Construction of Knowledge Test to Measure Knowledge of Buffalo Keepers

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ABSTRACT

The knowledge test was developed to measure the knowledge of buffalo keepers. Pertinent items were collected covering all aspects of buffalo production. After getting jury opinion on the items of test index of item difficulty, index of item discrimination and index of item validity were worked out. To administer the knowledge test a respondent is given one mark for each correct answer and zero mark for each wrong answer. The total score of the respondents on all items of the test is taken on the basis of their knowledge score and the respondents may be categorized into three groups having low, medium and high knowledge about buffalo production.

Key words: *Knowledge, Reliability, Validity, Biserial correlation, Item difficulty index, Discrimination index*

India holds fourth rank in the world in livestock population. The total population of livestock in the year (2003) was 497.7 million in India (Anonymous, 2003-04).The annual milk production of India was approximately 88.10 million tonnes in 2003-04, which is nearly 14.5 per cent of the world's milk production.

India also possesses about 56.8 per cent (92 million) of the world's buffalo population and is also a homeland for the best milk breed of buffaloes in the world. Buffaloes are considered more useful not only for quality butter and ghee but also for reasons such as higher fat components in milk, ability to utilize agriculture by produce and require fewer amounts of kilocalories to produce one kilogram milk.

Although the economic contribution of livestock seems to be quite substantial in the agricultural economy as well as in the national economy, the farmers who raise buffaloes are yet ignorant of scientific management practices.

If, feeding, breeding and other management practices fit in the proper operation, it would be possible to reach the desired level of milk production. To bring improvement in the cognitive domain of the buffalo keepers' behaviour it is essential to know about their existing knowledge levels about the improved buffalo production practices. For adoption of recommended improved technologies it is prerequisite on the part of adopters that they possess good knowledge about these technologies and practices. In the present context the term knowledge was conceptualized as the understood information about recommended buffalo production practices possessed by the buffalo keepers. A knowledge test has been defined by Bloom et al. (1995) as a test which refers to those behaviours and test situations which emphasize remembering by the recall of idea, material or phenomena. With this background a knowledge test was developed to assess the knowledge of buffalo keepers.

METHODOLOGY

For developing knowledge test the procedure followed by Jha and Singh (1970) was adopted with little modification.

Collection of items: Items about buffalo production were collected from the pertinent literature, personal experience, discussions held with the experts and pilot study conducted in the area of investigation. In all there were 66 items covering all the knowledge aspects of buffalo production. The items were edited and drafted in such a way that each item highlighted only one idea and did not have any ambiguity. All the items were having logical sequence.

Jury opinion : These 66 items were sent to the forty experts. The experts were requested to check each item

carefully whether the items were really measuring the knowledge of the respondents about buffalo production or not. They had, of course, liberty to add/delete or modify any of the items. After considering the opinion of the experts, 50 items were retained in the knowledge test.

Item analysis : The item analysis was done on the lines of technique used by Jha and Singh (1970) which yielded three kinds of information viz., index of item difficulty, index of item discrimination and index of item validity. The index of item difficulty indicated the extent to which an item was difficult to understand while the index of item discrimination was to find out whether an item really discriminated a well informed farmer from a poorly informed one. The index of item validity provided the information on how well an item measured or discriminated in agreement with rest of the test.

The 50 items were administered to 54 identical respondents who were not included in sample but they were included in pre-testing. Each statement was having two response categories either correct or wrong. Each correct answer was given '1' score while wrong answer was awarded '0' mark. Thus total score secured by all individual respondents on 50 items for correct answers was the knowledge score.

The scores obtained by 54 identical respondents were arranged in descending order and divided into six group's i.e. 9 respondents in each group. The groups were named as G1, G2, G3, G4, G5 and G6. The range of score obtained by the respondents of six groups was as follows:

Table 1. Range of scores obtained by the respondents
N= 54

S.No.	Scores out of 50	Respondents
G1	46 to 44	9
G2	43 to 40	9
G3	39 to 36	9
G4	35 to 32	9
G5	31 to 28	9
G6	27 to 25	9

For the purpose of item analysis, the middle two groups G3 and G4 were eliminated keeping four extreme groups with high and low scores. The data pertaining to the correct response for all the items in respect of these four groups were tabulated for calculating the difficulty and discrimination indices.

Item difficulty index (P): The index of item difficulty was worked out as the percentage of the respondents answering on items correctly. The assumption in this item index of difficulty was that the difficulty is linearly related to the level of respondents' knowledge about buffalo production practices. When a respondent answered an item, it was assured that the item was less difficult than his ability to cope with it. In this study with this assumption, the items with P values ranging from 25 to 82 were considered for final selection of knowledge battery. It was calculated by following formula:

No. of respondents answered correctly

$$P = \frac{\text{No.of respondents answered correctly}}{\text{Total no. of respondents}}$$

To illustrate, P or item no.19 (Table 2) was worked out in this way

$$P = \frac{33}{54} \times 100$$

$$P = 61.11$$

Discrimination index ($E_{1/3}$) : The second criterion for item selection was the discrimination index indicated by E1/3 values of item. In the present study, the items with E1/3 values ranging between 0.13 to 0.62 were considered for final selection. This index (E1/3) was calculated by the following formula:

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

Where, S1, S2, S5 and S6 are frequencies of correct answer in the group of G1, G2, G5 and G6, respectively.

N= Total number of respondents in the item analysis

Substituting the value for item number 35 of the table 2 the value arrived at was:

$$E1/3 = \frac{(8+6) - (5+3)}{54/3}$$

$$= \frac{14-8}{18}$$

$$= \frac{6}{18}$$

$$E1/3 = 0.33$$

Biserial correlation : It is used for the test item validation when the criterion of validity is regarded as internal consistency that is the relationship of total score to a correct / incorrect response to any given item. Keeping this in view, with the help of formula used by Guilford (1965), the significance of the biserial correlation for each of the items was calculated and tested by using the formula given by Guilford (1965).

Following formula was used:

$$\text{Biserial correlation (rbis)} = \frac{Mp-Mq}{sd} \times \frac{pq}{y}$$

Where,

Mp = Mean of x values for higher group in dichotomized variable

Mq = Mean of x values for lower group in dichotomized variable

p = Proportion of cases in higher group

q = Proportion of cases in lower group

y = Ordinate of the unit normal distribution curve

with surface equal to 1.0 at the point of division between segments containing p and q proportion of the cases.

$$sd = \sqrt{\frac{\sum x^2}{n} - \frac{(\sum x)^2}{n}}$$

Where;

sd = Standard deviation
$\sum x^2$ = Sum of squares of the responses of respondents
$\sum x$ = Sum of values of the responses for all the items
n = No. of respondents

To illustrate, rbis for item no. 40 (Table 2) was worked out in this way: The summation of the total score obtained by the respondents considered for item analysis in relation to the list of 50 items, X = 35.5 and the standard deviation (st) = 6.81.

n = No. of respondents
P = 1221 (Summation of the score obtained by 34 respondents passing the items 1817-596= 1221).

$$Mp = \frac{1221}{34}$$

= 35.91 (mean score)

$$\text{Proportion (p)} = \frac{34}{54}$$

= 0.63

Q= 596 (Summation of score obtained by 20 respondents not passing the item 1817-1221 = 596)

$$Mq = \frac{596}{20}$$

= 29.80 (Mean scores)

$$\text{Proportion (q)} = \frac{20}{54}$$

= 0.37

Pq/y= 0.6174, table value from Guilford (1965).

The proportion passing and failing are 0.63 and 0.37 respectively. The 'y' ordinate from table is 0.3776 Hence,

$$= \frac{0.63 \times 0.37}{0.3776}$$

= 0.6174

$$rbis = \frac{Mp - Mq}{sd} \times pq/y$$

$$rbis = \frac{35.91 - 29.80}{6.81} \times 0.6174$$

= 0.5539

*Test of significance of rbis: T*he coefficients of biserial correlation were tested for their significance by using the following formula as given by Guilford (1965).

$$t = \frac{rbis}{\sqrt{\frac{Pq/y - r2bis}{\sqrt{N}}}}$$

Where,

$\frac{rbis}{\sqrt{Pq/y - r2bis}}$ = Biserial correlation
= Standard error of biserial correlation
$\sqrt{N}$ = Total number of respondents

In this illustration for item no. 40 (Table 2), the values were

rbis = 0.5539
r2bis = 0.3068
$\sqrt{N}$ = 7.35

$$t = \frac{0.5539}{\frac{1.279 - 0.3068}{7.35}}$$

$$= \frac{0.5539}{0.1399}$$

= 4.19

(Significant at 0.01 per cent level of probability)

Representative of the test : Though, the aforesaid criteria were the main considerations for the final selection of the knowledge items, yet care was taken not to eliminate the important aspects 'if any. For this purpose experts' opinion about the items was considered.

Thus, in light to the four criteria, described above, 42 items were finally selected, which formed actual (final) format of the knowledge test.

Reliability : In the present study "Split halves method" was used to find out the reliability of the test. In this method 42 items were divided into equal halves with 21 odd number statements in one group and 21 even number statements in the other group. These were administered to 30 respondents separately who were not included in the final sample.

Having obtained the two sets of scores for each of the 30 respondents, coefficient correlation (reliability coefficient) between the two sets of scores was calculated, which was found to be highly significant (r= 0.7921). Therefore, it is concluded that the scale was reliable.

Validity : The biserial correlation (rbis) was considered as a measure of test items validity. Highly significant biserial correlation coefficient (rbis) values proved the construct validity of the items included in knowledge test battery.

Method of scoring knowledge: The final knowledge test had 42 items relating to buffalo production practices. Equal weightage was given to each item. For correct answer '1' score was awarded and '0' for wrong answers. Thus, knowledge test was ready for administering to the actual respondents.

Table 2. Aspects of knowledge about improved buffalo production practices with difficulty index, discrimination index and biserial correlation

S.No.	Buffalo production practices	P	E1/3	rbis
1	Important local breeds of buffalo for higher milk production	85.19	0.24	4.91*
2	Recommended breeds are important	77.77	0.36	2.99*
B	*Breeding*			
3	Symptoms of animals in heat	85.19	0.34	3.33*
4	Age of puberty in buffalo	85.19	0.36	2.90*
5	Age of first calving of the buffalo	77.78	0.28	2.92*
6	Method of insemination	85.19	0.30	3.21*
7	Advantages of A.I.	55.56	0.31	4.25*
8	Time of insemination when in heat	57.41	0.42	3.97*
9	Type of bull to be used for breeding	24.13	0.12	1.71 NS
10	Serving buffalo after calving	53.70	0.49	2.93*
11	Period of heat cycle in buffalo	75.93	0.39	2.89*
12	Confirmation about animal's conception	53.70	0.11	1.34 NS
13	Number of services a bull can be used for per week	46.36	0.35	2.29*
14	Feeding of a serving sire	72.22	0.42	2.19*
15	Appropriate length of age upto which a sire can be used for servising	59.30	0.26	2.23*
16	Proper ration for a dairy buffalo	55.56	0.35	3.27*
17	Computation of balanced ration	46.30	0.42	2.95*
18	Periodicity of concentrate feeding to a milking buffalo	21.25	0.11	1.09 NS
19	Improved fodder crops grown in area	61.11	0.44	4.93*
20	Most nutritive seasonal and perennial fodder crops for buffalo	18.32	0.08	1.77 NS
21	Importance of green fodder for buffalo	20.22	0.12	1.78 NS
22	Type of green fodder	88.33	0.41	3.88*
23	Every day mineral mixture requirement for the buffalo	22.27	0.13	1.89 NS
24	Enrichment of dry fodder for feeding to buffalo	53.70	0.39	2.99*
25	Methods used to increase the nutritive value of fodder	83.33	0.41	2.09*
26	Colostrum feeding to newly born calves	81.48	0.42	4.66*
27	Quantity of colostrum to be given to newly born calves	21.97	0.11	1.63 NS
28	Advantages of colostrum feeding	46.30	0.30	2.77*
29	Additional feed requirement for advanced pregnant buffalo	62.96	0.31	3.26*
30	Special ration to the buffalo soon before calving	24.73	0.17	1.16 NS
31	Special ration to the buffalo soon after calving	55.56	0.27	2.19*
C	*Management Practices*			
(i)	*Housing*			
32	Different types of housing systems for buffalo	72.22	0.42	2.45*
33	Area requirement for a buffalo in different sheds	85.19	0.56	3.25*
34	Type of flooring to be used for animals in a shed	74.07	0.55	2.77*
35	Method of keeping buffalo calves	55.56	0.33	3.30*
36	Maintenance of cleanliness in buffalo houses	85.19	0.14	4.96*
(ii)	*Health careand hygienr*			
37	Common diseases against which vaccination is done	83.33	0.45	4.80*
38	Practicing deworming of animals	79.63	0.47	3.29*
39	Safety measures to be taken for house hygiene	83.33	0.56	4.25*
40	Eradication of external parasites of buffalo	62.96	0.28	4.19*
41	Inferences to be drawn when animal is off -fed	85.19	0.47	3.95*
42	Precautions to be taken in the disposal of carcass	53.70	0.41	3.99*
(iii)	*Clean milk production*			
43	Correct method of milking	77.78	0.62	4.89*
44	Sanitary precautions to be taken while milking the animals	53.70	0.30	4.78*
45	Type of utensils to be used for clean milk	46.30	0.17	2.09*
46	Time after which the colostrum free milk is available from buffalo	61.11	0.26	3.25*
47	Measurement of the quantity of milk produced	70.37	0.47	2.88*
48	Stopping milking a buffalo before 2 months of calving	46.40	0.56	2.19*
49	The calf to suck its mother after 2-4 hours of calving	66.67	0.39	2.02*
50	Importance of keeping milk production record	72.13	0.67	4.26*

*Significant at 1 per cent level
P= Item difficulty index
E1/3= Discrimination of index
rbis = Biserial correlation coefficient
NS= Non significant

The knowledge index was calculated on the basis of following formula:

$$\text{Knowledge index} = \frac{X1+X2+X3\cdots\cdots X_n}{n} \times 100$$

Where,

X1, X2, X3……Xn = scores of items and

n = number of items.

Maximum possible knowledge score for 42 items including sub items was 102 and minimum was zero.

The mean and standard deviation of all the respondents' scores were computed for classifying the knowledge level in different categories. Based on the mean knowledge score and standard deviation three levels of knowledge of buffalo keepers were categorized under low, medium and high. The categorization was done according to following consideration:

Low knowledge level = Less than (Mean knowledge –SD)

Medium knowledge level = From (Mean knowledge $\pm$ SD)

High knowledge level = Above (Mean knowledge + SD)

Administration of knowledge test: While administrating the test, a respondent will be 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 will be considered as the knowledge score of the respondents. On the basis of their knowledge score the respondents may be categorized as low, medium and high knowledge respondents. The test so developed could be used for assessing the knowledge levels of buffalo keepers. Based on the knowledge levels the strategies could be chalked out for implementing buffalo development programmes.

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