ARAŞTIRMA MAKALESİ

The Economic Analysis of the Conversion of Wheat to Pasta

Rahmi TAŞCI[1*], Sevinç KARABAK[1], Merve BOLAT[1], Belma ÖZERCAN[1], Serhan CANDEMİR[2] Asuman KAPLAN EVLİCE [3], Turgay ŞANAL[4], Selami YAZAR[5], Goncagül SARI[6], Selda ARSLAN[7]

[1] Field Crops Central Research Institute / Department of Agricultural Economics / Ankara
[2] Malatya Turgut Özal University / Faculty of Agriculture / Department of Agricultural Economics / Malatya
[3] Sivas Science and Technology University / Faculty of Agricultural Sciences and Technology / Department of Field Crops / Sivas
[4] Field Crops Central Research Institute / Department of Quality and Technology / Ankara
[5] Field Crops Central Research Institute / Department of Breeding and Genetics / Ankara
[6] Turkish Pasta Industrialists Association / Ankara
[7] Institute of Agricultural Economics and Policy Development / Ankara

*** Sorumlu Yazar**
Tel.: -
rahmi.tasci@tarimorman.gov.tr

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Abstract
This study aims to determine the production cost of durum wheat in Türkiye and the price changes that occur until it reaches the end consumer after being processed into pasta. Türkiye is one of the most important producer countries in the world in durum wheat production, which is the main raw material of pasta production, and it is also one of the gene centers of the situation. Moreover, Türkiye is one of the world's most important pasta producer countries. The study data were obtained in 2019 by applying a face-to-face survey with 280 agricultural farms in Ankara, Çorum, and Yozgat, which are some of the important provinces of Türkiye's durum wheat cultivation. As a result of the research, the production cost of durum wheat in farms is calculated as USD 0.11/kg, the output price of the pasta in the pasta factory is USD 0.35/kg, and the consumer purchase label price of the pasta produced in pasta factories was calculated as USD 0.70/kg. Thus, it has been determined that the durum wheat, which costs USD 0.11/kg on the farm, reaches a 288,9% added value when pasta passes into the consumer's hand. The overuse of agricultural inputs in farms and pasta factories increases production costs.

Buğdayın Makarnaya Dönüşümünün Ekonomik Analizi

Özet
Bu çalışmada Türkiye'de makarnalık buğdayın üretim maliyeti ve makarna haline getirildikten sonra son tüketiciye ulaşana kadar oluşan fiyat değişimlerinin belirlenmesi amaçlanmıştır. Türkiye, makarna üretiminin ana hammaddesi olan makarnalık buğday üretiminde dünyanın en önemli üretici ülkeleri arasında yer almakta olup, aynı zamanda gen merkezlerinden biridir. Ayrıca Türkiye, dünyanın en önemli makarna üretici ülkeleri arasında yer almaktadır. Çalışmanın verileri, 2019 yılında Türkiye'nin makarnalık buğday ekiminin önemli illerinden olan Ankara, Çorum ve Yozgat'ta 280 tarım işletmesi ile yüz yüze anket uygulanarak elde edilmiştir. Araştırma sonucunda, işletmelerde makarnalık buğday üretim maliyeti 0.11 ABD doları/kg, makarna fabrikasında makarnanın çıkış fiyatı 0.35 ABD doları/kg ve makarna fabrikalarında üretilen makarnanın tüketici satın alma etiket fiyatı 0.70 ABD doları/kg olarak hesaplanmıştır. Böylece işletmede kg başına 0.11 ABD dolar maliyeti olan durum buğdayının, makarna tüketicisinin eline geçtiğinde %288.9 katma değere ulaştığı tespit edilmiştir. İşletmelerde ve makarna fabrikalarında tarımsal girdilerin fazlalığı üretim maliyetlerini artırmaktadır.

1.Introduction

Pasta is a food that has been produced and consumed since ancient times. It is reported that pasta-like products were produced in ancient Rome, European countries, and China and were first consumed by the Chinese in 1700 BC (TMSD, 2022). It is stated that pasta was brought to Europe by Marco Polo on his return from Far East travels in 1292, and the production of dry pasta in its current commercial form is quite new (Cubadda and Carcea, 2003).

Pasta is widely consumed because it has a long shelf life, its varieties can be prepared with both formal and nutritious foods, it is nutritious because of its nutritional properties, it has low fat and salt contents (for additive-free pasta), it is delicious, it has a slow digestion rate, and finally, it is an economical food (Yüksel et al., 2011).

Pasta consumption, and therefore the demand for pasta, is increasing rapidly worldwide. The main reasons for this increase are the fact that wheat is a key staple, pasta is an easy-to-prepare, economical food with high nutritional value, it appeals to the tastes of all segments of society, and it can be preserved for a long time without spoiling (Akın, 2017; Bayav and Gül, 2024). The world's annual pasta production is approximately 16.9 million tons. Italy ranks first with 3.89 million tons, the USA ranks second with 2 million tons, and Türkiye ranks third with 1.90 million tons. In terms of pasta consumption per capita per year, Italy ranks first with 23.5 kg, Tunisia ranks second with 17.0 kg, and Türkiye ranks 14th with 7.53 kg (IPO, 2022).

Türkiye is among the most important producer countries in the world in the production of durum wheat, which is the main raw material of pasta production. Türkiye is also one of the gene centers of durum wheat. Durum wheat, which constitutes the primary raw material for pasta production, is imported into Turkey to a substantial degree. A key factor accounting for this import activity is the support provided for pasta exports, whereby companies exporting pasta are granted exemption from customs duties on raw material procurement under the Inward Processing Regime.

It is observed that the Covid-19 pandemic, which has affected populations worldwide, not only poses significant challenges to public health, economic stability, and social structures, but also brings about notable shifts in consumers' eating habits. Janssen et al. (2021) reported an increase in the consumption of pasta, flour, eggs, long-life milk, and frozen foods in Italy during the pandemic. In addition, it has been observed that citizens tend to stock up on food during the full closure of countries during the measures implemented to control the Covid-19 pandemic. According to the results of a study in Germany in which 1,242 people participated, it was determined that 14% of the participants stocked up on products with long consumption times, such as pulses, pasta, rice, and canned food. According to the results of the research, it is seen that consumers give priority to long-lasting foods instead of fresh food during this period (Baltacı and Akaydın, 2020).

Pulses, rice, and pasta varieties, which are among the foods with long shelf life, are food items that consumers always want to easily access and stock in their homes. For this reason, pasta costs always continue to be important, especially for consumers with low income levels. This study calculates the production cost of durum wheat in Türkiye and compares the changes in the price of pasta among the actors in the value chain in the process from the conversion of wheat to pasta until it reaches the end consumer. Thus, it aims to provide information to the sector and to create data for policymakers.

2.Material and Methods

The data for this study were collected from two distinct groups. Face-to-face surveys were administered to 280 farms that grow durum wheat as part of their production pattern to determine the production cost of durum wheat. In addition, 18 actively operating pasta factories in Türkiye were surveyed to ascertain production costs. Ankara, Çorum, and Yozgat provinces—located in the Central Anatolian Region and collectively representing a large share of Türkiye's durum wheat cultivation—were purposively selected for the cost assessment. Samples were drawn separately for each province based on the durum wheat cultivation area (in decares) reported by the Ministry of Agriculture and Forestry, General Directorate of Agricultural Reform. A stratified random sampling method was employed to determine the number of sample farms within each group, and the sample size was calculated using the formula proposed by Yamane (1967). Since the principal objective of this research is to determine pasta production costs, the durum wheat production costs are presented as an overall average obtained from all surveyed farms.

$$n = \frac{\sum(N_h S_h)^2}{N^2 D^2 + \sum N_h S_h^2} \qquad D^2 = d^2 / z^2$$

In the formula;
n : Number of samples,
N : The number of farms in the population,
N_h : The number of farms in the hth strata
S^2_h : variance of the hth strata,
d : Allowable margin of error from the population mean,
z : the z value in the standard normal distribution table according to the error rate.

In determining the sample size, it was studied within a 90% confidence interval with a 10% error margin.

The “Neyman Method” was used to distribute the determined sample volume to the strata and the distribution was made with the formula $N_hS_h*n/ \Sigma N_hS_h$.

Table 1 Distribution of business survey numbers by provinces

Provinces	0 - 25			26 - 75			76 - 200			201 - +			Total	
	N	n	C.V.	N	n	C.V.	N	n	C.V.	N	n	C.V.	N	n
Ankara	4 764	3	33	12 239	17	30	10 898	36	28	3 450	33	33	31 351	89
Çorum	10 113	12	33	13 431	42	31	4 540	32	28	524	11	33	28 608	97
Yozgat	8 159	5	33	18 464	28	30	10 684	38	28	2 214	23	32	39 521	94
Total	**23 036**	**20**	**99**	**44 134**	**87**	**91**	**26 122**	**106**	**84**	**6 188**	**67**	**98**	**99 480**	**280**

As part of the research, face-to-face surveys were conducted with the managers of pasta factories. Using the whole counting method, managers and technical personnel from 18 of the 25 pasta factories actively operating in Türkiye were interviewed. Although the total number of factories and surveys differs due to shared management across some factories, the study was designed to reflect the views of all factories.

Calculating production and product costs in farms is a complex and meticulous field of study. Agricultural product costs vary significantly across provinces, villages, and even individual farms, making it arguable that there is no uniform cost for these products, as each farm may have a unique cost structure. While some believe that the actual cost of a product cannot be precisely calculated due to various farm expenses, these limitations and difficulties do not hinder ongoing studies and research on cost calculation in agricultural products (Talim, 1973).

The primary purpose of determining the usage levels of cost and physical production inputs in agriculture is to enable income and cost analysis of individual production activities on farms. Additionally, it is necessary to continuously research agricultural product costs to evaluate agricultural policy results, monitor resource use activities on farms, and track developments in agricultural techniques (Anonymous, 2001). Calculating the amount of inputs used in durum wheat production, production cost, and profitability is expected to benefit regional planning and future research, as well as provide farmers with a basis for comparing the profitability of durum wheat and other field products to determine their production patterns. This study aims to reveal the physical and material value of inputs used in durum wheat production, determine the producer's profit-loss status by calculating product cost, and identify the cost elements with the highest share and measures to reduce them.

In determining the cost of durum wheat, production input costs, gross profit, and net profit were analyzed through economic comparisons of various tillage and sowing methods used in wheat production. Single crop budget analysis was employed to calculate operating costs, while production costs were determined using the alternative cost method (Açıl, 1974; Özkan, 1996). Descriptive statistical procedures, such as mean and percentage, were utilized to evaluate the data. The average labor hours required for a decare were based on an eight-hour working day (Açıl, 1974).

Input prices for seeds, fertilizers, pesticides, and diesel used in production and sourced from outside the farms were calculated using the values provided by farmers during the survey. All cost calculations relied on the farmers' declarations.

Repair and maintenance costs were determined by considering the actual expenses incurred by the farms for tools, machinery, and buildings (Demirci, 1978). Variable costs in durum wheat production, which fluctuate based on the quantity produced, were calculated by aggregating the costs of inputs such as seed, fertilizer, pesticides, irrigation water, oil, repairs, labor, harvesting, marketing, and fuel. The gross product value was determined by adding non-operational agricultural income and housing rent to the gross production value (Açıl and Demirci, 1984). Similarly, gross domestic product value was calculated by adding non-farm agricultural income and rental cost of housing to gross production value (Açıl and Demirci, 1984).

Pasta factories, as agricultural-based industrial enterprises, process durum wheat to produce pasta. They serve as a wheat-marketing channel for wheat-producing farmers while also being a sector that manufactures pasta for consumers. In the process where wheat enters the pasta factory as raw material and leaves as pasta, pricing the stages that affect the cost of the pasta is highly challenging. In fact, the pasta factory managers interviewed during the research

expressed the effect of production stages on cost as a percentage rather than specifying the cost items in the pasta production processes individually as prices. This decision was made to protect trade secrets and due to commercial competition. Using the obtained data, the pasta cost was ultimately calculated.

3. Findings and Discussion

In recent years, the direct impact of supply chain strategies implemented by enterprises on their competitiveness has garnered significant attention from both academia and the business world. Challenging competition conditions, globalization, rapid technological advancements, and shortened product life cycles have compelled businesses to reevaluate their supply chain strategies. To remain competitive in these circumstances, businesses must effectively manage their supply chains. This effective management necessitates the coordination of collaborative efforts among supply chain members and the control of supply chain costs throughout the entire chain. In this context, the interoperability of supply chain management and target costing becomes evident. The critical objectives of successful Supply Chain Management, as outlined by Ataman (2002), are as follows:

•Cost reduction

•Enhanced profitability

•Improved competitiveness

•Increased business value

•Heightened sensitivity to market changes and expanded market share

•Enhanced customer service performance

•Reduced response time

•Minimized inventory costs

Within the scope of this study, the supply chain of pasta sector factories was analyzed, and the chain from pasta production to consumption was

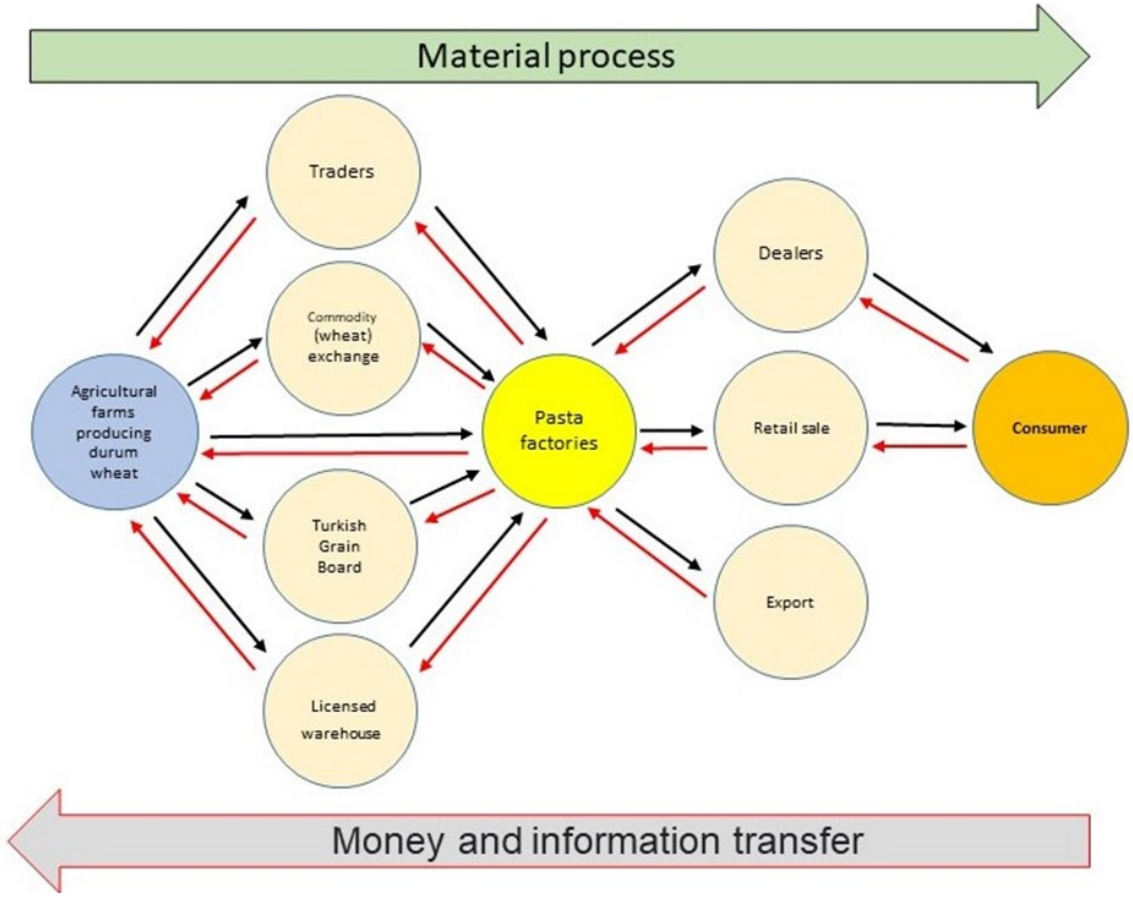

Figure 1 Structure of pasta industry supply chain

In the pasta industry supply chain, farms producing durum wheat serve as the primary suppliers. As the initial link in the chain, these farms play a pivotal role in supply management, cost control, and product quality. The unit cost of durum wheat, producer price, factory price, and retail pasta price are all substantially influenced by these farms. Moreover, the wheat variety grown determines key factors such as protein content, gluten amount, semolina yield, and other quality-related characteristics. Consequently, durum wheat production plays a vital role in enhancing cost efficiency and overall supply chain management by leveraging information from downstream stakeholders.

Table 2 presents the cost calculation for durum wheat production. The study revealed that the examined farms performed tilling twice for soil preparation, with a total cost of USD 2.70/da for the two operations (1.64+1.06). Base fertilizer and seed, the most critical cost-influencing inputs in wheat production, amounted to USD 10.82/da, while the cost of fertilization during the spring months was USD 4.40/da. Wheat harvesting on the studied farms was outsourced to a combine harvester, incurring a cost of USD 3.52/da.

Table 2 Durum wheat production costs (USD/decare*)

Production Process	**Labor**		**Traction**		**Equipment**	**Materials**			**Total Cost (USD)**
I.CULTIVATION	**Hour**	**Total (USD)**	**Hour**	**Total (USD)**		**Type**	**kg/Piece**	**Total**	
First Tillage	0.20	0.21	0.20	1.44	Plow				1.64
Second Tillage	0.10	0.10	0.10	0.96	Cultivator				1.06
Third Tillage	0.00	0.00	0.00	0.00	Roller				-
Sowing	0.10	0.11	0.10	0.60	Drill	Fertilizer	0.30	5.16	5.16
						Seed	18.00	4.95	5.66
II.MAINTENANCE									
a. Fertilizer	0.08	0.09	0.04	0.40	Fertilizer Machine		0.30	3.91	4.40
b. Plant Protection (Pesticide)	0.13	0.14	0.13	0.40	Pulveriser	Pesticide	0.00	0.25	0.79
d. Irrigation (water + labor + fuel)	0.00	0.00							-
III.HARVEST									
a. Harvest	Combine Harvester Cost			3.52	Combine Harvester				3.52
b. Transport (to market)	0.00	0.00	0.00	0.00	Trailer				-
IV.WORKING CAPITAL INTEREST									1.11
A-TOTAL VARIABLE COST	**0.61**	**0.65**	**0.57**	**7.32**				**14.27**	**23.34**
a. General Administrative Cost (A x %3)									0.70
b. Field Rent									14.35
B-TOTAL FIXED COST									15.05
C-TOTAL PRODUCTION COST (A + B)									**38.39**

*1 decare (da): 0,1 hectare (ha)

The analysis revealed that variable costs accounted for 60.81% of the total production costs, while fixed costs comprised 39.19%. Inputs such as fuel oil, seeds, fertilizers, and pesticides consist 37.17% of the variable costs.

Upon reviewing the expenses and incomes, the gross production value was calculated to be USD 93.69/da, with variable costs at USD 23.34/da and a gross profit of USD 70.35/da. Consequently, the net profit was determined to be USD 55.30/da. The examined farms yielded an average of 345.00 kg/da of wheat, with the average wheat cost per farm calculated at USD 0.11/kg. The selling price of wheat was USD 0.19/kg, resulting in a net profit of USD 0.08/kg from each kilogram of wheat produced (Table 3).

Table 3 Cost income statement in durum wheat production

COSTS	**Value (USD/da)**	**Rate (%)**
Labor Cost	0.65	1.68
Traction Cost	7.32	19.06
Material Cost	14.27	37.17
Variable Cost Interest	1.11	2.90
Total Variable Cost	**23.34**	**60.81**
Field Rent	14.35	37.37
General Administrative Cost	0.70	1.82
Total Fixed Cost	15.05	**39.19**
TOTAL PRODUCTION COST	**38.39**	**100.00**
COST and INCOME	**Value (USD/da)**	
Gross Production (USD/da)	93.69	
Variable Cost (USD/da)	23.34	
Total Cost (USD/da)	38.39	
Gross Profit (USD/da)	70.35	
Net Profit (USD/da)	55.30	
Yield (Kg/da)	345.00	
Production Cost per kg (USD/Kg)	0.11	
Sale price per kg (USD/Kg)	0.19	
Net Profit per kg (USD/Kg)	0.08	

3.1 Analysis of pasta production cost

Durum wheat, the primary raw material, accounts for the largest portion of pasta production costs. Table 4 illustrates the cost structure of the pasta industry. Semolina cost has the most significant share in pasta cost at 62%, followed by depreciation expenses at 8%. Selling (marketing) and financing expenses rank third in the pasta cost item, with a combined 12%. Marketing expenses encompass costs such as packaging and transportation. The high level of financing expenses is likely attributed to the elevated interest rates, particularly in recent years.

Table 4. Semolina/ Pasta Cost Combination

Inputs	**Semolina (%)**	**Pasta (%)**
Durum Wheat	**88**	**-**
Labor	**2**	**5**
Electricity	**3**	**3**
Depreciation	**3**	**-**
Assistant Service	**4**	**4**
Semolina	**-**	**62**
Heating	**-**	**1**
Packaging	**-**	**5**
Depreciation	**-**	**8**
Marketing expenses	**-**	**6**
Financing	**-**	**6**
Total	**100**	**100**

Source: Turkish Pasta Industrialists Association (2024)

Pasta factories typically leverage local opportunities for product supply, relying on local traders and stock exchanges as their primary suppliers. However, when factories are unable to procure the necessary raw materials locally, they source them from outside the region or even abroad. In the supply chain, retailers obtain their products from both dealers (wholesalers) and directly from factories. Consumers represent the final link in the pasta industry's supply chain.

The pasta production cost is comprised of elements categorized under durum wheat production, pasta production, and distribution (Table 5). Among the actors involved in the value chain, which include producers, industrialists, and distributors, the cost factor is most significant in the pasta production phase. Within the scope of the research, the cost of durum wheat production was first calculated based on data obtained from

Table 5 Distribution of cost elements in pasta production

Durum wheat production	**Pasta production**	**Distribution**	
• Tillage • Irrigation • Fertilization • Spraying • Harvest • Transport wheat to sales points • Depreciations • Insurance •Taxes • Land Rent • General Administrative Expenses	• Domestic and International Raw Material Supply • Classification • Raw Material Storage • Kneading (semolina + water) • Vacuuming • Pressing • Cutting (shaping) • First pre-drying (ventilation) • Pre-drying • Softening • Final drying • Cooling • Ensiling • Packaging • Storage	Domestic Market Distribution •Marketing •Transport • Shelf Cost	Export Activities • Order Receiving • Preparation of Products • Required Documents and Transactions for Export •Transport

In this study, approximately 60 kg of semolina was obtained from 100 kg of wheat, and 59.31 kg of pasta was obtained from 78.6 kg of dough prepared by adding 31% water at 14% semolina moisture (Table 6).

Table 6. The amounts of semolina and pasta produced from 100 kg of wheat

Wheat Quantity (kg)	Semolina Yield (%)	Semolina Quantity (kg)	Semolina Moisture (%)	Additional Water (%)	Dough Amount (kg)	Dough Moisture (%)	Dough Dry Matter (%)	Pasta Moisture (%)	Pasta Quantity (kg)
100	60	60	14,0	31,0	78,6	34,35	65,65	13,0	59,31

According to the Turkish Food Codex Pasta Communiqué, the amount of wheat needed for 100 kg of pasta with a moisture content of 13% is 168.60 kg (Table 7).

Table 7. Wheat Required to Produce 100 kg of Pasta

Pasta Quantity (kg)	Pasta Moisture (%)	Pasta Dry Matter (%)	Additional Water (%)	Dough Moisture (%)	Dough Dry Matter (%)	Dough Amount (kg)	Semolina Quantity (kg)	Semolina Yield (%)	Wheat Quantity (kg)
100	13,0	87,0	31,0	34,35	65,65	132,52	101,16	60	168,60

*Semolina grinding efficiency is accepted as 60%.
*Semolina moisture content was accepted as 14%.
*The amount of water added is accepted as 31% of wet weight.
* Pasta moisture is accepted as 13% according to Turkish Food Codex Pasta Communiqué.

The value chain of durum wheat, from raw material to the final product of pasta, involves several stages that contribute to the overall cost and price of the end product. Table 8 illustrates the value gained by wheat throughout this process, starting from the durum wheat farms and ending with the final consumer. The initial stage of the value chain begins at the durum wheat farms, where the average cost of producing durum wheat was calculated to be USD 0.11/kg based on the surveyed farms. These farms then sell their wheat at an average price of USD 0.19/kg, representing the first value addition in the process.

Moving further along the supply chain, pasta factories purchase durum wheat as the primary raw material for pasta production. As shown in Table 7, approximately 1.68 kg of wheat is required to produce 1 kg of pasta. Consequently, the cost and price changes in Table 8 are calculated based on the equivalent of 1 kg of pasta. The average wheat purchase price for pasta factories was found to be USD 0.31/1.68 kg. Within pasta factories, the durum wheat undergoes processing and transformation into the final product. The average production cost of 1 kg of pasta in these factories was determined to be around USD 0.32. This cost encompasses various factors such as energy, labor, packaging, and other manufacturing expenses. Once the pasta is produced, it is sold from the factory at an average price of USD 0.35 /kg, representing another stage of value addition in the supply chain.

The retail price of pasta was determined to be USD 0.49/kg, while the shelf price paid by the final consumer was calculated at USD 0.7 /kg. Table 8 presents a comprehensive breakdown of the value chain from wheat to pasta, with each row providing different insights into the cost and price changes. Row A in Table 8 displays the values in USD $/kg (pasta) at each stage of the chain, starting from the wheat cost and progressing to the final pasta product. This row allows for a direct comparison of the monetary values across the different stages. Row B, on the other hand, showcases the percentage change between each column, highlighting the incremental value added at each stage of the value chain. By examining the percentage changes, stakeholders can identify the stages where the most significant value additions occur.

Row C takes a different approach by presenting the percentage change rates of each column in relation to the initial wheat cost (column 1). This row demonstrates the cumulative value addition that occurs as the durum wheat progresses through the value chain and is ultimately transformed into pasta. From the analysis of Row C, it is evident that durum wheat, which costs USD 0.19/1.68 kg at the farm level, experiences a remarkable value addition of 288.9% by the time it reaches the consumer in the form of pasta. This substantial increase in value underscores the significant transformative processes and value-adding activities that occur throughout the supply chain. Notably, the most substantial percentage change is observed in the sales price from the retailer to the consumer, with a striking 42.9% increase. This finding highlights the significant contribution of the retail stage to the overall value of the pasta product, emphasizing its crucial role in the value chain where pricing strategies and consumer perceptions hold great importance. The detailed value chain analysis presented in Table 8 offers a clear understanding of the cost and price dynamics at each stage, from wheat to pasta. By examining the percentage changes and cumulative value additions, stakeholders can gain valuable insights into the primary drivers of value creation and identify potential areas for optimization and improvement within the value chain.

Table 8 Pasta value chain

		1	2	3	4	5	6	7
		Wheat cost (1 kg)	Wheat sales (1,68 kg)	Pasta factory wheat buying (1,68 kg)	Pasta factory pasta cost (1 kg)	Pasta factory pasta selling (1 kg)	Retail cost (1 kg)	Consumer pasta buying (1 kg)
A	(USD)	0.11	0.18	0.31	0.32	0.35	0.49	0.70
B	% increase			72.2	3.2	9.4	40.0	42.9
C	% increase			72.2	77.8	94.4	172.2	288.9

4.Conclusion

Pasta is a staple food in modern diets, as it is one of the few foods that can be found on the tables of consumers from every socio-economic income group worldwide. Its popularity stems from its quick preparation, easy accessibility, and nutritional value. The pasta industry uses Triticum durum wheat to produce high-quality pasta, and the quality and properties of the wheat directly affect the quality of the final product. Durum wheat (Triticum durum) has more specific climate and soil requirements than bread wheat, limiting its cultivation to certain regions worldwide. In Türkiye, durum wheat can only be grown in specific areas due to its narrow adaptability (Yazar and Karadoğan, 2008). Türkiye has significant potential in the production of wheat, the raw material for pasta, and in the manufacturing of pasta. However, difficulties in supplying the produced raw materials at the desired quality level and quantity at reasonable prices negatively impact the pasta industry and its competitiveness in international trade. Pasta factories must not only procure the required amount of wheat but also purchase wheat of the necessary quality to produce pasta with the characteristics desired by consumers.

The production cost of durum wheat in Türkiye directly influences the production cost of pasta. The cost of durum wheat on farms producing durum wheat was calculated as USD 0.11/kg, with 60.81% of these cost items being variable costs and 39.19% being fixed costs. Among the variable costs, the most significant inputs affecting the cost are fuel, fertilizer, seed, and pesticide expenses. The sales price of the produced durum wheat was determined to be USD 0.19/kg, and the net profit was calculated as USD 0.08/kg.

Durum wheat farms typically market their products through traders and stock exchanges, and occasionally sell directly to pasta factories. In this research, it was found that pasta factories purchase wheat at USD 0.23/kg, incur a pasta production cost of USD 0.32/kg, and sell the final product at USD 0.35/kg. Consequently, it was calculated that the durum wheat required for 1 kg of pasta, which has a cost of USD 0.19/1.68 kg on the farms, reaches an added value of approximately 289% when it is delivered to the consumer as pasta.

In conclusion, the increasing cost of pasta poses a significant challenge to low-income consumers who rely on this staple food as an important source of nutrition. The potential impact on the accessibility and affordability of pasta for this vulnerable population should not be underestimated. To address this issue, it is imperative to explore strategies that can effectively reduce the overall cost of pasta production. The primary production stage, particularly the cultivation of durum wheat, presents a promising opportunity for cost reduction interventions. By focusing on optimizing durum wheat production practices, implementing sustainable farming techniques, investing in research and development, and strengthening extension services and farmer education, it may be possible to minimize production costs at the farm level. These efforts can create a cascading effect throughout the pasta value chain, ultimately leading to more affordable pasta products for low-income consumers. Addressing this challenge requires a concerted effort from various stakeholders, including policymakers, researchers, and industry players, to ensure that the nutritional needs of economically disadvantaged households are met while maintaining the sustainability and resilience of the pasta production system.

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