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## An assessment to measure knowledge level of goat farmers on Artificial Insemination (AI), Assam, India

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### Abstract

A Knowledge test scale was developed to measure the knowledge level of goat farmers on artificial insemination (AI) in goat in Assam. The respondents' knowledge index scores were found to be ranged from 16.7 to 76.7 per cent. The item difficulty index (20–80), item discrimination index ( $\geq 0.3$ ) and point-biserial correlation (significant at the 5% level of significance) were employed to determine the final items for the test scale. Twenty items were chosen from a pool of thirty items for inclusion in the final format of the test scale. The entire scale was determined to have a content validity and a reliability coefficient of 0.80.

**Keywords:** Artificial insemination, Assam, goat, farmers, knowledge scale

### Introduction

A powerful method that can give livestock farmers more control over the pace of genetic development and reproductive enhancement in their herds is artificial insemination (Foote, 2002) [17]. Due to its simplicity, affordability and effectiveness, this method is one of the most important advances in reproductive technology in livestock (Vishwanath, 2003) [24]. It is also thought to be an effective way to increase the global goat population (Luo *et al.*, 2019) [14].

Adoption of AI as a technology in animal husbandry is contingent upon various factors *viz.*, socio-personal-cultural and economic traits, education, capital, income, herd size, information accessibility and social network utilisation (Agustine *et al.*, 2019 and DuttaBaruah *et al.*, 2023) [1, 7]. Every farmer has a different knowledge level and attitude, resulting in varying perspectives and levels of adoption (Sirajuddin *et al.* 2018) [20]. The success and development of livestock farming are determined by the farmer's knowledge level and how well the farmer takes decisions for its improvement (Meena *et al.*, 2012) [15-16].

Knowledge on AI in goat and goat's reproduction status are on the fence for the goat farmers in India. In some studies, many traits had been used to measure the knowledge level. Nevertheless, it's uncertain if the traits are one-dimensional, because many research conflate knowledge and attitude together. Therefore, the importance of knowledge on AI in goat remains ambiguous (Tekale *et al.*, 2013 and Jena *et al.*, 2018) [23, 11]. Hence, to measure the knowledge of goat farmers about AI, a standardized knowledge test scale was developed for the present study.

### Methodology

In the present study, knowledge was delineated as the goat farmer's information and comprehension of artificial insemination (AI) in goats. The respondents were asked to respond to a series of questions, each of which contains a predetermined right response (Roy and Mondal, 1999) [18]. The knowledge test was created and standardized by implementing the following approach.

### Item (statements) collection

The procedure of item analysis was used to create the examination.

After an initial literature review, 38 items were gathered and edited following criteria laid down by Likert (1932) [13] and Edward (1957) [8]. Items were chosen for their apparent clarity, simplicity and general applicability. The selected items were subjected to scrutiny by an expert panel of ten judges by giving a tick mark in the form of relevant, not relevant and ambiguous. As per their judgments, 8 items were eliminated and finally 30 items were selected to perform initial knowledge test. All the 30 items were selected to perform initial knowledge test were in the objective form having Yes and No type.

**Quantifying Knowledge index (Ki):** The items were administered to 30 respondents of Khanapara, District

Kamrup-Metro, Assam, selected at random. Their responses were qualified by giving a score of one (1) to correct answer and zero (0) to an incorrect answer. An overall respondents' knowledge (table 1) was computed for each item measured independently by using knowledge index technique as adopted by Meena *et al.* (2012) [15-16].

$$Ki = \frac{S_R}{S_M} \times 100$$

Where, Ki=Knowledge Index  
 S<sub>R</sub>= Score obtained by respondents  
 S<sub>M</sub>=Maximum obtainable score

**Table 1:** Respondents' Knowledge index (Ki) for 30 items

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ki	43.3	70	16.7	70	33.3	66.7	73.3	50	46.7	36.7	40	46.7	70	43.3	76.7
item	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ki	73.3	60	60	63.3	33.3	33.3	23.3	66.7	60	46.7	16.7	43.3	40	33.3	30

The respondents' knowledge index for each statement was found to be ranged from 16.7 to 76.7 per cent.

**Item Analysis**

The item analysis used by Jha and Singh (1970) and Devi (1987) was carried out with three kinds of indices *viz.*, "item difficulty index", "item discrimination index" and "point-biserial correlation".

After computing the total scores obtained by the respondents (non-sample), they were divided into six equal groups arranged in descending order of total scores. These six groups were labelled as G1, G2, G3, G4, G5 and G6 respectively with five respondents in each group (table 2). Further, for the purpose of item analysis, from the six groups, the middle two groups (G3 and G4) were eliminated, retaining only the four extreme groups with high (G1 and G2) and low (G5 and G6) scores.

**Table 2:** Scores of respondents from six groups

Group	Respondents	Scores	Group	Respondents	Scores	Group	Respondents	Scores
G1	1	23	G3	11	16	G5	21	13
	2	21		12	16		22	12
	3	21		13	16		23	11
	4	21		14	16		24	11
	5	20		15	16		25	9
G2	6	19	G4	16	15	G6	26	8
	7	18		17	15		27	8
	8	17		18	15		28	8
	9	17		19	15		29	7
	10	17		20	14		30	5
Extreme groups with high score			Eliminated group			Extreme groups with low score		

**Difficulty index (Di)**

The degree of difficulty of an item is indicated by the item difficulty index (Di). The percentage of right answers to an item was used to figure out the item difficulty index (Di). In practical terms, if an item is intended to differentiate between individuals, it should not be so easy to the point where everyone can pass it, nor should it be so tough to the point where no one is able to pass it. The item with Di values ranging from 20 to 80 only was considered for the final selection of the knowledge test (table 3). It was calculated by the following formula:

$$Di = \frac{N_c}{N} \times 100$$

Where,  
 Di = Difficulty index  
 N<sub>c</sub> = Number of respondents answering correctly  
 N = Number of respondents in the sample (i.e. G1, G2, G5 and G6)

**Discrimination index (E<sub>1/3</sub>)**

The function of item discrimination index (E<sub>1/3</sub>) was used to find out whether an item really discriminates a well-informed farmer from a poorly-informed one. To calculate the values of E<sub>1/3</sub>, as suggested by Sureshverma *et al.* (2018) [22] and Arun *et al.* (2022) [2], the following formula was used

$$E_{1/3} = \frac{(S1+S2) - (S5+S6)}{N/3}$$

Where, S1, S2, S5 and S6 are the frequencies of correct answer in the group G1, G2, G5 and G6, respectively. 'N' is the total member of respondents of the sample selected for the item analysis.

The discrimination index varies from 0 to 1. The items with discrimination index ranging from 0.30 to 0.80 or ≥0.30 were selected for the final test (table 3).

**Point bi-serial correlation (RPBIS):** The main aim of calculating point bi-serial correlation was to work out the

internal consistency of items that is the relationship of total scores (0 to maximum value) to a dichotomized answer (1 if correct and 0 if incorrect) to any given item. In a way, validity power of item was computed by correlation of individual item of whole test. Point bi-serial correlation for each of item to preliminary knowledge test was calculated (Garrett, 1966) <sup>[9]</sup>.

$$RPBIS = (M_p - M_q) / \sigma \times P \cdot Q$$

Where,

RPBIS = Point bi-serial correlation.

MP = Mean total scores of the respondents who answered the item correctly on dichotomous variable.

Mq = Mean total scores of respondents who answered item incorrectly on dichotomous variable.

$\sigma$  = Standard deviation of entire sample.

P = Proportion of respondents giving correct answer to item on dichotomous variable.

Q = Proportion of respondents giving incorrect answer to item on dichotomous variable (or 1-P)

The calculated point biserial correlation values were statistically tested with n-2 degrees of freedom. Eventually, items having significant biserial correlation at 0.5 level of probability were selected for the final knowledge test (table 3).

### Results and Discussions

The items, having difficulty index ( $D_i$ ) value within 20 to 80 and discrimination index ( $E_{1/3}$ ) value 0.30 to 0.80 or  $\geq 0.3$  were selected for preparation of the final scale. Similar kind of methodology was also adopted by Dutta *et al.* (2023) <sup>[6]</sup> for the development of knowledge test scale. Along with the above selection criteria, those items which secured point bi serial correlation (rpbis) value which was significant at 5 % level of significance were selected for the final items of the knowledge test. Thus, finally, 20 items (Table 4) 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. In a similar pattern, Sureshverma *et al.* (2018) <sup>[22]</sup> created and standardized a knowledge test scale to quantify their research objectives.

### Reliability of the knowledge test

A split half reliability co-efficient of the test was computed by applying Spearman-Brown (1910) <sup>[21]</sup> prophecy formula as suggested by Singh (1986) <sup>[19]</sup> and Goswami and Das (2020) <sup>[10]</sup>.

$$r = 2r_{1/2} / 1 + r_{1/2}$$

Where,

r = Reliability co-efficient of the whole test.

$r_{1/2}$  = Reliability co-efficient of the half-test, found experimentally i.e. 0.67.

The reliability co-efficient of the whole test was found to be 0.80. Both these co-efficient provide an estimate of the internal consistency of the test and thus, the dependability of the test scores.

### Validity of knowledge test

The knowledge test's validity was demonstrated through content validity. Utmost care was exercised in the inclusion of comprehensive items including all the facets of knowledge pertaining to AI. Prior to selecting the final items, all the items underwent evaluation based on item difficulty, discrimination index, and point bi-serial correlation. Therefore, it was reasonable to believe that the test fulfils both the requirements for being a representative and a well-designed method of test creation, which are the criteria for ensuring the validity of the content.

**Table 3:** Difficulty index, discrimination index and Point biserial correlation of the knowledge items

Item no	Frequencies of correct answer of respondents in four extreme groups				Total frequencies of correct answers	$D_i$	$E_{1/3}$	RPBIS	Item Selection
	G1	G2	G5	G6					
1	4	4	4	1	13	65	0.5	0.43	Selected
2	4	4	3	0	11	55	0.5	0.39	Selected
3	2	2	0	1	5	25	0.3	0.15	Rejected
4	5	4	2	0	11	55	0.7	0.52	Selected
5	5	4	1	0	10	50	0.8	0.67	Selected
6	5	3	2	0	10	50	0.6	0.61	Selected
7	5	3	1	3	12	60	0.4	0.42	Selected
8	1	2	2	0	5	25	0.1	0.19	Rejected
9	4	4	3	3	14	70	0.2	0.39	Selected
10	4	1	2	4	11	55	-0.1	0.09	Rejected
11	5	2	2	3	12	60	0.2	0.38	Selected
12	0	0	3	1	4	20	-0.4	0.07	Rejected
13	4	3	0	4	11	55	0.3	0.39	Selected
14	0	1	2	0	3	15	-0.1	0.07	Rejected
15	3	4	1	5	13	65	0.2	0.35	Selected
16	5	3	4	0	12	60	0.4	0.46	Selected
17	5	3	0	1	9	45	0.7	0.21	Rejected
18	4	4	0	0	8	40	0.5	0.55	Selected
19	4	4	3	0	11	55	0.5	0.59	Selected
20	5	4	1	0	10	50	1.0	0.17	Rejected
21	4	3	0	3	10	50	0.4	0.48	Selected
22	2	0	3	2	7	35	0	0.00	Rejected
23	4	3	0	3	10	50	0.4	0.41	Selected
24	3	4	3	0	10	50	0.4	0.46	Selected
25	4	5	2	1	12	60	0.6	0.64	Selected
26	1	1	3	0	5	25	-0.1	0.00	Rejected

27	4	5	4	0	13	65	0.5	0.57	Selected
28	5	4	2	1	12	60	0.6	0.63	Selected
29	1	1	1	0	3	15	0.1	0.09	Rejected
30	4	3	2	0	9	45	0.5	0.40	Selected

### Method of scoring

The final test consisted of 20 items concerning knowledge of goat farmers towards artificial adoption (AI). The respondents can be asked to give correct or incorrect, yes or no, or a specific answer to some direct questions. The total knowledge

score may then be calculated by summing up score of correct answers. The range of score obtained by the respondents may vary from 0 to 20. The final format of the knowledge test scale (along with Assamese paraphrase) is presented in table 4.

**Table 4:** Final items selected for the knowledge test

Sl No	Item no	FINAL ITEMS (With Assamese paraphrase)	Yes/ No
1	1	Any idea, at what age, doe gets sexually mature? আপুনি জানেনে, কিমান বয়সত ছাগলী যৌন পৰিপক্ক হয়?	
2	2	Can you detect doe in estrous? ইষ্ট্ৰ'ছত ছাগলী ধৰা পেলাব পাৰিবনে?	
3	4	How long after kidding does a doe come into estrous? পোরলি জন্ম দিয়াৰ কিমান দিনৰ পিছত ছাগলী ইষ্ট্ৰ'ছত আহে?	
4	5	Do you know about doe's estrous cycle length? ছাগলীৰ ইষ্ট্ৰ'ছ চক্ৰৰ দৈৰ্ঘ্যৰ বিষয়ে জানেনে?	
5	6	Is a goat seasonal breeder? ছাগলীবোৰ ঋতু প্ৰজননকাৰী হয় নে?	
6	7	Can we do cross breeding in goat? ছাগলীৰ মাজত বৰ্ণসংকৰ কৰিব পাৰিবনে ?	
7	9	Have you heard about Artificial Insemination (AI)? আপুনি কৃত্ৰিম প্ৰজননৰ বিষয়ে জানেনে ?	
8	11	Is it ok to breed/AI doe at first estrous? ছাগলী ঋতুচক্ৰ আৰম্ভ হোৱাৰ প্ৰথমটো গৰমত প্ৰজনন কৰোৱাতো বিজ্ঞানসন্মত নে?	
9	13	Is AI superior to natural mating? কৃত্ৰিম প্ৰজনন প্ৰাকৃতিক প্ৰজননতকৈ উৎকৃষ্ট নে ?	
10	15	Is AI possible within the same breed? একেটা জাতৰ ভিতৰতে কৃত্ৰিম প্ৰজনন সম্ভৱনে?	
11	16	Do you know when to AI the doe after observing estrous? আপুনি জানেনে ছাগলীৰ ইষ্ট্ৰ'ছৰ কিমান দিনৰ পিছত কৃত্ৰিম প্ৰজনন কৰিব লাগে?	
12	18	Is there any time for pregnancy diagnosis after AI? আপুনি জানেনে, কৃত্ৰিম প্ৰজনন কৰাৰ কিমান দিনৰ অন্তৰালত গৰ্ভধাৰণ নিৰ্ণয় কৰিব পাৰি ?	
13	19	Do you know that multiple offspring can be obtained through AI? আপুনি জানেনে যে কৃত্ৰিম প্ৰজননৰ জৰিয়তে একাধিক পোৱালী লাভ কৰিব পাৰি ?	
14	21	Do AI reduces the purchasing and maintaining cost of bucks? কৃত্ৰিম প্ৰজননৰ জৰিয়তে, মতা ছাগলীৰ পোহ পালনৰ খৰচৰ পৰা বাচিব পাৰি ?	
15	23	Do you accept, AI progenies are more productive? আপুনি বিশ্বাস কৰেনে, কৃত্ৰিম প্ৰজননত হোৱা পোৱালিবোৰ অধিক উৎপাদনশীল ?	
16	24	Do you believe, AI progenies are disease resistant? আপুনি বিশ্বাস কৰেনে, কৃত্ৰিম প্ৰজননত হোৱা পোৱালিবোৰ ৰোগ প্ৰতিৰোধ ক্ষমতাশীল ?	
17	25	Do you think, AI reduces the transmission of diseases? আপুনি ভাবেনে, কৃত্ৰিম প্ৰজননে ৰোগ সংক্ৰমণ হ্ৰাস কৰে ?	
18	27	Is AI cost effective than other breeding methods? কৃত্ৰিম প্ৰজনন অন্যবোৰ প্ৰজনন পদ্ধতিতকৈ ব্যয়সাপেক্ষ?	
19	28	Are you aware of, where to get artificial insemination services? আপুনি জনেনে, কৃত্ৰিম প্ৰজননৰ সুবিধাবোৰ ল'বলৈ ক'ত যোগাযোগ কৰাব লাগে?	
20	30	Any idea how the quality of semen can be assured? বীৰ্যৰ মানদণ্ড কেনেদৰে নিশ্চিত কৰিব পাৰি সেই বিষয়ে আপুনি জানেনে ?	

### Conclusion

The present knowledge test scale was found to be reliable and had content validity. The scale constructed following standard procedures may be used by the researchers on similar studies.

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