status of agricultural market and value chain in Tripura. *Working Paper 2,* Centre For Agricultural Extension Innovations, Reforms and Agripreneurship, National Institute for Agricultural Extention Management, Hyderabad, India.

TWD 2022. *Stakeholder engagement plan, Tripura Rural Economic Growth and Service Delivery Project,* Govt. of Tripura, India. http://twd.tripura.gov.in.

Upadhyay, A. D., Patel, A. B. and Pandey, D. K., 2012. Analysis of food security of fish farmers of Tripura using clustering technique.*J. Comm. Mobil. Sustain. Dev*., 7(1): 32-37.