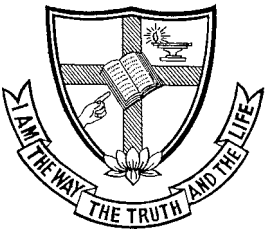
RATIONAL DISCOURSE

Vol.XII. No.1 & 2 January - December 2006

AN INTERDISCIPLINARY REFEREED JOURNAL
OF CURRENT RESEARCH
AND STUDIES



ACADEMIC CELL
MAR THOMA COLLEGE, TIRUVALLA,
KERALA - 689 103, INDIA

RATIONAL DISCOURSE

National Reg. No. 2493/96, ISSN No.0972 - 2955

Rational Discourse is a bi-annual registerd National Refereed Journal on topics of current research and studies in all disciplines, published by the Academic Cell of the Mar Thoma College, Tiruvalla, Kerala, affiliated to Mahatama Gandhi University and Accredited by the Nationl Assessment and Accreditation Council.

Subscription Rates		
Institutions	:	Rs. 150.00
Individuals	:	Rs. 75.00
Students	:	Rs. 40.00

Printed and Published by Prof. Koshy Thomas on behalf of
The Academic Cell, Mar Thoma College, Tiruvalla.
Type Setting and Printing:
Evangel Press, Tiruvalla. Ph. 0469 - 2630223

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INCHING TOWARDS NELCYNDA

Alex Mathew*
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Nelcynda figures prominently as an emporium of spice trade in the classical geographies. Though there are several pointers from ethnography and literature no systematic survey and study of archaeological remains have been carried out so far for the precise identification of the port. The paper seeks to forward the hypothesis that Nelcynda of the classical geographies may be Nakkida, near Tiruvalla. The hypothesis will help determine the specific locations for explorations which could bring out the much needed archaeological attestation with respect to the identification. We intend to proceed by recapitulating the precise references in the classical geographies and correlating them with information from ethnography and literature about the place. The paper also seeks to provide information on the widespread distribution of megalithic remains around Nakkida.

BACKGROUND

A commonly shared assumption in the historiography of Kerala is that 'no part of India was better known to the Romans than the Malabar coast', thanks to the availability of rare products such as the spices and the forest goods.[1] The period of trade/exchange relations of Malabar Coast with the outside world has been dated to a period as early as 1000 B C (Thomas 1932). The volume of maritime trade is argued to have increased with the frequency of the voyages in the first century AD, as the navigators learnt by this time, the

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rhythm of the South West and North East monsoon winds for sailing from the Red sea coast in July and returning from the Malabar Coast in December. The phenomenon usually referred to in historical writings as the 'Hippalus winds', enabled the voyagers to set sail from the Red Sea ports straight across the ocean and reach Muzuris on the Mala Coast in 40 days. By this time the Romans have come to dominate the trade with the East. With the steady growth of Roman economic strength, the shipment of spices from the Malabar Coast also seems to have increased. References in contemporary Roman records on the drain of silver and gold coins from the Empire is testified by the presence of huge hoards of gold and silver coins from different parts of South India. Three books on geography—*Periplus Maris Erythraei* of unknown authorship written in about the mid 1st century A D, *Naturalis Historia* of Pliny the Elder written about a decade later and *Geographia* by Ptolomy written during the mid 2nd century—are demonstrative of the prevailing compulsions for sea-faring enterprise driven by an irresistible desire for luxury goods. The most important item of export from the Malabar Coast was pepper.

Of the various ports mentioned in the geographies, those on the Malabar Coast, such as Muzuris, Tyndis, Barake and Nelcynda were of greater significance. The identification of the above ports however remains an intricate problem. It is only about the Muzuris—lying on the Periyar River near Kodungalloor—that there are confident claims. Even in this case, opinions vary as to where exactly on the Periyar the port should be located.[2]

Next in importance to Muzuris is Nelcynda, which according to *Periplus* (*PME*), was five hundred *stadia* south of Muzuris. The present paper seeks to focus on the issues relating to the identification of Nelcynda. It is hypothesised that Nelcynda of the classical geographies is Nakkida near Tiruvalla. The hypothesis is offered in the light of a re-reading of the classical accounts and correlating this reading with ethnographic and literary information about the place and so also with widespread distribution of megalithic remains around Nakkida. Conditions favoured the emergence Nakkida as a port from where could be disposed off huge stocks of pepper procured from the vast expanse of dense spice/pepper yielding lands. These lands

covered the vast lush green forest cover, located in between 30 and 55 minutes of the 76 degrees East longitudinal lines and between 20 and 30 minutes of the 9 degree North latitudinal lines. We also find a huge network of waterways right from the Western Ghats right up to the earliest palaeo-coastal line at Nakkida during the heydays of Red Sea trade. Nakkida is the specific spot where the two rivers Manimala and Pampa rivers come closest and get linked. We also find a linkage from Nakkida to the Achenkovil River which permits access to a still wider area of rich pepper growing regions along the Achenkovil River up to Punalur on the Western Ghats or even beyond.

Earlier Attempts

Scholars have tried to identify the port of Nakkida with Kallada on the Kallada River (Yule 1903), with Nirkunnam on the Meenachil River (Kanakasabhai 1904), with Niganda (which later on came to be known as Niranam) (I C Chacko 1979) and with Kottayam (Sastri 1955, Gurukkal and Whittakker 2001). The logical incompatibility between the Classical references and the each of the above attempts may be pointed out before proceeding.

Yule's attempt to identify Nelcynda with Kallada is mainly based on the commercial significance of the place as well as its location south of Muzuris on the river bank. However a major difficulty with this claim is the discrepancy on the distance as the specified in *PME*. He hand book has widely been hailed as an almost precise work.

Scholars like I C Chacko insist on a re-reading of Nelcynda as Neakunda on the basis of the assumption that the third letter 'alpha' in the original has been wrongly read as 'lamda' (Chacko 1979). This has provided the ground for him to identify the place with 'Niganda', the term used in Keralolpathi for the Brahman settlement Nirmannu or Niranam. This must also have been prompted by the fact the appellation used in Pliny's *Naturalis Historia* is Neacyndon. It is argued by I C Chacko that the identification of the port with Niranam would agree with the distance of 500 stadia from Muzuris and 120 stadia from Barace located at the mouth of the river to Nelcynda as laid down in *Periplus*. However, this would be in disagreement with the *Periplus* indication that the place lies on the

river Baris, since Niranam has only small canals and streams flowing through it while the main river stream flows away from Niranam. The close resemblances between Nakkida on the one side and Nelcynda of the *PME* and Neacyndon of Pliny on the other could have very well driven the scholar to the identification. The reason for the slip must have been on account of his fixation with the association of Niranam with St. Thomas tradition and as its status as a prominent market of a later period and also due to the scholar's preoccupation with its standing as a traditional Brahmin settlement.

It has been suggested by Whittakker and Gurukkal (2001) that Barake in *Periplus*—the village at the mouth of the river—could be identified as Vaiaskra near the port town of Alapuzha and Nelcynda the inland port could be Kottayam, lying on the Meenachil River course. The town had earned considerable repute as a centre of spice trade for long. It is pointed out that the distance from the mouth of the river and Kottayam through the Vembanad lake tallies with the one hundred and twenty stadia, the distance as laid down in *Periplus*. The mention of Kottanora in the *Periplus* as the place where pepper was brought in canoes has prompted the authors to identify it as Kuttanadu, the district centred on the town of Kottayam. The identification of Bacare, Nelcynda and Kottanora seem to be too far fetched. In the first place 'Kuttanadu' by no means satisfies the allusions to 'Kottanora' of the Classical accounts. Kuttanadu at present is not the name of any specific place, rather it is an appellation loosely applied to a vast area spread over in the Kottayam, Pathanamthita and Alapuzha districts, much of which is water-logged. Secondly, it is important that the geophysical status of Kuttanadu is not the one which is suited for the cultivation of pepper.

We feel that we are better placed at present to identify Nelcynda with Nakkida—hardly four kilometres from Tiruvalla to the south of the Manimala River and to the east of the Parumala Island encircled by the Pampa River. Besides the Classical Geographies, we dwell upon ethnographic information, archaeological data and insights from toponyms for the above identification.

REFERENCES IN CLASSICAL GEOGRAPHIES

The earliest Roman account of the ports are found in the anonymous work *PME* dated to the mid first century AD and is lauded by archaeologists for the precision on geographic directions given for navigation. The relevant details as found in the *PME* are reproduced below:

> Tyndis is of the Kingdom of Cerobothra; it is a village in plain sight by the sea. Muziris, of the same kingdom, abounds in ships sent there with cargoes from Arabia, and by the Greeks; it is located on a river, distant from Tyndis by river and sea five hundred stadia, and up the river from the shore twenty stadia. Nelcynda is distant from Muziris by river and sea about five hundred stadia, and is of another Kingdom, the Pandian. This place also is situated on a river, about one hundred and twenty stadia from the sea.
>
> There is another place at the mouth of this river, the village of Bacare, to which ships drop down on the outward voyage from Nelcynda, and anchor in the roadstead to take on their cargoes; because the river is full of shoals and the channels are not clear. The kings of both these market-towns live in the interior. And as a sign to those approaching these places from the sea there are serpents coming forth to meet you, black in color, but shorter, like snakes in the head, and with blood-red eyes. (Schoff 1912)

Gaius Plinius Scundus popularly known as Elder Pliny, author of the *Naturalis Historia* of the 2nd half of the first century AD also speaks of Neacyndon as the port to which pepper was brought from Kottanora (See Majumdar 1960). It is added that the 'Pandion used to reign there, dwelling at a great distance from the mart, in a town in the interior of the country called Modura'.

Pliny underlines the tremendous dissimilarity between the 'purchase and sale price' of the items of exports from the South Indian ports when he observes that these goods were purchased at a very low price and sold at hundred times higher prices in Rome by

the transmarine traders (Mc Crindle 1879). This would make it clear that trade in spices had always been highly beneficial for the merchants from the West and much importance was attached to pepper. It is estimated to have made up three fourths or more than half of the total bulk of the cargo bound for Rome (Champakalakshmi 1996).[3] The items of export from the ports mentioned are pepper, betel, precious stones, ivory, fine silk, spikenard etc (Mc Crindle 1879) and the items of import mentioned are wine, copper, arsenic, tin and ceramics. But the principal item of export from both the ports Muziris and Nelcynda were understood to be pepper and the people who entered into commercial contacts with the Romans were the megalithic people (Gurukkal and Whittaker 2001).

Nakkida: The Geological Setting

Let us now examine the extent to which the features and attributes of Nakkida satisfy the details provided by the Roman geographers. The location of the port as lying on the river Baris at a distance of 500 stadia from Muziris and as a place located 120 stadia from the mouth of the river Barace perfectly agrees with the distance specified in *Periplus* in bith the cases. We consider Barake of the geographies to be Purakkad, where one of the main branches of River Pampa opens into the Arabian Sea. The reference to 'serpents …black in colour, …… like snakes in the head, and with blood-red eyes' could be the briefest description of the crocodiles which infested the region even as late as the twentieth century. Similar descriptions of the crocodiles causing dangers to the travellers in the same waterway (between Purakkad and Kudamaloor in River Pampa) can also be found in the travelogue of the seventeenth century Dutch navy officer Nieuhoff. (See Sivasankaran Nair 1996)

Nakkida is the point at which Pampa is about 100 metres broad and this is the conspicuous point on River Pampa which connects Manimala and Achenkovil rivers by fairly wide navigable water course. As already mentioned, the channel to the Manimala appears to have narrowed down and eventually disappeared. But the link to Achenkovil called the Kakkad River is broad. All along the banks of the Pampa, Manimala and Achnkovil can be found extensive pepper growing areas right from the Western Ghats. As already pointed out Nakkida's connectivity allows it to procure pepper from the three main river courses—Manimala, Pampa and Achenkovil.

Change in the course of the rivers and the broadening of the paleo delta in Nakkida, must have caused a shift in the location of the port-area or even led to the proliferation of ports. For instance, the present site of the Travellers' Bungalow from where originates a small stream leading to the river Pampa appears to have been used as a port area even as late as the eighteenth century. The port eventually came into the possession of the of the Elangallor chief. It is noteworthy that this chief had been in control of pepper yielding lands such as Perumbranadu (Kalloopara) and also held several port areas such as Trikkunnapuzha and Tripperunthura.

Pandya Control over the Confluence

In the immediate proximity of Nakkida is a place called Pandanadu-Kottayam. It may be worth tracing the origin of this place name in the light of the references in the Classical geographies. The literal meaning of the place is the "the inside portion of Pandya possessions". In other words the place name could hence be construed as a symbolic expression which meant a stronghold of the Pandyas. This could be the inference deducible from the classical geographies. *The Periplus* says that Muziris was under the sway of the kingdom of Ceprobotras, while Nelcynda 'belonged to a different kingdom—that of the Pandion' (See Majumdar p.305). A similar account of the ports on the Kerala coast is also found in Pliny's *Natural History*. Having described Muzuris, where the sovereign is Caelabothras, Pliny moves on to provide details of Neacyndon, which was ruled by Pandion from Modura. The pepper to the above port was said to have been carried down in canoes from Cottanora (*Ibid* p. 339). The references in the *Periplus* has prompted Nilakanta Sastri to locate Nelcynda very near Kottayam on the western coast (Sastri 1955). He also considers Nelcynda to be part of the Pandya Kingdom (Sastri 1955). The contentions of some recent historical writings have to be taken seriously in this context. It is maintained that the socio-cultural milieu of the Tamil Heroic Poetry of the early historic period, maritime trade brought the much-needed items as resources for socio-political dominance and patronage (Champakalakshmi (1996). In the perspective of the plunder raids and the struggle for predatory control over places of strategic importance, one of the Pandya lineages could have taken control of this resourceful port area and made it their

centre of operations, on the banks opposite to the Nakkida port. Pandanadu must have derived its present name from there. Accordingly, Pandanad-Kottayam Pampa Coast could have been controlled independently by a lineage of the Pandyas or must have become an outstation of the Pandyas of Madurai. We intend to reiterate the point that the unique status of Nakkida as a port on the confluence of three rivers—Pampa, Achencovil and Manimala—was ample justification for the chief of a Pandya lineage to retain its hold on the place. The survey department maps of 1946[4] and 1963 give the name of a place Kottayam on the bank opposite to Nakkida and the local post office has been bearing the name Kottayam till the 70s of the last century. Adjacent to this place, there is a family bearing the name 'Kottayathu', which on enquiry has confirms that the family has taken its present name from the field name 'Kottathu' which they purchased.

On Kottanora

Kottanora mentioned by the geographers as the source of pepper, provides us with a vital clue to the identification of the Port. Near Chalapilli, there is an old market called Kottanadu which was predominantly dealing in Pepper. According to prevalent oral tradition, pepper used to be carried through a canal which connects Kottanadu with River Manimala at Kizvaipur. Pepper could be brought through Manimala River down to Keecheri valil from where one needed to turn south through a small canal that provided the linkage with Pampa. The canal no longer exists, but the bed is still traceable at several places. Evidence of an embankment north of Eramallikara suggests nothing less than deliberate human action in blocking a link river in the immediate vicinity of Kuthiathodu where the latter canal enters River Pampa. We are totally in the dark on the situation that occasioned the blocking of the canal.

Nakkida: The Great Emporium

The local traditions hail the reputation of Nakkida Theruvu for its vastness. There are also stimulating stories of the 'old port frequented by ships from far and wide' These would go a long way in authenticating the standing of Nakkida as a prominent port of the

ancient times. There is an old saying that 'one has to walk around and see the Nakkida *Theruvu*'. The expression '*theruvu*' is significant since it suggests a market. The saying is borne out of the prominence which the place commanded as a huge market.

The following observation of the first ever surveyors-Ward and Connor of the State of Travancore may be taken due note of:

> Baris is the Greek form of the second half of Pam-'payaar' with a Greek ending, and it has in Greek the sense of boat. So the Baris river is the boat river the name being significant on account of the large number of single-log boats (a curiosity to the Greeks) there engaged in carrying pepper down the upper "Cottonara" parts of the rivers which met at Neakynda because even the small Greek ships could not go up from Neakynda. Neakynda is the present Nakkida very near Niranam, and Naakkida means the "space between tongues" of rivers.[5] (*Manorama Diamond Jubilee Year Souvenir*, 1950, pp. 455-456)

Accordingly, identification of Nelcynda as the "space between the tongues" of rivers may be an insightful remark and may even be in line with the equation of Muziris of the classical accounts with the Cera port Muchiri hailed in the Tamil Heroic poems. The latter expression meaning "the split- lip" or the "hare-lip" is the rendering of what one find of the place where the two banks of the Pullut enters River Periyar (Gurukkal and Whittaker). However we are left with one problem, if Nakkida is to mean the "space between the rivers" Pampa and Manimala, for three such "spaces" are possible. (A) The whole region from Nakkida, north of River Pampa up to Perumballam and Valanjavattom, covering an area of about 2 sq. miles (B) from south of the Pampa in the Parumla island to the point where the link river to Achenkovil River begins, covering the area of about the 2 sq. miles (C) the areas including both (A) and (B) covering a total area of about 4 sq. miles.

ARCHAEOLOGICAL REMAINS

It has already been pointed out that the chief item of export from both the ports Muziris and Nelcynda were understood to be pepper and the people who entered into commercial contacts with the Romans were the chiefly the megalithic people. This necessitates a search for the megalithic sites around Niranam-Nakkida region for possible presence of Roman pottery amidst local wares to corroborate the exchange relations with the Western world. The information that could be gathered from both published and unpublished materials are given below.

Kavumbhagom and Tiruvalla located north of Nakkida have yielded some finds that comprise some burial jars with iron lamps or swords inside and a twenty feet square granite cellar (Sreedhara Menon 1975). Some 5 to 6 urns with a bayonet-like iron weapon in one of them was obtained from the premises of the Ulappethu temple near Valanjavattom in the immediate proximity of Nakkida. A set of six urn burials including a four-legged terracotta sarcophagus was obtained from a plot near Nakkida covered under Sy. No 456/2. But we are not in a position to say whether the sarcophagus had a lid. Five urns with a sword in one of them were found on the southern bank of the river at the Illimala Bridge on the Parumala-Chengannur road and yet another urn in the present YMCA compound at Niranam. These are places distributed in less than 10square miles along the banks of river Pampa in the Niranam- Parumala area. This is precisely the area where Alumthuruthi (Athan thuruthi) figuring in the *Uòòinîlisandçúam* and Niranam have flourished as trading centres. Niranam is the foremost traditional Syrian Christian settlement which developed into a trade centre. The presence of several *sasta* temples and *naga* and *yaksi* images [6] suggest strong inclinations to Buddhist and Jain religious observances in the locality. This observation pushes us further to associate the place with sustained mercantile activity and a correspondingly large occupational group of traders of an earlier period. Of particular interest is the reference to the 'Syrian Christians' of Kariyanattukavu Street (Kavumbhagom) made by Villuvattom Raghavan Nambiyar. They were mostly descendents of the trading community brought from Niranam for trade in ancient times (Nambiar 1929).

Equally significant is the information available from the Budhanur-Ennakkad- Kuttamperoor area lying south of the Nakkida. The name 'Budhanur' leads us to propose that it had been a settlement of Buddhist influence—probably the habitation site of a trading community. There are numerous reports of megalithic burial sites from around the place.

We have only very few reports of Roman coins being recovered from the Tiruvalla area. The strongest claim is that of a gold coin of Augustus Caesar's period obtained from Niranam, besides a few others from Puthen kavu and Ranni (Joseph 1932). If Nakkaida had been an emporium of pepper trade, hoards of gold and silver coins could have been many. But the scarce find of the coins need not negate the possibility of brisk trade and the consequent inflow of precious metals. We are more than compensated by a vast body of information in the form of oral traditions of 'people getting treasures' and 'becoming abruptly rich'. On the hoard of Kottayam (Kannur District), Satyamurthy, former Director of the Government department of Archaeology maintains that the purity of gold attracted the notice of the jewellers and the wealthier natives who had purchased them and melted down for ornaments and that almost the entire hoard have been irretrievably lost in this way (Satyamurthy 1992). The standard portrayals of treasure are *chena, kuḷavi, vaḷakkula* indicative of the particular shape of the mass of gold obtained. *Chena* or yam in local language is used as the standard term for the iron mass smelted by the local blacksmiths. *Kuḷavi* is the name given to the rotating spindle cylindrical, slightly thinner at one end of the grinding stone device, commonly found in Kerala. We are given to understand that yam and cylindrical shaped crucibles were in wide use among the smelters during the megalithic period. The third category appears to be the replica of plantain fingers found on the plant. We are not sure about the correspondence between the expression and the shape of the object found in the form of the treasure. Local enquiries made on the implications of the word give the impression that there prevailed the practice of gifting such gold articles to honour a person of high standing. A case in point is the gift made by local elites to the *tantri* of the Tharayil Kulikkattu Illam in connection with the consummation of certain elaborate/expensive

religious rites. These gifts are well documented in the *granthavari*-s of the family.

It has also got to be borne in mind that a substantial portion of the gold that came to Kerala must have gone out for the procurement of copper which was ever increasing in demand. Copper came to be used in huge quantities as roofing materials for the temples and other structures within the temple complex such as *kutambalam, nalambalam, valiambalam* etc. Again, copper was used as decorative material inside the temple and also for the making of bronze vessels and lamps; sponsoring of which was a common practice right from early medieval times. Consumption of copper also increased with the increasing number of elite groups who were keen on procuring copper and bronze vessels. It is to be further noted that over the years Mannar near Parumala has developed into one of the biggest craft centres in Kerala specialising in bronze, bell metal and a variety of other alloys.

The Parumala-Perumballam- Nakkida complex

Panayannar Kavu is Bhagavathi temple on the Parumala Island on the bank south of Nakkida. The temple carries much horror owing to fierce sacrifices performed there, including human sacrifices. To the local community, the northern most tip of the Parumala Island is part of Nakkida. A casual reference in a fifteenth century *Granthavari* equates Panayannar kavu in the Island with Mahodayapattinam. The place name is well-known as of headquarters of the Cera line of rulers, the descriptions of which are found in 9th century literature (Narayanan 1972). It is therefore obvious that the 'Mahodayapattinam' has been used in the *Granthavari* in a metaphorical sense. If the *Granthavari* seeks to find a '*pattinam*' inside the Parumala island, then one has to throw open the options to look at Nakkida as a town stretching into Parumala island on the southern bank of River Pamba. This would necessitate extending the search for Nelcynda into Parumala island also for possible find of Roman pottery.

The expression Perumballam would mean the 'large elevated place' and rightly so. What is most distinctive about the place is that

the 'Perumballam' never gets inundated even during the worst floods. As such it remains an extension of the port area. We have even so many stories from illegal sand miners about strange-looking wares along with sand. But the most astonishing collection of pottery in this Perumballam-Nakkida complex is found in an open field—presently used as a playground—within the premises of the sugar factory adjacent to a small Bhagavati temple. While widening the road from Valanjavattom junction on the Mavelikara Tiruvalla Road, workers had to remove huge quantities of port shreds along with soil. The open field was in the past occupied by a community of potters called *vellan*-s. The huge find of pottery—predominately local ware—belonging to the period from the pre-historic and megalithic periods to the present affirms the continuity of habitation or the intense trade transaction covering several centuries and the collective memory of the *vellan*-s is that they have been brought to Perumballam centuries ago. It seems likely that at least in certain cases, black dry pepper must have been packed in earthen jars before transportation. The *vellan*--s were also probably making long cylindrical jars as containers for pepper. It worth perusing recent reports of some 7.5 kilograms of black pepper found inside jars of Indian origin, obtained from the Red Sea port, of Berenike—the second port mentioned in the *PME* (See. www.exploration.org.people). It is also likely that local imitations of amphora also must have been produced in the region. One could as well be stumbling over Roman pottery amidst the huge plethora pottery found in the complex or in the places adjacent to Nakkida such as Pandanadu or Parumala.

Notes

1 For a typical representation see P J Thomas (1932) p. 259.

2 The port has been identified by Burnell as Crangannur. For details on more initiatives on the identification see Gurukkal and Whittaker 2001 and also Shajan, Tomber *et. al.,* 2005

3 Schoff is argued to have put the share of pepper at three fourths of the total exports while Warmington put it as more than half.

4 The first survey was conducted in 1913 and the map came out in 1946.

5 Reproduced from an article by T K Joseph in *Manorama Diamond Jubilee Year Souvenir*, Kottayam, 1950, pp. 455-456

6 The conversion of Buddhist temples into Hindu ones is understood to be a regular feature of the post eighth century Kerala. It is being suggested that a large number of such conversions have taken place in Niranam-Tiruvalla region by transforming Buddha into Sasta. Trikkunnapuzha has yielded a very clear instance of a conversion of the deity. An image of Buddha bearing the inscription "Putha" written on it is still found in the Sasta temple there. Several instances of the consecration of Sasta are found in the Kuzhikkattu Illam Grandhavari. For instance at the Ayyankovil Sasta Temple, Niranam dated in the 694 ME Doc. No.133. Also see *Ibid*, Doc. 134 dated 665 ME with respect to the consecration of Úâsta and Bhagavati images at Kumarankari temple. For proceedings of the sacraments held at the temple at the north of Kottarayil Chirakkadavu for the images of *Yaksa* and *Yaksi* in *Ibid* dated 694 ME, Doc. No 138. The manuscript is in the Oriental Research Institute and Manuscript Library, Trivandrum.

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IMPACT OF LAKKIDI CHECK DAM ON THE NUTRIENT DYNAMICS OF BHARATHAPUZHA RIVER, KERALA

A. Biju Kumar*
Kurian Mathew Abraham**
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Bharathapuzha River, Kerala State, India was studied for finding out whether smaller impoundments create alterations in nutrient dynamics of tropical rivers. Nutrients form the basic abiotic components of ecosystem dynamics as they have direct link with productivity. In both upstream and downstream areas of the check dam, seasonal variations were prominent for almost all nutrient parameters. Whereas significant variations in nutrients between upstream and downstream areas were observed only in the case of phosphate. Phosphate showed a positive correlation with nitrite both in upstream and downstream areas and with silicate in upstream area only. Similarly nitrite showed positive relationship with sulphate and silicate in upstream and only with sulphate in downstream area. Present study suggests that no high level ecological impacts on nutrient dynamics were caused due to Lakkidi check dam in Bharathapuzha River. Long-term modeling studies are required to unequivocally establish that smaller impoundments act as traps for nutrients, and alter the hydrography of the river.

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Key words:Bharathapuzha, hydrography, check dam, water quality, river, hydrography

Running Title: Intervention by Lakkidi check dams on tropical lotic hydrography.

INTRODUCTION

Lotic ecosystems serve human kind in a number of ways in addition to its ecosystem role in the biosphere. Rivers serve as transportation routes; as source of food, water and power; as sinks for waste products and as objects of artistic and metaphysical interest (Johnson *et al.*, 1995). Investigations all over the world revealed that many rivers no longer support socially valued native species or sustain healthy ecosystems that provide important goods and services (Naiman *et al.*, 1995). Moreover, rivers form unique freshwater lotic ecosystems which form an abode for immense biodiversity. The complete benefits out of rivers like power generation, irrigation, reservoir fisheries, ground water recharge, drinking water supply etc can be tapped in its full gravity for human welfare only if dams of suitable sizes are constructed across rivers, even though dam construction have negative impacts on lotic system. In India, the beneficial impacts of dams have been reported by many workers (Rangachari *et al.*, 2000). The impacts of dams upon natural ecosystems, particularly on rivers, have been profound, complex, varied, multiple and far-reaching (WCD, 2001). Changes in water quality of rivers due to the construction of dams have been recorded in literature (Petts, 1984; Hart *et al.*, 1991). However, water quality changes in the downstream and upstream areas of small impoundments such as check dams have not been well documented hitherto especially from tropical areas. The present paper gives an account of the hydrography in the upstream and downstream areas of check dam at Lakkidi in Bharathapuzha river, Kerala.

MATERIALS AND METHODS

Bharathapuzha, the second largest river in Kerala State, South India has its origin from the Anamalai Hills (Western Ghats) of Tamil Nadu; it flows towards west coast through the Palakkad, Thrissur

and Malappuram Districts of Kerala and debouches to Lakshadweep Sea at Ponnani. The Lakkidi check dam (10^0 45' N and 76^0 26' E) is a permanent concrete dam constructed across the Bharathapuzha river, measuring 90 metre in length, 2 metre in height and 0.5 meter in width. The check dam is bordered on either side with coconut, arecanut and banana plantations. The reservoir within the check dam is extensively used by the local populace for various purposes including bathing and washing.

Monthly water samples were collected during morning hours from three sampling stations each in the upstream and downstream areas of the check dam during April 2005 to March 2006. The means provided are the pooled averages of monthly samples taken from three different sampling sites each from the upstream and downstream areas. The samples were analysed for phosphate, nitrate, nitrite, sulphate and silicate following APHA (1992) procedures. The data collected were tabulated and seasonal variations were analysed using analysis of variance (One-way ANOVA). Two-way ANOVA was done for comparing the variations between streams, seasons and their interactions. Multivariate correlation analysis was employed to find out the relationship between various nutrient parameters with in each stream.

RESULTS AND DISCUSSION

Seasonal variations of all nutrient in the upstream and downstream areas of Lakkidi check dam, Bharathapuzha River is given in table 1. Analysis of variance (Two way ANOVA) comparing different streams and seasons are provided in table 2. Multivariate correlation analysis between various nutrient parameters in upstream and down stream area is depicted in table 3.

During the study period phosphate content (ìg/l) of water in the upstream area varied seasonally between 0.32 and 0.79, whereas in the downstream area the values ranged from 0.2 to 0.45 ìg/l. In both upstream and downstream areas phosphate content recorded considerable increase during summer months; the seasonal changes were also statistically significant in upstream ($F = 29.889$; $P< 0.01$) and downstream ($F = 8.836$; $P< 0.01$) stretches of the check dam.

The seasonal fluctuation might be due to the nutrient enrichment during monsoon rains which sinks in to upstream area due to which upstream area had more content than downstream. Results of two-way ANOVA showed significant variations in phosphate content between upstream and downstream areas of Lakkidi check dam ($F = 46.142$; $P< 0.01$), which may be due to the nutrient sink and siltation due to check dam. Phosphate showed significant positive and negative relationship with other nutrient parameters, both in upstream and downstream. One of the important ecological problems due to the dams is the impact of nutrient dynamics of the lotic system (American Rivers, 2002). But in the present study results reveal that the check dams are not creating problems as that of larger dams.

The seasonal variations of nitrate and nitrite content were also much apparent in both the streams, with maximum values during post-monsoon period; the nitrate and nitrite content differed significantly between seasons in the upstream and downstream areas. Seasonal variations in nitrate and nitrite content could be due to phytoplankton excretion, oxidation of ammonia and reduction of nitrate in addition to the decomposition of planktonic organisms apart from the monsoon input. The principal source of nitrogen is the rain water which in some cases may account for all nitrogen in surface waters (Visser, 1974). The increase in nitrate content during monsoon and post-monsoon seasons may be due to the influence of terrigenous matter carried by flood water as well as excess decomposition activity in the river (Reid and Wood, 1970; Desai *et al.*, 1995). Both, nitrate and the nitrite did not show any statistical difference between upstream and down stream area. Nitrate and nitrite showed different pattern of relationship with other nutrient parameters but each nutrient had almost similar relationship pattern in up and downstream, which shows that check dams do not alter the nutrient dynamics much. Usually an elevated level of nitrogen can be expected from impoundment as it functions as a nutrient sink, which was on the other way round in the present study. This may be due to the utilization of nitrates and nitrites by plankton and aquatic macrophytes.

Sulphate concentration in both upstream and downstream areas showed wide fluctuations in both upstream and downstream areas; the variations were from 11.38 to 25.21 ppm and 11.53 to 22.85 ppm,

respectively. The variations, however, were not statistically significant due to high variance. The annual average of sulphate in upstream area was 19.84±9.248 and that in downstream was 17.73±7.212. The seasonal variations were not significant between seasons and streams. Sulphate showed significant positive relationship with nitrite both in up and down stream. Sulphate content was low when compared to other nutrients and the fluctuations were high, which itself form a reason for statistical insignificance.

The diatom production, copepod abundance, food web structure and biogeochemical cycling in coastal seas depend on the amount of silica in the river discharges (Treguer *et al.*, 1995). The silicate content of water, in general, followed similar seasonal trends in both upstream (57.1 to 93 µg/l) and downstream (57.69 to 88.92 µg/l) areas. Higher values were recorded during post-monsoon and pre-monsoon periods due to terrestrial washing by monsoon and the seasonal variations in silicate content were significant in upstream area ($F = 8.321$; $P<0.01$) and downstream area ($F = 8.127$; $P<0.05$). Like nitrates, silicate also did not show and statistical difference between upstream and downstream. Silicate showed almost similar trend in upstream and downstream as far as the relationship with other nutrients were concerned. According to Silva *et al.* (2002) large number of reservoirs may increase silica fluxes in the river system and silicate leaching is primarily determined by the annual precipitation, discharge volume, climatic factors and catchment geochemistry. Presence of nine large dams in the upper reaches of Bharathapuzha would augment leaching of silicate to river water. As reported by Rao and George (1959) the lateritic nature of the drainage area may also be responsible for the high silicate concentration in river water.

According to Ogbeibu and Victor (1995) lotic waters are characterized by lower nutrient levels. In Lakkidi check dam, nutrients showed positive relationship among themselves, both in up and downstream areas. Phosphate showed a positive correlation with nitrite both in upstream and downstream areas and with silicate in upstream area only. Similarly nitrite showed positive relationship with sulphate and silicate in upstream and only with sulphate in downstream area.

In general, check dams in Bharathapuzha river did not alter the nutrient dynamics of the river. However, significant variations were observed in the case of phosphates. Long-term studies are warranted to unequivocally establish that small impoundments such as check dams alter the nutrient dynamics of tropical rivers and act as nutrient traps.

ACKNOWLEDGEMENT

The first author acknowledges the financial support provided by Department of Science and Technology, Government of India for research on the ecology and biodiversity of Bhrathapuzha River, Kerala.

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Table 1.

Seasonal variations of different nutrients in the upstream and downstream areas of Lakkidi check dam

Nutrient	Site		Premonsoon	Monsoon	Postmonsoon	Annual	F value (comparing seasons)
Phosphate (µg/l)	Up stream	Mean	0.79	0.32	0.56	0.56	29.889**
		± SD	0.112	0.056	0.083	0.217	
	Down stream	Mean	0.45	0.20	0.31	0.32	8.836**
		± SD	0.110	0.061	0.075	0.131	
Nitrate (µg/l)	Up stream	Mean	16.94	20.01	49.44	28.79	7.132*
		± SD	10.208	12.165	17.024	19.547	
	Down stream	Mean	17.88	18.51	46.38	27.59	8.285**
		± SD	11.657	9.973	12.184	17.245	
Nitrite (µg/l)	Up stream	Mean	0.27	0.19	0.24	0.23	16.045**
		± SD	0.025	0.022	0.014	0.040	
	Down stream	Mean	0.27	0.19	0.26	0.24	4.709*
		± SD	0.039	0.025	0.050	0.051	
Sulphate (ppm)	Up stream	Mean	22.93	11.38	25.21	19.84	3.945
		± SD	9.647	5.152	6.891	9.248	
	Down stream	Mean	18.82	11.53	22.85	17.73	3.833
		± SD	5.577	5.752	6.228	7.212	
Silicate (µg/l)	Up stream	Mean	93.00	57.10	75.34	75.14	8.321**
		± SD	7.178	10.580	17.358	19.004	
	Down stream	Mean	88.92	57.69	77.68	74.76	8.127*
		± SD	2.498	11.469	15.203	16.816	

*P<0.05; ** P<0.01

Table 2.

Analysis of variance (Two way ANOVA statistics) of nutrients comparing different streams and seasons at Lakkidi check dam

Nutrient	Source	Sum of Squares	df	Mean Square	F value
Phosphate	Streams	0.34	1	0.34	46.142**
(µg/l)	Seasons	0.53	2	0.26	35.845**
	Streams × Seasons	0.05	2	0.03	3.492
Nitrate	Streams	8.75	1	8.75	0.057
(µg/l)	Seasons	4680.63	2	2340.31	15.168**
	Streams × Seasons	16.28	2	8.14	0.053
Nitrite	Streams	0.00	1	0.00	0.271
(µg/l)	Seasons	0.03	2	0.01	14.199**
	Streams × Seasons	0.00	2	0.00	0.182
Sulphate	Streams	26.65	1	26.65	0.592
(ppm)	Seasons	684.35	2	342.18	7.602**
	Streams × Seasons	18.30	2	9.15	0.203
Silicate	Streams	0.89	1	0.89	0.06
(µg/l)	Seasons	4536.13	2	2268.06	16.312**
	Streams × Seasons	44.03	2	22.02	0.158

*P < 0.05; ** P < 0.01

Table 3.

Multivariate correlations between different nutrient parameters in upstream and downstream area of Lakkidi check dam

Parameters		Phosphate	Nitrate	Nitrate	Sulphate	Silicate	
Phosphate	Down Stream	1	-0.108	0.838**	0.47	0.816**	Up Stream
Nitrate		-0.19	1	-0.13	0.309	-0.029	
Nitrite		0.641*	0.011	1	0.634*	0.700*	
Sulphate		0.455	0.505	0.721**	1	0.338	
Silicate		0.486	0.107	0.539	0.44		

EFFECT OF FEEDING OF DIFFERENT SUBOPTIMAL DIETS ON THE OVARIAN WEIGHT IN THE RED COTTON BUG, *Dysdercus cingulatus* (Fabr.)

Reema A Mathews *

Feeding is essential for the acquisition of reserves for the development of ovary and the formation of yolk, thereby egg maturation and increased egg production. The daily consumption of different sub optimal diets such as distilled water (partial and full starvation), 5% sucrose solution, 1% vitamin free casein solution, 0.5% cholesterol solution were investigated. Those fed on distilled water consumed minimum and maximum rate was reported in sucrose fed bugs. Correlated with this, there observed a significant decrease in the weight of the ovary in sub-optimal diet fed bugs. In the normal diet-fed females the weight of ovary showed a gradual increase during pre-vitellogenic phase, reaching a climax in the vitellogenic phase and then decrease towards the post vitellogenic phase. These changes were significantly higher than from all other sub optimal diet-fed females. Thus feeding of natural food, the cotton seeds offer maximum reproductive potential in this insect.

Key Words: *Dysdercus cingulatus*, Nutrition, Ovary, Vitellogenic Phase,

Sub-optimal diets

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INTRODUCTION

Nutrition is the most important factor affecting total egg output in the majority of insect species (Engelmann 1970). Both the quantity and quality of food influence total egg production and egg laying in a given species (Johansson 1964)). Insects require a diet containing a source of energy, most frequently carbohydrates, proteins, lipids, vitamins especially of B complex and certain mineral salts (Dadd 1985). Thus nutrients are essential for both, building up of reserves and making yolk, ovarian tissues and there by egg maturation and increased egg production (Engelmann 1979). Lack of quality food for the adult females may adversely affect the development of ovarian tissues causing a reduction in the ovary size, fecundity and rate of egg production (Slansky 1980). In the light of the above facts, the present study was carried out to elucidate the relationship between feeding of different sub optimal diets ovarian growth in the red cotton bug, *Dysdercus cingulatus*.

MATERIALS AND METHODS

The red cotton bug, *Dysdercus cingulatus* (Fabr.) (Family: Pyrrhocoridae; Class: Insecta) has been selected for the present study. The bugs were reared in laboratory conditions at a temperature ranging from 26 to 32^{0}C; relative humidity of about 98% and light-dark cycle of 12:12. The newly emerged adult cotton bugs were separated from the stock colony in pairs and fed with soaked cotton seeds. These normal diet fed bugs (N = 10) were designated as the control. The experimental bugs were divided in to five groups (N = 10 per treatment) and were fed with sub-optimal diets such as full starvation, distilled water (partial starvation), 5% sucrose solution, 1% vitamin free casein solution and 0.5% cholesterol solution using a Potometer, designed by Muraleedharan and Prabhu (1978). The daily consumption of diets by the insects was studied for 10 days that coincides with the gonotrophic cycle of the insect. The mating status of these bugs was also investigated.

The present study was limited to the first gonotrophic cycle, which lasts for 7 days. The gravimetric analyses of female adults fed on normal and deficient diets were conducted daily for assessing their

ovary weights (in grams) in order to find out the influence of diets on oocyte development. For the collection of ovary, the insects of both control and experimental groups were vivisected in insect ringer (Ephrussi and Beadle, 1936) under a binocular dissection microscope.

Results were expressed as mean, standard deviation and were graphically represented. Results were statistically analsyed to compare experimental and control group using Student's t test. A probability level of less 0.05 was considered significant.

RESULTS AND DISCUSSION

Daily consumption of different liquid diets by the bugs using potometers are presented in Fig. 1. Insects that fed on distilled water, consumed the minimum and those fed on sucrose solution consumed the maximum (0.030 ± 0.004 ml). The quantity of cholesterol solution consumed was moderate (0.019 ± 0.002 ml). The quantity of casein solution consumed by a single individual was less than those fed on sucrose and cholesterol solution (0.017 ± 0.003 ml). In both fully and partially starved insects, the consumption rates of distilled water were almost same (0.006 ± 0.001 & 0.007 ± 0.001 ml), indicating that the rate of consumption is independent of the day or age subjected to starvation. Mating is absent among fully starved bugs. In casein and cholesterol-fed bugs, mating is occasional and in partially starved and sucrose-fed insects, mating occurs in the normal manner.

In the newly moulted, normal, adult females, ovaries are white structures firmly attached and extend from the abdominal segments 3 to 5. As the age progresses the volume and the weight of ovary also increases due to cell multiplication and deposition of yolk. In the normal diet-fed mated females, as the volume of ovary increased, its weight also increased gradually from day 1 (0.003 ± 0.001g/pair ovary) to day 6 (0.068 ± 0.001g/pair ovary) and then decreased on day 7 (0.057 ± 0.003g/pair ovary). Similarly, considerable increase in weight of ovary was recorded in normal diet-fed virgin females and partially starved, mated females that ranged between 0.004 ± 0.001 on day 1 to 0.063 ± 0.008g/pair ovary on day 6 and 0.005 ± 0.001 on day 1 to 0.022 ± 0.001g/pair ovary on day 6 respectively. In these two groups of females, the ovary weight decreased on day 7 as 0.032 ± 0.001mg/

pair ovary and 0.017 ± 0.001g/pair ovary respectively. In sucrose-fed, mated females, the weight of ovary increased from day 1 (0.005 ± 0.001)g/pair ovary) to day 7 (0.010 ± 0.002g/pair ovary). On the contrary, in fully starved, mated females, the weight of ovary was found to decrease steeply from day 1 to day 7 and accounted as 0.004 ± 0.001 to 0.001 ± 0.001g/pair ovary. Similarly, in fully starved and sucrose-fed, casein-fed, cholesterol-fed and also in casein-fed mated females, the ovary weights decreased significantly from day 1 to day 7 (Fig. 2) and that the ovaries of day 6 and 7, which were not distinguishable and measurable. However in cholesterol-fed mated females, the weight of ovary increased from 0.003 ± 0.001g / pair ovary on day 1 to 0.014 ± 0.001g / pair ovary on day 6 and then decreased to 0.012 ± 0.001g / pair ovary on day 7. All these data were statistically significant ($P<0.05$).

Analysis of the consumption rate of different suboptimal diets including distilled water showed that in *Dysdercus cingulatus*, those fed on distilled water consumed minimum and maximum rate reported to be in sucrose-fed bugs. Those fed on cholestrol solution, consumed moderate quantity and the rate of casein-fed bugs was intermediate between the sucrose-fed and cholesterol-fed. The results showed that in *Dysdercus cingulatus*, the food intake was of a minimal level when fed on artificial diets. Similar observations were documented in *Coccinella septempunctata*, where minimum food intake was seen when fed on artificial diets (Zhai, *et al* 1987). Detailed analyses in the present investigation showed that the decreased consumption rate or the quantity of the food intake as well as the quality of food influence vitellogenesis and subsequent processes to a greater extent, thus adversely affecting ovarian growth and egg production.

In *Dysdercus cingulatus*, the increasing consumption rate was in the order of sucrose solution ® cholesterol solution ® Casein solution ® distilled water.

The present study also reveals that in normal diet fed *Dysdercus cingulatus*, the volume and the weight of the ovary increase during the gonotrophic cycle and attain the maximum on the 6^{th} day of emergence and there after the value declines. This increase was due to cell multiplication and yolk deposition in eggs and the results

showed that nearly a twenty fold increase of the weight between day 1 and 6 of adult emergence. In the desert locust the size of the oocyte increased by increasing proteins during vitellogenesis and this increase parallels the increase in total weight (Hill *et al*., 1968). In partially starved and cholestrol-fed mated females similar conditions were seen. These may be due to the moderate quantity of food consumed that inturn is utilised for cell multiplication and yolk deposition to a certain extent. Here only a four fold increase in ovary weight was seen among the females. As there were no sufficient quantity of food, further growth and deposition of yolk is prevented and so in both the cases there was a decline in the weight of ovary on the 7th day. On the contrary, in sugar-fed mated female, there was a gradual increase throughout the gonotrophic cycle and was insignificant when compared to the control. The increase may be due to the amount of food consumed since the rate was comparatively high. However, this quantity was not sufficient to bring out matured eggs. In fully starved and casein-fed mated females, there was a continuous decrease in the weight of ovary from day 1 to day 7. Similar studies were reported in grasshopper, *Diabolocatantops pinguis* when fed on different host plants (Vedham and Muralirangam 1999). Thus as in other insect species, both quantity and quality of food affected the ovarian tissue and egg production. Sub-optimal diets reduced the rate of feeding and egg production in *D. cingulatus*. Thus feeding with the sub-optimal food in *D. cingulatus* decreases egg production, thereby promotes female sterility.

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Fig. 1. Feed consumption rate of bugs fed different sub optimal diets and normal diet during culture period

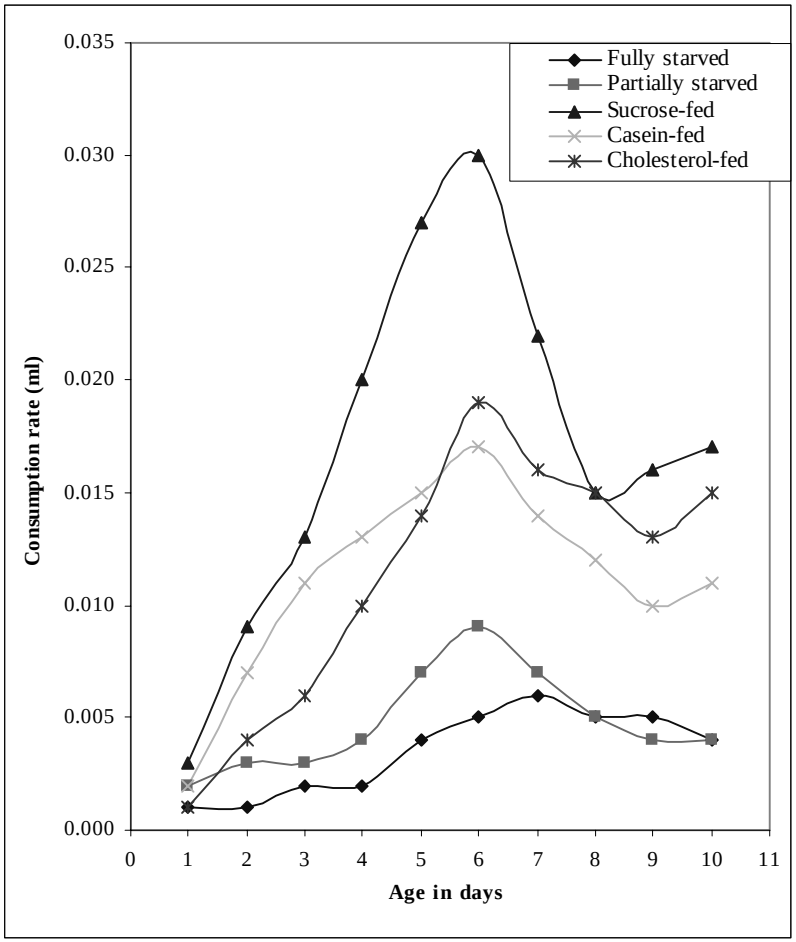
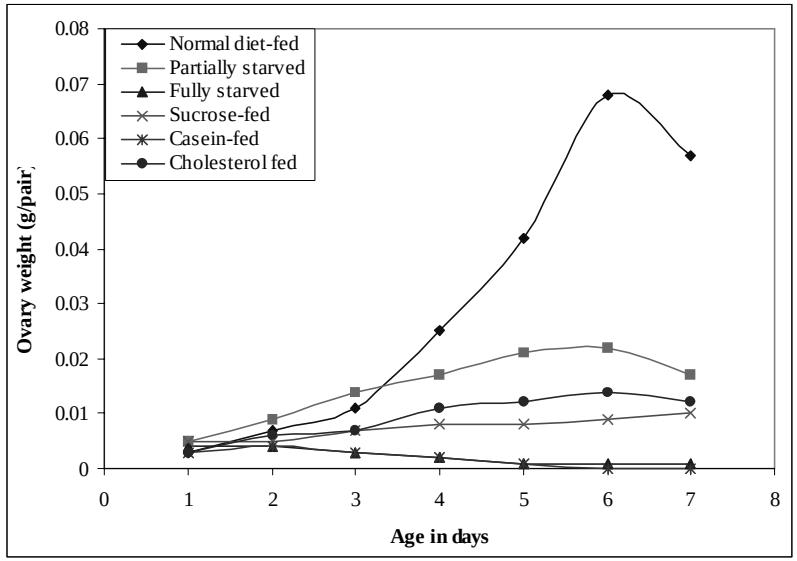


Fig.2. Ovary weight (g/insect) of bugs fed different sub optimal diets and normal diet during culture period



HEALTH SECTOR DEVELOPMENT IN KERALA: NEED FOR POLICY MEASURES

Suby Elizabeth Oommen*

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Over the decades since Indian Independence, Kerala has achieved good standards in health development. However in the recent past, it is felt that Kerala is losing its unique position as morbidity rates increase and the investment in public health infrastructure decrease. In this backdrop, this paper describes the history of health development and stresses upon the necessity of a participative health policy to ease the burden on common people.

Introduction

Health is one of the key building blocks of the Kerala's social attainments (Malayala Manorama, 2003). Kerala has achieved very good health standards in areas like birth rate, death rate, IMR, MMR, average life at birth as well as immunization and control of infections decreasing. But the state now faces problems like high morbidity rate, low maintenance of health infrastructure, shortage of man power. growing prevalence of life- style diseases and diseases of the elderly, re- emergence of some diseases like malaria, diarrhoea, T.B, Dengue fever and rapidly increasing medical cost. Medical cost is increasing with the rise in the cost of drugs and equipments. The number of private hospitals with specialties is increasing. But we find that the quality of public health services has failed to keep pace with public demand and expectation (GoK 2004). The primary health centers located in all panchayats have served the public well especially the poor in the past. But the government health centers and hospitals in recent years have suffered for want of adequate resources for

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providing regular supply of medicines and modern equipments and the economic reforms with accent on cutting public expenditure have accelerating this trend. In Kerala, private medical services now far outstrip the government facilities in the density of beds, personal and the range of sophisticated modes of diagnosis and therapy. The poor and even a sizeable portion of the middle class are priced out by the private sector medical services, which have sprung up following the inflow of gulf money. Allowing these trends will endanger the sustainability of the Kerala Development Model. The need to gear up the government health infrastructure, especially the public care centre to take care of the preventive, promotive and curative health care needs of the people is loud and clear (Oommen 2000).

It is also to be noted that Kerala has nurtured a political climate wherein the rights of the poor and the under privileged have been upheld and fought for. This was the result of a fairly long period of struggle for social reforms emphasizing dignity of people who were considered socially 'inferior' which later found expression in secular-democratic movements culminating in nationalist and socialist movements. One common thrust of all such movements was on education and organization of the downtrodden people. Hence, as has been pointed by many social scientists there is a remarkable reduction in the rate of exploitation of the underprivileged in Kerala compared to other Indian states.

The present study seeks to analyze the trends and patterns in health sector of Kerala, analyze the existing health policy and suggest suitable alternatives. The indicators used here for analysis are life expectancy, infant mortality rate, and infrastructure in the healthy sector.

Trends and patterns of health sector

Kerala achieved high health standards through widespread growth of the three systems of medicine Allopathy, Ayurveda and Homeopathy. Now in Kerala there is at least one health care institution in each grama panchyat. During 1980-81, there were 144 Allopathy hospitals, 85 Ayurveda hospital and 17 Homeopathy hospitals. The number of beds during 1980-81 was 24543, 1818 and

535 respectively. Recently the three systems together treated 18.84 lakh inpatients and 756.6 lakh outpatients (GoK 2003).

However, there is widespread fear that the Public Health System is getting alienated from the people and only 50% of the people, even from lower income group seek medical help from the Government hospitals. This is alarming because, it indicates the fall in quality of services by the Government hospitals.

Although Kerala is not the wealthiest state in India, it's one of the country's top performing states in health sector. Mortality per 1,000 live births is among the lowest in the country, far less than India's over all rate of 63 (GoK 2003). The infant mortality rate of India and Kerala over the years is given in the Table (1).

Table 1

Infant mortality rate of India and Kerala

Year	India	Kerala
1971	129	58
1981	114	40
1991	80	16
2001	70	15.6

Source: Economic Survey

Indian IMR is about $\frac{1}{2}$ that of Brazil and on par with rates found in higher income countries such as Argentina and Uruguay. During 1971 IMR of Kerala was 58, it decreased to 17 in 1991 (World Bank 2003).

There is a declining in trend in the case of birth rate, death rate and fertility rate. During 1971, the birth rate was 31.1: it decreased to 19 during the year 1991. By 2003 it again decreased to 16.90. The death rate was 9.0 in the year 1971. By 2003 it declined to 6.40. There shows a decline in the fertility rate also. It was 4.1 during the year 1971 currently the total fertility rate is 1.70. The decline in fertility rate is prominent among the educated group. As the educational groups are aware of health, hygiene and sanitation they have a high accessibility than others and there is high health maintenances. The impact of education in the medical field proved to be success in this case. Improved child health and higher levels of education, particularly female education is among the most important for Kerala's low and declining birth rate and general acceptance of a small family norm (World Bank 2003).

Table 2

Birth Rate, Death Rate and Fertility Rate

	INDIA			KERALA		
Year	Birth Rate	Death Rate	Fertility Rate	Birth Rate	Death Rate	Fertility Rate
1971	36.9	14.9	5.2	31.1	9	4.1
1981	33.7	12.6	4.5	26.8	7	2.8
1991	29.5	9.8	3.6	18.3	6	1.8
2001	25.9	8.7	3.2	17.1	5.1	1.7

Source: Economic Review

Table 2 shows Kerala's declining trend in Birth rate, death rate and fertility rate compared to India.

The table shows that Kerala achieved progress in controlling birth rate, death rate and fertility rate.

The state shows high life expectancy. In 1951-60, life expectancy for males was 46.17 and for females 50. During 2001 it was 70 for males and 73.62 for females. In terms of life expectancy at birth, Kerala is at least ten years higher than that of India

Table 3

Life expectancy of India and Kerala

	INDIA		KERALA	
Year	Male	Female	Male	Female
1978-80	64.70	69	54.1	54.1
1990-91	69	72	59	59.1
1991-96	67.23	72.37	60	64
1996-2002	68.23	73.62	62	64

Source: Malayala Manoramma Year Book 2003

The use of health Services is high in Kerala with more than 90% of births delivered in health facilities and 80% of Children fully vaccinated. Kerala has achieved near universalisation of immunization. But immunization achievements in programme like BCG, measles and TT in 2003-2004 are below 2002-2003. The impact

of education on health have introduced more doctors, nurses sophisticated medical equipment, medical care facilities, medical institution and medicine etc,. The immunization programme, high proportion of institutional deliveries, improvement in ante- natal, post natal health care and infant care through trained and educated women have together contributed to lower the maternal and infant mortality rate in Kerala (GoK 2002).

Kerala spends fairly substantial amount on public health compared to other Indian states, which is evident from per capita Government health expenditure. In Kerala it was Rs. 50 crores in 1980-81, by 2001- 2002 it raised to 238 crores as against the all India average of Rs.191 crores (GoK 2002).

The Government of Kerala has provided assistance for implementing major activities like woman and children health programmes, health counselling, health awareness camps, and immunization programmes etc. Recent statistics indicate that communicable diseases like dengue fever, malaria, cholera are remerging as a serious health problem. Cardio vascular disorder and cancer are two leading non-communicable diseases causing mortality (Hindu 2005).

Keralites place high value on health and education. Among the poor, health services have long been considered a right. In the 1950's and 1960's poor became increasingly politicized regarding health. Kerala was the only state of India where the socio- economic arrangement were in place to absorb international advances in the last three decades in public health (Prakash 2006). The density of medical establishments to population is substantially higher in Kerala than the rest of India. In an area of mass literacy and high, people demand more health facilities use the health system more and use it better.

The privatization of health care has had long-lasting effects in this sector. The private hospitals have far outpaced government facilities in the provision of hi-tech methods of diagnosis and therapy such as computerised tomography (CT) scans, endoscopy units, magnetic resonance imaging, neonatal care units etc. According to

one estimate, 22 out of 26 CT scan centres in Kerala were in the private sector in 1995. The simultaneous growth of disposable income helped the people access these services. But those who are without adequate means are left in the lurch. The lack of effective barriers or benchmarks in this system aggravates the problem. The absence of adequate government regulation is a common problem to most of the states of India.

Kerala has achieved high health standards through undesired growth of three system of medicine, Allopathy, Ayurveda and Homeopathy. Three Systems of medicine together had 246 hospitals and 26755 beds in it during 1980-81. By 2000-2001 it raised to 287 hospitals with 35547 beds and 1437 dispensaries. There was 4714 PHC 's in 1990-91, it increased to 5009 by 2001.

Allopathy system of Medicine

The table showing district wise distribution of hospitals, beds, dispensaries and PHC's under allopathic is given below.

The table shows that Ernakulam had the greatest number of hospitals and dispensaries during 1980-1981 to 2000-2001 followed by Thiruvananthapuram and Thrissur. During 1980-81 there was 144 Allopathy hospitals with 24543 beds by 2000-2001 the number of hospitals was 143 with 31933 beds. The number of dispensaries has increased from 159 in 1990-91 to 164 in 2000-2001. Palakkad and Ernakulam stand at the top in the case of public health center during the year 1980-1981 to 2000-2001. The district Thiruvananthapuram had the highest number of hospitals beds in the years 1980-1981, 1990-91 and 2000-2001 with 4746, 5714 and 6251 respectively.

Table 4

Distribution of Hospitals, Beds, Dispensaries and PHCs under Allopathy System of Medicine

		1980				1990				2001			
Sl	District	Hospitals	Beds	Dispensaries	Beds	PHCs	Beds	Hospital	Beds	Dispensaries	Beds	PHCs	Beds	Hospitals	Beds	Dispensaries	Beds	PHCs	Beds
1	Trivandrum	19	4746	3	20	17	272	18	5714	6	34	76	300	19	6251	9	34	77	490
2	Kollam	12	1556	1	10	20	217	9	1473	1	15	63	266	9	1500	-	-	65	342
3	Pathanamthitta	-	-	-	-	-	-	11	3282	1	-	64	287	7	618	1	-	57	504
4	Alappuzha	13	3101	1	-	20	221	5	491	1	-	45	273	12	3475	1	-	65	457
5	Kottayam	14	2274	-	-	15	184	13	2295	-	-	58	419	13	2502	-	-	61	580
6	Idukki	4	194	-	-	5	70	3	328	1	-	56	357	3	328	2	-	52	524
7	Ernakulam	20	2320	2	48	17	295	21	2639	3	68	79	606	22	3010	5	68	77	935
8	Thrissur	19	3039	3	-	19	250	19	3249	6	-	80	495	18	3518	5	6	87	640
9	Palakkad	11	1024	4	-	13	137	8	1054	8	-	80	755	8	1147	8	-	82	804
10	Malappuram	8	775	3	-	14	114	7	929	5	-	91	562	7	1302	6	-	95	770
11	Kozhikode	10	3348	2	-	13	126	10	3923	3	-	66	184	10	5214	3	-	69	311
12	Wayanad	-	-	2	-	4	6	3	367	6	-	30	180	2	331	7	-	25	318
13	Kannur	14	2166	5	-	15	250	10	1558	10	-	71	236	10	2298	9	56	79	785
14	Kasargode	-	-	-	-			3	257	3	-	48	111	3	433	3	-	46	263
	Total	144	24543	2	6	78	172	2142	140	27559	51	117	143	31927	5	9	164	937	7723

Source: Economic Review 1982, 1992 & 2002

Forming a Health Policy for Kerala

The growth of health facilities in Kerala offers many lessons in development. The active role of the state government has been a key factor in the expansion of health sector facilities. The initial period of rapid growth in the health facilities was dominated by the public sector, up to 1980's. But later, due to fiscal and other problems there was a slowdown of growth.

Kerala's present health scenario can be described as 'Low Mortality High Morbidity Syndrome'. The social milieu of the state is changing and features of a consumer society are visible in all occupations. Health is no more seen as a right but as a commodity to be purchased by money. Private sector has outpaced the development of facilities in the government sector in the provision of sophisticated modalities of diagnosis and therapy. More seriously the public sector is subjected to internal privatization. The irregular supply of medicines and other materials force patients seeking medical care from the government hospitals to buy them from outside. A similar situation exists in the case of laboratory facilities as well.

To improve this dismal scenario concerted efforts should be made to formulate a People's Health Policy for the state which would re-instate the primacy of the government health services. The administrative and financial decentralization of health services department, while ensuring community participation in formulating and implementing health care programs and reforms can ensure people's participation in this sector. The Panchayati Raj offers the platform to demand the resources for a health service in which people play the dominant role and will be the chief beneficiaries. If this becomes a reality, then Kerala can unveil another unique model of participatory health care worth emulating not only by other Indian states but also by other developing economies.

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REDRAWING IMAGES OF TERRITORIALITY: FUNCTIONAL ROLE OF POPULAR FICTION WITH REFERENCE TO LEON URIS' *EXODUS* AND *THE HAJ*

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This paper analyses the narrative strategies employed by Leon Uris, a Jewish- American writer of Popular Fiction, in his novels Exodus and The Haj which serve to legitimize Jewish settlement in Palestine and the territorial expansion of the state since 1948. The paper also attempts to highlight the parallels between the processes involved in Israeli settlement and colonization in Palestine as represented in the novels, and European Colonialism. Further, it makes an enquiry into the author's ideological agenda, which in turn necessitates an examination of the political contingencies that favoured the production and reception of Uris' works.

Books belonging to the class of popular fiction were generally relegated to a category of popular entertainment unworthy of serious study. However there has been a major shift in scholarly response from limiting their scope to appreciating their literary merit, to treating them as powerful materials typifying the thought of a particular period as well as influencing the course of history.

This paper seeks to highlight certain select crucial narrative strategies employed by Leon Uris in his works *Exodus* and *The Haj*, which serve to legitimize Jewish settlement in Palestine and the territorial expansion of the state since 1948. This paper also attempts to examine how these novels take on events of the past for the realization of political programmes in the present.

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Exodus was published soon after the Sinai Campaign of 1956 when the reactionary and expansionist character of the Zionist Movement had become quite evident. Uris' *Exodus* was published in an era when American –Jewish interest in Israel was slight and the levels of philanthropy and tourism were, by later standards low and when ethnicity was muted or disdained as an embarrassing vestige of the receding immigrant past. (Whitfield 2004). *Exodus* was produced as a result of the efforts made by Edward Gottlieb, an American public relations man, seeking to improve Israel's image in the United States. Gottlieb hit upon the idea of hiring a writer to go to Israel and write a heroic novel about the new country. The writer was Leon Uris and his novel *Exodus* became an international publishing phenomenon, the biggest best seller in the United States since *Gone With the Wind*. (see Neff Donald 1995). The novel was immediately translated into some fifty languages including a Russian *Samizdat* version. Discussing the social impact of the novel critics have pointed out that *Exodus* did more to popularize Israel with the American public than any other presentation through the media. (See Said, Garnick, Lovett-Graff, Liptzin et al). The year Doubleday released *Exodus* former Israeli Prime Minister David Ben Gurion himself declared, "As a piece of propaganda it's the greatest thing ever written about Israel" (qtd. in Whitfield 2004).

Public opinion affects foreign policy decisions and interest groups gain influence when it appears that public opinion supports their positions. In general, sympathy for Israel in the United States has remained fairly constant since the 1960's. However, the 1982 war showed a different trend. Israeli invasion of Lebanon and the massacre of Palestinian refugees at Sabra and Shatilla seemed to have had a significant effect on American attitudes towards Israel. Extensive US media coverage especially on network television of the Israeli actions in Beirut, and the Sabra and Shattila massacres resulted in affecting Israel's standing in US eyes. Support for Israel was down and sympathy for the Arabs was now up (See Reich Bernard 1984). Leon Uris' *The Haj* published in 1984 is to be viewed in the backdrop of the political context discussed above.

Many of the myths and accepted tenets of Zionist thought which serve to validate the Jewish occupation of Palestine and the

systematic expulsion of Palestine's indigenous Arab community find expression in the novels of Leon Uris. Incidentally these have been identified as components of a "basic conquest myth" invoked by every European conquering regime (see for instance Said 1979, Finkelstein 1995). The historian Francis Jennings has stated that the core component of this myth is the belief that the territory stated for conquest is a "virgin land" or "wilderness," thinly populated by unsettled tribes whose aboriginal rights of tenure are at best tenuous since they have not worked the land (qtd. in Finkelstein 1995). Further the claim of a civilizing mission, the depiction of the use of force as a justifiable act of 'self-defence' against 'aggression', and the strategy of invoking the colonialist rhetoric of a 'divinely-ordained mission' for the conquest enterprise may also be discerned in the writings of Uris.

For Uris, Palestine on the eve of Zionist settlement is a stagnant land—a land that had fallen into decay and desolation through centuries of Ottoman and Arab neglect—a place full of deep swamps and jungle growth and poisonous snakes, and ravaged by malaria and pestilence. Through a series of descriptions Uris drives home the image of Palestine as a desolate and forsaken land impatiently waiting for its redeemers, thereby promoting the typical Zionist formula put forward by Israel Zangwill, a close associate of Chaim Weizmann, the first President of Israel— "A Land Without A People for a People Without Land".

For Uris, the Arabs and Ottomans are people who had "raped and abandoned the fields of Palestine", and turned it into a "desolate, desperate land". Uris strives to maintain that the Arabs of Palestine had forfeited whatever right they had to the land because they had neglected it, allowing it to become a desolate wasteland. This is made explicit through the words of Gideon Asch a Palestinian Jew, to Haj Ibrahim the *mukhtar* of Abu Yesha an Arab village: "Its not your land Ibrahim. You've given up on it long ago. You've neither fought for it, nor worked for it, nor ever called it a country of its own" (*Haj* 1984).

The string of images employed by Uris highlighting Arab and Ottoman 'neglect' and 'decripitude' serve to create the impression

that Palestinian land was there for Jewish exploitation, because the Jews understood the value of land in a way impossible for the native Arabs. Uris' picturisation of the Arabs as belonging to a stationary, stagnant culture, incapable of appreciating the land they lived on, serves to validate their dislocation by an 'advanced, enterprising, civilized' immigrant Jewish population.

In both *Exodus* and *The Haj*, Uris talks at length about the selfless services of the Jewish pioneers of the early 20th century towards the redemption of the land that had been "hemorrhaging to death"(*Haj* 1984). The author points out how the pioneers brought the festering malarial swamps, the unyielding rock and desert, and the denuded earth back to life.

Uris' Jews are heroic pioneers who tame the wilderness through hard labour and ingenuity. The writer devotes considerable space in both *Exodus* and *The Haj* to relate the efforts made by the Jewish settlers from the 19th century to modern times to redeem the land and to make the desert bloom. For instance in *The Haj* Uris draws a bleak picture of the Palestine of Ottoman days to highlight the change that this region had undergone with Jewish immigration. Uris paints graphic pictures of the efforts made by such Jewish groups as the poverty stricken Hassidim fleeing centuries of terror and persecution at the hands of the Russians and Poles, ordinary Jews of a pioneering nature taking flight from the horrors of Christian Europe, and the "new breed of Jews" who came from the ghettos of East Europe at the turn of the 20th century in organized groups. The "useless acreage" that absentee Arab landlords had dumped on the Jews, are said to give way to "carpets of green" with the coming of the Jews, and "the energy of building was heard, and millions of trees grew where none had grown for centuries" (*Haj* 1984). Innumerable descriptions of such enterprise are drawn in various sections of both *Exodus* and *The Haj*. The work of the Zion Settlement Society in such places as the Jezreel Valley, the Huleh Swamps and the Negev Desert may be pointed out as specific instances. The creation of Shoshanna the first *kibbutz* in Israel, may be taken as a case in point. Under the leadership of Jossi and Yakov Rabinsky the marshes and swamps are rolled back foot by foot, eucalyptus trees planted to soak up the water, drainage ditches carved out by hand after a lot of back breaking

work, irrigation water brought in, first in water cans on donkey back—the system finally giving way to Arab water wheels, irrigation ditches and finally a network of dams to trap the winter rains [*Exodus* 1958]. According to Uris, the Jewish immigrants brought "tenacity, vitality, and a love and longing for the Promised Land" (*Haj* 1984). Uris' language is shot through with the rhetoric of Zionism which has appropriated a great deal of the language of European Colonialists attempting to deal with "native backwardness". Uris' claims clearly echo the pronouncements made by such Zionist leaders as Chaim Weizmann; "It seems as if God has covered the soil of Palestine with rocks and marshes and sand, so that its beauty can only be brought out by those who love it and will devote their lives to healing its wounds''(qtd in Said 1979).

The narrative strategies employed by the author, which explain the Jewish acquisition of new locations and the outright use of aggression for the same may also be examined in this context. Here acquisition of new lands are themselves presented as acts of self-defence without which the Jews would remain perpetually vulnerable. Jewish aggression is in this context articulated as self defence to counter Arab aggression.

For Uris, Zionism is not a movement of conquest, but one committed to gaining Palestine by virtue of labour where force is used only when necessary in self-defence. Uris speaks at length about the ordeals endured by Jewish youth groups sent to the borders to build combined farming and defensive settlements. They are said to virtually "build a wall of flesh" across Gaza which is described as "the toughest of the frontiers", "the principal base and training ground of the Egyptian sponsored *fedayeen*" where "the victimized Arab Palestinians were allowed to wallow in listlessness and become wards of world charity while they were pumped full of hatred by the Egyptians" (*Exodus* 1958). These images of vulnerable border settlements surrounded by angry Arab hordes projected by Uris, becomes significant in the context of Israel's occupation of the Sinai and the Gaza Strip following the 1956 war, and American and Soviet pressures on Israel to withdraw from the occupied territories. Uris totally sidelines Israel's expansionist ambitions and presents the

annexation of strategic locations as the Gaza Strip, the Negev and the Golan Heights as purely defensive measures. Uris comments on the vulnerability of the string of Jewish settlements along the Galilee easily exposed to Syrian tanks and artillery from the Golan Heights. According to Uris, Syrian artillery could sit on this mountain and simply rain down their fire. The Jews had no guns which could reach that far. As Uris notes, "It took no Saladin to figure out that the Jews would be driven underground by the barrage, after which Syrian tanks and infantry would merely have to sweep down and eradicate them" (*Haj* 1984). Uris also observes how the Zion Settlement Society had purchased land on the Lebanese border at a point where Arab infiltration was taking place. According to Uris, this was the first time that the Jews had picked a spot for a *kibbutz* because of its strategic value (*Exodus* 1958). This implied that new settlements selected for their strategic value were meant purely for choking off Arab aggression.

Uris' images serve the purpose of validating Israel's claims as a peace loving state surrounded by vicious enemies who are out to exterminate the Jews. The rationale for the explicit use of the war machine against hostile enemies is hence not inconsistent with the ultimate and lasting objective of peace for Israel. To Uris, Israeli violence is nothing more than "retaliation" in "self defence". Moreover Israeli Jews are accorded the status of a community which values human life. Thus the Israel presented in the works of Uris is the staunch upholder of Western values against "fundamentalist, terrorist" Islam.

One can easily find close resemblances between the standard perception of the European civilising mission in the colonised terrain in Orientalist discourse, and Uris' claim of a Jewish civilising enterprise in Palestine. Uris plays down such issues as Zionism's initial strategy of gradual settlement and its eventual resort to armed conquest, with the specific aim to transform Palestine into an exclusively Jewish state. Instead the writer's focus is on the supposedly civilizing mission of Jewish settlement. Complimentary remarks hailing Jewish contributions to Palestine's Arab community are voiced through Arab characters themselves, so as to give greater effectiveness to views regarding the civilizing mission of Jewish occupation. For instance,

Exodus depicts enlightened Arabs like Kammal, *mukhtar* of Abu Yesha acknowledging the contributions of the Jews:

> I have watched the Jews come back to perform miracles on the land. We have nothing in common in religion or language or outlook. Yet … the Jews are the only salvation for the Arab people. The Jews are the only ones in a thousand years who have brought light to this part of the world. (*Exodus* 1958)

Sheikh Walid Aziz though a sworn enemy of the Jews is shown speaking in the same vein. The old man also sees the Jews as the only foreigners to come to Palestine without the aim of exploiting the Arab. Having done well by the land, the Jews he feels can be trusted more than anyone else, including the Syrians, the Jordanians, or the British (*The Haj* 1984*)*.The Jews are shown as capable of providing to the Arabs "a window to the world", and of providing a better future planned for the Arab Palestinians than that offered by their "Arab brothers over the border" (*Haj* 1984).

Uris brings in several instances of Jewish contribution towards improving the Palestinian Arabs' standard of life. He speaks at length about the contributions of the Yad El Jews towards transforming the lives of the Arabs of Abu Yesha. This includes the setting up of special schools for the Arabs to teach them sanitation, the use of heavy machinery and new farming methods, the extension of medical facilities, bringing tap water to Abu Yesha, making it the first Arab village in all of Palestine to have it and providing electric irrigation pumps into their fields to demonstrate to the Arabs how to farm intensively through irrigation (*Exodus* 1958).Gideon Asch's advice to the Haj to get rid of the goats and try some of the cattle brought in by the Jews, to send Arab children to their clinics so that "they don't have to die of stomach or chest pain" or "go through life blind from trachoma", as well as Gideon's offer of electricity to the neighbouring Arab village of Tabah, and of running a wire to their café, so that a radio could be installed—all project the image of a Jewish community engaged in a mission of civilizing the "primitive" Arab (*Haj* 1984). Uris takes the typical Orientalist stance that the Arabs and Islam exist only as "communities of interpretation", essentially voiceless

until represented by Western spokesmen, as he lists the "needs" of the Arabs with regard to leaders, in Barak's 'Summary of the Refugee Situation' : not "desert sheiks who own thousands of slaves", or "hate-filled religious fanatics", or " men whose entire thinking is in the Dark Ages" but "leaders with the courage to face the real problems of ignorance, illiteracy and disease". Uris' firm conviction regarding a Jewish civilizing mission is brought out in the following statement; "Israel today stands as the greatest single instrument for bringing the Arab people out of the Dark Ages" (*Exodus* 1958). Uris drives home the same point with intense sharpness through the words of Ari Ben Canaan, reminding his childhood friend Taha about the 'benefits' brought to his people by the Jews

> These stone houses in your village were designed and built by us. Your children can read and write because of us. You have sewers because of us and your young don't die before the age of six because of us. We taught you how to farm properly and live decently .We have brought you things that your own people would not give you in a thousand years. (*Exodus* 1958)

The complexities associated with the mass exodus of Palestinians from their homeland and the occupation of these lands by the Jews receives detailed treatment in *Exodus* and *The Haj*. To Uris the lands that the Jews occupied were those abandoned by the fleeing Palestinians. There was no intimidation, nor was there any forceful eviction of Arabs by the Jews. That the Arabs of Palestine were urged by their fellow Arabs to leave, to run for their lives while the invading Arab armies purged the land of the Jews, is a standard position maintained by the author in both the novels. Uris also makes claims of Jewish appeal to the Arabs not to bring tragedy upon themselves by unnecessary evacuation and self imposed burdens. Futher, Uris also puts forward suggestions towards resolving the Palestinian refugee crisis through the exchange of the Arab population of Palestine with the Jewish population of the Arab countries. Israel's responsibilities towards the repatriation of the Arab refugees are dismissed categorically through the following words:

> The Arabs argue that the Palestinian refugees themselves do not want to be resettled but want their farms in Palestine back. This is sheer nonsense….If the Arabs of Palestine loved their land, they could not have been forced from it- much less run from it without real cause…This is not the reaction of a man who loves his land (*Exodus* 1958).

The expulsion of Palestine's indigenous Arab population from their homeland, for the accommodation of an immigrant Jewish community is a stark reality viewed from the Arab point of view. Uris' constant harping on Arab responsibility for the Palestinian exile and Arab "indifference" to their plight, effectively overshadows Jewish machinations towards the deliberate expulsion of the Palestinian Arabs. Uris' attempts at delegitimizing the Palestinian Arabs' right of return in *The Haj* have to be viewed in the context of a wide range of events involving Israeli excesses such as the nation's invasion of Lebanon, the massacre of Palestinian refugees at Sabra and Shattilla, the subsequent expulsion of the PLO from Lebanon, and international pressures on Israel to withdraw from the West Bank and Gaza, to make possible the establishment of a Palestinian State comprising those areas.

Uris' rendition of the events associated with the creation of the State of Israel, the exodus of the Jews from different parts of the earth, and the 'spectacular' achievements of the Jewish fighters struggling against innumerable odds, are done in such a way that they suggest the presence of an omnipotent force at work, continually aiding the Jews. When Uris quotes *The Bible* as predicting the 'rebirth' of Israel and when these predictions appear to concur with specific instances mentioned in the novels, the author makes possible the legitimization of Israel's sovereignty. *Book Four* of *Exodus* beginning with the Arab- Israeli war of 1948, echoes many of the heroic battle stories found in the *Old Testament*. The author's repeated references to Biblical quests, the use of *The Bible* as supporting evidence and the invocation of God's 'promise' to the Jews as stated in the various books of the *Old Testament*, all underscore Uris' attempts to project the establishment of Israel as the fulfilment of a divinely ordained mission.

Several such instances may be cited from *Exodus* where episodes of current history particularly those constituting Israel's war against the Arab forces, are made to appear like the re-enactment of events that occurred in the past as narrated in the *Old Testament*. In effect, the present is made to appear as the unfolding of divine will, the outcome of which cannot be different from that of the biblical past.

The Bible is also used in a number of other ways to legitimise the claim of a providential sanction for the Jewish occupation of Palestine. Each book section in *Exodus* has biblical motifs as its title such as 'Beyond Jordan'; The Land is Mine', 'An Eye for an Eye', 'Awake in Glory' and 'With Wings as Eagles'. Further each of these book sections is prefaced with verses from *The Bible* which correspond to the above motifs.

Uris makes much claims of a Jewish proprietary rights to Palestine—a claim made on the basis that since the ancient Hebrew forefathers of the Jewish people had lived and been buried in Palestine, only the Jews could establish an authentic connection with the land. In this context it may be noted how Anita Shapira in her work *Land and Power* points to the recurrent motif in Zionism of the "mysticism that links blood and soil", the "cult of heroes, death and graves", the belief that "graves are the source of the vital link with the land" and that "they generate the loyalty of man to that soil" (qtd in Finkelstein 1995). Uris' Zionist agenda is well discernible in the manner in which he seizes upon this sort of historical claim to the land to justify the occupation of Arab Palestine.

Besides, the specific spots and places that lie scattered in geographic space are linked to specific events narrated in the *Old Testament*, so as to make an inseparable association between the distant past of the Jews and their present. This kind of narrative makes possible the conception of the present occupation of these regions as the unfolding of divine will. For instance Yakov and Jossi Rabinsky on their arrival at Mount Tabor are seen identifying the place as the spot where the biblical Deborah and Baraak hid with their armies and swooped down to crush the invading host of Canaanites (*Exodus* 1958). Ari identifies Ein Dor as the place where

Saul met the witch and the bald top of Mount Gilboa where Gideon was buried and where Saul and Jonathan fell in battle to the Philistines (*Exodus* 1958). The spot chosen for the burial of Akiva Ben Canaan at Mount Carmel is pointed out as the place which held the altar of the Prophet Elijah- "the ground where Elijah had proved the power of God against Jezebel's priests of Baal" (*Exodus* 1958). The young *Palmach* fighters in their struggles against Kawukji's forces are seen to be inspired, to push forward undauntedly as they are reminded of the Biblical associations of the land they are fighting for, and what Palestine means to the Jews. The various spots of their encounters with the Arabs are identified as the *wadi* where King David lived as a guerrilla fighter, the place where Samson was born, where Joshua made the sun stand still, the valley where David met Goliath, and the historic fighting ground of Armageddon. Uris also notes that at night *The Bible* was read to the exhausted warriors as a source of inspiration for the superhuman efforts the next day would call forth (*Exodus* 1958). Through such instances Uris lends greater credence to claims regarding the Jews' intimate bond with Palestine and its history.

Thus we find that the picture of Palestine- before the period of Jewish settlement- presented in Uris' novels, is that of a backward province in an even more backward empire. The transformation that has been done on such a geographical space would hence make imaginings possible about the existence of a spiritual bond between God and the Jews and still further as the fulfilment of a Covenant between the two where Israel is conceivable as an exclusive zone of Jewish habitation and where the non-Jewish conglomerations have no place.

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EFFECT OF BLENDING WITH FRUITS ON THE RELEASE OF BIOAVAIALABLE AMINO ACIDS DURING FERMENTATION OF MILK

Jinsu Varghese *
Haridas M **

Running Title**: Free amino acids in some blended yoghurts**

Addition of certain fruits is known to change the protein turnover of fermented milk. With a view to explore the nutritive value, bioavailable amino acids in plain and some fruit blended fermented milk were determined and compared. The fruits selected for the present study were banana, jackfruit and pineapple. Fermentation in blended yoghurts was found to enhance proteolysis and the release of soluble free amino acids. On comparison, it was seen that free amino acid increase in order Milk alone>Milk blended with Banana>Milk with Jackfruit>Milk with Pineapple and these changes were significant at 1% level. It was concluded that addition of the selected fruits enriched lactic fermented milk which could be exploited further in preparing value based products or as ingredients in pharmaceuticals.

Key words: lactic fermentation, free amino acids, proteolysis, whey, tyrosine value

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Introduction

Milk proteins contribute about 20-30% of proteins in diet in developed and developing countries owing to their role in various facets of human nutrition. Most milk-proteins are consumed as fermented products. The nutritional aspects of fermented products are well documented (Hambraeus 1982). Fermentation by lactococci enhances

the proteolytic activity and release of amino acids in milk systems which form a yardstick in assessing the nutritive value as well as health benefits. In addition the free amino acids present in food are more rapidly absorbed after ingestion, than protein derived amino acids.

Supplementation of fermented milk with fruits is known to increase the nutritive value. Some provide an ideal environment for the growth of most lactic acid bacteria (Chopra and Prasad, 1992). Groux (1976) reported that certain amino acids like serine, glutamic acid, proline, valine, leucine, isoleucine and tyrosine in yoghurt indirectly act as precursors for the formation of major aroma compounds in the fermented product.

In recent years, greater public awareness of nutrition and health has created a tremendous scope and expansion of fermented milk products. The nutritional aspects of probiotics have further increased its demand In view of consideration of the above facts, this study was specifically planned to determine and compare the pool of amino acids in some fruit blended yoghurts. Fruits selected in this study are inexpensive and abundant in our country.

Materials and Methods

Preparation of fermented milk: Milk for the studies was prepared by reconstituting skimmed milk powder (Hi Media, Bombay, India) for assuring the consistency of results.10% (w/v) of milk was inoculated with 2%(v/v) of stock of Dahi culture mix procured from National Dairy Research Institute, Karnal, India and incubated for 14,16 and 18h at 25°C.

Preparation of blended yoghurts: Skimmed milk was prepared as above and cooled at room temperature.10% (w/v) fruit pulp of the ripe ,uncooked edible part procurred from local market was added to the cooled milk and inculated with 2% (v/v0 of stock Dahi culture and incubated for 14,16 and 18h at 25% C.

Preparation of whey: After fermentation plain and blended yoghurts were centrifuged at 700g for 10 min and supernatant now called whey were stored at 4^{O} C for analysis for free amino acids.

Analysis of Total Free Amino Acids (TFAA)

10 ml of the whey prepared from plain and fruit added bio yoghurts were mixed with 40 ml 15 %(w/v) Trichloroacetic acid (TCA) to precipitate protein. In 30 min, the insoluble protein was removed by filtration. The clear filtrate was extracted with diethyl either to remove trichloroacetic and was adjusted to pH 2.5 - 2.8 with 1N HCl. An aliquot was taken and total free amino acids were determined by the technique of Moore and Stein, (1948).

Statistical analysis was carried out using Two- way ANOVA for interpretation of results. The results are presented as the mean of six replications ± SD. Significance was accepted at pd" 0.01 levels.

Estimation of Proteolytic Activity

The method of M. E. Hull (1947) was adopted to measure the proteolytic activity. A previously prepared standard tyrosine curve showing optical density for various tyrosine concentrations was used to calculate the sample reading into its tyrosine equivalent. Values were expressed in mg/ml.

Statistical analysis was carried out using Two- way ANOVA for interpretation of results. The results are presented as the mean of six replications ± SD. Significance was accepted at pd" 0.01 levels.

Result and Discussion

It has been observed that under natural or household preparation of dahi (country yoghurt), total soluble protein content of fermented

milk and its forms with additives decrease with increase in time of fermentation(results not shown). While total free amino acids registered an increase with increased time of incubation with starter culture. This implies that with the increased time of fermentation, protein got degraded into free amino acids, hence, a decrease in protein content and corresponding increase in free amino acid content.

As evident from Table 1, TFAA was more in fruit yoghurt whey than in plain yoghurt whey. The initial increase of free amino acids at zero hour was probably due to the contribution of fruits as well as the acid hydrolysis. However, the subsequent increase after fermentation was due to proteolysis brought about by the microbes as well as enzymes of the fruits. These changes were significant as evident from Table 2 ($P<0.01$). It was also found that there was an increase in TFAA with increasing hours of fermentation under study. Due to the proteolytic activity of microbes, milk proteins were partly digested resulting in the liberation of peptides and free amino acids; hence an increase in free amino acid was recorded. The total amino acid content of yoghurt also reflected a balance between proteolysis and assimilation by the bacteria. Some amino acid, such as glutamic acid, proline and, to a lesser degree, alanine and serine, are presumably not required by the yoghurt organisms and these accumulate in larger quantities in the product than the remaining amino acids which are utilised by bacteria like Streptococcus thermophilus and Lactobacillus bulgaricus during growth and/or fermentation (Miller and Kandler, 1967).

There are various reports on the release of free amino acids in fermented milk products with and without fruits, cereals, coffee, etc. (Mavropoulou and Kosikowski, 1971, Rasic, Stojsavlivic and Curic,1971, Tamine and Robinson 1977, Biasiola et al, 1995;).But the total free amino acids of the banana, jackfruit and pineapple yoghurt whey were carried out for the first time The differences in the results of above studies were attributed to different types of milk used and in preparation of fermented product. However, the present result 42mg/100ml (Table 1, 18 h fermented milk alone) is more or less agreeing with the observation by Bruekner and Haush (1990) who have reported 36.8mg / 100 ml of TFAA in curdled milk. Chopra and Prasad (1994) have reported TFAA to be 70 mg / 100g in curd

prepared from buffalo skim milk incubated at 30^{O} C $\pm 1^{O}$C for 10 – 12 h.

From the results presented here, it reveals the fact that acidic conditions of fruit flavored yoghurts favor the growth of lactic acid bacteria, hence proteolysis occurs faster

resulting in release of more free amino acids. After fermentation, the increase in free

amino acids is traced to digestion (partial or complete) of existing proteins and due to secretion from the microbes.

Table 3 shows the proteolytic activity of dahi culture in plain yoghurt and fruit pulp-yoghurts under natural conditions, in terms of liberation of tyrosine. It exhibited a progressive increase in the proteolytic activity with increase in duration of incubation and with addition of fruits in the sequence-banana<jackfruit<pineapple. These changes found to be significant at 1% level. Sreeja and Prasad (1995) reported 0.18 mg/g and 0.20 mg tyrosine/g in dahi and their results conforms to the present study. The value of tyrosine actually indicates the metabolic activity of the microbes in the system.

Increase in proteolytic activity is attributed to two factors, one is the gradual addition of protease by the booming bacteria and the other is the change in the activity of proteolytic enzymes in relation to pH. This may be due to the opening up of sites in protein where protolytic enzymes can act (as lowering of pH can cause unfolding/ denaturation of protein from the nascent structures).

The higher amount of free amino acids in fruit yoghurts might be due to the higher proteolytic activity in such yoghurts. Estimation of proteolytic activity of different fruit yoghurts fits exactly to the pattern of the amount of their total free amino acids. It shows that the increase in total free amino acids in fruit yoghurts is due to increase in proteolytic activity only, not due to decrease in consumption of free amino acids for growth alone. However, it does not mean that fruit yoghurts do not consume more free amino acids from media for enhanced growth. It only means that the proteolytic activity is more in fruit yoghurts than plain yoghurts.

Thus on comparison, it is seen that pool of free amino acids and proteolytic activity increase in order M>MB>MJ>MP and these changes are significant at 1% level (Table 2& 4). Thus, showing that bioavailability of free amino acids is highest in milk with pineapple.

In conclusion, fruit blend yoghurt whey forms better quality protein for human special nutrition and can be utilized as ingredients for the preparation of other value based products.

Acknowledgment

The financial support by Council for Scientific and Industrial Research (CSIR) is gratefully acknowledged.

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Table 1

Total free amino acids (TFAA) (mg/100 ml) of whey from plain and fruit pulp added

Yoghurts at different intervals of fermentation

	0h	14h	16h	18h
M	17(2)	27(3)	38(2)	42(1)
MB	23(2)	32(3)	42(1)	51(1)
MJ	30(2)	43(4)	50(3)	66(4)
MP	83(10)	91(6)	99(6)	115(7)

Average of six readings (SD)

M – Milk alone; **MB** – Milk +Banana; **MJ** – Milk Jackfruit; **MP** – Milk + Pineapple.

Table 2

TWO-WAY ANOVA of Table 1

Source of Variation	Degree of Freedom (df)	Sum of Squares (SS)	Meansumof Squares (MSS)	Calculated F- ratio
Between time Interval	3	1985	661.7	85.05*
Between types	3	10748.5	3582.8	460.52*
Error	9	70	7.78	-

*P<0.01

Table 3

Proteolytic activity in terms of tyrosine (mg/ml) liberated of plain and fruit pulp blended yoghurts at different intervals of fermentation

	0h	14h	16h	18h
M	0.10(.010)	0.14(.005)	0.16(.009)	0.19(.010)
MB	0.15(.005)	0.19(.015)	0.22(.023)	0.27(.024)
MJ	0.18(.013)	0.23(.038)	0.28(.027)	0.31(.026)
MP	0.71(.096)	0.77(.040)	0.83(.116)	0.93(.109)

Average of six readings (SD)

M – Milk alone; **MB** – Milk +Banana; **MJ** – Milk Jackfruit; **MP** – Milk + Pineapple.

Table 4

TWO-WAY ANOVA of Table 3

Source of Variation	Degree of Freedom (df)	Sum of Squares (SS)	Meansumof Squares (MSS)	Calculated F- ratio
Between time Interval	3	0.0424	0.0141	22.23*
Between types	3	1.1314	0.3771	592.89*
Error	9	0.0057	0.0006	

*P<0.01

MICROBIAL DEHALOGENATION

Laiju Sam*

Dehalogenases are enzymes that catalyse the cleavage of carbon-halogen bond (s) yielding hydroxy or oxyalkanoic acids from mono or disubstituted compounds. Halogenated compounds are active ingredients of pesticides. Therefore, dehalogenases are potential candidates for bioremediation studies. Microorganisms that produce dehalogenases, factors affecting dehalogenation and biotechnological applications of dehalogenases are discussed.

Intensive industrialisation and adoption of modern agricultural practices are the most significant hallmarks of the twentieth century that has paved the way to increased food production and development. On the other hand, indiscriminate use and release of xenobiotic compounds, indispensable to agriculture and industry, have led to gross environmental contamination (Alexander, 1965; Bollag and Alexander, 1974; Hill 1978). Amongst these compounds, the halogenated organic compounds are of the utmost concern due to their toxicity and limited biodegradability. The halogenated compounds are active ingredients of herbicides, pesticides, fungicides, solvents and refrigents which have been released into the soil (Merian and Zander 1982; Pearson, 1982).

Owing to their recalcitrance, toxicity, persistence and carcinogenity these chemicals have been designated priority pollutants (Environment Protection Act, 1990). The toxic nature of these compounds were overlooked because of the belief that the natural microbial community present in the soil could eventually mineralize any compound. This sense of security began to fade with the appearance of pesticides such as dichlorodiphenyltrichloroethane

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(DDT) in the food chain and the resultant biomagnification in the higher levels of the food chain. These observations led to investigations into the ability of natural microbial populations to detoxify xenobiotic compounds in the natural environment (Hale et al., 1957; Broda et al., 1981). It was revealed that a number of compounds thought to be nonbiodegradable were susceptible to microbial degradation as long as they shared structural similarity to substrates found in natural catabolic pathways (Hill, 1978).

Microbial Dehalogenases

The growing scientific concern led to the investigations into the ability of microorganisms in producing dehalogenating enzymes collectively called 'dehalogenases'. These enzymes catalyse the cleavage of carbon-halogen bond (s) yielding hydroxy or oxyalkanoic acids from mono or disubstituted compounds (Hardman 1991). Once the carbon halogen bond is cleaved, the products are readily metabolised by the central metabolic pathways of the microorganism (Fig.1).

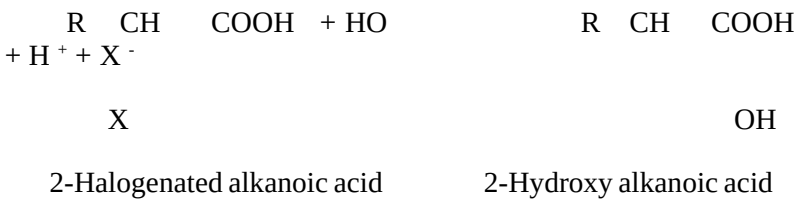

Fig.1. The reaction catalysed by 2-haloacid dehalogenases. R is a short chain alkyl group or hydrogen and X is ahalogen atom.

Dehalogenase producing microorganisms are selected for their ability to utilize halo-alkanoic acids or haloalkanes as the sole source of carbon and energy. For example, microbes dehalogenating 2,2-dichloropropionic acid (2,2 DCPA), the active ingredient of the herbicide dalapon was isolated from soil (Kearney et al., 1964). Furthermore, dehalogenases help the microorganisms to survive in a hostile environment as most halogenated compounds are toxic (Peters, 1952). Thus dehalogenation may be physiologically important as detoxification mechanisms, helping the survival of the microbes in

hostile environments, than as mechanism for the utilization of the halogenated compound for growth (Slater, 1994).

Dehalogenase Producing Microorganisms

Several microorganisms capable of utilizing 2-halogenated alkanoic acids as the sole source of carbon and energy have been readily isolated from soil and were mainly *Pseudomonas* species (Davies and Evans 1962; Goldman 1965; Goldman et al., 1968; Little and Williams, 1971; Senior et al., 1976; Slater et al 1978; Kawasaki et al., 1981; Hardman and Slater, 1981; Hardman 1982; Tsang et al., 1988; Smith et al., 1990).

Bacteria such as *Alcaligenes* (Kohler and Kohler 1989), *Arthrobacter* (Kearny et al., 1964), and fungi such as *Trichoderma viride* (Jenssen 1959) have been reported to produce dehalogenases.

Few dehalogenases are not normally expressed in their original hosts, such as DehII (Hope and Slater 1995), Dhls 5I (Kohler et al., 1998), dehI^{o}PP3, dehI^{o}PP3, deh I^{o}1a (Hill et al., 1991 and Chd1 (Tsang and Sam, 1999). These are encoded by "cryptic genes" which are phenotypically silent DNA sequences not normally expressed during the life cycle of an individual but capable of activation as a rare event in few members of a large population by mutation, recombination, insertion elements or other genetic mechanisms (Hall et al., 1983, Sam 2000, Tsang and Sam 1999).

Factors Affecting Dehalogenation

The efficiency of halogen removal depends on the particular halogen atom involved. Higher the electonegativity of the halogen atom, greater the bond strength between the carbon-halogen (Slater, 1994). This accounts for the easy isolation of microorganisms that dehalogenate chloro substituted alkanoic acids than the fluoro-compounds. Further, compound stereospecificity, the numer of halogen atoms and its position on the substituted molecule affects the dehalogenation mechanism. Compounds substituted in the C2 position are more easily dehalogenated than at any other position.

Increasing the chain length and the number of halogen substitution decreases the rate of dehalogenation (Hardman, 1991; Slater, 1994).

BIOTECHNOLOGICAL APPLICATIONS OF DEHALOGENASES

Dehalogenases as Industrial Biocatalysts

Synthesis of halogenated compounds by biotransformations have economic advantage over chemical organic synthesis. Esters of MCPA are used as intermediates in the production of pharmaceutical products and halocarboxylic acids are key intermediates in the production of herbicides. If racemic MCPA is used for chemical syntheses, racemic products are generated among which only one of the product is biologically active while the other half would be the inactive compound. Selective dehalogenation of one of the isomers of MCPA, exploiting the chiral specificity of 2-haloalkanoic acid dehalogenases is used to remove the L- or D- isomeric form from a chiral mixture of 2MCPA (Motosugi et al., 1983). Imperial Chemical Industries (ICI) Biological products U.K used *P. putida* AJ1/3to produce L-MCPA for use in herbicide manufacture from racemic MCPA (Taylor, 1987). The process has been scaled up commercially. Despite the wealth of data on haloalkanoic acid dehalogenases, no significant applications or bioremediation processes have emerged (Swanson, 1999). But, enzymes have been identified that hold the potential for bioremediation and industrial applications. A thermostable enzyme from *Pseudomonas* has been characterized (Liu et al., 1994). Also, an enzyme from *Azotobacter* RC has been characterized, with higher substrate affinity, better thermostability and resistance to enzyme inhibitors, all ideal characteristics for a higher productivity biocatalyst (Diez et al., 1996). There has also been interest in extending the substrate range of these enzymes to longer chain 2-haloalkanoic acids by use of polar organic solvents (Hassan et al., 1991). L- haloacid dehalogenase purified from *P. putida*, (Motosugi et al, 1982) was lyophilized and its activity in anhydrous dimethyl sulphoxide, toluene and other organic solvents were tested. 2-Haloacids with long alkyl (C5-C-16) or aromatic (phenyl and benzyl) side chains were inert in water but dehalogenated effectively in anhydrous dimethyl sulphoxide by the lyophilized enzyme.

Applications In Bioremediation

Haloalkane dehalogenase DhlA from *X. autotrophicus* has been successfully employed for bioremediation of ground water polluted with 1,2 dichloroethane (Stucki et al., 1995). The source of ground water pollution was from a former pharmaceutical plant were 1, dichloroethane was used as a solvent. This haloalkane was not present until industrially synthesized in 1922 and is used in vinyl production (Schanstra et al., 1996; Krooshof et al., 1997). In addition to ground water studies, research has been carried out on the removal polychlorinated biphenyls (PCB's) from soil sediment. One successful study focused on decontamination in sediments of the Hudson River by using indigenous aerobic microorganisms which decholrinate PCB's and cleave biphenyl rings. This led to a reduction in higher chlorinated PCB's and therefore decreased toxic contamination (Harkness et al., 1993).

Janssen et al., (1994) suggested that transgenic plants capable of fully degrading xenobiotic compounds as 1-2 dichloroethane could be used in bioremediation. Naested et al, (1999) have shown that DhlA dehalogenase can be expressed in *Arabidopsis* and that DhlA gene can be used as a negative selection marker in plants. This is due to the accumulation of intermediate halogenated alcohols, particularly the aldehydes that are more cytotoxic than the original haloalkane substrate. Engineered expression of downstream aldehyde dehydrogenase (op den Camp and Kuhlemeier, 1997) and DhlB haloalkanoic acid dehalogenase could lead to the development of bioremediating plants capable of degrading dichloroethane or other haloalkane pollutants.

Currently most studies are focused on broadening substrate specificity and improving the activity of the enzyme by protein engineering (Schanstra et al., 1996). Site directed mutagenesis (SDM) is employed to alter the enzyme for enhanced catalytic rate, increased substrate affinity and a broader range of substrate specificity. Holloway et al., (1988) expanded the range of chlorinated solvents degraded by *X. autotrophicus* GJ10 to include trichloroethylene by modification of the enzyme. Four bulky amino

acids lining the active site, Phe 14, Asp10, Phe1, and Trp 15 were replaced by Ala residues in separate single amino acid residue replacement mutants. The Phe14 and Asp 10 variants showed increased specific activity against larger substrates such as 1, 6 dichlorohexane as compared to the wild type.

The future of biological applications of dehalogenases lie in bioaugmentation studies (Hardman, 1991). Bioaugmentation can take three forms: (1) stimulation of existing soil organisms, (2) removal of organisms from contaminated sites for enrichment and selection in laboratory before returning cocktails of organisms and (3) bioaugmentation with genetically engineered organisms (Hardman, 1991). More dehalogenases await characterization for their biotechnological applications in future.

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ECONOMICS OF EDUCATION IN KERALA – AN ANALYSIS

Suby Elizabeth Oommen *

Kerala education system has emerged as a single largest economic activity of the state. Kerala's achievement in the field of education- near total literacy, free and universal primary education, low drop out rate at the school level, easy access to educational institutions gender equality in access etc are well known. In these respects, Kerala is often compared not only with the other Indian states or developing countries but also with some of the developed countries recent times have witnessed the entry of new breed of private agencies into the education sector. It is also seen that for overcoming the financial crisis, a number of self financing courses have been started. Kerala today requires large quantum of funds for improvement of quality at all levels. This analysis concentrates on the development of education sector development and also the Government expenditure pattern on education.

Education is a vital sector of national importance as it directly contributes to the process of nation building on the one hand and a positive factor for economic development on the other. It is significant to note that, education is becoming an area for extensive research and analysis primarily on account of its policy implications. It is now argued that human resource development should be given the highest priority in nation building. It has been pointed out that the countries like South Korea, Taiwan, Singapore and Japan have achieved the status of miracle economies by giving the most favoured treatment to education. It has become clear that the national wealth and income

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of different countries are dependent on the investment in education. No nation can survive in the new millennium without developing its own intellectual base. The Human Development Report (1991) makes a reference to the global race for knowledge. It goes on to say that knowledge is the new asset and the global gap between know and know how is widening. The present paper concentrates on development of education sector and Government expenditure pattern on education sector in Kerala.

General Trends in the Development of Education in Kerala

The significance of education was realized even during the national movement and stress was laid on the need to provide a quality education, which commensurate with the economic aspirations, as well as social and cultural million of India.

In India, education has expanded at a very fast rate during the post independence era. There was spectacular increase in the number of institutions enrolment, literacy rate and expenditure. At the time of independence, there were only 20 universities, 400 colleges with student strength of 2,50,000. But now India has more than 250 universities nearly 13,000 colleges and about 75,00,000 students. Indian educational network is the second largest in the world. The educational system expanded considerably during the last five decade as a result of great Government investment, even though country's achievements in terms of absolute number are impressive and quite inadequate in relation to its population.

Education development had taken place in Kerala well before independence. The unique position, which Kerala attained in the educational map of India, is not the result of any sudden spurt of activity in the field of education in recent times but the climax and culmination of enlightened policies followed by the rulers of early days and intellectual pursuits of people spread over several centuries.

It is seen that after independence, the growth in the number of lower primary, middle, high schools and arts and science colleges had expanded the facilities for General education. There has been a substantial growth in private educational institutions due to the policy

of the grants in aid given to meet the salary expenditure of the staff. As the government followed a policy of free school education, it helped all categories of students to attain school education. Though facilities for General education increased, acute shortage was there in the field of professional education such as medicine, engineering, management and technology due to shortage of the educational institutions. Integrated Education of Disabled Children also started in 1974-75 which aimed at providing educational opportunities to all children with disabilities under the general school system with hundred percent central assistance.

But by 1975, the educational sector witnessed more structural changes. In the case of lower primary schools, there had been a decline in the number of schools and students mainly due to the decline in population growth. But there had been a substantial increase in upper primary schools and high schools. Compared to the earlier phase, the drop out of the students in the lower and upper primary levels declined. During this period, Vocational Higher Secondary Education was introduced in 19 Government high schools in Kerala. There are now 375 Vocational Higher Secondary Education of which 247 are in Government Sector and 128 are in private. A substantial increase in the number of Arts and Science colleges had created more opportunities for students for higher education in general subjects. However, the stagnation in the number of professional educational institutions had denied opportunities for a large number of students to attain professional education. This forced large scale migration of students to other states for higher education.

After 1991, the educational sector, witnessed substantial expansion in areas like Plus Two schools, Arts and Science colleges, and Professional educational institutions. Due to the policy of promoting private professional colleges, there has been a substantial increase in the number of professional educational institutions like engineering colleges, medical colleges, other medical institutions since 2001. The number of engineering colleges increased from 30 in 2000 to 83 in 2004 and medical colleges 6 to 13. This created opportunities for the students in Kerala to study professional courses within the state. Sarva Shiksha Abhiyan was started in 2002-2003 which aimed to provide quality elementary education to all children in the age group

6-14. Government of Kerala in 1994 introduced computer education in selected Government high schools. However, computer education did not grow and spread as envisaged and hence a separate agency for implementing computer education was started during 2001.

It may be noted that the educational policy of the state and the wide network of educational institutions have enabled the state to attain remarkable growth in the literacy rate over the years. Literacy rate of Kerala is well above the national average and it is the highest among the Indian states. Table 1 provides data on the literacy level of the state and country

Table 1

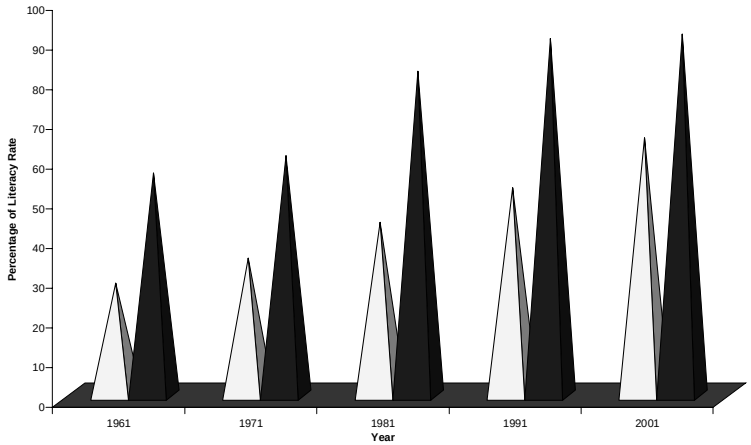
Literacy rate of India and Kerala

Year	India	Kerala
1961	28.30	56
1971	34.45	60.42
1981	43.57	81.56
1991	52.21	89.86
2001	64.84	90.92

Source: Economic review 1982, 1992, 2002

Figure I

Literacy Rate



It is shown in the table and figure that Kerala achieved tremendously in the literacy rate. The national literacy rate in 2001 was 64.84 % as against 52.21% in 1991. During 2001, the literacy rate of Kerala rose to 90.90%. The national literacy rate during 1961 was 28.30 %, by 1971 it increased to 34.45%. During 2001, the literacy rate again increased to 64.84%. Looking into the literacy rate of Kerala, it is also seen that in 1961 it was 56%, by 1971 it rose to 60.42%. The rise in literacy rate of nation was greater than the state during this period. During 2001, the literacy rate of Kerala rose to 90.90% showing a sharp increase. The literacy rate of Kerala almost doubled in 2001 census. Kerala's male literacy rate at 94.20% and female literacy at 87.86% are unique compared to the corresponding national figures of 75.85% and 54.16% respectively. A discernable feature is that the belt of Kottayam, Alappuzha and Pathanamthitta is having very high literacy rates. Regional and gender disparities in literacy rates are low in Kerala.

School Education

There are now 12, 322 schools and 48.94 lakhs enrolled students. Private sector manages 63.5% schools with 67% students and 66.6% teachers. Out of the total schools in 2004, 6716 are lower primary 2964 are upper primary and 2642 are High schools. Out of 51 new schools started during 2004, 6 are Government schools. Peak enrolment in schools was 59.07 lakhs in the year 1992. In Kerala, there is no gender disparity in enrolment. SSLC examination results for the last five consecutive years show an upward trend in both the number of students appeared and pass percentages. Drop-out rate has been showing a declining trend over the past several years. Various schemes have been implemented to reduce the school drop-out rate. Teacher-pupil ratio is one of the important indicator that influence class room transaction. Teacher-pupil ratio in Kerala has improved marginally to 1:28:3 in 2003-2004. Department of Higher Secondary Education was formed in 1990 with the introduction of plus two courses in few schools during 1990-1991. However pre-degree was fully shifted from colleges during the 9th plan period. During 1990-91, there were 932 higher secondary schools but by 2003, the first year of 10th plan period, 322 new schools were started. Private registration was introduced for HSS courses during the academic year 2001-2002. Table 2 provides data pertaining the expansion of schools, enrolment of students and teacher pupil ratio.

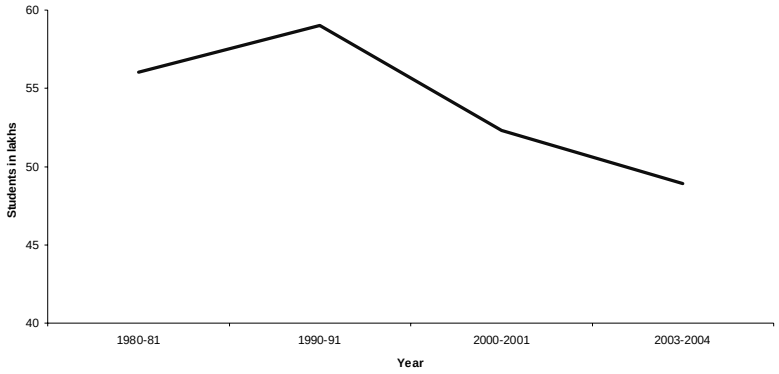
Table 2

Number of schools, enrolment and teacher-pupil ratio

Year	Number. of schools	Enrolment of students	Teachers	Teacher pupil ratio	No. of higher secondary schools
1980-81	11590	56.03 lakhs	174 339	1:30:9	-
1990-91	12145	59.01 lakhs	19100 8	1:30:8	932
2000-2001	12310	52.34 lakhs	185060	1:28:1	931
2003-2004	12322	48.94 lakhs	1729 36	1:28:3	1565

Figure 2

Trend line showing enrolment of students in schools



It is shown from the table that the number of schools during 1980-81 was 11590, by 2003-2004 the number have increased to 12322. There was a slight increase in the number of schools over the years. In the enrolment of students, it is evident from the table that during 1980-81, it was 56.03 lakhs, it increased to 59.01 lakhs in 1990-91, then there was a slight decline of 52.34 lakhs and by 2003-2004, the enrolment again declined to 48.94 lakhs. It is seen that after 2000-2001, a declining trend is projected. This trend may be due to peculiar demographic syndrome experiencing in Kerala. Kerala is becoming the land of 'ageing population'. Proportion of child population is decreasing and it has its reflection in the actual enrolment too. The number of teachers in 1980-81 was 174339, the number have risen to 191008 by 1990-91. But after 1990-1991, the number of teachers has fallen. In order to recognize with the National

Education Policy, Higher secondary course was introduced in the state. As a first step, during 1990-91, 31 Government schools were upgraded to the status of higher secondary schools. In 1990-91, it was 932, the numbers of schools have increased to 1565 by 2003-2004, this increase in solely, due to an increase in the number of unaided higher secondary schools. Kerala ranked the most developed state at all levels of schooling except higher secondary. At the higher secondary level, Haryana ranked the highest followed by Kerala, Punjab and Rajasthan.

It is seen that the number of schools and higher secondary schools have increased over the years. The above trend line also indicates that there has been a slight decrease in the enrolment of students over the years.

University Education

There has been a phenomenal growth of educational infrastructure at the college level since the formation of Kerala in 1956. In response to organized demands from various constituencies, the state government began to build the establishment of colleges offering degree in Arts and science. At present there are 7 universities that manage higher education. There are 290 Arts and Science colleges in 2004, of which 38 are government and 104 are private unaided. Out of 38 Government Arts and Science colleges, seven old and large colleges have been declared as centers of excellence and out of them four have NACC accreditation. The other colleges are creating facilities to get NACC accreditation. There were 1.69 lakh students studying in the various Arts and Science colleges under the 4 universities of Kerala during 2004 and the total number of teachers was 10347 (excluding unaided colleges) Universities have started several self financing Arts and Science college institutions over the last four years. With the increasing demand for skill based and job oriented education, universities are shifting from conventional humanities and social sciences courses to professional and technical courses. Most of the self financial institutions are run by private investment.

Privatisation of Education

State intervention has made education less expensive and more accessible to all strata of the society in the state till the initiation of economic reform. The Government wants to make Kerala the destination for education, for people from all parts of the world. With this aim Government initiated privatisation in a rigorous way.

In fact, the financial crisis of the state coupled with the change in attitude of rulers has led to the privatisaion of education with the intention of producing good results. The Government had commercialized the education sector which created problems for the lower income groups in getting access to higher as well as lower levels of education. The demand for more self-financing colleges stemmed out of the widely prevalent notions that students were sole beneficiaries of higher education.

The day-to-day activities of the universities are financed through plan and non-plan grants provided by Government of Kerala, internal receipts and other sources. Technical education system in Kerala consists mainly of engineering colleges, polytechnics, vocational higher secondary schools, Industrial training institutes and Technical high schools. State Government started to sanction more self financing engineering colleges in private sector since 2000. The rapid increase in the number of engineering colleges in a short period has led to non-availability of qualified good quality teachers in a number of colleges. The resistance to conversion of selected institutions into autonomous ones also stands in the way of improvement of quality and starting new courses to meet emerging demands from industry. Technology also plays an important role in increasing the quality of education. Information computer technology like OHP, multi media projector, AIDS etc have contributed a new dimension for teaching. The table 3 shows the number of arts and science colleges, engineering and polytechnic colleges in Kerala.

Table 3

Number of colleges in Kerala

Colleges	1980-81	1990-91	2000-01	2003-04
Arts and Science	133	172	186	290
Engineering	6	9	62	93
Polytechnic	20	30	47	59

Source: Economic Review 1982, 2005

The above table indicates that the number of arts and science colleges, engineering and polytechnic have increased over the years. In 1980-81, the number of arts and science colleges was 133 but by 2004, it increased to 290. The Arts and science colleges still dominate the higher education sector irrespective of the mushrooming of new generation professional colleges. In recent years, there has been a remarkable increase in the number of engineering colleges especially in the number of private self financing colleges. By the end of the ninth plan, the number of engineering colleges was 44. At present, there are 93 engineering colleges. The total number of approved engineering colleges in India is 1358 with an intake capacity pf 450954.

Expenditure on Education

Kerala spent Rs.2929 crores for education during 2002-2003 as against Rs.2444 crores in 2001-2002. During 2003-2004 it is estimated to have spent Rs.3101 crores. This shows that state expenditure on education have increased by 19.8% into 2003-2004 over 2001-2002. In Kerala, primary and secondary education account for more than 69 percentage of total expenditure on education. The proportion of

education expenditure to total expenditure of Government was 9.9% in 2002-2003, whereas in Kerala the proportion was 11.7% in 2003-2004. The table 4 shows the expenditure on education sector in Kerala.

Table 4

Expenditure on Education (Rs. In Crores)

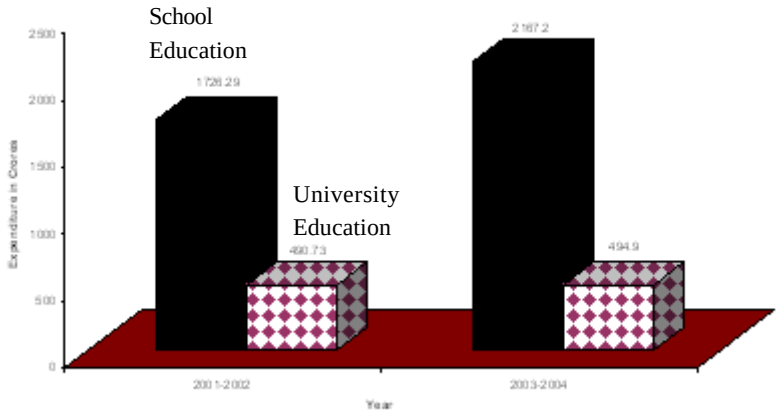
Education sector	2001-2002	2003-2004
School education	1726.29 crores	2167.2
Higher education	50.94	191.2
Vocational higher education	28.95	63.96
University and higher education	490.7.3	494.9
General	20.06	29.07
Technical Education	126.91	155.0
Total	2444 crores	3101 crores

Source: Economic Review 2005

Figure 3

Expenditure on school education and

University education



UNIVERSITY EDUCATION

It is shown from the above table that Kerala expanded Rs.3101 crores for education during 2003-04. During 2004-05, it is established to have spent Rs.3569.19 crore. This shows that, states expenditure on education increased by 3.63% in 2003-04 over 2002-03 and the estimated expenditure in 2004-05 over 2003-04 shows 17.62% increase. In 2001-2002, the expenditure on school education was 1726.29 crores, it increased to 2137 crores in 2003-2004. In higher education, vocational and university also the expenditure increased by 2004. But it is seen that there was a large increase in the expenditure in higher education and school education. In the education sector more expenditure is allocated to school education. Whereas,

expenditure allocation is less in technical education. Expenditure on school education has increased at a great rate over the years, whereas expenditure on university has only a slight increase.

The analysis shows that, over the years the numbers of schools have increased but there have shown a decline trend in the enrolment of students. An increasing trend was also depicted in the expenditure on education.

It can therefore be concluded that the general economic standards of the people can be raised if more investment is put on education sector. As education will contribute a group of skilled people which are an asset to the economy. Government must introduce and take measures to improve the inappropriate curricula of education system and also the regional balances existing in the education sector. Steps are to be taken to see that the brain-drain is stopped and their services utilized for the socio-economic development of our country, the education which is mainly relied upon in other developing countries for enlarging their skills, will not achieve its purpose in Kerala. Government must allocate resources on education for creating and enlarging the human skills properly utilize the available skills by prohibiting the emigration of the skilled personnel. The importance of education sector is increasing, because the policy makers and leaders of economy had come to know about the fact that without development of educational sector, there will not be development in the economy.

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