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Community Empowerment through Synbiotic Feed Technology Innovation in The Poultry Industry to Support Productivity and Food Safety

Ifhan Dwinhoven[1], Andi N Renita Relatami[2,3], Fajar Syamsurya[3], Sri Wahyuni Firman[4], Andi Aridhasari Sudirman[5], Andi Sudirman[6], Sultan Mubarak Z[7], Asmi Citra Malina A.R. Tassaka[8], Rahmi[9].*

[1]*Fish Hatchery Technology Study Program, Department of Aquaculture, Pangkep State Polytechnic of Agriculture,*
[2]*Veterinary Medicine Study Program, Faculty of Medicine, Hasanuddin University, Jl Perintis Kemerdekaan Km 10, Makassar, 90245, South Sulawesi,*
[3]*PT Pertamina Patra Niaga Aviation Fuel Terminal Hasanuddin, Makassar, 90761, Indonesia,*
[4]*Aquaculture Study Program, Faculty of Science and Technology, Muhammadiyah Education University Sorong, Sorong 98418, West Papua,*
[5]*Nursing Departement, University of Muhammadiyah Pare-pare, South Sulawesi, Indonesia,*
[6]*Nursing Study Program, Health Polytechnic Ministry of Health Makassar, South Sulawesi, Indonesia,*
[7]*Livestock Agribusiness Pangkep State Polytechnic of Agriculture, Pangkep, South Sulawesi, Indonesia,*
[8]*Departement of Fisheries, Faculty of Marine Sciences and Fisheries, Hasanuddin University, Makassar, 90245, South Sulawesi, Indonesia*
[9]*Aquaculture Study Program, Faculty of Agriculture, University of Muhammadiyah Makassar, 90234, South Sulawesi, Indonesia.*

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CORRESPONDING AUTHOR

*E-mail: Ifhan.dwinhoven@polipangkep.ac.id

A B S T R A C T

The poultry farming industry is part of the growing agro-complex sector and is essential in providing animal protein to support national food security. The productivity and safety of the food produced are still challenging in cultivation activities. The Socialization of Poultry Farming Management and Training on Making Independent Synbiotic Feed based on ODB bacteria from PT Pertamina Patra Niaga AFT Hasanuddin oil Cather is a community empowerment activity that has an impact on the beneficiary community, namely the Lelang Kassie farmer women's group and the Baji Mangai Village community, Maros Regency. This activity includes socialization, training, and application of technology in duck farming activities. Increased knowledge and skills of the community can independently produce ODB bacterial starter, which is then used in synbiotic feed and applied to poultry. This has an impact on the potential for increasing community income, and this innovation can encourage an increase in duck production with the quality of meat and eggs produced safe from chemical residues.

Contribution to Sustainable Development Goals (SDGs):
SDG 1: No poverty
SDG 2: Zero hunger
SDG 3: Good health and well-being
SDG 12: Responsible consumption and production
SDG 15: Life on Land

1. INTRODUCTION

1.1. Research Background

Indonesia's increasing population will impact various aspects of life, which has a relationship with the social, economic, and political fields [1]. Most of the Indonesian population depends on the agricultural sector to meet food needs economically and fulfill the food consumed's nutrition. Therefore, the Indonesian government must sustainably ensure that the entire population has sufficient food needs, namely by intensifying development in food security [2].

Indonesia's increasing population will impact one of the agro-complex sector industries the poultry farming industry, which is one of the essential keys in providing animal protein to support national food security. Demand for animal protein is increasing, which is related to the rapid increase in population. Duck farming is one type of meat that is widely consumed by the public, besides cows, goats, and chickens. Broiler ducks are potential egg and meat-producing poultry, so in its development, it is expected to be an alternative to meet the needs of protein of animal origin. This can be seen from the duck population in 2015 of 45,321,956 heads, while in 2020, it increased to 58,243,335 heads, and production in 2015 of 34,854 to 44,361 tons in 2020. The increasing need for broiler ducks encourages farmers to pay more attention to the products produced and to maintain the health status of the livestock raised [3].

Increasing livestock productivity, especially broiler ducks or laying ducks, requires good quality feed for growth to provide good performance for broiler ducks [4]. In addition to feed, health performance is a determining factor for increasing productivity. The role of bacteria synbiotic feed technology in which probiotic bacteria are formulated in poultry feed rations is one alternative to increase production and sustainability of poultry farming, to support food security.

The use of synbiotics to replace the role of Antibiotic Growth Promoter (AGP) has been widely done because the use of AGP can have adverse effects, both for livestock and humans, including spurring resistance to certain bacteria, genotoxicity, allergies, and causing residues in livestock products. So, it is necessary to find an alternative to replace it with probiotics combined with prebiotics in synbiotic feed technology [5]. Synbiotic feed refers to nutritional supplements that combine probiotics and prebiotics in the form of synergism, therefore, synbiotics can improve the health status and growth of livestock [6].

In 2020, the HSSE team of PT Pertamina Patra Niaga AFT Hasanuddin, through an innovation team called PC-Prove Enviro Operation Services in the Continuous Improvement Program (CIP) event, made innovations in waste management in the oil catcher. This innovation isolated oil waste degrading bacteria (ODB) as many as nine bacterial isolates. Characterization of these isolates can also be used as probiotic bacteria in cultivation activities in the agro-complex sector, such as shrimp, duck, and agricultural and plantation crops. Furthermore, this technological innovation is applied to AFT Hasanuddin CSR activities, which are always committed to utilizing ODB Probiotic bacteria in community empowerment activities [7]. ODB bacterial technology innovation was disseminated in the farmer group assisted by PT Pertamina Patra Niaga AFT Hasanuddin, namely the Lelang Kassie duck farming group, Maros Regency.

1.2. Literature Review

Cases of residual contamination of veterinary drugs in the form of antibiotics are still widely found in Indonesia. Based on previous studies, antibiotic residues found in chicken meat and chicken liver are sulfa antibiotics, oxytetracycline, enrofloxacin, tetracycline, ciprofloxacin, and macrolides. The most common antibiotics found in livestock products, especially meat, are antibiotics of the tetracycline type, including chlortetracycline and oxytetracycline [8]. Antibiotic residue cases that occur in Indonesia still occur in several regions. Still, the presence of tetracycline antibiotic residues, although with a small amount. The government can improve supervision of the quality and safety of food of animal origin from farms to consumers, such as supervising the use of antibiotics in livestock which must be carried out under the supervision of a veterinarian and conducting counseling to increase farmers' awareness and public concern for the safety of food of animal origin [9], one of which is countermeasures using probiotics to increase the immunity of livestock from bacterial infections.

Groups of bacteria that include probiotics include Bacillus sp., Photobacterium sp., and Lactobacillus sp. [10]. Bacillus species are very suitable for use because they do not produce toxins, are easy to grow, do not require expensive substrates, the ability of Bacillus to survive at high temperatures, and the absence of metabolic by-products. Bacillus bacteria are a type of bacteria found in almost all places, including the digestive tract. Feeding probiotic B. amyloliquefaciens to tilapia feed at a concentration of 105 CFU/mL optimized the values of total erythrocytes, total leukocytes, and hematocrit percentage. Significant findingsinfluenced others, including body weight and specific growth rate [11]. B. amyloliquefaciens was able to inhibit the growth of V. alginolyticus bacteria with an inhibition zone of 3.5 cm and V. harveyi with an inhibition zone value of 4 cm and was also positive for catalase [12] These bacteria have characteristics that have the potential to be used as probiotics in the aquaculture industry and another agro-complex industry, especially vibrio biocontrol agents [13].

Unlike probiotics, prebiotics do not augment existing bacterial colonies but rather provide nutrients for the existing flora, allowing the colonies to naturally grow and thrive. Since probiotics are primarily active in the interior of the small intestine and prebiotics are only effective in the large intestine, the combination of the two can provide synergistic results. Probiotics are live microbial foodstuffs that are beneficial to the host while prebiotics are non-digestible foodstuffs that beneficially affect the host by selectively stimulating the growth and activity of one or several microorganisms in the colon that have the potential to improve the host However, synbiotics are a mixture of probiotics and prebiotics that beneficially affect the host and thereby improve the health and well-being of the host [6].

1.3. Research Objective

This activity aims to show that the application of independent synbiotic feed technology can support the health and growth of ducks so that increased productivity of sustainable duck cultivation plays a role in providing animal protein that supports national food security.

2. MATERIALS AND METHODS

The application of synbiotic feed technology innovation in this community empowerment activity was carried out during 2024 at the Lelang Kassie Farmers Group, Maros Regency, South Sulawesi, Indonesia. The Lelang Kassie Women Farmers Group (KWT) comprises 14 housewives who manage a duck farm held by PT Pertamina Patra Niaga AFT Hasanuddin.

The method of implementing activities in this community service includes:

1. Socialization of the application of microbial technology in the agro-complex sector

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2. Training on making ODB bacterial culture with a simple fermenter
3. Training on feed formulation and independent synbiotic feed production
4. Application of synbiotic feed in the maintenance of Peking duck farming
5. Impact Evaluation: Analysis of program success based on productivity, reduced operational costs, and environmental impact.

3. RESULT AND DISCUSSION

3.1. Socialization of the application of microbial technology in the agro complex sector

In this activity, socialization was carried out by delivering material based on microbial utilization in daily life. The material was delivered by microbiology expert practitioners who have researched and applied this technology in various industries in the agrocomplex sector. The Lurah attended this activity as the local government, PT Pertamina Patra Niaga AFT Hasanuddin CSR Team, 14 Women Farmers Group (KWT) members, and the surrounding village community. The socialization material emphasizes the benefits of microbial application in the agrocomplex sector, be it livestock, fisheries, or agriculture.

The role of microbes is very important in increasing production and sustainability because microbes can help the absorption of nutrients in the body, increase immunity, and maintain good cultivation environmental conditions. Good microbes known as probiotics are beneficial bacteria for their hosts that can produce lactic acid to balance the microfloral tract in the digestive tract [14]. Not only that, but participants also gained additional scientific insights into the mechanism of action of microbes, their impact on livestock health, and how to make these probiotics in simple household-scale fermenters.

Figure 1. Socialization and Training of Hasanuddin Agrocomplex Program on Poultry Farming Management and Training on Making Independent Synbiotic Feed based on ODB bacteria from PT Pertamina Patra Niaga AFT Hasanuddin oil cather.

3.2. Training on making ODB bacterial culture with simple fermenters

Training on making ODB bacterial cultures in simple household-scale fermenters was carried out with the aim that participants, in this case, the Lelang Kassie Women Farmers Group (KWT), have technical skills in the production of probiotics that can be utilized in broader aspects of the agrocomplex sector. The cultured ODB bacteria are ODB isolate bacteria confirmed as Bacillus sp. The combination of *Bacillus subtilis*, *Bacillus cereus*, and *Bacillus thuringiensis* with *Lactobacillus acidophilus*, *Lactobacillus bulgaricus*, and *Streptococcus thermophilus* as Probiotics has the potential to reduce ammonia pollution in poultry houses [12]. Subtilis at a dose of 0.1 grams/kg and 0.2 grams/kg feed can affect feed efficiency and egg mass of laying hens.

The Standard Operating Procedure of ODB bacterial culture by following the technical instructions on HaKI PT Pertamina Patra Niaga AFT Hasanuddin HaKI, 2023 regarding technical instructions for making Byored, is as follows:

A. Fermentor Preparation:

1. Fill each fermenter with RO water (+/- 13 L)
2. Add 4 g sodium metabisulfite/gallon
3. Leave open for 12 hours

B. Preparation of inoculum

1. All tools and materials are sterilized except bacterial isolates
2. Bacterial isolates are purified
3. Fermentation materials were weighed according to the Oil Degradation Bacteria (ODB) formulation: Dextrose 390 g, Beef 130 g, Fermipan 2 g.
4. All ingredients were cooked and then allowed to stand.
5. After cooling, the media is put into the fermenter
6. Put the bacterial inoculum into the fermenter
7. Incubate for 7 days
8. Organoleptic check and total plate count of bacteria with standard density 10^9 cfu/ml.
9. Product packaging and labeling

3.3. Socialization of local raw material-based feed formulations and independent synbiotic feed production

Feed is one of the limiting factors in the livestock industry, where this component can reach up to 70% of total production costs. The socialization of independent feed was delivered to participants to allow them to choose local feed raw materials that are readily available, affordable, and have nutritional content. Feed formulas for ducks generally use ingredients that contain nutritional content according to livestock needs, especially crude protein, fiber, energy, calcium, and phosphorus. Broiler ducks aged 2-7 weeks need energy nutrients of 3,000 kcal/kg, 16% protein, 0.6% calcium, and 0.3% phosphorus [15].

Figure 2. Training on ODB Probiotic Production on simple household-scale fermenters integrated in the Hasanuddin Agrocomplex program.

The formulation of synbiotic feed in the ration is: Local fishmeal [10], tofu pulp (30%), bran (25%), Alzola flour (10%), cull milk (15%), starch (4%), whiting (0.5%), Vitamin mix (0.5%) and probiotic ODB 10 ml/kg feed. Giving synbiotics can affect the condition of intestinal microflora in livestock. The mechanism of action of synbiotics is that the intestinal microflora given synbiotics will increase lactic acid bacteria (LAB) that can produce lactic acid. Acidic lactic acid serves to lower the pH in the intestine. A decrease in pH in the intestine can prevent the development of harmful pathogenic bacteria and cause the digestive tract to be healthy, activate digestive enzymes, and optimize nutrient absorption. Increased protein deposition will improve the formation of interior quality (yolk index, haugh unit, yolk color, and duck egg white pH. Adding synbiotics can improve feed efficiency and increase egg productivity and animal health so that the interior quality of eggs increases [16].

Figure 3. Demonstrate the practice of making self-synbiotic feed based on ODB bacteria from PT Pertamina Patra Niaga AFT Hasanuddin oil Cather.

3.4. Application of self-synbiotic feed in Peking duck culture rearing

Peking duck rearing was initially bred in Mainland China. The main advantage of peking ducks is their fast growth rate; in about 40 days of rearing, the body weight of these ducks has reached more than 2 kg. In addition, peking ducks also have excellent endurance so they are not susceptible to disease (Hastuti & Subekti, 2018). Peking ducks (Anas platyrhynchos domestica) aged 1-7 days with a population of 250 ducks reared until 100 days old. Synbiotic feeding requires 100 g/head/day.

Figure 4. Peking duck rearing.

3.5. Impact Evaluation

The innovation of synbiotic feed application technology in duck farming has an impact on increasing the knowledge and skills of the Lelang Kassie farmer women group, Baji Mangai Village, Maros Regency, South Sulawesi, in utilizing synbiotic feed to increase duck production. The farmer women group also has the skills to make probiotics in simple fermenters on a household scale. This skill is a very new innovation for the people of Baji Mangai Village.

The Lelang Kassie farm women's group in Baji Mangai Village can produce up to 50 liters of ODB probiotics per month. The probiotics are used in duck farming and applied to the agriculture and fisheries sectors by the local community. The production of ODB probiotics also has the potential to become a new business that can be sold at a price range of Rp.35,000 - Rp. 50,000 per liter. Currently, the demand for probiotics is still very high.

The application of ODB Probiotics in synbiotic feed for ducks has an impact on increasing duck productivity. The maintenance is carried out by weighing the ducks every week until the end of maintenance. During the 12 weeks of maintenance, it was found that the body weight gain of the ducks was 2,900 g to 3,700g. With the application of this technology, the prevalence of sick ducks decreased. Thus, minimizing the use of antibiotics for food safety. The survival rate of ducks can also reach 92% during rearing.

4. CONCLUSION

The Socialization of Poultry Farming Management and Training on Independent Synbiotic Feed Making based on ODB bacteria

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from PT Pertamina Patra Niaga AFT Hasanuddin oil catcher had an impact on the beneficiary community, namely the Lelang Kassie farm women's group and the Baji Mangai Village community, Maros Regency. With increased knowledge and skills in poultry farming management and microbial technology innovation, they can independently produce ODB bacterial starters used in synbiotic feed applied to poultry. This has an impact on the potential for increasing community income, and this innovation can encourage an increase in duck production with the quality of meat and eggs produced safe from chemical residues.

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