

Apriori-Based Data Mining of Sales Transactions at Buya Aqiqah MSME

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Abstract: Buya Aqiqah is a micro, small, and medium enterprise (MSME) providing aqiqah—an Islamic ceremonial catering service traditionally celebrating a child's birth—and general catering in Depok, Indonesia, since 2003. Although the enterprise has accumulated substantial sales transaction data, these records have previously served solely as manual administrative archives rather than an analytical foundation for identifying customer purchasing patterns to support managerial decision-making. This study aimed to apply the Apriori algorithm to discover association patterns among menu items using Buya Aqiqah's historical sales transaction records. Guided by the Knowledge Discovery in Databases (KDD) framework, the analysis was executed using RapidMiner Studio. A total of 137 digitized sales transactions were selected, cleaned, transformed into binary format, and evaluated across three parameter scenarios: Scenario 1 (minimum support 5%, minimum confidence 50%), Scenario 2 (minimum support 10%, minimum confidence 60%), and Scenario 3 (minimum support 15%, minimum confidence 70%). Across all three scenarios, two valid association rules consistently emerged: *Gulai* → *Sate* (support 67.2%, confidence 94.8%, lift ratio 1.065) and *Sop* → *Sate* (support 19.7%, confidence 100%, lift ratio 1.123). Scenario 1 was determined as the most representative parameter setting because it captured the broadest frequent itemset coverage without omitting any valid rules. The results position *Sate* as the core menu item consistently paired with other dishes, confirming that the identified associations reflect genuine purchasing behaviors rather than random co-occurrences. These findings provide empirical evidence for management to design targeted bundling packages—specifically *Gulai-Sate* and *Sop-Sate*—while prioritizing inventory procurement for core ingredients.

Keywords: Data Mining; Apriori Algorithm; Association Rules; Purchasing Patterns; Rapidminer.

1. Introduction

Transaction data generated from daily business activities has become an increasingly valuable strategic asset for supporting managerial decision-making, particularly in identifying customer purchasing behaviors and hidden product affinities (Syahri *et al.*, 2023; Fatah & Aini, 2025). In competitive retail and culinary environments, transaction records extend far beyond their traditional administrative function by serving as empirical evidence to uncover cross-selling opportunities and optimize promotional packaging (Aditya *et al.*, 2023). Buya Aqiqah is a micro, small, and medium enterprise (MSME, locally known in Indonesia as UMKM) located in Depok, Indonesia, that has provided aqiqah—an Islamic ceremonial catering service traditionally performed to celebrate the birth of a child—and general catering services since 2003. Over more than two decades of operation, the enterprise has accumulated a substantial volume of sales transaction records across various staple menu items, including gulai, sate, sop, semur, and cacak. However, these historical transaction logs have been documented manually in physical sales ledgers and retained merely as administrative archives, leaving the valuable purchasing patterns embedded within the data entirely unexplored. The lack of systematic analytical processing of Buya Aqiqah's sales records has led managerial decisions, particularly regarding menu bundling and promotional pricing, to depend heavily on subjective intuition and personal observation. This operational limitation is common across micro and small culinary enterprises in Indonesia, where manual bookkeeping and limited digital infrastructure frequently prevent regular data utilization (Mahardhika *et al.*, 2026). In ceremonial catering, misjudging customer menu combinations not only reduces the commercial appeal of bundled offers but also creates operational inefficiencies in ingredient procurement, given that fresh meat and perishable cooking supplies require precise demand forecasting. Without a structured, data-driven approach to determine which menu items are frequently purchased together, MSMEs like Buya Aqiqah risk launching promotional packages that misalign with real customer preferences, thereby undermining customer satisfaction and operational margins.

Association rule mining using the Apriori algorithm offers an established computational framework to discover co-occurrence relationships within transactional databases. Prior research has confirmed the efficacy of this technique across multiple commercial settings. Miranda *et al.* (2022) implemented the Apriori algorithm in RapidMiner on hampers sales records, identifying six association rules with confidence levels between 58% and 75%. In the food and beverage domain, Yudhistira *et al.* (2023) analyzed coffee shop transactions and discovered strong association rules exceeding 75% support and 90% confidence to guide promotional strategies. Anggraini *et al.* (2023) demonstrated that association rule mining provides actionable insights for general retail sales strategies. In the MSME sphere specifically, Hanani *et al.* (2023) used the Apriori algorithm to synchronize stock management with bundling packages, whereas Rosmiati *et al.* (2025) integrated the algorithm with a Mix Bundling Pricing model to determine economically optimal product sets. Beyond retail sales, Safitry *et al.* (2025) [cek sitasi: pastikan apakah merujuk ke Safitry *et al.* atau Suwaryo *et al.*] expanded the application of the Apriori algorithm to mattress-material consumption logs for production optimization. Complementing these association techniques, Sarimole *et al.* (2024) applied K-Means clustering to categorize inventory into sales-performance groups; however, clustering techniques partition data into clusters without generating directional, item-to-item dependency metrics such as support, confidence, and lift. Despite these diverse applications, empirical studies examining traditional aqiqah and ceremonial catering enterprises remain scarce. This research gap is further pronounced because such enterprises still rely on unstandardized manual records, making systematic data transformation a vital precursor to computational mining. To address these challenges, the present study conducts an Apriori-based association rule mining analysis within the Knowledge Discovery in Databases (KDD) framework, applied to 137 digitized sales transactions of Buya Aqiqah spanning the 2025–2026 period. The primary objectives are to evaluate the stability of the discovered menu associations across three distinct minimum support and minimum confidence scenarios, identify core paired menu items with statistical significance validated by lift ratios exceeding unity, and deliver actionable, data-driven bundling recommendations that Buya Aqiqah management can readily adopt. By demonstrating how raw, manual sales ledgers can be systematically digitized and mined, this study contributes practical guidelines for operational decision-making in culinary MSMEs while expanding the empirical literature on association rule mining within specialized ceremonial catering services. The remainder of this paper is organized as follows. Section 2 reviews related work on association rule mining and the Apriori algorithm across various business contexts. Section 3 describes the proposed methodology, including the KDD stages, dataset, tools, and testing scenarios used in this study. Section 4 presents the results of the three testing scenarios and discusses their implications. Section 5 concludes the paper and offers recommendations for future research.

2. Related Work

Several studies have applied the Apriori algorithm and related association rule mining techniques to sales transaction records across various business sectors. Miranda *et al.* (2022) implemented the Apriori algorithm using RapidMiner to analyze the sales transactions of Sheshop, a hampers retail business, successfully identifying six valid association rules with confidence values ranging from 58% to 75%. In the beverage and culinary segment, Yudhistira *et al.* (2023) deployed the Apriori algorithm at Kandang Kopi Tasikmalaya, uncovering strong association rules with support values above 75% and confidence exceeding 90%, which directly informed their promotional pricing strategies. Similarly, Anggraini *et al.* (2023) analyzed general retail transactional data, demonstrating that frequent itemset extraction provides a rigorous empirical foundation for inventory positioning and cross-selling. Within the MSME sector, transactional data mining has proven particularly valuable for overcoming intuitive operational management. Hanani *et al.* (2023) utilized the Apriori algorithm on sales records from Sibucin_id, an online micro-enterprise, to synchronize stock management and guide product bundling decisions. Rosmiati *et al.* (2025) extended this analytical capability by combining the Apriori algorithm with a Mix Bundling Pricing framework, yielding both associative itemsets and commercially viable package pricing models. In a similar vein, Hibnastiar *et al.* (2025) generated objective product package recommendations directly from historical sales transactions, substantially diminishing reliance on owner intuition. Addressing perishable inventory, Yulianto and Elsandra (2024) conducted market basket analysis in a commercial bakery, emphasizing that digital record-keeping is an indispensable prerequisite for regular computational data mining.

Beyond retail and culinary environments, researchers have also demonstrated the applicability of association algorithms across distinct industrial workflows. Safitry *et al.* (2025) applied the Apriori algorithm to raw material consumption logs in mattress manufacturing to optimize production schedules, showing that association mining extends effectively to operational back-end processes. In digital commerce, Arinal and Rusmarhadi (2024) evaluated customer transaction affinities, whereas Firmansyah and Odi (2023) addressed inventory stock-out risks using the FP-Growth algorithm. As an alternative data-driven approach, Sarimole *et al.* (2024) employed K-Means clustering to classify retail goods based on sales volumes for inventory forecasting; nevertheless, clustering partitions items into general groups without producing directional item-to-item dependency metrics such as support, confidence, and lift. A comparative synthesis of these related works is provided in Table 1.

Table 1. Summary of Related Work

Author (Year)	Business/Domain	Method	Main Result
Aulia Miranda <i>et al.</i> (2022)	Hampers retail (Sheshop)	Apriori (RapidMiner)	6 rules; confidence 58–75%
Yudhistira <i>et al.</i> (2023)	Coffee shop	Apriori	Support >75%; confidence >90%
Anggraini <i>et al.</i> (2023)	General retail	Association rule mining	Rules used for sales strategy
Hanani <i>et al.</i> (2023)	Online MSME	Apriori	Rules for stock & bundling
Rosmiati <i>et al.</i> (2025)	MSME product packages	Apriori + Mix Bundling Pricing	Optimized package pricing
Hibnastiar <i>et al.</i> (2025)	Product packages	Apriori	Objective package recommendation
Yulianto & Elsandra (2024)	Bakery goods (perishable goods)	Market Basket Analysis	Highlighted need for digital records
Arinal & Rusmarhadi (2024)	E-commerce	Big data methodology	Purchasing pattern analysis
Firmansyah & Odi (2023)	E-commerce inventory	FP-Growth	Stock-out prevention
Laila Safitry <i>et al.</i> (2025)	Mattress-material usage	Apriori	Production optimization
Sarimole <i>et al.</i> (2024)	Retail stock grouping	K-Means Clustering	3 sales-based product clusters

Across these empirical investigations, association rule mining via the Apriori algorithm has demonstrated robust efficacy across diverse commercial domains, ranging from retail shops and bakeries to online MSMEs and manufacturing plants, as summarized in Table 1. However, the operational domain of aqiqah and ceremonial catering enterprises—characterized by manually archived transaction logs and a specialized, meat-centric menu—remains unexamined in the existing data mining literature. This study addresses this empirical void by

implementing the Apriori algorithm across multi-scenario threshold parameters for Buya Aqiqah, while demonstrating the critical data transformation process required to convert handwritten sales records into actionable business intelligence. Association rule mining quantitatively measures dependencies between co-occurring items using three primary statistical metrics: support, confidence, and lift ratio. Let $I = \{i1, i2, \dots, im\}$ be the set of all menu items, and let $D = \{t1, t2, \dots, tn\}$ represent the database of sales transactions, where each transaction t is an itemset such that $t \subseteq I$. An association rule is an implication of the form $A \rightarrow B$, where $A \subset I, B \subset I$, and $A \cap B = \emptyset$. Support measures the proportion of total transactions in D containing both itemsets A and B , defined as:

$$Support(A \rightarrow B) = P(A \cup B) = \frac{t \in D \text{ s.t. } A \cup B \subseteq t}{D} \quad (1)$$

Confidence quantifies the conditional probability that a customer purchases itemset B given that itemset A has already been selected, reflecting the rule's operational reliability:

$$Confidence(A \rightarrow B) = P(B | A) = \frac{Support(A \cup B)}{Support(A)} \quad (2)$$

To verify that the co-occurrence of A and B represents a true statistical association rather than a random coincidence, the lift ratio is computed:

$$Lift(A \rightarrow B) = \frac{P(BA)}{P(B)} = \frac{Confidence(A \rightarrow B)}{Support(B)} \quad (3)$$

A lift ratio greater than 1 indicates a positive association between itemsets A and B , values equal to 1 indicate statistical independence, and values below 1 reflect negative affinity. These metrics serve as the quantitative evaluation benchmarks across the testing scenarios conducted in this study.

3. Methodology

This study employed a quantitative data mining approach grounded in the Knowledge Discovery in Databases (KDD) framework, comprising five sequential stages: data selection, data cleaning, data transformation, data mining, and pattern evaluation. This structured framework was chosen because it provides a systematic methodology for converting raw, handwritten transactional archives into structured, interpretable patterns to support managerial decision-making at Buya Aqiqah. The dataset comprised historical sales transactions from Buya Aqiqah covering the 2025–2026 operating period, containing an initial total of 137 transactions. Because these sales records had originally been maintained manually in paper ledgers, they were systematically digitized into Microsoft Excel (.xlsx) spreadsheets. During the data selection and cleaning stages, irrelevant attributes such as customer identifiers, phone numbers, and physical addresses were removed, leaving only the transaction identification number and the recorded food menu items. The primary menu items documented in the transactions included Gulai (spiced meat curry), Sate (skewered grilled meat), Sop (clear meat soup), Semur (sweet soy-based stew), and Cacak (spiced side dish). All 137 digitized transaction logs contained complete item descriptions; consequently, no transactions were discarded due to missing or corrupt entries. The cleaned dataset was subsequently converted into binary tabular format (true/false flags) through nominal-to-text and numerical-to-binominal transformations in RapidMiner Studio to satisfy the input prerequisites for frequent itemset mining. The computational workflow was constructed in RapidMiner Studio using an integrated operator pipeline, as illustrated in Figure 1. RapidMiner Studio was selected for its visual, parameter-controllable interface, which facilitates precise configuration of support and confidence thresholds without necessitating custom programmatic scripting. Microsoft Excel was utilized exclusively during the initial digitization and formatting stage before database ingestion.

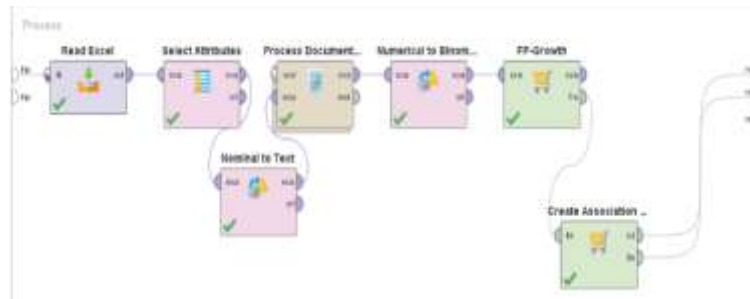


Figure 1. Operator Pipeline in RapidMiner Studio

The operator architecture depicted in Figure 1. executed the data transformation and rule extraction sequentially. The Read Excel operator loaded the digitized tabular records into the workflow environment. The Select Attributes operator filtered the dataset to isolate transactional food items from non-analytic columns. Textual dish descriptions were tokenized and mapped via Process Documents and Nominal to Text, while Numerical to Binomial converted item occurrences into a binary matrix. To generate frequent itemsets, the FP-Growth operator was applied based on the established minimum support thresholds, followed by Create Association Rules to extract relationship patterns satisfying the target minimum confidence levels. Although this investigation conceptually grounds its evaluation in association rule mining principles originally popularized by the Apriori framework, RapidMiner deploys the FP-Growth operator to enhance computational efficiency in frequent itemset tree construction prior to rule generation. To evaluate the mathematical stability and behavioral robustness of the resulting menu relationships, three distinct threshold scenarios were established: Scenario 1 (minimum support 5%, minimum confidence 50%), Scenario 2 (minimum support 10%, minimum confidence 60%), and Scenario 3 (minimum support 15%, minimum confidence 70%). These incremental thresholds enabled a systematic sensitivity analysis of rule retention under increasingly stringent filtering parameters. Each generated rule was evaluated against its lift ratio metric, wherein a value greater than 1 served as the decisive validity benchmark confirming that the co-occurrence between menu items represented an empirical affinity rather than an arbitrary co-occurrence.

4. Results and Discussion

4.1 Results

The dataset analyzed in this study comprised 137 sales transactions from Buya Aqiqah that had undergone digitization and systematic data cleaning. All 137 transactional records were verified as complete and subsequently processed through RapidMiner Studio. A comprehensive summary of the dataset attributes and scope is presented in Table 2.

Table 2. Dataset Description

Description	Detail
Data source	Buya Aqiqah, Depok
Data period	2025–2026
Initial number of transactions	137 transactions
Number of transactions after cleaning	137 transactions
Data format	Microsoft Excel (.xlsx)

To evaluate the sensitivity and behavioral stability of the extracted item associations, computational mining was conducted across three distinct parameter scenarios. These scenario configurations systematically increased the filtering thresholds to observe their direct impact on the retention of frequent itemsets and valid association rules. A comparative summary of the execution across the three testing scenarios is provided in Table 3.

Table 3. Comparison of the Three Testing Scenarios

Scenario	Min. Support	Min. Confidence	Frequent Itemsets	Rules Formed	Valid Rules
Scenario 1	5%	50%	8	2	2
Scenario 2	10%	60%	7	2	2
Scenario 3	15%	70%	6	2	2

As detailed in Table 3, all three parameter scenarios yielded exactly two valid association rules, despite the contraction of frequent itemsets from eight to six as the minimum support threshold rose from 5% to 15%.

This threshold elevation eliminated only infrequent secondary combinations, such as the Sate–Semur itemset, which satisfied only the permissive 5% support boundary of Scenario 1. Consequently, Scenario 1 was designated as the primary representative baseline because it retained the broadest spectrum of underlying item relationships without generating redundant or invalid rules. The two robust association rules identified across all testing configurations are presented in Table 4.

Table 4. Valid Association Rules and Their Values

No	Association Rule	Support	Confidence	Lift Ratio	Status
1	Gulai → Sate	67.2%	94.8%	1.065	Valid
2	Sop → Sate	19.7%	100.0%	1.123	Valid

Figure 2 illustrates a graphical comparison of the support, confidence, and lift ratio metrics across the two validated association rules, highlighting the trade-off between transaction frequency and conditional rule strength.

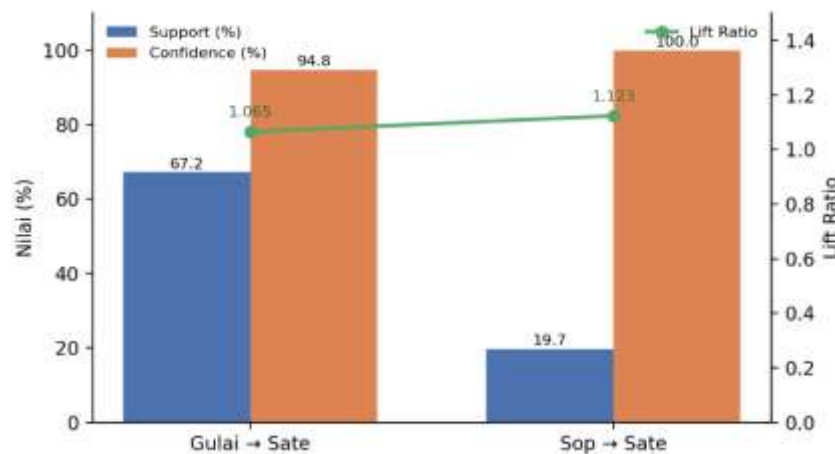


Figure 2. Comparison of Support, Confidence, and Lift Ratio of the Association Rules

4.2 Discussion

The association rule $\text{Gulai} \rightarrow \text{Sate}$ exhibited a support value of 67.2%, indicating that the combination of Gulai and Sate occurred concurrently in approximately 92 out of the 137 evaluated customer transactions. The confidence value of 94.8% demonstrates that customers ordering Gulai almost universally selected Sate within the same catering order. Furthermore, the lift ratio of 1.065—being strictly greater than 1—statistically verifies that the co-occurrence of Gulai and Sate represents an authentic behavioral affinity rather than a random purchasing occurrence. Conversely, the second rule, $\text{Sop} \rightarrow \text{Sate}$, registered a comparatively lower support value of 19.7% (approximately 27 transactions) but achieved the theoretical maximum confidence level of 100%. This absolute confidence indicates that every customer who ordered Sop invariably included Sate in their purchase without exception. The corresponding lift ratio of 1.123, slightly higher than that of the first rule, indicates a marginally stronger statistical coupling between Sop and Sate, despite its lower overall transaction volume. Because the lift ratios of both rules exceed unity, both associations provide statistically sound foundations for strategic decision-making. The stability of these rules across layered testing thresholds corroborates the methodological conclusions of Rosmiati *et al.* (2025), who demonstrated that multi-scenario parameterization yields reliable association rules for MSME product bundling. However, the confidence metrics observed in this study (94.8% and 100%) substantially exceed the levels documented by Miranda *et al.* (2022) in the hampers retail sector, which spanned 58% to 75%. This divergence is primarily attributable to the specialized and streamlined menu structure inherent to aqiqah catering compared to broad retail inventories, resulting in highly homogeneous purchasing patterns. Aligning with Hanani *et al.* (2023), these findings confirm that dormant manual transaction logs can be computationally transformed into strategic insights for bundling and promotional execution. Furthermore, the results reinforce the findings of Hibrastiar *et al.* (2025) regarding the efficacy of transaction-driven mining in establishing objective, data-backed packaging strategies that eliminate reliance on owner intuition.

From an applied managerial standpoint, Buya Aqiqah can immediately leverage these empirical insights to establish targeted commercial packages, specifically formalizing a "Gulai–Sate" package as the primary volume driver and a "Sop–Sate" package as a specialized premium offering. Because Sate serves as the indispensable anchor item across both rules, maintaining rigorous procurement controls and buffer inventories for Sate ingredients must become a strategic operational priority to prevent supply bottlenecks. Moreover,

these findings highlight the necessity of adopting digital point-of-sale systems, as advocated by Yulianto and Elsandra (2024), to facilitate routine automated data mining without requiring periodic manual digitization. The empirical scope of this study was constrained by several factors. Primarily, the dataset was limited to 137 transactions derived from a single catering enterprise during one operating timeframe; therefore, while the extracted rules exhibit internal statistical stability across the tested scenarios, their generalizability to other catering establishments with divergent menu configurations remains to be validated. Additionally, the experimental evaluation examined only the Apriori framework within the RapidMiner pipeline; comparative evaluations against independent FP-Growth implementations or clustering methodologies, such as K-Means (Sarimole *et al.*, 2024), were not conducted under identical benchmark conditions. While these constraints do not impair the validity of the findings for Buya Aqiqah, they define the boundaries within which the current conclusions should be applied.

5. Conclusion and Recommendations

This study demonstrated the empirical application of association rule mining using the Apriori algorithm within the Knowledge Discovery in Databases (KDD) framework, executed through RapidMiner Studio on 137 digitized sales transactions from Buya Aqiqah. Experimental testing across three threshold scenarios established two persistent association rules: $Gulai \rightarrow Sate$ (support 67.2%, confidence 94.8%, lift ratio 1.065) and $Sop \rightarrow Sate$ (support 19.7%, confidence 100.0%, lift ratio 1.123). Scenario 1 (minimum support 5%, minimum confidence 50%) emerged as the optimal parameter configuration, maximizing frequent itemset coverage without compromising rule validity. With both lift ratios exceeding unity, these associations confirm strong, statistically significant purchasing affinities, providing the enterprise with a verifiable empirical basis to establish dedicated menu bundling packages and prioritize inventory management for Sate ingredients. The primary contribution of this research lies in demonstrating how dormant, manually recorded transactional records in specialized ceremonial catering MSMEs can be systematically digitized and converted into actionable business intelligence. Notwithstanding these contributions, the findings are bounded by the single-enterprise dataset and the exclusive evaluation of the Apriori algorithm. Future research should expand this analytical scope by incorporating larger, multi-year transaction streams captured via automated point-of-sale systems, extending the inquiry to comparative evaluations between Apriori, standalone FP-Growth, and clustering methodologies such as K-Means across diverse culinary sectors.

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