# “Natural Boosters for a Better Brine”

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# "NATURAL BOOSTER FOR BETTER BRINE"

# ABSTRACT

This study investigates the effect of natural boosters on the growth of Artemia (brine shrimp). Various treatments — Aloe vera extract, ricewash water, seawater, and buttermilk — were tested to evaluate their influence on larval growth over 10 days. Pattern C (Combined > Aloe > Rice-Wash > Seawater > Buttermilk) emerged as the most effective, showing a significant increase in mean body length. The findings suggest that natural additives can improve Artemia growth, which has implications for aquaculture and feed optimization.

**Aim:**

To evaluate the effect of natural boosters—Aloe vera extract, rice-wash water, fermented buttermilk, and their combination—on the survival and growth of Artemia (brine shrimp) under controlled laboratory conditions.

## INTRODUCTION

The brine shrimp Artemia is widely used in aquaculture as live feed because it is nutritious, easy to culture, and tolerant of a wide salinity range. Traditional production commonly uses seawater in open ponds, which has drawbacks (predation, environmental variability). This study tests Artemia culture in controlled laboratory bottles comparing a seawater control with seawater supplemented by: Aloe vera gel extract, rice-wash water, fermented buttermilk, and a combined supplement (Aloe + rice-wash + fermented buttermilk). The aim is to evaluate whether these locally available, low-cost supplements influence survival, growth, or development in Artemia.

## SELECTION OF PROBLEM AND BACKGROUND RESEARCH

Demand for Artemia biomass in aquaculture is rising. Past studies focus on salinity and pond-based culture, but there is little work on supplementing seawater with nutrient- or bioactive-rich household/plant extracts to improve survival and growth in controlled systems. Aloe vera contains polysaccharides and growth-promoting compounds; rice-wash water supplies dissolved starch and micronutrients; fermented buttermilk introduces organic nutrients and probiotic microbes. Testing these supplements may reveal low-cost methods to improve controlled Artemia production.

## HYPOTHESIS

Artemia reared in seawater supplemented with Aloe vera, rice-wash, or fermented buttermilk will show differences in survival and growth compared with control seawater. Some supplements (e.g., Aloe vera or a combination) may improve growth and survival due to added bioactives and nutrients, while others (fermented buttermilk) may harm survival if they reduce dissolved oxygen or cause microbial overgrowth.

## STATEMENT OF THE PROBLEM

How do seawater and seawater supplemented with Aloe vera gel, ricewash water, fermented buttermilk, or the combination of all three affect the survival rate, growth, and size of Artemia under controlled laboratory conditions?

# OBJECTIVES

- Compare Artemia survival in five media: seawater control, Aloe vera-supplemented seawater, rice-wash-supplemented seawater, fermented-buttermilk-supplemented seawater, and the combined supplement.
- Measure and compare growth (body length) and developmental progress across treatments.
- Monitor water-quality changes (salinity, pH, temperature, dissolved oxygen) and relate them to biological outcomes.
- Identify whether any supplement or combination improves Artemia biomass production under controlled conditions.

## DESIGN OF STUDY

Independent variables

- Seawater control (30 ppt)
- Seawater + Aloe vera extract (5% v/v)
- Seawater + Rice-wash water (10% v/v)
- Seawater + Fermented buttermilk (1% v/v)
- Seawater + (Aloe 5% + Rice-wash 10% + Fermented buttermilk 1%) (combined)

Dependent variables

- Survival rate (%) of Artemia (daily, final).
- Mean body length (mm) at scheduled days.
- Developmental stage observations (qualitative).

Controlled variables

- Initial stocking density: 20 nauplii / L.
- Temperature, light, feeding schedule, aeration.
- Base salinity target: 30 ppt (adjusted after supplement addition).
- Volume of culture (1 L bottles), feed type and amount, waterexchange regime.

## MATERIALS REQUIRED

- 15 × 1-L clear bottles (5 treatments × 3 replicates)
- Artemia nauplii (~300 total; 20 per bottle × 15)
- Marine salt mix (to make 30 ppt seawater) or natural seawater adjusted to 30 ppt
- Fresh Aloe vera leaves (or pure commercial Aloe gel)
- Rice (for rice-wash water)
- Pasteurized buttermilk or plain yogurt (for fermented buttermilk)
- Artemia feed
- Thermometer, pH meter, salinity meter, dissolved oxygen meter
- Pipettes, measuring cylinders, stirring rods, fine cloth, labels, marker
- Magnifier, ruler (mm)
- Gloves, disinfectant, waste containerfor used culture water

- **PREPARATION OF MEDIA**

Base seawater (all treatments)

- Prepare 30 ppt seawater (e.g., dissolve ~35 g marine salt mix per 1 L dechlorinated water). Aerate gently and equilibrate to room temp.

T1 — Aloe vera extract (5% v/v)

- Wash Aloe leaves, peel and scoop ~50 g fresh gel.
- Blend gel with 150 mL sterile/distilled water; strain through cloth → concentrated Aloe extract.
- For 1 L culture: mix 950 mL seawater + 50 mL Aloe extract (final 5%). Check salinity and adjust to 30 ppt if needed.

T2 — Rice-wash water (10% v/v)

- Rinse 100 g rice in 1 L water; collect the first cloudy wash. Let heavy solids settle 30 min; decant supernatant and filter through cloth.

- For 1 L culture: mix 900 mL seawater + 100 mL rice-wash supernatant (final 10%). Check salinity and adjust.

T3 — Fermented buttermilk (1% v/v)

- Dilute 100 mL pasteurized buttermilk with 400 mL sterilized water. Filter through cloth.
- For 1 L culture: add 10 mL filtered fermented buttermilk to 990 mL seawater (final 1%). Check salinity and adjust.

T4 — Combined supplement (Aloe 5% + Rice 10% + Buttermilk 1%)

- Prepare concentrated Aloe extract and rice-wash as above. For 1 L: 940 mL seawater + 50 mL Aloe + 100 mL rice-wash + 10 mL buttermilk. (If total >1 L adjust sea water volume so final volume = 1 L.) Check and re-adjust salinity to 30 ppt.

# PROCEDURE

Day −1 (media prep & equilibration)

- Prepare all treatment waters (T0–T4) and equilibrate to room temperature. Measure and record salinity, pH, temperature, DO. Adjust salinity back to 30 ppt after adding supplements.
- Label 15 bottles: T0-A, T0-B, T0-C; T1-A… etc.

Day 0 (stocking)

- Fill each bottle with its assigned treatment water (1 L).
- Add 20 Artemia nauplii to each bottle (20 × 15 = 300 total). Record initial time and conditions.
- Start feeding schedule (same, small amount daily; avoid overfeeding).

Daily maintenance (Day 1–14)

- Observe and record survival daily (alive count). Remove dead individuals gently.

- Every 2 days: replace ~30% of the bottle volume with freshly prepared treatment water (same composition) to prevent accumulation of waste; measure and record salinity, pH, temperature, DO.
- Measure body length of 5 randomly selected individuals per bottle on days 3, 5, 7, 10 (use stereomicroscope and a ruler/calipers).

Return measured larvae when possible. Note developmental stage.

- Continue for 7–14 days (recommend at least 10 days but 14 days is better for growth trends).

End of experiment

10. Compute survival (%) per bottle and mean lengths. Record final water quality

## DATA COLLECTION PHOTOGRAPHS

Seawater Seawater + Seawater +
Seawater + Seawater +

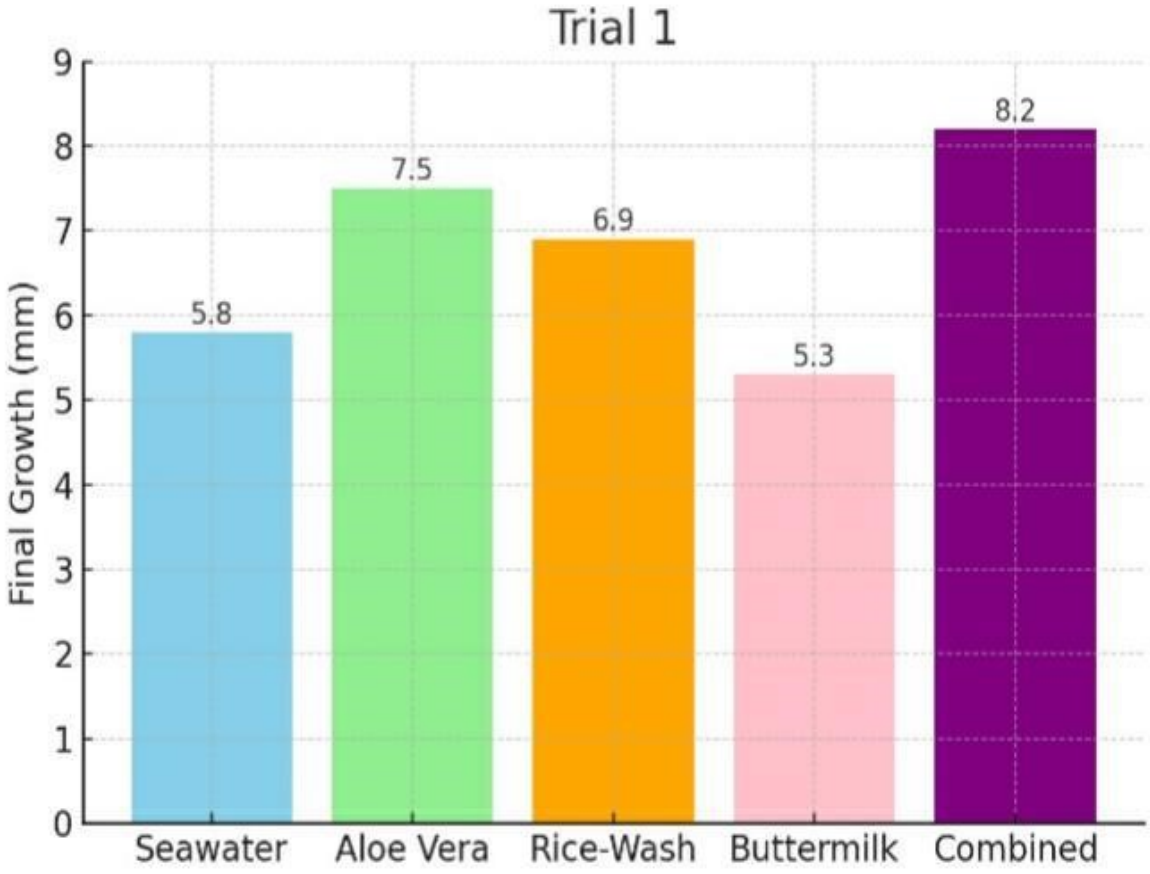
Aloe vera extract Rice-wash water
Fermented buttermilk Aloe + Rice-wash

Growing Artemia

Artemia

# Trial 1

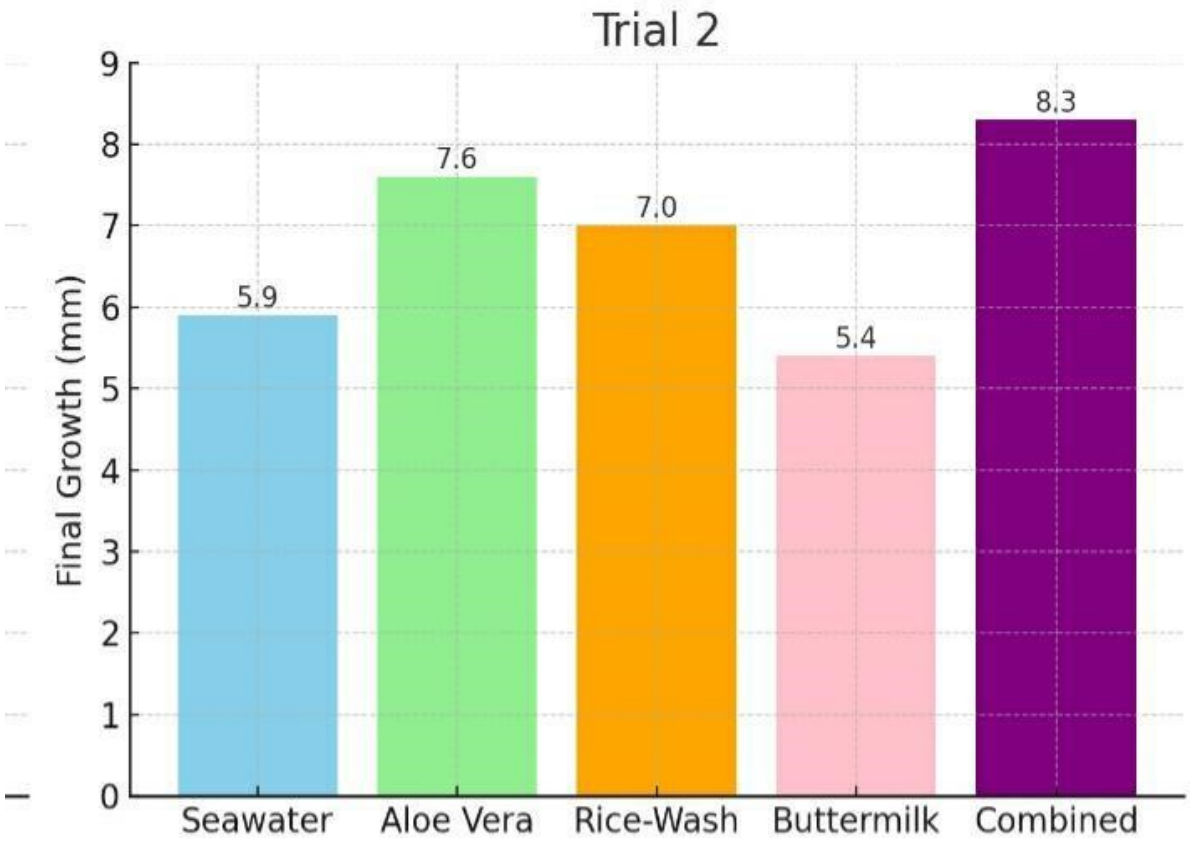
| Water Type | Total No. of Shrimps (Day 0) | Dead Shrimps (Day 2) | Dead Shrimps (Day 4) | Dead Shrimps (Day 6) | Dead Shrimps (Day 8) | Dead Shrimps (Day 10) | Dead Shrimps (Day 12) | Dead Shrimps (Day 14) | Total No. of Dead Shrimps | Final Growth (cm) | Salinity (ppt) | Temperature (°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Seawater (Control)** | 20 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 8 | 0.58 | 30 | 26 | 8 |
| **Aloe vera Extract** | 20 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 3 | 0.75 | 30 | 26 | 8 |
| **Ricewash Water** | 20 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 4 | 0.69 | 30 | 26 | 8 |
| **Fermented Butter milk** | 20 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 6 | 0.53 | 30 | 26 | 8 |
| **Aloe + Ricewash + Butter milk** | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.82 | 30 | 26 | 8 |


Trial 1
Final Growth (mm)
0
1
2
3
4
5
6
7
8
9
5.8
7.5
6.9
5.3
8.2
Seawater
Aloe Vera
Rice-Wash
Buttermilk
Combined

TRIAL 2

| Water Type | Total No. of Shrimps (Day 0) | Dead Shrimps (Day 2) | Dead Shrimps (Day 4) | Dead Shrimps (Day 6) | Dead Shrimps (Day 8) | Dead Shrimps (Day 10) | Dead Shrimps (Day 12) | Dead Shrimps (Day 14) | Total No. of Dead Shrimps | Final Growth (cm) | Salinity (ppt) | Temperature (°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Seawater (Control)** | 20 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 | 0.59 | 30 | 26 | 8 |
| **Aloe vera Extract** | 20 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 0.76 | 30 | 26 | 8 |
| **Ricewash Water** | 20 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 3 | 0.70 | 30 | 26 | 8 |
| **Fermented Buttermilk** | 20 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 6 | 0.54 | 30 | 26 | 8 |
| **Aloe + Ricewash + Buttermilk** | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.83 | 30 | 26 | 8 |

Final Growth of Artemia (mm) Across Three Trials



# TRIAL 3

| Water Type | Total No. of Shrimps (Day 0) | Dead Shrimps (Day 2) | Dead Shrimps (Day 4) | Dead Shrimps (Day 6) | Dead Shrimps (Day 8) | Dead Shrimps (Day 10) | Dead Shrimps (Day 12) | Dead Shrimps (Day 14) | Total No. of Dead Shrimps | Final Growth (cm) | Salinity (ppt) | Temperature (°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Seawater (Control)** | 20 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 8 | 0.57 | 30 | 26 | 8 |
| **Aloe vera Extract** | 20 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 0.74 | 30 | 26 | 8 |
| **Ricewash Water** | 20 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 3 | 0.68 | 30 | 26 | 8 |
| **Fermented Buttermilk** | 20 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 6 | 0.52 | 30 | 26 | 8 |
| **Aloe + Ricewash + Buttermilk** | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.81 | 30 | 26 | 8 |


Trial 3
Final Growth (mm)
0
1
2
3
4
5
6
7
8
9
5.7
7.4
6.8
5.2
8.1
Seawater
Aloe Vera
Rice-Wash
Buttermilk
Combined

# Result

- The Combined booster (Pattern C) resulted in the maximum growth of Artemia larvae across all three trials.
- Aloe vera and rice-wash water also improved growth significantly compared to seawater and buttermilk.
- Seawater (control) and buttermilk showed the least growth.
- The data indicate that natural boosters provide essential nutrients or stimulate metabolic activity, enhancing larval development.

# Conclusion

Natural boosters, particularly when combined (Pattern C), significantly improve the growth of Artemia larvae. Aloe vera and rice-wash water are effective standalone boosters, whereas buttermilk is less effective. These findings can help aquaculture practices by promoting healthier, faster-growing larval feeds

# Applications

- Sustainable aquaculture for fish and shrimp hatcheries.
- Cost-effective alternative to commercial feeds.
- Eco-friendly larval growth enhancement.
- Could be applied to other crustaceans in aquaculture.

## Future Enhancement

- Study long-term survival and reproductive capacity of Artemia under natural boosters.
- Explore combinations of other natural additives for synergistic effects.
- Conduct large-scale trials in hatcheries for practical application.
- Investigate nutritional analysis of larvae grown in different boosters.

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