

KEY TRENDS AND PRACTICES AMONG FEED MILLERS IN PUNJAB: KNOWLEDGE, PRODUCTION AND MARKET STRATEGIES

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ABSTRACT

A planned study was conducted purposely on 30 feed millers of Punjab to assess knowledge level and perception regarding feeding practices along with the evaluation of training, investment, production, marketing dynamics and quality assurance practices. The study found that most feed millers are middle-aged (40%) with at least a high school education, with 53.33% holding undergraduate degrees and 26.67% possessing postgraduate qualifications. Experience levels vary widely, with 43.33% having 1 to 10 years of experience and 30% over 20 years. Specialized training has been received by 56.67% of millers, though 43.33% have not. A significant number (59.33%) have invested 1-2 crores in machinery, and 56.67% produce both customized and branded feed using semi-automatic equipment. This will improve feed quality and enhance livestock productivity and health. The survey shows that 50% of feed millers have high expertise in feed practices, 30% have moderate knowledge, and 20% have low knowledge, indicating a need for targeted education. Knowledge scores range from 4 to 21 and correlate positively with experience and training, but not with age or education, highlighting the importance of experience and training in improving knowledge. To address knowledge gaps, it is essential to implement educational and training programs tailored to varying expertise levels.

Keywords: Feed Miller, Knowledge, Practices, Punjab, Trend

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Nutritional management is crucial for dairy animal health and productivity, with feed costs accounting for 60-70% of total production expenses (Nimbalkar *et al.*, 2021). Economical feed solutions are needed to enhance productivity and boost farmers' profits. Feed shortages and poor nutrition can reduce milk yield and production, as feeding directly affects animal performance. In Punjab, there is a 28.60% fodder shortage and a 35.60% concentrate feed shortage (Singh *et al.*, 2018), with poor-quality concentrate feed hindering productivity improvements (Sallan *et al.*, 2020).

The Indian animal feed market was valued at USD 13.8 billion in 2022, projected to reach USD 17.4 billion by 2028, with a 6.3% CAGR from 2023 to 2028 (IMARC Group, 2023). Punjab's 1,300 cattle feed mills produce about 5.7 million tonnes annually, but only 18-20% is branded (Anonymous, 2023). Branded feed allows farmers to focus on herd management, providing assurance of quality and balanced nutrition (Abdollahi *et al.*, 2013). The feed industry plays a vital role in meeting livestock nutritional needs and addressing fodder shortages through scientifically balanced feeds.

Branded feed quality reflects feed manufacturers' knowledge of feed formulation. The technology and processes used by feed millers are critical in assessing feed quality. Evaluating operational standards, technological advancements, and training can identify best practices and areas for improvement. Research can reveal quality control gaps, suggest capacity-building interventions, and

promote innovative technologies, leading to better feed formulations, improved animal nutrition, and increased livestock productivity and sustainability.

Many manufacturers lack awareness of essential practices like pellet size and ingredient sequencing needed for a homogeneous feed mixture. Addressing these issues is vital for enhancing cattle feed quality, productivity, and dairy sector sustainability. This study examines feed millers' perceptions and knowledge, covering production processes, quality assurance, and market strategies, as the first of its kind in Punjab and potentially India.

MATERIALS AND METHODS

A sample of 30 feed millers was randomly selected from various regions of Punjab to examine their perceptions of branded versus self-made concentrate feed. A pre-structured interview schedule was used to conduct personal interviews, assessing the feed millers' knowledge levels and perceptions. Marketing channels were evaluated and ranked using Garrett's ranking technique based on their mean scores. The dependent variable in this study was the knowledge level of feed millers regarding feeding practices. A set of scientifically designed questions assessed their understanding of key feeding strategies for cattle and buffalo, such as salt and mineral mixture additions and pellet size. Responses were scored as 1 for correct and 0 for incorrect answers. The millers were categorized into low, medium, and high knowledge levels based on their scores, with mean and percentage calculations used for analysis. The acquired data was analysed and organized in

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accordance with the study's objectives, utilizing relevant statistical techniques such as percentage calculations, mean calculations, frequency distribution, correlation analysis. The statistical analyses were conducted using SPSS version 20.0. The study also evaluated the processes and technology employed in feed manufacturing, along with feed testing and other awareness metrics.

RESULTS AND DISCUSSION

General profile of feed millers

The data in Table 1 reveals that the majority of feed millers are middle-aged (40.00%), followed by older individuals (33.33%), and a smaller segment of young millers (26.67%). This age distribution is similar to findings in Punjab by Sallan (2020), although it contrasts with Mir (2020), who found younger millers to be predominant. Regarding education, all feed millers had at least a high school education, with the majority holding undergraduate degrees (53.33%), followed by postgraduate qualifications (26.67%). Experience levels varied, with 43.33% having 1 to 10 years of experience, indicating a presence of new entrants, while 30.00% had over 20 years of experience, reflecting seasoned expertise. Ownership is predominantly proprietorship (80.00%), with partnerships accounting for 20.00%, aligning with Sallan's (2020) findings in Punjab. These results underscore the importance of education and a mix of experience levels in sustaining industry innovation and development.

Communication profile of feed millers

The analysis of feed millers reveals (Table 2) that a majority (56.67%) have undergone specialized training in feed manufacturing, although a significant minority (43.33%) have not participated in such training. This reflects a proactive approach among many millers towards skill acquisition. A notable trend is seen in interstate mill visits, with 63.33% of millers exploring operations beyond their home states, while only 13.33% have visited international mills, indicating potential barriers to global exploration. Additionally, 70.00% of the feed millers are members of professional societies, such as the All Feed Millers Association (AFMA) in Punjab, suggesting strong industry engagement and collaboration efforts. These findings are consistent with those reported by Sallan (2020) and Mir (2020) regarding industry practices in Punjab.

Distribution of feed millers according to feed mill operational metrics

A significant majority (59.33%) invested 1-2 crores in machinery, while 26.67% invested less than 1 crore as seen in Table 3, aligning partially with Sallan's (2020) findings. In feed production, 56.67% of millers produce both customized and branded feed, allowing them to meet diverse market demands. All feed millers operate on a

Table 1. Distribution of feed millers according to their demographic profile

Attributes	Parameters	Frequency	Percentage
Age (years)	Young (Up to 35 years)	8	26.67
	Middle (36 to 50 years)	12	40.00
	Old (51 and above years)	10	33.33
Education	Illiterate	0	0.00
	Primary school	0	0.00
	Middle school	0	0.00
	High school	2	6.67
	Senior secondary	4	13.33
	Graduate	16	53.33
Experience	Postgraduation	8	26.67
	Low (1-10 years)	13	43.33
	Medium (11-20 years)	8	26.67
Type of ownership	High (above 20 years)	9	30.00
	Partnership	6	20.00
	Proprietorship	24	80.00

Table 2. Distribution of feed millers according to their communication profile

Attributes	Parameters	Frequency	Percentage
Training	Attended	17	56.67
	Not Attended	13	43.33
Interstate Mill-Visit	Yes	19	63.33
	No	11	36.67
Abroad Mill-Visit	Yes	4	13.33
	No	26	86.67
Member of any society	Yes	21	70.00
	No	9	30.00

daily production cycle and cater to multiple feed categories, such as lactating and transitional, with 76.67% focusing solely on dairy animals. Machinery-wise, 83.33% utilize semi-automatic equipment. Most millers (96.67%) use hammer mills for grinding, while 86.67% prefer horizontal mixers for blending. The predominant electricity load is 101-200 kW. The majority (43.33%) prepare 3-4 batches per hour, with a production capacity of 1-2 tonnes. Additionally, 80% use the sprinkling method to incorporate molasses into feed and 86.67% do not purchase FCI auctioned seeds. These findings are consistent with industry practices observed by Singh *et al.* (2012) and Mir (2020) in Punjab.

Distribution of feed millers according to their feed analysis and awareness metrics

Results shown in table 4 highlights that 90.00% conduct feed testing, primarily focusing on the final product rather than individual raw materials (86.67%). Testing frequency varies, with 43.33% testing monthly and 20.00% testing weekly. Awareness of aflatoxin contamination is universal among millers (100.00%), with 93.33% actively testing for it, a contrast to Mir (2020) in Punjab, where fewer millers tested for aflatoxins. These

Table 3. Distribution of feed millers according to feed mill operational metrics

Attributes	Parameters	Frequency	Percentage
Investment	> 1 crore	8	26.67
	1-2 crore	16	53.33
	3-4 crore	3	10.00
	5-6 crore	3	10.00
Feed production	Customised	2	6.67
	Branded	11	36.67
	Both	17	56.67
Feed production cycle	Daily	30	100.00
	Demand based	0	00.00
Feed Categories	Lactating	4	13.33
	Heifer + Lactating	1	3.33
	Heifer+Lactating+Dry	4	13.33
	Heifer+Lactating+Dry +Calves	1	3.33
	Heifer+Lactating+Dry +Transitional+Calves	20	66.67
Feed production for other species	Yes	7	23.33
	No	23	76.67
Type of feed	Mash	5	16.67
	Pellet	8	26.67
	Mash + pellet	13	43.33
	Mash+pellet+crumble	3	10.00
	Mash+pellet+crumble +Flakes	1	3.33
Machinery	Automatic	5	16.67
	Semi-automatic	25	83.33
Grinding in mill	Hammer mill	29	96.67
	Roller mill	0	0.00
	Attrition mill	1	3.33
Mixing	Horizontal mixer	26	86.67
	Vertical mixer	4	13.33
	Liquid mixer	0	0.00
	Other type of mixer	0	0.00
Electricity load	<100 KW	7	23.33
	101-200 KW	12	40.00
	201-300 KW	4	13.33
	>300 KW	7	23.34
Batches in one hour	(1-2)	2	6.67
	(3-4)	13	43.33
	(5-6)	12	40.00
	(7-8)	3	10.00
Capacity (in tonns)	(1-2)	23	76.67
	(3-4)	4	13.33
	(5-6)	2	6.67
	>6	1	3.33
Molasses	Sprinkling method	24	80.00
	Other method	6	20.00
FCI Seed Purchase	Yes	4	13.33
	No	26	86.67

findings are aligned with that of Kang'ethe *et al.* (2009). Most millers (71.43%) perform aflatoxin tests monthly. These practices underscore the industry's commitment to maintaining quality and safety standards in feed production.

Table 4. Distribution of feed millers according to their feed analysis and awareness metrics

Attributes	Parameters	Frequency	Percentage
Testing of feed	Yes	27	90.00
	No	3	10.00
Frequency of testing (n=27)	Weekly	6	22.22
	Monthly	13	48.15
	Every three months	5	18.52
	Randomly	3	11.11
Testing sample	Each raw material	4	13.33
	Whole feed	26	86.67
Awareness regarding aflatoxin contamination	Yes	30	100.00
	No	0	0.00
Testing for aflatoxin contamination	Yes	28	93.33
	No	2	6.67

Distribution of feed millers according to their pellet size and PDI of feed produced

Results reveals a preference for producing 6 mm pellets for cow, buffalo, and heifer/calf feed, with 46.67% and 63.33% of millers, respectively, opting for this size. Only 10.00% produce 4 mm pellets for cow feed (as shown in table 5). In terms of Pellet Durability Index (PDI), 46.67% of feed millers report a good PDI, while 26.66% achieve an excellent PDI, demonstrating effective pellet integrity during handling. However, another 26.66% report an average PDI, indicating a need for improvement. These findings highlight efforts among feed millers to optimize pellet quality and durability, although variations exist compared to Sallan's (2020) observations on pellet size preferences in Punjab.

Distribution of feed millers according to brands and price range available

Results in table 6 show that the majority of feed millers produce 3-4 brands, with some offering as many as 9-10 brands. Feed prices are evenly distributed across three categories: ` 1,000-2,000, ` 2,100-3,000 and ` 3,100-4,000 per quintal, with no feed priced in the ` 4,100-5,000 range. Most feed mills (63.33%) have a supply radius exceeding 200 km, while smaller percentages have supply radii of 51-100 km, 101-150 km, 151-200 km and less than 50 km. This indicates a broad distribution strategy and varied product offerings among feed millers.

Knowledge level of feed millers

The survey reveals that 50% have a high level of expertise in feed practices and formulation, indicating strong proficiency in technical aspects of feed production (as shown in table 7) . A further 30% possess a moderate level of knowledge, suggesting they could benefit from additional training though Shelly *et al.* (2019) suggested that the knowledge index of the feed millers was relatively low. The remaining 20% have a low level of knowledge, highlighting a need for substantial improvement. This distribution

Table 5. Distribution of feed millers according to their pellet size and PDI of feed produced

Attributes	Parameters	Frequency	Percentage
Pellet size of Cow feed	4 mm	3	10.00
	5 mm	13	43.33
	6 mm	14	46.67
Pellet size of buffalo feed	5 mm	3	10.00
	6 mm	19	63.33
	8 mm	8	26.67
Pellet size of heifer/ calves feed	4 mm	11	36.67
	5 mm	14	46.67
	6 mm	5	16.67
PDI (Pellet durability index)	95 per cent (excellent)	8	26.67
	90 per cent (good)	14	46.67
	<90 per cent (average)	8	26.67

Table 6. Distribution of feed millers according to brands and price range available

Attributes	Parameters	Frequency	Percentage
Number of Brands available	(1-2)	7	23.33
	(3-4)	12	40.00
	(5-6)	4	13.33
	(7-8)	2	6.67
	(9-10)	5	16.67
Price range per quintal (in rupees)	1000-2000	10	33.33
	2100-3000	10	33.33
	3100-4000	10	33.33
	4100-5000	0	00.00
Feed Supply Radius (in km)	<50	2	6.67
	51-100	4	13.33
	101-150	3	10.00
	151-200	2	6.67
	>200	19	63.33

underscores the diverse levels of expertise among feed millers and points to the potential need for targeted educational interventions to elevate industry-wide knowledge.

Feeding Knowledge score of Feed Millers

Knowledge score of Feed millers falls into medium knowledge category, it means that overall feed millers had moderate level of knowledge as outlined in Table 8 with minimum and maximum knowledge score of 4 and 21, respectively.

Correlation of knowledge score with different variables

Results reveals that the knowledge score of feed millers shows a significant positive correlation with experience and training at the 0.001 level. Additionally, a significant positive correlation exists between age and experience. However, the analysis indicates no significant relationship between the knowledge score and age or education as presented in Table 9. This suggests that while experience and training substantially impact knowledge levels, age and education do not significantly influence feed millers' knowledge scores.

Table 7. Distribution of feed millers according to their knowledge level

Attributes	Parameters	Frequency	Percentage
Knowledge level	Low (1-7)	6	20.00
	Medium (8-14)	9	30.00
	High (15-21)	15	50.00

Table 8. Feeding Knowledge score (Mean $\pm$ S.E.) of total feed millers (N=30)

Feed millers	Knowledge score (Mean $\pm$ S.E.)	Feeding knowledge level
Overall (N=30)	12.87 $\pm$ 0.934	Medium

Table 9. Correlation coefficient 'r' of Knowledge score with demographic profile of feed millers

Pearson correlation coefficient 'r'	Age	Education	Experience	Training	Knowledge score feed miller
Age	1	-0.212	0.728**	0.076	0.294
Education	-0.212	1	-0.193	0.000	0.008
Experience	0.728**	-0.193	1	0.180	0.528**
Training	0.076	0.000	0.180	1	0.605**
Knowledge score feed miller	0.294	0.008	0.528**	0.605**	1

** . Correlation is significant at the 0.01 level (2-tailed)

Analysis of marketing channels adopted by feed millers of Punjab

In the interview process, a comprehensive compilation of eight distinct marketing channels was obtained through in-depth consultations with subject matter experts, a thorough review of pertinent literature, and detailed discussions with feed millers. These channels represent a variety of strategies and methods commonly employed by feed manufacturers to effectively reach target markets and distribute their products.

Table 80 provides a detailed analysis of how feed millers prioritize these marketing channels. Notably, the "Performance" channel received considerable attention, with 61 dairy farmers ranking it as their top choice, followed by 32 farmers placing it second, and 30 farmers ranking it third. This indicates the substantial importance attached to product performance and its direct influence on consumer preferences and satisfaction within the dairy farming sector.

On the other hand, the "Better Quality" factor exhibited a more varied level of priority, with one dairy farmer ranking it second and 12 farmers placing it fourth. This variability suggests a mixed perception among feed millers regarding the significance of product quality as a determining factor in their marketing strategies.

Table 81 employs Garrett's value calculation to offer a deeper analysis of the overall impact of these marketing channels as perceived by feed millers. The top three channels identified were "Farmers direct purchase,"

Table 10. Calculation of Garrett value and ranking of marketing channel utilized by feed millers (n=30)

Marketing channels	Rank order								Total score	Average Rank score	
	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th			
Farmers direct purchase	1200	603	360	0	0	0	0	0	2163	72.10	I
Retail marketing	640	1005	420	0	0	0	0	0	2065	68.83	II
Wholesale marketing	640	201	900	212	0	0	0	0	1953	65.10	III
Through milk cooperatives	0	134	120	954	282	80	0	0	1570	52.33	IV
Through Veterinarians	0	0	0	371	799	240	0	0	1410	47.00	V
Through university/KVKS	0	0	0	0	282	720	66	80	1148	38.27	VI
Franchise	0	0	0	53	47	160	627	100	987	32.90	VII
Collaborating with other brands	0	0	0	0	0	0	297	420	717	23.90	VIII

“Retail marketing,” and “Wholesale marketing,” ranked first, second, and third, respectively. This ranking highlights the primary methods through which feed manufacturers engage directly with their customer base, including direct sales to farmers, retail outlets, and wholesale distribution networks.

In contrast, channels such as “Collaborating with other brands” ranked eighth, reflecting a relatively lower level of influence in the marketing strategies employed by feed millers. Similarly, “Franchise” was ranked seventh, suggesting its limited application or perceived impact within the competitive landscape of feed marketing channels.

Overall, these findings offer valuable insights into the strategic priorities and decision-making processes of feed millers in Punjab. They underscore the pivotal role of performance-driven marketing strategies and direct customer engagement in achieving success within the feed manufacturing sector. Additionally, they highlight areas where feed millers could potentially refine or adjust their market outreach and product positioning strategies.

Furthermore, exploring digital marketing could help tap into younger, tech-savvy farmers who are more likely to use online platforms for purchasing. Finally, diversifying their product offerings to cater to specific livestock needs can help feed millers tap into niche markets, ensuring they remain competitive and meet a broader range of customer demands. By focusing on these strategies, feed millers can strengthen their market position and drive growth.

CONCLUSION

To address the identified knowledge gaps among feed millers, it is crucial to implement targeted educational and training initiatives that cater to varying levels of proficiency. Advanced training modules should be developed for those with medium knowledge to elevate their expertise to a higher level. For individuals with low knowledge, foundational training programs combined with ongoing educational opportunities are essential for substantial improvement. These training programs should emphasize practical, hands-on experiences and incorporate the latest

advancements in feed formulation and best practices. By focusing on experience-based learning and practical application rather than solely on traditional theoretical education, the feed milling industry can enhance overall proficiency. This approach will lead to improved feed quality and subsequently better livestock productivity and health.

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