Construction of Knowledge Test to Measure Knowledge of Buffalo Keepers

M.L. Meena¹, N.K. Sharma² and Aishwarya Dudi³

1. SMS (Agri Ext.), CAZRI, KVK, Pali-Marwar (Rajasthan) 306 401
2. Ass.Prof. & Head, Deptt.of Ext. Edu., SKN, COA., Jobner (Rajasthan)
3. SMS (Home Science), CAZRI, KVK, Pali-Marwar (Rajasthan) 306 401

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>
<thead>
<tr>
<th>S.No.</th>
<th>Scores out of 50</th>
<th>Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>46 to 44</td>
<td>9</td>
</tr>
<tr>
<td>G2</td>
<td>43 to 40</td>
<td>9</td>
</tr>
<tr>
<td>G3</td>
<td>39 to 36</td>
<td>9</td>
</tr>
<tr>
<td>G4</td>
<td>35 to 32</td>
<td>9</td>
</tr>
<tr>
<td>G5</td>
<td>31 to 28</td>
<td>9</td>
</tr>
<tr>
<td>G6</td>
<td>27 to 25</td>
<td>9</td>
</tr>
</tbody>
</table>

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 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:

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

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

\[
P = \frac{33}{54} \times 100 = 61.11
\]

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

\[
E_{1/3} = \frac{(S_1+S_2) - (S_5+S_6)}{N/3}
\]

Where, \(S_1, S_2, S_5\) and \(S_6\) are frequencies of correct answer in the group of G1, G2, G5 and G6, respectively.

\(N = \text{Total number of respondents in the item analysis}\)

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

\[
E_{1/3} = \frac{(8+6) - (5+3)}{54/3} = \frac{14 - 8}{6} = \frac{18}{6} = 0.33
\]

**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:

\[
\text{Biserial correlation (rbis)} = \frac{M_p-M_q}{\sqrt{sd} \times y}
\]

Where,

\(M_p\) = Mean of \(x\) values for higher group in dichotomized variable
\(M_q\) = 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
deivation (st) = 6.81.

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

$$M_p = \frac{34}{34} = 35.91 \text{ (mean score)}$$

Proportion (p) = $\frac{54}{34} = 0.63$

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

$$M_q = \frac{20}{20} = 29.80 \text{ (Mean scores)}$$

Proportion (q) = $\frac{54}{20} = 0.37$

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,

$$0.63 \times 0.37 = 0.3776$$

$$0.6174 \times \frac{0.63}{0.3776} = \frac{35.91 - 29.80}{6.81} \times 0.6174$$

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

$t = \frac{rbis}{\sqrt{N \text{ (Pq/y) - r}^2 \text{bis}}}$

Where,

- $rbis$ = Biserial correlation
- $\text{Standard error of biserial}$
- $N$ = Total number of respondents

In this illustration for item no. 40 (Table 2), the values were
$rbin = 0.5539$
$r^2\text{bis} = 0.3068$
$\sqrt{N} = 7.35$
$0.5539$

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

$= \frac{0.1399}{0.5539}$

= 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
with 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

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

*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:

\[
\text{Knowledge index} = \frac{X_1 + X_2 + X_3 + \ldots + X_n}{n} \times 100
\]

Where, 

\[
X_1, X_2, X_3, \ldots, X_n = \text{scores of items and } n = \text{number of items.}
\]

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 ± 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.

**REFERENCES**