JURNAL PERIKANAN DAN KELAUTAN
Volume 28 No. 1, February 2023: 97-102

e-issn : 2721-8902
p-issn : 0853-7607

Food Waste Potential as Alternative Feed Catfish Cultivation: an Overview

Potensi Limbah Sebagai Pakan Alternatif Budidaya Lele: an Overview

Gede Agus Surya Pratama[1*,] Sang Ayu Made Putri Suryani[1], I Nengah Muliarta[1]
[1]*Faculty of Agriculture, Universitas Warmadewa*
Jl. Terompong 24 Tanjung Bungkak Denpasar Bali, Indonesia
**email: beegede.gasp@gmail.com*

Received
20 December 2022

Accepted
25 January 2023

Abstract

Food waste in urban areas is an endless problem, considering that waste will continue to exist. The technique of managing waste to become an alternative feed for catfish is one of the steps to overcome the problem of waste and at the same time becomes an alternative fish feed solution for fish cultivators. The purpose of this research is to process food waste into fish feed. The method used in writing this article is literature review. Based on the results of the literature review and the author's analysis, it can be concluded that food ingredients that can be processed into catfish feed are food waste by utilizing fermentation or by mixing or formulated with other raw materials such as (fish meal, magot, tofu dregs, and fine bran). The fermentation process can use fishery products sold in the market, including (EM4, Boster, etc) which are mixed with molasses.

Keywords: Feed, Catfish Cultivation, Food Waste

Abstrak

Food Waste/limbah makanan di perkotaan menjadi suatu masalah yang tidak ada habisnya, mengingat sampah akan terus ada. Teknik pengelolaan sampah menjadi pakan alternatif ikan lele adalah salah satu langkah untuk mengatasi persoalan sampah dan sekaligus menjadi sebuah solusi pakan ikan alternatif bagi pembudidaya ikan. Tujuan dari penelitian ini adalah pengolahan limbah sisa makanan menjadi pakan ikan. Metode yang digunakan dalam penulisan artikel ini adalah *literatur review*. Berdasarkan hasil literatur review dan Analisa penulis maka didapatkan kesimpulan, bahan makanan yang dapat diolah menjadi pakan ikan lele adalah limbah makanan dengan memanfaatkan fermentasi ataupun dengan pencampuran atau diformulasikan dengan bahan baku yang lainnya semisal (tepung ikan, magot, ampas tahu dan dedak halus). Prosen fermentasi dapat menggunakan produk-produk perikanan yang dijual di pasartan antara lain nya (EM4, Boster, dll) yang dicampur dengan molase.

Kata Kunci : Pakan, Budidaya Ikan lele, Food Waste

1. Introduction

The Indonesian government is facing quite big challenges not only to increase the production of cultivated fish to meet domestic consumption needs but also for the export market which has various requirements. These requirements are mandatory in winning competition in regional and international markets, which determine the acceptability and competitiveness of aquaculture products. Efforts to produce aquaculture products that meet quality and food safety requirements must be implemented in line with efforts to increase aquaculture production (Windriani, 2017).

Windriani, (2017) based on FAO The State of World Fisheries and Aquaculture 2016, Indonesia's 2014 aquaculture production in Southeast Asia was the largest, while compared to the rest of the world it was the third largest producer, after China and India. This shows Indonesia's enormous interest in increasing the competitiveness and acceptance of its products in regional and international markets. Catfish is a type of freshwater fish originating from Africa, namely African catfish (*Clarias gariepinus*) and local catfish (*Clarias batrachus*) and has been cultivated commercially by Indonesian people, especially in Java. Catfish cultivation is growing rapidly because 1) it can be cultivated in limited land and water sources with high stocking densities, 2) cultivation technology is relatively easy to master by the community, 3) marketing is relatively easy, 4) the required business capital is relatively low and 5) business time it doesn't take too long. Along with the increasing demand for catfish, the cultivation business opportunities are increasingly open. Catfish farming, both hatchery and enlargement can be carried out with large capital, but even with a limited amount of capital, it can be done.

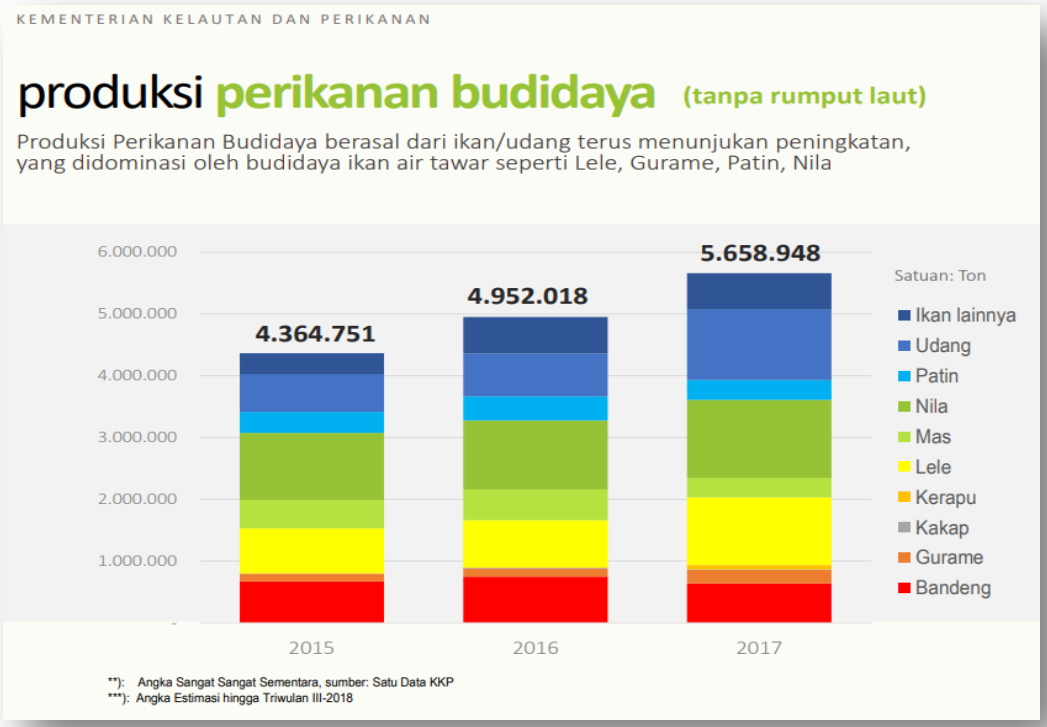
There is quite a lot of public interest in consuming catfish as a source of animal protein, this is because catfish has an affordable price, is easy to process, and has a good taste (Wardani *et al.*, 2017). The high public interest in catfish commodities encourages aquaculture business actors to strive for maximum production. Efforts that can be made by cultivators to increase catfish production are by optimizing the quality and efficiency of feed that can support catfish production.

Windriani (2017) now, catfish farming is generally managed intensively. Cultivating catfish as the initial chain of the catfish business has a considerable opportunity to support the government in programs to create jobs and increase people's income. Economically, catfish farming is very profitable because catfish have high economic value, do not require complicated maintenance, and are high protein producers so they are very good for fulfilling people's nutrition, the selling price is affordable to the public and easy to obtain on the market. In the aquaculture business, the need for feed is the largest component of production costs, which ranges from 80-85% of the total production costs. Currently, the biggest component of production costs is due to the high price of feed, so it is still a big obstacle. This is related to the dependence on imported feed raw materials whose prices continue to increase.

Widagdo *et al.* (2016) as an example of the potential for catfish enlargement cultivation in Gunung Pati District, Semarang City is very high because it has an available land area and human resources, most of whom work as fish cultivators; the marketing potential of catfish rearing cultivation in Gunung Pati District, Semarang City is quite high because the demand for catfish consumption has increased and the potential for developing catfish enlargement cultivation in Gunung Pati District has strengths and opportunities that can be exploited to minimize weaknesses and threats and the possibility of developing an enlargement farming business catfish to maintain continuity of production. The SO strategy is used in the development of catfish enlargement cultivation, namely utilizing government policies in the development of catfish enlargement cultivation and optimizing the use of available land to increase production. The production of catfish enlargement cultivation in Gunung Pati District, Semarang City using semi-intensive methods can be developed with the potential of available land and supporting human resources. Cultivation production yields 27 tons/year, the available land area is 5.35 Ha, and market potential in 2015 reached 355.8 tons/year. Based on the analysis of internal factors, the biggest strength is the area of cultivated land (0.42) and an analysis of external factors, namely the area of land in the Gunung Pati sub-district (0.41). The right alternative strategy is SO (Strengths-Opportunities) with a score of 3.93 and the SWOT quadrant is in the position I, namely aggressive which uses strengths and opportunities to minimize weaknesses and threats. The conclusion obtained is that the potential for cultivating catfish enlargement in Gunung Pati District, Semarang City is quite good using semi-intensive methods; market potential in Gunung Pati District is quite high due to increased catfish consumption; the potential for developing catfish rearing cultivation in Gunung Pati District has strengths and opportunities that can be exploited to minimize weaknesses and threats and the possibility of developing a catfish rearing cultivation business to maintain production continuity; The strategy used is the SO strategy by utilizing government policies in the development of enlargement cultivation.

The average growth of cultivated fish production in Q1 – III 2015 – 2018, the highest commodities: Gurame 68.15%, Catfish 56.32%, Patin 31.76%, Shrimp 30.02%, Tilapia 7.62% • Production Fish TW I-III 2017 – 2018: Catfish increased from 841.75 thousand tonnes to 1.81 million tonnes (114.82%): Gurame increased from 169 thousand tonnes to 356.53 thousand tonnes (110.88%): Catfish increased from 245.75 thousand tons to 492 thousand tons (100.23): Biofloc activities were able to increase catfish production (KKP, 2018). Fish as a food

ingredient in Indonesia has several advantages, including: as a source of essential nutrition, white meat, universal nature, relatively cheap price, relatively short production process, and local supply. The fish consumption rate in 2010 was 30.48 kg/cap/year, increasing annually to reach 38.1 kg/cap/year in 2014 with a growth rate of 5.78%. Fish supply in 2010 was 38.39 kg/cap/year and increased to 51.8 kg/cap/year in 2014 with a growth rate of 7.85% (Junaidah, 2017).



(Source: KKP, 2018)

Feed is an important component in catfish farming to support the growth and survival of cultivated fish. Commercial feed currently has a high price so business actors in freshwater fish farming can spend up to 75% of the total costs required for cultivation (Wardani *et al.*, 2017). The high price of this feed is due to the use of raw materials for pellet factory feed that is an imported commodity, thereby reducing large costs for catfish farmers. The high price of feed results in the profit obtained by the cultivator not being optimal and can even make a loss. Feeding must also pay attention to quality and quantity so that it is in accordance with the nutritional needs needed by fish. The quality feed has complete nutritional content, is easily digested by fish, and does not contain substances harmful to fish (Yunaidi *et al.*, 2019).

According to (Yanuar *et al.*, 2018) restaurant waste that can be used includes; leftover vegetables, leftover fruits, and leftovers from restaurant food (rice, meat, eggs). From the restaurant waste, testing was carried out on its nutritional content.

Table 1. Results of laboratory analysis of restaurant waste materials (Yanuar *et al.*, 2018)

No	Name Ingredients	Composition of Nutritional Content					
		Proteins	Calcium	Phosfor	Coarser Fiber	Fat	Metabolic Energy
1	Household Food Waste	10.89%	0.08%	0.39%	9.13%	9.70%	1.780 kkal/kg

Table 2. Results of laboratory analysis of restaurant waste materials using fermentation technology (Yanuar *et al.*, 2018)

No	Name Ingredients	Dry Matter (%)	Persentage Based on dry Matter (BK)			
			Ash	Crude Protein	Crude Fat	Coarse Fiber
1.	Fermented Food Waste	88.91	8.94	22.40	5.96	19.12

Based on the results of the proximate analysis test for feed ingredients originating from restaurant waste, feed ingredients with fermentation technology are the best animal feed ingredients because they have a high protein value of 22.40%. This can be used as raw material for fish feed because the standard requirement for fish protein is 20-60%. The results of pelleted fish feed that are made at this time are the type of sinking type feed. The sinking type pellet fish feed is suitable for catfish type feed (Yanuar *et al.*, 2018).

2. Method

The method used in writing this article is a literature review. A literature review is a national or international literature search that is carried out using a number of pieces of literature that supports the writing being done. The method is by reviewing, summarizing, and the author's thoughts on several library sources (articles, books, internet, and other sources). Searching for articles or journals is carried out with a vulnerability of 10 years back from 2022 to 2012 by using the keywords utilization of food waste as an alternative feed for catfish.

The literature review is the first and most important step in preparing a research plan. The literature review is a literature search and research by reading various books, journals, and other publications related to research topics, to produce an article regarding a particular topic or issue. There are two main objectives of the literature review. First, a literature review is conducted with the aim of writing a paper to introduce new studies on a particular topic that those who are active in that topic need to know. This study can be published at any time in the public interest. Examples of studies of this kind can be seen, for example, in the Annual Review of Anthropology, Annual Review of Sociology, and so on. Those who are new to becoming novice researchers on a particular topic can use this issue of the annual review as initial reading.

The second purpose of the literature review is for the benefit of the research project itself. In this case, conducting a literature review is to enrich our insights about our research topic, helps us formulate research problems, and help us determine the appropriate theories and methods to use in our research. By studying other people's studies, we can determine whether to imitate, repeat, or criticize a particular study. We use other people's studies as comparison material for our own studies. By criticizing other people's writings, we then create something new. In this paper, the literature review will specifically be discussed for the benefit of their own research, especially for students who will write their final scientific work – thesis, thesis, or dissertation.

Writing a literature review means that we show our readers that: First, we know about other studies that have been done by people regarding our research topic. We are familiar with and understand a body of knowledge about our research topic. We are building self-credibility in the body of knowledge that is the topic of our research. A literature review shows the reader about our mastery of the topic of our study. The better and more complete the writing of the literature review, the better people's respect for us as the authors of the study. Second, the literature review will link the study we are about to conduct with the widespread discourse in the literature on the topic. We close the gap that exists between the research project we are working on and the world of literature in general, and we even expand on previous studies. We understand the flow of previous research on this topic. With this knowledge, we then design how the new research project that we are going to do can be connected to the path of existing research on this topic. A good literature review can place the research project being designed into the context of a field of study related to general literature, research topics, and research areas or communities.

Third, showing our ability to integrate and summarize what other people already know about our field of study. One review summarizes and synthesizes the overall results of the research, which ones have been agreed upon, which ones are still being debated, and which ones are still being encroached on, and approximately the direction in which our research topic will develop in the future. Fourth, by learning from others we can give birth to new thoughts. A good literature review identifies aspects that are still dark and provides new insights and hypotheses for further research. Reports or information that will be used in a literature review can be found in books, scholarly papers, dissertations, government documents, police reports, or papers presented at seminars. Below are several sources for writing a literature review.

Periodicals can be found in newspapers, popular magazines, television, radio, and the internet, but are usually incomplete. All of that is condensed writing by journalists for the benefit of readers. The description is less detailed. When asked to write a 'Literature Review', many novice students google the topic via the internet or refer to non-professional sources, non-academic journals, or articles in newspapers. Students must be able to distinguish between scientific publications and popular writings. They should refer to academic and professional sources. The true student, writing a serious research paper, must rely on academic literature, that is, original papers published in academic journals and books. It's hard to find this stuff, and it's also hard to read it, especially if it's written in a foreign language. However, this is a correct provision and must be carried out.

Professional researchers usually write papers in various publications such as books or academic monographs, papers in scientific journals, chapters in academic books, and papers presented in scientific meetings (seminars, etc.). We have to look for original academic articles to be able to see what databased authors are saying (Marzali, 2016)

3. Result and Discussion

The results of the articles collected and the author's analysis, good quality fish feed is needed to support sustainable catfish farming activities. The very high price of catfish feed makes fish farmers look for a solution or alternative fish feed without compromising the quality of the feed. The author's analysis of alternative feeds from food waste such as (rice waste, bread, fruit peels, tofu dregs, etc.) can be used for catfish feed, before using

it, it would be best if the feed is weighed first according to the feed formulation desired by the catfish farmer. Mixing of feed ingredients starts with the least amount of ingredients until it is homogeneous. Then add water and stir until mixed. After the mixture of ingredients becomes homogeneous, the feed is mould using a feed molding machine. The molded feed is then dried by drying it in the sun. After drying, the feed is stored in a closed container and placed in a dry room (not damp and not exposed to direct sunlight) so that the feed is not damaged and the aroma of the feed is maintained.

Muntafiah (2020) states that catfish farmers in Mranggen use pellet feed as the main feed and use alternative feeds in the form of tiren chicken, bran, and maggot. The protein content of the pellets ranges from 25 – 30% depending on the type of pellets used. The protein content of bran ranges from 14.5 - 30% so it cannot support catfish growth optimally. The use of raw material for chicken tiren is able to reduce production costs, but its nutritional content cannot be maintained. Maggot has a high protein content of 30-40% and is easy to maintain. One alternative to fish feed is to utilize food waste or food waste.

Muntafiah (2020) waste, especially in big cities, is an endless problem, over time, now there are waste management techniques to become an alternative to fish feed. Besides, the waste problem being resolved, it can also be a feed solution for fish feed prices that are very high and can create business opportunities. Anggraeni & Rahmiati (2016) stated that feeding tofu dregs content could increase the growth of catfish. The best feeding was given to the AT2 treatment, which was a mixture of tofu dregs plus shrimp heads, which resulted in the highest growth weight but was not significantly different from the AT1 treatment, which was a mixture of tofu dregs and fish heads.

In addition, according to (Selopes *et al.,* 2020), the addition of fermented fish stomach waste to artificial feed has no effect (P>0.05) on LPH, absolute growth, and survival but has a very significant effect (P>0.05) on feed efficiency where treatment (A) 11.24%, (B) 14.13%, (C) 20.12% and (D) 11.94%. The addition of 75% fermented fish stomach waste per kg of feed shows the most efficient use of feed. Apart from formulating feed, it can also be done by fermentation, namely by mixing bacteria into the feed to be formulated. this is in accordance with the opinion (Yanuar *et al.,* 2018) the method of processing organic waste is that restaurant waste collected every day and placed in one container by separating waste such as toothpicks, plastic food wrappers from the waste and then processing it with a fermentation technique. The fermentation technique was carried out by adding fermenting bacteria under anaerobic conditions for 21 days

Yanuar *et al.* (2018) after a 21-day process, the fermented feed were added with rice bran, salt, and starch mixed homogeneously until dough was formed. The feed dough is formed into pellets and then dried in the hot sun or oven. The data were analyzed qualitatively from theory, practice, and practice of making fish feed. Yanuar et al., (2018) the results of the proximate analysis of restaurant food waste ingredients are: 22.40% crude protein; Crude fiber 19.12%; Crude fat 5.96; Ash 8.94%; and dry matter 88.91%. Based on the results of the analysis of the fermented food waste material, this material can be included in animal feed ingredients because it has a high protein value of 22.40%.

Anis & Hariani (2019), administration of EM4 (Effective Microorganism 4) culture results from different media on feed has a significant effect on the specific growth rate (SGR), feed conversion ratio (FCR), and survival rate (SR) of catfish larvae. Treatment E is a feed treatment with the addition of fermentor 3 giving the best SGR, FCR, and SR responses with values obtained respectively 5.91 ± 0.04%, 0.88 ± 0.04%, and 73.50 + 1, 91%.

4. Conclusions

Feed is an important aspect in aquaculture activities, alternative fish feed by utilizing food waste can be used as a solution to high feed prices and can help waste management in urban areas.

5. Suggestion

Further research is needed on the use of food waste as alternative feed for catfish farming.

6. References

[KKP] Kementerian Kelautan dan Perikanan. (2018). Refleksi 2018 dan Outlook 2019.

Anggraeni, D.N., & Rahmiati. (2016). Pemanfaatan Ampas Tahu Sebagai Pakan Ikan Lele *(clarias batracus)* organic. *Biogenesis Jurnal Ilmiah Biologi*, 4(1):53-57.

Anis, M.Y., & Hariani, D. (2019). Pemberian Pakan Komersial dengan Penambahan EM4 (Efektif Microorganisme) untuk Meningkatkan Laju Pertumbuhan lele *(Clarias* sp*). Jurnal Riset Biologi dan Aplikasinya.* 1(1)

Junaida, I.S. (2017). Tingkat Konsumsi Ikan di Indonesia: Ironi di Negeri Bahari. *Jurnal Penyuluhan Perikanan dan Kelautan*, 11(1):12-24.

Muntafiah, I. (2020). Analisis Pakan pada Budidaya Ikan Lele *(Clarias* sp*)* di Mranggen. *Jurnal Riset Sains dan Teknologi*, 4(1): 35-39.

Selopes, M., Indrawati, E., Mulyani, S., Budi, S. (2020). Analisis Efektifitas Fermentasi Limbah Perut Ikan Terhadap Pertumbuhan dan Sintasan Ikan Lele *Clarias* sp. *J. of Aquac. Environment*, 3(1): 1-5.

Wardani, R.E., Prayogo, M., & Agustono, M.K. (2017). Potensi Penambahan Azolla sp. dalam Formulasi Pakan Pembedahan. *Journal of Aquaculture and Fish Health*, 6(2)

Widagdo, A.B., Elfitasari, T., & Basuki, F. (2016). Strategi Pengembangan Budidaya Pembesaran Ikan Lele (*Clarias* sp) di Kecamatan Gunung Pati Kota Semarang. *Prosiding Seminar Nasional Tahunan ke –V Hasil-Hasil Penelitian Perikanan dan Kelautan (Juni)*:199-211

Windriani, U. (2017). *Budidaya Ikan Lele Sistem Bioflok.* Direktorat Produksi dan Usaha Budidaya.

Yanuar, A., Tyasari, F.G., & Dughita, P.A. (2018). Pemanfaatan Limbah Organik dari Rumah Makan Sebagai Alternatif Pakan Ternak Ikan Budidaya. *AGRONOMIKA*, 13(1).

Yunaidi., Rahmanta, A.P., & Wibowo, A. (2019). Aplikasi pakan pelet buatan untuk peningkatan produktivitas budidaya ikan air tawar di desa Jerukagung Srumbung Magelang. *Jurnal Pemberdayaan*, 3(1)