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

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Abstract

Kerala was worst affected by flood disaster in August 2018. The most effective strategy to mitigate the adverse effects of flood disaster is providing the general public with basic knowledge of how to respond to disasters. The present study was contemplated to develop and standardise a scale for measuring dairy farmers' knowledge on disaster response. Based on thinking and differentiation of well knowledgeable dairy farmers from poorly knowledgeable dairy farmers 27 items comprehensively covering each aspect of disaster response was constructed. Based on relevancy test, 16 items were selected. These selected knowledge items were subjected to item analysis comprising of difficulty index, discrimination index and point biserial co- relation. A total of 9 items were selected for the final scale. The reliability of the knowledge test was measured by Cronbach alpha. Cronbach's alpha was found to be excellent .811, which is very high and indicates strong internal consistency among the 09 items. The developed knowledge test was found to be highly stable and dependable measurement.

Keywords: *Disaster, response, knowledge scale, reliability, validity.*

Knowledge is a highly valued state in which a person is in cognitive contact with reality. Knowledge is a relation, on one side of the relation is a conscious subject, and on the other side

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is a portion of reality to which the knower is directly or indirectly related. (Zagzebski, 2017). The knowledge and skills are derived from man's daily interactions with the environment, observations and experiments. (Lenka and Satpathy, 2020). Disasters are defined as sudden unforeseen events with natural, technological or social causes that lead to destruction, loss and damage (Alexander, 2005). India has been traditionally vulnerable to natural disasters on account of its unique geo-climatic conditions. Among the flood-affected nations, India is known as one of the severely flood-affected countries in Asia, with one-fifth of global flood deaths and 12 per cent of geographical areas prone to various kinds of floods. (Mohanty *et al.,* 2020).

In August 2018, the state of Kerala experienced its worst flooding since 1924. As per IMD data, Kerala received 2346.6 mm of rainfall from 1 June 2018 to 19 August 2018 in contrast to an expected 1649.5 mm of rainfall which was about 42 per cent above the normal. (CWC, 2018).This unusual rainfall resulted in the most devastating floods of the century. The flooding occurred as a result of extreme rainfall in a short period of time, the geographical uniqueness of Kerala's land pattern and lack of quality drainage system (Saravanan *et al.,* 2021). Union of India declared this flooding as Level 3 calamity "calamity of severe nature". The state witnessed a loss of 400 human lives along with the loss of nearly 12,000 dairy animals and the destruction of about 57,000 hectares of cultivated land (Sachin *et al.,* 2022). The estimated economic loss was more than $3.8 million (Hunt and Menon, 2020).

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, community preparedness to respond to the flood 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. Further, the report recommended for improving knowledge, innovative measures and appropriate use of technology to address the flood situation (United Nations, 2018).

The agriculture and animal husbandry sectors are most vulnerable to disaster fury. According to Behera *et al.* (2020) floods results in unavailability of feed and shelter, affecting livestock in a stressed condition and ultimately suppressing their immunity, making them susceptible to infectious diseases. Li *et al.* (2013) contemplated that the most effective strategy to mitigate the adverse effects of a disaster is providing the general public with basic knowledge of how to respond to disasters (disaster response knowledge).

In this context, it is prudent that the dairy farmers are made knowledgeable about the methods to overcome flood and other disasters. Accordingly, a knowledge test was developed to assess dairy farmer's knowledge on disaster response 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 response. Hence, the present study was contemplated to develop and standardise a scale for measuring dairy farmers' knowledge on disaster response.

Materials and methods

In the present study, knowledge was operationalised as the information and understanding of the dairy farmer regarding disaster response. The knowledge test was developed and standardised by employing the following procedure

Item collection and relevancy rating

The content of knowledge test was composed of questions (items). An item pool of questions was prepared by reviewing the literature, referring textbooks and conducting discussions with subject matter specialists and field extension personnel. The questions were designed to test the knowledge level of flood-affected dairy farmers about disaster response. A total of 27 knowledge items were initially constructed for the relevancy test. The selected statements were subjected to scrutiny by an expert panel of judges to determine the relevancy and screening for inclusion in the

final scale as per the method suggested by Kumar and Ratnakar (2016). The statements satisfying the following criteria i.e., relevancy percentage >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 used for creating a viable question bank and to assess the respondent's performance as a part of formative assessment. 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 16 questions selected were subjected to sixty respondents who were flood affected dairy farmers. The investigation was conducted in two panchayats *viz.,* Kozhinjampara and Perumatty gram panchayats in Palakkad district, Kerala during December 2020 and the duration of study was 60 days. Initially, the base data of flood affected dairy farmers in the two panchayat were collected from panchayat office, Kerala state Animal Husbandry Department and Department of Dairy Development. A total of thirty flood affected dairy farmers from each panchayat were randomly selected.

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 (p-value), also called ease index, describes the percentage of respondents who correctly answered the item. It ranges from 0 – 100 per cent. The higher the percentage, the easier the item. The recommended range of difficulty is from 25 – 75 per cent. Items having p-values below 25 per cent and above 75 per cent are considered difficult and easy items respectively. (Hingorjo and Jaleel, 2012). The difficulty index of each of the 16 items was calculated dividing the total correct responses for a particular item by the total number of respondents as under

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

where,

Pi = difficulty index in percentage of the i^{th} item
ni = number of respondents giving correct answer to i^{th} item
Ni = total number of respondents to whom the items were administered i.e. 60

Discrimination index (DcI)

The item discrimination value of an item indicates the degree to which a single item predicts the value of the item battery. It is the ability of each individual item to discriminate between respondents with different levels of knowledge by measuring its correlation score on each item with the overall test score. The difficulty index values range from -1 to 1. The higher the value, the better the item measures what is intended to measure (Priyadharshini *et al.*, 2021). 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 17 items was worked out using E1/3 method to find out the item discrimination, as given below. In this method, the 60 respondents were divided into six equal groups, each having ten respondents and they were arranged in descending order of the 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 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

Table 1. Item analysis

Sl. No	Knowledge items	DI	DcI	Rp-bis value
1	During the event of flood disaster , dairy animals have better chance of survival if they are untethered*	71.67	0.3	0.384
2	During flood disaster move the dairy animals to higher ground *	63.33	0.3	0.341
3	Animals are natural swimmers*	68.33	0.3	0.353
4	The foremost important step to be taken in response to flood disaster is evacuation*	60	0.45	0.423
5	108 is Nationwide emergency contact number in case of any emergency*	70	0.25	0.287
6	101 is the phone number to be contacted in case of Fire	85	0.45	0.575
7	The Kerala Disaster Response Force is stationed at Peermedu, Idukki District	25	0.3	0.247
8	The regional response Centre of National Disaster Response Force is stationed at Kozhikode	11.67	0.35	0.411
9	Advice about care and management of animals during disaster can be accessed from veterinary department*	78.33	0.3	0.417
10	The nearest NDRF unit for Kerala is stationed at Arakonam - CISF	13.33	0.4	0.448
11	Name any voluntary organisations in your locality involved in disaster response (Name any one)*	70	0.45	0.495
12	During flood one should move in still water , not in moving water*	61.67	0.55	0.406
13	Walking in six inches of moving water will be dangerous	86.67	0.35	0.325
14	Kerala state emergency operations centre phone number is +91 471-236 4424	11.67	0.35	0.415
15	During cyclones the animals are safer outside than those sheltered	16.67	0.5	0.491
16	Deceased dairy animals should be disposed by deep burial*	53.33	0.45	0.408

*Statements selected for knowledge test

DI – Difficulty index DcI – Discrimination index Rp-bis - Point biserial correlation

of highest and higher scores, respectively

S5 and S6 are the frequencies of correct answers of lower and lowest scores, respectively

Point biserial correlation (Rpbis)

The main aim of calculating point biserial correlation (Rpbis) is to work out the internal consistency of the items i.e., the relationship of the total score to a dichotomized answer to any given item. It is the correlation between right/wrong scores obtained by respondents on a given set of items. It is a special type of correlation between a dichotomous variable (the multiple-choice item score which is right or wrong, 0 or 1) and a continuous variable (the total score on the test ranging from 0 to the maximum number of multiple-choice items on the test) (Sureshverma *et al.,* 2018). The point biserial correlation is calculated by

$$Rpbis = \frac{Mp-Mq}{Sigma} X\sqrt{pq}$$

where,

Rpbis 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, having difficulty index value within 0.25 to 0.75 and discrimination index value above 0.2 were selected for preparation of the final scale according to methodology adopted by Kumar *et al.* (2016). Along with the above selection criteria those items which secured point bi serial correlation value which was significant at 5 per cent level of significance were selected for the final items of the knowledge test. Thus, finally, 09 items (Table 1) were selected for the knowledge test which was considered as neither too difficult nor too easy to reply to and could discriminate the well-informed individuals from the less-informed ones.

Validity of the knowledge test

The validity of a scale is defined as "the extent to which an instrument measures the latent dimension or construct it was developed to evaluate" (Chan *et al.,* 2021). The validity of the knowledge test was established through content validity. Content validity refers to the adequacy with which a measure assesses the domain of interest. The need for content adequacy is vital if the items are to measure what they are presumed to measure. 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 was 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 a sensible approach of test construction, the criteria for content validity.

Reliability of the knowledge test

Reliability is defined as consistency in results from repeated measurements(Louangrath, 2018). The reliability of the test was determined by the Cronbach alpha coefficient of reliability test. The selected knowledge items were administered to 40 flood affected dairy farmers who were selected randomly from two panchayats viz., Kozhinjampara and Permatty in Palakkad 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

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

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 (0.811), 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. The table also highlights the Cronbach's alpha that would result if a given item was deleted. It also shows the alpha value if the given item was 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 .811 to .808. It explains that the alpha would drop with the removal of the first knowledge statement (Item1), which appears to be useful and contribute to the overall reliability of the knowledge scale.

Taber (2018) 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

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	1.83	6.240	0.378	0.808
Item 2	1.82	6.219	0.377	0.808
Item 3	1.85	6.528	0.271	0.819
Item 4	1.80	5.600	0.641	0.775
Item 5	1.80	5.978	0.464	0.798
Item 6	1.83	5.840	0.568	0.785
Item 7	1.80	5.198	0.833	0.747
Item 8	1.84	5.859	0.575	0.784
Item 9	1.81	5.998	0.469	0.797

(0.45–0.96), not satisfactory (0.4–0.55) and low (0.11). In present developed knowledge scale, the alpha value was found to be reliable, which indicates the strong internal consistency among the set of items.

Conclusion

Items selected for knowledge test fall within the range of recommended difficulty index, discrimination index, reliability and validity to ensure correct measurement of knowledge on disaster response. The test so developed could be used for assessing the knowledge level of dairy farmers on disaster response. 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 response beyond the study area with suitable modifications. Before application of this knowledge test to broader category of farmers in other vocations a need based analysis to understand the actual problem faced, need to be undertaken to understand.

Conflict of Interest

Certified that there is no conflict of interest to be declared in the present work.

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