DETERMINATION OF BIOCHEMICAL COMPOSITION AND PARASITIC INFESTATION OF *RITA RITA* (HAMILTON-BUCHANAN, 1822)

Shahela Alam[1*] and Hamida Khanum[2]

Dhaka Commerce College, Mirpur, Dhaka-1216, Bangladesh

ABSTRACT: A total of 350 *Rita rita* were examined from January 2018 to December 2019 for investigations on parasite infestation and proximate composition. From *R. rita*, a total of nine species of parasites were recovered and identified, including one ecto-parasite (*Lernaea cyprinacea*) and eight endo-parasites. Among the endo-parasites, there were four trematodes (*Notoporus leiognathi*, *Saccacoelium obesum*, *Sterrhurus musculus* and *Clinostomum piscidium*), one nematode (*Ascaroid* larva) and three acanthocephalans (*Cavisoma magnum*, *Corynosoma alaskense* and *Corynosoma strumosum*). The parasite community was dominated by trematodes and acanthocephalans comprising 59.12% and 31.99% of the total number of helminth parasites dominated by *Notoporus leiognathi* (18.26%) trematodes. The prevalence of infestation of ecto-parasite was 24.8% (87 specimens) and mean intensity was 3.34 ± 1.62 per infested fish. The prevalence of infestation of endo-parasites was 64.57% (226 specimens) with intensity 2.64 ± 1.12. The observation on biochemical analysis of *R. rita* presented small variation in nutrient contents. Protein (17.11%), fat (6.07%), moisture (74.09%), carbohydrate (3.95%) and ash level (1.43%) were higher in non-infected than infected fish.

Key words: *Rita rita*, Fish parasites, Biochemical composition, Carbohydrate, Protein, Moisture, Ash.

INTRODUCTION

Body composition is a good indicator of a physiological health of fish. Its analysis provides an idea about percentage of moisture, protein, fat, ash and their relation into size and condition factor (Shammi and Bhatnagar, 2002). Body composition illustrates the nutritional quality of food because analysis of biochemical composition including protein, fat and ash is very important in assessing food value (Kamal *et al.*, 2007). So, biochemical evaluation is necessary to ensure the nutritional value as well as eating quality fish (Azam *et al.*, 2004). The parasites causes depletion of the nutritional contents in host's

body and results in the low productivity, loss in fish industry (Hiware, 1999). Understanding the biochemical composition of *Rita rita* helps assess the nutritional value of the fish, which is crucial for both human consumption and aquaculture. This information can guide dietary recommendations and improve food security. Analyzing the biochemical components, such as proteins, fats, vitamins and minerals can provide insights into the health and growth potential of the species. This is particularly relevant for aquaculture practices, where optimizing feed formulations can enhance growth rates and overall fish health. The biochemical composition can serve as an indicator of the environmental health of aquatic ecosystems. Changes in composition may reflect the impact of pollution, habitat degradation or changes in food availability. For conservation purposes, understanding the biochemical makeup of *Rita rita* can inform strategies to protect the species and its habitat, especially if it is threatened or endangered. Raman (2017) reported the proximate composition, amino acid, fatty acid and mineral composition of different size groups of *R. rita*. Proximate analysis showed that the fish is rich in protein and low in fat. The protein content (19.55%) was found to be the highest in medium size fishes.

Rita is important commercial fish due to its meat taste (Anonymous, 2000). However it has become critically endangered and red listed. Many scientist works on different aspects of this commercially important food fish like (Laghari *et al.*, 2009 and Jafri *et al.*, 1998) but no literature is available on body composition of this important catfish. So, present work will be useful for consumers to get nutritional rich fillet of fish for consumption. Fish and shellfish can be used as an efficient meat replacement in meat-eating countries, thanks to their lower environmental impact than livestock animals that are fit for human consumption (de Boer *et al.*, 2020). Fish typically contains 66%–81% water, 16%–21% protein, 1.2%–1.5% mineral, 0.2%–25% fat, and 0%–0.5% carbohydrate. Carbohydrates and non-protein compounds are often in negligible percentages, typically <0.5% (Ahmed *et al.*, 2022 and Arjunsinh *et al.*, 2024). *Rita rita* is typically found in freshwater environments such as rivers, lakes and ponds across South Asia. Its ecological status is closely linked to the health of these aquatic ecosystems, which can be affected by pollution, habitat destruction and changes in water quality. As a bottom feeder, *Rita rita* plays a crucial role in the aquatic food web. It helps maintain the balance of the ecosystem by consuming detritus and organic matter, which contributes to nutrient cycling. Climate change poses a significant threat to freshwater ecosystems, potentially altering the habitats and conditions necessary for *Rita rita*'s survival. Changes in water temperature, flow patterns and availability of resources can impact its ecological status. The present observation had been done on biochemical analysis of *R. rita* and variation in nutrient contents eg.

protein, fat, moisture, carbohydrate and ash level in non-infected and infected fish. Understanding the nutritional profile of *Rita rita* can lead to improved aquaculture practices. By optimizing feed formulations based on the fish's biochemical composition, farmers can increase growth rates and yield, boosting production and profitability in the aquaculture sector. As a source of protein, *Rita rita* can play a significant role in food security. Research that highlights its nutritional value can promote its consumption, contributing to improved dietary diversity and nutrition for local populations, particularly in regions dependent on fish as a primary protein source. The study can raise awareness about the health benefits of consuming *Rita rita*, encouraging marginalized populations to incorporate it into their diets. This can lead to improved health outcomes, particularly in areas where access to diverse food sources is limited. Involving marginalized communities in research initiatives can empower them and provide opportunities for education and skill development. This engagement can foster a sense of ownership and responsibility toward local resources. Research findings can inform sustainable fishing methods, helping marginalized communities maintain fish populations and protect their livelihoods in the long term. Sustainable practices can prevent overfishing and ensure that fish stocks remain viable.

MATERIAL AND METHODS

A total of 350 *Rita rita* specimens were autopsied and examined from January 2018 to December 2019, collected from Swarighat in the Dhaka district of Bangladesh. After collection, the fish were placed in an ice box with ice and transported to the laboratory for observation. The weighed samples were thoroughly rinsed with saline water (0.75%) and dried by absorbing moisture with filter paper. The cleaned and dried fish were treated separately according to the specific methods required for analyzing different nutrient contents of *R. rita*. Each nutrient analysis was repeated 3 to 5 times and the mean values were recorded. The washed samples were soaked with blotting paper and then with filter paper at room temperature to eliminate surface water. They were promptly placed in desiccators to prevent further moisture evaporation while determining their proximate composition, including moisture content, protein, fat and carbohydrate. These determinations were conducted following the methods outlined by Gopalan (1971) and A.O.A.C. (1975).

Methods for biochemical analysis:

Determination of moisture content: 3 – 5 gm was taken in a constant weight crucible. It was then dried at 100-105ºC temperature in an oven for 4 hours and

cooled in a desiccators and weight again. Heating, drying, cooling and weighting were continued until a constant weight was obtained (Gopalan, 1971).

Calculation:

Initial weight = Sample weight + crucible weight (Before heating)

Final weight = Sample weight+ crucible weight (After heating)

$$\text{Percentage of moisture} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Sample weight}}$$

Determination of protein content: The protein content of a food stuff may be obtained by estimating the nitrogen content of the material and multiply the nitrogen value by 6.25 (A.O.A.C. 2000). This was referred to as crude protein content, since the non-protein nitrogen (NPN) present in the material was taken into consideration in the present investigation.

Reagent Preparation:

Digestion Mixture: A mixture of potassium sulfate and copper sulfate was prepared in a ratio of 98 g to 2 g. The components were finely powdered using a mortar and pestle and thoroughly mixed.

Sulfuric Acid Solution (0.1 N): Concentrated sulfuric acid (2.78 ml) was carefully added to distilled water, and the total volume was adjusted to 1000 ml. The solution was standardized using a standard sodium carbonate (0.1 N) solution.

Sodium Hydroxide Solution (0.1 N): Sodium hydroxide (4 g) was dissolved in distilled water, and the volume was made up to 1000 ml. This solution was standardized using a standard sulfuric acid (0.1 N) solution.

Sodium Carbonate Solution (0.1 N): Anhydrous sodium carbonate (5.3 g) was dissolved in distilled water, and the volume was adjusted to 1000 ml.

Sodium Hydroxide(40%): Sodium hydroxide (40%) was prepared by dissolving the appropriate amount in distilled water to make a final volume of 100 ml.

Methyl Red Indicator: Methyl red indicator (0.1 g) was dissolved in 60 ml of alcohol, and the volume was brought up to 100 ml with distilled water.

Procedure: The Kjeldahl method for protein determination consists of three main steps: digestion, distillation, and titration.

Digestion: An accurately measured sample was placed on weighing paper and transferred to a clean, dry 500 ml Kjeldahl flask. To this flask, 5 g of the digestion mixture and 25 ml of pure concentrated sulfuric acid were added. A glass rod was inserted to prevent frothing and bumping. A blank flask containing all reagents except the sample was prepared for comparison. The

flasks were heated in a Kjeldahl digestion chamber, starting at a low temperature (10°C) until frothing ceased, followed by an increase to 60°C until the solution became colorless. After digestion, the flasks were cooled and diluted with 100 ml of distilled water. A small piece of litmus paper was added to confirm the solution was acidic.

Distillation: Prior to distillation, the Kjeldahl apparatus was thoroughly washed with distilled water. In a receiving 250 ml conical flask, 25 ml of 0.1 N sulfuric acid was added. In a measuring cylinder, 75 ml of 40% sodium hydroxide was prepared and carefully poured down the side of the Kjeldahl flask, resulting in a blue litmus paper indicating alkalinity. The flask was sealed with a stopper containing a connecting tube, which was connected to the ammonia receiving flask containing 0.1 N sulfuric acid. The mixture was boiled at a controlled rate to ensure that water and ammonia distilled over steadily, avoiding the suction of sulfuric acid into the Kjeldahl flask and preventing ammonia from escaping.

Titration: The ammonia absorbed in the receiving flask containing 0.1 N sulfuric acid was titrated with 0.1 N sodium hydroxide, using three drops of methyl red as an indicator. A reagent blank was also distilled and titrated for comparison.

Calculation: The protein content of the sample was calculated using the following formula:

$$\text{Percentage of Protein} = \frac{(c-b) \times 14d \times 6.25 \times 100}{a \times 1000}$$

Where:

a = Sample weight (g)

b = Volume of sodium hydroxide required for back titration to neutralize 25 ml of 0.1 N H_2SO_4 (for sample)

c = Volume of sodium hydroxide required for back titration to neutralize 25 ml of 0.1 N H_2SO_4 (for blank)

d = Normality of sodium hydroxide used for titration

The conversion factor of nitrogen to protein is 6.25, and the atomic weight of nitrogen is 14.

Determination of fat content: A moisture-free sample weighing 5 g was placed in a conical flask, and 100 ml of a chloroform: methanol solution (2:1) was added. The mixture was allowed to stand overnight to facilitate extraction. Following this, the sample was filtered, and the filtrate was transferred to a separating funnel. To the filtrate, 20 ml of a 0.58% sodium chloride solution was added. The separating funnel was shaken vigorously to ensure proper mixing

and then allowed to stand for 4 to 6 hours. After this period, the lower phase was collected and washed repeatedly with sodium chloride solution until the lower phase appeared clear. Finally, the lower phase was transferred to a dry, pre-weighed conical flask, and the fat content was estimated gravimetrically.

Calculation:

$$\text{Percentage of fat} = \frac{\text{Weight of extract}}{\text{Sample weight}} \times 100$$

Determination of carbohydrate content: The content of available carbohydrate was calculated by difference i.e.by subtracting the sum of the value (per 100 gm) for moisture, ash, protein and fat from 100 gm (A.O.A.C. 2000).

Determination of calorie content: The calorie content of the fish flesh was calculated by multiplying by carbohydrate, protein and fat by 4, 4 and 9 respectively (A.O.A.C. 2000).

RESULTS AND DISCUSSION

In the present study, an attempt has been taken due to determine the percentage (g/100 g) of nutrients such as moisture, ash, fat, protein, carbohydrate contents (mg/100 g) and energy (K cal) in *R. rita*. The results of the proximate composition of *R. rita* have been analyzed to compare the values of components in the two species of infected and non-infected fishes, in different size groups and also due to determine the relationship of the nutritional components with rate of infestation.
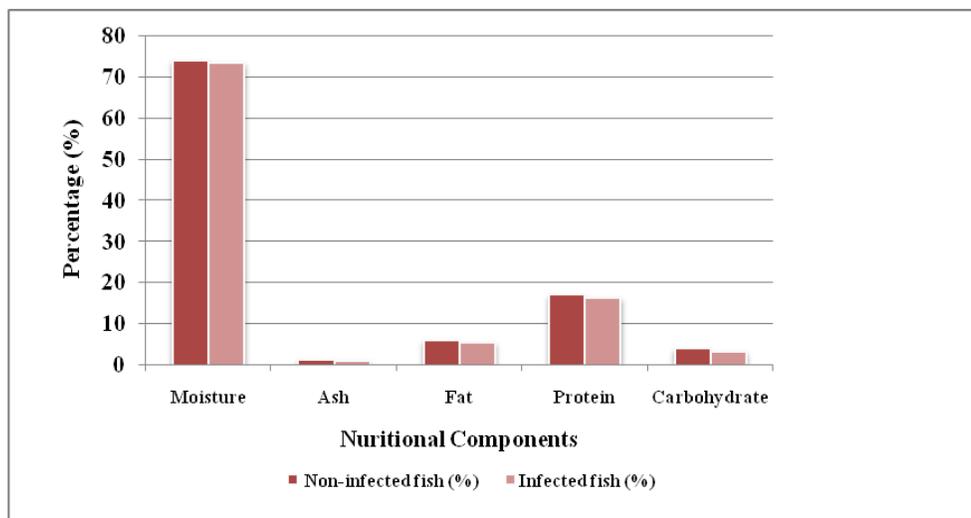

Fig. 1. Percentage of nutritional components in infected and non-infected *R. rita*
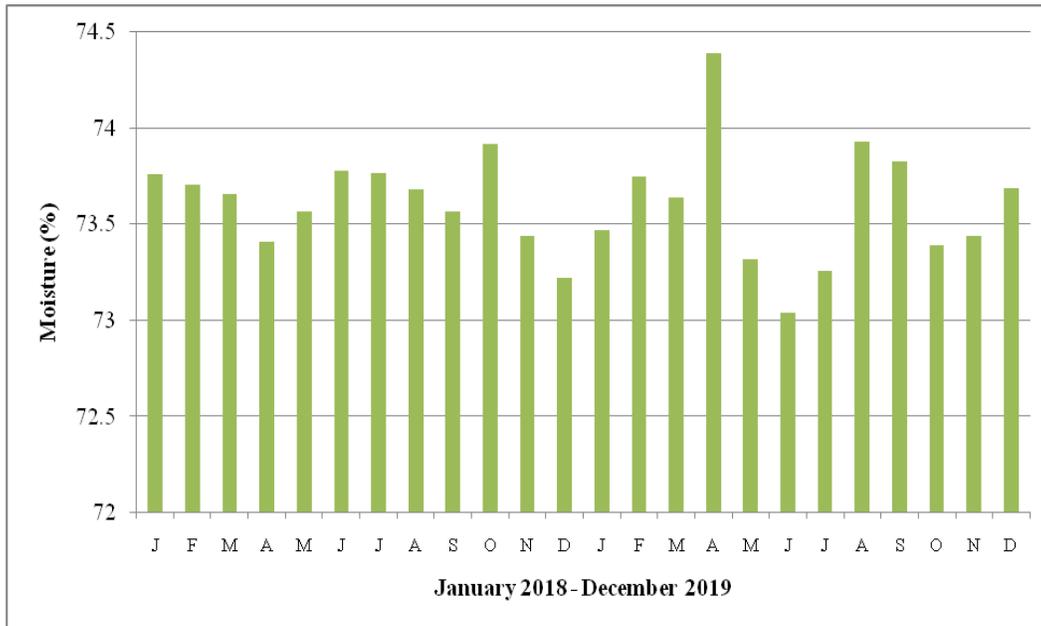
Fig. 2. Monthly percentage of moisture in *R. rita* (January 2018 – December 2019)
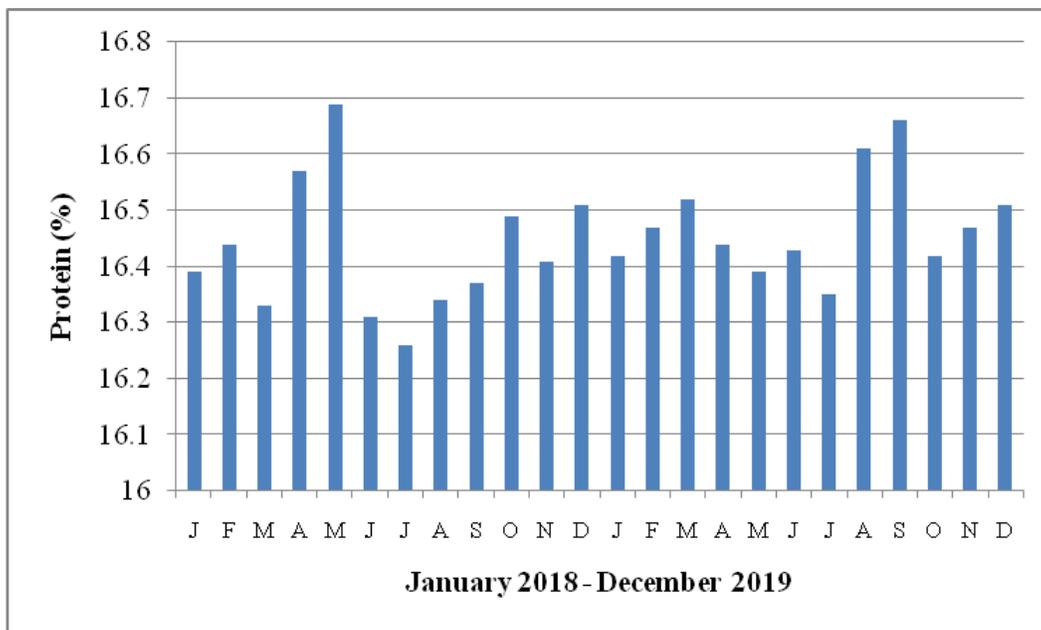

Fig. 3. Monthly percentage of protein in *R. rita* (January 2018 – December 2019)

In infected *R. rita*, the percentage of nutritional components were as, moisture: 73.61g/100g, ash 1.12g/100g, fat 5.51 g/100g, protein 16.45g/100g and

carbohydrate was 3.27 %. Besides these, the non-infected *R. rita* contains the nutritional components as- the moisture 74.09 g/100g, ash 1.43g/100g, fat 6.07g/100g, protein 17.11g/100g and carbohydrate was 3.95% (Fig.1). In *R. rita*, the percentage of moisture was higher in rainy season (73.92 g/100g, Oct'18) whereas, the lower moisture content was recorded in winter (73.22 g/100g, Dec'18). In 2019, the maximum percentage of moisture was recorded in summer (74.39 g/100g in April'19) while the minimum was also in summer (73.04 g/100g in June'19) [Fig-2].
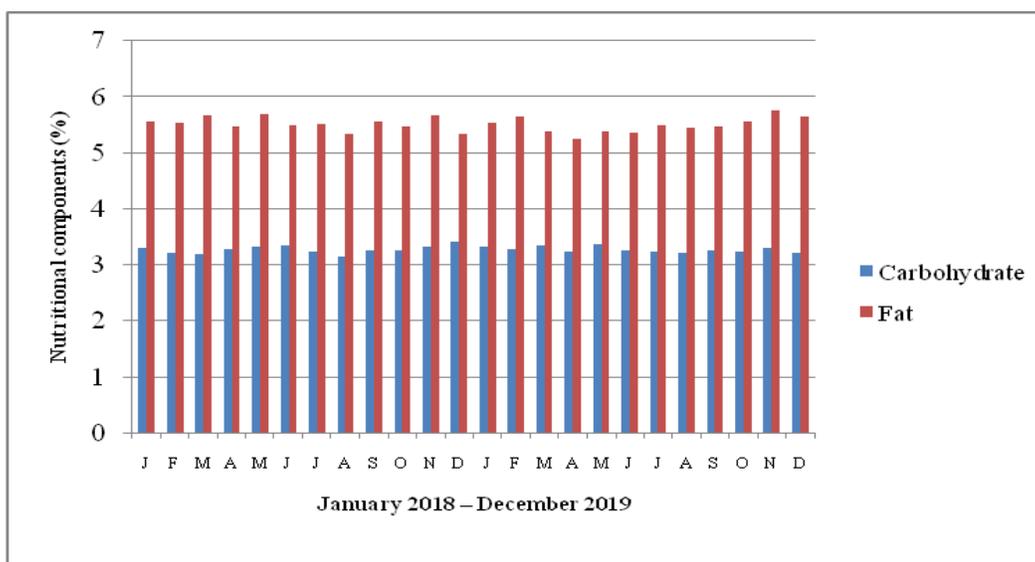

Fig. 4. Monthly percentage of nutritional components (fat and carbohydrate) in *R. rita* (January 2018 – December 2019)

The pattern of seasonal variation of percentage of protein content in *R. rita* was recorded maximum in 2018 in summer (16.69 g/100g, May'18) and the value was lowest during rainy season (16.26 g/100g in July'18). The highest percentage of protein content 16.66g/100 g was observed during rainy season (Sep'19) while the lowest was 16.35g/100 g recorded in rainy season (July'19) [Fig-3]. The percentage of carbohydrate in *R. rita* was higher during winter (3.41 g/100g, Dec'18) and lower during rainy season (3.14 g/100g, Aug'18) while in 2019, the maximum percentage was recorded also in summer (3.36 g/100g, May'19) and the minimum was in rainy season (3.21g/100g, Aug'19) [Fig-4]. In 2018, the highest value of fat in *R. rita* was observed during summer (5.69g/100g, May'18) and the lowest value was in winter (5.33g/100g, Dec'18). In 2019, the value was higher in winter (5.77 g/100g, Nov'19) while, the lower
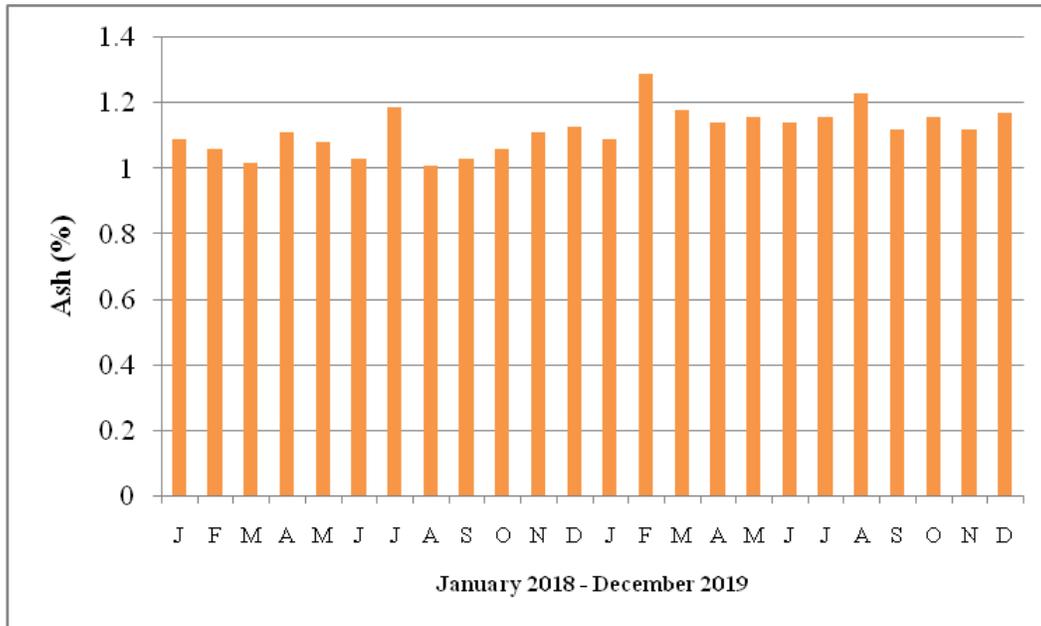
Fig. 5. Monthly percentage of ash in *R. rita* (January 2018 – December 2019)

was found in summer (5.26 g/100g, April'19) [Fig-4]. In Jan-Dec'18, the maximum percentage of ash in *R. rita* was recorded during winter (1.13g/100g, Dec'18) while the minimum was in rainy season (1.01g/100g, Aug'18). In 2019, the highest value was found in winter (1.29g/100g, Feb'19) and the lowest value was found also in winter (1.09g/100g, Jan'19) [Fig-5]. Fishes are rich in having good nutritive value, serving as a food for human being which is a most important group of vertebrates (Prakash and Verma, 2018; Kumar *et al.*, 2020). There are both micro and macro nutrients present in fish. The macro nutrients are proteins, fats, and carbohydrate, whereas, the micro nutrients like vitamins and minerals are crucial components (Mohanty, 2015). Protein contains nitrogen, carbon, hydrogen and oxygen. Protein got multiple physiological importance as a growth material for the organism, a part of fuel of the organism, structures of living materials are composed of different types of protein molecules. Carbohydrate is readily available fuel of the body, constitutes the structural material of the organism plays as a key role in the metabolism of amino acids and fatty acids. The above mentioned nutritional components promote the value of *Rita rita* to the common people and make them more interest to take these fishes enormously than the other fishes.In the present investigation, 87 out of 350 *R. rita* were found to be infected with a single ectoparasite species, *Lernaea cyprinacea*, showing a prevalence of 24.8% and a mean intensity of 3.34 ± 1.62 (Fig-6).
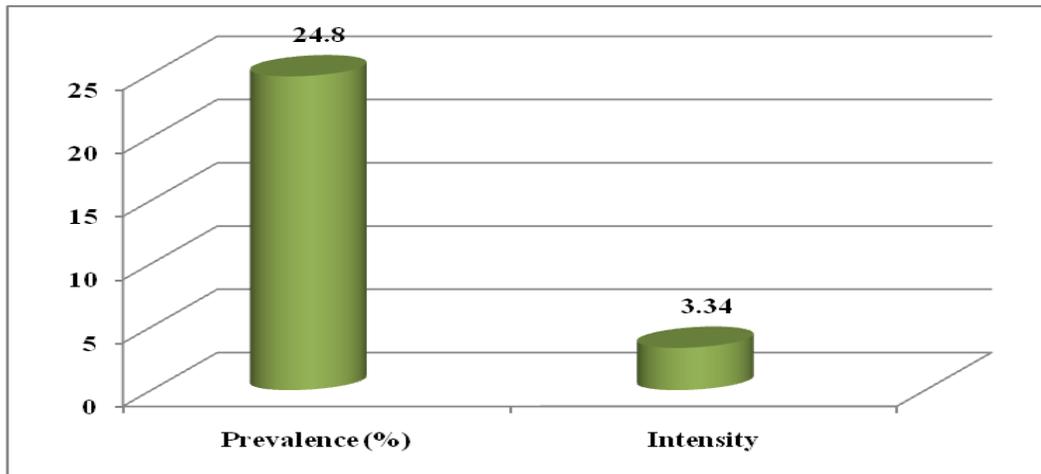
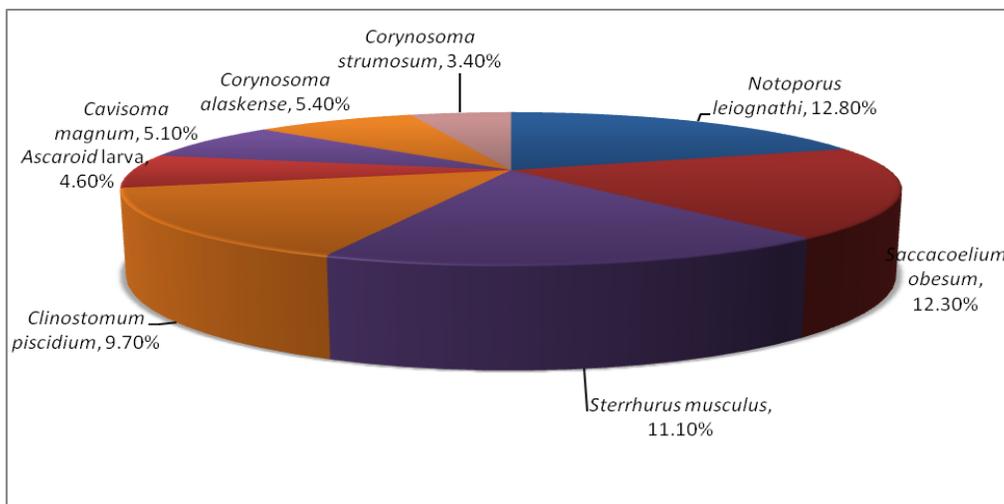Fig. 6. Prevalence and intensity of ecto-parasite (*Lernaea cyprinacea*) in *R. rita*

Fig 7. Prevalence of endo-parasites in *R.rita* (January 2018 – December 2019)

The four trematode species recorded in *R. rita*—*N. leiognathi, S. obesum, S. musculus* and *C. piscidium*—showed prevalences of 12.8%, 12.3%, 11.1% and 9.7%, with mean intensities of 2.42 ± 0.61, 2.42 ± 0.61, 1.82 ± 0.46 and 2.03 ± 0.51, respectively. In addition, three species of acanthocephalans were collected from *R. rita*: *Cavisoma magnum, Corynosoma alaskense* and *Corynosoma strumosum*, with prevalences of 5.1%, 5.4%, and 3.4% and mean intensities of 2.72 ± 0.68, 4.63 ± 1.16 and 4.50 ± 1.13, respectively. The *Ascaroid* larva was the only nematode species detected in *R. rita*, exhibiting a prevalence of 4.6%

and a mean intensity of 3.31 ± 0.83 and was moderately abundant, accounting for 8.87% of the total parasite population (Fig-7).

According to Chilima (2007), fish is generally a good source of protein, containing 18 - 20%. Protein and fat are the two most important nutrients found in fish and their levels tell us how well the organism is able to meet its nutritional needs. Fish have varying chemical compositions depending on the age, sex, environment and season with protein levels ranging from 16-21%, lipids 0.1-25%, ash 0.4-1%, moisture 60-81% and even high moisture content of 96% (Muraleedharan *et. al.*, 1996).
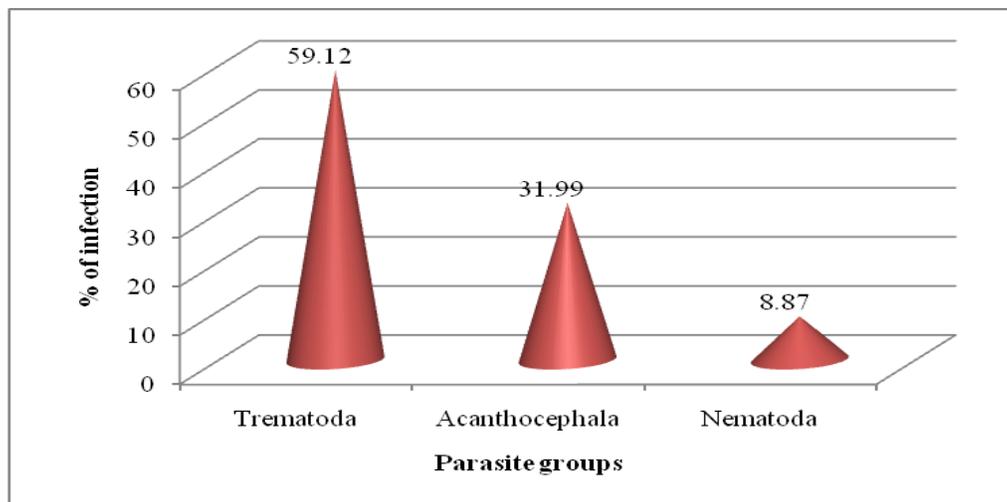

Fig. 8. Percentage of infestation of different endo-parasite groups in *R. rita*

Among the different classes, the rate of infestation of trematodes in *R. rita* was 59.12%. The second highest infestation rate was 31.99% for acanthocephala and then the last group nematodes were 8.87% (Fig-8).

A fluctuation in the individual biochemical components of the flesh, throughout the year was observed in both infected and non-infected fishes. Protein, carbohydrate, fat contents were higher in winter (dry months) than the summer (hot months), analysis which agrees with Adhikari and Noor (1967) in case of *Puntius puntius*. On the other hand, it is also evident from the present results that moisture was higher in winter and lower in summer. Moisture content was always higher in infected female than infected male in both the fishes because during spawning period the fishes naturally showed lower percentage of nutrient contents. Rubbi *et al.*, 1987 showed that incase of some fresh water fish, moisture contents were higher, protein and fat contents were lower in matured female fish with eggs.

In the present investigation, the analytical determination of nutrient contents (moisture, protein, fat, carbohydrate and ash) of *R. rita* were done by the conventional methods demonstrated by A.O.A.C., 1975 and Pearson, 1962 on weight basis.

The techniques for analysis of data and the terms used to denote the relationships of host-parasites were expressed according to Margolis *et al.*, 1982. To complete the statistical calculation of the present data, the "chi-square test", proportion test (p =), correlation – coefficient test (r =) and simple significance of student "t-test" (Baily, 1959; Winifred, 1972) were computed. Johnstone (1918) analyzed the amount of fat in Halibut and the ranged from 0.5% - 9.6% where the protein content remained constant at close to 18%. Stansby (1954) found the micro nutrient content of the edible flesh of certain freshwater fishes and those were 76.8% moisture, 1.2% ash, 5% fat and 19% protein. Jafri (1968a, 1968b and 1969) published a series of work on the seasonal changes in the biochemical compositions of common carp *Cirrhina mrigala*, catfish *Mystus seenghala*, freshwater murrel *Ophiocepfalus punctatus* and catfish *Wallagonia attu*. He indicated that the nutritive value of *W. attu* is higher than that of *M. seenghala*. He determined the changes in fat, moisture, protein and ash contents. The highest fat content in the muscle coincided with the period of peak ripeness. The protein cycle in various tissues showed a close relationship with maturation and spawning. Protein value in all the tissues was generally low during the winter. Jafri (1969) worked on the seasonal changes in the biochemical composition of common carp and cat fish including *W. attu*. He indicated that the nutritive value of *W. attu* is higher than that of *Mystus seenghala*.

Biochemical composition of fish shows very wide variation from one species to another within the same species in different portions of the body, from season to season, according to age, size, growth etc. The important constituents of the fish in their order of magnitude are moisture, protein, fat and minerals. Flesh from healthy fish contains 60 – 84% water, 15- 24% protein and 0.1 -2% fat. The proportions of constituents are species specific and main variation seen in fat content. Lean fish have less than 0.5% fat and fatty fish have more than 2% fat (Haque, 1975). People of all ages from children over a year to older persons can enjoy fish, because its protein is highly digestible (Nittleton, 1985). The protein from fish source would of utmost importance in supplying the nutritional need for the under nourished children as well as pregnant and lactating woman. Thus fish protein is the best animal protein and very much essential for human body development, but parasitic infestation interferes with the protein contents of fish body. Fish proteins comprise all the ten essential amino acids in desirable

strength for human consumption. Aside from the main components such as moisture, protein, fat and ash, fish contains many other important micro nutrients (Calcium, phosphorus, iron, vitamins etc.). It is rich of essential dietary requirements constituted of protein (6-28%), moisture (28-90%), oil (0.2 – 64%), ash (0.4 – 1.5%), carbohydrate 0.6% (maximum), vitamins: A,B,C,D and E. Fishes are also good source of riboflavin, iron, calcium, phosphorus and magnesium (Banu *et al.*, 1991).

Flowra *et al.*, 2012 worked to assess the proximate composition, five dried fish samples of *Mystus vittatus*, *Channa punctatus*, *Chanda nama*, *Corica soborna* and *Trichuirus haumela.* They reported that moisture content ranged from 14.06% to 24.58%, protein varied between 44.08% to 65.65% (moisture basis) and 53.45% to 76.39% (dry matter basis); lipid content of the selected dried fishes ranged from 1.91% to 17.76% (moisture basis) and 2.31% to 21.54% (dry matter basis); Ash content varied from 9.63% to 22.73% (moisture basis) and 11.21% to 28.15% (dry matter basis). Laghari *et al.*, 2019 investigated *Tilapia Zillii* biochemical composition and nutrient content. They discovered that the range of moisture, protein, fat, and ash content percentages varied from month to month. Roopma *et al.*, (2013) reported to investigate the effect of frozen storage on the proximate, biochemical and microbial profile of the muscle of a silurid cat fish (*Wallago attu*). The fish muscle was subjected to the frozen storage for a period of one month and the analysis was carried out at an interval of 10 days. It was observed that proximate composition viz. protein, lipid, moisture and ash content decreased significantly ($P<0.05$) with increase in the duration of frozen period. The fresh (unfrozen) samples revealed the highest values for all i.e.15.45 ± 0.2% for protein, 4.02 ± 0.04% for lipid, 81.66 ± 0.03 for moisture and 1.48 ± 0.1% for ash while the least values were observed at the end of one month frozen storage period i.e. 10.14 ± 0.015%, 2.36 ± 0.03%, 74 ± 0.05% and 1.33 ± 0.02% for protein, lipid, moisture and ash respectively. Thus, considering the importance from consumer point of view, these studies reveal that a significant loss is observed in fish during frozen storage. However, it could be implied that fish could be kept under frozen conditions when preservation is of utmost importance, so as to retain its taste and nutrition. Zaman and Khanum (2013) worked on proximate analysis of *Mystus aor* (Hamilton) and *Mystus bleekeri* (Day) in relation to parasitic infestation. A total 1011 *Mystus aor* and 1039 *Mystus bleekeri* were examined during January 2004 to December 2005. The results of the biochemical analysis revealed that protein and carbohydrate contents were found higher in *M. bleekeri* than in *M. aor*, while, lipid content was much higher in *M. aor*. In uninfected *M. aor*, the percentage of moisture and lipid (68.54 ± 1p.40 g/100g and 5.70 ± 0.45 g/100g) observed higher than uninfected *M. bleekeri* (67.11 ± 1.59 g/100g and 4.49 ± 0.33 g/100g) while, the values of protein and carbohydrate contents were higher in

uninfected *M. bleekeri* than uninfected *M. aor.* In infected *M. aor* and *M. bleekeri,* the percentage of moisture (72.38± 1.5 g/100g and 72.85 ± 1.52 g/100g) found higher than uninfected one. The percentage of protein, lipids and carbohydrate were higher in uninfected fishes than in the infected fishes. Moisture content in both the catfishes found higher during hot and wet seasons and lower in dry season, while, the value of carbohydrate found higher in dry season and comparatively lower in hot and wet seasons. Tidame *et al.,* 2021 experimented with rohu, mrigala, silver pomfret, pomfret which were selected for carrying out estimation of protein and carbohydrate from their body tissue. Authors reported the amount of protein in rohu was 9.406 mg/g, mrigala 6.901 mg/g, silver pomfret 8.868 mg/g and pomfret 6.428 mg/g respectively; the carbohydrate content as 0.258 mg/g in rohu, 3.151mg/g in mrigala, 0.0097 mg/g in pomfret and 1.69 mg/g in silver pomfret. The authors concluded that, rohu is rich in protein followed by silver pomfret whereas; mrigal contains more carbohydrates as compared to remaining fishes under study.

The analyzed results of nutritional components revealed that, the moisture content of *R. rita* was 73.61 g / 100 g whereas, the percentage of protein and fat contents were16.45 g / 100 g and 5.51 g / 100 g. Non-infected fish exhibited significantly greater amounts of biochemical nutritional components (moisture, protein, fat, carbohydrate, and ash) compared to infected fish. Gull *et al.*, 2024 shows seasonal variation strongly influences the proximate composition and essential element content of pelagic and demersal fish, reflecting the effects of habitat and feeding habits on energy transfer. Essential elements followed the order K > Na > Ca > Mg > Mn > Zn, with highest levels during the spring inter-monsoon, while biochemical composition peaked in pelagic species during the southwest monsoon and summer, and was lowest for all species during the autumn inter-monsoon.

Rehman *et al.*, 2024 showed that the fish *Rita rita* contained 77.62 ± 3.47% water, 0.73 ± 0.19% ash (wet weight), 0.87 ± 0.19% fat (wet weight) and 20.78 ± 3.32% protein (wet weight). Correlation analysis revealed that water content was highly significantly correlated with protein (r = 0.996), organic content (r = 0.999) and ash (r = 0.339), while body weight showed significant correlations with most body constituents, including fat (r = 0.808) and protein (r=0.628). Khan *et al.*, 2025 worked with three fish species, *Notopterus notopterus* (Foli), *Ompok pabo* (Pabda) and *Cirrhinus reba* (Raik), that are native to the Mathabhanga River were the subjects of this study to assess their nutritional values. There were differences in the percentages of the fishes' biochemical composition; three species have notable amounts of moisture (64.37 to 77.70%), crude protein (13.87 to 17.18 %), crude fat (2.92 to 12.54 %), ash (2.36 to 5.86 *%), carbohydrate* (2.19 to 3.06%) and energy (92.46 to 197.09 Kcal/100g) respectively.

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