

THE EFFECT OF TOFU DREGS AND CUCUMBER ON THE GROWTH OF TUBIFEX WORMS (*Tubifex* sp.)

Pengaruh Penggunaan Ampas Tahu dan Mentimun terhadap Pertumbuhan Cacing Sutra (*Tubifex* sp.)

Afdal Jasman, Boni Ikhlas*, Lisa Mayasari, Endryeni

Aquaculture Study Program, Faculty of Science, Nahdlatul Ulama University of West Sumatra

S. Parman Street No.119 A 25136 Padang Sumatra Barat

*Corresponding Author: boni.ikhlas@gmail.com

(Received January 13th 2026; Accepted June 19th 2026)

ABSTRACT

Tubifex worms (*Tubifex* sp.) are high-protein natural feed organisms for fish fry, and the use of tofu dregs and cucumber as a culture medium may support their growth. This study aimed to determine the effect of using tofu dregs and cucumber as a culture medium on the growth of *Tubifex* worms. *Tubifex* worms are a protein-rich natural feed widely used in fish and shrimp farming, especially during the larval stage. Tofu dregs, a solid by-product of the tofu industry, contain protein and fiber, while cucumber has a high water content and contains minerals that may support substrate moisture and quality. The study was conducted experimentally using a completely randomized design (CRD) with four treatments: A (100% tofu dregs), B (85% tofu dregs + 15% cucumber), C (75% tofu dregs + 25% cucumber), and D (65% tofu dregs + 35% cucumber), with three replications for each treatment. The parameters observed included absolute biomass growth (g), individual abundance (individuals/L), and water quality (temperature and pH). Treatment C produced the highest average biomass growth (62.00 g) and individual abundance (89.22 individuals/L). These results indicate that a combination of 75% tofu dregs and 25% cucumber was the optimal medium formulation for supporting the growth of *Tubifex* sp. The use of organic materials such as tofu dregs and cucumber in *Tubifex* worm culture may provide an efficient, inexpensive, and environmentally friendly alternative for natural-feed production.

Keywords: *Tubifex* sp., tofu dregs, cucumber, biomass growth, cultivation medium

ABSTRAK

Cacing sutra (*Tubifex* sp.) merupakan pakan alami berprotein tinggi untuk benih ikan. Pemanfaatan ampas tahu dan mentimun sebagai media budidaya perlu dikaji untuk mendukung pertumbuhan cacing sutra. Penelitian ini bertujuan untuk mengetahui pengaruh penggunaan ampas tahu dan mentimun dalam media budidaya terhadap pertumbuhan cacing sutra. Cacing sutra merupakan pakan alami kaya protein yang banyak digunakan dalam

budidaya ikan dan udang, terutama pada fase larva. Ampas tahu sebagai limbah padat hasil industri tahu mengandung protein dan serat yang tinggi, sedangkan mentimun memiliki kadar air dan mineral yang dapat menunjang kelembapan dan kualitas substrat. Penelitian dilakukan secara eksperimental menggunakan rancangan acak lengkap (RAL) dengan empat perlakuan, yaitu A (100% ampas tahu), B (85% ampas tahu + 15% mentimun), C (75% ampas tahu + 25% mentimun), dan D (65% ampas tahu + 35% mentimun), dengan tiga ulangan pada setiap perlakuan. Parameter yang diamati meliputi pertumbuhan biomassa mutlak (g), kelimpahan individu (individu/L), dan kualitas air (suhu dan pH). Perlakuan C menghasilkan rata-rata pertumbuhan biomassa tertinggi sebesar 62,00 g dan kelimpahan individu sebesar 89,22 individu/L. Hasil tersebut menunjukkan bahwa kombinasi 75% ampas tahu dan 25% mentimun merupakan formulasi media yang optimal dalam mendukung pertumbuhan *Tubifex* sp. Penggunaan bahan organik seperti ampas tahu dan mentimun dalam media budidaya cacing sutra dapat menjadi alternatif yang efisien, murah, dan ramah lingkungan untuk produksi pakan alami.

Kata kunci: *Tubifex* sp., ampas tahu, mentimun, pertumbuhan biomassa, media budidaya

INTRODUCTION

Tubifex worms (*Tubifex* sp.) are aquatic organisms of high economic value, particularly as a natural feed source in fish and shrimp farming. These worms have a high protein content—reported to range from 55% to 60%—and contain essential amino acids required by fish and shrimp fry during their early growth stages (Alfianto *et al.*, 2022). The high demand for *Tubifex* worms as natural feed makes *Tubifex* sp. culture a promising activity. However, productivity in *Tubifex* worm culture is strongly influenced by the quality of the culture medium and the organic materials used. A key challenge is providing a nutrient-rich yet environmentally friendly culture medium. In practice, farmers may use organic materials such as animal manure, rice bran, and kitchen waste. However, these materials are not always sustainably available and may generate waste that can degrade water quality if not managed properly (Yulianto *et al.*, 2020). Consequently, there is a need for alternative culture media that are readily available, inexpensive, and capable of supporting optimal worm growth. Tofu dregs—a solid by-product of tofu production—contain significant levels of protein and can serve as a nutrient source for aquatic organisms. According to Ramadhan *et al.* (2023), tofu dregs contain approximately 23–27% crude protein, as well as crude fiber and fat that can be utilized by microorganisms and worms during metabolic processes. However, when used in excess without being combined with other materials, tofu dregs can decompose rapidly and degrade water quality.

On the other hand, cucumber (*Cucumis sativus*) has a high water content (approximately 95%) and contains vitamins and minerals that may support microbial growth and maintain moisture in the culture medium. According to Syafrudin *et al.* (2021), cucumber also contains antioxidants and vitamin C, which may contribute to substrate condition and support physiological processes. The use of cucumber as a component of an organic medium in *Tubifex* culture has rarely been studied. A combination of tofu dregs and cucumber at specific proportions may create a culture medium with a balanced nutritional composition and suitable physical conditions, thereby supporting worm growth and reproduction. This study was conducted to examine the effect of tofu dregs and cucumber-based media on the biomass growth of *Tubifex* worms at the laboratory scale.

This study aimed to identify an optimal media formulation to enhance the productivity of *Tubifex* sp. culture in an efficient and environmentally friendly manner. Furthermore, the utilization of organic materials such as tofu dregs and cucumber supports the principles of the

circular economy and integrated waste management, which are increasingly relevant to sustainable development (Wibowo & Setiawan, 2021).

RESEARCH METHODS

Place and Time

This research was conducted for 4 weeks, from August to September 2023, in Alai, Limau Manis Village, Pauh District, Padang City. Tofu dregs were obtained from a tofu factory in the Pauh area, while cucumbers were purchased from a traditional market in Padang City. During the research, environmental conditions were maintained at a temperature of 25–28°C and a water pH of 6.5–7.5, in accordance with the reported requirements for *Tubifex* worms (Ramadhan *et al.*, 2023).

Tools and Materials

Materials:

1. *Tubifex* worms (*Tubifex* sp.) obtained from prior laboratory cultivation, and tofu dregs serving as both the culture medium and feed.
2. Fresh cucumber (*Cucumis sativus*).
3. Chlorine-free clean water for the rearing medium.
4. Molasses and EM-4 (Effective Microorganisms) as tofu dregs fermentation ingredients (optional, if using fermentation).

Tools:

1. Plastic container or aquarium for cultivation media (size 30x30x30 cm).
2. Digital scale with 0.01-gram precision.
3. Thermometer and pH meter for monitoring water temperature and pH.
4. Media stirring device.

Research Design

The study employed a completely randomized design (CRD) with four treatments.

The treatments were as follows:

Treatment A consisted of 100% tofu dregs.

Treatment B consisted of 85% tofu dregs + 15% cucumber.

Treatment C consisted of 75% tofu dregs + 25% cucumber.

Treatment D consisted of 65% tofu dregs + 35% cucumber.

Each treatment was carried out in three replications.

Research Procedure

Media Preparation

The tofu dregs were thoroughly washed and partially dried; if used, they were fermented for three days with the addition of molasses and EM-4. The cucumber was cut into small pieces to facilitate consumption by the *Tubifex* worms.

Container Preparation

The culture vessel is filled with clean water as required and supplied with the appropriate medium according to the treatment.

Stocking of *Tubifex* Worms

Tubifex worms with a uniform total weight (e.g., 10 grams) are stocked in each container.

Maintenance

The medium and environmental conditions were maintained for 4 weeks, with a 30% water exchange performed weekly to maintain water quality.

Growth Observations

Each week, samples of *Tubifex* worms were collected from each container, and the average

length and total weight of the worms were measured using a stereomicroscope and a digital scale.

Data Analysis

Growth data were analyzed using one-way analysis of variance (ANOVA) to determine the effect of the treatments. Before ANOVA, the data were subjected to normality and homogeneity tests. If the ANOVA results indicated significant differences ($p < 0.05$), the Least Significant Difference (LSD) test was performed to compare the treatments (Gomez & Gomez, 1984).

RESULTS

Abundance of Tubifex Worms

Biomass growth of Tubifex worms during the study was measured based on the change in wet weight (grams) from the beginning to the end of the rearing period. The observed biomass growth reflects the ability of the media (tofu dregs and cucumber) to meet the nutritional requirements of the worms. Absolute biomass growth was calculated using the following formula (Effendie, 1997):

$$\text{Absolute Growth of } W = W_t - W_0$$

Description:

- W_t = Average weight of worms at the end of the study (grams)
- W_0 = Average weight of worms at the start of the study (grams)

Table 1. Average abundance of *Tubifex* worms for each treatment.

Treatment	Average abundance (individuals/L)
A (100% tofu dregs)	70,44±18,59
B (85% tofu dregs + 15% cucumber)	75,44±22,11
C (75% tofu dregs + 25% cucumber)	89,22±34,11
D (65% tofu dregs + 35% cucumber)	77,00±23,48

Absolute Biomass Growth of Tubifex Worms

Observations of the absolute weight growth of Tubifex worms reared for 30 days in various media compositions of tofu dregs and cucumber included the average initial weight, final weight, and absolute weight gain in grams.

Table 2. Absolute Biomass Growth of Tubifex worms (*Tubifex* sp.)

Treatment	Average initial weight (g)	Average final weight (g)	Absolute weight gain (g)
A (100% tofu dregs)	50±0,00	75,00±3,00	25,00
B (85% tofu dregs + 15% cucumber)	50±0,00	86,33±1,53	36,33
C (75% tofu dregs + 25% cucumber)	50±0,00	112,00±1,00	62,00

D (65% tofu dregs + 35% cucumber)	50±0,00	88,33±1,53	38,33
-----------------------------------	---------	------------	-------

Water Quality

During the rearing of *Tubifex* worms under the different treatment compositions of tofu dregs and cucumber, water quality data were obtained and are presented in Table 3.

Table 3. Initial and final water quality parameters during *Tubifex* worm rearing.

Treatment	Beginning		End	
	Temperature (°C)	pH	Temperature (°C)	pH
A	27	8,83	28	7,80
B	27	8,87	27	8,40
C	28	8,03	28	7,90
D	27	8,15	28	7,50

DISCUSSION

Abundance of *Tubifex* Worms

The results in Table 1 show that Treatment C (75% tofu dregs and 25% cucumber) yielded the highest abundance—89.22 individuals/L with a standard deviation of 34.11. This indicates that this compositional combination provided the most suitable environmental and nutritional conditions for the growth and reproduction of *Tubifex* worms. According to Ramadhan *et al.* (2023), tofu dregs contain high levels of crude protein and organic matter, which support the growth of microorganisms that serve as natural food for the worms. The addition of a proportional amount of cucumber (approximately 25%) provides nutritional variety—specifically vitamins and water—that helps maintain substrate moisture and supports metabolic processes.

Treatment A (100% tofu dregs) showed the lowest abundance (70.44 individuals/L), although the result was still considered quite good. This may be attributed to high levels of organic matter that do not fully decompose, potentially leading to higher ammonia concentrations, which can inhibit growth and slow down worm reproduction (Effendi, 2003).

Treatment D (65% tofu dregs, 35% cucumber) resulted in lower abundance compared to Treatment C, though still higher than Treatment A. This is likely because an excessive amount of cucumber caused the medium to become overly wet and prone to rapid decay, which can degrade water quality and trigger the growth of pathogenic microbes.

According to Boyd (2015), balancing organic matter in the medium is crucial to prevent excessive decomposition, which leads to reduced oxygen levels and increased free ammonia. Therefore, a treatment utilizing an optimal mixture of tofu dregs and cucumber is essential to achieve maximum population abundance.

Absolute Biomass Growth of *Tubifex* Worms

Data regarding the absolute weight growth of *Tubifex* worms over a 30-day rearing period are presented in Table 2. All treatments showed an increase in biomass weight, although

the magnitude varied depending on the medium composition. Treatment C—a mixture of 75% tofu dregs and 25% cucumber—exhibited the highest absolute weight growth at 62.00 g, increasing from an initial weight of 50.00 g to 112.00 g. This indicates that the combination of tofu dregs as a protein source and cucumber as a source of moisture and minerals provided favorable medium conditions for *Tubifex* worm growth. According to Ramadhan *et al.* (2023), tofu dregs are rich in crude protein and fiber, while cucumber has a high water content and contains minerals that may improve substrate conditions and facilitate the worms' metabolic processes.

Treatment D, composed of 65% tofu dregs and 35% cucumber, resulted in a biomass increase of 38.33 g—slightly higher than Treatment B (36.33 g), which used 85% tofu dregs and 15% cucumber. These results suggest that adding cucumber at a moderate proportion may contribute positively to biomass growth. However, in Treatment D, the higher cucumber content may have increased medium moisture and the risk of rapid substrate decomposition, potentially reducing water quality. This is consistent with Boyd (2015), who noted that high organic loads and excessive moisture can reduce dissolved oxygen and increase free ammonia concentrations.

Meanwhile, Treatment A, which used 100% tofu dregs, yielded the lowest biomass increase at 25.00 g. This suggests that a single-component medium may be less capable of meeting the nutritional requirements of the worms. Furthermore, excessive decomposition of protein-rich tofu dregs may produce ammonia, which can inhibit growth (Effendi, 2003). Thus, an appropriate combination of tofu dregs and cucumber is important for enhancing *Tubifex* worm biomass growth, with the 75:25 proportion (Treatment C) producing the highest biomass increase in this study.

Water Quality

Data in Table 3 indicate that, at the start of the rearing period, water quality parameters were within the ranges reported as suitable for *Tubifex* culture. Temperature values across all treatments ranged from 27–28°C, while pH values ranged from 7.80 to 8.87 at the beginning and from 7.50 to 8.40 at the end. Putri (2014) stated that *Tubifex* worms grow and reproduce optimally in media with dissolved oxygen levels of 2.75–5 mg/L and temperatures of 25–28°C. Factors affecting aquatic organisms include water-quality parameters such as temperature, dissolved oxygen, pH, and free CO₂. Tolerable limits reported by Alabaster *et al.* (1982) include dissolved oxygen of 2–8 ppm, pH of 6.7–8.6, free CO₂ of 10 ppm, and temperature of 20–28°C.

According to Syahputra (2020), *Tubifex* worms grow optimally in media with sufficient oxygen and a pH between 7.0 and 9.0. Furthermore, Effendi (2003) stated that excessively acidic or alkaline pH levels can inhibit the metabolism of microorganisms involved in the nutrient cycle of *Tubifex* worms.

CONCLUSION

The highest population abundance was observed in Treatment C (89.22 ± 34.11 individuals/L), followed by Treatments D and B with abundances of 77.00 ± 23.48 individuals/L and 75.44 ± 22.11 individuals/L, respectively. The lowest abundance was recorded in Treatment A (70.44 ± 18.59 individuals/L). The data indicate variation in the abundance of *Tubifex* worms among treatments. The highest absolute biomass growth was observed in Treatment C (62.00 g), followed by Treatment D (38.33 g) and Treatment B (36.33 g), while the lowest value was found in Treatment A (25.00 g).

ACKNOWLEDGEMENT

The author wishes to express gratitude to Nahdlatul Ulama University of West

Sumatra, as well as Mr. Boni Ikhlas, Ms. Lisa Mayasari, and Ms. Endryeni, for their guidance and assistance in completing this research; the author also extends thanks to all parties who provided permission, support, and facilities throughout the conduct and completion of this study.

REFERENCES

- Alabaster, J. S., & Lloyd, R. (1982). *Water Quality Criteria for Freshwater Fish*. FAO, London.
- Alfianto, A. D., Suryaningtyas, V. A., & Rosyida, S. (2022). Kandungan Nutrisi dan Potensi Cacing Sutra sebagai Pakan Alami dalam Akuakultur. *Jurnal Akuakultur Tropis*, 7(2), 113–119.
- Boyd, C. E. (2015). *Water Quality: An Introduction*. Springer.
- Gomez, K. A., & Gomez, A. A. (1984). *Statistical Procedures for Agricultural Research* (2nd ed.). New York: John Wiley & Sons, Inc.
- Effendie, M. I. (1997). *Metode Biologi Perikanan*. Yayasan Dewi Sri. Bogor
- Effendi, H. (2003). *Telaah Kualitas Air bagi Pengelolaan Sumber Daya dan Lingkungan Perairan*. Yogyakarta: Kanisius.
- Putri, Sriwisuda, D., Supriyono, E., & Djokosetiyanto, D. (2014). Pemanfaatan Kotoran Ayam Fermentasi dan Limbah Budidaya Lele pada Budidaya Cacing Sutra dengan Sistem Resirkulasi. *Jurnal Akuakultur Indonesia*, 13(2), 132-139.
- Ramadhan, R., Nuraini, N., Aryani, N., & Heltonika, B. (2023). Pengaruh Ketebalan Media Fermentasi Ampas Tahu dan Padat Tebar Terhadap Pertumbuhan Cacing Sutra (*Tubifex sp.*). *Jurnal Intek Akuakultur*, 7(1), 1–8. <https://doi.org/10.31629/intek.v7i1.5496>
- Syafrudin, S., Fauziyah, N., & Sari, R. M. (2021). Kandungan Nutrisi dan Potensi Limbah Sayuran dalam Media Budidaya. *Jurnal Agroekoteknologi Tropika*, 10(2), 45–51.
- Syahputra, N. A., Rosmaiti, & Isma, M. F. (2020). Pengaruh Pemberian Pakan Alami yang Berbeda terhadap Pertumbuhan Cacing Sutra (*Tubifex sp.*) dengan Sistem Resirkulasi. *Jurnal Ilmiah Samudra Akuatika*, 4(2), 42–49.
- Wibowo, P. Y., & Setiawan, R. (2021). Pengelolaan Limbah Organik Rumah Tangga Berbasis Ekonomi Sirkular. *Jurnal Pengelolaan Lingkungan Berkelanjutan*, 5(1), 25–33.
- Yulianto, R., Darmawan, R., & Handoko, D. (2020). Penggunaan Media Organik dalam Budidaya Cacing Sutra dan Pengaruhnya Terhadap Kualitas Air. *Jurnal Akuatik*, 11(1), 67–74.