Sustainable Agriculture Research Journal
(SAR JOURNAL)

e-ISSN: 3109-3825
https://e-journal.tematikapertanusantara.sch.id/index.php/SAR-Journal
Vol.1 (No.2): 86-95, 2025

Analysis of the Number of Packaging Damages in Cup Milk Products in the Dairy Industry in Sleman Regency, Yogyakarta

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ABSTRACT

A defect or product flaw refers to a condition in which a product fails to meet predetermined quality standards and therefore requires repair or rework. This study aims to analyze the occurrence and causes of defects in cup milk products produced by a dairy industry. The research was conducted during an internship period using several data collection methods, including direct observation of the production process, interviews with the operations manager, and a review of relevant literature. Packaging is a critical component in maintaining the quality and safety of dairy products. It functions not only as a protective barrier against physical, chemical, and microbiological contamination, but also plays an essential role in preserving the freshness, taste, and nutritional value of milk during storage and distribution. High-quality packaging can reduce product damage, extend shelf life, and provide essential product information to consumers, thereby increasing consumer trust. The collected data were analyzed using quality control tools, namely control charts and a fishbone diagram. The analysis identified two dominant types of defects: loosely sealed cup lids and underfilled cups. The results indicate that the level of packaging damage did not exceed control limits, suggesting that defect rates were still within acceptable standards. However, several factors contributed to the defects, particularly human error caused by employee fatigue due to a high volume of orders. In addition, the use of semi-manual packaging machines increased workload and reduced sealing accuracy. The percentage of defects consisted of 52.42% loosely sealed lids and 47.58% underfilled cups. Overall, these findings indicate that although defects are present, the packaging quality remains within a reasonable and controlled range.

Keywords: *control chart, packaging defects, diagram*

Introduction

Milk is a whitish-yellow liquid produced from the secretion of mammary gland cells in mammals and contains various essential nutrients that support immunity and body balance. Milk contains nearly all the nutrients needed by the human body, such as proteins, fats, carbohydrates, minerals, and vitamins. The protein content in fresh milk is especially important for the body, making milk one of the main food sources commonly consumed by the public (Pramesthi & Hari, 2015). Product packaging is a container or protective material that functions to prevent or reduce the risk of damage to the packaged goods. Meanwhile, packaging refers to the process of providing a container or wrapper for a product. Packaging can also be understood as a systematically designed system intended to prepare a product for distribution, sale, storage, and use (Rasa et al., 2023).

A control chart is a graphical method used to evaluate whether a product is within the limits of statistical quality control, thereby helping to identify problems and lead to quality improvements (Fajaranie & Khairi, 2022).

e-ISSN: 3109-3825
https://e-journal.tematikapertanusantara.sch.id/index.php/SAR-Journal
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To determine whether the collected data falls within the required limits, a p-chart control chart is used. The reason for using a p-chart control chart is that the data follows a binomial distribution, where there are only two possible outcomes defective or non-defective and the number of samples inspected is not constant over time (Rafiani & Desrianty, 2021). Analysis of packaging defects in cup milk products can help the company maintain and improve product quality by integrating and controlling defect levels to achieve a zero-defect condition. The p-chart was chosen because it is suitable for analyzing defect proportions, such as those found in cup milk packaging. This chart can handle varying sample sizes and provides a clear visualization of defects. The Seven Tools method is used to identify the root causes of product defects and to assist in finding solutions to these problems.

Research Method

a. Field Observation

   Direct observation was carried out by observing the production site and counting the number of packaging defects in the products.

b. Problem Formulation

   Problem formulation is the process of identifying, organizing, and detailing a problem clearly and with greater focus so that it can be analyzed and solutions can be sought. In this step, the emphasis is placed on the issues discovered during the discussion.

c. Interview

   The interview was conducted to obtain on-site information by communicating directly with the head of production.

d. Data Collection

   Data collection was carried out using company records from the period of March 2025 to April 2025, using the population frequency of cup milk production results over a span of 6 weeks.

e. Literature Study

   Literature study is a method carried out by collecting, reviewing, and analyzing various written sources relevant to the topic being discussed. These sources may include books, scientific journals, articles, theses, dissertations, and other references that can support the subject of the study.

f. Conclusion

   The conclusion is drawn after processing and analyzing the data obtained from the problem in accordance with the initial problem formulation. It is presented in bullet points, addressing the research questions and objectives that were intended to be answered.

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Results and Discussion

The analytical method applied to identify packaging defects involves three techniques from the Seven Tools as problem-solving aids. The Seven Tools are statistical instruments used to trace the root causes of quality issues, helping management identify the main causes of defects in products (Damayant et al., 2022). One of the quality control methods used in this analysis to approach a zero-defect level is the application of a p-chart control chart and a fishbone diagram.

Table 1. Packaging Defect Data of 180 ml Cup Milk Products

No	Day's	Production Quantity	Loose Cup Lid	Underfilled Cup	Total Defect	%Packaging Defects
1	1	50	5	4	9	18.00%
2	2	78	4	3	7	9.00%
3	3	145	8	5	13	8.70%
4	4	5	0	0	0	0.00%
5	5	154	7	9	16	10.39%
6	6	21	0	0	0	0.00%
7	7	200	13	7	20	10.00%
8	8	115	3	9	12	10.43%
9	9	83	0	0	0	0.00%
10	10	109	3	3	6	5.51%
11	11	49	5	4	9	18.37%
12	12	134	6	4	10	7.46%
13	13	116	0	4	4	3.45%
14	14	245	7	5	12	4.90%
15	15	70	4	2	6	8.57%
	Total	1574	65	59	124	115%

Based on Table 1, in the first week, the highest percentage of packaging defects occurred on Saturday, March 1, 2025, at 18% from a production total of 50 cup milk units. In the second week, the highest percentage was recorded on Friday, March 14, 2025, at 10.00% from a production of 200 cup milk units. In the third week, the highest percentage occurred on Wednesday, March 19, 2025, at 10.43% from a production of 115 cup milk units. In the fourth week, the highest packaging defect percentage occurred on Thursday, March 27, 2025, at 18.37% from a production of 49 cup milk units. In the fifth week, the highest percentage was recorded on Friday, April 4, 2025, at 4.90% from a production of 245 cup milk units. In the sixth week, the highest percentage of packaging defects occurred on Saturday, April 12, 2025, at 8.57% from a production of 70 cup milk units.

Table 2. Data on Packaging Defect Type: Loose Cup Lid (C1)

No	Day's	Production Quantity	Loose Cup Lid	Defect Proportion
1	1	50	5	0.001
2	2	78	4	0.051

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3	3	145	8	0.055
4	4	5	0	0.000
5	5	154	7	0.045
6	6	21	0	0.000
7	7	200	13	0.065
8	8	115	3	0.026
9	9	83	0	0.000
10	10	109	3	0.028
11	11	49	5	0.102
12	12	134	6	0.045
13	13	116	0	0.000
14	14	245	7	0.029
15	15	70	4	0.057
	Total	1574	65	0.603
	Mean	104.933	4.333	0.040

Table 3. CL, UCL, dan LCL Loose Cup Lid (C1)

CL	UCL	LCL
0.041	0.056	0.026
0.041	0.056	0.026
0.041	0.056	0.026
0.041	0.056	0.026
0.041	0.056	0.026
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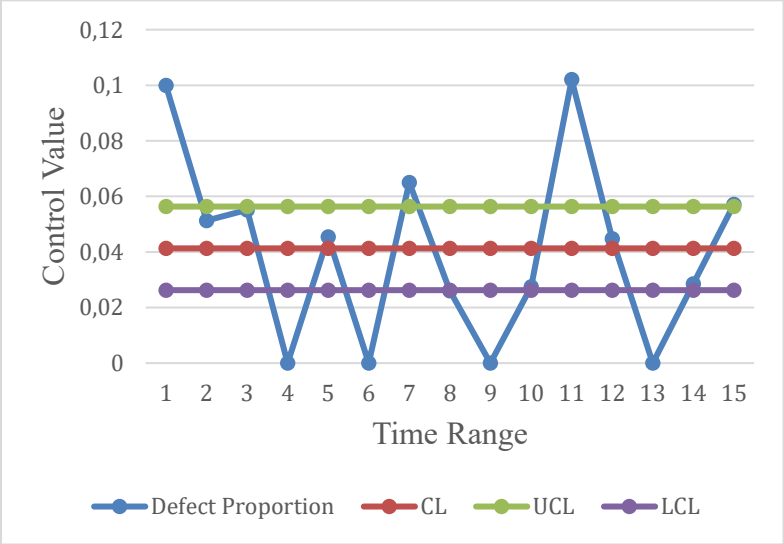

Figure 1. Control Chart of Loose Cup Lid (C1)

Based on Figure 1, there are data points that fall outside the upper control limit (UCL) and below the lower control limit (LCL). The center line (CL) value is 0.041, with an upper control limit (UCL) of 0.056 and a lower control limit (LCL) of 0.026. Figure 1 shows that some data points exceed both the UCL and LCL, but still remain within an acceptable range. Therefore, the defects or damages need to be more closely monitored and control measures should be improved.

Table 4. Data on Packaging Defect Type: Underfilled Cup (C2)

No	Day	Production Quantity	Underfilled Cup	Defect Proportion
1	1	50	4	0.001
2	2	78	3	0.051
3	3	145	5	0.055
4	4	5	0	0.000
5	5	154	9	0.045
6	6	21	0	0.000
7	7	200	7	0.065
8	8	115	9	0.026
9	9	83	0	0.000
10	10	109	3	0.028
11	11	49	4	0.102
12	12	134	4	0.045
13	13	116	4	0.000
14	14	245	5	0.029
15	15	70	2	0.057
	Total	1574	59	0.603
	Mean	104.933	3.933	0.040

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Table 5. CL, UCL, dan LCL Underfilled Cup (C2)

CL	UCL	LCL
0.037	0.052	0.023
0.037	0.052	0.023
0.037	0.052	0.023
0.037	0.052	0.023
0.037	0.052	0.023
0.037	0.052	0.023
0.037	0.052	0.023
0.037	0.052	0.023
0.037	0.052	0.023
0.037	0.052	0.023
0.037	0.052	0.023
0.037	0.052	0.023
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0.037	0.052	0.023

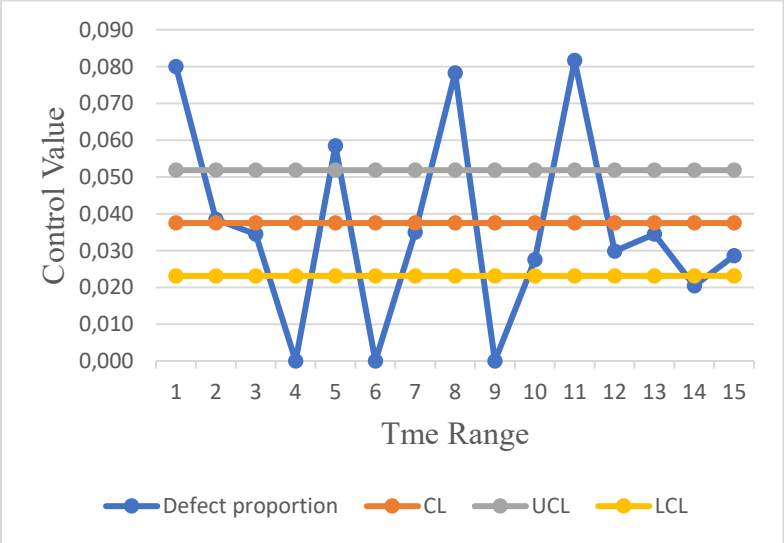

Figure 2. Control Chart of Underfilled Cup (C2)

Based on Figure 2.4, several data points are observed to fall outside the upper control limit (UCL) and cross the lower control limit (LCL). The central line (CL) is valued at 0.037, with an upper control limit (UCL) of 0.052 and a lower control limit (LCL) of 0.023. As shown in the figure, defects in cup milk products characterized by incomplete filling of milk in the cup (C2) include observations that exceed both the UCL and the LCL; however, these deviations are still within an acceptable or reasonable range. Nevertheless, this condition indicates that defects or product nonconformities require stricter monitoring and improved control to enhance product quality.

e-ISSN: 3109-3825
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The fishbone diagram is a method used to assist in solving existing problems by breaking down each issue that occurs and identifying everyone involved, along with possible factors that may be the root causes of the problem (Kristono, 2019).

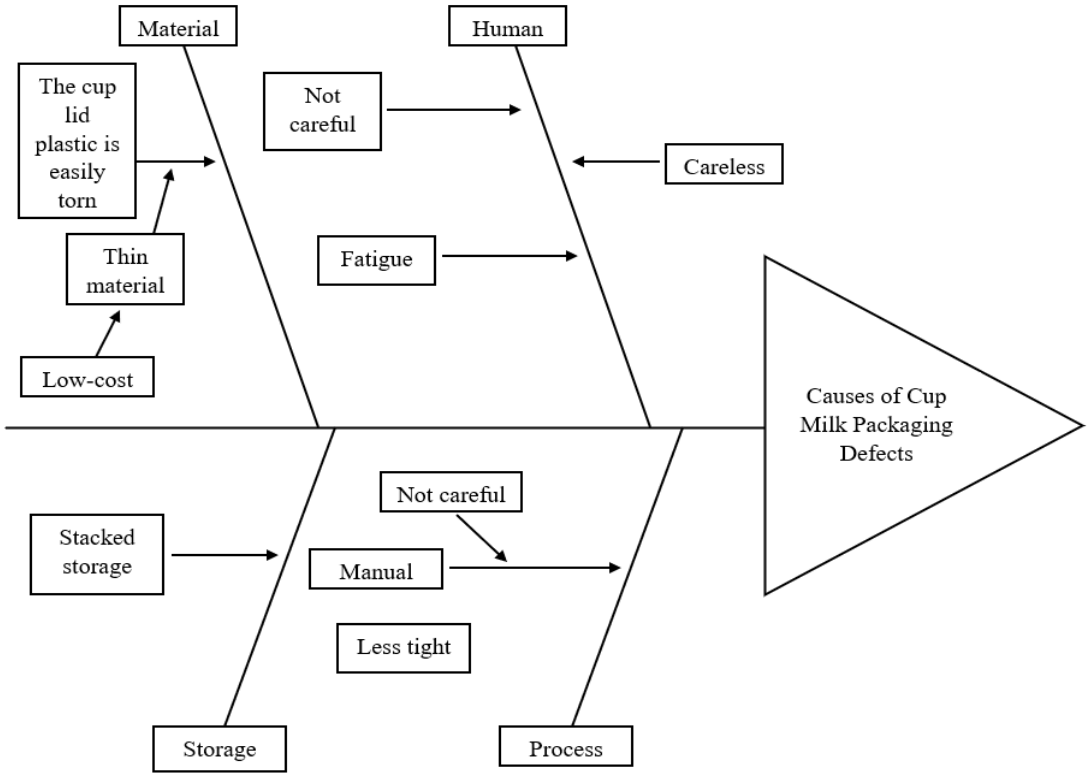

Figure 3. Fishbone Diagram of 180 ml Cup Milk Product Defects

1. Human

   The first factor contributing to packaging defects in cup milk products is human error. Negligence is one of the key causes, often resulting from employee fatigue and overtime work. In addition, high production targets driven by a large volume of orders lead to overexertion among employees, increasing the likelihood of packaging defects.

2. Storage

   The second factor contributing to packaging defects is environmental disturbance. Conditions in the storage area often involve stacked storage of products, which can lead to damage to the packaging.

3. Material

   The third factor contributing to packaging defects in cup milk products is the packaging material itself. Packaging damage can occur due to the use of thin plastic lids that are easily torn. This issue is often a result of using low-cost packaging materials.

e-ISSN: 3109-3825
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4. Packaging Process

   The fourth factor contributing to packaging defects is the packaging process itself. The cup milk packaging is carried out using a semi-manual machine. Due to the high volume of orders for other products, employees often experience fatigue, leading to reduced attention to detail. This lack of precision during the packaging process results in packaging defects.

Conclusion

The types of defects found in the 180 ml cup milk product, after analysis, include loosely sealed cup lids and underfilled cups. The percentage of packaging defects consists of 52.42% for loosely sealed cup lids and 47.58% for underfilled cups. The factors contributing to these packaging defects are human error, the packaging process, packaging material, and storage conditions specifically, the stacking of products during storage.

References

Adha, M. A., Supriyanto, A., & Timan, A. (2019). Strategies For Improving the Quality of Madrasah Graduates Using a Fishbone Diagram. *Tarbawi: Journal of Educational Management Studies*, 5(01), 11–22.

Adji, F. P., Ridhani, U., & Ikhsan, M. (2023). Design And Development of a Mixer for Bread Dough. *Journal Tematis: Technology, Manufacturing, and Industry*, 5(1), 8–16.

Asmoro, U. Y. (2019). Production Process Control of Reinforcing Steel Using a P Control Chart (Case study: PT Krakatau Wajatama Cilegon). *Journal Gerbang STMIK Bani Saleh*, 9(1).

Cindy Prastika, A., Wiradendi Wolor, C., & Office Facilities and Infrastructure Maintenance, A. (2023). Office Administration and Secretarial Management at CV Kolaborasi Pemuda Cerdas. *Journal of Office Administration and Secretarial Studies*, 2(1), 94–103.

Eviyanti, N. (2021). Fishbone Diagram Analysis to Evaluate Aluminum Equipment Manufacturing: A Case Study at SP Aluminium Yogyakarta. *JAAKFE UNTAN (Journal of Auditing and Accounting, Faculty of Economics, Universitas Tanjungpura*), 10(1), 10–18.

Damayanti, K., Fajri, M., & Adriana, N. (2022). Quality Control in Furniture Manufacturing at PT Jaya Abadi. *Bulletin of Applied Industrial Engineering Theory*, 3(1), 1–6.

Deglas, W. (2023). The effect of polyethylene (PE), polypropylene (PP), high-density polyethylene (HDPE), and overheated polypropylene (OPP) plastics on the quality of Mas bananas. Journal of Agriculture and Food, 5(1), 33–42.

Fajaranie, A. S., & Khairi, A. N. (2022). Observation of Packaging Defects in Dried Noodle Products Using Control Charts and Fishbone Diagrams at a Noodle Manufacturing Company in Semarang, Central Java. *Journal of Food Processing*, 7(1), 7–13.

Fitriaji, A. A., & Domodite, A. (2022). Analysis of Efforts to Improve Electrical Panel Production Quality to Reduce Defects Using the DMAIC Method. *TEKNOSAINS: Journal of Science, Technology, and Informatics*, 9(2), 90–100.

Jannah, D. R., Turmizi, T., & Bukhari, B. (2023). Quality Control Analysis Of 220 Ml Cup Filling Using the Six Sigma Method at PT IMA Montaz Sejahtera. *Journal of Applied Mechanical Science*, 7(2), 57–61.

Kartikasari, V., & Romadhon, H. (2019). Analysis of Quality Control and Improvement in Tuna Canning Processes Using Failure Mode and Effect Analysis (FMEA) And Fault Tree Analysis (FTA): A Case Study at PT XXX, East Java. *Journal of Industrial View*, 1(1), 1–10.

e-ISSN: 3109-3825
https://e-journal.tematikapertanusantara.sch.id/index.php/SAR-Journal
Vol.1 (No.2): 86-95, 2025

Khomah, I., & Rahayu, E. S. (2015). Application of P Control Charts for Rubber Quality Control at PTPN IX Batujamus/Kerjoarum. *AGRARIS: Journal of Agribusiness and Rural Development Research*, 1(1), 12–24.

Kiki, E., Lie, D., Efendi, E., & Sisca, S. (2019). Quality Control Analysis to Improve Product Quality at CV Bina Teknik Pematangsiantar. *SULTANIST: Journal of Management and Finance*, 7(1), 24–33.

Kristanti, N. D. (2017). Shelf Life of Pasteurized Milk in Relation to Thermoduric Microbial Quality and Chemical Characteristics. *Journal of Animal Product Science and Technology (JITEK),* 12(1), 1–7.

Kristono, I. S. (2019). Fishbone Diagram Analysis (Ishikawa Diagram). Bandung: IPB Press.

Lindayani, Setiawan, F. B., Matitaputty, S. J., Sitinjak, E. L. M., & Hartajanie, L. (2022). Improving the Quality of Cow's Milk Through Pasteurization Innovation. *Universitas Katolik Soegijapranata Proceedings* (Vol. 1).

Pradika, A. Y., Chusniati, S., Purnama, M. T. E., Effendi, M. H., Yudhana, A., & Wibawati, P. A. (2019). Total Escherichia Coli Testing of Fresh Cow Milk at The KPSP Karyo Ngremboko Dairy Farmer Cooperative, Purwoharjo, Banyuwangi. *Jurnal Medik Veteriner*, 2(1).

Pramesthi, R., & Hari, T. (2015). Quality control analysis in manufacturing processes. Journal of Industrial Engineering, 4(April), 69–74.

Rariani, V. I., & Desrianty, A. (2021). Proposed Quality Control Improvement for Waring Products Using the Six Sigma Method. *e-Proceeding FTI*.

Rani, A. M., & Setiawan, W. (2016). Analysis of Sanding Mark Defects in TMC Pick-Up Units Using the Seven Tools Method At PT ADM. *JISI: Journal of Industrial Systems Integration*, 3(1), 15–22.

Rasa, I. N. M. A. G., Astiti, M. P., Eryani, I. A. A. P., Yudiastari, I. N. M., & Semaryani, I. A. A. M. (2023). *The Importance of Packaging in Product Marketing*. Scopindo Media Pustaka.

Ridhani, M. A., Vidyaningrum, I. P., Akmala, N. N., Azzahro, S., & Aini, N. (2021). Potential Effects of Various Sugar Types on the Sensory and Physicochemical Properties of Sweet Bread: A Review. *Journal of Food Science and Technology*, 8(3), 61–68.

Riyanto, B., Trilaksani, W., & Lestari, R. (2016). Sport Nutrition Drinks Based on Octopus Protein Hydrolysate. *Journal of Indonesian Fisheries Product Processing*, 19(3), 339–347.

Rozi, A., & Gresik, P. P. (2018). Quality Improvement Analysis in Phthalic Anhydride Production Using the DMAIC Approach. *Journal MATRIK*, 1693, 5128.

Saputra, A., Junaidi, J., Supriyanto, A., & Surtono, A. (2022). Design and Realization of a Mass Measuring Instrument (Digital Scale) Using a Load Cell Sensor Based on Arduino. *Journal of Theory and Application of Physics*, 10(02), 159.

SNI 3144.1:2011. Fresh cow's milk. National Standardization Agency of Indonesia.

Soukotta, D., Matrutty, T. E., Setha, B., Tapotubun, A. M., Leiwakabessy, J., & Tupan, J. (2023). Application of Surimi Technology from Tuna Trimmings and Processing of "Kaki Naga" Products. *MITRA: Journal of Community Empowerment*, 7(1), 31–41.

Sutisna, N. W., & Effane, A. (2022). Management Functions of Facilities and Infrastructure. *Journal Karimah Tauhid*, 1(2), 227–233.

Suyanto. (2022). Cooling Load of GEA Plug-In Cold Room Type GAC-245 for Fish Preservation. *Marine Science and Technology Journal*, 2(2), 82–90.

Uniba, J. T. E. (2022). Prototype of a Digital Weighing Scale. *Journal of Electrical Engineering*, 6(2), 2–7.

Vianty, K. D. O., Hutabarat, J., & S. T. S. L. A. (2022). Overall Equipment Effectiveness Analysis to Improve Cup Filling Machine Productivity Using the Six Big Losses Approach. *Valtech Journal (Industrial Engineering Student Journal)*, 5(1), 50–57.

Vokasi, F. (2019). Development of a Monitoring System Program for a Milk Analyzer Based on Android.

Wandani, J. C., Sukanta, S., & Nugraha, B. (2024). Quality Control Using Control Charts and the 5-Whys Approach for Unit X At PT M. *UNISTEK*, 11(2), 87–97.

e-ISSN: 3109-3825
https://e-journal.tematikapertanusantara.sch.id/index.php/SAR-Journal
Vol.1 (No.2): 86-95, 2025

Wijanarti, S., Rahmatika, A. M., & Hardiyanti, R. (2018). Effect of Manual Roasting Time on Product Quality. *National Journal of Applied Technology*, 2(2), 212–222.

Zarwinda, I., Nadia, N., & Rejeki, D. P. (2022). Formulation of Hard Candy Using Defective Gayo Arabica Coffee. *Journal of Pharmaceutical and Health Research*, 3(3), 188–122.