Jurnal Teknik Mesin
Mechanical Xplore (JTMMX)
Mechanical Engineering
Vol. 5 No. 2 (2024) pp. 102-112
p-ISSN: 2746-0045 e-ISSN: 2746-3672

# Design and Construction of Poultry Feather Plucking Machine with a 2 kg Processing Capacity

**Boby Agung Pratama[1], Rudy Rafli[1], Apri Setiawan[2, *], Dibyo Setiawan[2], Harry Prayoga Setyawan[1]**

[1]Jurusan Teknik Mesin, Politeknik Raflesia, Jl. S. Sukowati No. 28, Curup, Rejang Lebong, Bengkulu, 39114, Indonesia
[2]Jurusan Teknik Mesin, Politeknik Negeri Bandung, Jl. Gegerkalong Hilir, Ciwaruga, Bandung Barat, West Java, 40559, Indonesia

**ABSTRACT**

The poultry industry plays a crucial role in meeting the growing global demand for meat. However, the feather plucking process remains a significant challenge, particularly for small-scale poultry farmers who often rely on manual methods that are time-consuming, labor-intensive, and potentially unhygienic. This study aimed to design and construct an affordable and efficient poultry feather plucking machine with a 2 kg processing capacity. The machine was designed using 3D modeling software and constructed using plastic materials for the bucket and rotating disc, and steel for the electric motor mount. The use of plastic components aimed to reduce production costs while maintaining efficiency and minimizing the risk of damage to poultry skin during the plucking process. Functional tests were conducted to evaluate the machine's performance, revealing an average processing time of 28 s per bird, a 30% reduction compared to manual plucking. The machine's efficiency was also assessed, demonstrating a 30% improvement over manual methods. The total production cost of the machine was Rp. 450,000, which is more economical than previous studies. Although the developed machine showed promising results, further study is needed to explore additional parameters such as energy consumption, maintenance requirements, and long-term durability. The incorporation of machine learning algorithms for automated cycle time optimization based on different poultry sizes and feather densities could also be investigated in future studies. Overall, this study contributes to the development of affordable and efficient poultry feather plucking machines, which can benefit small-scale poultry farmers and improve the overall efficiency of the poultry industry.

***Keywords:*** Poultry Feather plucking machine, Processing capacity, Poultry plucking, Design and construction

**Article information:**
Submitted: 23/01/2025
Revised: 14/02/2025
Accepted: 15/02/2025
Published: 15/02/2025

**Author correspondence:**
* ✉:
apri.setiawan@polban.ac.id

**Type of article:**

☑ Research papers

☐ Review papers



## 1. Introduction

Poultry processing is a crucial aspect of the agricultural and food industries and contributes significantly to meat production and the supply chain. Feather plucking is one of the most labor-intensive processes in poultry production. Manual processing is time-consuming, labor-intensive, and often unhygienic. Traditional feather removal methods involve hot water scalding followed by manual plucking, which can lead to inconsistencies in efficiency, hygiene issues, and longer processing time. The need for an efficient, cost-effective, and hygienic feather plucking machine is evident in small-and medium-scale poultry farms and processing businesses. Many commercially available machines are designed for large-scale operations, rendering them expensive and unsuitable for small-scale poultry farmers. Hence, designing and constructing a poultry feather plucking machine with a processing capacity of 2 kg can bridge this gap by providing an affordable, efficient, and easy-to-operate solution.

Meat is an essential source of nutrients for human growth, health, and cognitive development [1]. The global demand for meat continues to rise owing to population growth, increasing public awareness of balanced nutrition, and improved purchasing power driven by economic growth [2]. In particular, poultry meat has become a preferred choice owing to its affordability compared with other types of meat [3, 4]. However, the growth of domestic meat production remains relatively slow owing to suboptimal livestock management practices and the limited adoption of advanced livestock processing technologies [5]. One of the primary challenges in poultry processing is the feather plucking stage, which significantly affects efficiency, processing time, and labor requirements. In numerous poultry processing centers, feather plucking is still performed manually, necessitating substantial human labor and time, while also increasing the risk of inconsistency in feather removal and contamination. Therefore, developing an efficient, cost-effective, and reliable poultry feather plucking machine is crucial for improving productivity and ensuring higher hygiene standards in poultry processing.

Feather plucking is a crucial stage in poultry processing [6]. However, in many poultry processing centers, this process is still performed manually and requires significant time and labor [7, 8]. To address these challenges, numerous studies have explored the development of poultry feather plucking machines to enhance efficiency and productivity while minimizing potential damage to the poultry meat texture [9, 10]. Omoniyi Ezekiel B. et al. [11] developed a poultry feather plucking machine using a galvanized steel bucket with a capacity of two poultry per cycle. Adefuye O.A. et al. (2021) [12] designed and fabricated a poultry feather plucking machine made of steel plate with a capacity of 16.58 kg, which successfully plucked the feathers of a 1.8 kg broiler chicken in 22 seconds. Further development led to a stainless-steel bucket-type plucking machine capable of processing 1.95 kg of poultry in 25 s with an efficiency of 81% [13]. Additionally, a vertical bucket-type poultry feather plucking machine made of a steel plate achieved a plucking efficiency of 96% [6]. In 2023, a poultry feather plucking machine utilizing a stainless-steel bucket was developed, demonstrating an average plucking time of 20 s with an efficiency of 98.1% [14].These advancements in poultry feather plucking machines have significantly improved processing efficiency and reduced labor requirements in the industry. However, there is still room for further optimization, particularly in terms of increasing capacity and reducing processing time. Future studies should focus on developing machines that can handle multiple birds simultaneously while maintaining high plucking efficiency and minimizing poultry meat damage.

Unlike previous studies, which primarily utilized steel plates for the feather plucking bucket, this study introduced the use of elastic plastic as the primary material. The adoption of plastics aims to reduce production costs while maintaining their efficiency. This study aimed to develop an affordable poultry feather plucking machine capable of efficiently removing feathers in a short time. The methodology included planning, designing, manufacturing, and assembling the machine, followed by functional testing to evaluate its performance by measuring the processing time for a single bird per cycle. These results indicate that the machine operates effectively, which can potentially contribute to the poultry meat processing industry. The machine design incorporates a rotating drum with plastic fingers that gently removes feathers from poultry carcasses. This innovative approach reduces the overall weight of the machine and enhances its portability and ease of maintenance. Furthermore, the use of plastic components minimizes the risk of damage to the poultry skin during the plucking process, potentially improving the quality of the final product.

## 2. Methods

### 2.1. Working principle of the poultry feather plucking machine

The poultry feather plucking machine is designed to remove feathers from poultry that have been slaughtered and soaked in hot water. This machine significantly reduces the time required for feather removal compared to manual plucking, which is labor intensive and time consuming [15].

The machine operates based on the principles of rotation and friction, which effectively remove feathers from the poultry skin. This mechanized process enhances efficiency by accelerating feather plucking while minimizing human effort compared with manual methods [16]. The primary mechanism involves a rotating drive motor that generates the required motions. After being slaughtered and soaked in hot water, the poultry are placed into the machine, where an electric motor drives its rotation. As the poultry move against the plucker rubbers, the feathers are loosened and removed from the skin.

Plucker rubbers are typically made of flexible materials to prevent damage to poultry meat and skin [17]. Additionally, users must spray an adequate amount of water during operation to facilitate feather removal and ensure that the detached feathers are efficiently expelled through the output chute of the machine.

### 2.2. Design and construction method

Design and construction is a term for designing and creating an object from the beginning to the end of the manufacturing process [18]. Meanwhile, according to Ana Naela N. (2017) design and construction is the process of making drawings and sketches to be managed into elements which are then combined so that they have the function as expected [19]. Thus, design and construction can be interpreted as the activity of drawing, planning, and sketching several elements that are then combined into a complete and functional system or object [20]. The design process is conducted by focusing on important aspects of designing a machine, namely, ensuring that the machine can operate safely and effectively [21]. The method begins with planning, designing, manufacturing, and assembling. A flowchart of the study methods is shown in Figure 1.

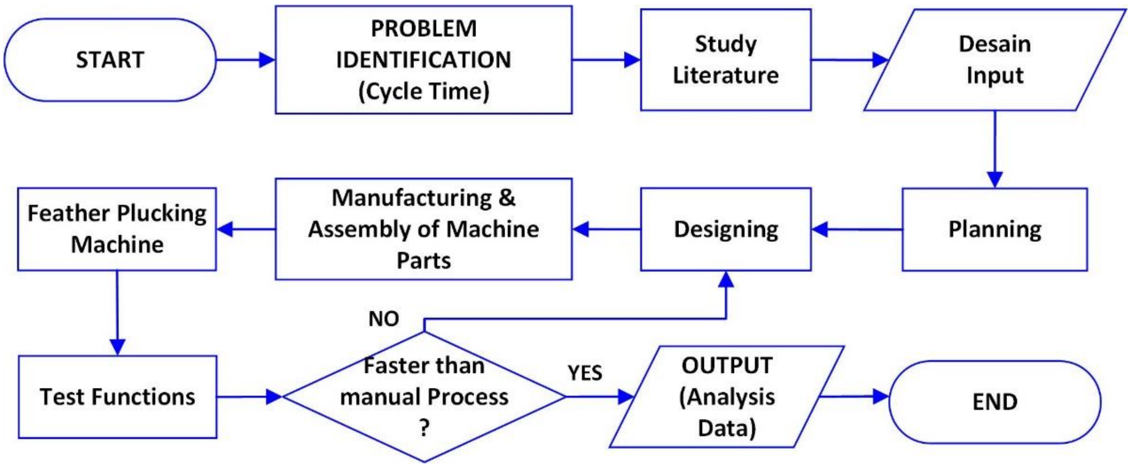


**Figure 1.** Study methodology flowchart

The project commenced by identifying the key elements of the poultry feather plucking device, which are listed in Table 1. These components include the bucket, lid, plucker rubber, rotating disc, electric motor and mount, exhaust hole, and control box. A 3D modeling program was used to create the design at full scale, as illustrated in Figure 2. The manufacturing process began with the creation of a bucket plucker, which utilized a plastic bucket to minimize expenses and improve material availability. Similarly, the rotating disc was made of plastic. A steel plate and hollow iron structure were attached to the underside of the disc to reinforce it and enable connection to the electric motor. The electric motor mount was constructed using hollow iron and steel plates joined through electric welding. A plastic controller box houses a dimmer that controls the speed of the electric motors. The final step involved assembling all poultry plucker components according to the design specifications.The assembled poultry feather plucking device underwent rigorous testing to ensure its functionality and efficiency. During the testing phase, various types of poultry were used to evaluate the performance of the device across different feather textures and sizes. The results demonstrated that the device successfully removed feathers from multiple bird species with minimal damage to the skin and meat.

https://doi.org/10.36805/jtmmx.v5i2.8966

**Table 1.** Poultry feather plucking machine components

| Component | Specification | Component Function | Quantity |
|---|---|---|---|
| Bucket | Dia. 460 x 570 (mm) | Poultry feather plucking Bucket | 1 unit |
| Bucket Lid | Dia. 460 mm | Bucket lid of poultry feather plucking machine | 1 unit |
| Rubber Plucker | Dia. 18 x 90 (mm) | Poultry feather remover | 1 pack (45 Pcs) |
| Rotating Disc | Dia. 380 x 51 (mm) | rotating the poultry in the plucker Bucket | 1 unit |
| Electric motor Mounting | Dia. 380 x 220 (mm) | Mounting for electric motor | 1 unit |
| Electric Motor | 220 V-AC, 250 W, 1300 RPM | Motor to drive the rotating disc | 1 unit |

The apparatus for avian plumage removal incorporates a mechanism that modulates the rotational velocity of the disc. Operators can regulate the angular speed of the disc using the control interface.

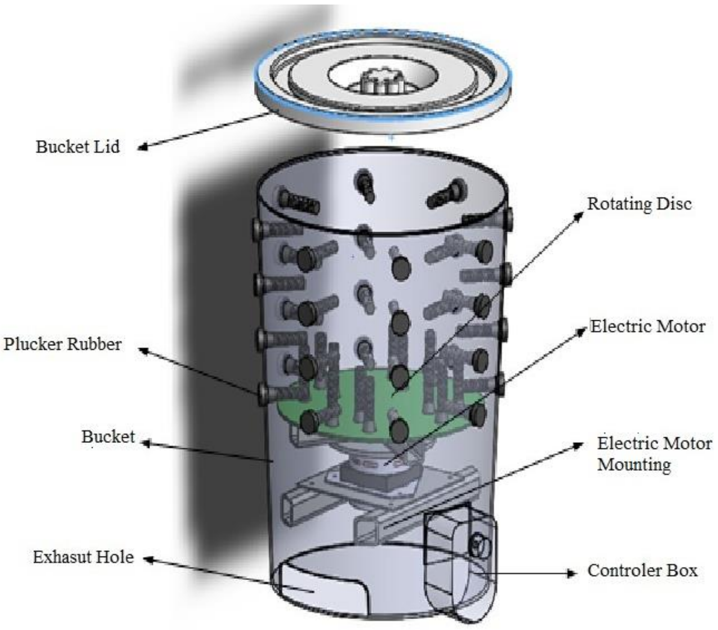


**Figure 2.** General design of poultry feather plucking machine components.

### 2.3. Functional test

Functional tests are conducted to ensure that all the machine components function properly [22, 23]. These tests measure the time required by the machine to process a single poultry animal per cycle. Additionally, a visual inspection of the plucked poultry was performed to assess the effectiveness of the machine in removing the poultry feathers. The results of these functional tests provide valuable insights into the efficiency and effectiveness of poultry-processing machines. By analyzing the processing time and visual inspection outcomes, engineers can identify areas for improvement and optimize machine performance. Furthermore, these tests help ensure that the machine operates more efficiently than manual processes.

## 3. Results and Discussion

### 3.1. Design analysis

The components of the poultry feather plucking machine were designed using 3D modeling software. These components comprise the bucket, rotating disc, and motor-mounting structures. Figure 3 illustrate the design specifications of the machine. The plucking bucket was engineered with a capacity of 2 kg, which was sufficient for processing one bird per operation. It incorporates 32 perforations, each 25 mm in diameter, which serve as anchoring points for the rubber plucking elements.

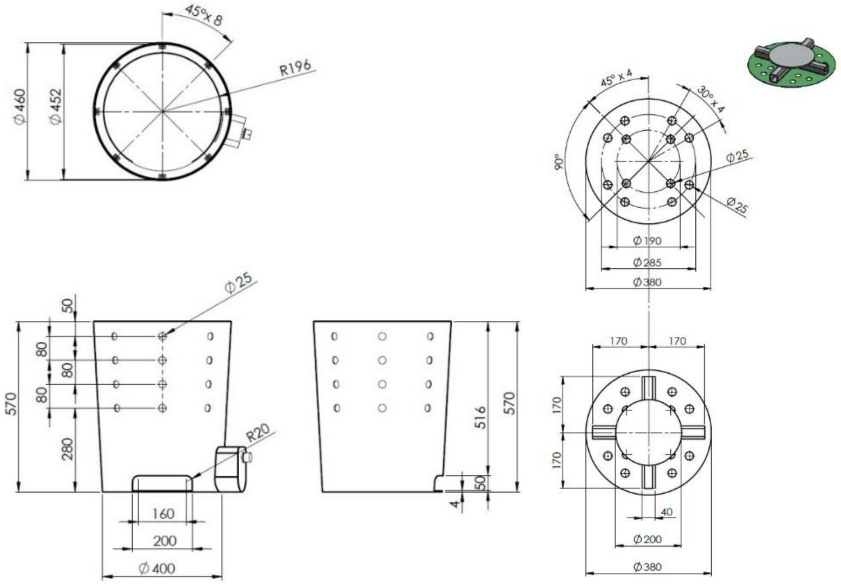

**Figure 3.** Design of the bucket and rotating disc.

The circular rotating component comprises 12 apertures for attaching the plucker rubber. A hollow steel section was integrated into the lower portion of the rotating component to enhance its structural integrity. The motor mounting apparatus comprised a steel plate in conjunction with a hollow steel section. Figure 4 illustrates the design specifications of the proposed model. This motor-mounting apparatus serves as a support structure for securely positioning the motor and affixing it to the bucket foundation.

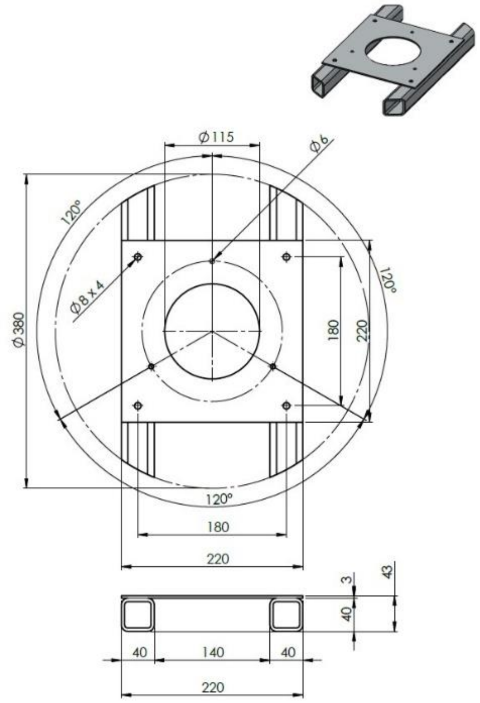

**Figure 4.** Design of the electric motor mounting

## 3.2. Manufacturing and cost analysis

**Figure 5** illustrates the components of the poultry feather-plucking machine. The bucket plucker was constructed using plastic. The fabrication began by measuring the dimensions of the feather output aperture, plucker rubber mounting aperture, and electric motor mounting aperture. The exterior of the bucket was coated using a spray-painting method.

Plastic trays and hollow steel were used for the rotating disc, which featured 12 apertures along its periphery for plucker rubber installation. The electric motor mount was fabricated from 35 × 35 mm hollow steel and steel plates. After cutting, the materials were assembled using electric welding.

The plucker rubber was carefully inserted into the 12 apertures on the rotating disc to ensure a secure fit for optimal removal of the feathers. The electric motor was then mounted onto the fabricated steel structure and precisely aligned with the rotating disc for efficient power transmission. Finally, the fully assembled machine underwent functional testing to verify its performance and readiness for poultry feather plucking.

**Figure 5.** Manufacturing process of the drum and bucket pluckers.

The apparatus was assembled by systematically placing each prepared component according to the established design specifications. Initially, the plucker rubber was affixed to the pre-drilled holes in both the bucket and player disc. Subsequently, the electric motor was mounted onto its designated support, followed by the installation of the rotating disc. These elements were then integrated to form a complete poultry feather-plucking apparatus. The culmination of this assembly process was a fully functional poultry feather plucking machine, as illustrated in Figure 6.

**Figure 6**. Final assembly of the poultry feather plucking machine.

To assess the production cost requirements for this machinery, it is imperative to evaluate various factors, including materials, volume, unit cost, and aggregate expenses. The cost budget plan for manufacturing poultry feather plucking machines is shown in Table 2. Notably, the construction of this apparatus incurs a cost of Rp. 450,000, representing a more economical alternative compared to prior investigations that reported production expenditures ranging from Rp. 550,000 to Rp. 772,000 [6][13].

**Table 2.** Budget plan for the poultry feather-plucking machine.

| Component | Volume | Cost | Total Cost |
|---|---|---|---|
| Bucket & Bucket Lid | 1 unit | Rp 50,000 | Rp 50,000 |
| Rubber Plucker | 1 pack (45 Pcs) | Rp 150,000 | Rp 150,000 |
| Rotating Disc | 1 unit | Rp 50,000 | Rp 50,000 |
| Electric Motor Mounting | 1 unit | Rp 15,000 | Rp 15,000 |
| Electric Motor | 1 unit | Rp 200,000 | Rp 200,000 |
| | Total | | Rp 450,000 |

### 3.3. Functional test results

Functional testing was conducted by measuring the processing time of the poultry feather-plucking machine. Pre-boiled poultry was used to facilitate feather removal. The test was performed twice at an electric motor speed of 1300 RPM, yielding an average processing time of 28 s per bird, representing a significant improvement of approximately 30% compared to the manual process, which required a cycle time of 40 s. The overall cycle time of the developed machine was 28 s, demonstrating competitive performance compared to previously reported cycle times of 22 s [12],25 s [13], and 20 s [14]. In contrast, manual plucking, as referenced in previous studies, had the longest cycle time of 40 s [24]. Figure 7 presents a comparative analysis of the cycle times recorded in this study with those from a previous study.

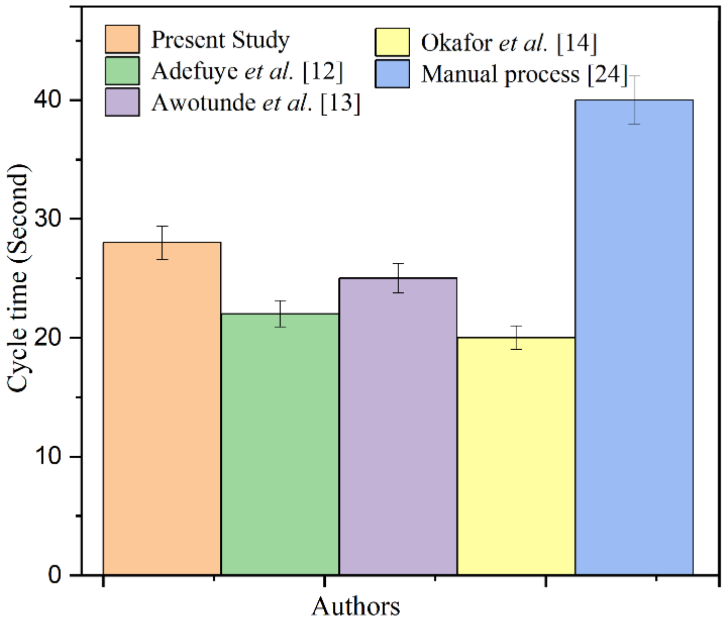


**Figure 7.** Cycle time comparison between the present and previous studies.

Furthermore, an efficiency improvement assessment was conducted by comparing the cycle time reduction of the developed machine with that of a manual process. The results indicate that the present study achieved a 30% reduction in processing time compared with the manual method, highlighting the effectiveness of the newly designed system. This reduction in cycle time suggests enhanced productivity and reduced labor effort, both of which are critical factors in commercial poultry processing. A shorter cycle time translates into a higher throughput, thereby increasing the economic benefits for small- and medium-scale poultry farmers. However, while this study demonstrates notable efficiency improvements, previous studies have reported greater cycle time reductions of 45% [12], 37.5% [13], and 30% [14], respectively. Figure 8 presents a comparative analysis of the efficiencies recorded in this study with those from a previous study.

Additionally, improved machine efficiency minimizes the exposure of poultry products to environmental contaminants, thereby ensuring better hygiene and food safety of the final product. A comparative graph illustrating the poultry feather plucking efficiency observed in the present study relative to that of a previous study is shown in **Figure 8**. This result is consistent with those of previous studies that reported similar findings [25]. Variations in the test results can be attributed to several factors, including differences in machine specifications, poultry species, poultry weight, poultry age, boiling temperature, and boiling duration [12, 26, 27].

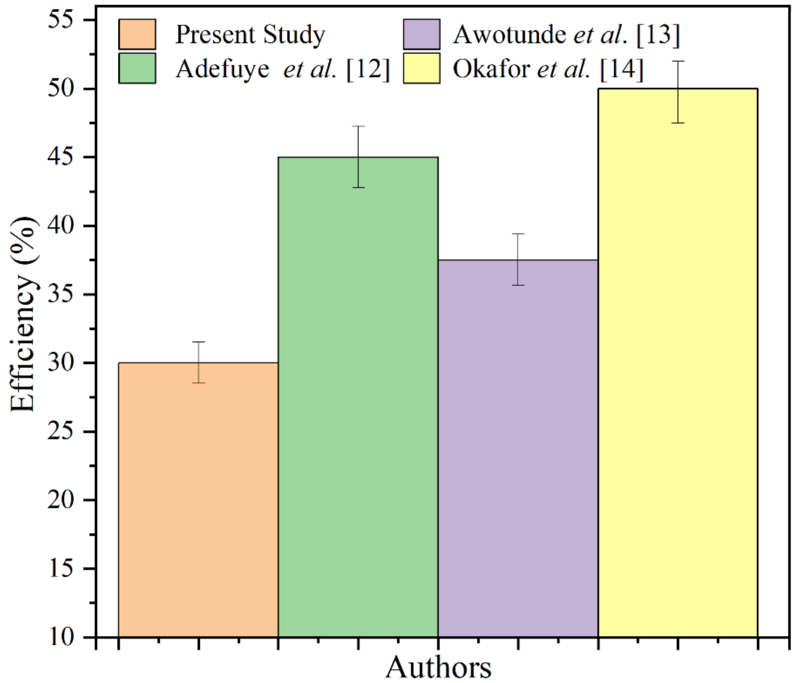


**Figure 8.** Comparison of the efficiency between the present and previous studies.

Although the developed machine demonstrated superior performance in terms of cycle time, further studies should explore additional parameters such as energy consumption, maintenance requirements, and long-term durability. Future studies could incorporate machine learning algorithms for automated cycle time optimization based on poultry size and feather density.

## 4. Conclusions

This study outlines the creation, implementation, and testing of a machine designed to pluck feathers from poultry, which can handle 2 kg at a time. To reduce manufacturing expenses while maintaining effectiveness, the device uses an elastic plastic container for feather removal. Machine development encompasses several stages: planning, design, production, assembly, and operational tests to evaluate its effectiveness. The device operates by employing rotational force and friction to remove feathers from poultry skin. The results of this study are as follows:

- The developed poultry feather plucking machine had a processing capacity of 2 kg.
- The use of elastic plastic for feather-plucking buckets significantly reduces production costs.
- The machine operates based on rotation and friction, thereby ensuring effective feather removal.
- Functional testing demonstrated an average processing time of 28 s per bird, reflecting a 30% improvement over manual plucking.
- The machine exhibited competitive efficiency compared with that of manual processing.
- The total production cost was Rp. 450,000, making it more affordable than similar machines in a previous study.

This machine provides a cost-effective and efficient solution for small- and medium-scale poultry farms and processing businesses. These findings indicate that the developed poultry feather plucking machine offers a practical and economical alternative for improving poultry processing efficiency, particularly in small-scale production.

## Author's Declaration

### Author's contribution and responsibility

**Boby Agung Pratama** conceptualized the study, designed the experimental framework, and supervised the research process. **Rudy Rafli** conducted data collection, statistical analysis, and result interpretation. **Apri Setiawan** managed the technical aspects of machine design and fabrication, including material selection and system optimization. **Dibyo Setiawan** performed performance testing, analyzed cycle time efficiency, and contributed to the discussion. **Harry Prayoga Setyawan** reviewed literature, compiled background research, and assisted in writing and editing the final manuscript. All authors have read and approved the final manuscript and take full responsibility for the integrity and accuracy of the study findings.

### Acknowledgment

The authors express their sincere gratitude to Politeknik Raflesia and the Department of Mechanical Engineering, Politeknik Negeri Bandung, for their valuable support and contributions to this research.

### Availability of data and materials

All data are available from the authors.

### Conflict of interest

The authors declare no conflict of interest.

## REFERENCE

[1] K. Diwyanto, "Prospek Dan Arah Pengembangan Komoditas Peternakan : Unggas, Sapi Dan Kambing-Domba," pp. 11–25.

[2] D. Rosyidi, A. Susilo, D. Amertaningtyas, M. W. Apriliyani, and D. T. Utama, *Industri Pengolahan Daging*. Universitas Brawijaya Press, 2021.

[3] A. Agus and T. S. M. Widi, "Current situation and future prospects for beef production in Thailand - A review," *Asian-Australasian J. Anim. Sci.*, vol. 31, no. 7, pp. 968–975, 2018, doi: 10.5713/ajas.18.0201.

[4] N. D. Wahyono and M. M. D. Utami, "A Review of the Poultry Meat Production Industry for Food Safety in Indonesia," *J. Phys. Conf. Ser.*, vol. 953, no. 1, 2018, doi: 10.1088/1742-6596/953/1/012125.

[5] N. Ilham, "Kelangkaan Produksi Daging: Indikasi dan Implikasi Kebijakannya," *Kelangkaan Produksi Daging Indikasi dan Implikasi Kebijakannya*, vol. 7, no. 1, pp. 43–63, 2016, doi: 10.21082/akp.v7n1.2009.43-63.

[6] M. Abubakar, A. Zakariyah, and A. Usman, "Design, Construction and Performance Evaluation of Chicken De-Feathering Machine," *Azojete.Com.Ng*, vol. 15, no. 3, pp. 702–713, 2019, [Online]. Available: www.azojete.com.ng.

[7] O. A. Tanimola, P. D. Diabana, and Y. . Bankole, "Design and Development of a De-Feathering Machine," *Int. J. Appl. Eng. Res.*, vol. 9, no. 22, pp. 5362–5367, 2014.

[8] K. Winangun, M. Malyad, Rizal Arifin, and Wawan Trisnadi Putra, "Meningkatkan Produktivitas Home Industri Melalui Mesin Pencabut Bulu Ayam Di Desa Gontor Kabupaten Ponorogo," *JURPIKAT (Jurnal Pengabdi. Kpd. Masyarakat)*, vol. 1, no. 1, pp. 39–47, 2020, doi: 10.37339/jurpikat.v1i1.283.

[9] U. K. C., A. S. O., and O. N. J., "OPTIMIZATION AND PERFORMANCE EVALUATION OF CHICKEN FEATHER PLUCKING MACHINE," *Pro ASP.NET Web API*, vol. 6, no. 7, pp. 463–

515, 2013, doi: 10.1007/978-1-4302-4726-5_16.

[10] B. Aji, Kardiman, and D. Iman, "Perancangan Dan Pengembangan Mesin Pembersih Bulu Ayam (Otomatis)," *J. Tek.*, vol. 15, no. 01, pp. 153–162, 2021, [Online]. Available: https://jurnal.polsri.ac.id/index.php/teknika/article/view/3455/1692.

[11] B. Omoniyi Ezekiel, P. O. Oyekola, O. Ovaha, A. Mohamed, and N. Lambrache, "Bird feather removal machine: Design and development," *Int. J. Recent Technol. Eng.*, vol. 8, no. 3, pp. 406–410, 2019, doi: 10.35940/ijrte.C4199.098319.

[12] A. O.A, A. K.A, and F. L.O, "Design, Fabrication and Performance Evaluation of Chicken De-Feathering Machine," *Int. J. Res. Rev.*, vol. 8, no. 12, pp. 703–711, 2021, doi: 10.52403/ijrr.20211285.

[13] Awotunde *et al.*, "Development of a Defeathering Machine from Locally Sourced Materials," *J. Technol. Educ. Niger.*, vol. 9, no. 5, pp. 1143–1149, 2018, doi: 10.4314/joten.v12i2.35706.

[14] O. C. Okafor, I. E. Ekengwu, A. M. Udefi, and O. K. Osazuwa, "Design and Implementation of a High-efficient Chicken Defeathering Machine for Commercial Utilization," *Int. J. Darshan Inst. Eng. Res. Emerg. Technol.*, vol. 12, no. 2, pp. 07–17, 2024, doi: 10.32692/ijdi-eret/12.2.2023.2302.

[15] Andriyono, R. D. Latuheru, K. A. Rahangmetan, and Cipto, "Rancang Bangun Alat Perontok Bulu Ayam Dengan Daya Putar Motor Listrik 2 HP Cipto [4]," vol. 05, no. 01, 2023.

[16] A. Defrian, Z. Zulfakri, Y. Malrianti, J. Aguswan, and A. D. Priono, "RANCANG BANGUN MESIN PENCABUT BULU AYAM TIPE VERTIKAL," vol. 1, no. 2, pp. 20–30, 2024.

[17] S. O. Adetola, G. . Daramola, and S. O. Ogundiran, "Development of a Household Poultry De-Feathering Machine with Better Efficiency," *IOSR J. Mech. Civ. Eng.*, vol. 11, no. 3, pp. 51–59, 2014, doi: 10.9790/1684-11385159.

[18] F. Fajriyah, A. Josi, and T. Fisika, "Rancang Bangun Sistem Informasi Tender Karet Desa Jungai Menggunakan Metode Waterfall," *J. Sisfokom (Sistem Inf. dan Komputer)*, vol. 6, no. 2, pp. 111–115, 2017, doi: 10.32736/sisfokom.v6i2.256.

[19] A. N. Nurhayati, A. Josi, and N. A. Hutagalung, "RANCANG BANGUN APLIKASI PENJUALAN DAN PEMBELIAN BARANG PADA KOPERASI KARTIKA SAMARA GRAWIRA PRABUMULIH Ana," *J. Teknol. dan Inf.*, vol. 7, no. 2, pp. 13–23, 2017.

[20] S. Wulandari, J. Jupriyadi, and M. Fadly, "Rancang Bangun Aplikasi Pemasaran Penggalangan Infaq Beras (Studi Kasus: Gerakan Infaq)," *TELEFORTECH J. Telemat. Inf. Technol.*, vol. 2, no. 1, pp. 11–16, 2021.

[21] H. Widiantoro, Zainuddin, M. Z. Rahmatullah, D. Setiawan, and R. Anggrainy, "Desain dan analisis kekuatan pisau dekortikator mesin pengolah daun nanas menggunakan metode elemen hingga," *J. PERANCANGAN, MANUFAKTUR, Mater. DAN ENERGI (JURNAL PERMADI)*, vol. 6, no. 2, pp. 123–136, 2024.

[22] H. Susanto, "Rancang Bangun Mesin Panen Padi Mini Dua Lajur dengan Motor Penggerak Tenaga Surya," *Pros. Semnastek*, pp. 1–11, 2018.

[23] M. Sofnivagi, M. Razi, and H. Hasrin, "Rancang Bangun Sistem Elektro Pneumatik Untuk Mesin Pencetak Biobriket," *J. Mesin Sains Terap.*, vol. 4, no. 1, p. 45, 2020, doi: 10.30811/jmst.v4i1.1744.

[24] C. Buckland, "Small scale poultry processing," 2005, [Online]. Available: www.fao.org/docrep/003/t0561e/T0561E03.htm.

[25] A. A. Adenigba, A. A. Adedeji, and A. C. Aboloje, "Design, Fabrication and Performance Evaluation of a Three-Phase Poultry Bird De-Feathering Machine," vol. 5, no. 10, pp. 268–277, 2022.

[26] C. C. Shung, K. Y. Hsin, F. J. Tan, and S. E. Chen, "Effects of Hard and Soft Scalding on Defeathering and Carcass Quality of Different Breeds of Chickens," *Animals*, vol. 12, no. 22, pp. 1–11, 2022, doi: 10.3390/ani12223145.

[27] O. A. Ogunnowo, A. F. Adisa, V. O. Adepoju, O. U. Dairo, S. O. Ismaila, and A. A. Babalola,

"Performance evaluation of a de-feathering machine with scalding tank," *Agric. Eng. Int. CIGR J.*, vol. 26, no. 1, pp. 241–248, 2024.