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CONSUMPTION PATTERNS, PRICE VOLATILITY, AND HOUSEHOLD ADAPTATION BEHAVIOR TOWARD THE RED CHILI COMMODITY IN MEDAN CITY

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Abstract

Red chili is among the most volatile horticultural commodities and a principal driver of food inflation in Medan City. This study aims to analyze household food consumption patterns, the dynamics and volatility of red chili prices, and consumer adaptation behavior in response to chili price fluctuations. A quantitative-descriptive approach was employed, drawing on a survey of 1,026 households distributed across more than thirty traditional markets, combined with daily market price data for the January 2023–September 2025 period. The data were analyzed using volatility measures (coefficient of variation) and a percentile-based threshold, price–consumption correlation, and chi-square tests. The findings reveal that food expenditure absorbs 65–75 percent of monthly household spending, while red chili is purchased by 92 percent of households on a daily-to-weekly basis, predominantly through traditional markets. The average curly red chili price reached IDR 36,890/kg with a coefficient of variation of 0.40, the highest among the commodities examined. Price and consumption are strongly and negatively correlated ($r = –0.68$), and the chi-square test confirms a significant relationship between chili price fluctuation and consumption reduction ($\chi^2 = 28.512$; $p = 0.000$). Households adapt defensively by seeking cheaper markets, reducing portions, and substituting fresh chili with dried chili or bottled sauce, thereby lowering nutritional quality among low-income coastal households. The policy implications emphasize early-warning price systems, cold-chain strengthening, and supply diversification.

Keywords: consumer adaptation, food consumption pattern, Medan City, price volatility, red chili

INTRODUCTION

In urban areas such as Medan City, the majority of households are not food producers but net buyers. As a consequence, the welfare of urban communities is highly sensitive to market price changes. Increases in the prices of staple goods such as rice, cooking oil, eggs, shallots, and especially red chili can rapidly erode household purchasing power. Among low-income groups, food expenditure may exceed 60 percent of total household income, so that even small price fluctuations exert a tangible pressure on their welfare. Among all food commodities, red chili occupies a distinctive position. It plays an important role in the formation of food inflation because its price movements are highly volatile, driven by weather variability, planting cycles, and disruptions in distribution. Its perishable nature and lengthy supply chain make red chili one of the principal contributors to food price volatility in Medan City. At the same time, red chili is a basic seasoning consumed by nearly all households, so that price surges are felt directly in daily shopping and dietary patterns.

The core problem is that the dynamics of red chili prices reflect not merely an economic issue but are also closely tied to household consumption patterns and adaptation strategies. When chili prices spike, households must decide whether to seek cheaper markets, reduce portions, or substitute fresh chili with alternatives. These decisions have direct implications for nutritional quality and welfare, particularly for vulnerable groups. Analyzing red chili therefore requires an integrated approach that combines the household consumption dimension with the price and consumer adaptation dimensions. Based on this background, the study aims to: (1) identify the pattern of red chili consumption within the household food consumption structure of Medan City; (2) analyze the dynamics and volatility of red chili prices together with their determinants; and (3) analyze consumer adaptation behavior in response to red chili price fluctuations. The novelty of this study lies in integrating the analysis of household food consumption patterns with the analysis of prices and consumer adaptation behavior, focused specifically on the red

chili commodity, thereby providing a comprehensive picture of how price pressure is transmitted all the way to the household table.

LITERATURE REVIEW

Supply Chains and Horticultural Price Volatility

Food supply chains in developing countries are generally characterized by long distribution channels involving numerous actors, ranging from farmers, collectors, wholesalers, inter-regional traders, and traditional market retailers, to final consumers (Timmer, 1986). Each layer adds a certain margin, resulting in a substantial price difference between producers and consumers. Supply-chain efficiency strongly affects consumer-level prices; an inefficient chain raises distribution costs, widens trading margins, and reduces both producer and consumer surplus (Reardon & Timmer, 2007). For perishable horticultural commodities such as red chili, distribution inefficiency amplifies price volatility because supply shocks cannot be absorbed through storage.

Information Asymmetry and Price Transmission

Information asymmetry arises when one party to a transaction possesses more information than another. In food supply chains, intermediary traders often have better access to price information than farmers or consumers. Studies by Aker (2010) in Niger and Jensen (2007) in Kerala demonstrate that limited information generates inter-regional price disparities, and that the introduction of communication technology reduces price dispersion while improving market efficiency. Price transmission is frequently asymmetric, whereby price increases are passed on to consumers more rapidly than price decreases, a phenomenon known as price stickiness.

Consumption Patterns, Elasticity, and Adaptation Behavior

Household food consumption patterns reflect socio-economic, cultural, and environmental conditions. The household response to price increases is determined by the demand elasticity of each commodity. Staple commodities such as rice are inelastic, so their consumption tends to remain stable, whereas complementary commodities such as chili are elastic, so their consumption is readily reduced when prices rise (Reardon & Timmer, 2007). Under price pressure, households adopt adaptation strategies that may be defensive (reducing or substituting consumption) or productive (increasing income). The literature gap addressed by this study is the empirical linkage between red chili price volatility and household-level consumer adaptation decisions in an urban setting, which to date have largely been analyzed separately.

METHOD

This study employs a quantitative-descriptive approach combined with the analysis of secondary market price data. Primary data were obtained through a survey of 1,026 respondent households distributed across more than thirty traditional markets in Medan City, encompassing central markets, peripheral markets, and horticultural markets, including Petisah, Sukaramai, Simalingkar, Pusat Pasar, Sei Sikambing, Helvetia, Kampung Lalang, and the Lau Cih Central Market. This distribution ensures the representativeness of consumer characteristics across the coastal (northern), central (urban), and southern (semi-rural) zones.

Secondary data in the form of daily curly red chili prices were collected from more than twenty active markets over the January 2023–September 2025 period. The variables examined include the proportion of food expenditure, purchasing frequency and source, price perception, average price, price spread, spatial market premiums, and household adaptation strategies. The data analysis techniques applied were: (1) descriptive analysis of consumption patterns, purchasing frequency, and price perception; (2) price volatility analysis using the coefficient of variation (CV) and a percentile-based threshold approach (the P90 and P95 thresholds) for early warning of price disparity; (3) correlation analysis to measure the relationship between prices and consumption frequency; and (4) a chi-square test to examine the significance of the relationship between price fluctuation and household consumption strategies. The results were then interpreted in an integrated manner to explain the transmission of red chili price pressure to consumption behavior.

RESULTS AND DISCUSSION

Red Chili Consumption within the Household Consumption Structure

The survey results indicate that the average household food expenditure in Medan City ranges between 65 and 75 percent of total monthly spending. This high proportion reflects a household economic structure that remains heavily dependent on staple goods, particularly among low-income groups and areas with limited market access.

Within this structure, red chili is a seasoning commodity purchased by 92 percent of households, with a daily-to-weekly purchasing frequency owing to its perishability and its close association with daily consumption. The purchasing pattern for chili differs significantly from that of durable staples. Between 60 and 70 percent of households purchase horticultural commodities (chili, shallots, vegetables) daily, whereas staples such as rice and cooking oil are bought monthly in large volumes. This makes red chili the commodity whose price changes are most frequently felt by households.

Table 1. Purchasing Frequency and Source of Household Horticultural Commodities

Group / Source	Daily (%)	Weekly (%)	Monthly (%)	Notes
Horticulture (chili, shallot, vegetables)	60–70	25–30	<5	Perishable; frequent restocking
Protein (chicken, egg, fish)	15–25	65–70	5–10	Freshness required; routine
Staples (rice, sugar, oil)	<5	20	70–75	Durable; monthly stocking

The principal source of red chili purchases remains dominated by traditional markets (70 percent of households), followed by grocery stalls (20 percent), supermarkets (8 percent), and digital platforms (2 percent). The dominance of traditional markets confirms that the transmission of red chili prices from the market to the household table occurs through a network of traditional traders that is highly sensitive to supply shocks.

Dynamics and Volatility of Red Chili Prices in Medan City

During the January 2023–September 2025 period, the price of curly red chili in Medan City exhibited volatile and segmented dynamics. Based on the processing of daily data from more than twenty active markets, the average price was recorded at IDR 36,890/kg, with a minimum of IDR 20,050/kg and a maximum reaching IDR 88,950/kg. The average inter-market price spread within a single day reached IDR 17,618/kg, with a median of IDR 15,000/kg, indicating a marked spatial disparity within the city.

Table 2. Daily Price Statistics for Curly Red Chili in Medan City (2023–2025)

Indicator	Value
Average price	IDR 36,890/kg
Minimum price	IDR 20,050/kg
Maximum price	IDR 88,950/kg
Average inter-market price spread	IDR 17,618/kg
Median price spread	IDR 15,000/kg
Alert threshold (P90)	IDR 28,000/kg
Extreme threshold (P95)	IDR 32,000/kg
Days in the alert category	11.6%
Days in the extreme category	6.3%

Using a percentile-based threshold approach, the alert threshold (P90) was set at IDR 28,000/kg and the extreme threshold (P95) at IDR 32,000/kg. Approximately 11.6 percent of observation days fall into the alert category and 6.3 percent into the extreme category. In other words, in every 9 to 16 days there is a potential inter-market price anomaly exceeding reasonable economic bounds, which generally coincides with weather disruptions, seasonal production declines, and consumption surges during Ramadan and major religious holidays. Red chili price movements are cyclical and clustered (volatility clustering), in which high-price periods tend to be followed by several subsequent high-price days. Based on trend analysis, three principal phases were identified throughout the year, as presented in Table 3.

Table 3. Seasonal Phases of Curly Red Chili Price Movement

Phase	Period	Price Range	Inter-market Spread	Main Trigger
Stable	January–March	IDR 28,000–32,000/kg	IDR 15,000–18,000/kg	Year-end harvest; smooth distribution
Seasonal Pressure	May–August	IDR 40,000–50,000/kg (premium >60,000)	IDR 25,000–35,000/kg	Dry season; Ramadan & Eid demand
Recovery	September–December	IDR 30,000–35,000/kg	IDR 15,000–20,000/kg	Highland supply recovers

This seasonal pattern reveals price asymmetry (price stickiness), in which price declines occur more slowly than price increases, owing to trader expectations and fixed distribution costs. Spatially, red chili prices form a consistent urban price gradient, with premium markets in the city center acting as price leaders and peripheral or wholesale markets acting as price stabilizers.

Table 4. Spatial Mapping of Inter-market Red Chili Price Premiums

Market Cluster	Example Markets (Premium)	Function
Premium (price leader)	Titi Kuning (+12.5%), Sambas (+12.4%)	Price setter; transmits 1–3 days earlier
Transitional (±0%)	Pusat Pasar, Petisah, Simalingkar, Sei Sikambing	Price transmission channel
Discount/wholesale (stabilizer)	Sukaramai (−5.9%), Belawan (−5.7%), Kemiri (−5.1%), Marelan (−4.6%)	Supply buffer & price stabilizer

Determinants of Red Chili Price Fluctuation

Red chili price fluctuations in Medan City are driven mainly by disruptions on the supply, distribution, and regulatory sides rather than by demand alone. Five principal factors consistently trigger price instability:

- Season and weather: extreme weather (heavy rainfall or prolonged drought) reduces chili and shallot production, triggering price surges of 20–50 percent at the trader level.
- Transportation and distribution costs: rising fuel prices and distribution congestion from Deli Serdang or Karo raise retail prices in Medan by up to 10 percent.
- Single-source supply dependence: the Medan market depends on the main Lau Cih horticultural hub, leaving it vulnerable to logistical disruption (a single point of failure).
- National and import policy: trade policy, import restrictions, and exchange-rate fluctuations also affect local prices.
- Trader behavior: some traders behave opportunistically, adjusting selling prices quickly when wholesale prices rise but slowly when they fall (asymmetric price transmission).

The supply-chain context reinforces these findings. Medan City's red chili requirement reaches approximately 12,081.74 tons per year, with Karo Regency serving as the core supplier (about 63 percent, a distance of ±78 km, with two-way price integration and a 1–2 day lag) and Simalungun acting as a year-end buffer (about 25 percent). The hegemonic supply structure concentrated in a few production centers makes red chili prices highly sensitive to single-source supply disruptions.

Price Effects on Consumption and Consumer Adaptation Behavior

Correlation analysis between prices and consumption frequency reveals a strong and consistent adaptation pattern. The correlation between chili prices and consumption is –0.68, indicating a strong negative relationship: a 10 percent increase in chili prices reduces consumption frequency by approximately 6–7 percent. This value is far larger than that for rice (–0.08), which is inelastic, and chicken meat (–0.45), which is moderately elastic.

Table 5. Correlation between Price and Consumption Frequency by Commodity

Commodity	Correlation (r)	Demand Type	Interpretation
Chili	–0.68	Elastic	Consumption quickly reduced as price rises
Chicken meat	–0.45	Moderately elastic	Shift to cheaper protein sources
Rice	–0.08	Inelastic	Consumption stable despite price rise

Household perceptions reinforce this picture of pressure: 68 percent of respondents rated staple prices as "somewhat expensive," 58 percent described prices as "unstable," and 76 percent felt that food expenditure had "increased compared with the previous year." Red chili and bird's-eye chili are consistently the commodities with the highest fluctuation. This is consistent with the perceived stability score for curly red chili of only 2.5 out of 5 (high-volatility category) and a CV of 0.40, among the highest of all food commodities.

Table 6. Comparison of Price Volatility across Commodities (Coefficient of Variation)

Commodity	CV	Volatility Category
Bird's-eye Chili	0.43	Very High
Curly Red Chili	0.40	High
Shallot	0.38	High
Broiler Chicken	0.25	Medium-High
Layer Eggs	0.22	Medium
Premium Rice	0.12	Low
Bulk Granulated Sugar	0.10	Low

Confronting this pressure, households pursue three dominant adaptation strategies: seeking markets with lower prices (72 percent), reducing food portions (60 percent), and substituting food items (48 percent). For chili specifically, the common substitution is replacing fresh chili with dried chili or bottled sauce as an instant seasoning alternative. These strategies are defensive in nature, lowering consumption quality rather than enhancing economic capacity, so that consumption decisions are driven more by survival-driven consumption than by taste preferences.

Statistical Relationship between Prices and Consumption Strategies

A chi-square test was conducted to examine the significance of the relationship between price fluctuation and household adaptation strategies. The results reinforce the correlation and perception findings.

Table 7. Chi-square Test Results for the Relationship between Price and Consumption Strategy

Variable Relationship	χ^2	df	p-value	Interpretation
Chili price fluctuation ↔ consumption reduction	28.512	4	0.000	Significant
Egg price fluctuation ↔ change in protein source	17.861	4	0.001	Significant
Oil price fluctuation ↔ purchasing frequency	9.327	4	0.025	Significant
Rice price fluctuation ↔ food substitution	5.283	4	0.071	Not significant

The relationship between chili price fluctuation and consumption reduction is highly significant ($\chi^2 = 28.512$; df = 4; p = 0.000). This confirms the character of chili as an elastic commodity that is readily reduced without disturbing basic needs. By contrast, the relationship between rice prices and food substitution is not significant (p = 0.071), confirming the inelastic nature of rice. Red chili thus functions as the first "adjustment valve" in household consumption patterns when price pressure emerges.

Differentiation of Adaptation by Income and Region

Adaptation strategies differ clearly by income level and geographic location. Low-income households have the narrowest scope for adaptation, whereas high-income households are better able to diversify their supply sources.

Table 8. Household Adaptation Patterns by Income Group

Income Group	Main Strategy	Explanation
Low (< IDR 4 million/month)	Reduce consumption & switch to cheaper food	Very limited purchasing power
Middle (IDR 4–6 million/month)	Seek lower prices & stock earlier	Reactive to prices
High (> IDR 6 million/month)	Stockpile & purchase online	Adaptive; able to diversify

Spatially, coastal areas (Belawan, Marelan, Labuhan) experience a 15–20 percent decline in purchasing power when food inflation occurs, far higher than the central (5–8 percent) and southern (4–6 percent) zones. The combination of low income, high dependence on traditional markets, and large distribution costs renders coastal areas the most vulnerable to red chili price shocks. In general, every 10 percent increase in food prices can reduce household purchasing power by 6–8 percent. Synthesizing all findings reveals a complete transmission chain: supply and seasonal shocks raise red chili price volatility, which is then passed on asymmetrically through the traditional market network, ultimately compelling households, particularly vulnerable groups, to undertake defensive adaptations that diminish nutritional quality. The policy implications emphasize three measures: strengthening an early-warning price system based on the P90/P95 thresholds; reinforcing cold-storage facilities and diversifying supply sources to reduce the risk of a single point of failure; and targeted low-cost food programs and transportation subsidies directed at coastal areas.

CONCLUSION

This study concludes that red chili is a key commodity linking food price volatility with household consumption behavior in Medan City. First, within a food expenditure structure that absorbs 65–75 percent of monthly spending, red chili is purchased by 92 percent of households on a daily-to-weekly basis through traditional markets, so that its price shocks are felt directly in daily shopping. Second, curly red chili prices are highly volatile, with an average of IDR 36,890/kg, a CV of 0.40, and an asymmetric three-phase seasonal pattern driven by weather, distribution costs, single-source supply dependence, policy, and trader behavior. Third, chili price and consumption are strongly and negatively correlated ($r = –0.68$), and the relationship between chili price fluctuation and consumption reduction is statistically significant ($\chi^2 = 28.512$; $p = 0.000$), so that households adapt defensively through seeking cheaper markets, reducing portions, and substituting fresh chili with dried chili or sauce, which risks lowering nutritional quality among vulnerable groups in coastal areas. Based on these findings, it is recommended that an early-warning price system based on the P90/P95 thresholds be strengthened, that cold-chain facilities be developed alongside diversification of red chili supply sources, and that spatially targeted price-intervention programs be directed at areas with the highest vulnerability. Further research is recommended to measure the longitudinal impact of such interventions on price stability and household nutritional quality.

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