A Study On Biochemical Composition Of Eri Pupae (Pilosamia Ricini)

Meenakshi Dutta Mazumdar

Abstract:— Philosamia ricini commonly known as 'eri' silkworm is reared by the indigenous tribes of Assam to obtain eri silk as well as to consume the pupae as a delicacy. For proper utilization of eri silkworm pupae it is necessary to have a detailed knowledge of its biochemical composition. In the present study, biochemical components in terms of moisture, dry matter, organic matter, total ash, minerals, crude fibre, soluble fibre of eri pupae were determined. Lipids were extracted using petroleum ether as solvent and total lipid was determined gravimetrically. A few lipid parameters viz. specific gravity, refractive index, iodine value, saponification value, acid value and cholesterol were also determined. Results of the study indicated that eri pupa is a potential source of protein and dietary lipid with a substantial amount of other nutrients.

Index Terms:— ash, biochemical analysis, lipid parameters, minerals, Philosamia ricini, protein, pupae

1 INTRODUCTION

India is the only country in the world producing all four varieties of natural silk viz.eri, tassar, mulberry and muga on commercial basis. The sericultural activity is mostly confined to the Brahmaputra valley and the surrounding areas extending to the foothills towards the North and the South. The North - Eastern states are the only region in the world where all four types of silkworms are reared. Of these eri culture is probably of indigenous origin and eri is distinctly different from others as it fulfills the requirements of warm clothing for poor rural folk(the poor man's silk) and the pupae constitute one of the major protein sources for the tribal people engaged in eri rearing. Genarally,after getting the silk from cocoons, the pupa are thrown away as wastes, but pupae from eri silkworm are not considered as waste as it is consumed by the tribal communities as delicacy.Judicial utilization of silkworm as a source of food is practised in many countries of the world[1]. [1]. Eri pupae has been reported as a delicious food item[2]. A large majority of the population in the country is malnourished and there is no denying the fact that inadequate diet is the chief cause of such malnutrition. Moreover, the rapidly rising demand for food cannot be met with the traditional protein sources of animal origin . As such search for non-traditional protein sources becomes a basic necessity to cope up with protein deficiency diseases [3].The human being are also used to eat silkworm pupae since long before in Asian silk-producing countries, and are considered as a delicacy in regions of India [4] and elsewhere. Moreover, judicious utilization of eri pupae can be a source of income through by-product generation [5]. Although a vast quantity of eri pupae is available in Assam, no systematic approach has been made to utilize this natural resource. The present study was therefore, designed with the objective to evaluate the biochemical composition of eri pupae.

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2 MATERIAL AND METHODS

Eri pupae were collected from the Department of Sericulture , Khanapara . The raw pupae were sun dried for three days, ground to powdered form and stored for use. The dried pupae were analysed for the biochemical constituents viz. moisture, crude protein, crude fibre, ash, calcium, iron, phosphorus,lipid extract and total lipid [6].Lipid of eri pupae was further characterized from the values of certain parameters called fat constants or lipid parameters. In the present study, the physical characteristics viz., specific gravity and refractive index and the chemical characteristics viz., iodine value, acid value and saponification value were also determined as per standard methods [6].The cholesterol content of eri lipid was determined by $FeCl_3$- H_2 SO_4 method. The different constituents of eri lipid viz. neutral lipid, glycolipid and phospholipid were separated by column chromatography. The datas were entered and analyzed and the variables for the laboratory parameters were expressed as mean and standard deviation.

3 RESULTS AND DISCUSSION

The biochemical composition of eri pupae has been depicted in Table1. In the present study the percentage of crude protein in eri pupae was found to be 59.40% which is comparable to the value of waste muga pupae and mulberry silkworm pupae 59.66% and 60.7% respectively as reported by[7][8]. The crude protein in waste muga pupae was observed to be between 58.4 to 60.9% as opined by[9] . It was further reported by[10] that deoiled silkworm pupae meal contained 66.13% of crude protein and full fat silkworm pupae contained 45.6% of crude protein. The crude protein in waste pupae of mulberry silkworm and in spent silkworm pupae are 48.98 and 48.75 percent respectively [11]. The crude protein of defatted pupae of the Antheraea pernyi was reported to be 71.9%[12]. The percentage of soluble protein in eri pupae was found to be 54.25% in the present investigation while[9] reported 52.57% in waste muga pupae. The percentage of total protein in silk worm pupae(Bombyx mori) was 55.6% as reported by([13].The high percentage of crude protein and soluble protein in eri pupae is indicative of its use as a protein source.

***Table 1**. Biochemical composition of Eri pupae in percentage (on dry matter basis)*

Parameters	Values
Moisture	8.60 ±0.05
Dry matter	91.40±0.26
Organic matter	95.12±0.19
Crude protein	59.40±0.25
Soluble protein	54.25±0.20
Lipid extract	19.17±0.07
Total lipid	25.00±0.20
Crude fibre	5.85±0.13
Nitrogen free extract	4.87±0.11
Total ash	4.88±0.17
Calcium	0.15±0.01
Phosphorus	0.61±0.01
Iron	0.04±0.02

The percentage of moisture content was found to be 8.60% which is a little higher than the reported value of [11] which is 7.18% in waste pupae of mulberry silkworm. The moisture content of waste muga pupae was observed to be 7.46% [9].The crude fibre content of eri pupae was found to be 5.85% which was comparable to the value 5.80% in mulbery pupae observed by [8]. The result of the present investigation showed that the percentage of ash in eri pupae was 4.88% whereas[11],[8] observed 2.19% and 5.8% respectively of ash in waste pupae of mulberry silkworm. The ash content reflects the amount of minerals present. The present study revealed that the percentage of calcium, phosphorus and iron are 0.15, 0.61 and 0.04 respectively. The reported value of phosphorus, and calcium in spent silkworm pupae are 474mg/100g and 158mg/100g [14]. In the present investigation the extraction of lipid was tried using Soxhlet extractor with petroleum ether as solvent The result showed 19.17% of lipid extract in eri pupae. The higher percentage of ether extract 27.58%and 25.75% in silkworm pupae was reported by[10],[8]. In another study, [13] reported much high content 32.2% of lipid in silk worm pupae of Bombyx mori. Total lipid content in eri pupae was gravimetrically estimated and it was found out that there exists a difference of 4-5% between the amount of total lipid and lipid extract. This indicates that 4-5% of lipid is not extractable by solvent extraction method. The present study also revealed that the refractive index and specific gravity of eri lipid are 1.42 at 30^0C and 1.09 at 35^0C respectively (Table 2). The refractive index of eri lipid is comparable to beef tallow 1.45 and muga lipid 1.48 [15],[16] . The comparatively high value of refractive index indicates long chain of unsaturated fatty acids. The specific gravity of eri lipid is also comparatively higher 1.09 in comparison to the value of muga lipid which is indicative of long chain fatty acids in eri lipid.

***Table 2:** Lipid parameters of Eri pupae*

Parameters	Value
Refractive index	1.42±0.03
Specific gravity	1.09±0.01
Iodine value	137.58±0.20
Saponification value	204.37±0.23
Acid value	77. 62±0.25
Cholesterol(%)	0.50±0.02

The iodine value gives an estimate of the relative amount of unsaturated fatty acid in the lipid. The iodine value of eri lipid was found to be 137.58 which is higher than the iodine value of muga lipid (114.92) reported by [16].The high iodine value of eri lipid indicates the presence of higher amount of unsaturated fatty acids compared to other animal lipids, namely chicken fat (64-76), lard (52-77), beef tallow (40-48),[15]

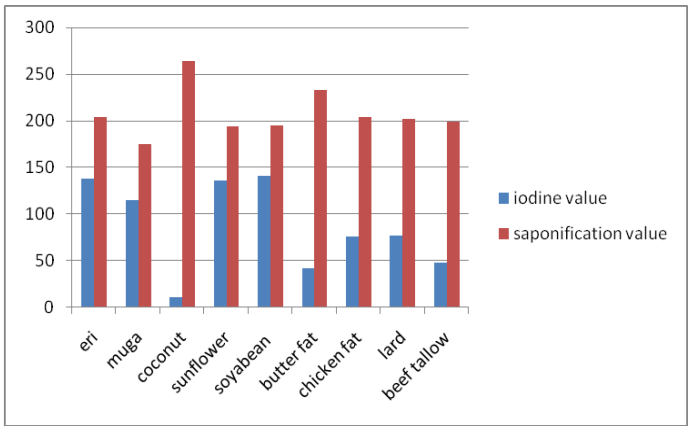

***Fig. 1** : Comparison of iodine value and saponification value of Eri lipid with different edible lipids*

The saponification value of lipids is indicative of the average molar mass and the size of fatty acid chain in the lipid. The present study reveals higher saponification value of eri lipid (204.37) than the reported value of muga lipid which is 175 [16]. However, the saponification value of eri lipid is comparable to most of the dietary lipids like chicken fat (194-204), lard (190-202), [15] Fig1. Acid value provides an idea about the amount of free fatty acids present in a lipid. The acid value of eri lipid was found to be 77.62. However,[16] reported higher acid value of muga lipid (153) in comparison to eri lipid. Low acid values in eri lipid indicate the presence of low amount of free fatty acids and have a lower tendency to become rancid than muga lipid. In the present investigation the percentages of neutral lipid and glycolipid were found to be 37.73% and 55.39% respectively which are little lower than the reported value of waste muga [16].The phospholipid was found to be 1.63%which can be compared with the values of butter1%[17].

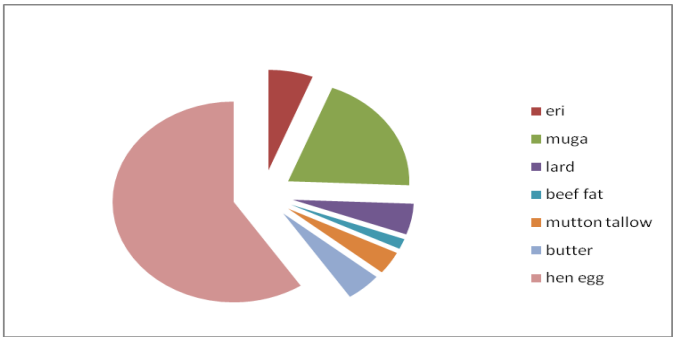

***Fig:2** Percentage of cholesterol content in eri lipid and in other lipids of animal origin*

Among sterols cholesterol is predominant in animal lipids. The percentage of cholesterol in the present investigation was found to be 0.50. The cholesterol content in eri lipid is almost comparable to the cholesterol of lard (0.37-0.42) [17].The cholesterol value of muga lipid reported in thestudy[16] was much higher 1.66 than eri lipid in the present investigation. Comparison of cholesterol content of eri lipid with some common edible lipids and muga lipid is depicted in Fig.2

4 CONCLUSION

The present study revealed that eri pupae on analysis have shown the presence of high percentage of crude and soluble protein, substantial amount of dietary lipids, organic matter, crude fibre and a number of minerals like calcium, phosphorus and iron. Due to the potential source of protein , eri pupae can be used as a non-traditional protein source in human diet to cope with protein deficiency diseases. As eri pupae can be procured in fresh condition, there is a scope to prepare protein rich food from eri pupae for human consumption.The lipid parameters viz. specific gravity, refractive index, iodine value, saponification value and acid value and also the presence of cholesterol, neutral lipid, glycolipid and phospholipid indicate the good quality of lipids present in eri pupae. Moreover, the lipid portion of eri pupae is of good quality. The lipids can be extracted for utilization in other fields like production of soap and detergents, paints and varnishes etc. The lipids of eri pupae also have a good dietary value.

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