

## Mediator margins in the dairy supply chain and factors influencing marketing preferences in Eastern Mediterranean region of Turkey

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**Abstract:** The purpose of this study is to identify the shares of the intermediaries in the Eastern Mediterranean region milk supply chain (I) and to estimate the factors influencing the raw milk marketing preferences of milk producers (II). The research was conducted in 2017 with 102 dairy farms and 36 dairy industry enterprises in Hatay, Kahramanmaraş, and Osmaniye provinces. As a result of the research, it was found that 85% of the milk produced by dairy farms was offered to the market, 65% of the milk entering the supply chain was transferred to the dairy industry and the average capacity utilization rate of the industry was 37%. It was found that the most rational chain for the milk producers and dairies among the 4 main marketing channels in the region is the third channel, which has two stages. Binary logistic regression was found to be significant ( $p < 0.01$ ) as a whole. It was found that “scale” and “price” variables explained the variation in marketing preference by 70%. The cattle unit in the livestock enterprise has a positive effect on the transfer of milk to the industry, and the possibility of selling the milk directly at a higher price has a negative effect. For a more sustainable market organization and supply chain, business scales need to be increased and raw milk prices should be linked with production costs.

**Key words:** Dairy, marketing, milk supply chain, price, producer

### 1. Introduction

Milk is of great importance for adequate and balanced nutrition of human beings. In 2018, 843 million tons of milk was produced by 150 million livestock enterprises, mostly in developing countries [1]. Today, almost all of the raw milk supplied to the market for processing is produced in dairy cattle farms. 90% of production of 22 million tons in the year 2019 in Turkey was obtained from dairy farming. The share of the region in which the research is conducted in national cattle stock and milk production is around 3% [2–4].

The two main actors of the dairy sector are dairy farms and dairy industry enterprises. Dairy farm enterprises are the backbone of the livestock sector, as they directly affect not only the milk and dairy products market, but also the red meat market, feed industry, and sector employment. The prerequisite for the continuity of production in these enterprises is to provide technical (care and feeding, genetic improvement, productivity) and health (preventive and therapeutic medicine) services and criteria at a good level. However, successful and sustainable dairy cattle breeding also depends on a rational market organization

and a stable market [5–7]. For the producer, sustainability can be achieved with a reasonable profitability at the end of the period provided that the reference values and balances in the capital structure are taken into account. The market structure dominating the sector determines the current raw milk prices, which is the most important variable for profitability along with production costs. Organizational dysfunction and oligopsonic market structure in Turkey results in the industrial sector imposing unfair and unprofitable prices on the producer [7–9]. This situation has an effect on the marketing preferences of the producer, causing informality, low capacity usage in the industry, and public health risks. The marketing organization and raw milk supply chain in the dairy sector are critical in solving these problems.

Marketing, which has been a dynamic concept with its constantly changing definition for the last hundred years, is a main business function. Marketing, which is a planning process targeting consumer needs and satisfaction from investment after the sales by using the marketing mix (product, price, place/distribution, promotion), now focuses on relationship rather than

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operations. Agriculture and livestock marketing is all the transactions of the products from the producer to the end consumer and their effects on the relevant actors (producer, intermediary, seller and consumer), including the definition above [5,10,11]. The fact that raw milk is also exposed to various processes until it turns into final products brings to mind the relationship between the structure and functioning of the milk supply chain and the marketing preferences of dairy farms. The manufacturer's marketing preferences are affected, on the one hand, by the structure and functioning of the relevant market, and by the technical and socioeconomic variables of their own business on the other [12–14].

Milk supply chain consists of all the stages and channels through which milk is produced until it reaches the final consumer. Throughout this chain there are channel members with coinciding or conflicting interests. The milk supply chain channel members in Turkey are dairy farms and dairies/factories that make up the dairy industry, producer associations and/or cooperatives, milk collection centers, brokers and traders. These perform many functions such as milk production, cooling, physicochemical and microbiological analysis, transportation, storage, processing, and packaging. Meanwhile, there are value-added resales due to transportation and changes in shape, where the selling price of one channel member constitutes the cost of the other. While the margin at each stage of the supply chain is referred to by its name, the total marketing margin is the sum of the margins at all stages. From these explanations, it is understood that retail prices include the cost of production of raw milk as well as the cost and profit shares of all actors in the supply chain [15–18]. The importance of the abovementioned operations to our subject is that the shares of dairy farms in the supply chain are not only for the sustainability of the sector, they also affect the producer's marketing preferences, the quantity and quality of the product, consumer welfare, and public health.

In the Eastern Mediterranean region, no comprehensive study was found in the literature on intermediary shares in the milk supply chain and factors affecting marketing preferences. The purpose of this study is to identify the intermediary shares in the milk supply chain in the region (I) and to estimate the factors affecting the raw milk marketing preferences of producers (II). Reflecting the perspective of both the producer and the industrialist, this research is expected to make a contribution for a more fair and stable operation in the dairy sector.

## 2. Materials and methods

### 2.1. Study area and sampling

The research was conducted in the Eastern Mediterranean region in the provinces of Hatay, Kahramanmaraş and

Osmaniye in 2017. For dairy farms and dairies, the minimum sample size was identified with a 10% maximum margin of error. The distribution of the sample by provinces was made by taking into account the records and activity reports of the relevant official institutions [4,19]. The sample was determined using the formula below:

$$n = N / [1 + N \times (e^2)] .$$

Here,  $n$  indicates the minimum sample size,  $N$  indicates the number of enterprises in the region, and  $e$  indicates the maximum margin of error [20,21]. With this formula, it was calculated that at least 100 dairy farms and 33 dairies (livestock based industrial enterprises) should be sampled in the region where the research was conducted. As a result, the research was conducted with 102 dairy farms and 36 dairies.

### 2.2. Questionnaire

Face to face survey method was used for data collection. A preliminary survey was conducted with some producers and industrialists before finalizing the surveys. The survey forms were created after the necessary corrections with questions including socioeconomic and technical characteristics (i) of dairy farms and dairy industry enterprises, raw material procurement and product sales prices (ii), views on the functioning of the market, and their preferences of marketing methods (iii).

### 2.3. Calculations of the margins

The shares of channel members in the retail price were calculated in terms of both absolute monetary value and relative value of the relevant year. In the milk marketing chain, the selling price of one of the channel members is the cost of the other member to which they serve as a supplier. Therefore, the unit margin has been calculated by taking the difference between the average current selling price and cost (Turkish currency, TRY). In the calculation of the margin, the relative share of the unit margin in the unit sales price was considered [17,18,22]. While buying and selling prices in the supply chain of milk producers and dairies are obtained through questionnaires, data on milk hawkers, an unregistered activity, were identified with the help of declarations of producers, dairy farms, and producers' unions. For the retail milk price offered for final consumption, the average price of 1 L of full-fat UHT and pasteurized packaged milk offered for sale in the chain supermarkets in the relevant provinces was taken into account.

Equations used are as follows [17,18,22]:

$$\cdot \text{Unit margin (TRY)} = \text{unit milk sales price} - \text{unit milk cost} \quad (\text{I})$$

$$\cdot \text{Margin (\%)} = (\text{unit margin/unit milk sales price}) \times 100 \quad (\text{II})$$

$$\cdot \text{Producer's share (\%)} = (\text{raw milk price/retail milk price}) \times 100 \quad (\text{III})$$

## 2.4. Statistical analysis and logistic regression model

The technical and socioeconomic characteristics of dairy farming and dairy industry enterprises, their views and preferences for marketing were identified by central tendency and distribution measures. The relationship between milk purchase prices and capacity utilization levels of dairy farms was analyzed using Spearman correlation analysis. The factors affecting the marketing preferences of the milk producers were estimated with binary logistic regression (BLR), one of the non-parametric regression methods. BLR is a flexible and practical method that examines the effects of independent variables on the categorical dependent variable. The dependent variable in the model is marketing preference of the milk producers (0: by their own means; 1: through industry). The explanatory, i.e. independent variables, were selected as the producer's age, education level, average monthly income, type of herd, farm scale, location of farm, and raw milk sales prices. Results of the model were interpreted with variable coefficients and Wald statistics [8,13,23–26].

## 3. Results

The findings are summarized in four categories: socioeconomic and technical characteristics of producers

and industrialists themselves and their businesses (I), preferences and views about supply and marketing (II), margins along the milk supply chain (III), and results of the model (IV).

Table 1, which includes some important characteristics of dairy farms, revealed that the age and occupational experience of the farmers participating in the research were average and their education level was relatively low. The average monthly income is close to the minimum wage level of the relevant year, but it is quite insufficient compared to the number of employed labour force. The majority of businesses are small scale and rural. If the milk consumed by calves is not taken into account, almost all of the milk produced is put on the market.

Some important characteristics of dairy industry enterprises are summarized in Table 2. While the age and experience of dairy managers are similar to those of dairy farms, their education level is higher. Since the average monthly turnover has wide variation and low response rate, they are not included in the table. Dairy farms, which are established in a more central position than dairy cattle businesses, supply the milk they use as raw material from an average of 23 different producers and use more than 80% of it in cheese and yoghurt production. Average

**Table 1.** Some socioeconomic and technical characteristics of dairy farms.

Characteristics of dairy farms		N	Mean (X ± SD)	Median (Min-Max)
Producers' features	Farmers' age (year)	102	42.11 ± 11.92	-
	Occupational experience (year)	101	18.41 ± 11.57	-
	Education level	102	-	2 (1–5) <sup>a</sup>
	Average monthly income	102	-	2 (1–6) <sup>b</sup>
Dairy farms' technical features	Number of livestock unit <sup>c</sup>	102		6 (1.2–49)
	Number of workforce	102	-	2.5 (1–8)
	Location of farms/enterprises	102	-	2 (1–6) <sup>d</sup>
	Distance from the nearest market	102	-	2 (1–3) <sup>e</sup>
	The usage of raw milk produced	Percentages (%)		
	Supplied to different markets	85.0		
	Consumed by calves	11.3		
	Consumed by family members of farmers	2.3		
	Converted into dairy products	1.4		
Total percentages of raw milk to be produced	100.0			

<sup>a</sup>1: Elementary school, 2: Middle school, 3: High school, 4: Bachelor, 5: Postgraduate.

<sup>b</sup>1: Less than 999 TRY, 2: 1000–1999 TRY, 3: 2000–2999 TRY, 4: 3000–3999TRY; 5: 4000–4999TRY, 6: more than 5000 TRY (\$1 USD ≈ 3.4 TRY in 2017).

<sup>c</sup>The reference unit was an adult dairy cow.

<sup>d</sup>1: Centrum of the village, 2: Out of the village, 3: Centrum of the town, 4: Out of the town, 5: Centrum of the city, 6: Out of the city.

<sup>e</sup>1: 0–9 km, 2: 10–19 km, 3: 20 km and more.

**Table 2.** Some socioeconomic and technical characteristics of dairies.

Characteristics of dairies		N	Mean (X ± SD)	Median (Min-Max)
Managers' features	Manager's age (year)	36	40.35 ± 8.39	-
	Occupational experience (year)	36	15.11 ± 8.46	-
	Education level	36	-	3 (1-5) <sup>a</sup>
Dairies technical features	Number of workforce	36	-	5 (2-200)
	Location of dairies	36	-	3 (1-6) <sup>b</sup>
	Distance from the nearest market	36	-	1 (1-3) <sup>c</sup>
	Number of producers from who milk obtained	36	-	23 (3-100)
	Production capacity (ton/day) - I	36	-	10 (1-200)
	Actual level of output (ton/day) - II	36	-	3.75 (0.2-45)
	Capacity utilization rate [(II / I) × 100]	36	-	37.5%
	The usage of raw milk to be processed	Percentages (%)		
	Use in "cheese" making	42.8		
	Use in "yogurt" making	39.0		
	Use in "butter" making	13.5		
	Use in "buttermilk" making	4.7		
	Total percentages of raw milk to be processed	100.0		

<sup>a</sup>1: Elementary school, 2: Middle school, 3: High school, 4: Bachelor, 5: Postgraduate.

<sup>b</sup>1: Centrum of the village, 2: Out of the village, 3: Centrum of the town, 4: Out of the town, 5: Centrum of the city, 6: Out of the city.

<sup>c</sup>1: 0-9 km, 2: 10-19 km, 3: 20 km and more.

capacity utilization rate-CUR for dairy farms in the region is 37%.

Table 3 shows the important preferences and views of dairy farmers and dairies about supply, sales, marketing, and profitability. It can be seen from the table that 65% of the producers transfer their milk to the industry, and approximately one third prefer street vendors/milk hawkers and direct sales to the market. The most critical factor that directs the milk producers to the relevant channel member is guarantee, that is, continuous sales. The most important factor in the supply decision of dairies is cost. The most profitable channel member in the sector is dairies according to dairy farms and retail markets according to dairies. According to both main stakeholders, the most important problem in the sector is unfair pricing and price fluctuations in raw milk and it has been declared that the responsibility for solving these problems belongs primarily to Turkey Ministry of Agriculture and Forestry.

The results of the research also show that the producers usually take their milk to the dairy with their own vehicles, while some prefer traders. The milk industrialists, on the other hand, supply the milk directly from the producer to a large extent (78%), only 22% of dairies use producer unions, collectors, and traders.

Table 4 shows that the average raw milk sales price at farm gate in Eastern Mediterranean provinces in 2017 was 1.19 TRY. Milk producers and dairies answered very low and normal, respectively, to the 5-point Likert-type question in which the opinions of the producers about sales and the supply prices. The average transit time of money into the hands of the milk producers after sales has been found to be between 15 and 30 days.

Figure 1 summarizes the intermediary shares in the Eastern Mediterranean region milk supply chain in 2017, both numerically and proportionally. Marketing channels in the region are realized in 4 different ways, namely direct (I), single-stage (II), two-stage (III), and three-stage (IV). The producers obtain the highest share (100%) from the first channel to which they sell milk directly, and they obtain the second highest share (58%) from the channel of street milkmen. However, the rational way of processing milk under healthy conditions and meeting the final markets is to transfer it to the industry. When the figure is examined again from this point of view, the most reasonable way for both the producer and the industrialist is 3rd channel. While the producer sells at a higher price than the second and fourth channels in this channel, the milk industrialist gets the highest share from the supply

**Table 3.** Opinions and preferences of the main stakeholders about the milk marketing.

Questions regarding milk marketing	Distribution of the responses in descending order		
	Responses	Percentages (%)	
I. Where do you prefer to sell your raw milk? (asked to dairy farmers)	a. I prefer to sell to dairies	29.8	
	b. I prefer to sell to street sellers (off the record)	28.7	
	c. I prefer to sell to dairy traders	21.3	
	d. I prefer to sell to producer associations	13.9	
	e. I prefer to sell directly to consumers	6.3	
	Total	100.0	
II. What is the main reason that determines where to sell your raw milk? (asked to dairy farmers)	a. Because of guarantee sale	37.4	
	b. Because of mutual trust and confidence	23.5	
	c. Because of absence of the options	20.3	
	d. Because of higher price of milk	13.5	
	e. Because of transportation advantages	5.3	
	Total	100.0	
III. What is the main reason for choosing your current supplier? (asked to dairies)	a. Because of cost advantages	31.3	
	b. Because of continuity and trust in supply	22.9	
	c. Because of absence of the options	22.9	
	d. Because of getting quality milk	20.0	
	e. Because of transportation advantages	2.9	
	Total	100.0	
IV. In your opinion, who is the most profitable in the dairy supply chain? (asked to both of them)		Dairy farms <sup>a</sup>	Dairies
	a. Dairies	48.6	5.4
	b. Retail shops	38.1	70.3
	c. Street sellers	12.3	16.2
	d. Dairy farmers	1.0	0.0
	e. Dairy traders	0.0	8.1
Total	100.0	100.0	
VI. In your opinion, what is the biggest problem about the dairy marketing? (asked to both of them)		Dairy farms <sup>a</sup>	Dairies
	a. Unfair price of raw milk and price fluctuations	65.7	30.6
	b. Producer associations' inadequacy in marketing	15.2	8.3
	c. Inadequacy of government incentives/supports	9.5	27.8
	d. Due to too many middlemen	6.7	16.7
	e. Unregistered and uncontrolled production	2.9	16.6
Total	100.0	100.0	
V. In your opinion, who is mainly responsible for handling the marketing problems? (asked to both of them)		Dairy farms <sup>a</sup>	Dairies
	1. Ministry of Agriculture and Forestry	49.5	41.7
	2. Producer associations	39.0	11.1
	3. Dairies	6.7	5.6
	4. Dairy farmers	2.9	33.3
	5. Municipalities/municipal government	1.9	8.3
Total	100.0	100.0	

<sup>a</sup>Farmers' responses were primarily considered in descending order for last 3 questions.

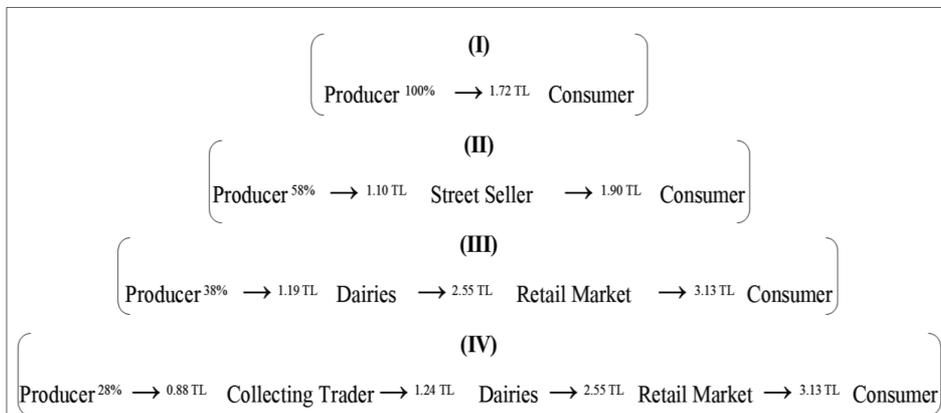
**Table 4.** Average raw milk prices, participants' opinions and trade payment times in 2017.

Questions about raw milk prices and payment times	Mean (X ± SD)	Median (Min-Max)
Farm gate raw milk selling price acc. to dairy farmers	1.19 <sup>a</sup> ± 0.42	-
Dairy farmers' opinion about selling prices	-	1 (1-5) <sup>b</sup>
Dairies' opinion about purchasing prices	-	3 (1-5) <sup>b</sup>
Payment times acc. to dairy farmers and dairies	-	3 (1-4) <sup>c</sup>

<sup>a</sup> \$1 USD ≈ 3.4 TRY in 2017.

<sup>b</sup> 1: Very low, 2: Low, 3: Normal, 4: High, 5: Very high.

<sup>c</sup> 1: 0-7 days, 2: 8-14 days, 3: 15-30 days, 4: 31 days and more.



**Figure 1.** Average selling prices and producers' margins according to different dairy supply channels (\$1 USD ≈ 3.4 TRY in 2017).

**Table 5.** Model findings regarding the factors influencing producers' marketing choice.

	B	S.E	Wald	Sig. (P)	Odds (Exp. B)
Constant	8.677	2.781	9.735	0.002	5865.283
Farmer's age	-0.039	0.038	1.014	0.314	0.962
Education level	1.219	1.225	0.989	0.320	0.296
Farmer's income	0.274	0.836	0.107	0.743	1.315
Location of farm	-0.650	0.706	0.847	0.357	0.522
Type of herd	0.664	0.741	0.804	0.370	1.943
Number of livestock unit	0.161	0.072	5.070	0.024	1.175
Current raw milk prices	-6.444	2.144	9.030	0.003	0.002
Model Summary	Model X <sup>2</sup>	-2 log likelihood		Pseudo R <sup>2</sup>	
	55.951	43.423		0.707	

chain with 53% [(2.55-1.19)/2.55 × 100] from this channel.

In this study, the statistical analysis of the data show that dairy farms that transfer their milk to the industry through a channel member have higher production value (p < 0.05) than those that directly put them on the market through their own means. Significant positive correlations were found between the milk purchase prices of dairies

and CUR and the amount of milk processed (p < 0.05).

Table 5 summarizes the results of the model showing the factors that affect the raw milk marketing preferences of dairy farms.

Hosmer-Lemesov test result (χ<sup>2</sup> = 8.093; p = 0.424) shows that there is no significant difference between observed and predicted values. The model was found to

be significant as a whole ( $p = 0.000$ ). The independent variables explain the variation in the milk producer's marketing choice by 70% (Nagelkerke R square 0.707). The variables affecting the marketing preferences are farm scale ( $p < 0.05$ ) and current raw milk price ( $p < 0.01$ ). The coefficients and values of these variables show that as the number of cattle in the enterprise increases, the milk is more likely to be transferred to the industry, and the producer turns to direct sales when they have the opportunity to sell milk at a higher price. The age, education, income level of the producer, herd type and the geographical location of the enterprise do not have a significant effect on the model.

Lastly, the findings obtained from the interviews with the producer unions in the region need to be discussed. The suggestions of the associations can be summarized as giving priority to older producers in financial supports, implementing the contracted production model, producers assuming more responsibility for protecting and improving raw milk quality, and finding new markets where the occasional excess milk supply can be sold.

#### 4. Discussion

An effective and strong marketing organization that will increase marketing efficiency in the dairy sector depends largely on a rational supply chain and functioning that protects the mutual rights and interests of the actors. The most important issues in healthy operation of this chain are the efficient organization of producers, the growth of enterprise scales, the association of raw milk prices with costs, and the integration of producer-industrialists [6,7,27]. These research findings and results of the model especially highlight the scale and price issues.

When the findings are analyzed in terms of the scale dimension, it is seen that the producers who supply their milk to the industry have a higher production level than those who directly put it into the final market. Here, high production capacity increases the bargaining power of the producer in pricing and contributes to the increase of marketing productivity. A study conducted in Trakya confirms the positive relationship between enterprise scale and milk supply to industry [13]. These findings also indicate that the increasing enterprise scale will increase integration with the industry. Also if scale and CUR issues are evaluated accurately and realistically in the feasibility studies of livestock investment projects, the possible risks of entrepreneurs during the operation period will decrease [28]. Low CUR for dairies that use raw milk in cheese and yoghurt production is a result of year-round supply difficulties, primarily during the winter months. This also points to the seasonality in cow milk supply. Another reason may be unfair competition due to production under the counter. CUR in the region of 37% on the average dairy coincide with values reported as

30% in a similar study and 39% in a total of 1725 dairies in Turkey [3,29]. Today, Turkey still lags behind the rest of the EU average in terms of scale and efficiency; as the desired scale increases are achieved, the negativities in the industry due to supply and CUR will gradually decrease [6]. As the results of the research also show, dairies are able to supply raw materials at higher prices as the amount of milk they process increases, and scale increases can also reduce producers' dissatisfaction with the price.

When the findings are analyzed in terms of the price dimension, the results of the statistical model show that the "possibility to sell milk at a higher price" leads the producer to direct sales. Although mutual trust and stability are very important in supply and sales preferences, low purchase prices in raw milk, which are not associated with costs, are the source of the problems. In the study, the milk producers' statement of "not at all satisfied" about the prices also confirms this finding. Pricing, which has not been fair and accurate for many years, has led to chronic problems in the industry such as low CUR, unfair competition, fraudulent practices on raw materials, public health risks, and slaughter of milking cows [7,27,29,30]. It is even probable that the current prices announced will negatively affect animal health and welfare. Because, as feed prices increase, the decline in milk prices may encourage the producer to use less feed and spend less on veterinaries, which may pave the way for diseases. All these evaluations show the importance of national raw milk price and quality-price relationship.

National raw milk prices, which should be determined by consensus between the producer-industrialist-public, should ensure sustainability in production by considering the common interests of the stakeholders, and observe the quality and regional differences. The reference point in pricing should be the balance between selling price and input costs. Since the studies on the economic analysis of dairy farms clearly reveal the relative share of feed expenditures in all cost items, it would be correct and practical to use the proportional relationship between raw milk and feed, namely the milk/feed parity in pricing. This value should be in the band of 1.5–2 according to producer organizations and academia, whereas in the last 20 years in Turkey, unfortunately, it remained only slightly above one [12,31,32]. Considering the relatively more stable factory feed prices rather than roughages, which follow a wider price range periodically, current raw milk prices in the region even fall behind the 2017 average recommended price (1.3 TRY  $\approx$  0.38 USD in 2017). In addition, if the national raw milk recommendation price for October–December 2020 was determined according to 1.5 parity, the price of a certain quality of raw milk would not be 2.30 TRY/kg today ( $\approx$  0.31 USD in January 2021), but it would be minimum 3 TRY/kg ( $\approx$  0.41 USD in January

2021). This opinion also supported by international milk markets. To give an example for December 2020, farm gate raw milk prices (adjusted for 4.2% fat and 3.35% protein) in European Union, United States and New Zealand were 35.3, 31.9, and 31.0 EUR/100 kg, respectively (1 EUR  $\approx$  9 TRY in December 2020) [33]. For the period of 2004–2018, EU-28 minimum and maximum raw milk prices were 24.39 and 40.21 EUR/100 kg, respectively. EU's producers struggle to production plan for the future, due to the large price volatility [34]. These figures indicate the importance both of price and price stability in developing and developed countries. While the recommended price of raw milk determined as 2.80 TRY/kg by the end of April 2021 by the Food Committee is not found satisfactory, it is emphasized that decision-making on pricing should be transferred from this committee to the National Milk Council.<sup>1</sup> The fact that these prices and rates are not accepted is attributed to the inflation anxiety of the public and the pressure of the industrial sector [14].<sup>2</sup> Industrial power and pressure in Turkey is also apparent in the raw milk market in high-firm concentration ratio [7]. Similarly, the coefficient that reveals the bargaining power of the producer in Iran is quite low compared to the industrialist [14]. Contrary to above statements, Brazilian raw milk market is very close to perfectly competitive and no oligopsony power over the input market [35].

Although raw milk pricing happens in an oligopsonic market, the industrialists, producers, and the state cannot be completely held responsible for low prices. Because unit milk sales prices also depend on the physical and microbiological quality of the milk, the milking system of the enterprise, cooling facilities, and production volume. This study showed that there are differences of up to 0.60 TRY between prices even in the same region and season (Table 4). Since raw milk tends to get easily spoilt, this quality is important not only for productivity in the industry but also for public health. However, achieving this quality depends on making technical and economic investments and managing cattle health with rational principles. If the quality-price relationship is not established correctly in the relevant region, these cost increases that occur while increasing the quality will unfortunately lead to a decrease in profitability.

In the dairy sector, especially the pricing, there are close relationships between organization, scale and quality, and the supply chain. While the structure of the milk supply chain has an impact on milk prices, intermediary margins and quality, the prices that are formed or announced in the market are also effective on the variety and length of this chain. Milk marketing channels in Turkey, currently

against the producer and consumer, are a long and complex structure [5]. In practice, although the variety and length of the chain depends on economic, geographic, technical, and demographic variables, the rational one is the short and efficient one. Such a structure will bring along a healthier relationship between producer and retail prices. Because in many countries, including Turkey, there is an asymmetric price transmission between raw and retail milk prices is against the producers [18]. In order to overcome this problem, it is among the suggestions that cooperatives and producer unions should establish dairy industry enterprises [27]. Of course, it is also necessary to ensure an infrastructure where these structures can make intervention purchases that can maintain price stability during peak periods of milk supply. The implementation of the contracted production model suggested in this study may be useful. However, necessary precautions should be taken to prevent this model from turning into a process where the producer is tied up with an advance payment.

The results of the study show that there are 4 different raw milk supply chains in the Eastern Mediterranean region. Although utmost producer benefit is possible through direct sales to the consumer, the shortest channel, this model is unacceptable except in exceptional cases. Because the only way to meet the quality, quantity, and diversity demands of markets by complying with public health criteria is to transfer milk to modern dairies and factories in sufficient quantity and quality. Moreover, there are only a few animal enterprises in Turkey that can fulfill the requirements of the “Communiqué on the Raw Milk Supply” numbered 2017/20, namely, having a physical and microbiological product quality (protein, acidity, density, number of colonies, etc.) that can sell raw milk directly to the consumer and that is free from zoonotic diseases [36]. Therefore, there are only the 3rd and 4th channels left, in which the industrialist is also in the supply chain. It is the 3rd channel that will serve the common interests of producers and industrialists. Because this channel not only gives the milk producer the opportunity to sell milk at high prices and have the best relative share in the retail price, but also offers the highest marketing share to the industrial segment. In this channel, which has two stages, dairies usually collect and process milk with their own vehicles and ship them to the grocery stores/supermarkets they have a contract with. The intermediary shares identified in this study coincide with a similar study conducted in Antalya in 2011 [17]. 3-fold relations/increase between the packaged UHT milk price and milk price at the farm gate in Turkey support the findings of this research [37]. A study conducted in

<sup>1</sup> Bloomberg HT (2021). Gıda Komitesi çiğ süt tavsiye fiyatını belirledi [online] (in Turkish). Website <https://www.bloomberght.com/gida-komitesi-cig-sut-tavsiye-fiyatini-belirledi-2270449> [accessed 11 December 2020].

<sup>2</sup> Yıldırım AE. Tarım, Süt. Çiğ süt referans fiyatı. Tarım Dünyası 2020 (in Turkish).

Slovakia showed that between the years of 2001 and 2007, the share received by producers from retail prices decreased from 52% to 35% and there was around 3 times the relationship between retail and farm gate prices [18]. The low bargaining coefficient of Iranian producers against industrialists is also an indication of their low retail share [14]. Horizontal integration via marketing cooperatives or strong farmer organisations is recommended for producers in their relations with suppliers and to overcome market related problems [8,9,34,38].

The transfer of raw milk to the industry through the supply chain is almost a necessity, as emphasized before. However, the industrial processing rate of milk in our country is still behind the developed countries. For example, while this ratio is over 95% in Germany and the United States of America, and 85% in Poland, this ratio is 45% in Turkey and it is 71% in Kars province [3,27,34,38]. In this study, this ratio was identified to be 65% in Eastern Mediterranean region, which is close to the ration of Turkey in general. The marketing preferences of the producer and the factors that shape this preference are effective in keeping this ratio low compared to developed countries.

In the study, the explanatory power of the model established to estimate the factors affecting the marketing preferences of the producer was found to be 70%. It may be suggested that similar studies to be conducted after this should focus on other significant variables that may explain the dependent variable further. In the Eastern Mediterranean region, the effective factors in the direct (from the farm gate or mobile vehicle) sale of milk to the consumer are enterprise scale and raw milk prices. This result coincides with the effect of current milk sales price on Trakya producers' marketing their milk through cooperatives, and it conflicts with the effect of education

level of producers [13]. It can be said that, in Turkey, scale increases, primarily in raw milk sales prices associated with production costs, and education-distribution work will enable more raw milk to be transferred to the industry. In this context, improvements will contribute not only to dairy enterprises, but also to the sector and the national economy.

In addition to the actors such as the European Union, New Zealand, and Australia, which still have a say in milk production and trade in the world, developing countries such as India and Pakistan have started to use their potential as well. Low genetic capacity, limited feed resources, and diseases are the main obstacles for developing countries [1,39,40]. The suggestion of finding new markets for excess milk supply in this study is an indication of a need and vision. Now, Turkey should discuss entering new markets by increasing the quality and meeting international criteria rather than increasing production. To achieve this, it is necessary to establish a fairer market structure and to eliminate diseases, which are obstacles for international trade.

We think that the findings and suggestions of this research will contribute positively to the structure and functioning of the sector. It seems possible to achieve the desired permanent improvements in the milk supply chain and marketing organization only with the joint efforts and coordination of the main stakeholders, namely dairy cattle enterprises, producer organizations, dairy industry, and the relevant ministry.

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