Assessing the impact of compound feed on Livestock: Saudi Arabian Livestock breeders perspective

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Abstract

This study analyzes livestock breeders' attitudes and experiences with compound feed in Saudi Arabia. A total of 108.901 livestock breeders were selected from the Ministry of Environment, Water and Agriculture roll, by using random sampling. Over 442 breeders participated, mostly male approximately 58.9% with an average age of 39 and around 9 years of education. The main occupation was livestock were (83.0 %). Sheep and goats were common (82% and 63%), in the Badia system (59.5 %). The main purpose of raising was commercial uses (62.4 %). but traditional feeding (Roughages and barley) and pasture systems dominated (59%). Only 27% used compound feed with barley and Roughages, and 34% never used it, citing concerns about cost, availability, and animal health. Those who used compound feed for over 7 years were the highest group (16.7%), suggesting slow adoption. Though 63% didn't observe health problems, others reported issues like 73% of the livestock breeder's changes in meat color, tumors, diarrhea, and reduced milk production. Further research is needed to understand these health concerns and improve compound feed usage in Saudi Arabia.

Keywords: Livestock sector; compound feed; forage; animal breeders; feeding practices

Introduction

Livestock plays an important role in food security and sustainable development, as demand for animal products has increased globally as a result of increases in population, improved incomes, and expanding urbanization. Globally, demand for animal products in developing countries has increased as a result of population growth. This need is expected to rise to 455 million tons of meat and 1077 million tons of dairy by 2050, which is more than in 2005 and 2007 (Alexandratos and Bruinsma, 2012). Animal protein (milk, eggs, fish, and meat) is one of the important nutrients for achieving food security. It is an integral part of human food around the world and contributes to building and enhancing the health of the human immune system. By 2050, the world population is expected to reach 9.4 billion people. So; It is important that global animal production rise by 2.3% every year until 2050 to meet the growing needs of the world population (Sun & Guan, 2018).

Animal feed affects production, profits, the environment, as well as human food security and health, and the cost of animal feeding represents 70% of the total costs of animal production and may rise in intensive or closed projects (Makkar, 2016). On the other hand, the materials used in the formulation of animal foods affect the environment, as well as food security and human health. In addition to the previous reasons, it may be economically costly. Improving knowledge and application of technical practices regarding livestock feeding, care, and production has a positive impact on improving sustainable rural livelihoods, food security, and increasing incomes (Young *et al.* 2014). Therefore, good nutrition increases the productive efficiency of the animal and thus profits (Linde *et al*., 2002). Many livestock production systems are rapidly evolving to meet the growing and sustainable demand for animal products. These systems focus on modern trends in maintaining a balance between intensifying livestock production and ensuring the livelihoods of families that depend on it, applying best practices for more sustainable livestock management and utilizing feed resources and diet products, and promoting innovative ways to reduce losses during feed production and, on the other hand, preserving the environment, especially land, and water, and competition for food and rations between humans and animals. (Robinson *et al.*, 2011; FAO, 2016).

Globally the Codex Alimentarius Commission (Codex) has issued a Guide to Good Animal Nutrition that sets out the basic principles of good animal nutrition practices at any stage of the feed chain, from feed producers to animal nutrition by breeders (Codex Alimentarius, 2004). In 2020, a new guide entitled "Good Practice Guide for the Feed Sector: Implementing the Codex Code of Practice on Good and Proper Nutrition for Animals" was issued for the purpose of providing comprehensive information and practical guidelines to breeders, producers and all stakeholders along the production chain and ensuring compliance with the requirements of these codes and practices. Regarding good animal nutrition (FAO/IFIF, 2020).

Nutritional systems are one of the most important practices that affect production, profits, the environment, as well as food security and human health (Makkar, 2016). In general, there are two systems for feeding animals. The first is traditional feeding, either through grazing or feeding the animal on grains and Roughages, together or separately, such as feeding on barley and alfalfa. The second is modern feeding with compound feed, which are homogeneous mixtures of feed materials. Raw material prepared from plant sources, mineral salts and vitamins in certain proportions with other feed additives such as mixtures of fatty acids and oils and is generally produced either in fine form or in the form of pellets or granules (SFDA, 2017). The use of integrated and appropriate feed for the animal that meets nutritional needs is linked to several reasons, including the personal and social characteristics of the breeder. There are also some reasons related to the feed itself, such as its poor quality that does not meet the nutritional and productive needs of the animal, or the feed factories' use of poor-quality feed inputs (MEWA, 2020).

Locally, the Kingdom of Saudi Arabia is making a great effort to develop the agricultural sector, both plant and animal. Within the framework of sustainable development, global food security and environmental preservation, the number of sheep reached about 21 million heads, goats about 6.5 million heads, camels 1.5 million heads, cows 302,000 heads, and 5 million poultry and birds (GASTAT, 2020).

The importance of the study is due to the fact that the cost of feed can constitute up to 70% of the total cost of animal projects. Saudi Arabia lacks the availability of natural Roughages for animals. Therefore, knowledge and rules of correct and ideal practices for feeding livestock may contribute to improving the productive efficiency of livestock in Saudi Arabia. Therefore, this study aims to analyze livestock breeders' reactions to compound feed by determining the beginning of the use of compound feed. Exploring the health problems resulting from the use of compound feed from the point of view of breeders.

The problem of the study lies in the crisis resulting from the shortage of barley supplies and the rise in its prices after the removal of government support for it in the Kingdom of Saudi Arabia in accordance with the decision of the Ministry of Environment, Water and Agriculture No. (1441/1/291035) dated December 21, 2019 (MEWA, 2019). Also, stopping the cultivation of green Roughages by decision of the Council of Ministers No. 66 dated 12/8/2015 (Council of Ministers, 2015). The need to shift from traditional feed (barley and alfalfa) to compound feed that would contribute to raising the efficiency of animal production.

In the absence of previous studies in the Kingdom of Saudi Arabia on the current situation of livestock breeders' attitudes towards compound feed and their safety and the problems they face in this regard.

The main objective of this study is to analyze the reactions and observations of livestock breeders towards compound feeds.

Materials and Methods

Samples were done in accordance with ethical approval from the Human Ethics Committee of King Saud University (Reference No. HEC 2021/758) to conduct this study.

Research Design

The research strategy adopted by this study is a quantitative research methodology using a survey design. A cross-sectional survey design was used to collect data at one point in time and examine the patterns of relationship between various variables at a particular time.

Study Population and Sample

The study population consisted of livestock breeders in the Kingdom of Saudi Arabia. Their information was obtained from the Ministry of Environment, Water and Agriculture (MEWA) database. As of December 31, 2021, the total number of livestock breeders registered in the database was 108901 (MEWA, 2021). An online survey was developed to collect data from January to March 2022. Electronic questionnaires were shared with all livestock breeders in the database through email and letter. The researcher prepared a letter that included the purpose of the study and contact information for the researcher. Livestock breeders were given one month to fill out the electronic questionnaire, and 281 questionnaires were delivered without any reminder. A reminder was then sent to all breeders who did not respond after this period. After this reminder, two weeks were given to complete the electronic questionnaire. During this period, a further 131 questionnaires were collected. The researchers sent a final reminder to all breeders who did not respond, giving them another two weeks to complete the electronic questionnaires. In this period, 116 responses were collected. A total of 528 responses were returned to the researchers. Eighty-six questionnaires were excluded due to incomplete data. Therefore, in the final analysis, the study sample consisted of 442 breeders.

Data collection tool

The questionnaire consists of two sections. The first section consists of the following information about the livestock farmer profile: gender, age, education, primary source of income, experience in livestock farming, membership in livestock associations, primary purpose of livestock raising, number of animals, and type of livestock operation. The second section is nutrition systems. The third section is about the use of compound feed and the health problems resulting from their use. Moreover, each item was examined based on its suitability for the study by five experts from the Department of Animal Production and Agricultural Extension at King Saud University

Additionally, pre-testing the tool with 15 livestock breeders before data collection ensures that the content is valid. Six items were reformulated to reflect the local raising context in Saudi Arabia, according to responses from breeders who participated in the pre-test. Not all breeders participating in the pilot study were included in the sampling process. Accordingly, the livestock breeders' attitudes scale proposed for the study reached the established standards of validity and content reliability.

Data analysis

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS, version 28.0, IBM Corp, Armonk, NY, USA.). Responses were reported using descriptive statistics methods such as frequency distributions, percentages, and arithmetic mean. Similarities and differences between the trends examined about the average adoption score were explored using hierarchical agglomerative cluster analysis. Euclidean distance was applied as a measure of divergence, and Ward's hierarchical clustering method was used for the trends of the livestock breeders under study

Results and Discussion

Socioeconomic Characteristics of the Respondents:

Table 1 shows the socio-economic profiles of the livestock breeders surveyed. The results reveal that more than half, 58.9%, are males due to this group's demand for raising livestock, which requires a nature of work related to raising animals and selling them in the markets, and therefore they are more capable of meeting the requirements of this profession, and 41.1% are females. Livestock breeders were 39.11 years old on average, and breeders had 9.8 years of education. Moreover, livestock breeding was the main occupation for the majority of breeders 83%. Also, 55.9% have less than 16 years of experience in raising livestock. Only a small proportion of breeders 9.1% were members of local livestock associations, and approximately one-third 32.5% were in regular contact with extension workers. In addition, commercial production was the main target of livestock farming at 62.4%. Regarding breeding characteristics, it also appears that breeders own and manage more than one type of animal.

As Table 1 shows, the majority of breeders (82.2%) own sheep, followed by goats at 63.3%. Most breeders (59.5%) raise livestock on pastures, while about 25.1% use barns to raise their animals. Finally, 32.4% of breeders relied on traditional feed (barley and roughage) as the main feeding system for their livestock, and this is consistent with what was reported by Salama *et al.* (2019) revealed that the rate of feeding on grains in Egypt has increased directly by 78.3% of livestock breeders, which is a traditional practice in the field of nutrition, while 27.4% of them use compound feed, barley, and roughages for feeding.

Table 1. Socioeconomic profile of the respondents.

Breeders Characteristics	Freq.	%	Mean	Std. dev.	Min.	Max.
Gender (n = 440)						
Female	181	41.1	0.59	0.49	0	1
Male	259	58.9				
Age (n = 402)						
Less than 35 years	195	48.5	39.11	12.66	22	90
35–55 years	159	39.6				
More than 55 years	48	11.9				
Education (n = 442)						
Illiterate	61	13.8	9.8	4.9	0	17
Less than 7 years	84	19.0				
7–12 years	189	57.8				
More than 12 years	105	24.4				
Livestock raising as a main source of income (n = 442)						
Yes	367	83	0.83	0.37	0	1
No	75	17				
Livestock raising experience (n = 395)						
Less than 16 years	221	55.9	17.26	12.47	3	38
16–30 years	104	26.3				
More than 30 years	70	17.8				
Membership in livestock associations (n = 442)						
Yes	40	9.0	0.09	0.28	0	1
No	402	91.0				
Regular contact with extension workers (n = 442)						
Yes	170	32.5	0.38	0.48	0	1
No	272	61.5				
The main purpose of raising livestock (n = 442)						
Commercial (Meat production)	198	44.8	n.a	n.a	1	5
Commercial (Milk production)	12	2.7				
Commercial (Meat and milk production)	66	14.9				
Personal use (meat or milk)	49	11.2				
Hobby	116	26.2				
Competition in beauty contests	1	0.2				
Animals (n = 442)						
Camels	93	21.1	n.a	n.a	1	4
Cows	29	6.6				
Sheep	363	82.2				
Goats	280	63.3				
Number of camels (n = 93)						
Less than 21	52	55.9	33.22	31.66	10	120
21–40	33	35.5				
More than 40	8	8.6				
Number of cows (n = 29)						
Less than 16	15	51.7	23.0	26.41	5	100
16–30	9	31.1				
More than 30	5	17.2				
Number of sheep (n = 363)						
Less than 101	122	33.6	144.66	92.3	70	850
101–200	110	30.3				
More than 200	131	36.1				
Number of goats (n = 280)						
Less than 51	123	43.9	96.48	82.29	50	550
51–100	81	28.9				
More than 100	76	27.2				
Type of livestock operation (n = 442)						
On pasture	263	59.5	n.a	n.a	1	4
Farm complex	60	13.6				
Barns	8	1.8				
Sheds	111	25.1				
Feeding system (n = 442)						
Roughages and grazing	89	20.1	n.a	n.a	1	4
Roughages and barely	143	32.4				
Compound feed	89	20.1				
Compound feed, barely, and Roughages	121	27.4				

Distribution of the livestock breeders according to willingness use of compound feed

The results of the overlay analysis distribution of the livestock breeders according to period, willingness, and health problems are summarized in Table 2. According to the use periods of compound feed, it was clear that the majority of breeders 16.7% started using compound feed (more than 7 years ago), followed by 16.1% who started using compound feed (1-2 years), then 8.4% started using com-pound feed (3 - 4 years old). While 6.3% have started using compound feed 5-7 years ago. This is consistent with what Rasyid *et al.* (2018) livestock breeders have low knowledge of compound feed, and this stems from not adopting modern technology in nutrition such as compound feed.

Table 2. Distribution of the livestock breeders according to period's, willingness and health problems use of compound feed.

Variables		Frequency	Percentage (%)	Total
Periods	*Interval*			442
	1-2	71	16.1	
	3-4	37	8.4	
	5-7	28	6.3	
	≥ 7	74	16.7	
	Don't used	232	52.5	
Willing-ness	*Existent*			210
	Yes	138	34.3	
	No	72	65.7	
Health* problems	*Existent*			442
	Yes	164	37.1	
	No	278	62.9	

Table 3. Distribution of the livestock breeders according to health problems variable

Health Problems*	*Frequency	Percentage (%)
Meat color	57	73
Abscesses	42	53.8
Diarrhea	37	47.4
Infection of diseases	34	43.6
Milk production	33	42.3
Hair pulling/loss	20	25.6
Wasting	16	20.5
Reproductive problems	15	19.2
Abortion	13	16.7
Total	**164	100

* More than one health problems; **breeders who reported having health problems

The results also showed that there was 52.5% didn't use compound feed for feeding livestock. Regarding the attitudes and willingness of the study participants to use the compound feed, we found that the majority of breeders representing 65.7% desire to continue using a compound feed, this is consistent with what John (2019) reported on the desire of the majority of livestock breeders' in Uganda to practice and use feed formulation at 70%. while (34.3%) didn't want to continue using the compound feed for their animals. The breeders have concerns about the welfare aspect of their flocks when using the compound feed, it is consistent with what Almutairi *et al.* (2023) stated that the vast majority of livestock breeders, 86.4%, have neutral attitudes toward compound feed.

They still need to create awareness of the importance of compound feed to help create positive attitudes that will be an incentive to increase the rate of compound feed adoption, Also consistent with Meena *et al.* (2014) found that there is a wide gap between modern technologies and their adoption in the field of livestock nutrition, reaching 67.37%, It is also consistent with the study of Morsy *et al.* (2018) found that the level of livestock breeders' adoption of guidelines for modern technology in animal production was low, at a rate of 69.4%. However, the results indicate that the majority (62.9%) didn't notice health or other problems in their livestock by using the compound feed, this is consistent with Blanco *et al.* (2015) that compound feed does not cause health problems when used in fattening lambs, consistent with Matar *et al.* (2020) that feeding lambs compound feed with roughages led to improved feed intake, increased body weight, and the meat had a higher content of unsaturated fatty acids. And 37.1% noticed health problems when using the compound feed, this is consistent with what was reported by Alhidary *et al.* (2017) that feeding compound feed lambs may increase the incidence of rumen acidity, which affects the health and productivity of ruminants

Regarding the type of health problems observed when using the compound feed, the data in Table (3) indicate that 73% of the livestock breeders noticed a change in the color of the meat, consistent with what was mentioned by Alhidary *et, al.* (2017) that feeding lambs on compound feed may cause the dark color of rumen tissue and It differs from what was mentioned by Alhidary *et al.* (2016) found that compound feed improved carcass characteristics and meat quality of Naimi lambs. while 53.8% of the livestock breeders noticed the appearance of abscesses on their livestock when using the compound feed and it noticed that 47.4% of the breeder's that their livestock suffering diarrhea, while it was found that 43.6% of the livestock breeders noticed that their livestock were suffering from various diseases. The reason for the emergence of these health problems may be due to not adding Roughages feed alongside compound feed, as compound feed may increase the incidence of the acidity of the rumen, which will negatively affect the health and productivity of ruminant animals.

It is also clear from the data in Table (3) that 42.3% of the livestock breeders notice problems with milk production in their livestock when using compound feed, and this is not consistent with Zhong et al. (2020) that feeding dairy cows with compound feed led to improved milk quality in terms of an increase in the percentage of milk protein and volatile compounds with good flavor in the milk, and a decrease in the percentage of milk fat, and the compound feed did not affect milk production. We also find that 25.6% noticed hair loss, and observations of the livestock breeders about wasting, reproductive problems, and Abortion were 20.5%, 19.2%, and 16.7%, respectively.

Conclusions

To our knowledge, this study is considered one of the first studies that addressed the extent of livestock breeders' reliance on compound feed and highlighted the health notes on their use from their point of view. Since this topic has rarely been discussed in previous studies in the context of Saudi Arabia, this study contributes to the existing literature by emphasizing the actual adoption rates of compound feed. It was found that about a third of breeders (32.4%) depend on traditional fodder (barley and roughage only). 65.7% wanted to continue using compound feed, but 34.3% did not want to continue using compound feed for their animals. Common health problems with compound feed were changes in meat color, abscesses, and diarrhea, However, one of the challenges in this study is that the observations were collected by self-reporting and the difficulty of linking the type of feed used to the symptoms that appeared on the animals.

Therefore, future research focusing on analyzing livestock breeders' knowledge and attitudes associated with the use of compound feed is urgently needed. Such a focus could further clarify the factors and/or stakeholders that help expand or hinder the adoption of compound feed and also requires more scientific studies to ascertain the quality and safety of compound feed and their relationship to these health problems. It is also important to direct livestock breeders to the importance of nutrition that meets the nutritional needs of the animal according to its productive and physiological state, and to encourage breeders to apply modern methods and good practices in animal production through proper nutrition and animal welfare to make the livestock industry more sustainable.

Ethical Approval: The study was conducted in accordance with the approval of the Standing Committee for Scientific Research Ethics at King Saud University (Reference No. HEC 2021/758).

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Data Availability Statement: All data sets collected and analyzed during the current study are available from the corresponding author on fair request.

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Conflicts of Interest: The author declares no conflict of interest.

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