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Feeding coping strategies adopted for dairy animals during the 2018 floods in Kerala, India

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Abstract

This study investigates the feeding coping strategies adopted by dairy farmers in the severely flood-affected districts of Thrissur, Ernakulam, and Idukki in Kerala, India, following the devastating 2018 monsoonal floods. The objective was to assess the cognitive and behavioral efforts employed by farmers to safeguard their livestock and preserve productivity. A sample of 180 dairy farmers from 12 purposively selected panchayats was surveyed, and adoption was measured using a three-category scale (Adoption Continued, Discontinued, or Never Adopted), which allowed for the computation of index scores and rankings. The results indicate that "stoppage of grazing and stall feeding the animals" was the universally highest-ranked coping mechanism across all three districts. Other highly ranked strategies included "creation of facilities for storage of excess fodder in higher grounds" and "sharing of feed and water among fellow farmers." Conversely, "adjusting cropping pattern to tackle flood" and "feeding feed additives like mineral mixture" were the least adopted strategies, reflecting disparities in implementation based on practical and topographical constraints. The findings emphasize the immediate and collaborative strategies utilized by farmers during the crisis.

Keywords: Floods, dairy farming, feeding coping strategies

Introduction

Livestock serves as a cornerstone of rural India's socio-economic structure, offering a secure investment avenue, steady income, social prestige, and nutritional security for smallholder families (BIRTHAL *et al.*, 2015) [4]. India hosts the world's largest livestock population, totalling 535.78 million heads as per the 20th Livestock Census (2019), including 192.49 million cattle, with significant contributions to GDP (approximately 4.5%) and employment for over 20 million rural households (Department of Animal Husbandry and Dairying, 2019) [5]. In Kerala, the livestock sector comprises about 17.5 million animals—cattle (3.4 million), buffaloes (0.4 million), goats (2.8 million), pigs (0.3 million), and poultry (10+ million)—supporting livelihoods amid the state's high human development index but vulnerability to climate hazards (Government of Kerala, 2020) [6].

Flood Vulnerability in Kerala

Kerala, in India's southwest, faces recurrent monsoonal floods due to its topography, with over 40% of its 38,863 km² area flood-prone, exacerbated by heavy rainfall (average 3,000 mm annually) and dam releases (Kerala State Disaster Management Authority, 2019) [9]. The 2018 floods, the worst in a century, resulted from 2,744 mm rainfall (23% above normal), causing 483 human deaths, the displacement of 1.4 million, and ₹31,000 crore economic losses, including severe agricultural submersion (5.54 lakh hectares) (Jayawardhana *et al.*, 2022) [8]. Livestock suffered immensely: over 200,000 animals affected or lost across 14

districts, with 46,000 cattle deaths, fodder destruction, and milk procurement drops of 25-30% statewide (Sasi & Satheesh, 2018) [17] (Arun and Senthilkumar, 2025) [3].

Materials and Methods

According to United Nations assessments, seven Kerala districts—Alappuzha, Ernakulam, Idukki, Kottayam, Pathanamthitta, Thrissur, and Wayanad—sustained the most severe impacts from the 2018 floods (United Nations, 2018) [19]. For this study, Thrissur, Ernakulam, and Idukki districts were purposively selected due to their substantial declines in milk procurement—33.58%, 29.58%, and 16.92%, respectively—despite Pathanamthitta recording the highest proportional drop (67.74%) from a comparatively low baseline production (Patil Sachin *et al.*, 2022) [15]. These districts thus better represented the broader regional crisis in Kerala's dairy sector, characterised by high livestock density and recurrent flood exposure (Jayawardhana *et al.*, 2022) [8]. Four panchayats from each district have been selected based on the severity of the flood. Based on secondary data from the Department of Dairy Development and the Kerala State Animal Husbandry Department, a sample of fifteen affected farmers was chosen at random from each selected panchayat. 180 responders from 12 panchayats constituted the final sample size.

Coping strategies, in this context, denote the cognitive and behavioural efforts employed by dairy farmers to manage or mitigate flood-induced stressors on livestock and livelihoods (Lazarus & Folkman, 1984) [10]. Consistent with

this transactional stress model, strategies were classified as problem-focused (e.g., direct interventions to alter the stressor, such as structural protections) or emotion-focused (e.g., efforts to regulate distress through resource sharing or psychological adjustment). The present investigation specifically examined feeding-related coping mechanisms, which aimed to safeguard dairy animals from starvation while preserving productivity amid annual monsoon risks.

Measurement of Feeding Coping Strategies

Potential feeding coping strategies were identified via an exhaustive literature review and consultations with domain experts from Kerala's veterinary and dairy extension services. Farmer adoption was assessed using a three-category response scale: continuously adopted (AC), adopted but discontinued (AD), or never adopted (NA). This continuum scoring system (2, 1, 0 points, respectively) captured the dynamic nature of practices under recurrent flooding, enabling computation of adoption indices and rankings for comparative analysis across districts (Saravanan *et al.*, 2022)^[16].

Results

The perusal of Table 1 indicated that in Thrissur district, stoppage of grazing and stall feeding them in shed during flood disaster was followed by 98.33 per cent of respondents. This was followed by creation of facilities for storage of excess fodder in higher grounds (93.33%),

sharing of feed and water with fellow farmers (83.33%), adoption of mixed farming (73.33%), cultivation of fodder for making hay to be used in event of flood (66.67%), feeding the crop residues and tree leaves damaged by the flood (66.67%), practice of planting flood resistant fodder trees like Bamboo(*Mula*), Garuga (*Kattunelli*), Erytherina (Indian coral tree, *Mullumurukku*) (66.67%), cultivation of flood resistant fodder (Guinea grass and Gamba grass) (63.33%), ascertaining the source of water before watering the animals during the flood disaster (63.33%), reducing the frequency of feeding to the non-productive animals during flood disaster (58.33%), adjusting the cropping pattern to tackle flood (50%) and feeding feed additives like mineral mixture to cope up with stress (35%).

In Idukki district, stoppage of grazing and stall feeding during flood disaster was followed by all of the respondents. This was followed by creation of facilities for storage of excess fodder in higher grounds (98.33%), sharing of feed and water with fellow farmers (95%), reducing the frequency of feeding to the non-productive animals during flood disaster (93%), adoption of mixed farming (83.33%), practice of planting flood resistant fodder trees like Bamboo(*Mula*), Garuga (*Kattunelli*), Erytherina (Indian coral tree, *Mullumurukku*) (83.33%), cultivation of flood resistant fodder (Guinea grass and Gamba grass) (75%) cultivation of fodder for making hay to be used in event of flood (68.33%), ascertaining the source of water before watering the animals during the flood disaster (61.67%).

Table 1: Feeding coping mechanisms followed by respondents (Percentage)

Sl. No.	Feeding management	Thrissur				Idukki				Ernakulam			
		AC	AD	NA	Total	AC	AD	NA	Total	AC	AD	NA	Total
1	Feeding the crop residues and tree leaves damaged by the flood	66.67	26.67	6.67	100	56.67	20	23.3	100	75	10	15	100
2	Reducing the frequency of feeding to the non-productive animals	58.33	25	16.67	100	93	0	6.67	100	88	0	11.67	100
3	Sharing of feed and water	83.33	15	1.67	100	95	0	5	100	88.33	0	11.67	100
4	Stoppage of grazing and stall feeding	98.33	1.67	0	100	100	0	0	100	100	0	0	100
5	Ascertaining the source of water before watering the animals	63.33	1.67	35	100	61.67	0	38.3	100	61.67	0	38.33	100
6	Cultivation of fodder for making hay to be used in event of flood	66.67	30	3.33	100	68.33	6.67	25	100	80	6.67	13.33	100
7	Facilities created for storage of excess fodder in higher grounds	93.33	0	6.67	100	98.33	0	1.67	100	96.67	0	3.33	100
8	Planting flood resistant fodder trees like Bamboo (<i>Mula</i>) Garuga (<i>Kattunelli</i>), Erytherina (Indian coral tree, <i>Mullumurukku</i>)	66.67	1.67	31.67	100	83.33	3.33	13.3	100	63	10	26.67	100
9	Feeding feed additive like mineral mixture to cope up with stress	35	6.67	58.33	100	23.33	20	56.7	100	31.67	20	48.33	100
10	Cultivation of flood resistant fodder (Guinea grass, Gambagrass)	63.33	28.33	8.33	100	75	0	25	100	53.33	10	36.67	100
11	Adjusting cropping pattern to overcome flood	50	13.33	36.67	100	15	23.3	61.7	100	25	23.3	51.67	100
12	Adoption of mixed farming	73.33	6.67	20	100	83.33	6.67	10	100	81.67	8.33	10	100
AC: Adoption Continued; AD: Adoption Discontinued; NA: Never Adopted													

feeding the crop residues and tree leaves damaged by the flood (56.67%), feeding feed additives like mineral mixture to cope up with stress (23.33%), and adjusting the cropping pattern to overcome flood (15%).

In Ernakulam district, stoppage of grazing stall feeding during flood disaster was followed by 100 per cent of respondents. This was followed by creation of facilities for storage of excess in higher grounds (96.67%), sharing of feed and water with fellow farmers (88.33%), reducing the frequency of feeding to the non-productive animals during flood disaster (88%), adoption of mixed farming (81.67%),

cultivation of fodder for making hay to be used in event of flood (80%), feeding the crop residues and tree leaves damaged by the flood (75%), practice of planting flood resistant fodder trees like Bamboo(*Mula*), Garuga (*Kattunelli*), Erytherina (Indian coral tree, *Mullumurukku*) (63%), ascertaining the source of water before watering the animals during the flood disaster (61.67%), cultivation of flood resistant fodder (Guinea grass and Gamba grass) (53.33%), feeding feed additives like mineral mixture to cope up with stress (31.67%) and adjusting the cropping pattern to tackle flooding season (25%).

Table 2: Index score and ranking of feeding coping mechanism followed by respondents

Sl. No.	Feeding management	Thrissur	Idukki	Ernakulam
1	Feeding the crop residues and tree leaves damaged by the flood	0.80(v)	0.67(ix)	0.80(vii)
2	Reducing the frequency of feeding the non-productive animals	0.71(viii)	0.93(iv)	0.88(iv)
3	Sharing of feed and water among farmers	0.91(iii)	0.95(iii)	0.88(iii)
4	Stoppage of grazing and stall feeding the animals	0.99(i)	1.00(i)	1.00(i)
5	Ascertaining the source of water before watering the animals	0.64(x)	0.62(x)	0.62(ix)
6	Cultivation of fodder for making hay to be used in event of flood	0.82(iv)	0.72(viii)	0.83(vi)
7	Facilities created for storage of excess fodder in higher grounds	0.93(ii)	0.98(ii)	0.97(ii)
8	Planting flood resistant fodder trees like Bamboo (<i>Mula</i>) Garuga (<i>Kattunelli</i>), Erytherina (Indian coral tree, <i>Mullumurukku</i>)	0.68(ix)	0.85(vi)	0.68(viii)
9	Feeding feed additive like mineral mixture to cope up with stress	0.38(xii)	0.33(xi)	0.42(xi)
10	Cultivation of flood resistant fodder (Guinea grass, Gamba grass)	0.78(vi)	0.75(vii)	0.58(x)
11	Adjusting cropping pattern to tackle flood	0.57(xi)	0.27(xii)	0.37(xii)
12	Adoption of mixed farming	0.77(vii)	0.87(v)	0.86(v)

The perusal of Table 2 indicate that in Thrissur district, stoppage of grazing and stall feeding them in shed during flood disaster with an index score of 0.99 ranked first among feeding coping mechanism. This was followed by creation of facilities for storage of excess fodder in higher grounds(0.93), sharing of feed and water with fellow farmers(0.91), cultivation of fodder for making hay to be used in event of flood(0.82), feeding the crop residues and tree leaves damaged by the flood(0.80), cultivation of flood resistant fodder (Guinea grass and Gamba grass) (0.78), adoption of mixed farming(0.77), reducing the frequency of feeding to the non-productive animals during flood disaster(0.71), practice of planting flood resistant fodder trees like Bamboo(*Mula*), Garuga (*Kattunelli*), Erytherina (Indian coral tree, *Mullumurukku*)(0.68), ascertaining the source of water before watering the animals during the flood disaster(0.64), adjusting the cropping pattern to tackle flood (0.57) and feeding feed additives like mineral mixture to cope up with stress (0.38).

In Idukki district, stoppage of grazing and stall feeding them during flood disaster with an index score of one ranked first among the feeding coping mechanism. This was followed by creation of facilities for storage of excess fodder in higher grounds(0.98), sharing of feed and water with fellow farmers(0.95), reducing the frequency of feeding to the non-productive animals during flood disaster(0.93), adoption of mixed farming(0.87), practice of planting flood resistant fodder trees like Bamboo(*Mula*), Garuga (*Kattunelli*), Erytherina (Indian coral tree, *Mullumurukku*)(0.85), cultivation of flood resistant fodder (Guinea grass and Gamba grass)(0.75), cultivation of fodder for making hay to be used in event of flood(0.72), feeding the crop residues and tree leaves damaged by the flood(0.67), ascertaining the source water before watering the animals during the flood disaster(0.62), feeding feed additives like mineral mixture to cope up with stress(0.33) and adjusting the cropping pattern to tackle flood (0.27).

In Ernakulam district, stoppage of grazing and stall feeding them in shed during flood disaster with an index score of one ranked first among feeding coping mechanism. This was followed by creation of facilities for storage of excess fodder in higher grounds(0.97), sharing of feed and water with fellow farmers(0.88), reducing the frequency of feeding to the non-productive animals during flood disaster(0.88), adoption of mixed farming(0.86), cultivation of fodder for making hay to be used in event of flood(0.83),

feeding the crop residues and tree leaves damaged by the flood(0.80), practice of planting flood resistant fodder trees like Bamboo(*Mula*), Garuga (*Kattunelli*), Erytherina (Indian coral tree, *Mullumurukku*) (0.68), ascertaining the source of water before watering the animals during the flood disaster(0.62), cultivation of flood resistant fodder (Guinea grass and Gamba grass)(0.58), feeding feed additives like mineral mixture to cope up with stress(0.42) and adjusting the cropping pattern to tackle flood (0.37).

Discussion

The result of the study indicated that the stoppage of grazing for the herd animals and feeding them in a shed during flood disasters was followed by all the farmers invariably in all the three districts as the animals are at high risk when they are allowed to graze during floods (Patil *et al.* 2022) ^[14] (Pashudhan Praharee 2023) ^[13]. Sharing of feed and water with fellow flood affected dairy farmers was adopted by almost all the farmers in all the districts. (The Hindu BusinessLine 2018) ^[18] This was followed by practice of creating facilities for storage of excess and dry fodder in higher grounds by almost all the farmers in all the districts, aligning with recommended feed banks for emergencies (Anitha *et al.* 2023) ^[1]. Reducing the frequency of feeding to the non-productive animals during flood disaster was followed by majority of dairy farmers in Idukki and Ernakulam district. (Arun and Senthilkumar 2020) ^[2] This coping mechanism was followed by only half of dairy farmers in Thrissur district. Adoption of mixed farming was followed by almost two thirds of dairy farmers in all the three districts

The following four coping mechanisms of feeding the crop residues and tree leaves damaged by the flood, cultivation of fodder for making hay to be used in event of flood, planting flood resistant fodder trees like bamboo (*Mula*), Garuga (*Kattunelli*), Erytherina (Indian coral tree, *Mullumurukku*) and cultivation of flood resistant fodder (Guinea grass, Gamba grass) was adopted by two third of dairy farmers in all the districts.

The coping mechanism of ascertaining the source of water before watering the animals during the flood disaster was followed by three fourths of dairy farmers in Ernakulam and Thrissur district. Feeding feed additive like mineral mixture to cope up with stress was followed by only one third of the dairy farmers in all districts. Adjusting the cropping pattern to tackle flooding season was followed by half of dairy

farmers in Thrissur district one fifth of the dairy farmers in Idukki and Ernakulam district.

The findings of the result was in accordance with findings of Meena *et al.* (2016)^[12] who attributed that flood destroys livestock feed and fodder and revealed that all the farmers preferred to store crop residuals and forage from forest area to fulfil the fodder demand during the anticipated flood season. The finding was further supported by Jahan *et al.* (2014)^[7] who reported that in Bangladesh, dairy farmers followed the practice of drying the rice straw and using it as for cattle feed during flood and Maiti (2013)^[11] who reported that drought affected dairy farmers followed feeding extra concentrate, supplementation of minerals and feed additives and usage of crop residue and hay as fodder as coping strategies.

The practice of adjusting the cropping pattern to tackle the flooding season was more easily followed in Thrissur district as it is plains, unlike Idukki district, which is mountainous, where mostly plantations such as spices and tea were cultivated.

Conclusion

The research clearly establishes that dairy farmers' immediate, problem-focused coping mechanisms were paramount during the 2018 Kerala floods. The universal adoption and top ranking of "stoppage of grazing and stall feeding the animals" highlights the critical importance of immediate animal safety during a disaster. The high index scores for both "storage of excess fodder in higher grounds" and "sharing of feed and water" affirm the effectiveness of community solidarity and proactive, structural measures. However, the study also revealed significant gaps in the adoption of long-term and preparatory measures, particularly in "adjusting cropping pattern" and "feeding feed additives." The lower adoption of cropping changes in mountainous Idukki, compared to the plains of Thrissur, demonstrates how local geography dictates the feasibility of specific strategies. To enhance long-term resilience against recurrent floods, extension agencies should focus on promoting and supporting these less-adopted strategies, ensuring that dairy farmers are equipped with a diverse and effective portfolio of coping mechanisms that are tailored to their regional context.

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