Gum Karaya: A Potential Supplement Fish Meal (SFM) For Enhancing Growth And Health In *Labeo Rohita* (Rohu Fish)

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Abstract:
Gum Karaya, is a natural plant-derived polysaccharide used as a mixed blend supplementary fish meal (SFM) in 7 different concentration (1%-7%) with the natural fish meal to enhance the growth and health of *Labeo rohita* (Rohu fish). At the end of the feeding period (21 days) growth performance, body composition, hematological and biochemical parameters of rohu fish were evaluated. The findings reveal a remarkable dose-dependent enhancement in growth performance, exemplified by specific growth rate (SGR), Relative Growth Rate (RGR), and daily weight gain, concomitant with a reduction in feed conversion ratio (FCR). Optimal growth, with a peak RGR of 34.05%, is observed at 5% Gum Karaya supplementation. Fish fed with 5% Gum Karaya exhibited the highest SGR, indicating an optimal supplementation level for maximum growth. Hematological assessments demonstrate a positive dose-dependent response in red blood cell count (RBC), white blood cell count (WBC), and hemoglobin (Hb) levels, which indicate stimulation of immune responses. Moreover, Gum Karaya supplementation led to favorable alterations in the biochemical constituents of fish muscles, including an increase in protein content and a decrease in lipid content. KSFM modulates various physiochemical parameters, including glucose, total protein, cholesterol, triglyceride, high-density lipoprotein (HDL), and low-density lipoprotein (LDL) levels, suggesting enhanced metabolic health. While biological health indices, such as the Gonadosomatic Index (GSI), show promise for improving reproductive health, Hepatosomatic Index (HSI) and Spleenosomatic Index (SSI) exhibit minor variations.
This experiment is first time report on the multifaceted benefits of Gum Karaya in enhancing the physiological and metabolic aspects of *Labeo rohita*, with significant implications for aquaculture practices and selective breeding strategies.

Keywords: Gum Karaya, *Labeo rohita*, dietary supplement, haematological parameters, aquaculture.

1. Introduction

Aquaculture plays a pivotal role in meeting the increasing global demand for Fish food, with freshwater fish species like *Labeo rohita* (commonly known as Rohu) being among the most prominent contributors to this industry, especially in South Asia (FAO, 2018). As consumer preferences shift towards healthier and more sustainable food sources, the quality of fish produced in aquaculture becomes paramount. Consequently, strategies to enhance the growth and health of commercially important species like Rohu are of great interest to the aquaculture sector. Rohu (*Labeo rohita*) is a highly prized freshwater fish in India and is the focus of extensive aquaculture operations in the region (Mandal, & Ghosh, 2019). As a result, efforts to improve the growth and health of rohu have been the subject of considerable research. In Fish farming fish health has direct link with their dietary intake (Hoseinifar et al., 2018). Specifically, diets containing naturally occurring components that can enhance a fish's immunity to diseases (Galal et al., 2018). The use of plant-based extracts and powders as potential replacements for chemical medications has gained importance now a days (Aydar et. al., 2016). Till date various dietary supplements have been explored, including natural compounds derived from plants. plant-derived substances tend to produce fewer adverse side effects compared to their chemical and synthetic food stuff and may even yield positive effects.

Gum karaya, a natural exudate derived from *Sterculia urens* (Paramanik and Bhattacharyya, 2021), has shown promise in several industries due to its unique physicochemical properties. (Prajapati et.al., 2013). It has been utilized in diverse industries, including food, pharmaceuticals, and cosmetics, owing to its unique physicochemical properties, such as its ability to form stable gels and emulsions (Verbeken et.al., 2003). While Gum Karaya has found multiple applications outside the aquaculture sector, its potential as a dietary supplement for enhancing the growth and health of fish, such as rohu, remains relatively unexplored. This work has been carried out to investigate the effects of Gum karaya supplementation on the growth performance, body composition, and haematological and biochemical parameters of rohu fish in aquaculture settings. The hypothesis of this study is that Gum Karaya, as a natural polysaccharide-based compound, may offer benefits as a dietary supplement for rohu fish. The potential for improved growth and health outcomes in fish through the inclusion of gum karaya in their diet will depict an exciting avenue for sustainable aquaculture practices. In this context, the present research aims to bridge the gap in our understanding of gum karaya's role in aquaculture by evaluating its effects on Rohu fish, contributing to the broader goal of improving the production of high-quality, healthy fish in sustainable aquaculture systems. This study represents the pioneering effort in India to investigate the impacts of a karaya gum as a SFM on growth, biochemical, haematological, responses in rohu

2. Materials and Methods:

Experimental Design

A total of seventy healthy rohu fish with an average initial weight of 26.37g were divided into seven groups. Each group was fed with a different supplemented diet- 1) Control group: Basal diet without gum karaya supplementation and 2) Treatment groups: Basal diet supplemented with gum karaya at varying concentrations (e.g., 1% - 7% of the diet). The feeding trial lasted for three weeks. (Hien et. al.,2017).

***Growth Performance Assessment*:**

Initial and final body weights were recorded for each fish. Relative Growth Rate (RGR), Specific Growth Rate (SGR) and Feed intake and feed conversion ratio (FCR) were calculated (Al-Bachry, et. al., 2020; Rahman and Arifuzzaman, 2021).

. Specific growth rate RGR, SGR and FCR were calculated using the following formula:

$$SGR = \frac{\ln(Wf) - \ln(Wi)}{t} \times 100$$

$$RGR = \frac{Wf - Wi}{Wi} \times 100$$

$$FCR = \frac{SFM}{Wf - Wi}$$

Where:
RGR = Relative Growth Rate
FCR = feed conversion ratio
SGR = Specific growth rate (gm/day)
Wf = Final body weight (g)
Wi = Initial body weight (g)
t = Duration of the feeding trial (days)

Body Composition Analysis:

After three weeks of regular feeding with SFM, fish were euthanized, and their whole-body compositions (protein, lipid, carbohydrate, ash) were analysed. The head and internal organs of the collected fishes were discarded. The edible part that is flesh was cut into small pieces and minced. Fillets of rohu was carefully prepared. Flesh was dehydrated at 95-105°C for 48 hours. Dry flesh was homogenised into powder by the help of mortal pestle (Njinkoue et. al., 2016). Total lipids were determined using the Bligh and Dyer (1959) method, and protein content was determined according to the Bradford method (Bradford 1976). Dried flesh was weighted and moisture % were calculated. Total carbohydrate content was quantified with anthrone reagent (Morris,1948). All analyses were performed in triplicate.

Haematological and Biochemical Parameters:

Blood was drawn from all fish under control and experiment group by cardiac puncture using sterile disposable plastic syringe with a 22- gauge needle moisturized with heparin sodium (1%). Blood was transferred into small-sized vials prerinsed with heparin and kept in the ice box. The blood sample was used for the estimation of haemoglobin, erythrocytes, and leucocytes count. Blood samples were collected from fish in each group for haematological and biochemical analysis. Haematological parameters included red blood cell count (RBC), white blood cell count (WBC), haematocrit (Hct), and haemoglobin (Hb) (Thangapandiyan et. al., 2020). Blood plasma were isolated by centrifugation and used for estimation of biochemical parameters viz. glucose, total protein, Cholesterol, TAG, HDL (High Density Lipoproteins) and LDL (Low Density Lipoproteins).

Weights of the liver, gonads, and spleen were recorded to calculate Hepatosomatic Index (HSI), Gonadosomatic Index (GSI) and Spleen somatic Index (SSI) (Abdulrahman et. al., 2019), these indices discriminate the health, condition, and reproductive status of the studied organisms, and they are widely applied in fields such as fisheries biology for scientific assessments and research purposes.

Hepatosomatic Index (HSI): HSI was calculated to evaluate the relative liver weight concerning the total body weight.

$$\text{HSI (\%)} = \frac{\text{Liver weight (gm)}}{\text{Body weight(gm)}} \times 100$$

Gonadosomatic Index (GSI):

GSI was calculated to assess the reproductive condition, with a focus on the gonads (testes or ovaries) relative to the overall body weight.

$$\text{GSI (\%)} = \frac{\text{Gonad weight (gm)}}{\text{Body weight(gm)}} \times 100$$

Spleenosomatic Index (SSI):
SSI was calculated to measure the condition of the spleen concerning body weight.

$$\text{SSI (\%)} = \frac{\text{Spleen weight (gm)}}{\text{Body weight(gm)}} \times 100$$

Statistical analysis
Analysis of variance was conducted by using the general linear models (GLM) using Minitab. Fisher's LSD tests was used to compare between means of the control and experiment treatments

3. Results:
Growth Performance:
Fish in the treatment groups (KSFM: Karaya supplemented Fish Food) were exhibit higher SGR values compared to the control (Fig1). A positive dose-dependent improvement in growth rate indicated by specific growth rate (SGR) was observed along with the increasing concentration of KSFM, however after addition of 4% no significant increase was observed. Additionally, a reduction in feed conversion ratio (FCR) in the treatment groups was recorded which reflects the efficient utilization of dietary nutrients in aquaculture. Relative weight gain rate (%RGR) also significantly increase in KSFM supplementation conditions. Maximum RGR % was 34.05±2.76 in 5% KSFM. There were no significant differences (P> 0.01) in the initial biomass of rohu fish among the different conditions in experiments that lasted 4 weeks, however significant differences (P <0.01) in the total weight gain increase rate (gm) and the daily weight gain in favor of the treatment 4%KSFM by 1.39 gm. A significant difference (P <0.01) between all the concentration of KSFM supplements in the rates of relative growth RGR and specific growth S.G.R. % (w/day) was also observed.

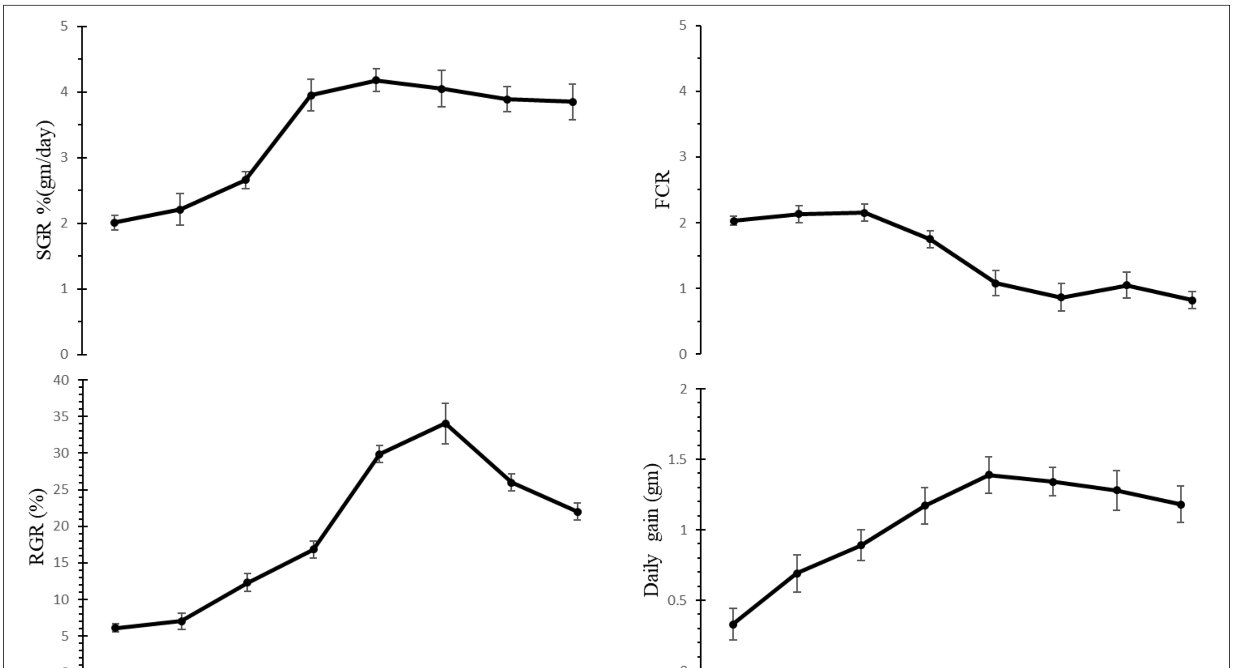

Fig 1: Effect of different concentration of KSFM food supplement on Growth performance of *Labeo rohita* in terms of daily gain, SGR, RGR and FCR.

2. *Biochemical constituents of Fish Muscles of control and experimental fishes:*
Our initial observations showed that Gum Karaya supplementation may lead to favourable changes in the body composition of Rohu fish. KDFM food supplement results a significant increase in protein content(p<0.05) and a significant decrease in lipid content (p<0.01) in the fish (Table 1). These changes in body composition may indicate improved nutritional efficiency and enhanced muscle development in response to gum karaya supplementation. No significant alterations were recorded in moisture content and ash contents in experimental conditions.

Table:1- Approximate composition in 100 g of muscle tissue from *Labio rohita* fed with samples supplemented Gum Karaya basal diets. Values are given as Means ± SD (n = 7).

Nutrients	Control (pure FM)	1% (KSFM)	2% (KSFM)	3% (KSFM)	4% (KSFM)	5% (KSFM)	6% (KSFM)	7% (KSFM)	Significant difference
Moisture (%)	76.63 ± 0.33	76.65±0.33	76.36±0.54	77.05±0.69	76.97±0.33	76.59±0.76	76.65±0.33	76.58±0.46	NS
Protein(gm)	16.47 ± 0.53	16.24±0.55	16.61±0.51	18.77±0.53	19.81±0.53	20.83±0.84	21.73±1.53	24.85±2.18	*
Lipid(gm)	2.86 ± 0.08	3.09±0.69	2.82±0.27	2.14±0.58	1.39±0.14	1.12±0.28	1.17±0.15	1.13±0.15	**
Carbohydrate (gm)	3.56 ± 0.16	3.63±0.16	3.98±0.67	4.22±0.2	4.41±0.33	4.28±0.2	4.28±0.2	4.29±0.2	**
Ash (gm)	2.13 ± 0.13	2.17±0.12	2.21±0.13	2.22±0.14	2.12±0.13	2.12±0.13	2.14±0.14	2.11±0.13	NS

* (P<0.05); ** (P<0.01); NS: not significant

3. *Haematological Parameters:*

Gum Karaya has been associated with potential immunomodulatory effects, and thus, we expected differences in red blood cell count (RBC), white blood cell count (WBC), haematocrit (Hct or packed-cell volume (PCV)), and haemoglobin (Hb) levels. The results on different blood parameters indicate that the values of red blood cell counts (RBCs), white blood cell counts (WBCs) and Haemoglobin (Hb%) was increased significantly in fish of group with maximum increase rate at 4% and 5% KSFM food supplements (Table 2). However, no significant Variation was observed on hematocrit (PCV) contents. significant alterations in these parameters may suggest an enhancement of the fish's immune system.

Table 2: Hematological parameters of *Labio rohita* fed with supplemented Gum Karaya basal diets Values are given as Means ± SD (n = 7).

	Control (pure FM)	1% (KSFM)	2% (KSFM)	3% (KSFM)	4% (KSFM)	5% (KSFM)	6% (KSFM)	7% (KSFM)	Significant difference
RBC ($10^6/mm^3$)	1.34 ± 0.29	1.36±0.28	1.32±0.15	1.41±0.15	1.85±0.33	1.86±0.46	1.36±0.33	1.33±0.15	*
WBC ($10^3/mm^3$)	10.30 ± 0.28	10.86±0.25	11.05±0.32	11.60±0.35	11.85±0.2	12.55±0.23	12.80±0.35	12.78±0.28	**
Hb ($g.dL^{-1}$)	7.86 ± 0.29	7.84±0.33	8.16±0.33	8.85±0.67	9.11±0.67	9.24±0.37	9.27±1.02	9.24±0.86	*
PCV (Haematocrit)	35.7 ± 2.73	35.76±2.47	35.73±2.79	35.9±2.61	35.83±2.78	35.89±2.87	35.81±2.69	35.83±2.77	NS

* (P<0.05); ** (P<0.01); NS: not significant

4. *Physiochemical Parameters:*

Preliminary data suggest that Gum Karaya supplementation may influence various biochemical parameters related to metabolic and hepatic functions. Serum biochemical parameters in terms of glucose, total protein and cholesterol level, Triglyceride, HDL and LDL of fish both control and experimental conditions are presented in Table 3. The concentration of cholesterol, triglycerides, LDL decreased significantly ($p < 0.05$) in the blood serum of fish where as glucose, total protein and HDL content increased significantly in response to KSFM. These changes may indicate improved metabolic health and liver function.

Table3: Physiochemical Parameters of *Labio rohita* fed with supplemented Gum Karaya basal diets Values are given as Means ± SD (n = 7).

	Control (pure FM)	1% (KSFM)	2% (KSFM)	3% (KSFM)	4% (KSFM)	5% (KSFM)	6% (KSFM)	7% (KSFM)	Significant difference
Glucose	1.74±0.33	2.04±0.34	2.15±0.34	2.24±0.36	2.39±0.32	2.43±0.33	2.42±0.35	2.43±0.34	**
Total protein	38.05±1.13	36.16±1.12	38.69±1.11	39.02±1.13	41.27±1.14	41.34±1.13	41.47±1.15	41.52±1.13	*
Cholesterol	2.97±0.42	3.11±0.44	3.05±0.41	2.98±0.52	2.71±0.37	2.64±0.42	2.58±0.38	2.46±0.37	**
Triglyceride	2.6±0.41	2.55±0.37	2.31±0.35	1.98±0.32	1.56±0.3	1.44±0.22	1.37±0.23	1.23±0.2	**
HDL	1.18±0.12	1.42±0.13	2.16±0.17	2.58±0.24	3.41±0.34	3.89±0.32	4.05±0.41	4.19±0.44	**
LDL	1.27±0.13	1.14±0.11	1.02±0.1	0.91±0.12	0.84±0.11	0.82±0.1	0.84±0.1	0.79±0.12	**

* (P<0.05); ** (P<0.01); NS: not significant

5. Biological health indices:

Different indices to know the physiological health status were calculated in terms of Gonadosomatic Index, Hepatosomatic Index and Spleenosomatic Index, represented in table 4. Results shows a positive correlation of Gonadosomatic Index along with increasing concentration of KSFM($p \leq 0.05$), however no significant difference of Hepatosomatic Index and spleenosomatic Index were recorded.

Table 4: *Biological health indices* of *Labio rohita* fed with supplemented Gum Karaya basal diets Values are given as Means ± SD (n = 7)

	Gonadosomatic Index	Hepatosomatic Index	Spleenosomatic Index
Control (pure FM)	0.694±0.33	1.791±0.44	0.117±0.04
1% (KSFM)	0.668±0.32	1.768±0.38	0.118±0.02
2% (KSFM)	0.746±0.35	1.781±0.26	0.119±0.02
3% (KSFM)	0.797±0.36	1.71±0.78	0.125±0.03
4% (KSFM)	0.877±0.34	1.869±0.4	0.128±0.02
5% (KSFM)	0.895±0.35	1.867±0.41	0.122±0.04
6% (KSFM)	0.902±0.37	1.878±0.45	0.123±0.03
7% (KSFM)	0.912±0.41	1.881±0.43	0.121±0.05
*Significant p≤0.05	**	NS	NS

4. Discussion:

Growth Performance:

The results of our study indicate a notable improvement in the growth performance of Rohu fish with Gum Karaya supplementation. This finding aligns with previous research demonstrating the positive effects of dietary supplements on fish growth (NRC, 2011). The observed dose-dependent increase in specific growth rate (SGR), Relative Growth Rate (RGR) and daily weight gain, whereas a decrease in feed conversion ratio (FCR) in treated groups corroborate the notion that Gum Karaya enhances the utilization of dietary nutrients for growth (NRC, 2011; Chen et al., 2018). Similar growth-promoting effects have been reported for other natural polysaccharides in fish (Zahran et al., 2014). These results suggest that Gum Karaya has the potential to be a valuable dietary supplement for aquaculture operations aiming to improve the growth performance of rohu fish. Fish receiving 5% Karaya gum supplementation exhibited the highest RGR (34.05%), suggesting an optimal supplementation level for maximum growth. This optimal level, however, appears to diminish slightly (no significant alteration) when supplementation is increased to 6% and 7%, where the RGR values decrease to 26% and 22.01% respectively. This pattern of growth enhancement aligns with prior research in fish nutrition (Chen et. al., 2020), Such findings underscore the potential benefits of dietary supplementation strategies in aquaculture (Tacon and Metian, 2008; Tacon and Metian, 2015).

The control group exhibited a daily weight gain rate of 0.33 grams, while fish receiving 1% supplementation displayed a noticeable increase to 0.69 grams. As supplementation levels continued to rise, so did the daily weight gain rates, reaching a peak of 1.39 grams in the 4% supplementation group. However, it's noteworthy that the daily weight gain rates declined slightly at the highest supplementation levels of 6% and 7% (1.28 and 1.18 grams respectively). These results corroborate the dose-dependent growth-enhancing effects of Karaya gum observed in the study, aligning with prior research on algae extract supplementation in *Labeo rohita* (Sattanathan et. al.,2022).

Biochemical constituents of Fish Muscles of control and experimental fishes:

The alteration in biochemical constituents, specifically the increase in protein content and the decrease in lipid content in fish receiving Gum Karaya supplementation, is a promising outcome. This indicates a shift towards a more favourable protein-to-lipid ratio in the fish, which is desirable for producing high-quality, lean fish with market appeal (Jobling, 2012; Li et. al., 2021). At the same time the carbohydrate content also increased in a significant quantity by gum karaya supplementation, thus the findings support the idea that Gum Karaya may influence nutrient deposition patterns and potentially enhance muscle development (Li et al., 2021). Further investigations into the underlying mechanisms of these changes are warranted to optimize its application in aquaculture. No significant change in ash content across all food supplemented fish suggests that Karaya gum supplementation did not have a substantial impact on the mineral content of the fish. This observation aligns with the idea that dietary supplements like Karaya gum may primarily influence macronutrient utilization and growth rather than altering the mineral composition of fish tissue (Staffolo et. al., 2012)

Haematological Parameters:

In this experiment hematological measures were used to assess the physiological condition of the *Labeo rohita*. As noted by Svobodová et al. (2005), these parameters are commonly utilized to evaluate the nutritional status and dietary composition concerning the fish's habitat. White blood cell count (WBC), red blood cell count (RBC), and hematocrit (HCT) are instrumental in evaluating feed toxicity and fish health (Ozovehe, 2013). In our study, it was observed that RBC, WBC, and hemoglobin (Hb) levels exhibited dose-dependent increases, with the most significant increments noted in fish fed diets containing 4% to 5% of the KSFM with fish meal. Hb, RBC, and WBC contents significantly changed throughout the supplementation levels suggests that use of gum karaya for fishmeal did not have a negative impact on fish health. The results support the finding of experimental diets on the haematological parameters of healthy catfish (Dienye and Olumuji, 2014; Erhunmwunse and Ainerua, 2013). Different concentration of KSFM have considerably different levels of WBC and RBC, which show the presence of physiological characteristics and rising levels of antigens in the circulatory system (Taufek et. al., 2016). More RBC facilitates better oxygen transmission, which improve fish health. Increase in WBC contents reveals that KSFM food additive help in better anti-infection and immunostimulatory actions as earlier reported in spirulina food supplementation by Yeganeh et. al., (2015). The potential immunomodulatory effects of Gum Karaya are noteworthy. Research on other natural compounds, such as beta-glucans, has demonstrated their ability to enhance the immune response in fish (Kumar et al., 2019).

Physiochemical Parameters:

The experimental conditions involving Rohu fish with Karaya gum (KSFM) food supplementation across various concentrations have yielded diverse and remarkable outcomes in terms of biochemical parameters. Changes in these parameters are indicative of how Karaya gum supplementation can impact the metabolic health of the fish. The findings reveal a dose-dependent trend in several key biochemical markers: Glucose Levels: The results demonstrate a gradual increase in glucose levels with increasing Karaya gum supplementation, suggesting that higher supplementation levels may be associated with greater glucose utilization or availability. This observation aligns with previous research on dietary supplements influencing glucose metabolism in fish (Li et. al., 2020). Total Protein Levels: Total protein levels exhibit fluctuations but generally follow a similar trend of increasing with higher Karaya gum supplementation levels. This suggests that the supplementation may positively influence protein metabolism and synthesis in the fish. Previous studies have shown similar effects of dietary supplements on protein metabolism (Wang et. al., 2019). Cholesterol and Triglyceride Levels: Cholesterol levels show fluctuations, with a peak at 2% supplementation, while triglyceride levels gradually decline with increasing supplementation levels. These changes may indicate variations in lipid metabolism influenced by Karaya gum supplementation. Research in fish nutrition has previously reported the impact of dietary additives on lipid profiles (Gou et al., 2021). HDL and LDL Levels: High-density lipoprotein (HDL) levels exhibit a substantial increase with higher Karaya gum supplementation, while low-density lipoprotein (LDL) levels follow a decreasing trend. These shifts suggest a positive influence on lipid profile, with higher levels of HDL (often referred to as "good cholesterol") potentially indicating improved cardiovascular health in fish. The effects on HDL and LDL are consistent with the influence of dietary supplements on lipid metabolism in fish (Zheng et. al., 2017; Stacpoole et. al., 1989). The results highlight the complex interplay between Karaya gum supplementation and various metabolic parameters in Rohu fish. The dose-dependent responses observed in glucose, total protein, cholesterol, triglyceride, HDL, and LDL levels suggest that Karaya gum may have a modulatory effect on fish metabolism. These findings contribute to our understanding of how dietary supplements can influence the metabolic health of fish, with potential implications for aquaculture practices and nutrition.

Biological health indices:

The changes observed in different biological health indices like Gonadosomatic Index (GSI), Hepatosomatic Index (HSI) and Spleenosomatic Index (SSI) of Rohu fish under different Karaya gum (KSFM) supplementation levels provide valuable insights into how this dietary supplement affects the fish's reproductive and physiological health. These indices provide insights into potential effects on reproduction, liver size, and immune system health, further research is needed to fully understand the mechanisms behind these changes and their implications for Rohu fish physiology and aquaculture practices

Gonadosomatic Index (GSI): The GSI reflects the relative size of the gonads (reproductive organs) compared to the total body weight of the fish. In this study, GSI shows a slight increase with increasing Karaya gum supplementation, with the highest value observed at 7% supplementation though maximum rate of increase was observed on 4%KSFM supplement (26.37% compared to control) followed by slower increase up to 31.42, this result indicates that KSFM supplement induces early sexual maturity to the fish (Wani et. al., 2018).

Hepatosomatic Index (HSI): HSI measures the relative size of the liver compared to the total body weight. The results show modest variations in HSI across different supplementation levels. While these changes are not significant, they suggest that Karaya gum supplementation may not have a pronounced impact on liver size or function in rohu fish. This aligns with the idea that the supplement primarily affects other aspects of fish metabolism and physiology, as discussed in previous responses.

Spleenosomatic Index (SSI): The spleen is a key organ in the immune system, and its size can be influenced by various factors, including stress and disease (Kole et. al., 2018). SSI reflects the relative size of the spleen compared to the total body weight. In this study, SSI displays minor fluctuations across supplementation levels, without a clear dose-dependent trend. These variations may be within the normal range of biological variability and may not indicate a substantial influence of Karaya gum on spleen size.

While these indices provide insights into potential effects on reproduction, liver size, and immune system health, further research is needed to fully understand the mechanisms behind these changes and their implications for Rohu fish physiology and aquaculture practices

5. Conclusion:

In conclusion, use of Gum Karaya as a dietary supplement in the feeding schedule of Rohu fish has shown substantial benefits for growth performance and metabolic health. The research findings revealed a clear dose-dependent improvement in various growth parameters, including specific growth rate (SGR), Relative Growth Rate (RGR), and daily weight gain, coupled with a reduction in feed conversion ratio (FCR). These results underscore the potential of Gum Karaya to enhance the efficient utilization of dietary nutrients, making it a promising candidate for aquaculture operations seeking to optimize the growth performance of Rohu fish. Alterations in biochemical constituents of fish muscles, including increased protein content and decreased lipid content, support the quality improvement on fish health. Significant variation in physiochemical parameters, such as glucose, total protein, and lipid levels, suggest a modulatory effect of Gum Karaya on fish metabolism. While the study offers insights into the supplement's potential benefits on reproductive health and immunostimulatory effects. With reference of biological health indices, the Gonadosomatic Index (GSI) increases with KSFM supplementation why may trigger early sexual maturity, offering valuable prospects for selective breeding and aquaculture management. However, the Hepatosomatic Index (HSI) and Spleenosomatic Index (SSI) displayed only minor variations across supplementation levels, suggesting that Gum Karaya may not exert significant effects on liver size or spleen size. These findings collectively illustrate the multiple impact of Gum Karaya on the metabolic and physiological parameters of Rohu fish, highlighting its potential as a versatile dietary supplement in aquaculture.

The findings of this study hold significant implications for the aquaculture industry, particularly for Rohu fish production. Gum Karaya has shown promise as a natural dietary supplement that can enhance growth, improve body composition, and potentially boost immune function and metabolic health in Rohu fish.

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Conflict of Interest:
This manuscript is free from any conflict of interest.

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