

Acquisition and Retention of Knowledge about Animal Feed Technologies in Veterinary Medical Education

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Authors' contributions

This work was carried out in collaboration among all authors. Author Aparna designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors SKK and JH managed the analyses of the study. Authors HKV and JS managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: An awareness and knowledge retention study w.r.t animal feed technologies was conducted on 115 students of BVSc & AH.

Study Design: It was a pre, post and delayed post test study.

Place of Study: Guru Angad Dev Veterinary & Animal Sciences University Ludhiana India.

Methodology: Ten animal feed technologies were selected for evaluation viz: Mineral mixture (MM), Urea treatment of wheat straw (UTWS), Uromin lick (UL), Silage, Hay, Bypass fat (BF), Bypass protein (BP), Total mixed ration (TMR), Buffer and Probiotics. Students were evaluated for their awareness and knowledge through 50 multiple choice questions at three stages, Pre test:

before beginning of Animal Nutrition courses Post test-I: immediately after completion of courses and Post test-II: 6 months after completion of courses.

Results: In Pre test, awareness for Mineral mixture was 19.1 per cent, UTWS 0.9 per cent Silage 19.1 per cent, Hay 20 per cent, Buffers 36.5 per cent and Probiotics 43.5 per cent. None of the students was aware about Uromin lick, BF, Bypass protein and TMR in Pre test. None of the students had knowledge about UTWS, UL, BF, BP and TMR in Pre test (score=0). Awareness and knowledge score raised in Post test-I and declined in Post test-II for all technologies. Mean knowledge score was 0.97/ 50 in Pre test, 38.60 in Post test I and 21.49 in Post test II (statistically significant $P < 0.01$).

Conclusion: Students lost 44.32% knowledge at a gap of six months after its acquisition. At the time of Post test-II students were studying in fourth semester and were going to apply this knowledge after their graduation (3.5 years). By that time the loss of knowledge could be much higher hence retention of knowledge must be focused upon.

Keywords: Retention of knowledge; knowledge gain; animal feed technologies.

1. INTRODUCTION

In veterinary medical education it is imperative that students not only assimilate the knowledge but also retain it, not only for good academic performance but also for future application under field conditions. In India 75% population is engaged in agriculture and have dairy farming as their major allied activity. The enterprise of dairy farming depends a lot on balanced and rational feeding because 65-75% of routine expenses of this enterprise are incurred on the feeding of the animals. Not only this, nutrition is also associated with health and prophylaxis. Animal feeding technologies namely Silage making, Hay making, Bypass fat, Bypass protein, Mineral mixture, Total mixed ration, Urea treatment of wheat straw, Uromin lick, Buffer and Probiotics not only help to cut the feed cost but also alleviate shortage of fodder, increase nutrient digestibility, maintain rumen environment, provide balanced nutrition, protect animals from metabolic and deficiency diseases and help in reducing wastage of feed resources Bharathidasan et al., [1]. Some of these technologies are widely known to farmers and some are yet to get mass market appeal. The main constraint to large-scale adoption of nutrition technologies in general has been identified as the lack of information/knowledge to users/ farmers BIRTHAL and TANEJA, [2]. Aparna et al. [3] reported low level of knowledge about animal feeding practices among dairy farmers in Punjab. Veterinary extension workers can help immensely here provided, apart from clinical skill they have an updated knowledge about animal feeding practices too.

Guru Angad Dev Veterinary and Animal Sciences University (GADVASU), Ludhiana is the prime veterinary institute in India (Accredited

by Veterinary Council of India) and caters the need of veterinary sciences education to Punjab state and other parts of India by virtue of formal teaching of students through BVSc & AH (a five and half year degree programme). BVSc and AH students study the animal nutrition aspects in first two semesters. After completion of BVSc & AH education programme the beneficiaries are eligible for clinical practice and veterinary officership. Veterinary officers the main extension agents in field therefore they ought to be competent in the essential skills about animal feed technologies, ('Day-one competencies'). veterinary ^{4A}ccording to curriculum veterinary students study animal nutrition courses during first four semesters and thereafter no course is there. Ford et al. [4] reported that non usage of skill/ knowledge may lead to its loss or decay due to longer length of retention interval and infrequent opportunities to practice the skill Ford et al., [4]. Any such loss may affect the competence of veterinary practitioners and productivity of animals. Ferreira et al [5] evaluated health students and inferred loss of acquired knowledge after a gap of six months. The fact was well supported by Hundal et al [6], who evaluated paraveterinary students in Punjab (India) for their cognitive domain about animal feed technologies during their internship and inferred low-medium level of awareness and put forward the need for improvement so as to bridge the productivity gap through extension.

Keeping above factors in mind, the present study was planned and it was one of the pioneer studies in the state which focussed on evaluation of learners of BVSc&AH programme in the field of veterinary science with respect to their awareness and knowledge and its retention about Animal Feed Technologies (AFTs).

1.1 Objectives

- To assess the awareness of students about animal feed technologies before and after taking the courses in Animal Nutrition and its retention after six months.
- To estimate the knowledge of students about animal feed technologies before and after taking the courses in Animal Nutrition and its retention after six months.

2. MATERIALS AND METHODS

GADVASU, Ludhiana conducts five and half years BVSc & AH programme as per the guidelines of Veterinary Council of India (VCI, India) in College of Veterinary Science in GADVASU, Ludhiana (Punjab) and Khalsa College of Veterinary & Animal Sciences, Amritsar (Punjab) (KCVAS). Whole 2015 batch (total 115 students) of first year students of BVSc & AH in both the colleges were selected for awareness and knowledge gain and retention study.

2.1 Development of Knowledge Test

Ten animal feed technologies (AFTs) were selected for evaluation viz: Mineral mixture (MM), Urea treatment of wheat straw (UTWS), Uromin lick (UL), Silage making, Hay making, Bypass fat (BF), Bypass protein (BP), Total mixed ration (TMR), Buffer and Probiotics. The questionnaire had three parts:

2.1.1 Socio personnel profile

It included Overall Credit Point Average (OCPA), rural/urban family background.

2.1.2 Awareness assay

It included a list of ten selected technologies and respondents were asked whether they are aware about the existence of the technology or not. Dichotomous answers were to be given as YES or NO.

2.1.3 Knowledge test

Knowledge test part had 50 multiple choice questions just like other researchers Ali et al. [7] and Tuyisenge et al. [8]. All questions had total four options with single correct option. Questions about knowledge level of animal feed technologies were collected from the pertinent literature, personal experience, discussions held with the experts and pilot study conducted in the

area of investigation. Each technology was tested through five multiple choice questions. Pilot testing was done.

2.2 Research Methodology and Experimental Design

A prospective, repeated-measures (before and after) quasi experimental design was selected to assess the knowledge of farmers at 3 pre-specified time points (Pre test, Post test-I and Post test-II. Pre test: Before beginning of Animal Nutrition courses i.e. beginning of first semester, Post test-I: Immediately after completion of applied animal nutrition courses (Second year students/end of 3rd semester) and Post test-II: 6 months after completion of applied animal nutrition course work (Third year students/ end of 4th semester). The Post test-I was knowledge gain test, while Post test-II was retention test.

2.3 Assessment of Awareness about Afts

Score 1 was given to the candidate who answered "YES" to the awareness about the existence of the technology and 0 if the answer was "NO". Maximum score for awareness assay was 10 and minimum score was zero.

2.4 Assessment of Knowledge of Afts

Each correct answer was scored as one and each wrong answer was scored zero. The sum of score was taken as knowledge score. Maximum score possible was 50 and minimum was 0.

2.5 Statistical Analysis

Data was analysed using frequency, percentage, chi square test and ANOVA by SPSS version 22.0

3. RESULTS AND DISCUSSION

3.1 Demographic Profile of Veterinary Undergraduate Students

The demographic profile of students (Table 1) reveals that out of 115 students, 75 were male and 40 were female making it a percentage of 65.2 and 34.8, respectively. OCPA indicated that 36.5 per cent students had their OCPA in the range of 6.00-6.99, 54.8 per cent had it in the range of 7.00-7.99 and the rest 8.7 per cent had their OCPA above 8.00. The mean OCPA was

7.22 with minimum being 6.0 and maximum of the batch belonged to urban background while being 9.10 (Fig. 1). About 64.3 per cent students 35.7 per cent were from rural background.

Table 1. Demography characterization of gender, overall credit point average (OCPA) and family background of respondents (students) in formal education programme in India

Demographic character		Frequency (N=115)	Per centage
Gender	Male	75	65.2
	Female	40	34.8
OCPA	6.00-6.99	42	36.5
	7.00-7.99	63	54.8
	>8.00	10	8.7
Family background	Rural	41	35.7
	Urban	74	64.3

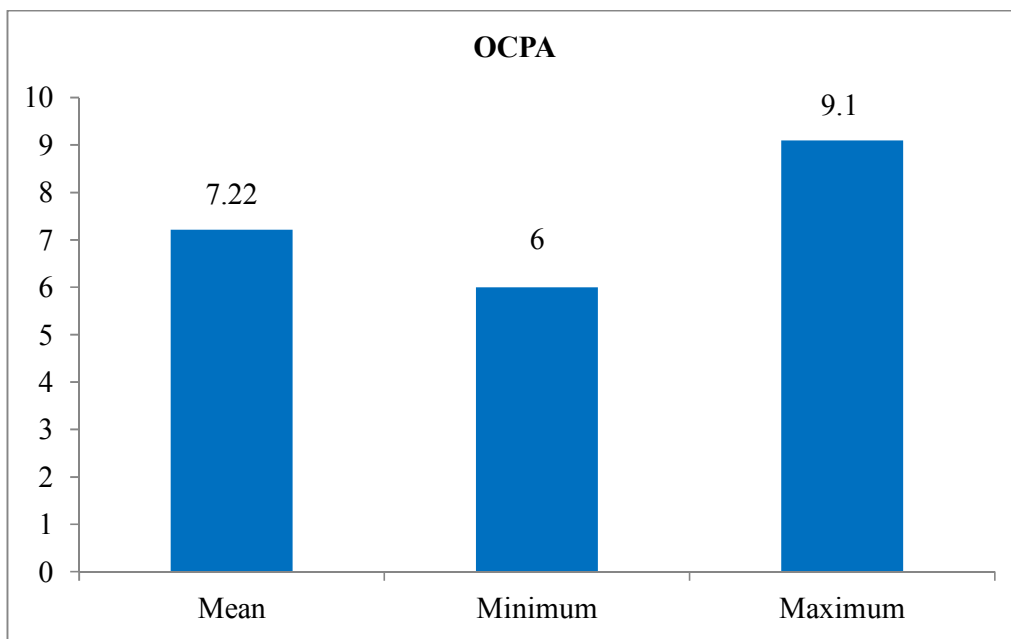


Fig. 1. Overall Credit Point Average (OCPA) profile of BVSc & AH Students in India

Table 2. Frequency of awareness of students of India towards different AFTs across Pre test, Post test-I and Post test-II evaluation

Name of technology	Awareness/familiarity N=115			χ ²	P-value
	Pre test	Post test-I	Post test-II		
Mineral mixture	22 ^a (19.1)	115 ^b (100)	115 ^b (100)	254.64	0.00
UTWS	1 ^a (0.9)	114 ^c (99.1)	105 ^b (91.3)	296.90	0.00
Uromin lick	0 (0)	111 ^c (96.5)	84 ^b (73)	244.54	0.00
Silage	22 ^a (19.1)	115 ^b (100)	115 ^b (100)	254.65	0.00
Hay	23 ^a (20)	115 ^b (100)	115 ^b (100)	250.91	0.00
Bypass fat	0 (0)	111 ^c (96.5)	105 ^b (91.3)	289.51	0.00
Bypass protein	0 (0)	112 ^c (97.4)	104 ^b (90.4)	290.03	0.00
TMR	0 (0)	113 ^c (98.3)	108 ^b (93.9)	307.91	0.00
Buffer	42 ^a (36.5)	115 ^b (100)	113 ^b (98.3)	165.29	0.00
Probiotics	50 ^a (43.5)	115 ^b (100)	113 ^b (98.3)	151.85	0.00

Figures in parenthesis indicate percentage; UTWS: Urea treated wheat straw, TMR: Total mixed ration, Figures with different superscripts in a row differ significantly (**P<0.01)

3.2 Awareness/Familiarity of Veterinary Undergraduate Students towards Different Afts over pre Test, Post Test-I and Post Test-II Evaluation

Table 2 depicts the students' familiarity with chosen AFTs under study across time between the 3 testing points. During Pre test merely a fraction of students were aware about some of the technologies for example Mineral mixture had 19.1 per cent, UTWS 0.9 per cent, Silage 19.1 per cent, Hay 20 per cent, Buffers 36.5 per cent and Probiotics 43.5 per cent awareness. None of the students was aware about Uromin lick, Bypass fat, Bypass protein and TMR before they took any course in the subject of animal nutrition. Awareness about Mineral mixture, Hay, Silage and UTWS could be attributed to the fact that students who had rural background had heard about these terms which is also evident from correlation with independent variables (Table 4) where though not significant but a positive correlation of knowledge and family background was seen in Pretest evaluation. On the other hand awareness about the terms Buffers and Probiotics mainly came from higher secondary education curriculum. The scenario changed altogether in Post test-I because students had undergone courses of animal nutrition, hence they were familiar with all the technologies. Awareness about Mineral mixture and Silage soared from 19.1% to 100% in Post test I and sustained at 100% in Post test II too. Hay had 20% awareness in Pre test which increased to 100% in Post test II and its awareness was maintained at 100% level in Post test II also. For all other technologies also there was immense improvement in awareness during Pre test to Post test I (statistically significant $P < 0.01$).

In Post test II significant decline ($P < 0.01$) in awareness was observed as compared to Post test-I. The awareness per centage for technologies e.g. Uromin lick came down from 96.5 per cent to 73 per cent from Post test-I to Post test-II. For UTWS awareness during Post test I to II declined from 99.1 to 91.3, for Bypass fat 96.5 to 91.3, for Bypass protein 97.4 to 90.4 and for TMR 98.3 to 93.9 per cent from Post test-I to Post test-II, respectively. However for Buffers and Probiotics the decline was statistically non significant (from 100 per cent to 98.3 per cent). Noteworthy is that technologies for which students were more aware in pretest (Hay Silage, Buffers, Probiotics and Mineral mixture) were retained better in Post test II. All these technologies had no or non significant loss of

awareness which means that their background knowledge played well. The data is well supported by Marzano [9] who states that though students' learning depends on the skill of the teacher, the interest of the student, and the complexity of the content, but what students already know about the content is one of the strongest indicators of how well they will learn new information. Relative relatedness and advantages of technologies may also affect retention. This indicates that some technologies had better retention than others but keeping in mind the proficiency of vets, need for strengthening of the pedagogy (Parker, 2009) is also there.

Table 3 depicts students' knowledge level across three points of time. Data indicated lowest score in Pre test, highest score in Post test-I and comparative loss of score in Post test-II for all the technologies. Data revealed that none of the students had knowledge about UTWS, UL, BF, BP and TMR in Pre test (Knowledge score =0). Silage and Hay gave the respondents an average score of 0.02/5 and 0.05/5, respectively which may be attributed to their rural family background. However Mineral mixture, Buffers and Probiotics were comparatively better known to students as they scored 0.23/5, 0.26/5 and 0.41/5, respectively. The probable reason being that these technologies get reference in chemistry and biology during higher secondary education.

Post test-I reflected gain of knowledge as score rose significantly ($P < 0.01$) for all the technologies and Post test-II witnessed significant ($P < 0.01$) loss of score for all the technologies. Knowledge score for Mineral mixture was 0.23 in pretest and 4.59 in Post test I and 4.11 in Post test II. For UTWS the score was 0.0, 3.40 and 1.48, for UL the score was 0.0, 4.55 & 2.18, for Silage 0.02, 4.17 & 2.49, for hay 0.05, 3.94 & 1.77, for Bypass protein 0.00, 3.22 & 1.89, Bypass fat 0.00, 4.37 & 2.83, for TMR 0.0, 4.01 & 1.61 and for Probiotics 0.41, 3.30 & 2.67 in Pre test, Post test I and II respectively.

Lecture method with audiovisual aids is the most common method of teaching in most of universities (Parker 2009) and the same methodology of teaching was adopted in present study also. A huge gain in awareness and knowledge score in Post Test I indicates effectiveness of formal education programme at GADVASU and high level of grasping attention, perception and storing & recovery of past processes by the students. Ferreira et al [5] also

Table 3. Technology wise knowledge test score of students of India towards AFTs over Pre test, Post test-I and Post test-II evaluation

Name of technology	Knowledge test score			PSE	P-value
	Pre test	Post test-I	Post test-II		
Mineral mixture**	0.23 ^a	4.11 ^c	2.59 ^b	0.098	0.000
UTWS**	0.00 ^a	3.40 ^c	1.48 ^b	0.091	0.000
Uromin lick**	0.00 ^a	4.55 ^c	2.18 ^b	0.114	0.000
Silage**	0.02 ^a	4.17 ^c	2.49 ^b	0.103	0.000
Hay **	0.05 ^a	3.94 ^c	1.77 ^b	0.099	0.000
Bypass fat**	0.00 ^a	4.37 ^c	2.83 ^b	0.112	0.000
Bypass protein**	0.00 ^a	3.22 ^c	1.89 ^b	0.087	0.000
TMR**	0.00 ^a	4.01 ^c	1.61 ^b	0.102	0.000
Buffer**	0.26 ^a	3.53 ^c	1.98 ^b	0.086	0.000
Probiotics**	0.41 ^a	3.30 ^c	2.67 ^b	0.088	0.000

UTWS: Urea treatment of wheat straw, TMR: Total mixed ration, Figures with different superscripts in a row differ significantly (**P<0.01)

reported gain in knowledge after lecture, wherein, mean of correct answers in the pretest was 4.6, in Post-test 11.9, and in delayed post test it was 9.2 out of total of 14 points (P<0.01).

It is mentionable here that with the exception of hay the technologies for which students' knowledge was better in Pre test were better known in Post test II also (Mineral mixture, Silage, Buffers, Probiotics) which again lays emphasis on background knowledge.

Summarized view is that students had mean knowledge score of 0.97 out of 50 in Pre test (when they had not taken any course in Animal Nutrition), with minimum score being 0 and maximum being 6. Just after completion of course in Animal Nutrition the score level soared to 38.60 with minimum being 18 and maximum being 50. But, at a gap of six months the mean score came down to 21.49 with minimum being the 6 and maximum being 34 and the difference was statistically significant at all three time points (P<0.01).

In adults if knowledge is not maintained it may be lost from short term memory system Daniels [10]. This appeared correct in this study as there was loss of score in Post test II. Doucet et al. [11] also conducted a retention study in undergraduate veterinary pharmacology students and inferred decreased score in retention test (51.3 per cent from 61.7 per cent). Likewise Naeem, [12] also noticed that although the teaching intervention led to an immediate increase in knowledge of medical undergraduate students (score in pre test was 12.33 and in post test was 15.38) but this knowledge was not retained at the end of the year (score 12.29). The

deterioration of scores was described by Custers [13] who reported that medical students forget roughly 25–35 per cent of basic science knowledge after one year, more than 50 per cent by the next year. According to Farr [13] the rate of decay is directly dependent upon the degree to which the learner has mastered the knowledge or skill, hence the greater the mastery the slower the decay [14]. The degree of mastery is increased by further practice by the learner.

Another important aspect is the passage of time after knowledge acquisition, for which the learned knowledge and skill are not applied. Though in ongoing study loss of knowledge in six month (Post Test I to Post Test II) interval was much less than the gain occurred during Pre test to Post test I period and the overall gain in knowledge at the end of study period was found significant for all the technologies (P<0.01), but, at the time of Post test-II/ retention test students were studying at the end of third semester and they were going to apply this knowledge after their graduation i.e. after 3.5 years of retention test and by that time the loss of knowledge can be much higher as forgetting is ubiquitous.

Apart from mastery and time gap, Farr [14] reported that type of task and the strategies of instruction also impact learning and retention. For example General view about lecture method is that students usually sit passively in lecture halls and mostly write without thinking activity Arlt et al., [15] leading to superficial learning which is easily forgotten. Solution to low retention can be demonstration method of teaching Auwal et al., [16], problem based learning (PBL) to complement traditional type Nandi, [17], performance based task Rahn and Moraga, [18],

Table 4. Correlation of independent variables with knowledge level, gain in knowledge and retention of knowledge in students of India

Variable	Pretest	Post test-I	Post test-II	Pre- Post test-I	Pre- Post test-II	Post test-I- Post test-II
OCPA	0.007	0.220	0.129	0.214	0.126	0.033
Family background	0.032	-0.006	0.056	-0.016	0.048	-0.055

audience response system Plant, [19], Doucet et al., [11] and more frequent tests Roediger et al., [20]. Parkinson [21] reported higher motivation of students' in new or clinically relevant topic. Arlt et al [15] endorsed the concept of team-based development of critically appraised topics (CATs) for students in veterinary medicine. Singh and Verma [22] conducted a study to identify a learning style preferred by students of BVSc & AH and concluded that out of 308 students 24 per cent preferred PPT, 36 per cent Chalk and talk, 13 per cent group discussion and demonstration 23 per cent. These aspects need further investigations in the ongoing study.

Table 4 describes the trend of correlation of independent variables with the knowledge and retention score over three tests and interval between them. OCPA of students was definitely positively correlated to the scores but non-significantly. Family background's association depicted varying trend as the association was positive at the time of Pre test i.e. the rural background had positive association with scores but at the time of Post test-I association turned to negative. Again at the time of Post test-II, the association was positive for students from rural background. This could be attributed to the fact that students from rural background could correlate the knowledge at their place and hence could retain more Marzano [9].

4. CONCLUSION

Veterinary undergraduate students showed loss of knowledge about animal feed technologies in a gap of six months. By the time the students graduate this loss may increase further, leading to loss of proficiency. Keeping in mind the utmost need for knowledge about animal feed technologies in field practice we need to improve retention of knowledge. For this, background knowledge of students, innovative teaching methods, maintainance of information by students through information sources and a course in animal nutrition near to completion of graduation programme may be helpful which needs to be probed out further.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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