(BNM) in African catfish *Clarias gariepinus*, where the feed conversion ratio was noted to be 1.20 [48].

E. Survival Rate

The survival rate, defined as the percentage of fish that remained alive during the rearing period compared to the initial stocking number [49], is a key indicator of fish tolerance and viability [50]. Table 3 presents the survival rate of carp fry reared for 42 days.

TABLE III
SURVIVAL RATE OF COMMON CARP FRY

Treatments	Survival Rate (%)
T_A	$70.00^{a} \pm 0.50$
T_B	$80.00^{ab} \pm 0.50$
T_C	$88.33^{b} \pm 0.76$
T_D	$83.33^{b} \pm 0.58$
T_E	$85.00^{b} \pm 0.50$

*Means in the same column followed by the same letter are not significantly different at $p<0.05$

Based on the data in Table 3, feeds supplemented with FRWM exhibited a survival rate exceeding 80%. This can be attributed to the digestibility of feed ingredients processed through fermentation, which reduces the energy expenditure required for digestion and allows for enhanced vitality. [51] support this finding, suggesting that fermented feed ingredients offer improved nutrition and digestibility, resulting in increased energy absorption. A high survival rate is often associated with two other parameters: the feed conversion ratio and the daily growth. Proper fish health management, as indicated by favorable daily growth rates and feed conversion, contributes to an increased survival rate.

The survival rate of fish is influenced by both abiotic and biotic factors, including competition, population density, age, and adaptability to the environment [52]. In this research, age plays a crucial role, as the carp seeds used were relatively uniform, enabling equitable competition for available feed. The survival rates observed in all treatments fell within the normal range. According to [53] guidelines for common carp fry production, a minimum survival rate of 70–80% is considered acceptable, indicating that the overall survival rate in this study meets the specified standards.

Effective cultivation management, including attention to stocking density, feed quality, and water quality, significantly influences the survival rate [54]. Feed quality, particularly through fermentation, plays a vital role in supporting fish survival. FRWM, like other fermented feeds, generally provides higher quality compared to non-fermented feeds, including a softer texture and improved aroma, resulting in increased fish appetite and positively impacting fish growth and survival [55]. However, it is important to note that feeding alone does not singularly affect fish survival; other factors, such as stress during the rearing period, may contribute to fish mortality. [56] concur that carp (*Cyprinus carpio*) survival is not solely dependent on feed quality.

The survival rate of carp fry in this study demonstrated favorable outcomes comparable to previous research. [57] reported a survival rate ranging from 50.0% to 88.9% for common carp fed fermented substrate consisting of rice bran and coconut dregs using *Rhizopus oryzae*. [58] achieved an optimal survival rate of carp ranging from 86.67% to 93.33% with the addition of fermented cassava leaf meal. [59] A survival rate of 96.00% was observed for carp treated with additional fermented cocoa pod meal. Additionally, [60] reported a survival rate ranging from 83% to 100% for carp fed with fermented cassava leaf meal as a substitute, utilizing *Rhizopus* sp.

F. Water Quality

The quality of water is a crucial factor in ensuring the success of fish farming. It plays a significant role in the growth and development of fish. Therefore, it is essential to regularly monitor water quality parameters such as temperature, dissolved oxygen (DO), pH, and ammonia concentration. Once a week, temperature, dissolved oxygen (DO) measurements, and pH levels were taken, whereas ammonia concentration was measured at the beginning, middle, and end of the observation period. The results of the water quality measurements obtained during the study are presented in Table 4.

TABLE IV
AVERAGE VALUE OF WATER QUALITY

Treat.	Observed Parameters			
	Temp. (ºC)	pH	DO (mg/L)	Ammonia (mg/L)
T_A	28.28±0.95	7.98±0.27	6.70±0.82	0.11±0.04
T_B	27.87±1.00	8.00±0.21	6.68±0.89	0.07±0.02
T_C	27.64±0.37	7.87±0.23	6.84±0.87	0.06±0.01
T_D	28.23±1.23	7.90±0.22	6.76±1.04	0.06±0.01
T_E	29.09±1.60	7.90±0.23	6.47±0.95	0.06±0.01
Standard	24-30ºC[a]	6.5 – 8.5[a]	≥3[a]	<1[b]

[a][53], [b][62]

Optimal water quality is crucial for the growth and success of fish farming activities. The results of water quality measurements for all feed treatments during the study indicated that water quality was within the standard range for fish growth [53,62]. The incorporation of fermented FRWM meal in carp feed did not produce any notable impact on water quality throughout the fish-rearing procedure. The pH levels measured during the study ranged from 7.87–8.00, which falls within the pH tolerance limit for carp growth according to [60]. [61] explained that the tolerance limits of organisms to pH can be affected by various factors, including temperature, dissolved oxygen, alkalinity, and the presence of anions and cations. Low pH levels can reduce dissolved oxygen content, which may lead to decreased oxygen consumption, increased respiratory activity, and decreased appetite.

Ammonia (NH3) is a toxic end product of nitrogen metabolism that originates from organic materials and fish metabolism excretions and is eliminated through the kidneys and gill tissue [60]. During the observation period, the recorded water parameter readings for ammonia ranged from 0.06 to 0.11 mg/L, which falls within the acceptable water quality range that promotes the growth of carp. This is consistent with [62] suggestion that the optimal ammonia level for common carp farming is less than 1 mg/L. Maintaining the ammonia level within the acceptable range is essential to prevent the accumulation of toxic substances in the fish farming environment, which can negatively impact fish health and growth.

IV. CONCLUSION

The research findings demonstrate that the probiotic, when used at a dose of 8% (P1), is effective as a starter in the

fermentation process and enhances the chemical composition of FRWM. The protein content increased by 84.25%, while the crude fiber and fat decreased by 15.17% and 3.94%, respectively, surpassing other treatments. Furthermore, the treatment with the most favorable results regarding FRWM was T_E, where 40% FRWM was added. This is evident from the specific growth rate of common carp (*Cyprinus carpio*) fry, which reached 1.05%, a feed conversion ratio of 0.80, and the highest survival rate observed in T_C, with an addition of 20% FRWM, reaching 88.33%. These results highlight the potential of utilizing FRWM as a key ingredient in fish feed, as it can be developed into a viable feed source that improves carp cultivation productivity.

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