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Value Chain Analysis of Jameed Production in Jordan

Doukhi Abdelrahim Alhunaiti[1], Mohamed Ahmed Hamdan[2]

[1] Department of Agricultural Economics and Agribusiness, Faculty of Agriculture, University of Jordan, Amman, Jordan
[2] Department of Finance, College of Business, Jazan University, Jazan, Saudi Arabia
Corresponding author: Doukhi Abdelrahim ALHUNAITI

ABSTRACT: Jameed is a traditional product produced by fermenting and drying dairy products which have been salted, which plays a significant role in culture and livelihood of people in Jordan, especially as it relates to the association with Mansaf, Awassi sheep breeding and households. In this paper, the analysis of the Jameed value chain is conducted with regard to the supply of inputs and primary production through processing, trade and consumption using value-chain analysis, rapid rural appraisal, sector statistics, stakeholder evidence and a structured survey involving 400 Awassi sheep breeders. The findings reveal that the constraints include reliance on purchased feed, limited natural grazing, seasonal availability of milk, traditional processing, limited access to improved technology, food safety risks and reliance on intermediaries. The evidence from the survey reveals that 85.0% of breeders regarded high feed costs as a constraint, 65.8% reported lack of grazing and 61.0% indicated seasonality. Of those Jameed producing farms, 76.4% applied traditional processing while 23.6% used improved or semi-mechanized processing. Importantly, the official 2025 Department of Statistics trade data provide crucial information on the market of Jameed: imports of Jameed amount to 3,417,430 kg valued at JD 7,875,855 compared with exports of 481,682 kg valued at JD 1,122,963 and re-exports of 3,850 kg valued at JD 11,272. This means that there is a deficit in the trade of almost JD 6.74 million.

1. INTRODUCTION

Jordanian small ruminant production takes place in an environment of environmental scarcity, changing pastoralism and increasing market integration. Sheep and goats are major sources of meat, milk and income, especially in areas where climate is unfavorable for the development of agricultural activity. Awassi sheep is particularly important due to the ability to adapt to arid conditions and because their milk is used in production of different traditional dairy products like yogurt, ghee, cheese and Jameed. Gradually, declining mobility, degradation of rangeland and marketization of livestock production resulted in increased use of feed bought from outside the farm and created dependency of productivity and profitability of small ruminants system on input costs and public support for feed production (Hijazi et al., 2018).

Jameed is a dairy product made of sheep or goat milk by fermentation and drying. Jameed is linked to Mansaf in cultural and culinary context and thus it is economically, socially and culturally valuable rather than nutritionally (Hilali et al., 2024; Haddad et al., 2021). Drying helps to turn seasonal and perishable milk into the product that can be stored, transported and sold for a long period of time (Hilali et al., 2024; Konuspayeva et al., 2023). Drying makes it possible for rural households to obtain additional value from milk production and thus diversify income. Women usually conduct crucial processing steps in production of Jameed and thus changes in Jameed processing and sales may also have implications for gender dynamics inside rural households (Hundaileh and Fayad, 2019).

Nevertheless, there are certain limitations facing the Jameed chain on various fronts. Firstly, breeders suffer from the high cost of feed, limited availability of grazing lands and seasonal milk production. In addition, animal health needs are to be taken into account at the upstream phase. During the processing phase, traditional processing techniques may sometimes be labour-

intensive and lead to variations in composition, hygiene and physical properties. Further downstream, decentralized household-based production may decrease the bargaining power of producers and create a need for intermediaries while imports of foreign products may threaten domestic Jameed through their price competitiveness and commercialization. At the same time, regional traditional foods like Al-Karak Jameed enjoy high premium due to association of origin with quality and cultural traditions (Al-Saed et al., 2012; Hilali et al., 2024).

Earlier studies have examined different elements of this value chain. Studies focused on small dairy technology have indicated that technological improvements, namely improved separation of fat, hygienic handling of the product and proper drying conditions can result in better physicochemical parameters and economic performance from milk processing (Alu'datt et al., 2015; Alu'datt et al., 2016; Hilali et al., 2017; Hilali et al., 2024). Other scholars concentrated on the nutrition value, food safety, geographic identification and economic opportunities associated with traditional dairy foods. While being important, technical progress in milk processing does not provide solution to all other possible limitations of the chain mentioned above (Al-Saed et al., 2012; Hilali et al., 2024).

In such a context, a value chain approach is indeed relevant since it focuses on the product as the result of a set of activities rather than the processing procedure itself. The value chain approach links together input suppliers, breeders, processors, traders, retailers, institutions, and consumers and makes it possible to understand the technical obstacles in the context of governance and market dynamics. Moreover, the approach can help define the points of value creation, risk concentration and coordinated intervention which can bring certain benefits to all participants beyond the possibilities of individual actors (Awad et al., 2024).

Nowadays, the trade aspect becomes especially significant. Previously made analyses of the sector revealed the presence of significant differences between domestic production and consumption; however, recently available customs data allows to get more up-to-date information about market dependence. According to the data provided by Department of Statistics in 2025, Jameed is mentioned separately under HS 040390100 and demonstrates the significant difference between imports and domestic exports. Such information transforms the issue of market into measurable trade imbalance and makes the analysis of import substitution, product differentiation and export possibilities more valid.

Therefore, the present study is focused on the identification of the Jameed value chain in Jordan; the description of the production, processing, and marketing characteristics among Awassi sheep breeders; the definition of the most critical technical, institutional, and market obstacles; the examination of the selected relationships in the breeder survey; the assessment of the foreign-trade position based on official statistics of 2025 and the determination of upgrading priorities for safer, more effective and competitive Jameed sector. Particular attention is given to feed dependency, processing technology, women's involvement, food safety, cooperation, geographical origin, and the relationship between domestic upgrading and trade performance.

2. MATERIALS & METHODS

2.1 Study design

A value chain design involving VCA and Rapid Rural Appraisal (RRA), sector statistics/reports review, stakeholders' interviews, and a structured breeder survey was employed. This design was used since the Jameed sector comprises both tangible aspects of farm-level factors and intangible aspects of institutional relationships that could not be covered using a single indicator. VCA was applied to establish actors, activities, products and information flows to uncover institutions and upgrading points from input supply to consumption. RRA and semi-structured stakeholder interviews were used to capture the pathways and relationships in the market structure, governance structure, operation bottlenecks, and institutions. The survey part aimed at providing quantitative data on breeder and production conditions, processing practices and constraints, and markets.

2.2 Study population and sampling framework

The study population comprised Awassi sheep breeders in Jordan. In the survey, 400 breeders from the most important sheep producing regions in Jordan were included. Respondents were identified from accessible breeder networks and local agriculture contacts in the chosen production area. Participation in the survey was conditional on breeders being active in Awassi sheep farming and able to give adequate information about production, feeding, processing and marketing activities of their farm.

In all, 400 questionnaires were used in the analysis. Since a complete description of the sampling frame and individual probabilities of being selected were not known for this analysis, this sample cannot be called a probability-based national sample.

Consequently, the results of the analysis should be treated as those for a geographically varied sample of Awassi sheep breeders, and not the results based on statistically weighted samples of sheep breeders in Jordan.

2.3. Questionnaire

This questionnaire contained four major components: household and farm characteristics; production and processing of sheep milk; marketing channel, cost and price seasonality; and links with traders and other value chain actors. It included information on household and farm level variables, grazing and feeding conditions, whether the producer produces Jameed, the method of processing, the price of production, the contribution of Jameed to the household income, production and marketing constraints, and perceptions of any potential upgrading activities. The producer perception measures were measured using a 5 point agreement scale where 1 = strongly disagree to 5 = strongly agree. In order to measure constraints, multiple response options were provided since producers can face different constraints at the same time.

2.4 Value Chain Mapping and Secondary Data

The value chain mapping involved mapping of stakeholders and markets which helped in categorizing the value chain into inputs, primary production, processing, trade, retail and consumption. The analysis involved the role of Ministry of Agriculture, veterinary services, feed suppliers, private traders, processors, food safety organizations and exports. Special focus was made on the levers for upgrading the chain technically, organizationally and politically (Ministry of Agriculture, 2020).

Secondary data sources include government statistics, industry reports, literature review and institutional databases. For international trade, secondary data sources include Jordan Department of Statistics Harmonized System 2025. The original table clearly shows Jameed (HS 040390100) from laban raib (040320000) and fermented or acidified milk products (040390900). Quantities are measured in kilograms, and prices are shown in Jordanian dinars. Trade balance is seen as exports, including re-exports, less imports. Customs unit value is used to measure the trade value per kilogram and it is not used to show the price at the farm gate and retail.

2.5 Statistical analysis

Data collected in the questionnaires from 400 breeders was analyzed using SPSS. Frequency and percentage were calculated for categorical data while mean and standard deviation were calculated for continuous data. Multiple-response analysis was conducted for production and marketing constraints. Chi-square test was used to assess the association between categorical data, Welch's independent-samples t-test was done to examine the difference in selling price according to processing method, one-way ANOVA was used to compare the regional price differences and logistic regression was used to identify the factors affecting Jameed production in farms. The significance was set at .05 alpha level.

2.6 Ethical considerations

The research was conducted among adult livestock breeders and other actors within the value chain and did not involve any clinical intervention, procedure or handling of health information. It was voluntary and the research objectives were clearly stated to the participants before their participation in the survey. Respondents were informed that the collected data would be treated in confidence and used exclusively for research purposes. No personal details are presented in this paper and only the aggregated results of the study are presented here.

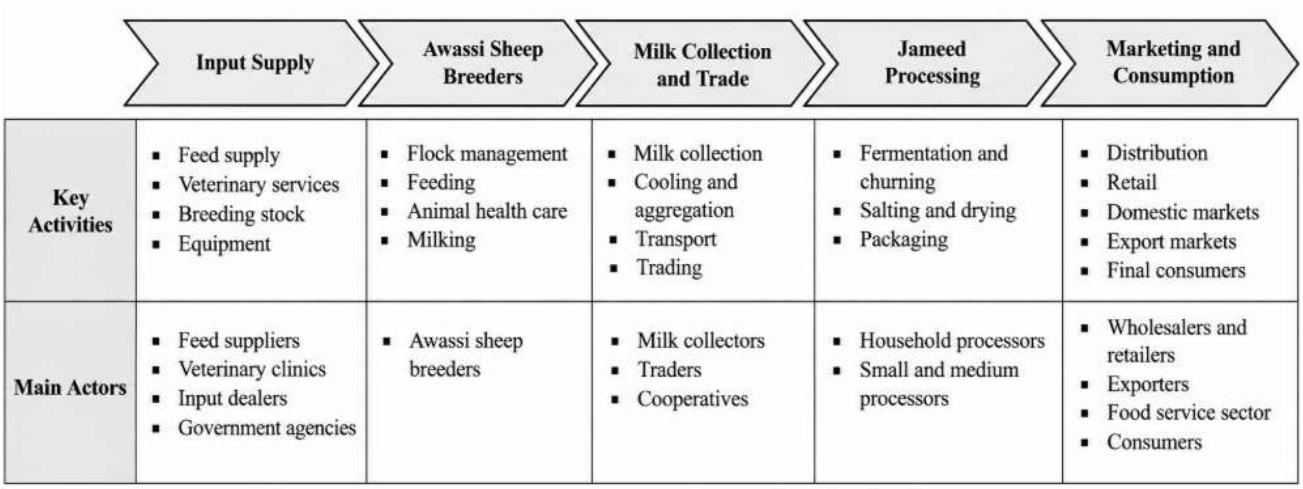
3. RESULTS & DISCUSSION

3.1 Structure and governance of the Awassi sheep and Jameed value chains

The entire value chain consists of input suppliers (feed, veterinary, equipment, packaging etc.), breeders, processors and other parties (traders, retailers, exporters and final consumers). It is also affected by public institutions via provision of animal health services, feed support, standards, food safety controls and extension services. Therefore the structure of the chain is more complex than linear milk production and consumption process; it involves a network, where breeder's decision-making process depends on both input markets and marketability options of the product.

Breeders are the central production link but they are highly dependent on other actors whose role they can hardly control. Input markets (via feed traders and public support institutions) affect the costs of maintaining the flock; veterinary institutions affect animal health and milk safety; intermediaries affect market opportunities; processors and retailers affect the standards of product acceptance. Such structure provides the opportunity for breeder margins to be squeezed due to high input costs and poor

bargaining position during selling the product. Therefore the value-chain approach focuses on governance in addition to production. Figure 1 depicts major actors and activities within the Awassi sheep-Jameed value chain.



	Input Supply	Awassi Sheep Breeders	Milk Collection and Trade	Jameed Processing	Marketing and Consumption
Key Activities	▪ Feed supply ▪ Veterinary services ▪ Breeding stock ▪ Equipment	▪ Flock management ▪ Feeding ▪ Animal health care ▪ Milking	▪ Milk collection ▪ Cooling and aggregation ▪ Transport ▪ Trading	▪ Fermentation and churning ▪ Salting and drying ▪ Packaging	▪ Distribution ▪ Retail ▪ Domestic markets ▪ Export markets ▪ Final consumers
Main Actors	▪ Feed suppliers ▪ Veterinary clinics ▪ Input dealers ▪ Government agencies	▪ Awassi sheep breeders	▪ Milk collectors ▪ Traders ▪ Cooperatives	▪ Household processors ▪ Small and medium processors	▪ Wholesalers and retailers ▪ Exporters ▪ Food service sector ▪ Consumers

Figure 1. Main Actors and Activities in the Awassi Sheep–Jameed Value Chain in Jordan

3.2 Upstream production conditions and feed dependency

Official sector data place the national sheep-and-goat population at approximately 4.10 million head and aggregate production-input expenditure at about JD 253.2 million, with concentrated feed accounting for approximately 71% of input costs (Department of Statistics [DOS], 2026). These figures indicate that feed is not a peripheral operating expense but a central determinant of livestock-sector economics. When feed prices rise, the effect can be transmitted throughout the Jameed chain through the cost of maintaining dairy animals and the effective cost of milk used for processing.

The breeder survey reinforces this interpretation. Natural grazing averaged 3.00 months per year (SD = 0.73), indicating that grazing can supplement but cannot replace purchased feed for most of the production year. Subsidized feed coverage averaged 14.90 days per month (SD = 3.06). The mean subsidized feed price was approximately JD 175 per ton, whereas the mean open-market price was JD 229.9 per ton (SD = 15.32). The difference between supported and open-market prices creates a clear exposure to cost escalation once the subsidized allocation is exhausted.

This exposure is also visible in the reported constraints. Eighty-five percent of breeders identified high feed cost as a constraint, 65.8% reported limited natural grazing and 61.0% reported seasonality of milk or Jameed production. On the perception scale, the statement that feed cost is a major constraint obtained the highest mean (M = 4.33, SD = 0.63), while limited grazing increasing production cost also received strong agreement (M = 4.10, SD = 0.78). These results connect the macro-level cost structure with farm-level experience and support treating feed policy as a primary upgrading issue rather than merely a background condition.

Veterinary support partly offsets upstream vulnerability. Public animal-health services and vaccination campaigns reduce disease risks, while private veterinary clinics and pharmacies provide localized treatment. Nevertheless, dairy value chains require particular attention to rational antimicrobial use and withdrawal periods because residues in raw milk can create both food-safety and fermentation problems (Rahman et al., 2021). Strengthening residue surveillance and breeder awareness would therefore protect both consumers and processors

3.3 Jameed processing, technology and product differentiation

Jameed processing converts highly perishable milk into a concentrated, shelf-stable product through a sequence that includes filtration, heating or warming, fermentation, churning or fat separation, concentration, straining, salting, shaping and drying (Alu'datt et al., 2015; Hilali et al., 2024). Traditional processing relies on culturally embedded equipment and open-air or household drying practices (Hamad et al., 2017; Hilali et al., 2024). The survey reports a mean milk-to-Jameed conversion of 11.97 L/kg, closely corresponding to the commonly cited requirement of approximately 12 L of raw sheep or goat milk for one

kilogram of dried Jameed. This high concentration ratio helps explain why milk availability and feed cost are transmitted strongly into the economics of the final product (Abu-Lehia, 1988; Hilali et al., 2015).

Among the 400 surveyed breeders, 296 farms or households (74.0%) reported producing Jameed. Of these producers, 226 (76.4%) used traditional processing and 70 (23.6%) used improved or semi-mechanized processing. Thus, traditional methods remain dominant, but a substantial minority has adopted some degree of technological upgrading. Jameed contributed an average of 19.7% of household income among producers, indicating that it is economically meaningful without necessarily being the sole source of livelihood.

Improved small-scale technologies described in previous research include mechanical fat separation and enclosed natural-convection solar drying. Reported advantages include improved consistency, greater recovery of butterfat or ghee, lower water and energy use, improved product lightness and better hygiene (Alu'datt et al., 2016; Hilali et al., 2017). Such technologies are relevant because they address several survey constraints simultaneously: labor intensity, limited equipment access, food-safety concerns and the need to increase returns from a fixed quantity of milk.

Technology adoption should nevertheless be interpreted carefully. The survey found a mean selling price of JD 9.21/kg for traditional processors and JD 9.47/kg for improved or semi-mechanized processors, but Welch's t test showed that the difference was not statistically significant. This indicates that adopting improved equipment does not automatically generate a price premium. Financial returns may instead arise through labor savings, reduced losses, better recovery of co-products, improved quality consistency or access to market channels that are difficult to measure through selling price alone.

Figure 2 presents the Jameed-specific chain from input supply through processors and traders to domestic and foreign consumers. The diversity of processors—including traditional farmers, home producers, small artisanal workshops, women-led dairies and commercial firms—creates both resilience and standardization challenges. A uniform upgrading strategy would therefore be inappropriate. Household producers may benefit most from shared equipment, hygienic drying and cooperative marketing, while commercial processors may require stronger traceability, product specifications and brand differentiation (Hundaileh and Fayad, 2019).

Figure 2 illustrates the main stages of traditional Jameed production, from milk filtration, warming and culturing through churning, pressing, salting, kneading, forming and drying. The process highlights the sequential transformation of raw milk into the final dried Jameed product.

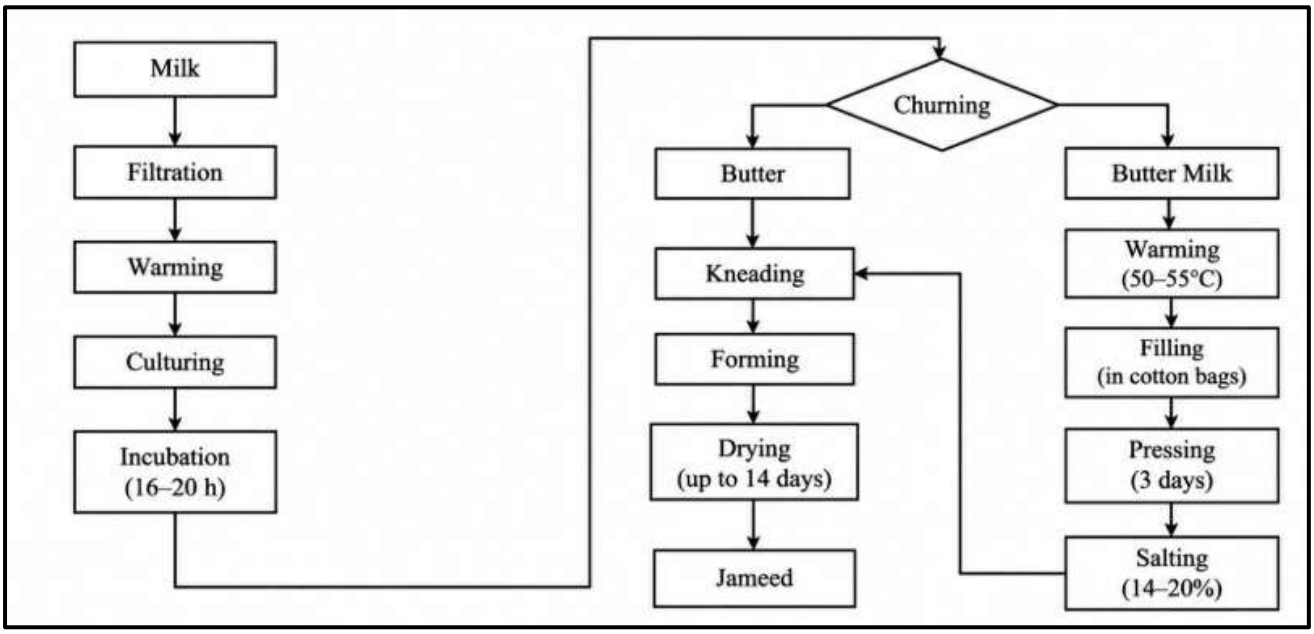


Figure 2. Traditional Jameed Production Process. Source: Hilali et al. (2023)

3.4 Market structure, price differentiation and foreign trade

Jordanian Jameed has demonstrated export potential beyond the domestic market. A sector assessment based on ITC Trade Map data reported that Jordan exported dairy products to approximately 25 countries in 2017 and identified the United States as an important destination, with approximately USD 840,000 in dairy exports to that market consisting mainly of Jameed. The same assessment identified long-shelf-life liquid Jameed as a product with further growth and export potential (Hundaileh & Fayad, 2019).

Table 1. Jordan's foreign trade in Jameed and related fermented dairy products, 2025

HS code	Product	Imports kg	Imports JD	Domestic exports kg	Domestic exports JD	Re-exports kg	Re-exports JD	Total export value JD	Trade balance JD
040320000	Laban raib	5,723,708	5,849,734	9,900	9,045	0	0	9,045	−5,840,689
040390100	Jameed	3,417,430	7,875,855	481,682	1,122,963	3,850	11,272	1,134,235	−6,741,620
040390900	Other fermented/acidified milk products	1,270,121	2,708,565	119,026	120,269	0	0	120,269	−2,588,296

Source: Jordan Department of Statistics, External Trade Statistics, Harmonized System (HS), 2026. Trade balance = total export value minus import value.

The official figures for 2025 trade in Jameed exhibit a significant disparity in the market. Jordan imported 3,417,430 kg of Jameed with a customs value of JD 7,875,855, and on the other hand, the country exported 481,682 kg with a value of JD 1,122,963 and re-exported 3,850 kg with a value of JD 11,272. As a result, the total value of exports is JD 1,134,235 which created a negative trade balance of JD 6,741,620. The imports are seven times greater than the domestic exports in terms of quantity, while the net imports after domestic exports and re-exports are around 2.93 million kg. This clearly indicates a heavy reliance on imports in the formal trade market.

However, the trade statistics have to be understood properly. It does not indicate that the imports are higher than the domestic production of Jameed in Jordan, since customs statistics reflect the foreign trade and not the domestic production or consumption of a product. Therefore, what should be said is that the imports are much higher than the exports and Jordan has a significant negative Jameed trade balance.

On the other hand, the presence of domestic exports amounting to 482 thousand kg indicates that Jordanian Jameed has its market outside the country. This is crucial since Jordanian Jameed, especially those from Al-Karak and traditional methods of processing, have cultural prestige (Hilali et al., 2024). Indeed, the pronounced regional price pattern seen later on in the survey analysis suggests the possibility that origin and authenticity have value in the marketplace. Thus, not only should the policy goal focus on substituting cheap imports, but it should also enhance the competitiveness of verified Jordanian Jameed as a distinctive product to satisfy domestic and export markets such as Gulf and Arab diasporas.

The customs value suggests that the average unit value of Jameed imports is approximately JD 2.31/kg while domestic exports average JD 2.33/kg. These customs values for unit value of imports/exports cannot be equated directly to the survey breeder price of JD 9.27/kg since they represent two different types of transactions. Indeed, it is critical to make the distinction since customs values refer to declared values of the traded goods while the survey price reflects producer-level transaction.

From a value chain perspective, the trade deficit of JD 6.74 million is a potential vulnerability as well as a market opportunity. The high cost of imports suggests that there is already a sizable domestic market being served by imports. As long as Jordanian producers can increase production competitively without sacrificing safety, quality, and authenticity of the products, then some of this existing demand can be met by domestic production. Hence, import-substitution strategies should be linked to increasing

the efficiency of the feed supply, the availability of milk, productivity and efficiency in processing, quality control and aggregation of the products for domestic sales and export markets.

In addition to making the case for the economic significance of the study, this trade analysis also reinforces its relevance to rural development. Increased domestic production of the product competitively could generate a demand for milk, animal husbandry, milk collection, processing, packaging, transport, quality assurance, marketing and exportation. It would also provide justification for value chain development policies that are linked to rural entrepreneurship and job creation policies. In this regard, youth who graduated in agricultural sciences, food sciences and related disciplines can be encouraged to create specialized enterprises that process Jameed, utilize common processing facilities or purchase seasonally produced milk from breeders to produce value-added products.

3.5 Statistical results

The breeder survey is micro-level data that can be used in conjunction with the sector and trade analysis. The sampling frame was spread geographically in the North, Central and South areas of the country, where the Central area made up 37.2% of the sample, the North 35.8% and the South 27.0%. The male share of respondents was 65.8%, while women made up 34.2%. Education levels were relatively low, with primary and secondary schooling being the most common, but one-third of the respondents had a higher level of education like a diploma or university degree. The average age of the respondent was 47.06 years (SD=11.32), the average age of farming experience 27.25 years (SD=12.12) and the average number of heads of flock 218.12 (SD=163.22).

Table 2. Profile of the N=400 breeder sample

Characteristic	Category	n	%
Region	North	143	35.8
	Central	149	37.2
	South	108	27.0
Gender	Male	263	65.8
	Female	137	34.2
Education	Primary or less	101	25.2
	Secondary	168	42.0
	Diploma	81	20.2
	Bachelor or higher	50	12.5

Table 3. Production and feed conditions

Variable	Mean	SD
Natural grazing (months/year)	3.00	0.73
Subsidized feed coverage (days/month)	14.90	3.06
Subsidized feed price (JD/ton)	175.0	≈5.0
Open-market feed price (JD/ton)	229.9	15.32

The structural feed issue is shown by Table 3 at the farm level. Natural grazing occurs for a short period throughout the year, whereas subsidized feed is available for almost half of the month. The cost of the open-market feed being more than the subsidized feed by about JD 55 per ton explains the steep cost increase in cases where the breeders buy more feed than the subsidization allows. It is because of this reason that the results of the survey related to costs of feed and grazing restrictions are consistent.

Table 4. Jameed production and processing indicators

Indicator	Result
Households/farms producing Jameed	296/400 (74.0%)
Traditional processing among producers	226/296 (76.4%)
Improved/semi-mechanized processing	70/296 (23.6%)
Mean milk-to-Jameed conversion	11.97 L/kg
Mean Jameed share of household income	19.7%
Mean selling price	9.27 JD/kg

The high percentage of farmers involved in the production of Jameed proves that milk processing is not an insignificant undertaking among the sampled group of breeders. However, the prevalence of traditional milk processing demonstrates that technological upgrading has not been achieved yet. The 19.7% average share of household income provides justification for making investments in increasing efficiency and marketing; however, this also implies that breeders will consider the process of Jameed production together with their other livestock-related occupations.

Table 5. Multiple-response constraints reported by breeders

Constraint	n	% of N=400
High feed cost	340	85.0
Limited natural grazing	263	65.8
Seasonality of milk/Jameed production	244	61.0
Labor-intensive processing	215	53.8
Marketing dependence on middlemen	190	47.5
Limited equipment/technology access	176	44.0
Limited access to finance	158	39.5
Veterinary/food-safety concerns	147	36.8

Note. Multiple responses were permitted; percentages therefore do not sum to 100%.

This hierarchy of constraints is telling since the top three issues are faced at or prior to processing: feed costs, grazing constraints, and seasonality. It signals that marketing reforms alone would not be able to solve the industry's problems. On the other hand, over half of the respondents perceived the process of processing to be labor-intensive, nearly half of the respondents perceive themselves as being dependent on intermediaries, and 44.0% of the respondents experienced difficulty with the availability of machinery and technologies.

Table 6. Producer perceptions

Statement	Mean	SD
Feed cost is a major constraint	4.33	0.63
Subsidized feed allocation is insufficient	4.02	0.77
Limited grazing increases production cost	4.10	0.78

Statement	Mean	SD
Marketing channels limit producer returns	3.55	0.91
Improved processing technology is beneficial	3.82	0.85
Stronger food-safety monitoring is needed	3.70	0.89
GI/origin certification would benefit Jameed	4.14	0.74
Cooperatives could improve bargaining power	3.96	0.79

Note. Five-point scale: 1 = strongly disagree to 5 = strongly agree.

The producer perceptions confirm the objective constraint measurements. The perceptions that received the highest consensus were that feed costs are the greatest, followed by geographical-indication or origin certification and its cost implications in case of limited grazing. Producer perceptions about favoring cooperatives and improved processing technology were also favorable. The low mean score given to marketing channels limiting returns (M = 3.55) should not be taken to mean that marketing is unimportant; instead, it highlights that production-related factors such as feed and grazing have more priority for the breeders. This sequence is helpful for policy design as the inclusion of producers in policies becomes possible if interventions are targeted at the constraints considered the most pressing by the breeders.

3.5.1 Inferential analysis

There was a significant association between the processing method and the main marketing channel, $\chi^2(3) = 23.12$, $p < .001$. This means that both traditional and improved/semi-mechanized processors use different marketing channels to sell their products. Although it is expected that improved processing technology makes it possible for processors to utilize the same marketing channel, the significance of the chi-square does not prove this claim or identify which channel yields the highest profits.

The average selling price was JD 9.21/kg for traditional processors and JD 9.47/kg for improved/semi-mechanized processors. There was no statistically significant difference between the two, $t(103.80) = -1.18$, $p = .241$. This finding is important since it highlights that it should not be assumed that adoption of improved technology automatically translates into higher prices. Benefit from technology adoption is possible through reduced costs, saving labor, uniformity of products, shelf life or buyer access among others.

One-way analysis of variance results revealed that there was a statistically significant regional difference in selling price, $F(2, 293) = 9.53$, $p < .001$. This is in agreement with the findings showing the existence of a premium price in the south region because of the Al-Karak Jameed (Hilali et al., 2024). Therefore, the regional price differences do not depend only on costs of production, but other factors might play roles in determining the prices.

Table 7. Binary logistic regression for Jameed production

Predictor	B	SE	p	OR	95% CI for OR
Flock size (per 100 head)	0.454	0.118	<.001	1.575	1.249–1.987
Female respondent	0.596	0.262	.023	1.816	1.086–3.035
South vs North	1.368	0.358	<.001	3.929	1.949–7.922

Predictor	B	SE	p	OR	95% CI for OR
Central vs North	0.093	0.263	.722	1.098	0.656–1.837
Experience (per 10 years)	0.084	0.100	.397	1.088	0.895–1.323

A number of characteristics are found to have an influence on the production of Jameed based on the logistic regression model. Each increase of one unit of 100 head in the size of the flock is expected to increase the odds of Jameed production by 1.575 times, controlling for all other variables in the model. The interpretation of the association seems reasonable from the perspective of the value chain because larger flocks mean a larger and more dependable supply of milk for processing. Respondents being female was associated with having 1.816 times the odds of having produced Jameed compared to being male. Again, this makes sense considering the role of women in household dairy processing activities. Having come from the South, respondents had significantly higher odds of having produced Jameed (OR = 3.929) compared to those who came from the North. No statistical significance between the central and northern regions was detected. Farming experience is also not statistically significant after controlling for all other predictors.

Overall, these results indicate that participation in Jameed production has to do with resource scale, gendered processing responsibilities and regional specialization in production. Some of the implications for upgrading include that intervention programs should target not only commercial farms, but also women's household production and the southern regional concentration of production, keeping its traditional flavor.

3.6 Integrating farm evidence with the 2025 trade position

The breeder survey and the 2025 trade data are data sources describing two levels of the same value chain and become most valuable when considered together. According to the breeder survey, Jameed production takes place at farm level on a wide scale, with 296 out of 400 respondents (74.0%) producing Jameed. However, according to the survey, there are several constraints that may limit the scale, frequency and competitiveness of local production: high feed costs were reported by 85.0% of breeders, limited grazing by 65.8%, seasonality by 61.0%, labor-intensity of processing by 53.8%, reliance on middlemen by 47.5%, lack of technology by 44.0% and financing by 39.5%. On the other hand, the trade data shows that imports substantially outweigh exports. Therefore, the two pieces of evidence are complementary, not contradictory: Jordan has a significant base of domestic production, which operates under certain constraints and, at the same time, the local market absorbs large amounts of imported Jameed.

Thus, the integrated analysis brings about another policy question: instead of asking 'how can Jordan increase Jameed production?', one should ask 'how can Jordan increase competitive, safe and marketable Jameed production?'. Otherwise, increased production may be impossible due to feed costs, processing inefficiencies, quality problems, financing problems and poor market access; on the other hand, improved production and organization without development of market opportunities would limit the effect of such upgrading.

There is a tangible economic reason for the kind of coordination in question in the form of the trade deficit. Even substituting for a portion of the current import value through domestic Jameed competitively produced would leave more value within Jordan, while expanding the variety of exports would earn extra foreign exchange. Thus the required approach needs to be dual, consisting in substitution of imports in market segments where domestic producers could compete effectively, and developing exports in segments where Jordanian origin, traditional features, quality and reputation would provide differentiation.

This approach is rural employment-oriented as well. According to the survey, at present, Jameed makes up an average 19.7% of household income in producing farms and the female participation is strongly associated with the involvement in the production of Jameed. Based on the production potential already existing, it would be possible to develop entrepreneurship initiatives among young rural inhabitants and graduates in the relevant areas like agriculture, food science and the like. Such training could consist in hygienic production, standardizing the process, quality control, costing, packaging, business planning, traceability and marketing. It is possible for new businesses not to own any livestock, but rather concentrate on buying milk in season and producing standardized Jameed out of it, thus providing another sales opportunity for breeders.

3.7 Synthesis of SWOT and priority of upgrading

The combined results suggest the existence of a value chain which is culturally recognized and has premium-market potential, although there is much weakness in it in terms of the upstream and midstream sectors. The strengths consist in the cultural reputation of Jordanian Jameed, its shelf stability, the existing skills of household processors, processing skills of women, the southern production tradition and the presence of export activity domestically (Hilali et al., 2024).

Opportunities exist in cooperative aggregation, hygienic processing, mechanical separation, controlled drying, product diversification, traceability, geographical-origin certification, higher-priced diaspora markets, and capture of some portion of the massive domestic market supplied through imports. The trade deficit up to 2025 makes import substitution a concrete economic opportunity rather than a policy aspiration. Drought and rangeland degradation, feed-price inflation, cheaper imports, product adulteration, inconsistencies, food-safety failures, and potential consumer loss of faith in traditional products represent threats.

Upstream policies should work on improving the adequacy of the allocation of feeds while promoting effective use and stewardship of rangelands. Since the survey reveals that subsidies cover about half a month on average, in evaluating feed policies, consideration must be given not just to subsidized prices but also to amount and timing of allocation. Animal-health initiatives should promote withdrawal-period knowledge and residue control in order to avoid milk contamination and affect fermentation.

Midstream upgrades should emphasize technologies that fit realistically in scale. Shared mechanical separators, hygienic dryers, culture standardization, cooling and aggregation facilities will cut costs for individuals in adopting technologies. The seasonal use of the equipment may indicate the desirability of cooperative ownership of such technologies. Training should encompass both technical and sanitation, record-keeping, and quality-control skills so that technology adoption results in quality products and not just machines (Al-Saed et al., 2012; Hilali et al., 2017; Hilali et al., 2024).

The implementation of downstream initiatives needs to be strengthened by standards enforcement, traceability, and verifiable claim to origin. Survey results showing high mean for perceived benefit from GI/origin certification ($M = 4.14$) indicate producers' support, while the region-specific price differential provides economic reason to protect origin. Certification must go along with specifications, verification, and collective marketing. Otherwise, an origin brand will fail to yield value for producers.

Another issue to solve is the problem of bargaining caused by decentralization of production process. Almost half of the survey participants stated their reliance on intermediaries, and producers recognized the potential of cooperatives to increase their bargaining position ($M = 3.96$). The aggregation of produce allows decreasing transaction costs, makes quality control possible, and creates shipment size adequate for institutional and export markets. In addition, it gives the possibility to negotiate such terms as packaging, transportation, and procurement of inputs collectively.

An additional aspect is the linkage of the process of value chain upgrading to youth employment and entrepreneurship. Training programs need to specifically address young people and graduates in agriculture, animal production, food science, agribusiness, and related fields. Instead of focusing only on technical production skills, the training program should integrate processing of Jameed along with hygiene, quality assurance, financial management, packaging, e-marketing and marketing of products. Business models may include farm-based processing, specialized milk procurement and processing businesses, women/youth cooperatives and joint processing facilities for several small-scale breeders.

Start-up financing is particularly important because 39.5 percent of the interviewed breeders listed it as a problem and improved equipment requires an initial financial investment. The use of development finance institutions, along with relevant funds at the national level, such as the Development and Employment Fund, combined with appropriate development projects at the local, regional or international levels can help support the viable businesses using well-designed start-up financing, guarantees, equipment sharing or matching grants. Such support should be provided under conditions of training, compliance with quality standards and a sound business plan, and decrease as businesses gain their commercial footing. Such a phased program will make entry into the business easier without creating any form of dependency on subsidies.

Such effects can go beyond just the benefits for the processing business. An increased demand for locally produced milk can improve the incomes of breeders, while the expansion of processing can provide employment in collection, quality control,

packaging, storage, transportation, marketing and exporting of the products. With proper quality standards and markets developed, such a strategy can help promote rural income diversification and prevent youth from migrating out of the area. This can help create more local added-value, while improving the country's trading position. All such effects should be viewed as the effects of development, not automatic outcomes of the process.

Finally, trade policies should be aligned with value-chain upgrading. The objective must not be the elimination of all imports irrespective of cost and consumer preference but should focus on making local Jameed products competitive in cases where there is a natural advantage in Jordan regarding authenticity, origin, reputation, and proven processing skills. Analysis of the HS 040390100 trade series over time would provide an informative performance metric. A reduction in the trade deficit accompanied by stability or growth of domestic exports would suggest improvements in competitiveness through upgrading, though interpretation would require the consideration of domestic production and price data as well.

4. CONCLUSION

Jameed competes as part of a larger Awassi sheep production and rural livelihoods system, where competitiveness relies on conditions throughout the entire value chain. The survey among 400 breeders indicates that feed costs, inadequate grazing, and seasonality are the key constraints upstream, and intensive labor, intermediary reliance, technological deficiency, and financial restrictions are other challenges mid- and downstream. It thus becomes evident that upgrading Jameed competitiveness involves coordinated actions and not just technical intervention.

The trade statistics of 2025 provided by the Department of Statistics put a decisive market perspective on the analysis. Jordan imported approximately 3.42 million kg worth JD 7.88 million and exported approximately 0.48 million kg worth JD 1.12 million. Including the re-exports, the trade deficit amounted to approximately JD 6.74 million. These numbers do not provide information about the overall domestic production, but they indicate that there is strong dependence on imports in terms of formal trade. On the other hand, the presence of significant domestic exports means that Jordanian Jameed is able to reach international markets.

Together, this evidence indicates the need for a dual competitiveness approach. First, domestic suppliers would be enabled to secure a higher market share through efficient feed conversion, consistent supply of raw milk, cooperative aggregation, hygienic processing, proper technology, tracing and improved distribution. Second, export diversification would concentrate on differentiated products based on their proven origin, quality, authenticity and cultural reputation such as Al-Karak Jameed products. The goal is not to simply increase production, but to produce a safe, quality and differentiated Jameed through market mechanisms, which would result in a greater value share for both breeders and processors.

At the same time, the findings make it possible to design development efforts, which would link the sector development to rural employment and entrepreneurship opportunities. This could include training and enterprise development schemes, targeting youth and especially graduates in fields of agriculture, food science and similar disciplines, as well as developing the concept of farm-level processing, seasonal raw milk purchase, shared processing capacity, cooperatives and specialized dairy enterprises. Start-up costs could be a barrier to entry, which is why an appropriately designed and temporary financing from development finance institutions and related programs could be considered.

Should such intervention increase competitive domestic supply while maintaining quality, it would enable retaining some of the value embedded in the import of Jameed, improving income of rural households, generating employment, both direct and indirect, and facilitating foreign exchange earning through differentiated exports. Such progress could be measured through such indicators as domestic market share, producer margins, employment generation, quality control compliance, export performance and HS 040390100 trade balance.

In future research, connections need to be made between the actual farm-level cost of production and the cost of processing, the retail price, and annual sales figures. It would then be possible to evaluate the impact of any changes to feed policy, cooperative structures, technology, entrepreneurial capacity or certification on lowering costs, increasing the profit margin for producers, increasing market share and improving the balance of trade on Jameed. Research on consumers must also assess the willingness to pay for origin, traditional processing, certification and various forms of the product.

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AUTHOR CONTRIBUTIONS

Both authors contributed to the study conception and design, data analysis and interpretation, manuscript preparation, critical revision, and approval of the final manuscript.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest related to this study.

ETHICS STATEMENT

Participation in the study was voluntary, and informed consent was obtained from all participants prior to data collection. Participants were informed of the purpose of the study, and the confidentiality and anonymity of their responses were maintained throughout the research process.

DATA AVAILABILITY STATEMENT

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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