Providing a combination of chicken manure and broth in a different concentration to the production count of *Daphnia magna*

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**Abstract.** This study used a combination of chicken manure and chicken broth which was fermented first with the aim to knowing the effect and the best dose of the combination of chicken manure and broth so as to increase the amount of *Daphnia magna* production optimally. This research is experimental using Completely Randomized Design method which consists of 4 treatments with 5 replications. Data analysis was processed using ANOVA and Duncan. The results showed that the fermentation of manure and chicken broth with a dose of P3 (7.5 mL/L) on day 8 gave the highest yield (41950 ind/L) compared to other treatments. Based on ANOVA analysis, it was shown that the combination treatment of chicken manure and broth compared with no combination on the count of *Daphnia magna* production had a significant effect (P<0.05). Duncan's test results showed that P3 treatment was significantly different from P0 and P1 but not significantly different from P2 treatment, with an average difference of P2 (5mL/L) 7419 ind/L and P3 (7.5mL/L) 8328 ind/L for 14 days growth.

1. Introduction

The poultry farming industry generally produces liquid waste with a protein content of 35% consisting of protein with the amino acids leucine, phenylalanine, and histidine [1]. The results of processing these proteins will produce high Biological Oxygen Demand - (BOD) and Chemical Oxygen Demand (COD) values due to the activity of bacteria that decompose protein in waste aerobically [2]. One of the efforts to utilize the liquid waste of the chicken factory in the form of chicken claw broth is to use the waste as a growth medium for *Daphnia magna*. Which according to [3] the nutritional content of chicken feet broth contains 10.49% fat content, 34.56% protein and 41.59% BETN per 100gr dry weight.

Natural feed like Daphnia in the provision should be concerned about the quality, quantity, and availability [4]. *Daphnia magna* is a kind of natural feed that is cultured for freshwater fish hatcheries because it has excellent nutritional content and is suitable for fish larvae [5]. Chicken manure is generally used as a culture medium for the growth of *Daphnia magna*. Chicken manure in water is a natural organic substance that also functions as a substrate for growth of phytoplankton and bacteria [6]. However, according to [7] and [8] When cultivating *D. magna* using chicken manure media, mass deaths often
occur, especially if given supplementary feed because the higher dose of administration results in a decrease in water quality which results in reduced dissolved oxygen, dissociation. ammonia becomes toxic and dissolves toxic sulfide compounds, resulting in several negative impacts for cultivation over a long period of time. Therefore, another alternative is needed as a culture medium for *D. magna* so that this study was conducted with the aim of knowing the effect of a mixture of liquid industrial. waste in the form of chicken broth mixed with chicken manure as a culture medium for growth in the hope of increasing the amount of *D. magna* production and knowing the optimal concentration of use. a combination of manure and chicken stock feed so as to increase the amount of *D. magna* production.

2. Materials and methods

This research requires tools are aquarium, digital scale, urine bottle, petri dish, measuring cup, Lup, aerator, DO meter, thermometer and pH meter. The ingredients used are chicken manure, chicken broth, *Daphnia magna*, and fermented material containing molasses and EM4. The feed was fermented before being given to the culture media using 1 ml of EM4 probiotic bacteria and molasses as an activator with a ratio of 1:1 into 100 ml of water for 1 liter and allowed to stand for ± 3 hours. This is in accordance with the preliminary test which refers to the research of [9] and [10], in their research the use of 1 ml EM4 as the optimum result and the ratio of sugar and EM4 mass is 1:1 and left for ± 3 hours.

This research was conducted experimentally using 4 treatments with 5 replications. Dosage of feeding in culture media is:

- **P0**: Control; using a dose of 7.5 mL/L from 15 grams of chicken manure
- **P1**: using a combination dose of 2.5 mL/L from a combination of 15 grams of chicken manure and 50 mL of chicken broth
- **P2**: using a combination dose of 5 mL/L from a combination of 15 grams of chicken manure and 75 mL of chicken broth
- **P3**: using a combination dose of 7.5 mL/L from a combination of 15 grams of chicken manure and 100 mL of chicken broth

The parameter observed in this study was the number of populations, which was then followed by statistical testing using the ANOVA test and Duncan's further test to determine the effect and differences of giving chicken manure suspension alone with a combination of chicken manure and broth suspension to ensure optimal feeding.

3. Result and discussion

3.1. Proximate Analysis from combination of chicken manure and broth

Table 1 presents the results of testing the nutrition from combination of chicken manure and broth given to *Daphnia magna* on culture media

| Treatment  | Carbohydrate (%) | Protein (%) | Fat (%) | Fiber (%) | Ash (%) | BETN  |
|------------|------------------|-------------|---------|-----------|---------|-------|
| P0 (Control) | 37.86            | 43.40       | 7.46    | 6.02      | 11.28   | 31.84 |
| P1         | 18.46            | 52.66       | 21.5    | 8.50      | 7.38    | 9.96  |
| P2         | 16.66            | 54.10       | 21.66   | 7.74      | 7.58    | 8.92  |
| P3         | 12.15            | 60.95       | 20.36   | 6.80      | 6.54    | 5.35  |

Notes: P0 = 15 grams of chicken manure, P1 = 15 grams of chicken manure and 50 mL of chicken broth, P2 = 15 grams of chicken manure and 75 mL of chicken broth, P3 = 15 grams of chicken manure and 100 mL of chicken broth.
3.2. Growth population of Daphnia magna

Results of the observation of the average population density of individual *Daphnia magna* per liter (ind/L) using a combination of manure and chicken broth in various treatments during the 14 days of the study are presented in table 2.

| Treatment | Day 0 | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 |
|-----------|-------|-------|-------|-------|-------|-------|-------|-------|
| P0        | 100   | 236a  | 400b  | 480a  | 660a  | 911a  | 1296a | 1940a |
| P1        | 100   | 450ab | 890ab | 1100a | 1350a | 2520a | 3160a | 5140c |
| P2        | 100   | 460ab | 1620bc | 2440b | 3520b | 7030b | 9180b | 10860b|
| P3        | 100   | 540b  | 2090c | 3330b | 4270b | 7700b | 9520b | 11790b|

Note: Different superscript letters in the same column indicate that there is a significant effect of the concentration of suspension combination of dirt and broth on the total production of *Daphnia magna* children (p<0.05). P0= Control; Chicken manure suspension 7.5 mL/L, P1= Giving a combination of suspension chicken manure and broth 2.5 mL/L, P2= Giving a combination of suspension chicken manure and broth 5 mL/L, P3= Giving a combination of suspension chicken manure and broth 7.5 mL/L.

3.3. Water quality

Measurement of water quality obtained the average results for the management of *Daphnia magna* culture with a maintenance period of 14 days is 23-29.8°C literature, 7.2-8.3 pH, 4.07-4.28 mg/L Dissolved Oxygen and 0.05-1 mg/L ammonia for P0, 23-29.7°C literature, 7.2-8.2 pH, 4.03-4.29 mg/L Dissolved Oxygen and 0.03-0.3 mg/L ammonia for P1, 23-29.7°C literature, 7.2-8.2 pH, 4.13-4.27 mg/L Dissolved Oxygen and 0.03-0.5 mg/L ammonia for P2 and 23-29.7°C literature, 7.2-8.2 pH, 4.08-4.30 mg/L Dissolved Oxygen and 0.03-0.5 mg/L ammonia for P3. The results of water quality measurements during culture were still within optimal limits for the growth and reproduction of *Daphnia magna* although bad results were found in ammonia P0.

*Daphnia magna* cultivation using feed with various doses, suspension of different combinations of chicken manure and broth in *Daphnia magna* cultivation affects the survival rate and production amount. The concentration of protein, amino acids and fats in the feed affects the fecundity or production of offspring per brood and the speed of embryonic development in cladocera [8], as well as in *Daphnia Magna* when the quality and quantity of feed is given in a controlled manner, the possibility of producing optimal production will increase higher [11] and [12]. The combination of manure and chicken broth used in the cultivation media contained 52.66-60.95% protein, 12.15-18.46% carbohydrates, 20.36-21.5% fat, 6.8-8.5% fiber, 6.54-7.38% ash content, and 5.35-9.96% BETN content. While feed without combination or mixture has lower nutrition. The combination of manure and fermented chicken stock has better nutritional content than ordinary chicken manure without mixture and fermentation [13]. The nutritional content includes increased protein and fat content caused by catabolic bacterial activity or breaking down complex components into simpler and easier to digest [14]. Increasing the concentration of protein, carbohydrates and fat in the feed affects the production of offspring per brood and the speed of embryo development in cladocera (*Daphnia sp.*) [15].
The survival rate of *Daphnia magna* cultured using a suspension concentration of a combination of manure and chicken broth showed a significantly higher number compared to rearing media without a combination or mixture. According to [16] the factors that affect the survival rate are abiotic and biotic factors. Abiotic factors include physical factors, water chemistry of a water or often referred to as water quality [17]. During the study, dissolved oxygen (DO) ranged from 4.03-4.30 mg/L, temperature ranged from 23-29.7°C and pH ranged from 7.2-8.3 and ammonia was 0.3-0.5 mg/L which still supports the survival rate of *D. magna*. The increase in pH and ammonia values during the study was caused by the addition of feed to live media without siphoning at all during maintenance [18] and [19]. The optimal range of water quality suitable for the growth and reproduction of *Daphnia magna* is DO <3.5 mg/L. According to [20], temperature 21-29°C [21], pH between 6.5-8.5 and ammonia ranged from 0.35 to 0.61 mg/L [22].

Cultivation of *Daphnia magna* using a combination of manure and chicken broth suspension feed concentration resulted in a higher abundance or production amount than the concentration of chicken manure suspension without the combination (control). Cultivation of *D. magna* produced the highest amount of production at a suspension concentration of 7.5mL/L (P3) combination of manure and chicken stock. Total production of *D. magna* at treatment P0; P1; P2 and P3 from the first day to the 14th day reached a total of 146285 ind/L; 222000 ind/L; 556450 ind/L and 624600 ind/L. The highest population increase during rearing occurred on day 8 with a total production of 24550 ind/L (P0), 34000 ind/L (P1), 73850 ind/L (P2) and 79350 eng/ L (P3).

Cultivation of *Daphnia magna* with a suspension concentration of 7.5 mL/L (P3) combination of manure and chicken broth was the highest concentration of suspension combination of manure and chicken broth that could increase the fecundity and production of *D. magna*. This is because the available feed content in sufficient quantities with good quality and quantity of feed can meet the nutrients and increase the growth of *D. Magna* [23]. According to [24] amount of *Daphnia magna* is influenced by the availability of feed according to the number of individuals in the cultivation container and supported by good environmental conditions. After treatment P3 (7.5mg/L) followed by treatment P2 (5 mg/L) which according to ANOVA analysis followed by Duncan's test, there was a very significant difference between the two. The nutritional value of the feed that is qualified for the production of *Daphnia magna* and the condition of good water quality make both of them successful in producing optimal production [25]. Feed quality which includes high concentrations of protein and fat in feed can increase the reproductive ability of cladocera parthenogenesis, by increasing fecundity and speed of embryo development [24].

Treatment of P0 (7.5 mg/L) with suspension of chicken manure from dry manure alone without any mixture or fermentation process first resulted in the highest amount of production on the eighth day with a density of 24550 ind/L. This treatment resulted in the smallest average production amount compared to the treatment using the mixture, even producing a much different density compared to the treatment using the mixture and the highest concentration was P3 (7.5 mg/L). This small amount of production is because the available food is not able to support optimal production of *D. magna*, it causes *Daphnia magna* to produce male individuals and reproduce sexually. This statement is in accordance with [25] insufficient amount of feed causes *D. magna* to produce male offspring and reproduce sexually by producing epipia, and culture with fermented and combination produces higher fecundity than without fermentation [12].

4. Conclusion
Based on the results of the research that has been carried out, it can be concluded that the combination of manure and chicken broth has a significant effect in increasing the amount of *Daphnia magna* production compared to feed that only contains chicken manure without mixture and the optimal amount of *Daphnia magna* production occurs in *Daphnia magna* cultivation with suspension concentration. the combination of manure and chicken broth was 7.5 mL/L (P3).
5. References
[1] Mujahid F R 2016 Chemical Engineering Scientific Articles p 1-7.
[2] Sari LA, Masithah ED and Alamsjah MA 2018 Journal of Fisheries and Marine Research 2 (1): 9-14.
[3] Hashim P, Ridzwan M S, and Bakar J 2014 Inter Journal of Bioengineering and Life Sciences 8 250-254.
[4] Holy NH and Sari LA 2020 IOP Conference Series: Earth and Environmental Science 441(1).
[5] Loekman NA, Manan A, Arief M, and Prayogo P 2018 Journal of Aquaculture and Fish Health 7(2), 78-83.
[6] Islama D, Nurhatijah, Muntadhar M, and Fadhli M 2018 Aquaculture Journal 2 7-14.
[7] Darmawan J 2014 Bio Jurnal 13 57-63.
[8] Luthfi H, Muhar N, and Eriza M 2015 Aquaculture Journal Bung Hatta University 7 1-10.
[9] Izzah N, Suminto and Herawati V E 2014 J Aquaculture Manage and Technol. 3 44-52.
[10] Pratama NA, Rahardja BS, and Sari LA 2020 IOP Conference Series: Earth and Environmental Science 441(1).
[11] Azmi KA, Arsad S, and Sari LA 2020 IOP Conference Series: Earth and Environmental Science 441(1).
[12] Damayanti KY, Mubarak AS, and Sari LA 2020 IOP Conference Series: Earth and Env Science 441(1).
[13] Liyana S, Sari LA, Dewi NN, Masithah ED, Sahidu AM and Pursetyo KT 2019 IOP Conference Series: Earth and Environmental Science 236(1).
[14] Bakri M 2017 Pengaruh Dedak Padi Fermentasi dengan Mikroorganisme Lokal dalam Ransum Terhadap Konsumsi Protein Kasar dan Serat Kasar Puyuh (Coturnix – Coturnix Japonica) Thesis (Makassar: Faculty of Animal Husbandry, Hasanuddin University).
[15] Fink P, Plifitsch C, and Marin K 2011 Plos One 7 1-8.
[16] Cahyono B 2009 Budidaya Biota Air Tawar (Yogyakarta: Kanisius) p 263.
[17] Dwiardan KH, Sari LA, Sari PDW, Nindarwi DD, and Arsad S 2020 IOP Conference Series: Earth and Environmental Science 441(1).
[18] Sari LA, Sari PDW, Nindarwi DD, Arsad S and Affandi M 2019 Ecology, Environment and Conservation 25 (July SupplIssue): S26-S31.
[19] Sari LA, Pursetyo KT, Arsad S, Masithah ED, Setiawan E and Affandi M 2019 Pollution Research 38 (August SupplIssue): S27-S32.
[20] Homer D H and Waller W T 1983 Water Air Soil Poll J. 20 23-28.
[21] Firmandus R 2015 e-Jurnal Rekayasa dan Teknolo Budidaya Perairan 4 449-452.
[22] Kusumaryanto H 2011 Aquaculture J Institut Pertanian Bogor.
[23] Rinawati M, Sari LA, and Pursetyo KT 2020 IOP Conference Series: Earth and Environmental Science 441(1).
[24] Zadereev E and Lopatina T 2007 Aquaculture Ecology J. 41 255-261.
[25] Sari LA, Satyantini WH, Manan A, Pursetyo KT, and Dewi NN 2018 IOP Conference Series: Earth and Environmental Science 137 (1).

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