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A scale to measure knowledge level of dairy farmers affected by Kerala flood 2018 on disaster recovery

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Abstract
Kerala is worst affected by flood disaster in August 2018. Livestock sector was one of the worst affected with death of dairy animals and drastic reduction in milk production. In this context, it is imperative that the dairy farmers are sensitized and trained to face future disasters confidently. With this background the present study was contemplated to develop and standardize a scale for measuring dairy farmers' knowledge on disaster recovery. On the basis of thinking and differentiation of well knowledgeable dairy farmers from poorly knowledgeable dairy farmers 41 items comprehensively covering each aspects of disaster recovery were constructed. After performing relevancy test with help of extension specialists, 16 items were selected. The obtained scores from each 16 items were used for item analysis comprising item difficulty index, discrimination index and point biserial co- relation. All the items which had a difficulty index ranging from 0.25 to 0.75, discrimination index above 0.2 and point biserial correlation value which was significant at 5% level of significance were selected for final knowledge scale. A total of 09 items were selected in final scale. Reliability of knowledge test was measured by Cronbach alpha. Cronbach's alpha was found to be excellent 0.835, which is very high and indicates strong internal consistency among the 09 items. Developed knowledge test was found to be high stable and dependable measurement.

Keywords: dairy farmers, knowledge test, difficulty index, discrimination index, cronbach alpha test of reliability, validity

Introduction
Knowledge is a body of understood information possessed by an individual. (Bhatt and Patel, 2009) [1]. Knowledge is one of the most important elements of behaviour as it commands a very important role in the covert and overt behaviour of an individual. Knowledge has the capacity to make a person enabled to make progress in occupational life using science and technology. It makes human involved in any occupation far more competent, advanced and sophisticated being to handle business. (Shafi and Chauhan, 2021) [2]. An appropriate knowledge test helps to know the level of relevant knowledge of the target population.

Disaster is a sudden, calamitous event bringing great damage, loss and destruction and devastation to life and property. The damage caused by disasters is immeasurable and varies with the geographical location, climate, the type of the earth surface and degree of vulnerability. (Shah, 2011) [3]. India is highly vulnerable to natural disasters especially earthquakes, floods, drought, cyclones and landslides. India is ranked 11th among 15 countries facing "extreme risk" from natural disasters. (Arun and Senthilkumar, 2020) [4]. Among the various natural disasters, the flood is the greatest natural disaster that results in the massive loss of vegetation (Kashyap *et al*., 2021) [5]. India is the most flood-affected nation in the world after Bangladesh. (Kausik and Sharma (2012) [6]. India has faced 649 disasters of various natures from 1915 to 2015. Out of these 649 disaster events, 302 disasters were caused by flood with on an average of 3 floods per year. This accounted approximately 47% of total disasters took place in India in the last 100 years. (Tripathi, 2015) [7]. Gupta *et al*. (2003) [8] surmised that flooding cause wide spread damage to human lives, crop, plantation, property, infrastructure and business. Floods also leave in their wake epidemiological threats, breakdown of social order and migration. Rapid population growth and unplanned development is accelerating vulnerability to floods as deforestation worsens the incidence of floods and settlements encroach into flood-prone lands. Roughly 30 million people in India are affected by floods and more than 1500 lives lost each year.

Disasters affect the animals in the same way as human beings. Livestock population is the first to be affected in the precarious situation due to natural disaster like flood, drought, cyclone,

volcanic eruption, earth quake and tsunami. (Heath *et al*. 1999) [9]. During any disaster for human beings, supplies of essential commodities are maintained even with great difficulty. In such situations saving of human life is considered on top priority basis and thus rescue, relief and rehabilitation is more directed for the people of affected areas with meagre attention to livestock and their sufferings (Pyne *et al*. 2009; Rasool *et al*. 2020) [10, 11].

Kerala experienced an abnormally high rainfall from 1 June 2018 to 19 August 2018. As per IMD data, Kerala received 2346.6 mm of rainfall in this period in contrast to an expected 1649.5 mm of rainfall which was about 42% above the normal. (Central Water Commission, 2018) [12]. The flooding affected over 5.4 million people and caused severe damages to housing, transport networks, power supplies and other infrastructure, alongside destroyed crops and lost livestock. The initial post disaster needs assessment estimated recovery needs of US$ 4.4 billion. (Anonymous, 2020) [13].

One of the key gaps as observed in Kerala post disaster needs assessment (PDNA) Floods and landslides - August 2018 by United Nations was that the flood warning is understood by people but was ignored. Hence, the community preparedness to respond to such disaster was low. Although the flood warnings were provided to the community, there was reluctance to respond to warnings due to lack of knowledge about the impact of the flood. Knowledge, innovation, and the appropriate use of technology are vital in addressing the sustainable development and climate change challenges that loom large today. (Anonymous, 2018) [14].

The Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030 addresses knowledge-related issues and provides the opportunity to highlight the critical role of knowledge in disaster risk reduction. Disaster risk reduction policy and practices require knowledge for informed decision making and coordinated action. The SFDRR sets first priority for action as understanding disaster risk which relates to issues of knowledge, that are directly or indirectly linked to information and knowledge. (UNISDR, 2015a) [15].

The SFDRR also points to the importance of ensuring knowledge dissemination, taking into account the needs of different categories of users. This is important since many countries do not systematically collect disaster-related facts, data, and information. Depending on the agency or institution, the collection ranges from hazard type to risk exposure and disaster damage. Thus, knowledge is scattered among various actors and arenas with limited coherence, coordination, and sharing. (UNISDR, 2015b) [16].

Disaster recovery is a phase in the emergency management cycle that frequently overlaps with the emergency response. Its goal is to restore normal community activities that were disrupted by disaster impacts through a process involving both activities that were planned before disaster impact and those that were improvised after disaster impact. (Lindell, 2013) [17] The disaster recovery phase involves diffuse, long term, and potentially quite costly activities which aims for early return to normalcy and the reduction of future vulnerability to disasters. (Labadie, 2008) [18].

The flood and other disasters are more likely to affect humans in coming years. The agriculture and animal husbandry sector are most vulnerable to the disaster fury. In this context it is prudent that the farmers are made knowledgeable about the methods to overcome flood and other disasters successfully. Accordingly, a knowledge test was developed to assess dairy farmer's knowledge on disaster recovery keeping in mind the vulnerability of the Kerala dairy farmers to flood disaster. There is no proper scale available to measure dairy farmers' knowledge on disaster recovery. Hence, the present study was contemplated to develop and standardise a scale for measuring dairy farmers' knowledge on disaster recovery. For the purpose of this study, knowledge was operationalised as the information and understanding of the dairy farmer regarding disaster recovery. Knowledge test score can also be used as a variable to test its relationship with other variables.

Methodology

The present investigation was conducted in two panchayats *viz*., Kozhinjampara and Perumatty gram panchayats in Palakad district, Kerala during December 2020. A sample of 60 respondents was selected *i.e.* 30 from each panchayat. The knowledge test was developed by employing following the procedure and the standardization of the test items were presented below.

Item collection

The content of knowledge test was composed of questions (items). An item pool of questions was prepared by reviewing literature, referring textbooks and conducting discussions with subject matter specialists and field extension personnel. Finally, a through scrutiny of the item pool was done with the assistance of subject matter specialists. The questions were designed to test the knowledge level of flood affected dairy farmers about disaster recovery. A total of 41 knowledge items were initially constructed for relevancy test.

Relevancy rating

It was possible all the statements collected may not be relevant equally in measuring the knowledge level of flood affected dairy farmers about disaster recovery. Hence, these statements were subjected to scrutiny by an expert panel of judges to determine the relevancy and screening for inclusion in the final scale. For this, the entire 41 statement list was sent to panel of judges who are experts in the field of extension education. The statements were sent to 45 Judges with request to critically evaluate each statement for its relevancy to measure knowledge level of flood affected dairy farmers on disaster recovery. The judges were requested to give their response on a four point continuum *viz*., most relevant, relevant, somewhat relevant and with scores 4, 3, 2 and 1 respectively. The relevancy score of each item was established by adding the scores on the rating scale for all the judges' responses. From the data three types of tests *viz*., relevancy percentage, relevancy weightage and mean relevancy scores was worked out for all the statements.

The statements satisfying the following criteria i.e., Relevancy % >70, Relevancy weightage >0.70 and Mean relevancy score > 2.8 were selected

A total of 16 items were selected.

Item analysis

Item analysis is a valuable, yet relatively simple, procedure performed after the examination that provides information regarding the reliability and validity of a test item. (Considine *et al*. 2005) [19]. It also tells how difficult or easy the questions were, the difficulty index, and whether the questions were able to discriminate between respondents who performed well on the test, from those who did not, the discrimination index. (Sim and Rasiah, 2006) [20].

All the items collected for the construction of the knowledge test were in the objective form. The questions were yes or no items involving impersonal and objective assessment. The 22 questions selected were subjected to sixty respondents who were flood affected dairy farmers. The responses were scored. For each correct answer, one mark was assigned. For each wrong answer as well as those which the respondents don't know as scored as zero. The respondents' total knowledge score was calculated by summating the scores of all the questions. The calculated knowledge scores were used to calculate Difficulty Index, Discrimination Index and Point biserial correlation.

Difficulty index (DI)

Difficulty index is defined as the percentage of those respondents recording either a true or false response for a particular branch in a multiple true-false response, multiple choice questionnaire who gave the correct response. (Dixon, 1994) [21]. Difficulty index (p-value), also called ease index, describes the percentage of respondents who correctly answered the item. It ranges from 0 - 100%. The higher the percentage, the easier the item. The recommended range of difficulty is from 25 - 75%. Items having p-values below 25% and above 75% are considered difficult and easy items respectively. The difficulty of a question varied from individual to individual. Simple index of difficulty item is the percentage of the respondents answering an item correctly. The difficulty index of each of the 22 items was calculated dividing the total correct responses for a particular item by total number of respondents as under

$$pi = \frac{ni}{Ni} \times 100$$

Where,
Pi = Difficulty index in percentage of the ith item
ni = Number of respondents giving correct answer to ith item
Ni = Total number of respondents to whom the items were administered i.e. 60

Discrimination index (DcI)

Discrimination index is a measure, of how the 'good' respondents are doing versus the 'poor' respondents on a particular question. (Taib and Yusoff, 2014) [22]. The statement which is answered correctly by everyone or the one which is not answered by anyone in the sample had no discrimination value. Therefore, only those statements with high power to discriminate the respondents who varied in the level of knowledge were included in the final list. The discrimination power of all the seventeen items were worked out using E1/3 method to find out the item discrimination, as given below. In this method, those 60 respondents were divided into six equal groups, each having ten respondents and they were arranged in descending order of their magnitude of their knowledge scores as obtained from them. The middle two groups were eliminated. Only four extremes groups i.e. the groups with highest and lowest scores were considered in order to calculate the 'Discrimination Index'. It is calculated by the following formula:

$$E1/3 = \frac{(S1 + S2) - (S5 + S6)}{N/3}$$

Where,
N = Total number of respondents to whom the items were administered.
S1 and S2 are the frequencies of correct answers of highest and higher scores, respectively.
S5 and S6 are the frequencies of correct answers of lower and lowest scores, respectively.

Point biserial correlation (Rp bis)

A correlation between a continuous and a dichotomous variable is known as the point-biserial correlation (Demirtas and Hedeker, 2016) [23]. Point biserial is a product moment correlation that is capable of showing the predictive power an item has contributed to prediction by estimating the correlation between each item and the total test score of all the examinees (Essen and Akpan, 2018) [24]. To check the internal consistency of an item, its relationship with the total score when it was found to a dichotomised answer to a given item, point biserial correlation was computed.

$$Rp\ bis = \frac{Mp - Mq}{Sigma} \times \sqrt{pq}$$

Where,
Rp bis is the point biserial correlation
Mp is the mean of the total score of the respondents who answered an item correctly
Mq is the mean of the total score of the respondents who answered an item incorrectly
Sigma is the standard deviation of the entire sample
p is the proportion of the respondents giving correct answer to an item
q is the proportion of the respondents giving incorrect answer to an item
The calculated point biserial correlation values were statistically tested with n-2 degrees of freedom.

Results and Discussion

The items were collected from different sources and were administered to 60 respondents. Scores were given as 1 against a correct response and 0 for an incorrect one. After getting response of all the 22 items, the difficulty index, discrimination index and point bi serial correlation were calculated using the formula discussed in the methodology section. (Table 1) The items, having difficulty index value within 0.25 to 0.75 and discrimination index value above 0.2 and point bi serial correlation value which was significant at 5% level of significance were selected as final items of the knowledge test. Thus, finally 09 items (Table 1) were selected for the knowledge test which were considered as neither too difficult nor too easy to reply and could discriminate the well -informed individuals from the less-informed ones.

Table 1: Item analysis

S. No.	Knowledge items	DI	DcI	Rp bis value
1	How deceased dairy animals are identified? (Name any one)*	45.00	0.7	0.649
2	Insurance is the best method to alleviate loss of the animal in disaster event*	68.33	0.4	0.392
3	The insurance premium amount charged by insurance companies per year is 2.75 percent of insured value*	43.33	0.65	0.610
4	Which Organisation offers dairy animal insurance? (Name any one)*	33.33	0.3	0.390
5	Do you know the process of filing Insurance claim in event of death of dairy animals?*	35.00	0.5	0.424
6	Do you know the procedure for filing compensation form government?*	35.00	0.45	0.454
7	Post mortem of the deceased dairy animals is done by Veterinarian	56.67	0.2	0.226
8	The nodal agency for flood hazard management in Kerala is revenue department	18.33	0.35	0.408
9	Paddy lands and Wet land are called as Flood Buffer	23.33	0.7	0.580
10	The conservation of Paddy land and wetland act is enacted on 2005 in Kerala	21.67	0.65	0.549
11	The toll free number for flood emergency operations centre in Kerala is 1077*	68.33	0.4	0.392
12	The online portal for payment to CMDRF is cmdrf.kerala.gov.in*	31.67	0.45	0.364
13	Contribution to CMDRF is entitled for income tax exemption*	45.00	0.35	0.277
14	RFID tagging of dairy animals is being carried out for correct identification and to monitor vaccination history of the animals	10.00	0.2	0.295
15	Establishment of mobile veterinary services units to provide on-site service delivery is a major initiative of government post flood 2018	16.67	0.5	0.512
16	The Calamity fund from central government for disaster management is National fund for calamity relief	15.00	0.25	0.257

*Statements selected for knowledge test

Standardisation of the scale

Validity of the knowledge test

Validity refers to the degree to which evidence and theory support the interpretations of test scores for proposed uses of tests (Kane, 2016) [25]**.** The validity of the knowledge test was established through content validity. The content validity of the knowledge test was ensured by choosing items in consultation with various subject matter specialists. All possible care was taken while selecting the items and the same were subjected to difficulty and discrimination index and point biserial correlation, to select the final statements. Hence, it was logical to assume that the test satisfied representative as well as sensible approach of test construction, the criteria for content validity.

Reliability of the knowledge test

Kumar (2016) [26] stated that when a test gives consistently the same results when applied to the same sample, the test is said to be reliable. The reliability of the test was determined by the Cronbach alpha coefficient of reliability test. Cronbach's coefficient alpha is widely used as an index of reliability and frequently reported in social and behavioural studies. (Zumbo and Rupp, 2004) [27]. An attempt was made to study and evaluate the reliability of developed knowledge scale through Cronbach's alpha by using Statistical Package for Social Sciences (SPSS). The test was administered to 40 flood affected dairy farmers who were selected randomly from two panchayats *viz*., Kozhinjampara and Permatty in Palakad district, Kerala during December 2020. The collected data were tabulated and analysed to estimate the alpha value. The alpha was calculated using formula as follows:

$$\alpha = \frac{K}{K-1}\left(\frac{\sum_i^K = 1\ \sigma^2 y_i}{\sigma^2 x}\right)$$

Where,

α = Cronbach's alpha reliability coefficient

K = Number of items

$\sigma^2 y_i$ = The variance of item i for the current sample of persons

$\sigma^2 x$ = The variance of the observed total test scores

Cronbach's alpha was found to be excellent .835, which is very high and indicates strong internal consistency among the 09 items. Essentially, this means that respondents who tended to select high scores for one item also tended to select high scores for the others; similarly, respondents who selected a low score for one item tended to select low scores for the other knowledge statements. Thus, knowing the score for one knowledge statement would enable one to predict with some accuracy the possible scores for the other knowledge statements.

Table 2 highlights the column containing the 'Corrected Item-Total Correlation' for each of the items. It indicates the correlation between a given knowledge item and the sum score of the remaining items. Table 2 also highlights the Cronbach's alpha that would result if a given item was deleted. It shows that, the alpha value if the given item were not included among a set of items. For example, for Item1, if it was deleted the Cronbach's alpha would drop from the overall total of .835 to .828. It explains that the alpha would drop with the removal of first knowledge statement (Item1), which appears to be useful and contribute to the overall reliability of the knowledge scale.

Taber (2018) [28] surmised that alpha values were described as excellent (0.93-0.94), strong (0.91-0.93), reliable (0.84-0.90), robust (0.81), fairly high (0.76-0.95), high (0.73-0.95), good (0.71-0.91), relatively high (0.70-0.77), slightly low (0.68), reasonable (0.67-0.87), adequate (0.64-0.85), moderate (0.61-0.65), satisfactory (0.58-0.97), acceptable (0.45-0.98), sufficient (0.45-0.96), not satisfactory (0.4-0.55) and low (0.11). While increasing the value of alpha is partially dependent upon the number of items in the scale, it should be noted that this has diminishing returns. In present developed knowledge scale, the alpha value was found to be excellent, which indicates the strong internal consistency among the set of items. Thus, Cronbach's alpha found that items used in scale for data collection were appropriate and reliable.

Table 2: Item total statistics

Item	Scale mean if item deleted	Scale variance if item deleted	Corrected item - total correlation	Cronbach's alpha if item deleted
Item 1	1.81	6.569	0.449	0.828
Item 2	1.80	6.848	0.313	0.842
Item 3	1.82	6.890	0.318	0.841
Item 4	1.78	5.998	0.658	0.805
Item 5	1.78	6.124	0.606	0.811
Item 6	1.80	6.298	0.560	0.816
Item 7	1.77	5.540	0.870	0.778
Item 8	1.81	6.319	0.566	0.816
Item 9	1.79	6.274	0.558	0.816

Conclusion

The reliability and validity of the scale indicated the precision and consistency of the results. The present developed scale shows better reliability and has strong and positive correlation between all the items, so there is no need to re-examine and modify the individual items for further investigation. With administering the test, a respondent were given one mark for each correct answer and zero mark for each wrong or don't know answer. The total score of the respondents on all items of the test were considered as the knowledge score of the respondents. On the basis of their knowledge score the respondents may be categorised as low, medium and high knowledge respondents. The test so developed could be used for assessing the knowledge level of dairy farmers on disaster recovery. Based on the knowledge levels the strategies could be chalked out for implementing disaster mitigation activities. This scale can be used to measure the farmers' knowledge on disaster recovery beyond the study area with suitable modifications.

References

1. Bhatt PM, Patel HB. A scale to measure knowledge of dairy farmers regarding improved animal husbandry practices. Gujarat Journal of Extension Education 2009;20-21:11-14.
2. Shafi, Mahammad RS, Chauhan NB. Factors affecting basic essential knowledge of dairy farmers' sons to be successful dairy farmers. Indian Research Journal of Extension Education 2021:21(2&3):94-97.
3. Shah AJ. An overview of disaster management in India. WIT Transactions on the Built Environment 2011;119:73-83.
4. Arun L, Senthilkumar R. An Indian Perspective of Flood and Livestock. International Journal of Current Microbiology and Applied Science 2020;9(06):2495-2502.
5. Kashyap A, Prusty S, Dubey M, Santra AK, Jain A. Feeding strategies during natural calamities. The Pharma Innovation Journal 2021;SP-10(1):232-236.
6. Kaushik AD, Sharma VK. Flood Management in India. Indian Journal of Public Administration 2016;58(1):119-136.
7. Tripathi P. Flood disaster in India: an analysis of trend and preparedness. Inter-disciplinary Journal of Contemporary Research 2015;2(4):91-98.
8. Gupta S, Javed A, Datt D. Economics of flood protection in India. In Flood Problem and Management in South Asia. Springer, Dordrecht 2003, 199-210.
9. Heath SE, Kenyon SJ, Zepeda Sein CA. Emergency management of disasters involving livestock in developing countries. Scientific and Technical Review of the Office International des Epizooties 1999;18:256- 271.
10. Pyne SK, Samanta G. Livestock management at different levels of disaster-strategy and execution. Indian Journal of Animal Research 2009;43(2):99-102.
11. Rasool S, Hamdani SA, Fayaz A, Jan A, Sajad S, Akand AH. Potential risks and their management strategies adopted by livestock owners during natural calamity in Jammu and Kashmir, India. The Pharma Innovation Journal 2020;SP-9(9):27-29.
12. Central Water Commission. Study Report. Kerala floods of August 2018. https://reliefweb.int/sites/reliefweb.int/files/resources/Rev-0.pdf
13. Anonymous. Disaster Risk Reduction in India-Status Report 2020. https://reliefweb.int/report/india/disaster-risk-reduction-india-status-report-2020
14. Anonymous. Kerala Post Disaster Needs Assessment Floods and Landslides 2018. https://reliefweb.int/report/india/kerala-post-disaster-needs-assessment-floods-and-landslides-august-2018
15. UNISDR. Sendai framework for disaster risk reduction 2015-2030. United Nations International Strategy for Disaster Reduction 2015a. https://www.wcdrr.org/preparatory/post2015.
16. UNISDR. Global Assessment Report on Disaster Risk Reduction 2015: Making Development Sustainable: the Future of Disaster Risk Management. United Nations. International Strategy for Disaster Reduction 2015b. https://www.undrr.org/publication/global-assessment-report-disaster-risk-reduction-2015
17. Lindell MK. Recovery and reconstruction after disaster. Encyclopedia of natural hazards. (Bobrowsky eds) 2013, 812-824.
18. Labadie JR. Auditing of post-disaster recovery and reconstruction activities. Disaster Prevention and Management: An International Journal 2008;17(5):575-586.
19. Considine J, Botti M, Thomas S. Design, format, validity and reliability of multiple choice questions for use in nursing research and education. Collegian 2005;12(1):19-24.
20. Sim SM, Rasiah RI. Relationship between item difficulty and discrimination indices in true/false-type multiple choice questions of a para-clinical multidisciplinary paper. Annals-Academy of Medicine Singapore 2006;35(2):67-71.
21. Dixon RA. Evaluating and improving multiple choice papers: true-false questions in public health medicine. Medical education 1994;28(5):400-408.
22. Taib F, Yusoff MSB. Difficulty index, discrimination index, sensitivity and specificity of long case and

multiple choice questions to predict medical students' examination performance. Journal of Taibah University Medical Sciences 2014;9(2):110-114.
23. Demirtas H, Hedeker D. Computing the point-biserial correlation under any underlying continuous distribution. Communications in Statistics-Simulation and Computation 2016;45(8):2744-2751.
24. Essen C, Akpan G. Analysis of difficulty and point-biserial correlation indices of 2014 Akwa Ibom State Mock Multiple Choices Mathematics Test. International Journal of Education and Evaluation 2018;4(5):1-11.
25. Kane MT. Validity as the evaluation of the claims based on test scores. Assessment in Education: Principles, Policy & Practice 2016;23(2):309-311.
26. Kumar R, Slathia PS, Peshin R, Gupta SK, Nain MS. A test to measure the knowledge of farmers about rapeseed mustard cultivation. Indian Journal of Extension Education 2016;52(3&4):157-159.
27. Zumbo BD, Rupp AA. Responsible Modeling of Measurement Data for Appropriate Inferences: Important Advances in Reliability and Validity Theory. In David Kaplan (Ed.), The SAGE Handbook of Quantitative Methodology for the Social Sciences Thousand Oaks, CA: Sage Press 2004, 73-92.
28. Taber KS. The use of Cronbach's alpha when developing and reporting research instruments in science education. Research in Science Education 2018;48(6):1273-1296.