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APPEAL

I am delighted to introduce this issue of International Journal of Science and Humanities (IJSH) to the students and research community on behalf of Islamiah College (Autonomous), Vaniyambadi, a century old institution serving for the cause of education to socially, economically and educationally weaker sections of the society. The IJSH, is a peer reviewed research journal of interdisciplinary nature that cater the needs of the teaching and research society. The aim of the journal is not only to provide a space for leading research work but also provide a platform for the budding researchers to publish their maiden attempt in the field of science and humanities. The objective of IJSH is to publish up-to-date, high-quality and original research papers alongside relevant and insightful reviews.

The initiative to start this journal was taken by Janab L.M Muneer Ahmed, the Former Secretary & Correspondent of this College with an aspiration to keep the research vibrant in this campus. Now, the torch is handed over to me from June 2016 onwards to run this journal on non-profitable basis without compromising its aims and objectives. At this juncture, I appeal to all teaching and research communities to concentrate on both teaching and research relevant to society, which are symbolically related as the two faces of the same coin. I also appeal to all reviewers and editors not to compromise with the quality of the input and promote this journal to the next level with excellent output. Finally, I pray Almighty to provide guidance for development and success of this journal. Best wishes and thanks for your contribution to the IJSH.

Dr. ANWARULLAH HAJEE
Secretary & Correspondent
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END-TO-END PERFORMANCE FOR CELLULAR NETWORK WITH LOCALIZATION AND DETECTION CONCEPTS – AN OVERVIEW

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Abstract

In today's world, the users of wireless devices (Eg: - Smart Phones etc.) not only have the expectancy in the accessibility of better network services but rather opting for high End-to-End (E2E) performances in their applications. The End-to-End (E2E) measurement is a design framework in which features relating to their specific applications are hosted in the end nodes for communication. The End-to-End performance of user's specific application may differ in huge amount according to the availability of the network, the type of mobile devices or the type of network devices. In this proposed topic, we assess the complete measurement system that finds End-to-End performance metrics along with the service providers for these factors. Also, those data's collected from a major network service providers, our approach includes the expected End-to-End service performance with a regression based techniques and also performance degradation detection based on service levels and finally localizing the service degradation using association-rule-mining techniques (A technique which is meant to find frequent patterns, correlations, associations etc.). The proposed topic examines that most of the instance problems, performance degradation can be assigned to non-network-location paths, such as a set of applications running on different models of network devices.

Keywords: Cellular Data Network, Degradation Performance, End-to-End Performance.

1. Introduction

In today's scenario, the users of mobile phones and other devices focusing not only on the availability of services rather they have expectation of application performances which sounds better compared to other networks, that is, End-to-End performances [1 – 3]. This End-to-End performance will differ according to application and

geographic location, time of day and day of week. It is a crucial work for cellular data service providers to provide best service for their customers. In this context, the End-to-End performance means, performances that user experiences for a certain user locations, device type and application type [3].

In this work, [5] we examine degradation of End-to-End performance with detection and localization (Such as low performance while loading webpages) at cellular service providers across four different sections, Cellular service providers, content providers, device manufacturers and application developers. For discerning, we need to detect End-to-End performance degradation in advance before users call the customer care of network providers to complain. For localization technique, [6, 7] we need to find the causes for the degradation of End-to-End performance. When degradation of End-to-End performance faces by the users, they dont have any clue about the responsibility of an existing problem. Often, when these types of situation arises, users usually points out all the faults to their cellular service providers and may call customer care center for complaint, which also cause the damage to their reputations and financial losses for the providers. Moreover, when the service providers receive such calls, it is a long lasting, manual and labor intensive process for them to locate where the issue is, and after the issue is resolved, the actual issue may not be the cellular service providers problem. The localization findings allow cellular service providers to solve the service issues and communicate with customers effectively and engage content providers as well as device manufacturers or application developers and operators to jointly troubleshoot (rejuvenate the service) from the basement of the systems.

2. An Approach to Detect and Localize E2E Performances

In this paper, [8 – 10] we enhanced a complete approach for detecting and localizing End-to-End performance method at network providers using four dimensions, [10, 11] User location, content providers, device type and application types. Here, we bring into account an unknown flow level data [12, 13] collected from the main stream network of a major cellular service provider from an existing data to calculate TCP loss ratio and Round Trip Time (RTT) as an End-to-End performance metrics[14]. For each TCP flow, we capture information as the device type (J), the application type (R), and the content provider being accessed (M) and the user access point ((H), these values are assigned based on hypothesis) and also standard co- ordinated universal time (UTC). Initially, we use existence data to build regression based models which captures the normal performance of End-to-End performance, that is, the flow of data corresponding to a user location, content provider, device type, and application type. Then we use strong regression for this type of modelling because it can reduce the impact of high range data points on the produced model [7][8][14]. Firstly,[12] we delegates End-to-End performance in a Quad-dimensional matrix which we call as an End-to-End matrix which is previously denoted as E1 = [1H, 1M, 1J, 1R]. We build a basement model

for all End-to-End instances, identifying the End-to-End instance groups that have different performance according to its base, and then separate these groups according to the model leaving the other End-to-End instances still being evaluated by the baseline model. Second, we use our models to track out the performance degradation for every End-to-End instance on an hourly basis. For example, each End-to-End instances are brought to view whether the performance in the testing phase is remarkably much worse than the expected results based on our models. We mark it as degrading. The next step is each End-to-End instance is labelled and marked as degrading and non-degrading. In this case, we use association-rule-mining [15] to localize the source of performance degradation, for example, Rule device (J), email → degrading indicates that, for a span of time for all locations and content providers, the users of cellular network are getting remarkably degraded performance for their email applications.

3. Evaluation Assessment Techniques

For evaluation purposes, we use different synthetic sets of anomaly detection hypothesis. An example of flow chart is given for reference. The process of anomaly detection methods is given for reference.

Apart from this, the first set consists of 19 scenarios involving only one set from the four dimension values. The second involves 26 scenarios with two dimensions and the third set involves 19 scenarios with three dimensions. Each scenario has one hour anomaly related with a group of instances in the End-to-End performance. Each synthetic set of anomaly detections consists of 64 synthetic anomalies that we injected into collected datas which are successfully tracked and localized. In this detection scenario, we implement three different dimensions (One dimension, two dimensions and three dimensions). It produced approximately 90%, 70% and 80% confidence threshold [14, 15]. We totally implemented and arranged our tracking and localization technique on an operational network and also examined performance anomalies in a separate disclosure for packet loss ratios and Round Trip Time (RTT). After monitoring different user locations, device types and application types and content providers for a short span of time, we came to the conclusion that, there is no observation of performance anomalies in the user location dimension, which means that a single user location alone cannot be blamed for anomalies occurring during a one period of time [14 – 16]. There is only 16 one dimensional anomaly events occurred in the content providers and 27 device types respectively which is a small amount compared to anomaly events in application areas.

Also, in multi-dimensional cases, we nearly detected more than seven thousand End-to-End instances as anomalous [15, 16]. In some cases, 83% of these instances involved by content provider and 86% involved in device types and same amount is also involved in application type. In general we say that 80% of the times, the anomalies are not due to the issues in cellular network. The overall topic reveals that, most of the

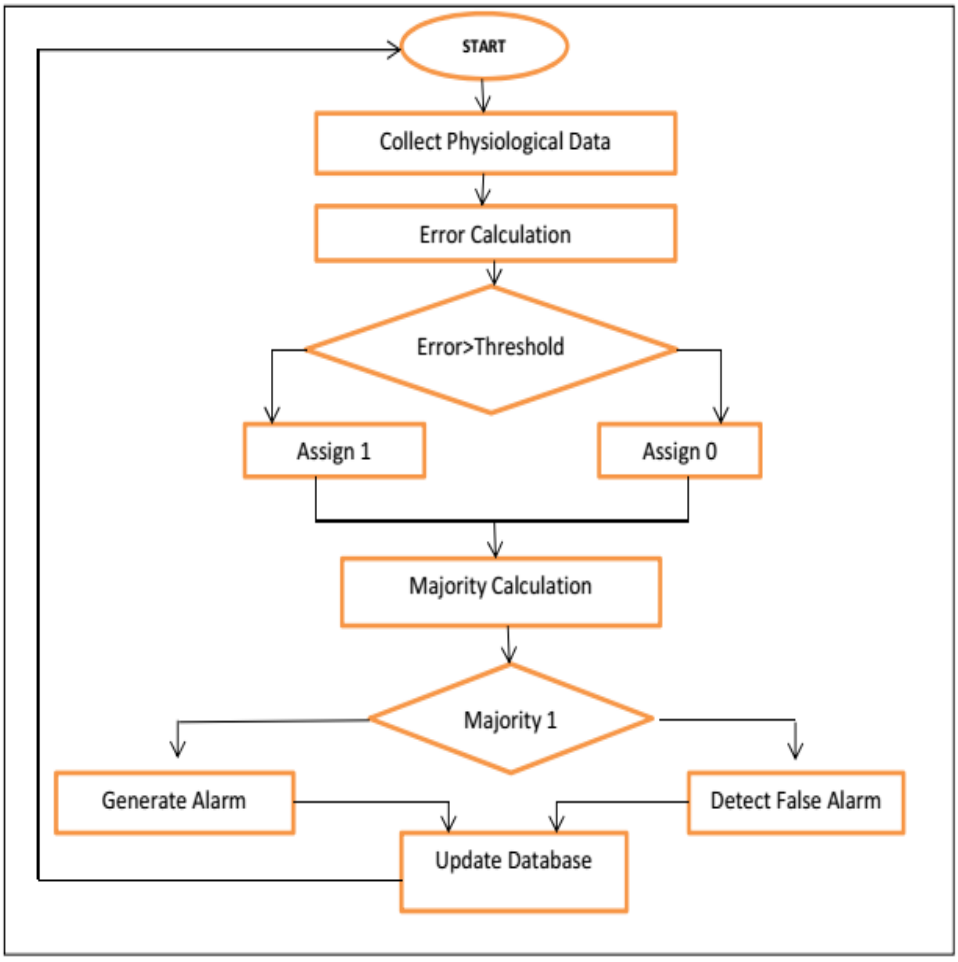

Figure 1: Work Flow of Anomaly Detection Technique

time content providers, device types and application are involved in the performance degradations.

4. Conclusion

End-to-End techniques are implemented for the betterment of network signal connections. In these scenarios, Network providers uses four dimension process (Viz.,) User location, content providers, device type and application types. These techniques were brought into existence with different fields. In fact, usage of Association rule mining technique finds the location of degradation performances with different aspects. Detection of Anomaly with different dimensions provides different results and the future enhancement can be made with different scaling dimensions techniques.

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EXPLORATION OF ASCIDIANS FROM THE UNTAPPED COASTAL AREA, THARUVAIKULAM, SOUTHEAST COAST OF INDIA

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Abstract

Despite growing concerns about the spread and impact of non-indigenous ascidians, many ascidian communities are poorly known and many coastal areas in India are untapped. Ascidians, by virtue of their seasonal breeding and invasiveness, need continuous monitoring for their occurrence and distribution. A field study was conducted during 20172018 at Tharuvaikulam coast for the first time in India to record the occurrence of ascidians. The study revealed the occurrence of 18 species of ascidians belonging to 7 genera and 6 families. All these 18 species were new to this station. The most abundant colonial species were *Polyclinum fungosum*, *P. nudum*, *P. tenuatum* and *Ecteinascidia venui*. Only one solitary ascidian, *Microcosmus exasperates*, was reported in this station for the first time. Maximum representation was from the family Polyclinidae (8) followed by Didemnidae (4). As this preliminary survey recorded all the 18 ascidians as new to this station, a detailed and continuous sampling along with seasonal availability, succession at different depths etc., is sure to yield a rich diversity of ascidians in future.

Keywords: Ascidians, Diversity, Gulf of Mannar, India, Tharuvaikulam, Tunicates.

1. Introduction

Members of Class Ascidiacea, commonly called as tunicates or ascidians belonging to the subphylum Urochordata, are the largest and most diverse group among the macro fouling communities in marine benthic ecosystem. They are found to attach with natural

and artificial substrates in the intertidal and subtidal zones of coastal habitats throughout the world. Research on ascidians around the world is truly stunning as they contribute a major share to raise the world marine biodiversity; provide a fertile ground for a number of aquatic fauna; form a part of food chain; are prey for many marine animals; are store house of bioactive compounds; and serve as indicators to assess the quality of water. Currently, more than 3300 ascidian species including both simple and colonial forms have been described in all marine habitats from the tropics [1] to the poles [2, 3] and from shallow water to the deep sea [4, 5]. Hither to, more than 450 species of ascidians have been recorded in Indian coastal waters by various researchers at different situations [6 – 19].

Still, there are many untapped places yet to be explored for understanding the diversity of ascidians. One of these places is Tharuvaikulam coast which is located in Gulf of Mannar. This coast is sandy and always calm in nature, except in few seasons. Due to the presence of Jetty and heavy traffic fishing vessels from nearby port and fishing harbours, one may expect introduction of ascidians in these structures. With this background, a study was carried out to explore the ascidians in this untapped area for the first time.

2. Materials and Methods

Area Description

Tharuvaikulam coast (Latitude 8°89′N and Longitude 78°1′E) located in Gulf of Mannar, southeast coast of India (Plate 1) is provided with a variety of suitable natural as well as artificial substrata for the settlement of ascidians. The Jetty installed in the Tharuvaikulam coast near the fishing area and presence of huge number of fishing vessels provide major substrates for the settlement of ascidians.

Method of Collection

The present study was carried out during the period from July 2017 to June 2018 covering all the four seasons such as premonsoon (July-September), monsoon (October-December), post monsoon (January-March) and summer (April-June). Sampling was done during Aug 2017 (premonsoon), Dec 2017 (monsoon), Feb 2018 (post monsoon) and May 2018 (summer).

Specimens of ascidians were sampled from the pillars of the Jetty and hull of boats during low tide period and variety of collection methods were used to obtain the organisms. Hand tools were used to remove animals from solid surfaces like pillars of jetty, small rocks and hull of fishing vessels by snorkeling. Several other collection methods were also used such as hand picking, peeling off, dislodging of animal, etc.

Figure 1: Map showing the station, where the ascidians were collected

Identification

All the materials collected were narcotized with menthol and then preserved in 10% buffered formalin in seawater. The specimens were sorted and identified to species or the lowest practicable taxon, with dissection, compound and stereo microscopes using taxonomic keys [20].

3. Results

In the present survey, a total of 18 species under 7 genera and 6 families (Perophoridae, Styelidae, Pyuridae, Polyclinidae, Polycitoridae and Didemnidae) were recorded from Tharuvaikulam water (Table 1). Only one solitary ascidian and 17 colonial were recorded for the first time in the study station. Maximum representation was from the family Polyclinidae (8) followed by Didemnidae (4), Polycitoridae (3), Perophoridae, Styelidae and Pyuridae (1) each (Fig 1).

Table 1: List of Ascidians encountered during the present study

Species	S/C	Status	Season			
			Pre-monsoon	Monsoon	Post-monsoon	Summer
ORDER : PHLEBOBRANCHIA						
FAMILY: PEROPHORIDAE						
Ecteinascidia venui Meenakshi, 2000	C	N	a	x	–	x
ORDER : STOLIDOBRANCHIA						
FAMILY: STYELIDAE						
SUB-FAMILY: POLYZOINAE						
Symplegma oceania Tokioka, 1961	C	C	x	–	x	x
FAMILY: PYURIDAE						
Microcosmus exasperates Heller, 1878	S	I	–	–	x	–
ORDER : APLOUSOBRANCHIA						
FAMILY: POLYCITORIDAE						
**Eudistoma microlarvum* Kott, 1990	C	C	–	–	x	x
E. pyriforme (Herdman, 1886)	C	I	–	–	a	x
E. viride Tokioka, 1955	C	EI	–	–	x	x
FAMILY: POLYCLINIDAE						
Polyclinum fungosum Herdman, 1886	C	C	x	–	x	a
P. glabrum Sluiter, 1895	C	I	x	x	x	a
P. indicum Sebastian, 1954	C	N	x	x	x	x
P. madrasensis Sebestian, 1952	C	N	x	x	x	x
P. nudum Kott, 1992	C	C	x	–	x	a
P. saturnium Savigny, 1816	C	C	x	–	x	x
P. solum Kott, 1992	C	C	x	–	x	x
P. tenuatum Kott, 1992	C	C	x	x	x	a

FAMILY: DIDEMNINIDAE						
Tridemnum caelatum Kott, 2001	C	C	–	–	x	a
T. cyclops Michaelsen, 1921	C	C	–	–	x	x
T. vermiforme Kott, 2001	C	C	–	–	x	x
Didemnum psammatode (Sluiter, 1895)	C	EC	x	x	x	x

Note:
C: Colonial; S: Solitary; N: Native;
C: Cryptogenic; I: Invasive; EC: Established Cryptogenic; EI: Established Invasive
x: Present; a: Abundant; - : Absent

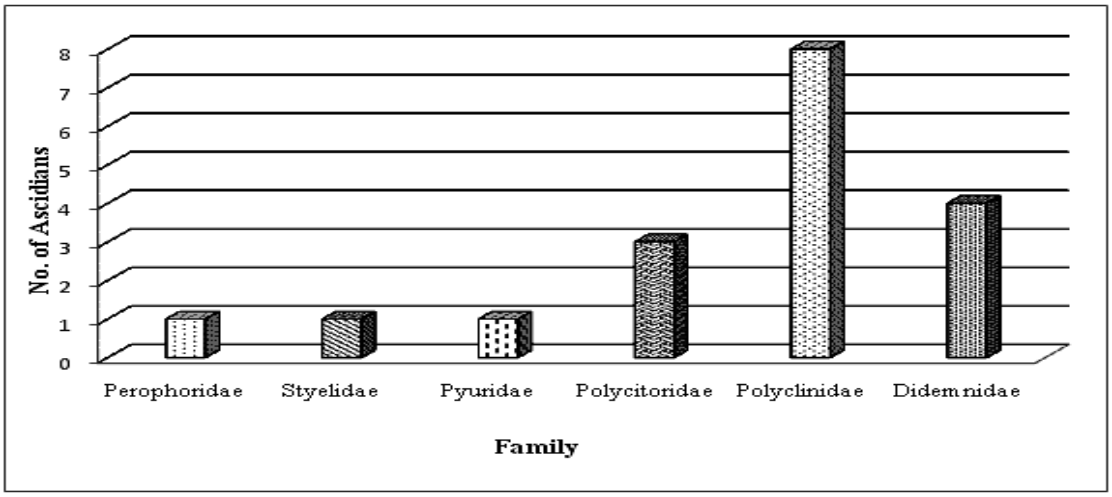

Figure 2: Representatives of the Ascidian families recorded in the present study

Among the 18 species, only 3 species were native and rest of the species was alien ascidians. 11 species of ascidians are cryptogenic and 3 were invasive species. Highest number of species (8) was from the family Polyclinidae. Members of this family were distributed commonly in a variety of substrata in this station. Remarkable distribution of polyclinides was *Polyclinum glabrum* and *P. tenuatum* and they can be considered as key species. *P. saturnium* and *P. tenuatum* were found abundant and fouled the hull of boat. Next to Polyclinidae, four species such as *Didemnumpsammatode*, *Trididemnumcaelatum*, *T. cyclops* and *T. vermiforme* were reported from the family Didemnidae. *T. vermiforme* was found abundant and formed large colony on the hull of boat also. The family Polycitoridae was represented by three species: *Eudistoma microlarvum*, *E. pyriforme* and *E. viride*. Several colonies of *E. pyriforme* were found throughout the jetty. Remaining three families such as Perophoridae, Styelidae and Pyuridae were represented by single species each. A short description about these species is given below.

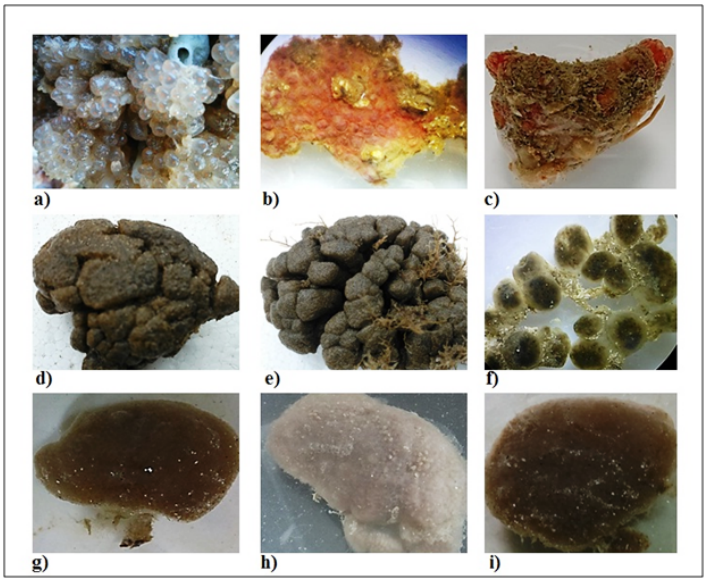

Figure 3: Plate 2. Images of Ascidians collected at Mandapam Coast. a) Ecteinascidia Venui b) Symplegma Oceania c) Microcosmus Exasperatus d) Eudistoma Microlarvum e) E. Pyriforme f) E. Virde g) Polyclinum Fungosum h) P. Glabrum i) P. Indicum

Ecteinascidia Venui (Meenakshi, 2000) (Plate 2a)

This species was commonly available and found abundant during August and September 2017. Bunches of colonies with 80-100 individuals were found attached to the pillars of jetty at a depth of about 1-2 meters. Zooids are transparent, cylindrical, up to 1.5 to 2 cm in height and with 0.7 to 0.9 cm wide branchial sac. Zooids are attached to a common branched stolon network with a short stalk at the posterior end of the zooid. Living colonies are light transparent coloured anteriorly with yellowish orange pigment spots on both siphons. The pigment spots cannot be seen while in preservative. The test is thin, transparent and very delicate. Both the branchial and atrial siphons are orange coloured posteriorly. The body wall is thin and transparent with strong circular muscles in the branchial sac and longitudinal muscles in the siphon.

Symplegma Oceania (Tokioka, 1961) (Plate 2b)

This species was commonly available except monsoon season. Few small colonies were found in the pillars of jetty and hull of boats at a depth of about one meter. The species forms flattened colonies of dome shaped zooids with two colour morphs, pink and yellow. Seldom 4 branchial folds; no cloacal system; gonads large and few. Test is rough and hard but zooids are loosely bound. Stigmata rows 8 to 14 and 10 to 16 stomach folds.

Microcosmus Exasperates (Heller, 1878) (Plate 2c)

This species was found very rare and a single specimen was observed in the pillar of jetty at one meter depth during post monsoon. The globular body is enclosed within a leathery and wrinkled tunic. The tunic is orange or purple, maintaining colour in formalin, and contains some sand and encrusting organisms on the surface. Both siphons are lobed with four triangular lobes. There are 12 large and 18 smaller branched oral tentacles arranged on a muscular ring. The pharynx has 8 folds on each side. Branchial line has numerous siphonal spines, characteristic feature of this species. The species are light reddish orange in living condition.

Eudistoma Microlarvum (Kott, 1990) (Plate 2d)

Few small colonies were found to occur during postmonsoon and summer season in the Jetty. The colony is divided into irregular lobes up to 2.0 cm high and 1.5 thick. Sand embedded throughout the surface test, sparsely distributed at lower half the colony. Test is transparent. Zooids are very small up to 4 mm long when extended and are white and thread-like in preservative. They do not form systems. Both branchial and atrial siphons are relatively short. The branchial sac has 3 rows of up to 8 stigmata

E. Pyriforme (Herdman, 1886) (Plate 2e)

A single large colony and several small colonies were found to attach in pillars at 1 m depth during post monsoon. The colony was attached to the pillar of jetty at a depth of two meters. Colonies are lobed and robust with sand throughout the surface test. Common cloacal openings are absent. Colonies are 10 cm long and 1.5 2 cm thick. Zooids are linear and 2-3 cm in length. Short thorax with 3 rows of stigmata. Pigment cells distributed throughout the thorax. A long stolonic vessel at the end of the abdomen.

E. Viride (Tokioka, 1955) (Plate 2f)

Few small colonies were found at 1 m depth during post monsoon and summer months. Colonies are Greenish yellow in colour with free of epibionts. Lobes of the colonies are closely packed. Black spots on either side of the oral siphons basal region are the characteristic mark. No distinct constriction between thorax and abdomen.

Polyclinum Fungosum (Herdman, 1886) (Plate 2g)

Many large colonies were observed in pillars during the month of May 2018. The colour of the colony is sandy like brown or light black in living condition and dark brown in preservative. Colonies are cushions to about 7 cm in diameter and up to 1.5 cm thick. Test gelatinous, translucent internally. Sand is embedded in the surface test. The test is usually soft in preservative. Branchial lobes six, atrial lip is long originating from the body wall anterior to the atrial opening. There are 14 rows of up to 16 relatively short oval stigmata. No longitudinal folds in stomach.

P. Glabrum (Sluiter, 1895) (Plate 2h)

Several medium sized colonies were present in pillars of jetty at a depth of 1-2 meters throughout the periods of study and found abundant during summer. The colony is dark black or dark brown in living condition and brown in preservative. No sands embedded in the surface of the test. No longitudinal folds in stomach, branchial lobes six, Ovary in post abdomen. Abdomen and post abdomen separated by constriction. Gut loop twisted. The test is usually soft in preservative. Atrial languet originates from body wall anterior to the aperture. Distinct brachial papillae are present. Atrial lip is long and moderately wide with fine longitudinal muscles. Thorax with 12 rows of up to 18 oval stigmata.

P. Indicum (Sebastian, 1954) (Plate 2i)

Number of medium sized colonies of this species was present at a depth of 1-2 meters throughout the periods of study. The colony is greenish brown or brown in living condition. No longitudinal folds in stomach, branchial lobes six, Ovary in post abdomen, Abdomen and post abdomen separated by constriction, Gut loop twisted. Colonies are larger, soft and mushroom shaped. Attached by a small part of the base of the colony. Sand encrusts the sides and under surfaces an in patch on the upper surface and is sparse internally. Zooids are narrow. Thorax is small with horizontal gut loop. The branchial sac is narrow with 13 rows of 14 short oval stigmata. Atrial languet originates from body wall anterior to the aperture.

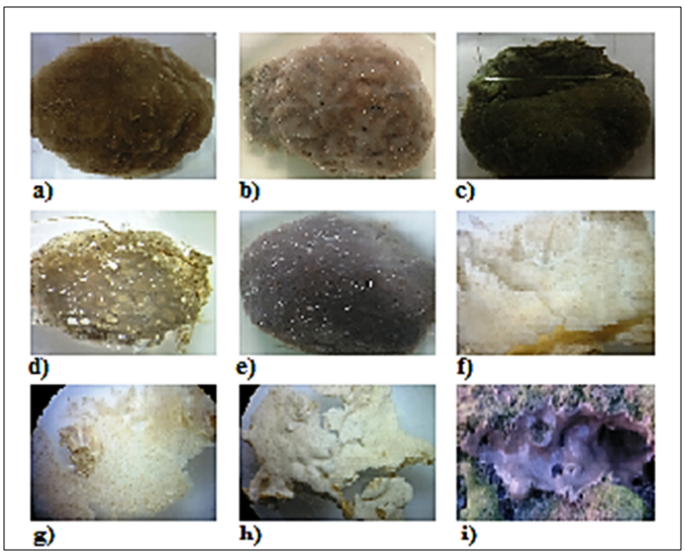

Figure 4: Plate 3. Images of Ascidians collected at Mandapam Coast. a) Polyclinum Madrasensis b) P. Nudum c) P. Saturnium d) P. Solum e) P. Tenuatum f) Trididemnum Caelatum g) T. Cyclops h) T. Vermiforme i) Didemnum Psammathode

P. Madrasensis (Sebastian, 1954) (Plate 3a)

Several colonies were found at a depth of 1-2 meters throughout the study periods. The colonies are hard cushions to 5 cm in maximum dimension, usually sand free, but sand particles embedded at the bottom. The colonies are yellowish green in living condition and dark brown in preservative. No longitudinal folds in stomach, branchial lobes six, Ovary in post abdomen, Abdomen and post abdomen separated by constriction, Gut loop twisted. Zooids are long. Atrial lip s long originated from the body wall anterior to the atrial opening. There are 12-14 rows of up to 14 relatively short oval stigmata.

P. Nudum (Kott, 1992) (Plate 3b)

Few medium sized colonies were recorded from pillars of jetty at a depth of 1-2 meters in premonsoon and post monsoon and found abundant in summer. The colony greenish brown or brown in living condition and brown in preservative. No longitudinal folds in stomach, branchial lobes six, Ovary in post abdomen, Abdomen and post abdomen separated by constriction, Gut loop twisted. No sands on the either surface of the test or embedded within the colony. Atrial languet originating from the upper rim of the atrial aperture. Long club shaped posterior abdomen is present. Cloacal apertures are protruded from the surface on conical elevations.

P. Saturnium (Savigny, 1816) (Plate 3c)

This species was commonly available except monsoon season. Few small colonies were found attached to the hull of boats at a depth of 1-2 meters and also in pillars of Jetty. Colonies are cushions up to 2.0 cm in diameter, with sand throughout the surface. The internal test is soft and translucent. Light brown in preservative. Zooids arranged throughout the test in a circular system. Zooids are about 2 mm long with relatively long thorax and a long neck joining the posterior abdomen to the abdomen. Long atrial languet with 5-6 minute pointed papillae. Atrial lip arising from the upper rim of the atrial aperture. Zooids have 12 rows of up to 16 closely packed short oval stigmata. Well matured embryo in the peri-branchial cavity can be seen.

P. Solum (Kott, 1992) (Plate 3d)

Small colonies were observed from hull of boat and pillars of Jetty also at a depth of 1-2 meters except monsoon season. The colonies are rounded cushions to 4 cm in greater extent and up to 1 m high. A layer of sand is distributed in surface test. The internal test is soft, transparent and free of sand grains. Zooids are arranged in double rows surrounding the cloacal apertures. Zooids are slender in shape and 5-6 mm long. Thorax is long, about half of the length of zooid. The posterior abdomen is narrow and relatively long, more or less club-shaped. Branchial sac is wide with 14-16 rows of about 10-12 oval stigmata. Atrial tongue is long and narrow extending from the body wall.

P. Tenuatum (Kott, 1992) (Plate 3e)

Few small colonies of this species were present in pillars of jetty at a depth of 1-2 meters throughout the periods of study and abundant in summer season only. The colonies are fleshy cushion sheets up to 6 cm in maximum extent with rounded border. The colonies are fixed to the substrate by the whole of the under surface. The test is gelatinous. The thorax and abdomen are together about 3 mm long. Long atrial languet is produced forwards from the upper rim of the atrial siphon. 5-6 minute pointed papillae form a fringe along the straight tip of the atrial lip. 13 rows of up to 12 relatively short oval stigmata with conspicuous conical branchial papilla. The gut loop is twisted and the distal part of the loop curves forward as is a characteristic for the genus.

Trididemnum Caelatum (Kott, 2001) (Plate 3f)

Many colonies of about 8 cm diameter were found at 2 meter depth during post monsoon and abundant in summer. Colony is thin encrusting sheet with a single layer of sand externally. The surface test is thin without spicules around the common cloacal aperture. Spicules uniformly distributed with conical rays. Zooids are small with short branchial siphon with its rim divided in 6 triangular lobes. Atrial siphon is posteriorly directed. Larvae present in the basal test with long spherical larval trunk.

T. Cyclops (Michaelsen, 1921) (Plate 3g)

Few colonies were encountered during post monsoon and summer in the pillars of Jetty at one meter depth. Colony thin encrusting sheet, up to 1.0 cm long. A layer of bladder cells conspicuous around the outer margin of the colony. Spicules stellate uniformly distributed and crowded with pointed rays. Orange coloured pigment cells throughout the test. Zooids short, 1-1.5 mm long, with 3 rows of up to 6-7 stigmata. Retractor muscle short. Branchial siphon upright with 6 lobes.

T. Vermiforme (Kott, 2001) (Plate 3h)

Few large colonies of this species were observed in both Jetty and hull of boats at one meter depth during post monsoon and summer. Colony is thick and fleshy, up to 5 to 7 cm in maximum dimension. Conspicuous circular common cloacal apertures along the surface of the test. The surface test is folded forming the shape of lobes. Spicules are large and stellate with conical pointed rays. Zooids are small, up to 1 mm long with relatively short branchial siphons. Orange-coloured embryos are crowded in the surface layer of the test.

Didemnum Psammatode (Sluiter, 1895) (Plate 3i)

Several medium sized colonies were present in pillars of jetty and also in the hulls of boats throughout the periods of study. This species is abundant in all the habitats. Colony forms thin encrustating sheets spreading over the substrates with characteristically restricted thoracic common cloacal center. The colony is muddy colour both in living and preserved condition. Fecal pellets are embedded throughout the colony. Spicules occur throughout the surface test and around the branchial apertures, but not crowded. Zooids are very small, less than 1 mm long with 4 rows of stigmata. Atrial opening is wide.

4. Discussion

The present study reports a total of 18 new records of ascidians from the Tharuvaikulam water and suggesting that the diversity of ascidian in this station is rich. This clearly indicates the occurrence and distribution of ascidians are increasing in the Gulf of Mannar region. Moreover changing of physico-geographical structures such as establishment of new jetty, heavy traffic of pleasure crafts, fishing vessels, coast guard vessels, etc. favour the entry of new ascidians from various coastal waters of India.

Presence of 15 non-indigenous ascidians at this study station signals the increasing trend of entry of alien species. Once the alien species established their colonies for prolonged period of time, they may become invasive species which in turn may cause ecological damage. Physical, chemical and geographical parameters are considered to be the most important factors in ascidian communities influencing abundance and distribution of the species. The substrate type as well as the relationship between environment and larvae is added to the above elements[21]. The study area is located in Gulf of Mannar, a high mega biodiverse region and characterized by the high sea clarity and calm in nature except in few seasons. These features tend to promote rich ascidian diversity. This result could be justified with result of Moore who stated that ascidians recruit in clear sea water and uniform flow[22].

Ascidian diversity is influenced by coastal development patterns and environmental impacts[23]. Ascidians are common inhabitants of harbours and marinas in both temperate and tropical waters[24]. By virtue of sedentary nature of adult and motile larvae, they can easily be translocated by ships and boats and also through ballast waters. New entry of many ascidians to this station may be correlated with coastal traffics and establishment of new jetty. Coastal shipping patterns determine dimension of ascidian diversity and also increasing invasive state of ascidians[25].

Ecteinascidia venui and polyclinids were found abundant and predominant in shallow region and this could be substantiated with the fact that nutrient in the shallow water regions are readily available. High concentration of nutrients usually coincides with coastal development. Increasing anthropogenic development along the

Tharuvaikulam coastline may contribute to a change in ascidian population as increasing coastal development is associated with entry of non-native ascidians.

It is noteworthy to observe at Tharuvaikulam water that there is relatively dearth of solitary species of ascidians and abundance of colonial ascidians. This station is type-locality for polyclinides and large number of the genus (7) considered here to be a key genus at Tharuvaikulam water.

Further detailed and continuous sampling along with seasonal availability, succession at different depths is sure to yield a rich diversity of ascidian in future. Since ascidians are potential producers of novel compounds and have nutrient value, this updated knowledge on occurrence and distribution of ascidians can be better utilized for human welfare

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SPATIAL AND TEMPORAL VARIATIONS IN THE OCCURRENCE OF SOLITARY ASCIDIAN PHALLUSIA NIGRA SAVIGNY, 1816 IN THOOTHUKUDI (SOUTH EAST COAST) AND VIZHINJAM (SOUTH WEST COAST) OF INDIA

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Abstract

In marine systems, invertebrates are the largest and most diverse component throughout the world. Ascidians are conspicuous and well-studied members of this group, however, much of what is known about their occurrence and seasonality is limited to particular species or locations. Understanding spatial and temporal variations in occurrence of ascidians is vital for the effective utilization and conservation of ascidians. Temporal and spatial variations in the occurrence of the solitary ascidian, Phallusia nigra and hydra graphical parameters between V.O. Chidambaranar Port (Southern East Coast) and Vizhinjam Port (Southern West Coast) of India were studies over a period of two years from Oct 2015 to Sep 2017. Changes in the abundance of this species and in the relative physico-chemical parameters were evident between years and stations. All observed variation was within-habitat variation and not readily related to any of the factors already known to affect the density of settlers or their subsequent survival, such as exposure to polluted and / or contaminated water. There was significant variation in the densities of settlers and recruits on all spatial scales at any given time. Variation among months and among years was also great at any given spatial scale. The data and results from this study may serve as a starting point for monitoring Phallusia nigra occurrence in the port area. Continued and expanded monitoring of this species occurrence will be a vital component in future utilization and conservation efforts.

Keywords: Post-Monsoon, SCUBA divers, Ascidians and ANOVA.

1. Introduction

In recent decades, marine ecosystems have come under increasing stress from environmental features, land based sources of pollution, shipping, physical impact of maritime activities, dredging, coral mining etc., which in turn cause upset collectively the distribution pattern of intertidal sedentary communities. Ascidians belonging to Class Ascidiacea of sub-phylum Urochordata are one among the key ecological groups as the environmental parameters limiting their recruitment, dispersal, survival and reproduction. Ascidians contribute major share in increasing biodiversity of marine ecosystem and provide home for a number of aquatic fauna, a part of food chain, prey for many marine animals, storehouse of bioactive compounds (Tamilselvi 2008; Abdul Jaffar Ali et al., 2011; Abdul Jaffar Ali & Tamilselvi 2016) and serve as indicators to assess the quality of water (Tamilselvi et al., 2010).

A basic understanding of the natural environment where sea squirts inhabit can be beneficial to captive aquarist attempting to duplicate natural habitats and hence, finding information concerning the natural environment is very valuable. Comprehensive knowledge of the seasonal occurrence of ascidians would be helpful in predicting their annual settlement, which would ensure success in the culture of commercially important ascidians and also in the formulation of suitable control measures. Changes in position of land, sea masses and hydrographical conditions during geological times are undoubtedly important and have been used to explain the widespread occurrence of certain species.

Recruitment of ascidians varies considerably both in space and season, which can have important consequences of population and community structure. Seasonal changes in the structure of the population depend on reproduction, growth and mortality, but little is known regarding the way in which ascidian population vary over a period of year. The local distribution of species encounters number of ecological problems and the striking differences in ascidian fauna of apparently similar habitats for the most part still await explanation.

Most studies have been concerned with annual ascidians based on designed materials through one year period or more (Miller, 1952; 1954; Dybern, 1965) or population studies of ascidians settled on artificial substrata suspended in the sea close to the surface (Goodbody, 1962; Lambert, 1968).

The information on the occurrence and seasonal variations of ascidians in the different habitats like littoral, sub-littoral, sheltered shores, benthic and natural hard substratum are available from the different parts of the world but very little information was found incidentally in papers dealing with fouling and biology of ascidians from the Indian coast (Swami and Karande, 1988; Venkat et al., 1995; Meenakshi, 1997: Tamilselvi et al, 2013). The literatures give several examples of life cycle studies on simple as well as colonial ascidians. Few attempts have been made to study the subtidal perennial population living on natural substrata and none at all have followed small

population in-situ throughout their lifetime. Phallusia nigra Savigny, 1816, is a solitary ascidian and has hitherto been recorded from the Indian waters ie. from Thoothukudi (South East Coast) and Vizhinjam (South West Coast) (Abdul Jaffar Ali, 2004). This common large solitary ascidian typically a velvety black or dark brown in colour, has a clean test throughout its life and this, combined with its conspicuous colouration makes it an ideal animal for ecological study and hence, this animal is chosen for the present study.

With this in mind, a two-year long comparative study was made with a view to obtaining detailed information on the seasonal variations in the occurrence of P.nigra in relation to hydrographical characteristics between the two ecologically significant stations.

2. Material and Methods

Description of the Study Areas

For the present study, two ecologically significant stations were selected viz. Thoothukudi (Station 1) (8.7507 N 78.2029 E) and Vizhinjam (Station 2) (76°56′15″E – 8°22′30″N) situated south east coast and south west coast of India respectively.

Station 1 (V.O. Chidambaranar Port)

This port is one of the most important cargo as well as fishery harbours with full-fledged year round mariculture operations. The study area (Map 1) (8.7507 N 78.2029 E) is situated opposite to the Central Electro Chemical Research Institute and permanent finger jetty, 1200 meters away from the South Break Water (SBW) with very limited wave action. The granite rocks are laid down to prevent soil erosion on the slopes of the Harbour basin. Few large barges are anchored in this harbour area regularly. The study area and the nearby coastal areas may be considered as heavily polluted not only because of shipping activities but also due to the establishment of fertilizers plants and Thermal Power Plant. The seasons mentioned in the station 1 are being the cyclic phenomenon influenced by north east monsoon and can be distinguished as Post-monsoon (Jan Mar), Summer (Apr Jun), Pre- monsoon (JulSep) and Monsoon (Oct Dec).

Station 2 (Vizhinjam Bay)

Vizhinjam is situated in the Neyyattinkara Taluk, in the Trivandrum Dist Southwest coast of India (Map 1) about 16 km south to Trivandrum city (76°56′15″E – 8°22′30″N). The beach is narrow and the bay area is enclosed by the break water construction of the Harbour jetting into the sea on the western side and Kottappuram on the eastern side. This bay is a protected area and the depth is varying from 10 15 m and the area opposite to the breakwater in the open sea is in the depth of 15 20 m. The bay is protected

from the heavy wave action but heavy surf action and drift may be persisting from December to May every year. The bottom of the collection site is muddy mixed with loose sand. Water is clean upto 2 m depth. This station is subjected to periodical water current and upwelling. This station and the nearby coastal areas may be considered contaminated with human faecal matters and sewage but less pollutant with industrial effluents. Vizhinjam coast is subjected to pronounced seasonal changes in climatic regions with 3 generally distinct seasons such as Pre-Monsoon (Feb May), Monsoon Season (Jun Sep) and Post-Monsoon (Oct Jan). This bulk of rainfall in this area is due to south west monsoon.

Population Distribution

Monthly observations were made for a period of two years from Oct 2015 to Sep 2017. With the help of SCUBA divers, the quadrate method of sampling was adopted to study the abundance of ascidians. The size of the quadrate was one m2 and the spacing (or) distance between quadrates was also kept more or less fixed. The mean value of 5 quadrates observed were taken and expressed as number of individuals per m^2.

Hydrographical Parameters

Water samples were collected from the habitats of the respective stations to find out the seawater temperature, salinity and dissolved oxygen. Temperature was measured using a centigrade thermometer. Salinity and Dissolved oxygen were estimated following the method described by Stickland and Parson (1968) and Winkler (1975) respectively.

3. Results

The results of the environmental parameters and total populations of *P.nigra* from each station during the study period are shown in Figs 1 to 4.

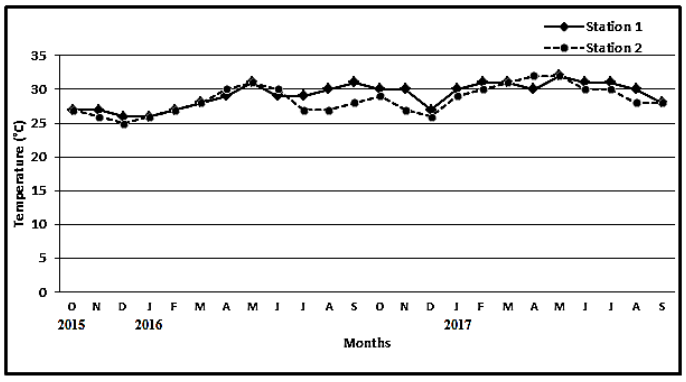

Figure 1: Variations in Temperature during the study periods at station 1 & 2

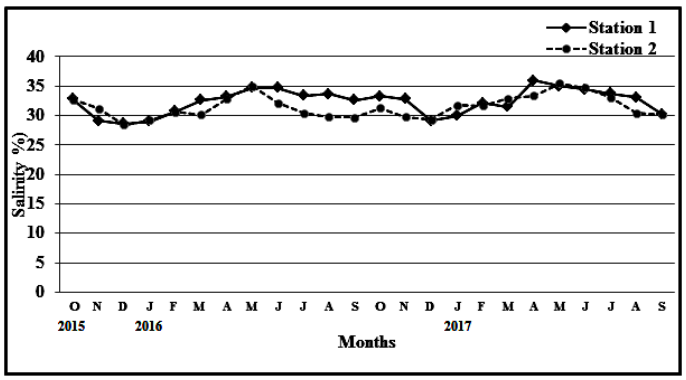

Figure 2: Variations in Salinity during the study periods at station 1 & 2

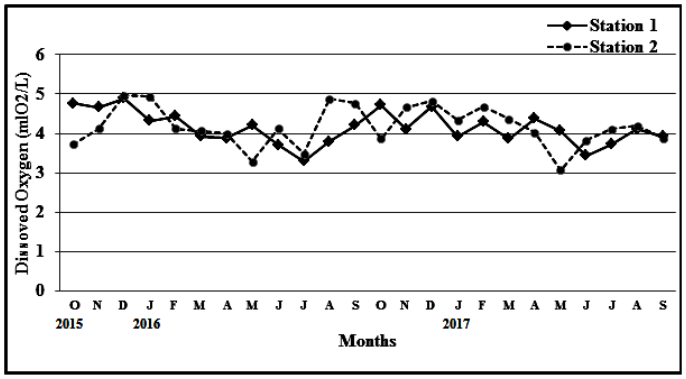

Figure 3: Variations in Dissolved oxygen during the study periods at station 1 & 2

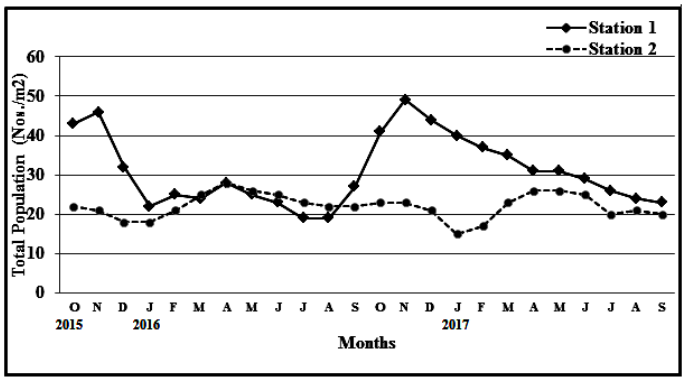

Figure 4: Variations in Total population during the study periods at station 1 & 2

At station 1, the temperature range varied from 26 to 32°C. The minimum temperature was recorded during December 2015 and the maximum was during May 2017. A steady increase in temperature was observed from post-monsoon season (Feb

Mar) and the highest temperature was during the summer season (Apr May). Salinity was concomitant with increasing temperature. Salinity ranged between 28.62 and 35.91%. Minimum saline condition was prevailed during December 2015 (monsoon season). A steady increase in salinity was observed from post-monsoon season (Jan Mar) and maximum salinity was recorded during April 2017 (summer season). Seasonal variations in dissolved oxygen were not conspicuous as salinity. Dissolved oxygen values ranged from 3.44 mlO_2/l to 4.89 mlO_2/l. During monsoon season (Dec 2015), a high value of dissolved oxygen was observed and low value during summer (June 2016).

Application of ANOVA for Temperature, Salinity and Dissolved Oxygen between the years at station 1 showed that there was no significant difference ($P < 0.005$).

Table 1: One-way ANOVA on Temperature, Salinity and Dissolved Oxygen between the years at Station 1

Parameters	**1**	**SS**	**df**	**MS**	**F**
Temperature	Between Groups	18.375	1	18.375	2.27*
	Within Groups	55.5833	22	2.52652	
	Total	**73.9583**	**23**		
Salinity	Between Groups	1.5965	1	1.5965	0.349*
	Within Groups	100.477	22	4.56714	
	Total	**102.073**	**23**		
Dissolved Oxygen	Between Groups	0.03154	1	0.03154	0.172*
	Within Groups	4.03396	22	0.18336	
	Total	**4.0655**	**23**		

*** - insignificant**

During the study period of Oct 2015 to Sep 2017 the population density ranged from 19 (Aug 2016) to 49 m^{-2} (Nov 2016). The peak period of recruitment during monsoon season for both the years was 46 m^{-2} (Nov) in the I year and 49 m^{-2} (Nov) in the II year. The fall period was during pre-monsoon season for both the years and the density was 19 m^{-2} (Aug) in the I year and 23 m^{-2} (Sep) in the II year.

At station 2, temperature varied from 25°C to 32°C. Seasonality in sea water temperature showed same trend as station 1. Salinity ranged between 28.42% and 35.42%. Similar trend of salinity variation was observed at station 2 also. Dissolved Oxygen values fluctuated during the study period with the minimum value of 3.07 mlO_2/l was being recorded in May 2017 (pre-monsoon season) while the maximum value of 4.97 mlO_2/l was noted in December 2015 (post-monsoon season).

Application of ANOVA for Temperature, Salinity and Dissolved Oxygen between the years of study at station 2 showed insignificant difference ($P < 0.005$).

Table 2: One-way ANOVA on Temperature, Salinity and Dissolved Oxygen between the years at Station 2

Parameters	**1**	**SS**	**df**	**MS**	**F**
Temperature	Between Groups	16.66667	1	16.66667	4.86*
	Within Groups	75.33333	22	3.424242	
	Total	**92**	**23**		
Salinity	Between Groups	5.870704	1	5.870704	1.63*
	Within Groups	79.19189	22	3.599631	
	Total	**85.0626**	**23**		
Dissolved Oxygen	Between Groups	0.015504	1	0.015504	0.055*
	Within Groups	6.116758	22	0.278034	
	Total	**6.132262**	**23**		

*** - insignificant**

The population density ranged from 15 (Jan 2017) to 28 m^{-2} (Apr 2016). The peak period of recruitment was observed during pre-monsoon season during the study period and the density was 28 m^{-2} (Apr 2016) in the I year and 26 m^{-2} (Apr & May 2017) in the II year. The fall period was observed during post-monsoon season for the both the years and the density was 18 m^{-2} (Dec 2015 & Jan 2016) in the I year and 15 m^{-2} (Jan 2017) in the II year.

Correlation co-efficient analysis between hydrographical parameters and total population of *P.nigra* showed insignificant correlation at station 1 whereas at station 2 correlation co-efficient between temperature and total population was significant at 5% level (P = 0.005), salinity and total population was significant at 2% level (P = 0.02) and correlation co-efficient between dissolved oxygen and total population showed significant positive correlation at 1% level (P = 0.01).

Table 3: Correlation Co-efficient between Hydrographical Parameters and total population of P. nigra in both stations

Environmental Parameters	**r - value**		
	Station 1	**Station 2**	**P-value**
Temperature Vs Total Population	0.05*	0.46	0.05^{1}
Salinity Vs Total Population	0.05*	0.52	0.02^{2}
Dissolved Oxygen Vs Total Population	0.38*	0.55	0.01^{3}

*** - 1. Significant at 5% level**
2. Significant at 2% level
3. Significant at 1% level

Application of one way ANOVA for the total populations at station 1 and 2 revealed that the occurrence of ascidian varied significantly, but ANOVA between the years of observations at station 1 and 2 showed insignificant variations.

Table 4: One-way ANOVA on recruitment of P. Nigra between Stations and Years

Recruitment of P. nigra	**1**	**SS**	**df**	**MS**	**F**
Between stations	Between Groups	936.33	1	936.33	21.01*
	Within Groups	2049.58	46	44.56	
	Total	**2985.92**	**47**		
Between years at station 1	Between Groups	247.04	1	247.04	3.46*
	Within Groups	1569.92	22	71.36	
	Total	**1816.96**	**23**		
Between years at station 2	Between Groups	5.04	1	5.04	0.49*
	Within Groups	227.58	22	10.34	
	Total	**232.63**	**23**		

*** - insignificant at 5% level**

4. Discussion

Hydrographical parameters observed for the study period (October 2015 to September 2017) showed same seasonal variations at both stations.

Temperature and salinity decreased during monsoon season and increased during summer season but the peak period of recruitment was during monsoon season and fall period was during pre-monsoon season at station 1. Hence, seasonal variations in the occurrence of *P.nigra* could not be correlated with variations in the hydrographical parameters and it was evident with the insignificant correlation co-efficient obtained between total population and other hydrographical parameters. Swami and Karande (1988) also reported that the absence of recruitment of ascidians during monsoon season could not be attributed to variations in the hydrological parameters.

Dybern (1967) reported that Ciona sp. preferred the salinity range of 11 % to 35 %. Yamaguchi (1975) found that *Styela plicata* did not actively reproduce in the coldest months. Turon and Becerro (1992) reported that summer appears to be the unfavourable season with ascidian undergoing recession and resting periods. Hence, based on the early works in different parts of the world the insignificant co-efficient correlation obtained between population and hydrographical parameters at station 1 could be justifiable.

The density of ascidian population was higher at station 1 and this might be due to the fact that at station 1 different kinds of suitable substratum like barges, pilings, cement blocks, hull of ships and raft used for mariculture practices were available for the settlement of *P.nigra* and also due to the possibility of fresh introduction of larvae through heavy transport of ships and vessels.

Unlike at station 1, the variations in hydrographical parameters could be corroborated with changes in the occurrence of the *P.nigra* at station 2. The obtained positive significant correlation between Total population and environmental parameters also supported the above view. Goodbody (1974), while studying the breeding behaviour of various ascidians and correlated with temperature, turbidity or rainfall, reported that these parameters might play a role in the recruitment of some ascidians.

Further at station 2 the peak recruitment of ascidian could be correlated with the productivity of plankton which was usually reported to be high during the months of summer (Apr & May) (Divakaran, et al., 1980). Goodbody (1974) pointed out that *Ascidia nigra* was probably very dependent on phytoplankton for its food and required large quantities. The density of ascidian population was lower and could be attributed to the absence of stable and suitable substratum and also to the fact that station 2 is exposed to open sea with excellent water current and periodic upwelling, which might affect the settlement of larvae of ascidians.

The differences in the recruitment between the stations might also be due to the physical difference especially their sedimentary dynamics and food availability etc, between the two marine environments. Rocha et al., (1999) reported that the differences in the recruitment and breeding could be attributed to the water temperature range, photoperiod, food availability, current intensity, water exposure etc. Life history traits such as longevity and reproduction are subjected to adaptation to environmental and biotic conditions, so that the species may show phenotypic plasticity. (Rinkevich, et al.,1993).There are many examples of ascidians that showed differences in life history trait in different seasons between such populations (Ciona intestinalis Miller, 1952; Dendrodoa grossularia Miller, 1954), separated by only 60 km (Podoclavella mollucensis Davis, 1989) or even in the same area (Botrylloioles sp.- Rinkevich et al., 1993; Apidium glabrum Durante and Sebens, 1994).

On the basis of the data available in both stations, it may be concluded that the recruitment occurs throughout the year. Goodbody (1974) also reported that Ascidia nigra breeds throughout the year but apparently has peaks of reproductive activity at certain times particularly in the winter months.

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GIANT TIGER PRAWN, PENAEUS MONODON IN INDIA: A REVIEW ON PRAWN PRODUCTION, DISEASES, DIAGNOSIS AND IMMUNOSTIMULANTS STATUS

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Abstract

In India, eleven species of shrimp have been found to be suitable for culture among 23 species available. *Litopenaeus vannamei*, *Penaeus monodon* and *Macrobrachium rosenbergii* are the major species contributing in Indian aquaculture industry. Total tiger prawn production increased in 2016 compared to previous year. In India, the giant tiger prawn *Penaeus monodon* is becoming an increasingly important targeted species, as its culture is considered to be the great potential income source among farmers. This study reviews the current production status of giant tiger prawn, diseases caused by various pathogens, various diagnostic methods available to detect early infections and the availability of various drugs to treat the tiger prawn diseases.

Keywords: Giant Tiger Prawn, Penaeus Monodon, Aquaculture, Pathogens, India.

1. Introduction

Aquaculture, the practice of growing freshwater and marine plants and animals like finfish and shellfish under human-controlled conditions. The aquatic species present in culture have been domesticated in 20th century and an estimated 106 aquatic species have been domesticated over the past decade. The worldwide shrimp industry has grown at a tremendous rate since 1950. As naturally occurring (wild) shrimp appear to have reached maximum harvest, the demand for shrimp has been met largely through expansion of shrimp aquaculture. Among the extensively cultivated species of fish and shellfish in the coastal waters of India, penaeid shrimp occupy the foremost place.

In shrimp farming, lifecycle of shrimp is completed under controlled conditions, resulting improved size, which in turn result in more uniformly sized shrimp being produced. Shrimp farming offers significant employment opportunities, which help to alleviate the poverty of local coastal populations in many areas.

The quality and quantity of production from this farming system are found to be low due to indiscriminate stocking of seeds, short time allowed to grow the seed before harvesting and little managerial procedures involved by way of eradication of predatory and competitive species and control of water quality. This system during the past two decades has been improved through eradication of undesirable organisms from preparation of the field, stocking the species of shrimp that grow fast and grow them to marketable size with adequate feed and water supply. The yield as well as the quality of shrimp harvested by this system is found to be of higher. This semi intensive practice is now rapidly spreading and gaining importance in the country. The successful growth of shrimp farming sector increasingly hampered by many factors such as lack of technically qualified manpower, improper site selection, defective farm design, rapid intensification, overcrowding of farms in restricted locations and disproportionate development of industry related to supply of quality farm inputs paved the way for poor environmental conditions in ponds.

One of the major factors which influences the production and quality of seed in the hatchery and their subsequent culture in grow out system is the diseases and parasites affecting the stock. There are a variety of lethal viral diseases that affects shrimp. In the densely populated, mono-culture farms such virus infections spread rapidly and may wipe out the whole shrimp populations. A major factor for the transfer the vector to these viruses is water itself and thus any virus outbreak also carries the danger of decimating shrimp living in the wild. This study aim to address current production status, shrimp diseases and various diagnostic methods to detect early infections and study the availability of potential drugs to treat the tiger prawn diseases.

Giant Tiger Prawn, *P. monodon* as the Candidate Species

Although there are many species of shrimp and prawn, only a few of the larger ones are actually cultivated, all of which belong to the family of penaeid and within the genus Penaeus. In India there are more than 50 species of shrimp available in marine waters, with wide distribution in both tropical and temperate ecosystems. Only eleven species of shrimp have been found to be suitable for culture among 50 species available in our waters. Penaeus monodon is the major species contributing to Indian aquaculture industry. P. monodon is a marine crustacean that is widely reared for food. India has a long tradition of aquaculture and is a leader in the world after China. A sub-continent, with seas around three sides, India has a long coastline of about 8129 kms. The countrys continental shelf is estimated as 0.5 million square kms, within its Exclusive Economic Zone (EEZ) that extends to 2.2 million square kms. The sea coast along the main land and around the islands provide vast scope for development of sea farming, which has

considerable potential to augment production of seafood for the domestic as well as export markets.

Production Status of P. monodon

According to recent reports, giant tiger prawn, is now considered to be one of the most important farmed crustacean species contributing to the Indian prawn aquaculture industry and great interest is now focused on improving the productivity of this species. In Indian scenario, according to the Marine Products Export Development Authority statistics (2016), during the year 2015-16 a total of 81,452 metric ton of shrimps were produced. During the year 2014-2015, shrimp production was estimated to be around 73,156 metric ton and the year 2013-2014 production was 76,798 metric ton. West Bengal ranked first among the states in 2016, Odisha second, Andhra Pradesh third and Kerala fourth while, Tamil Nadu was ranked sixth. The Tiger shrimp production is restricted to mostly traditional bhery/ghery areas as the scientific farms have adopted L. vannamei with additional facilities. Year-wise production detail of Tiger shrimp is presented in Table 1.

Table 1: Year-wise Production of Tiger Shrimp

Sl. No	State	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
1	West Bengal	40,275	45,999	52,581	53,049	53,526	61,998
2	Maharashtra	1,120	1,721	2,010	1,083	178	6
3	Odisha	7,520	10,901	14,096	11,075	10,075	9,191
4	Gujarat	5,675	4,869	6,045	4,362	2,184	1,243
5	Andhra Pradesh	49,030	51,081	25,948	2,883	2,962	3,739
6	Kerala	8,075	8,138	5,175	3,360	3,643	3,490
7	Tamil Nadu & Pondicherry	4,020	12,097	17,220	916	73	1,103
8	Karnataka	2,090	609	180	56	499	682
9	Goa	320	51	48	14	16	0
	Total	**1,18,575**	**1,35,466**	**1,23,302**	**76,798**	**73,156**	**81,452**

Shrimp Diseases

Like other animals, the shrimp are also affected by viruses, bacteria, fungi, protozoan and metazoan parasites. The infectious diseases of economic importance to shrimp culture are those with viral, rickettsial, bacterial, fungal, protozoan and metazoan etiologies. A number of non-infectious diseases are also important to the shrimp industry and are due to environmental extremes, nutritional imbalances, toxicants and genetic factors. All the diseases of marine shrimp are summarized in Table 2. In the following section, an attempt is made to briefly review the most valuable studies carried out on penaeid shrimp diseases abroad and in India.

Table 2: Major Diseases of Marine Shrimp

Viral diseases	**Bacterial Diseases**	**Fungal diseases**
White spot syndrome virus (WSSV)	Vibrio diseases	Rickettsia
Hepatopancreatic parvovirus (HPV)	Septic HP necrosis	Larval mycosis
Lymphoidal parvo-like virus (LPV)	Hatchery vibriosis	Fusariosis
Baculoviral midgut gland necrosis (BMN)	Luminescent vibrio	
Monodon baculovirus (MBV)	Shell disease	
Baculovirus penaei type viruses (BP)	NHP bacterium	
Hemoyctes-infecting baculovirus (HB)		
Type C baculovirus (TCBV)		
Infectious hyperdermal and hematopoietic		
Necrosis virus (IHHNV)		
Hypodermal & hematopoietic necrosis baculo-like virus (HHNBV)		
RNA viruses	**Parasitic diseases**	**Non infectious diseases**
Taura syndrome virus (TSV)	Epicommensals:	Microsporidians
Lymphoid organ vacuolization virus (LOVV)	Leucothrix mucor	Nutritional Imbalance
Reo virus (REO-III & IV)	Peritrich protozoans	Toxic syndromes
Yellow head virus (YHV)	Gregarines	Environmental syndromes
		One month death syndrome
		Zoea II syndrome

Viral Diseases

Virus is the smallest group of living organisms. They always replicate in host cells since they lack the necessary biochemical machinery to manufacture proteins and metabolize sugars. Viral infections are common in crustaceans and approximately 20 viruses have been reported infectious (Nadala et al., 1998, Johnson et al., 1999). The crustacean viruses belong to number of families like Baculoviridae, Birnavirus, Bunyaviridae, Herpesviridae, Picornaviridae, Parvoviridae, Reoviridae, Rhabdoviridae, Togoviridae, Iridoviridae and a new family Nimaviridae (Lightner, 1993; Van Hulten et al. 2001; Yang et al., 2001; Sahul Hamed et al., 2006). Over the past decades extensive and intensive shrimp culture been established and as a result more significant knowledge of viral pathogens has been generated. Therefore, the most intensively investigated viruses have been isolated from cultured penaeids. Much less is known about viruses obtained from wild decapods (Johnson, 1984; Bonami and Lightner, 1991).

Currently, nine viruses are known to be enzootic in Western Hemisphere penaeids, and five of these pathogens have emerged as serious ones in one or more species of cultured shrimp. They are White Spot Syndrome Virus (WSSV), Monodon Baculovirus (MBV), Infectious Hypodermal and Haematopoietic Necrosis Virus (IHNNV), Taura Syndrome Virus (TSV), Yellow Head Disease Virus (YHV), Hepatopancreatic parvo like virus (HPV), lymphoid organ vacuolization virus (LOVV), Baculovirus penaei (BP) and Baculoviral midgut gland necrosis virus (BMNV). The viruses WSSV, MBV and HPV are more prevalent in India.

1.1. White Spot Syndrome Virus

White spot syndrome virus is the causative agent and responsible for severe economic losses in prawn culture industries throughout the world. The virus can survive and remain infective in seawater for 4 to 7 days without a host. WSSV is responsible for severe mortality within a few days after onset of the infection (Lightner, 1996). WSSV was first reported from farmed Marsupenaeus japonicus in Japan in 1993 and named as Penaeid rod shaped DNA virus (Inouye et al., 1994). In less than ten years this disease appeared and spread to global extent, creating the greatest economic damage by any of the aforementioned diseases. Clinical signs include reduction in food consumption, lethargy, loose cuticle, often reddish discoloration and the presence of white spots on the carapace and cuticle (Takahashi et al., 1994). This killer virus infects vital organs of the host and affects its vital functions including exchange of respiratory gases and excretory function (Yoganandhan et al., 2003). Transmission of the virus is mainly through oral ingestion and water borne routes in farms and by vertical transmission in the case of shrimp hatcheries (Rosenberry, 2002). Fast and specific diagnosis of the WSSV is carried out using two step-nested polymerase chain reaction (PCR). Histopathological changes in infected shrimps include prominent intranuclear eosinophilic to basophilic inclusions in the infected cells and cellular degeneration with hypertrophied nuclei and chromatin margination in the cuticular epidermis, gill epithelium, antennal gland, haematopoeitic tissue, nervous tissue and connective tissue and cellular necrosis and detachment of intestinal epithelial tissue.

Monodon Baculovirus

Monodon baculovirus (MBV) has been associated with high mortalities in hatchery-reared larval, post larval and early juvenile stages of P. monodon that originated from Taiwan (Lightner et al., 1983; Lightner, 1981). It is pathogenic. MBV infected tissues of several species of shrimp such as P. monodon Fabricius, P. penicillatus Alcock and Metapenaeus ensis De Haan (Chen et al., 1989). Symptoms of the disease include a reduction of feeding and growth, reduction in activity, and dark outgrowth on the gills surface of the shrimp. Mortalities occur primarily among post-larvae in the hatchery, although disease may also occur in juvenile and adult prawns (Johnson and Lightner, 1988). Presence of MBV occlusions in apparently healthy larvae in India has been

reported (Karunasagar et al., 1998). Adult brood stock can carry the virus and transmit MBV to offspring via horizontal transmission (Paynter et al., 1992), direct from water column or through cannibalism and it is believed, that transmission can also be vertical from brood stock to offspring. Infection can result in substantial economic loss due to poor performance in growth and reduced survival of post larvae up to 90% at high densities. Furthermore, stress and overcrowding are the predisposing factors that may increase the severity of MBV infection (Lightner et al., 1983). The MBV appear either free or within proteinaceous polyhedral occlusion bodies, DNA and replicate in nucleus. The nucleocapsids of MBV measure 42 ± 3 nm by 246 ± 15 nm, while the enveloped virions are larger, measuring 75 ± 4 nm by 324 ± 33 nm (Lightner et al., 1983). Diagnosis of MBV depends upon the demonstration of MBV occlusion bodies in hypertrophied nuclei of anterior midgut epithelium and hepatopancreatic cells by direct light microscopy or standard H&E staining. However, detection of occlusion bodies requires a high level of infection. The applications of molecular techniques including in situ hybridization (Poulos et al., 1994) and polymerase chain reaction (Belcher and Young, 1998) have been developed as more sensitive methods for detection of MBV.

Hepatopancreatic Parvo like Virus

Hepatopancreatic parvo like virus (HPV) is a small icosahedral, nonenveloped, single stranded DNA virus measuring 22-24 nm in diameter belonging to parvoviridae (Berns et al., 1995). HPV in the black tiger shrimp, P. monodon was first reported in Thailand. Hepatopancreatic virus is a serious pathogen of younger life stages of prawn leading to 50-100 % mortality. Stunted growth in HPV infected grow out ponds has been reported (Flegel et al., 1999). Signs of disease in individual prawns are not specific to HPV but include reduced growth, reduced preening, muscular opacity and hepatopancreatic atrophy. The Hepatopancreatic parvo like virus apart from infecting younger life stages also causes stunted growth in adult prawns leading to high economic loss worldwide (Flegel et al., 1999). HPV infects the epithelial cells of hepatopancreas and creates intra nuclear inclusion bodies (IBs) composed of electron dense, fine granular material. Shrimps affected by HPV show a tendency for surface and gill fouling by epicommensal organisms. HPV occurs in cultured and wild penaeids in Australia (Paynter et al., 1985), Africa, the Americas (Lightner, 1992), Israel (Colorni et al., 1987), Thailand (Flegel, 1996) and Kuwait (Lightner, 1996) and as well as in Asia. Definitive diagnosis is dependant on the demonstration of basophilic IBs within cells of the hepatopancreas, using histochemical techniques for light and electron microscopy. IBs are basophilic when fully formed and cause lateral displacement of the nucleolus and margination of chromatin. A rapid field test for HPV has been developed and involves fixing fresh smears of hepatopancreas and staining with Giemsa (Lightner et al., 1993). A diagnostic DNA probe and PCR primers for HPV are also available as commercial kits.

Yellow Head Disease Virus

Yellow head disease (YHD) is a viral infection of shrimp and prawn, in particular of the tiger prawn, P. monodon. Yellow head virus (YHV) was first reported by Limsuwan (1991) in cultured P. monodon adults in central Thailand. Juvenile shrimps are apparently most vulnerable to YHV infection, although earlier and later stages appear to be somewhat resistant. Yellow head virus is a positive-sense single-stranded RNA virus related to corona viruses and arteriviruses. YHV had also been identified in India, Malaysia, and Indonesia. The cephalothorax of infected shrimp turns yellow after a period of unusually high feeding activity ending abruptly, and the moribund shrimps congregate near the surface of their pond before dying. Within the ponds, infected animals, usually between 5 and 15 g begin consuming feed at an abnormally high rate for several days and then cease feeding entirely. One day after cessation of feeding, moribund prawns may be seen swimming slowly near the edges of the pond. By the third day, mass mortality occurs and the entire crop is typically lost (Chantanachookin et al., 1993). Available diagnostic techniques include histology, electron microscopy, and bioassay. YHV in Thailand may be transmitted to cultured penaeids in the ponds from wild crustaceans, introduced to the ponds with incoming water. A diagnostic PCR for YHV has been developed (Wongteerasupaya et al., 1996). PCR of nucleic acid using primers designed from the highly conserved sequence of the RNA polymerase gene (L Protein gene) of insect rhabdoviruses gave a predicted 450 bp PCR product (Flegel et al., 1996).

Baculoviral Midgut Gland Necrosis Virus

The pathogen responsible for Baculoviral Midgut Gland Necrosis (BMN) disease is Baculoviral midgut gland necrosis virus (BMNV), a non-occluded gut-infecting baculovirus, whose non-enveloped nucleocapsid measures 36 by 250 nm; enveloped virions measures 72 by 310 nm. Baculoviral midgut gland necrosis virus is known from hatchery-reared M. japonicus in southern Japan (Sano et al., 1984) and Korea (Lightner, 1996). In Japan, epizootics of BMNV have occurred since 1971 (Sano et al., 1984). Mortalities in hatcheries occur in mysis through 20-day-old post larvae (PL) and may reach up to 98% in PL9-10 (Sano et al., 1981). The onset of mortality is usually rapid. The first gross sign of infection is the white, turbid appearance of the hepatopancreas. Severely affected post-larvae may float inactively on the surface of the water and display a white midgut line (Lightner, 1988). BMNV infects the nuclei of hepatopancreocytes and causes margination of chromatin, hypertrophy, and nucleolar dissociation and ultimately the collapse of the hepatopancreas.

Baculovirus Penaei

The Baculoviridae is a family of occluded DNA viruses pathogenic for arthropods belonging predominantly to the insect order Lepidoptera (Blissard and Rohrmann,

1990). A crustacean baculovirus was first discovered in 1974 in the pink shrimp P. duorarum and named Baculovirus penaei (BP) (Couch 1974a, b). BP, also named L. vannamei single nuclear polyhedrosis virus (PvSNPV) was reported by Francki et al., 1991. BP infects cells of the hepatopancreatic and midgut epithelium (Couch, 1974a, b; Johnson and Lightner, 1988). To diagnose BP, the simplest method is to examine fresh squashes of the hepatopancreas or feaces for the presence of occlusion bodies by light microscopy (Overstreet et al., 1988). However, if occlusion bodies are rare or not present, as is the case, for example, during the prepatent stage of an infection (Blissard and Rohrmann, 1990), then detection of BP infection is problematic. Lewis (1986) described an immunosorbent assay and Bruce et al. (1993, 1994) described an in situ hybridization procedure for detecting BP.

Taura Syndrome Virus

Taura syndrome is one of the more devastating diseases caused by Taura syndrome virus (TSV) affecting the shrimp farming industry worldwide. TSV was first reported in mid-1992 in cultured L. vannamei near the Taura River, Ecuador. The disease is also variously described as Red Tail or Black spot disease. Clinical signs occur in seven hours after infection. Infected shrimp display anorexia, lethargy, erratic swimming behavior, opacification of the tail musculature, soft cuticle and chromatophore expansion (red tail). The acute phase can last up to 7 days and mortality rates can occur up to 95%. Taura syndrome virus is a member of the Discistroviridae family, genus Cripavirus. This intracytoplasmic virus is a 32 nm non-enveloped particle having icosahedral morphology. The virus produces high but variable rates of mortality at the pond level, from 5 -95% in L. vannamei, but has not posed a demonstrable threat to any other species. Infection can also result from carriers such as certain water insects that can be infected, or birds that may have consumed infected tissue. In addition, the disease can survive being frozen multiple times such that shipments of infected shrimp for consumption may also be responsible for some spread of the disease.

Infectious Hypodermal and Haematopoietic Necrosis Virus

Infectious hypodermal and haematopoietic necrosis virus (IHHNV) was first discovered in P. stylirostris, and L. vannamei in the Americas in 1981, starting in Hawaii. Countries, which have reported epidemics of IHHNV, includes south-east USA, Mexico, Ecuador, Peru, Brazil, Carribean, Central America, Hawaii, Guam, Tahiti, New Caledonia, Singapore, Malaysia and Thailand. Natural infections have been reported from P. stylirostris, L. vannamei, P. occidentalis, P. californiensis, P. monodon, P. semisulcatus and M. japonicus. IHHNV is a small single stranded DNA, unenveloped, icosahedral virus, 17-27 nm in diameter (Lightner et al., 1983), which replicates in the cytoplasm of cells of ectodermal origin and mesodermal origin. The clinical signs of IHHNV disease in P. stylirostris are nonspecific and include anorexia, lethargy and erratic swimming. Infected prawns have been observed to rise to the water

surface, remain motionless for a few moments then roll over and sink to the bottom. This behavior may be repeated until mortality occurs. Mortality may exceed 90% within several weeks of onset of infection in juvenile P. stylirostris (Bell and Lightner, 1987). Histological demonstration of prominent intra-nuclear Cowdry type A inclusion bodies (CAIs) provides a presumptive diagnosis of IHHNV infection. In haematoxylin and eosin (H&E)-stained, Davidsons or Bouins AFA preserved tissues, IHHNV CAIs are eosinophilic to pale basophilic, often haloed bodies within chromatin-marginated hypertrophied nuclei of cells in tissues of ectodermal and mesodermal origin.

Lymphoid Organ Vacuolization Virus

Lymphoid organ Vacuolization (LOVV) was first noted in L. vannamei farms in the Americas in the early 1990s (Brock and Main, 1994). In L. vannamei, LOVV has limited localized necrosis of lymphoid organ cells, but never been shown to impact production. It was later discovered in Australia, along with the other TSV-like virus GAV (Lightner, 1998). A RNA viral pathogen very similar to LOVV in L. vannamei has been recently discovered in Thailand in the lymphoid organ of P. monodon (Lightner, 2002). This new type of LOVV might be the causative agent of this slow growth phenomenon.

Gill Associated Virus (GAV)

GAV cause severe mortalities in cultured adult P. monodon from farms in Queensland, Australia during 1996. It occurred in the lymphoid organ and gills of infected shrimps. The host range of GAV is not known. Infected shrimps are lethargic, anorexic and swim near the surface and edges of ponds. They display degrees of pink to red coloration of the appendages and body surface. The gills may be yellow to pink. Gill fouling and tail rots are common among infected animals. Diagnosis is based on the demonstration by TEM of rod-shaped, enveloped virions and filamentous nucleocapsids in the cytoplasm of infected cells of the lymphoid organ and gills.

Other Viruses

There are a number of other viruses in Asia-Pacific region. P. monodon from Australia has been found to be the host for a number of viruses not yet present in other Asian countries. Recently Sritunyalucksana et al. (2006) found a new, apparently innocuous virus while investigating the cause of monodon slow growth syndrome (MSGS) in cultured black tiger shrimp, P. monodon. MSGS closely related to YHV was also discovered only in 1996, but had already been found in M. japonicus and is associated with disease in P. monodon farms in Australia and elsewhere in Asia. Many of these viruses, without methods of diagnosis, are probably being harbored unknown within the wild and cultured populations of shrimp throughout the world. It may not be until shrimp species from one location are moved to another and their viral flora comes into contact with new and/or nave or intolerant hosts that disease epidemics begin.

Crustaceans may be particularly problematic since they tend to have persistent, often multiple, viral infections without gross or even histological signs of disease (Flegel and Fegan, 2002a, b).

Bacterial Diseases

A number of diseases caused by bacteria have been reported from penaeid prawns. The majority of bacterial diseases are of a secondary etiology (Lightner, 1977). In most of the cases of bacterial infections in penaeid prawns, motile, gram-negative, oxidase-positive and fermentative rods have been isolated (Barkate, 1972; Lewis, 1973 a, b; Lightner and Lewis, 1975; Lightner, 1977; AQUACOP, 1977; Zheng, 1986 a, b). Most isolates have been Vibrio species, usually Vibrio alginolyticus, V. parahaemolyticus or V. anguillarum. Certain other gram-negative rods including Pseudomonas sp. and Aeromonas sp. may occasionally be involved in bacterial syndromes in penaeid prawns. Vibriosis is a major disease in shrimp aquaculture, affecting all developmental stages, from larvae in hatchery tanks to juveniles and broodstock in growout ponds. Different Vibrio species have been reported as opportunistic pathogen that cause serious production losses in shrimp farms with mortality upto 100%, particularly in post-larvae and juvenile populations (Karunasagar et al., 1994; Prayitno and Latchford, 1995; Vandenberghe et al., 1998; Sudheesh and Xu, 2001). Vibrio disease is described as vibriosis or bacterial disease, penaeid bacterial septicaemia, penaeid vibriosis, luminescent vibriosis or red-leg disease, and is widely distributed. Signs of Vibrio disease include lethargy, tissue and appendage necrosis, slow growth, slow larval metamorphosis and body malformation, bolitas negricans, bioluminescence, muscle opacity, melanization, empty midgut and anorexia (Karunasagar et al., 1994; Lightner, 1996b; Robertson et al., 1998; Smith, 2000). Sahul Hameed (1995) demonstrated a species-specificity in the susceptibility of three Penaeus species to a Vibrio campbelli-like bacterium. Luminous vibriosis, an important disease of hatchery-reared P. monodon (Lavilla-Pitogo et al., 1990), is presently a major disease in grow-out shrimp culture. The disease usually occurs during the first month of culture and can cause more than 50% mortality. Luminous Vibrio, the causative organism of the disease, is an opportunistic pathogen. They can invade the host through the hepatopancreas, a common target organ of most bacterial pathogens of shrimps (Frelier et al., 1992). These bacteria proliferate and colonize in the hosts digestive tract and become pathogenic. Thus, it is necessary to determine the bacterial load of the hepatopancreas to assess the levels of bacteria, specifically luminous Vibrio, that can be tolerated by the shrimp host. Larval mortalities associated with the presence of Vibrio harveyi have been reported in P. monodon and L. vannamei in Indonesia (Sunaryanto and Mariam, 1986), Philippines (Baticados et al., 1990; Lavilla-Pitogo et al., 1990), Thailand (Jiravanichpaisal et al., 1994), India (Karunasagar et al., 1994), Australia (Pizzutto and Hirst, 1995), Taiwan (Song and Lee, 1993; Liu et al., 1996) and Ecuador (Robertson et al., 1998). Disease outbreaks attributed to other Vibrio species such as V. alginolyticus,

V. damsela, V. parahaemolyticus, V. vulnificus and V. penaeicida have been observed in nursery or grow-out ponds of L. vannamei, P. monodon, M. japonicus and P. stylirostris. Necrotizing hepatopancreatitis (NHP), previously known as Texas pond mortality syndrome, is caused by gram-negative bacteria that attack the cells of the hepatopancreas. NHP occurs in juvenile and sub-adult of L. vannamei, P. aztecus, P. setiferus, P. stylirostris and P. californiensis. NHP causes the shrimp to stop feeding and growing. Other symptoms include a soft exoskeleton, generalized surface fouling, weakness and slow death. NHP is diagnosed by histopathology or with a specific gene probe. Losses have been reduced through early detection and rapid application of oxytetracycline medicated feed, avoiding high water temperatures and high salinity for several weeks shown to precede the development of this epizootic disease. Besides the above-mentioned bacteria, Leucothrix mucor and Leucothrix like filamentous ectocommensal bacteria occur on many species of shrimp (Shelton et al., 1975).

Fungal Disease

Fungal diseases are very common in larval and post-larval stages of marine shrimp. Several species belonging to phycomycetes fungi and a single genus of imperfect fungi are involved in causing fungal diseases in all the life stages of penaeid shrimp. Two general types of fungal diseases, systemic mycosis and localized mycosis, occur in cultured shrimp. The systemic mycosis of larval and post-larval stages of shrimp causes severe mortalities in hatcheries throughout the world (Barkate et al., 1974, Lightner, 1977 and AQUACOP, 1977). Chytriodinim parasiticum is found to be parasitic on the egg is believed to belong to penaeid shrimp in the Mediterranean region (Cachon, 1968). Lagenidium callinectes and related species including Sirolipidium like fungus belonging to the phycomycetes fungi have been responsible for epizootics in eggs and larvae of cultured shrimp (Cook, 1971; Lightner and Fontaine, 1973; Hatai et al., 1980). Only one member of imperfect fungus Fusarium solani has been reported to be responsible for mortalities in captive populations of several shrimp species (Johnson, 1983). This is an opportunistic pathogen and has been responsible for mortalities in several species of captive penaeids in North and Central America and Tahiti (Lightner, 1977, 1981). Egusa and Ueda (1972) have described a serious disease known as Black gill disease in M. japonicus caused by F. solani.

Protozoan Diseases

Shrimp serve as host of symbiotic, commensal, parasitic and pathogenic protozoans. Sprague and Couch (1971) published a list of protozoan parasites, hyperparasites and commensals of decapod crustacea. Couch (1978) reported an infection caused by amoeboflagellate of genus Leptomonas in protozoeal and mysis stage of brown shrimp (P. aztecus). Gregarines are common inhabitants of the guts of wild and pond-reared shrimp (Hutton et al., 1959; Couch, 1978; Johnson, 1978).

Gregarines did not cause any disease in shrimp even when present in large numbers in the gut (Johnson, 1978). Microsporidians have caused a characteristic disease called as "cotton" or "milk shrimp disease" both in the wild and pond-reared shrimp resulting in considerable loss to the production and value (Kruse, 1959; Overstreet, 1973; Johnson, 1978). Microsporidian infected shrimp have distinctly opaque body muscle with dark blue or blackish discoloration due to expansion of the cuticular chromatophores (Lightner, 1983). A number of species of protozoans have been reported to cause fouling and/or gill disease in all life stages of cultured shrimp (Couch, 1983; Lightner, 1983; Overstreet, 1983). The most commonly reported protozoans include stalked peritrichs such as Zoothamnium sp., Epistylis sp. and Vorticella spp., the loricate ciliate, Lagenophrys sp., an undescribed apostome ciliate and suctorean Acineta spp. (Couch, 1978; Overstreet, 1978; Lightner, 1983). These protozoans have been generally found attached on the gills, appendages and body surface of the larval, post-larval, juvenile and adult penaeids in the culture systems and when abundant on the surface of the gills, could cause hypoxia and death (Overstreet, 1973; Couch, 1978).

Metazoan Parasites

Metazoan parasites of marine shrimp comprise helminth parasites such as worms and bopyrid isopods. Most of the species reported to date, appear to have little effect on individual shrimp and probably little significant effect on populations of penaeids (Couch, 1978). Overstreet (1973) reported an unidentified microphallid metacercaria from abdominal muscle of white shrimp. The bopyrid isopods have been reported to parasitise the branchial chamber of shrimp in nature (Ahmed, 1978; Abu-Hakima, 1984).

Nutritional Disease

Only one nutritional disease syndrome of cultured shrimp has been identified. This disease occurs due to the ascorbic acid deficiency and is popularly called as black death disease. The disease occurs in shrimp, which are reared in closed systems, aquaria or flow-through systems in which most or all of the diet is artificial (Lightner, 1977; Lightner et al., 1979).

Diseases caused by Environmental Stress

Environmental stress such as super saturation of atmospheric gases, low oxygen levels, sudden temperature or salinity changes, overcrowding and rough handling lead to unhealthy state in shrimp and in severe cases, lead to large scale mortalities (Lightner et al., 1974; Johnson, 1978; Lightner, 1983). Several other diseases which include tumor-like growth (Sparks and Lightner, 1973; Lightner et al., 1987), lymphoma-like neoplasm (Lightner and Brock, 1987), blisters (Lightner, 1977), Golden shrimp (Johnson, 1978) and blue or white-eye disease (Lightner, 1983) have been reported.

Shrimp Immune Response

Crustaceans have an innate immune system, characterized by lack of immunoglobulin and memory, but are efficient enough to protect and preserve themselves from all intruding antigens. Various studies have been carried out to obtain the action of immunostimulants for enhancing immune response and reduction of diseases. Protective effects of various immunostimulants such as oral administration of peptidoglycan (Itami et al., 1998), lipopolysaccharide (Takahashi et al., 2000) and glucan (Song et al., 1997; Chang et al., 2003) have been reported against WSSV infection. In contrast to the well-studied effect of microbial immunostimulants on the immune system of shrimp (Liu et al., 2005), Venegas et al., (2000) have also reported a new concept of quasi immune response against WSSV in M. japonicus. Balasubramanian et al. (2007) carried out screening of various Indian medicinal plants and revealed that aqueous extract of Cynodon dactylon showed strong antiviral activity and immunostimulation against WSSV. Heat inactivated V. anguillarum was used as immunostimulant in post-larvae of tiger shrimp P. monodon (PL30), which reduce the mortality of post-larvae by vibriosis (Azad et al., 2005). The potential immunostimulating properties of commercial and other yeast-derived products were also evaluated for immunostimulating purposes. Chang et al. (2003) have reported that oral administration of β 1,3 glucan at an optimal level of 10 g per kg diet for 20 days effectively enhanced the immune system and improved the survival of WSSV-infected P. monodon. Chotigeat et al. (2004) administered crude fucoidan extracted from Saragassum polycystum to reduce the impact of WSSV infection in P. monodon. There is reduction in total haemocyte count in WSSV infected shrimps (Maeda et al., 1997, Henning et al., 1998, Chang et al., 1999, Jiravanichpaisal et al., 2001, Sahul Hameed et al., 2006a). Apoptosis occurs in WSSV infected haematopoitic tissues, which suggests the decline in the number of haemocytes resulted from both the hematopoietic tissue and the haemocytes themselves being targeted by WSSV (Lo et al., 2004). Haemocytes count also decreased in the early period of viral infection, even before obvious apoptotic cells were observed (Sahul Hameed et al., 2006a). It is due to the presence of a mechanism in crustacean immune system which removes virus-infected haemocytes from circulation by attaching them to host tissues, and it has been suggested that this mechanism operates in WSSV infection (Hennig et al., 1998). Low total haemocyte counts weakens shrimp defense system and reduce shrimp health as haemocytes play an important role in cellular defense (Lo et al., 2004, Sahul Hameed et al., 2006a). Haemolymph withdrawn from WSSV-infected shrimp always gives delayed or complete lack of clotting reaction (Lo et al., 2004). Crustacean haemocytes play important roles in the host immune responses like recognition, phagocytosis, melanization, cytotoxicity and cell-to-cell communication (Johansson et al., 2000). Sarathi et al. (2007) carried out a study to examine the histopathological and immunological changes in Vibrio alginolyticus-injected or white spot syndrome virus (WSSV)-injected shrimp F. indicus. In crustacea, melanization occurs when the cellular defense reactions are initiated

(Ratclilfe et al., 1985; Sderhll et al., 1986). Phenoloxidase (PO), the key enzyme in the synthesis of melanin, occurs in haemolymph as an inactive pro-enzyme proPO. Results from several experiments have shown that apart from their role in melanization, components of the putative proPO activating system stimulate several cellular defense reactions, including phagocytosis, nodule formation, encapsulation, and haemocyte locomotion (Johansson et al., 2000; Sderhll et al., 1986). Activated hemocytes also produce extra bactericidal substances, such as H2O2 and superoxide anion (O2-) that may increase disease resistance (Song and Hsieh, 1994). Prophenol oxidase (proPO) system prevalent in crustaceans makes them capable of resisting every possible antigen entering their body by promoting cell-to-cell communication and subsequent elimination of foreign particles. The proPO system has been proposed to act as both recognition and an effector component of the arthropod defense system (Ratclilfe et al., 1985; Albores et al., 1993; Ashida et al., 1990), since it can be specifically activated by sugars of constitutive polysaccharides from fungal or bacterial cell walls (Sderhll, 1982). In the brown shrimp, P. californiensis, enzymes of the proPO system are localized to circulating cells (Albores et al., 1993) and can be activated by -1, 3-glucans. In shrimp, as in all crustaceans, a dark pigmented spot appears after an animal is injured. This is due to the action of phenoloxidase (PO). In arthropods, phenoloxidase exists as an inactive zymogen called prophenoloxidase (ProPO) under normal physiological conditions and they can be activated by proteolytic cleavage by an endogenous trypsin like serine protease, otherwise known as phenol oxidase activating enzyme. Phenoloxidase (PO) enzyme that catalyzes both o-hydroxylation of monophenols and oxidation of phenols to quinones leading to synthesis of melanin (Sritunyalucksana and Soderhall, 2000). Conversion of ProPO to PO occurs through a serine protease called prophenoloxidase-activating enzyme (ppA) regulated by another protein, a2-Macroglobulin, a trypsin inhibitor (Perazzolo and Barracco, 1997). The ProPO- activating enzyme was purified from haemocytes of cray fish and it is a typical serine protease containing a clip, a proline-rich and a glycine-rich domain. The ProPO system has to be controlled and regulated to avoid the deleterious effect of active components of the system, and in particular PO, which can produce highly toxic intermediates. Several proteinase inhibitors, which prevent over-activation of ProPO and a phenoloxidase inhibitor have also been reported from several arthropod species (Pascual et al., 2003). When microorganisms are engulfed by haemocytes, a series of anti-microbial substances are generated. These substances include highly reactive oxygen species, such as supereoxide anion, hydrogen peroxide (H_2O_2), hydroxide ions (OH^-) and singlet oxygen. Although oxygen is an essential element for aerobic cells, it also causes potential cytotoxic problems from the generations of highly reactive oxygen species in the respiratory process. The effective and rapid elimination of reactive oxygen species (ROS) is essential to the proper functioning and survival of organisms. This is performed by anti-oxidant defense mechanisms, including superoxide dismutase (SOD) that scavenges the superoxide anion (Homblad and Soderhall, 1999). Recently,

enhanced level of Prophenoloxidase, Super Oxide Dismutase, Total Haemocyte Count and Clotting time were observed in Cynodon dactylon injected prawn, M. rosenbergii (Farook et al., 2015).

Terrestrial Medicinal Plants and Seaweeds

Terrestrial plants represented a possible source of new and interesting antiviral drugs and are useful to control viral diseases not only in human and also in animals. Antiviral research in plants has gained momentum since 1950. The alcoholic extract of the entire plant of Cynodon dactylon was found to have antiviral activity against Vaccinia virus (Dhar et al., 1968). The antimicrobial activity of five Chinese herb extracts against thirteen bacterial and two viral fish pathogens have been reported by Shangliang et al. (1990). The ethanol extract of Psidium guajava leaves was tested for antiviral activity against various fish and shrimp pathogenic viruses namely, Infectious Haematopoietic Necrosis Virus (IHNV), Infectious Pancreatic Necrosis Virus (IPNV) and Oncorhynchus masou virus (OMV) using CHSE-214 cell lines by plaque reduction assay. The ethanol extract of P. amarus and P. gugajava has been found to have antiviral activity against yellow-head baculovirus in Penaeus monodon (Direkbusarakom, et al., 1993). Direkbusarakom et al. (1996) has investigated that shrimp fed ethanol extract of Clinacanthus nutans had 95% survival rates when exposed to Yellow head virus (YHV) compared to only 25% survival in control group of black tiger shrimp. Antiviral tests against the shrimp pathogenic virus, yellow head virus (YHV), were also carried out using the injection method by Direkbusarakom et al. (1997). Baba et al., (1988) proved that sulphated polysaccharides present in the algal extract could inhibit both DNA and RNA viruses. The extract of Clinacanthus nutans against Yellow Head Virus (YHV) of shrimp and the results indicating that this plant could effectively control YHV infection in shrimp by Direkbusarakom, 1998. Biswas et al., 2002 reported that neem seed oil has been shown to exert to antiviral activity. The herbal activity compounds may inhibit or block the transcription of the virus to reduce the replication in the host cell and enhance the non-specific immunity. The effectiveness of aqueous composite mixture of 7 Indian medicinal plants (Aegle marmelos, Allium sativum, Curcuma longa, Cynodon dactylon, Lantana camara, Mimosa pudica and Ocimum sanctum) in controlling WSSV at the rate of 15 ppm was reported by Achuthankutty and Desai (2004). P. amarus has high effective activity against the fish viruses such as INHV and OMV and shrimp virus YHV was reported by Direkbusarakom (2004). A commercial plant extract derived from olive tree leaf (Olea europaea), successfully controlled salmonid rhabdovirus, viral haemorrhagic septicaemia virus (VHSV) was reported by Micol, et al. 2005. Citarasu et al. (2006) reported that the methanolic extract mixture of five different herbal medicinal plants supplemented diet indicated significantly more survival (74%) of the shrimp and reduction in the viral loads. The aqueous extract of Sargassum weighti (seaweed) showed significant anti-WSSV property against marine shrimp, Penaeus indicus and freshwater crab, Paratelphusa

hydrodomous by Balasubramanian, et al. 2006. The aqueous extract of L. camara and P. amarus and methanol extract of A. marmelos exhibited partial antiviral activity at the concentration of 150 mg/kg of animal body weight reported by Balasubramanian, et al. 2007. Yogeeswaran (2007) investigated that Methanolic extracts of the herbs Acalypha indica, C. dactylon, P. kurroa, W. somnifera and Z. officinalis effectively control WSSV injection with the herbal extracts and WSSV-incubated mixtures. Rameshthangama and Ramasamy (2007) carried out similar study, fed on the ethanolic leaf extract of the plant Pongamia pinnata the 40% percentage survival of shrimp was obtained at administering at 200 mg/kg of body weight, while 80% on administering at 300 mg/kg of body weight per day. Balasubramanian et al. (2008) reported that the plant extract of C. dactylon was found to be highly effective in preventing WSSV infection with no mortality and no signs of WSD (White spot disease) at 2% and 40% mortality at 1% in P. monodom, respectively. The extract of Phyllanthus amarus is a lignan composed of the compounds: niranthin, phyllanthin, and hypophyllanthin and the virucidal activities of these three substances were tested bymixing them with WSSV was reported by Loan et al., (2009). Gomez et al. (2009) reported the combination of herbal extracts and probiotics works as better antiviral activity and decrease the prevalence of WSSV in Litopenaeus vannamei. Dasyscyphin C extract of leaves of Eclipta prostrata have been shown antiviral activity against fish nodavirus, grouper nervous necrosis virus (GNNV) infected SIGE (Sahul Indian Grouper Eye) cell lines under in vitro conditions by Harikrishnan et al, 2010. Aqueous extracts of Cynodon dactylon (terrestrial plant) and Ceriops tagal (mangrove) exhibited protective effects against WSSV in Penaeus monodon (Sudheer, et al. 2011). Extracts of gymnemagenol from leaves of Gymnema sylvestre have been tested against the fish nodavirus, grouper nervous necrosis virus (GNNV) in infected SIGE cell lines under in vitro conditions by Khanna et al, 2011. The phytochemical screening, biochemical analysis, elemental analysis, antioxidant evaluation and phytochemical fingerprint profiling predicts that TP22C can protect L. vannamei from the WSSV infection was reported by Ghosh and Chakraborty (2013). Guo et al. (2014) reported the Scutellaria baicalensis root serves as a medicine and owns such effects as anti-virus. Recently, Farook et al., 2015 reported that the enhanced level of Prophenoloxidase, Super Oxide Dismutase, total Haemocyte Count and Clotting time in Cynodon dactylon injected prawn, M. rosenbergii.

Vaccination

Various vaccines like inactivated WSSV vaccine (Namikoshi et al., 2004; Huang et al., 2005), antibacterial components (George et al., 2006) and subunit recombinant vaccines (Kim et al., 2004; Li et al., 2005; Wei and Xu, 2005; Li et al., 2006a,b; Jha et al., 2006) have been tried so far against WSSV with notable results. Furthermore, immunostimulation and vaccination of shrimp with inactivated Vibrio species have been reported to provide some protection (Itami et al., 1989, Teunissen et al., 1998 and Alabi et al., 1999,). The envelope proteins VP19 and VP28 were selected, as both proteins

are likely to be the first to come into contact with the host cells and also because the envelope protein VP28 was shown to be involved in the systemic infection of shrimp (Van Hulten et al., 2001a). Neutralization experiments with VP28 have shown it to be involved in the systemic infection of WSSV (Van Hulten et al., 2001b; Syed Musthaq et al., 2006a). An oral vaccination strategy was adopted because injecting vaccines is not practically feasible in shrimp farming. Vaccines based on recombinant proteins have already been developed for some fish viruses (Leong and Fryer, 1993; Lorenzen and Olesen, 1997; Husgard et al., 2001). Witteveldt et al. (2004a,b) carried out a study on the protection of P. monodon against WSSV by oral vaccination, which showed that protection against WSSV could be induced in shrimp by vaccination; a subunit vaccine was generated with two major structural envelope proteins of WSSV, VP19 and VP28. Inactivated bacteria over expressing the WSSV envelope proteins VP19 and VP28 coated on food pellets were selected for delivery of the WSSV proteins. Vaccinations of shrimp with rVP26 or /and rVP28 at a 20-day interval resulted in significantly lower cumulative mortalities than what occurred among the control animals (Namikoshi et al., 2003). Recently studies on the protection of crayfish P. clarkii against white spot syndrome virus by oral administration of viral proteins expressed in silkworms were successfully carried out by Xu et al. (2005). Test groups fed a mixture of VP28 and VP19 showed a significantly higher survival (RPS, 96.5%) than the control. Since crustaceans have only a non-specific innate immune response and no long memory, developing a vaccine and using it as an effective control strategy is difficult. Development of RNA interference (RNAi) technology against WSSV is a possible solution to control the quick spread of this deadly disease. Recently, the percentage survival of post-larvae of M. rosenbergii treated with purified r-MCP protein and challenged with MrNV and XSV was 76.03% on 15th day post infection 99.78% survival was recorded in normal group on 15th day post infection and 0% survival was recorded in MrNV and XSV infected group on 10th day post infection (Farook et al., 2014).

RNA Interference

RNAi has been employed to manipulate gene expression, elucidate signal pathways, and knock down specific genes to evaluate their physiological roles or perhaps control pathogen infection (Fire et al., 1998; Kennerdell and Carthew, 1998; Ngo et al., 1998; Wianny and ZernickaGoetz, 2000). In addition, RNAi has been widely proven as an effective mechanism to suppress the viral infection or replication of many viruses, including the several important human pathogens such as poliovirus (Gitlin et al., 2002), HIV-1 (Jacque et al., 2002), hepatitis B virus (McCaffrey et al., 2003; Shlomai and Shaul, 2003), hepatitis C virus (Kapadia et al., 2003), foot and mouth disease virus (FMDV) (Kahana et al., 2004), influenza virus A (Ge et al., 2003), Dengue virus (Adelman et al., 2002), and SARS coronavirus (SCV) (He et al., 2003; Li et al., 2005). The results of these studies suggest the possibility of using RNAi as an antiviral tool

in disease prevention in shrimp aquaculture. Recently, a few groups have reported that viruses from the aquatic animals could be inhibited by exogenously synthesized long dsRNAs or siRNAs (Robalino et al., 2004, 2005; Tirasophon et al., 2005; Westenberg et al., 2005; Xie et al., 2005; Kim et al., 2007; Xu et al., 2007; Sarathi et al., 2008a,b). They showed that long dsRNA molecules could induce a sequence-independent antiviral immunity in shrimp (Robalino et al., 2004, 2005), and viral replication could be effectively inhibited by long dsRNA molecules and siRNA molecules in shrimp or fish cells (Tirasophon et al., 2005; Xie et al., 2005). Westenberg et al. (2005) have used siRNAs specific to VP15 and VP28 genes of WSSV and observed that shrimp injected with VP15 or VP28 siRNASs before WSSV challenge resulted a significantly lower mortality in shrimp. However, it has also been shown that non-specific siRNAs also reduce mortality in shrimp (Westenberg et al., 2005), and neither sequence-dependent nor sequence independent siRNAs could induce the antiviral action (Robalino et al., 2005). Xu et al. (2007) have used a specific 21 bp short interfering RNA targeting VP28 gene of WSSV and the results revealed that the transcription and expression of VP28 gene were silenced. The introduction of long dsRNAs corresponding to viral proteins is very effective in blocking WSSV infection in P. chinensis (Kim et al., 2007). Xu et al. (2007) showed that siRNAs targeting the mRNA of five genes include DNA polymerase gene (dnapol), ribonucleotide reductase small subunit gene (rr2), thymidine kinase and thymidylate kinase gene (tk-tmk), two structural protein genes vp24 and vp28, and effectively inhibited WSSV replication in shrimp. Yodmuang et al. (2006) and Tirasophon et al. (2005) also demonstrated the protection of P. monodon against yellow head virus (YHV) infection using protease dsRNA and silencing of YHV replication in penaeid shrimp cells by long dsRNA encoding structural and non-structural genes of YHV. Sarathi, et al. (2008) reported that crude extract of bacterially expressed dsRNA is a potential therapeutic agent against WSSV infection of shrimp. Based on the present data and the advantages of dsRNA on RNAi technology, an in vivo expression system to produce large amounts of virus-derived dsRNAs in bacteria to provide a practical control of shrimp diseases.

2. Conclusion

Giant tiger prawn farming plays an important role in India, contributing increased food production with great employment opportunities. Despite of several problems, the practice of prawn farming offered good opportunity to increase incomes for farmers. A range of public and private sector investments and initiatives are needed to realize the potential for growth and expanding economic output in prawn farming sector. Improvements are needed in prawn production technology, hatchery operations and strictly maintaining standard operating procedures. Disease free brood stock required for successful operation of prawn hatcheries. Low-cost pellet feed industries will help to increase farmers profit margins. Research in seed and feed production may need

to be given due attention focusing on existing technology, the transfer, adaption and development of new technology.

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APPLICATION OF INTUITIONISTIC FUZZY SETS OF THIRD TYPE IN CAREER DETERMINATION

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Abstract

Intuitionistic fuzzy set theory is very profitable to elaborate uncertainty and vagueness involved in decision making. In this paper, we propose an application of Intuitionistic Fuzzy Sets of Third Type which is an extension of IFS in career determination by using Normalized Hamming distance measure.

AMS Subject Classification: 03E72

Keywords: Intuitionistic Fuzzy Set (IFS), Intuitionistic Fuzzy Set of Second Type (IFSST), Intuitionistic Fuzzy Set of Third Type (IFSTT), Hamming distance, Normalized Hamming distance.

1. Introduction

After inspired from K. T. Atanassov's Intuitionistic Fuzzy Set [1], the present authors defined IFSTT [11] which is an extension of IFS. Many researchers studied the application of IFS and their extension in real life situations, like pattern recognition, medical diagnosis, career determination, electoral system and market prediction by using distance measures [3 – 6]. In this research paper, we have given the Hamming distance and normalized Hamming distance measures of IFS, IFSST and IFSTT and applied the same in real life situation to find the shortest distance.

The rest of the paper is designed as follows: In section 2, we have given the definitions of IFS and their extensions and also the distance measures of IFS and IFSST. In section 3, we have given an application of IFSTT in career determination using normalized Hamming distance measure and in section 4, we have given conclusion of the paper.

2. Preliminaries

In this section, we give some definitions of IFS and their extensions.

Definition 2.1. [1] *Let X be a non-empty set. An Intuitionistic Fuzzy Set (IFS) A in X is defined as an object of the form*

$$A = \{\langle x, \mu_A(x), \nu_A(x)\rangle : x \in X\},$$

where $\mu_A : X \to [0, 1]$ *and* $\nu_A : X \to [0, 1]$ *denote the membership and non-membership functions of A respectively, and*

$$0 \leq \mu_A(x) + \nu_A(x) \leq 1,$$

for each $x \in X$.

Definition 2.2. [1] *The degree of non-determinacy (uncertainty) of an element* $x \in X$ *in the IFS A is defined by*

$$\pi_A(x) = 1 - \mu_A(x) - \nu_A(x).$$

Definition 2.3. [7] *Let X be a non-empty set. An Intuitionistic Fuzzy Set of Second Type (IFSST) A in X is defined as an object of the form*

$$A = \{\langle x, \mu_A(x), \nu_A(x)\rangle : x \in X\},$$

where $\mu_A : X \to [0, 1]$ *and* $\nu_A : X \to [0, 1]$ *denote the membership and non-membership functions of A respectively, and*

$$0 \leq \mu_A^2(x) + \nu_A^2(x) \leq 1,$$

for each $x \in X$.

Definition 2.4. [7] *The degree of non-determinacy (uncertainty) of an element* $x \in X$ *in the IFSST A is defined by*

$$\pi_A(x) = \sqrt{1 - \mu_A^2(x) - \nu_A^2(x)}.$$

Definition 2.5. [8 - 14] *Let X be the non-empty set. An Intuitionistic Fuzzy Set of Third Type (IFSTT) A in X is defined as an object of the form*

$$A = \{\langle x, \mu_A(x), \nu_A(x)\rangle : x \in X\},$$

where $\mu_A : X \to [0, 1]$ *and* $\nu_A : X \to [0, 1]$ *denote the membership and non- membership functions of A, respectively, and*

$$0 \leq \mu_A^3(x) + \nu_A^3(x) \leq 1,$$

for each $x \in X$.

Definition 2.6. [11] *The degree of non-determinacy (uncertainty) of an element $x \in X$ in the IFSTT A is defined by*

$$\pi_A(x) = \sqrt[3]{1 - \mu_A^3(x) - \nu_A^3(x)}.$$

Definition 2.7. [16] *Let A, B, C be the IFSs in X, then the distance measure d between A and B is a mapping $d : X \times X \to [0, 1]$ satisfying the following axioms:*

(i) $0 \leq d(A, B) \leq 1$ *(boundedness)*

(ii) $d(A, B) = d(B, A)$ *(symmetric)*

(iii) $d(A, B) = 0$ *if and only if* $A = B$

(iv) $d(A, C) + d(B, C) \geq d(A, B)$ *(triangle inequality)*

(v) if $A \subseteq B \subseteq C$, *then* $d(A, C) \geq d(A, B)$ *and* $d(A, C) \geq d(B, C)$.

Definition 2.8. [16] *Let* $A = \{\langle x_i, \mu_A(x_i), \nu_A(x_i)\rangle : x_i \in X\}$, $\forall i = 1, 2, \ldots, n$, *and* $B = \{\langle x_i, \mu_B(x_i), \nu_B(x_i)\rangle : x_i \in X\}$, $\forall i = 1, 2, \ldots, n$, *be two IFSs in X. Then the distance measures between A and B is defined by:*

The Hamming Distance on IFS:

$$d_H(A, B) = \frac{1}{2} \sum_{i=1}^{n} \left(|\mu_A(x_i) - \mu_B(x_i)| + |\nu_A(x_i) - \nu_B(x_i)| + |\pi_A(x_i) - \pi_B(x_i)|\right).$$

The normalized Hamming Distance on IFS:

$$d_(n - H)(A, B) = \frac{1}{2n} \sum_{i=1}^{n} \left(|\mu_A(x_i) - \mu_B(x_i)| + |\nu_A(x_i) - \nu_B(x_i)| + |\pi_A(x_i) - \pi_B(x_i)|\right).$$

Definition 2.9. [15] *Let* $A = \{\langle x_i, \mu_A(x_i), \nu_A(x_i)\rangle : x_i \in X\}$, $\forall i = 1, 2, \ldots, n$, *and* $B = \{\langle x_i, \mu_B(x_i), \nu_B(x_i)\rangle : x_i \in X\}$, $\forall i = 1, 2, \ldots, n$, *be two IFSSTs in X. Then the distance measures between A and B is defined by:*

The Hamming Distance on IFSST:

$$d_H(A, B) = \frac{1}{2} \sqrt{\sum_{i=1}^{n} \left(|\mu_A(x_i) - \mu_B(x_i)|^2 + |\nu_A(x_i) - \nu_B(x_i)|^2 + |\pi_A(x_i) - \pi_B(x_i)|^2\right)}.$$

The normalized Hamming Distance on IFSST:

$$d_(n - H)(A, B) = \frac{1}{2n} \sqrt{\sum_{i=1}^{n} \left(|\mu_A(x_i) - \mu_B(x_i)|^2 + |\nu_A(x_i) - \nu_B(x_i)|^2 + |\pi_A(x_i) - \pi_B(x_i)|^2\right)}.$$

3. Application of IFSTT in Career Determination

In this section, we find the shortest distance between student and their career by using Normalized Hamming distance measure over IFSTT. It is very important to provide adequate information to students for proper career guidance and choice to enhance adequate planning, preparation and excellency. Intuitionistic Fuzzy Sets of third type plays a vital role in career determination since it incorporates the membership degree (i.e. the marks of the questions correctly answered by the student), the non-membership degree (i.e. the marks allocated to the questions the student failed) and the hesitation degree (which is the mark allocated to the questions the student do not attempt).

Definition 3.1 (15). *Let* $A = \{\langle x_i, \mu_A(x_i), \nu_A(x_i)\rangle : x_i \in X\}$, $\forall i = 1, 2, \ldots, n$ *and* $B = \{\langle x_i, \mu_B(x_i), \nu_B(x_i)\rangle : x_i \in X\}$, $\forall i = 1, 2, \ldots, n$, *be two IFSTTs in X. Then the distance measures between A and B is defined by:*

The Hamming Distance on IFSTT:

$$d_H(A, B) = \frac{1}{2}\sqrt{\sum_{i=1}^{n}(|\mu_A(x_i) - \mu_B(x_i)|^3 + |\nu_A(x_i) - \nu_B(x_i)|^3 + |\pi_A(x_i) - \pi_B(x_i)|^3)}.$$

The Normalized Hamming Distance on IFSTT:

$$d_(n - H)(A, B) = \frac{1}{2n}\sqrt{\sum_{i=1}^{n}(|\mu_A(x_i) - \mu_B(x_i)|^3 + |\nu_A(x_i) - \nu_B(x_i)|^3 + |\pi_A(x_i) - \pi_B(x_i)|^3)}.$$

Example 3.1. *Let* $S = \{S_1, S_2, S_3, S_4\}$ *be the set of students, C =* {*Engineering, Medicine, Agriculture, Software*} *be the set of departments and Sub =*{*English Language, Mathematics, Biology, Physics, Chemistry*} *be the set of subjects related to the career.*

We assume the selected students for examinations (i.e. out of 100 marks) on the above mentioned subjects to determine their career placements and choices. The table below shows careers and related subject requirements in terms of Intuitionistic Fuzzy values.

Table 1: Careers vs. Subjects

	English Language	Mathematics	Biology	Physics	Chemistry
Engineering	$\langle 0.6, 0.2\rangle$	$\langle 0.8, 0.1\rangle$	$\langle 0.5, 0.3\rangle$	$\langle 0.8, 0.1\rangle$	$\langle 0.8, 0.1\rangle$
Medicine	$\langle 0.7, 0.2\rangle$	$\langle 0.5, 0.2\rangle$	$\langle 0.9, 0.0\rangle$	$\langle 0.7, 0.2\rangle$	$\langle 0.8, 0.1\rangle$
Agriculture	$\langle 0.8, 0.2\rangle$	$\langle 0.5, 0.2\rangle$	$\langle 0.9, 0.0\rangle$	$\langle 0.6, 0.3\rangle$	$\langle 0.6, 0.3\rangle$
Software	$\langle 0.8, 0.1\rangle$	$\langle 0.8, 0.1\rangle$	$\langle 0.4, 0.2\rangle$	$\langle 0.7, 0.3\rangle$	$\langle 0.6, 0.3\rangle$

Each performance is described by two numbers i.e. membership and non-membership values. After the various examinations, the students obtained the following marks as shown in the table below.

Table 2: Students vs. Subjects

	English	Mathematics	Biology	Physics	Chemistry
S_1	$\langle 0.6, 0.3\rangle$	$\langle 0.7, 0.2\rangle$	$\langle 0.5, 0.3\rangle$	$\langle 0.4, 0.4\rangle$	$\langle 0.4, 0.4\rangle$
S_2	$\langle 0.8, 0.0\rangle$	$\langle 0.5, 0.3\rangle$	$\langle 0.6, 0.3\rangle$	$\langle 0.8, 0.2\rangle$	$\langle 0.8, 0.1\rangle$
S_3	$\langle 0.6, 0.1\rangle$	$\langle 0.5, 0.1\rangle$	$\langle 0.8, 0.2\rangle$	$\langle 0.5, 0.4\rangle$	$\langle 0.5, 0.3\rangle$
S_4	$\langle 0.4, 0.2\rangle$	$\langle 0.5, 0.1\rangle$	$\langle 0.3, 0.3\rangle$	$\langle 0.6, 0.2\rangle$	$\langle 0.5, 0.2\rangle$

Using the normalized Hamming distance measure of IFS, we calculate the distance between each student and each career with reference to the subjects, we get the table below.

Table 3: Distance between Students and Careers in IFS

IFS	Engineering	Medicine	Agriculture	Software
S_1	**0.2000**	0.2800	0.2400	**0.2000**
S_2	**0.1400**	**0.1400**	0.2000	0.2000
S_3	0.2600	0.2000	**0.1600**	0.2400
S_4	**0.2400**	0.2800	0.2800	**0.2400**

Since the student S_1 has got 0.2000 for both Engineering and Software subjects, he/she was still in an uncertain situation. The similar situation is for the students S_2 and S_4. To overcome this situation, we apply the normalized Hamming distance measure of IFSST, we calculate the distance between each student and each career with reference to the subjects, we get the table below.

Table 4: Distance between Students and Careers in IFSST

IFSST	Engineering	Medicine	Agriculture	Software
S_1	0.0805	0.0966	0.0807	**0.0588**
S_2	**0.0561**	0.0605	0.0713	0.0626
S_3	0.0850	0.0612	**0.0464**	0.0768
S_4	**0.0714**	0.0998	0.0995	**0.0714**

While the students S_1, S_2 and S_3 got settled choosing one subject each, but the student S_4 has got 0.0714 for both Engineering and Software subjects, he/she was still

in a dilemma. To overcome with his/her situation, we apply the normalized Hamming distance measure of IFSTT, we calculate the distance between each student and each career with reference to the subjects, we get the table below.

Table 5: Distance between Students and Careers in IFSTT

IFSTT	Engineering	Medicine	Agriculture	Software
S_1	0.0580	0.0638	0.0538	**0.0393**
S_2	**0.0390**	0.0439	0.0480	0.0412
S_3	0.0544	0.0412	**0.0301**	0.0499
S_4	**0.0451**	0.0700	0.0708	0.0479

From the table 5, the students S_1, S_2, S_3 and S_4 has to choose Software, Engineering, Agriculture and Engineering respectively. We inferred that, using normalized Hamming distance measures in IFSTT plays a vital role in obtaining the shortest distance than IFS and IFSST.

Remark If the distance between the student and career is shortest, then the student has to choose that career.

4. Conclusion

In this paper, we have applied the IFSTT in career determination for finding the shortest distance between the student and their career by using normalized hamming distance measure. It is still open to check the other measures for finding the shortest value.

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A STUDY OF MULTISTATE SYSTEM WITH IMPERFECT MAINTENANCE

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Abstract

The maintenance problem of a multistate system with $k-$failure states and l working states is studied. In this paper, we discuss about the comparative study on the optimization problem of costs in a multistate system with imperfect maintenance and a maintenance policy for a system with multistate components an approximate solution.

Keywords: Multistate, Maintenceance Problem, Maintenance Policy.

1. Introduction

In most of our real life situations owing to the ageing effect and accumulated wearing, the systems are degenerative in the sense that the successive operating times between failures will be shorter and shorter, while the consecutive repair times after failures are getting longer and longer. In other words, the successive operating times are stochastically decreasing and finally dying out, while the consecutive repair times are stochastically increasing and finally tend to infinity. To model a deteriorating system with this kind of characteristic, Lam (1988) introduced a geometric process repair model. Because the geometric process is a special monotone process, Stadje and Zuckerman (1990) introduced a general monotone process repair model that generalized Lam's work.

The classical reliability theory is based on the binary assumption that each component or system is either working perfectly or completely failed. However in many practically situations, a system may experience more than two possible states. For instance, a microwave transmitter may be working with full transmission range, working with degrade transmission range or completely failed. In another instance, a home security system may fail to detect a break in due to mechanical or electrical circuit failures. It may also create a false alarm due to the presence of a pet.

2. Multi-State System with Imperfect Maintenance

Gasmi and Mannai (2014) developed with the modeling of an imperfect maintenance model and the impacts of preventive maintenance between the two boundary cases are minimal and perfect. This model is assumed that costs of preventive maintenance are not constant but depend on the degree of repair, a virtual age process. A multistate system with N states are considered. The corrective maintenance actions are minimal. The system is minimally repaired at each failure and it will have same as before failure.

The virtual age of the item at time $V_k = \xi_k\ (v_{k-1} + t_k - t_{k-1}, k \geq 1)$ where t_k is the time of the k^{th} sojourn and $\xi_k\ (0 \leq \xi_k \leq 1)$ is the degree of repair at the time. We assume that $t_0 = 0$ and $v_0 = 0$. After repairing the failure during the $(k+1)^{\text{th}}$ sojourn is determine by $\lambda_{k+1}(t) = \lambda(t - t_k + v_k)$, $t_k \leq t \leq t_{k+1}$, $k \leq 0$.

This process $(t, \xi_k, k = 1, 2, \ldots, N) = t - t_k + v_k,\ t_k \leq t < t_{k+1}, k \geq 0$ is called the virtual age process.

Let X be modified Weibull distribution (α, β, γ) with density function.

$$f(x, \theta) = (\alpha + \beta\gamma x^{\gamma-1})\ \exp(-\alpha x - \beta x^{\gamma}),\quad x > 0$$

where $\theta = (\alpha, \beta, \gamma), \gamma > 0, \alpha, \beta > 0$ such that $\alpha + \beta > 0$.

In this model each preventive maintenance action reduces the age of the system to state s and every corrective maintenance is minimal and preventive maintenance actions are at fixed times $v, 2v, \ldots$. We assume that the cost function $C_{pm}(s, v) = C_s \left(\frac{1}{s+v}\right)^{\delta}$ where δ is the cost function and $H(k) = \sum_{i=1}^{k} r(i)$ where $r(i)$ is a failure rate.

Let C_{CM} and C_{PM} be the cost of corrective maintenance action and the cost of preventive maintenance action respectively. The cost function per time unite is defined as

$$C_{tot}(s, v) = \frac{C_{PM}(s, v) + C_{CM}(H(s+v) - H(s))}{v}.$$

Our main objective is to minimize this function this function with respect to s and v.

3. Multi-State Components

Gurler and Kaya(2002) discussed a maintenance policy for a system with multistate components and an approximate solution. For this model, a system composed of N identical and independently operating components which are connected in series. The condition of each component is characterized by $S + 1$ possible states, where 0 is the best state and S corresponds to the down state. The system states are classified into four categories in the following way: State 0 to $K-1$ are good, states K to $S-1$ are doubtful, state $S - 1$ is preventive maintenance due and state S is down.

The system operated under the control policy can be described by a multi-dimensional Markov process $X(t) = \{X_0(t), X_1(t), \ldots, X_(s-2)(t)\}$ where $X(t)$ is the number of components are in their t^{th} state at time t. Let $W(t)$ denote the number of components in the double states at time t, $t \geq 0$. We assume that all components are at state 0 at time $t = 0$. Define τ as the expected time until a system replacement takes place or the number of doubtful components reaches $N + 1$, whichever occurs first; k and ϕ as the expected number of backward and dummy jumps of $\{W(t), t \geq 0\}$ before a system replaced place and σ as the expected time until a system replacement takes place, given that there are $N + 1$ doubtful components at $t = 0$. Every dummy jump of $\{W(t), t \geq 0\}$ corresponds to a corrective replacement and every backward jump of $\{W(t), t \geq 0\}$ corresponds to a corrective component replacement with probability $1-\overline{p_k}$, and to a preventive component replacement with probability $\overline{p_k}$.

Let $C(K, N)$ be the long run average cost function obtained under the model. Then

$$C(K, N) = \frac{c_2[\phi + (1 - \overline{p_k})k] + c_1\overline{p_k}k + c_3}{\tau + P(T_1 \neq 0)\sigma}$$

where the cost of preventive and corrective component replacements are c_1 and c_2 respectively and the system replacement cost is c_3.

4. Conclusion

First we consider a multistate system with incomplete maintenance model, in this model the impact of preventive maintenance is not minimal and not perfect but lies between these boundary cases. The preventive maintenance actions rests thefailure rate of the item proportional to the virtual age. The expected total optimal maintenance cost under discrete modified Weibull distribution is obtained. A maintenance and replacement policy is proposed for a multi component, Multi-state system in which both the system and the components can be describedthrough a range of performance level varying from perfect functioning to complete failure.

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SYNTHESIS AND CHARACTERIZATION OF PHOSPHORYLATED CHITOSAN AND THEIR DERIVATIVES

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Abstract

In this paper we have discussed about the synthesis of $N-$methylene phosphorylate $O-$carboxymethyl chitosan and its chemical structure, solubility. The compounds were characterized by using FT-IR spectroscopy. The results show that the prepared compound has the excellent filmogenic nature and ion exchange capacity and as their solubility is tested in various solvents. Water is a better solvent for this derivatives. The prepared compound may be used as ion -exchange membrane for fuel cell applications.

Keywords: FT-IR, PH, Chitosan and CMC.

1. Introduction

Chitosan is a linear polysaccharide of (1,4) linked 2−amino deoxy $\beta - D$ glucan is the abundant polymer after cellulose. It has good biodegradability, nontoxic and various bio functionalities, immunity enhancing, wound healing, antibacterial and antifungal activities and some research reported that it also has an antioxidant properties. Chitosan has commercial as well as biomedical uses in the field of agriculture, cosmetics, nutrition pharmaceutical, textile industries artificial skin ophthalmology membranes etc. Chitosan is a weak base and is insoluble in water and organic solvents but it soluble in dilute aqueous acids ($PH < 6.5$) which can convert glucosamine in to soluble form $R - NH_3^+$. It has a primary amino group with a pKa value of 6.3 it alters the chitosan properties at lower pH it gets protonated and become positive charge and chitosan become water soluble cationic polysaccharides. The functional group of chitosan such as primary amino, primary and secondary hydroxyl groups offers considerable chemical modification of chitosan. In this paper we have synthesis N-methylene phosphorylated O-carboxymethyl chitosan suitable for fuel cell applications.

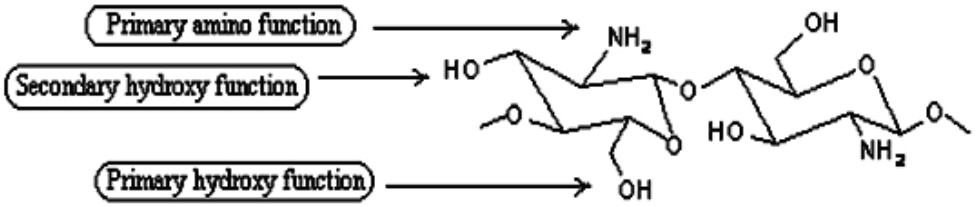

Figure 1: Structure of Chitosan

2. Materials and Methods

2.1. Materials

Chitosan was purchased from Rolex chemical industries, Mumbai with viscosity average molecular weight about 3,00,000 K Da. Mono chloro acetic acid, isopropanol, sodium hydroxide, ethyl alcohol, hydrochloric acid, orthophosphoric acid, formaldehyde, acetone, are purchased with AR grade.

Acetic acid, dimethyl sulfoxide (DMSO), carbon tetra chloride (CCl4), diethyl ether, benzene, toluene, dimethyl form amide (DMF) were used for solubility test.

2.2. Methods

2.2.1 FTIR Studies

Fourier transform Infra Red (FTIR) spectral analysis for chitosan, *O*−Carboxymethyl chitosan and *N*−methylene phosphorylated *O*−Carboxymethyl chitosan were performed Shimadzu IR spectrophotometer in 4000 - 400 cm^{-1} wave length range and using KBr pellet.

3. Experiment

3.1. Preparation of *O*−Carboxymethyl Chitosan

6.75g of sodium hydroxide were dissolved in isopropanol. 5g of chitosan added to it. The mixture was heated to 50°c for 1 hour. 7.5g of mono chloro acetic acid was dissolved in isopropanol, and then it was added into reaction mixture drop wise for 30 minutes and stirred continuously for 4 hours at 50°c. The reaction was stopped by pouring the mixture into ethyl alcohol. The solid was Filtered and rinsed in ethyl alcohol and then dried at room temperature to obtain sodium salt of carboxymethyl chitosan. This sodium salt of carboxymethyl chitosan was suspended in ethyl alcohol aqueous solution and then few ml of 37% hydrochloric acid was added and stirred for 30 minutes. The solid was filtered and rinsed in ethyl alcohol and vacuum dried.

The products were the $H-$form of carboxymethyl chitosan .

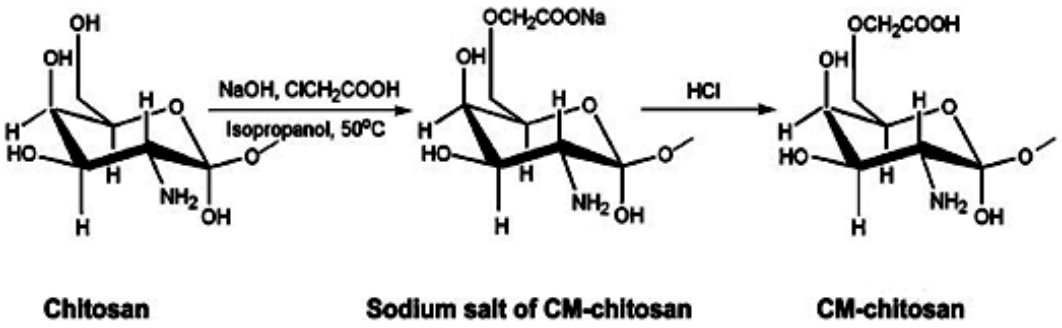

Figure 2: Structure of O-Carboxymethyl Chitosan

3.2. Preparation of $N-$Methylene Phosphorylated O-Carboxymethyl Chitosan

2g of $O-$Carboxymethyl chitosan in glacial acetic acid 1% are prepared and take equal amount of ortho phosphoric acid dissolved in water was added drop wise with continuous stirring for one hour. The temperature of the mixture was raised to 70°c with reflux and equal amount of 37% formaldehyde was added drop wise for one hour and the same temperature was maintained for above 6 h. A clear pale yellow solution was obtained. The excess solvent was removed using vaccum. The viscous solution was precipitated with acetone and the product was dried at 50°c.

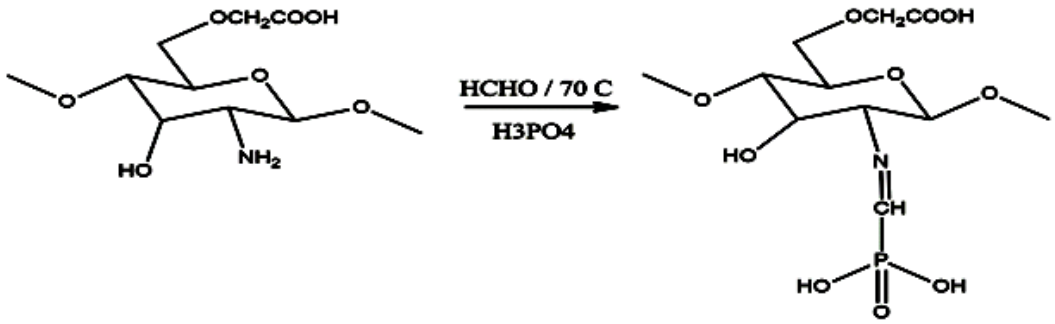

Figure 3: Structure of $N-$Methylene Phosphorylated $O-$Carboxymethyl Chitosan

4. Characterization

1031 cm^{-1} $C-O-C$ stretching, 1396 cm^{-1} $C-N$ stretching, 1645 cm^{-1} Amide - I band, 1552 cm^{-1} Amide - II band, 2926 cm^{-1} axial stretching, of $C-H$ bond, 3441 cm^{-1} stretching of $O-H$ and $N-H$ bonds.

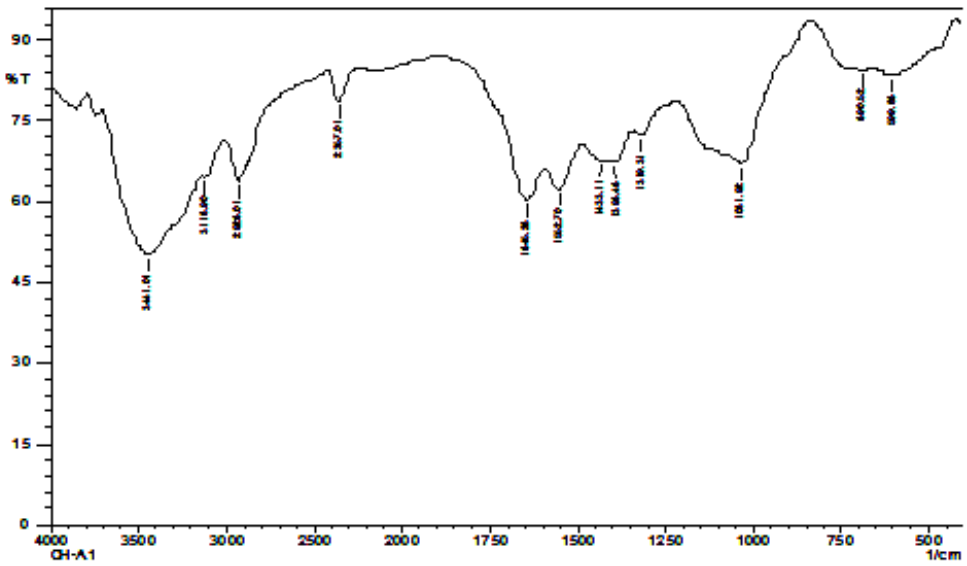

Figure 4: Wave number (cm^{-1}) FT-IR Spectrum of Chitosan

1034 cm^{-1} C-O-C stretching,1207 cm^{-1} C-O stretching, of COOH group, 1308 cm^{-1} C-O stretching, 1627 cm^{-1} Amide I band,1501 cm^{-1} Amide - II band, 1738 cm^{-1} C=O stretching of COOH group, 3424 cm^{-1} stretching of O-H and N-H bonds.

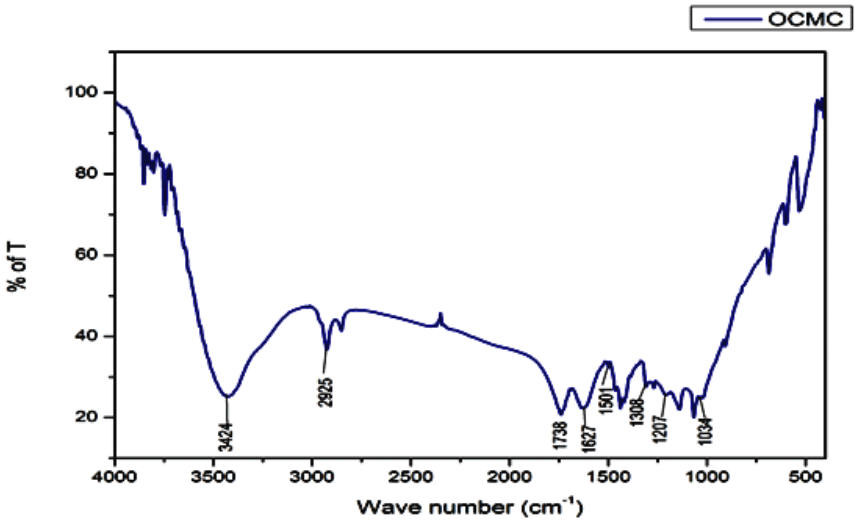

Figure 5: Wave number (cm^{-1}) FT-IR Spectrum Of O-Carboxymethyl Chitosan

492 cm^{-1} O-P-O bending, 1070 cm^{-1} P-O stretching, 1382 cm^{-1} P=O stretching, 1635 cm^{-1} N=CH band , 1710 cm^{-1} C=O stretching of COOH, 3421 cm^{-1} stretching of O-H and N-H bonds.

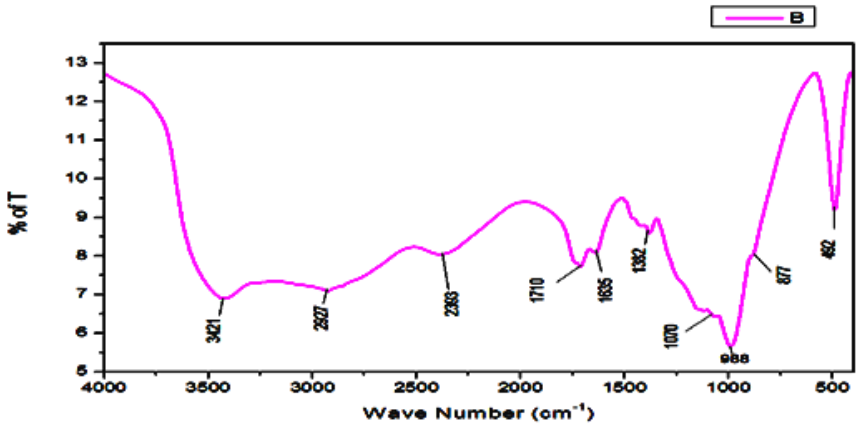

Figure 6: Wave number (cm^{-1}) FT IR Spectrum of N-Methylene Phosphorylated O-Carboxymethyl Chitosan

5. FTIR Results

5.1. Chitosan

The FTIR spectrum of chitosan is shown in Fig 4.1. The wide absorption band at 3441 cm^{-1} correspond to the axial stretching of $O-H$ and $N-H$, 1645 cm^{-1} indicates to amideI $N-H$ stretch 1552 cm^{-1} indicates to amide- II N-H stretch respectively the absorption peak at 1396 cm^{-1} indicates to $C-N$ stretching, the peak at 2926 cm^{-1} is attributed to the axial stretching of the $C-H$ bond the band at 1031 cm^{-1} indicates to $C-O$ stretching.

5.2. $O-$Carboxymethyl Chitosan

The FTIR spectrum of O-carboxymethyl chitosan is shown in Fig 5.2. The absorption band at 1738 cm^{-1} corresponds to the stretching of $C=O$ bond in the COOH groups, the 1207 cm^{-1} are attributed to the symmetric stretching vibration of $C-O$ in the COOH groups, the peak at 1627 cm^{-1} and 1501 cm^{-1} assigned to NH_2 indicates the carboxymethyl groups to be on the OH position. The peak at 1308 cm^{-1} indicates to the $C-O-C$ stretching.

5.3. $N-$Methylene Phosphorylated $O-$Carboxymethyl Chitosan

The FTIR spectrum of N-methylene phosphorylated O-CMC is shown in Fig 6.3 The $N-$methylene phosphorylated $O-$carboxymethyl chitosan shows the peak at 1635 cm^{-1} corresponds to the $N=CH$ stretching and the sharp peak at 492 cm^{-1} is due to the $O-P-O$ bending vibration of $P-OH$. The peak at 1070 cm^{-1} is assigned as $P-O$

stretching of $P-OH$ groups. The peak obtained at 1382 cm^{-1} is attributed to $P=O$ stretching vibration. The peak at 1710 cm^{-1} corresponds to the $C=O$ Stretching of COOH. This region shows that the substitution of the phosphorylated compound is at the $N-$function. It is also confirms that the carboxyl group is present in the derivative at C6 position. The peak at 988 cm^{-1} is due to the (PO_3^{2-}) ions. This reveals that the obtained phosphorylated derivative possess excellent ion- exchange capacity.

5.4. Solubility of Chitosan and its Derivatives

Table 1: Polar Solvents

Solvents	**Chitosan**	***O*−CMC**	**N-MP, O-CMC**
Water	Insoluble	Soluble	Soluble
Acetic acid	Soluble	Soluble	Soluble
Dimethylsulfoxide	Insoluble	Insoluble	Partially soluble
Ethanol	Insoluble	Insoluble	Insoluble
Dimethylformamide	Swelling	Insoluble	Insoluble

Table 2: Non Polar Solvents

Solvents	**Chitosan**	***O*−CMC**	**N-MP, O-CMC**
Carbon tetra chloride	Insoluble	Insoluble	Low viscosity gel
Diethyl ether	Insoluble	High viscosity gel	High viscosity gel
Benzene	Insoluble	Insoluble	High viscosity gel
Toluene	Insoluble	Insoluble	High viscosity gel

The solubility of the chitosan and their derivatives are tested in different polar and non polar solvents are given in table 5.2.1and 5.2.2. all the prepared chitosan derivatives like O-carboxymethyl chitosan and N-methylene phosphorylated O-carboxymethyl chitosan were found to be water soluble and also soluble in acetic acid but insoluble in ethanol, DMF, DMSO. The N-methylene phosphorylated O- Carboxymethyl chitosan is partially soluble in DMSO. The newly prepared N-methylene phosphorylated O-Carboxymethyl chitosan gives a high viscosity gel in the non polar solvents but with CCL4 it gives low viscosity gel. The O-Carboxymethyl chitosan is insoluble in carbon tetra chloride, benzene, toluene but it gives high viscosity gel in diethyl ether. In common water is a better solvent for both derivatives.

6. Conclusion

In the present work, we have successfully prepared a O- carboxymethyl chitosan by using mono chloro acetic acid and isopropanol, this was modified by introducing a phosphorylated group in the N=CH by using formaldehyde and phosphoric acid and characterized by FT-IR , The results confirmed the formation of N-methylene phosphorylated O-carboxymethyl chitosan derivative. Both the derivatives are tested in different solvents both are soluble in water. The substitution of phosphorylated group could show the excellent filmogenic nature and ion exchange capacity due to the presence of (PO) ions. And have the moisture absorption property. The presence of carboxyl group may increase its stability and solubility of the compound and helps to increase proton conductivity of the compound. The prepared phosphorylated derivatives may be used as an ion exchangeable membrane in fuel cells.

Acknowledgement

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COMPUTATIONAL STUDIES OF [1-(AMINOMETHYL) CYCLOHEXYL] ACETIC ACID AND ITS DERIVATIVES

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Abstract

This paper describes a large scale study of [1-(aminomethyl) cyclohexyl] acetic acid (Gabapentin) and its derivatives. The semiempirical quantum chemical properties of Gabapentin were optimised and characterised with quantum chemical methods. Modern semi empirical methods involve the generation of self consistent field.The usage of Semi-empirical software it prediction of pharmacological classification of the drug Gabapentin based on HPLC and non-empirical structural parameters was studied. And the stability of the molecules arising from hyperconjucative interactions, charge delocalization, and the natural atomic charges were analysed using natural bond orbital anyalysis. The results obtained from experimental and molecular modelling showed that Gabapentin and its important substituents may be synthesised for biologically important compounds.

Keywords:

1. Introduction

Semi-empirical quantum chemistry methods are based on the HartreeFock formalism, but make many approximations and obtain some parameters from empirical data. They are very important in computational chemistry for treating large molecules where the full HartreeFock method without the approximations is too expensive. Semi-empirical calculations have been most successful in the description of organic chemistry.semi empirical methods are very fast, applicable to large molecules, and may give accurate results when applied to molecules that are similar to the molecules used for parameterization.

The semi empirical models MNDO, AM1, and PM3 are available in many computational chemistry programs while the more recent PDDG/PM3 model has been implemented in the program BOSS. Some freely available computational chemistry programs that include many semi empirical models are MOPAC and WinMopac.

2. History of Gabapentin

Since Gabapentin was developed at Parke-Davis and was first described in 1975 Under the brand name Neurontin, it was first approved in May 1993 for the treatment of epilepsy in the UK, and was marketed in US in 1994. gabapentin was approved in the US for the treatment of postherpetic neuralgia in May 2002 A generic version of gabapentin first became available in the US in 2004. gabapentin brand name Gralise,e Horizant, was approved Jun 2012.

3. Methodology and Computational Details

Hardware

The programs were run on a CPU supported by -INTEL CORE(TM) 2DUO , E7200 processor clocking 2.53GHZ , running on Microsoft windows 7 professional SP2 with 64 bit support over a RAM of 2.00 GB.

Software

Chemsketch The molecule was drawn on chemsketch and was subjected to 2D optimization. Winmostar a graphical user interface software. That supports molecular modelling, MOPAC2016, MOPAC (Molecular Orbital Package) is a semi-empirical quantum chemistry program based on Dewar and Thiel's NDDO approximation were employed in the work.

4. Result and Discussion

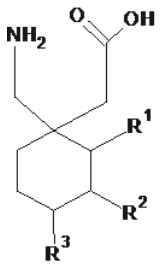


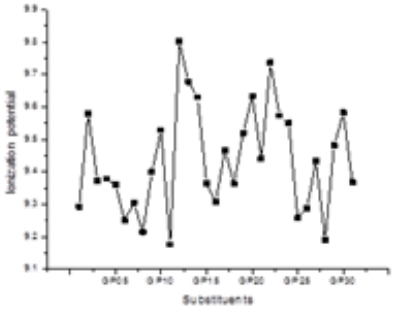
Table 1: General Structures of 1-(Aminomethyl)Cyclohexyl Acetic Acid and Substituent Table

Sl.No.	FORMULA	R^1	R^2	R^3
GB01	$C_9H_{17}NO_2$	H	H	H
GB02	$C_9H_{16}N_2O_4$	NO_2	H	H

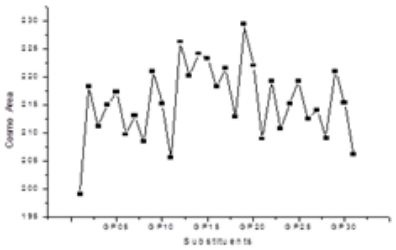
GB03	$C_9H_{16}NO_2Cl$	Cl	H	H
GB04	$C_9H_{16}NO_2Br$	Br	H	H
GB05	$C_9H_{16}NO_2I$	I	H	H
GB06	$C_{10}H_{19}NO_2$	CH_3	H	H
GB07	$C_{10}H_{17}NO_3$	CHO	H	H
GB08	$C_9H_{18}N_2O_2$	NH_2	H	H
GB09	$C_{10}H_{17}NO_4$	$COOH$	H	H
GB10	$C_{10}H_{16}N_2O_2$	CN	H	H
GB11	$C_9H_{17}NO_3$	OH	H	H
GB12	$C_9H_{16}N_2O_4$	H	NO_2	H
GB13	$C_9H_{16}NO_2Cl$	H	Cl	H
GB14	$C_9H_{16}NO_2Br$	H	Br	H
GB15	$C_9H_{16}NO_2I$	H	I	H
GB16	$C_{10}H_{19}NO_2$	H	CH_3	H
GB17	$C_{10}H_{17}NO_3$	H	CHO	H
GB18	$C_9H_{18}N_2O_2$	H	NH_2	H
GB19	$C_{10}H_{17}NO_4$	H	$COOH$	H
GB20	$C_{10}H_{16}N_2O_2$	H	CN	H
GB21	$C_9H_{17}NO_3$	H	OH	H
GB22	$C_9H_{16}N_2O_4$	H	H	NO_2
GB23	$C_9H_{16}NO_2Cl$	H	H	Cl
GB24	$C_9H_{16}NO_2Br$	H	H	Br
GB25	$C_9H_{16}NO_2I$	H	H	I
GB26	$C_{10}H_{19}NO_2$	H	H	CH_3
GB27	$C_{10}H_{17}NO_3$	H	H	CHO
GB28	$C_9H_{18}N_2O_2$	H	H	NH_2
GB29	$C_{10}H_{17}NO_4$	H	H	$COOH$
GB30	$C_{10}H_{16}N_2O_2$	H	H	CN
GB31	$C_9H_{17}NO_3$	H	H	OH

Table 2: A few computed properties of the derivatives

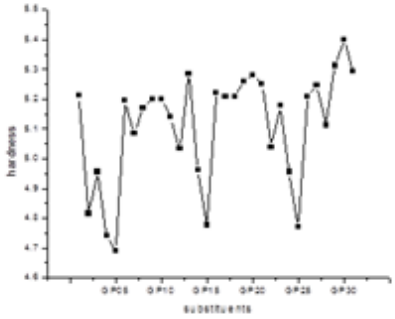
Sl. No.	EMPIRICAL FORMULA	IONISATION POTENTIAL (eV)	HOMO LUMO ENERGY DIFF (eV)	SOFTNESS	HARDNESS	COSMO AREA (A^2)	LOG P	ENZYME INHIBITOR
GP01	$C_9H_{17}NO_2$	9.293	10.424	0.1	5.212	199.1	0.6	0.16
GP02	$C_9H_{16}N_2O_4$	9.578	9.63	0.1	4.815	218.3	-0.1	0.33
GP03	$C_9H_{16}NO_2Cl$	9.373	9.911	0.1	4.956	211.1	0.7	0.2
GP04	$C_9H_{16}NO_2Br$	9.378	9.481	0.1	4.741	215	0.8	0.27
GP05	$C_9H_{16}NO_2I$	9.360	9.381	0.1	4.691	217.3	1.1	0.4
GP06	$C_{10}H_{19}NO_2$	9.250	10.389	0.1	5.195	209.7	0.9	0.34
GP07	$C_{10}H_{17}NO_3$	9.303	10.172	0.1	5.086	213.1	0.3	0.44
GP08	$C_9H_{18}N_2O_2$	9.214	10.34	0.1	5.17	208.4	-1	0.49
GP09	$C_{10}H_{17}NO_4$	9.400	10.399	0.1	5.2	221	-0.3	0.46
GP10	$C_{10}H_{16}N_2O_2$	9.528	10.398	0.1	5.199	215.2	0.3	0.2
GP11	$C_9H_{17}NO_3$	9.176	10.278	0.1	5.139	205.6	-0.5	0.55
GP12	$C_9H_{16}N_2O_4$	9.801	10.066	0.1	5.033	226.2	-0.4	0.24
GP13	$C_9H_{16}NO_2Cl$	9.677	10.569	0.1	5.285	220.1	0.5	0.17
GP14	$C_9H_{16}NO_2Br$	9.629	9.925	0.1	4.963	224.1	0.6	0.29
GP15	$C_9H_{16}NO_2I$	9.365	9.553	0.1	4.777	223.2	0.9	0.34
GP16	$C_{10}H_{19}NO_2$	9.307	10.442	0.1	5.221	218.3	0.6	0.18
GP17	$C_{10}H_{17}NO_3$	9.466	10.419	0.1	5.21	221.5	0.1	0.46
GP18	$C_9H_{18}N_2O_2$	9.363	10.414	0.1	5.207	212.8	-1.3	0.36
GP19	$C_{10}H_{17}NO_4$	9.519	10.515	0.1	5.258	229.3	-0.5	0.28
GP20	$C_{10}H_{16}N_2O_2$	9.633	10.563	0.1	5.282	222	0	0.23
GP21	$C_9H_{17}NO_3$	9.441	10.5	0.1	5.25	208.9	-0.8	0.51
GP22	$C_9H_{16}N_2O_4$	9.736	10.078	0.1	5.039	219.2	-0.6	0.25
GP23	$C_9H_{16}NO_2Cl$	9.572	10.355	0.1	5.178	210.6	0.2	0.15
GP24	$C_9H_{16}NO_2Br$	9.55	9.911	0.1	4.956	215.1	0.4	0.18
GP25	$C_9H_{16}NO_2I$	9.258	9.543	0.1	4.772	219.1	0.7	0.31
GP26	$C_{10}H_{19}NO_2$	9.2873	10.416	0.1	5.208	212.5	0.4	0.15
GP27	$C_{10}H_{17}NO_3$	9.4345	10.495	0.1	5.248	214	-0.2	0.43
GP28	$C_9H_{18}N_2O_2$	9.1913	10.225	0.1	5.113	209.1	-1.5	0.37
GP29	$C_{10}H_{17}NO_4$	9.4813	10.624	0.1	5.312	220.9	-0.7	0.26
GP30	$C_{10}H_{16}N_2O_2$	9.5817	10.798	0.1	5.399	215.4	-0.2	0.21
GP31	$C_9H_{17}NO_3$	9.3679	10.558	0.1	5.292	206.1	-1	0.42



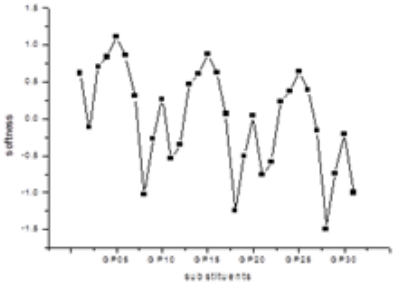
(a) Ionization potential



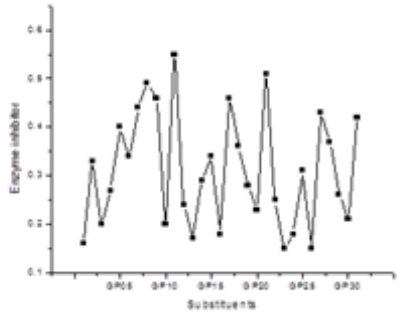
(b) Cosmo area



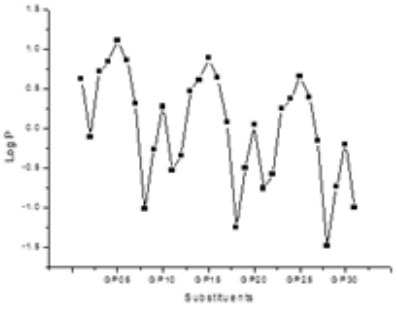
(c) Hardness



(d) Softness



(e) Enzyme Inhibitor



(f) Log P

Figure 1: GRAPHS

5. Discussion

The substituents were taken from spectro-chemical series,The main compound was first optimized and the properties such as ionisation potential, total energy, homo-lumo energy, log P, enzyme inhibitor etc. Ware the substituents positions were chosen with a

knowledge of chemical reactivity such as Ortho, Meta and Para substituent effect was felt at certain points and whose charges were calculated.

Out of the 30 derivatives, compound GP12 which has NO2 substitutent in the meta position to carbon atom highest ionisation potential value followed by GP22 which had NO2 in the Para position to the carbon atom of the cyclohaxane ring. The third highest ionization potential for GP13 which has Cl group in the mata position to cyclohaxane carbon atom.

The ionization potential of the next three compounds GP14, GP20 and GP30 also has Br and CN as the substituent ligands. Some of the compound had less ionisation potential than the parent compound, these include GP06, GP08, GP11, GP25, and GP28 that were found from the ligands such as CH3, NH2, OH, I and NH2 which have +I effect and electron releasing in nature, have lesser ionization potential. Therefore at places where metabolic activities are dependent upon the ionisation potential of the molecule, these substituents should be avoided.

Compounds with moderate ionization potential values were found to be with halogen atom such that the incorporation of electronegative atoms moderately affected the ionisation potential compared to those carbon atoms such as Nitrogen and those ligands with pi-electron releasing nature wherever good ionisation potential is considered.Conductor like screening model (Cosmo) is a parameter that determines the area of the molecule in a different phases. The Cosmo procedure generally provides the polygen surface around the system at Vander Waals distance which is very important for drug like interactions. This parameter was studied and the values were tabulated. Higher area was provided by GP19 followed by GP12 and GP14. This again showed that the presence of COOH, NO2, Br derivative is influential. As a result of that one can expect very large amount of interactions with the receptor molecules (or) the solvent medium. The next three series of the compounds GP15, GP17 and GP20. these kind of groups may be introduced to the parent compound that have the lowest Cosmo area. Interestingly GP12 and GP22 have the highest ionization potential because of the presence of NO2 ligand, which means at places where polarization effect is more important than the non-covalent inter-action, the NO2 derivative may be used.

Hardness of a molecule represents the property of resistivity to change. i.e. compounds with greater hardness in a series of molecules show their resistivity. In our series GP30 shows the higher hardness value followed by GP29 and GP31. It may be noted that the hardness is shown by molecule at substituents R3 i.e. on the cyclohaxane ring. Therefore any substitution at position R2 is bound to increase the hardness of the molecule and is very useful in places where ligand docking with macro-molecule without changing the structure. These series of a molecules can be bound to the receptor without changing the shapes and perform the metabolic activity. Therefore these three drugs may be prepared and tested for biological activity. These molecules are followed by GP06, GP09 and GP10. Again these are the molecules which have the substituent at R^1.

The softness represents the reactivity of a molecule, increasing order softness is present in the table and it may be noted that GP03, GP04, GP05, GP13, GP14, GP15, GP23, GP24,and GP25 all, have very great activity GP05 has Iodine substituent in the cyclohexane ring and the reactivity may thus the attributed to the these facts.

The enzyme inhibitor capacity is more for GP11, GP21, GP08. These three molecules have OH, OH and NH2 substituents is in the positions. Therefore this ligand, effect the enzyme inhibitor capacity. These are followed by GP09, GP17, GP07 and these have CHO, CHO & COOH as the substituent. GP07 & GP17 is a biologically active small molecule and its substitution will definitely have deserved activity. Thus this class of change may also be tested for biological activity.GP13, GP23 and GP26 substituents is lowest value.

Log P values which represent the ratio of distribution of the drug in aqueous and the organic layer were also computed. The three molecules GP11, GP21, and GP08 which had the highest enzyme inhibitor capacity have the low log P value, but GP08, GP18 and GP28 lowest log p value which means these drugs can be classified as important based on the semi empirical level calculation. However thorough Molecular Modelling has to be a done to establish the credential properties shown by these values. The highest log P value is shown by GP05, GP15 and GP06, which have iodine atom and methyl group alongside the benzene ring. So Iodine derivatives may be studied separately for the distribution factor and must be compared with the other methods of finding out the distribution parameters.

6. Conclusion

From the above discussion, it can be clearly established that the following compounds, viz: GP08, GP18, GP28, GP05, GP15, GP13, GP25, GP23, GP26, GP06, GP11 and GP21 may be synthesized, the biological activity and the parameters like logP and enzyme inhibitor be verified . The drug designing and modeling requires all the above techniques be adopted before a trial and medicinal or biological activity is carried out.

If the mechanism of the drug is known then some of the compounds may be subjected to docking studies or pharmacophore modelling. On the same grounds Structure-Activity, Structure-Property and Structure-Toxicity studies may be carried out and the efficient drug or medicine may then be evaluated.

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Part B:

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ICT APPLICATIONS IN PUBLIC LIBRARIES WITH SPECIAL REFERENCE TO VELLORE DISTRICT

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Abstract

Information Communication Technology occupy entire universe in this current scenario. ICT application is essential factor for the growth and development of every library. According to that primary objective of this study is to undertaken and analysed in Vellore District Public Libraries also findout the ICT application and facilities available in five selected libraries in vellore District. Research design - under the five blocks of libraries a systematic questionnaire administered for data collection. Findings - It is found from the analysis that the respondents aware about the computer usage and browse e-resources for their occupation or business. Suggestions are given to improve unable to understand the IT related aspects such as OPAC, databases, internet etc. available in the library.

Keywords: ICT Infrastructure, Public Libraries and Vellore District.

1. Introduction

Information and Communication Technology plays important role for not only in Libraries but also to the entire universe. The Union Government and the State Government has taking many initiatives for the infrastructure development of Public libraries. Out of the grant made by the Tamil Nadu government, 20 District Central Libraries are being automated with four nodes and one server. AutoLib software has been used for this purpose. Since major parts of the collections of these libraries are Tamil monographs, the AutoLib software has been enhanced to support these collections. It is also to note that a small LAN has been established in each library with Windows server 2003 software. And there is a plan to link all these District Libraries through the NIC infrastructure. The State Central Library has been automated with well established LAN system with AutoLib software and latest Hardware Technology. The Digital Library has been initiated with powerful Minolta 7000 scanners and OCR software. Digital conversions are kept as PDF and Tiff formats and the Digital Library is in the progress yet to operate. The initiatives also extended to the other district public libraries is desirable.

1.1. ICT Applications and Barriers

The followings are opined by the professionals who are involved in the applications of ICT in the public Library system in the state.

- Inadequate fund provisions.
- Lack of talented manpower, only countable number of professionals working are able to cope up with the application of latest technology.
- Poor salary and lack of encouragement.
- Many of the branch libraries are maintained and run by the non- professionals who are not even know A,B,C,D of the library profession.

Public libraries are otherwise called community libraries. Corporate houses can finance or sponsor various programmes of public libraries to fulfil their social responsibilities towards communities. Various examples and case studies have been incorporated below to corroborate this fact. In the last few years, the rapid and very exciting developments in information technology have revolutionised the way in which information is collected, displayed, and accessed. The synergy between information and communications technology (ICT) is allowing access to information in ways hardly imaginable. Many public libraries have responded to the challenge of the electronic public libraries have an exciting opportunity to help to bring everyone into this global conversation and to bridge what is often called the digital divide. They can achieve this by providing information technology for public access, by teaching basic computer skills and by participating in programmes to combat illiteracy. Corporate houses can finance these projects. However, to fulfil the principle of access for all, they must also continue to maintain services that provide information in different ways, for example, through print or the oral tradition. Such services are likely to occupy vital importance in the foreseeable future. The opportunities provided by the ICT can be utilised to develop these services in new and exciting ways.

2. Objectives

1. To identify the Public libraries in vellore District
2. To list out the Public libraries in Vellore District
3. To findout different kinds of Public libraries
4. To identify the ICT facilities available in the Public libraries
5. To study the usage level of ICT facilities
6. To know the awareness about ICT among the users.

3. Review of Literature

Subramanian, N. (2014) identified the electronic information use patterns of Yercaud tribal students in Salem district Tamil Nadu. This paper describes the background of the Yercaud tribal area, ICT facilities available in Yercaud, the awareness of school and college students about electronic resources.

Ramesh Babu, and Asok Kumar, (2003) Proposed by to share physical resources and access to e-resources in the context of public libraries in India. The authors have also identified the constraints in developing consortia approach to public libraries in India such as lack of automation in public libraries, attitude of library staff, and lack of trained staff in ICT application political and legal barriers and economics constraints.

Pettigrew, et.al (2002) conducted a study of how public libraries are using online community networks to facilitate the public's information seeking and use in everyday situations.. The authors further discussed (1) how the public is using networked community information systems and the Internet for daily problem solving, (2) the types of barriers users encounter, and (3) the benefits for individuals and physical communities from public library-community networking initiatives and the emergence of "information communities".

4. Research Design

There were 179 Public libraries available in the Vellore District, its includes Branch library, Rural library and District Central Library. Among this five blocks were taken into account for data collection. A systematic questionnaire has administered for data collection. After collection of data were fed into the computer excel sheet for anlaysis. SPSS Software package utilized for data analysis.

5. Limitations of the study

This study intends to study the community roles of the public libraries of the Vellore District. Even among the public libraries only five libraries were selected for the testification of the objectives and hypotheses of the study.

6. Data Analysis & Discussions

Journals and Magazines available in the Libraries under Study

The Table 1 presents the details about the number of Journals and Magazines subscribed in the libraries under Study. 102 total numbers of journals available in for study Libraries viz., Ambur, Alangayam, Ranipet and Kaveripakkam, 94 Tamil and 8 English journals and magazines are subscribed. In the Vellore public library, there are 163 Tamil and 12 English journals and magazines are subscribed. The other languages journals and magazines are not available in the libraries under study in the study areas.

Table 1: Journals and Magazines available in the Libraries under Study

S. No	Place	Tamil	English	Other Languages	Total no of Journals available
1	Ambur	94	8	-	102
2	Alangayam	94	8	-	102
3	Ranipet	94	8	-	102
4	Kaveripakkam	94	8	-	102
5	Vellore	163	12	-	175

Registered Members of the Study Libraries

The total number of registered members of the study libraries of the study in the Table 2 and Figure 1 The table 3 out of 29229 number of readers, 4412 male and 1051 female members are registered in the study libraries in Ambur library. In the Alangayam library 1435 male and 1197 female members are registered. In Ranipet 6112 male and 669 female members are registered. And 1630 male and 1080 female members are registered in Kaveripakkam Public library.

Table 2: Registered Members of the Study Libraries

S. No	Name of the Library	Male	Female	Total no of Readers
1	Ambur	4412	1051	5463
2	Alangayam	1435	1197	2632
3	Ranipet	6112	669	6781
4	Kaveripakkam	1630	1080	2710
5	Vellore	26109	3120	29229

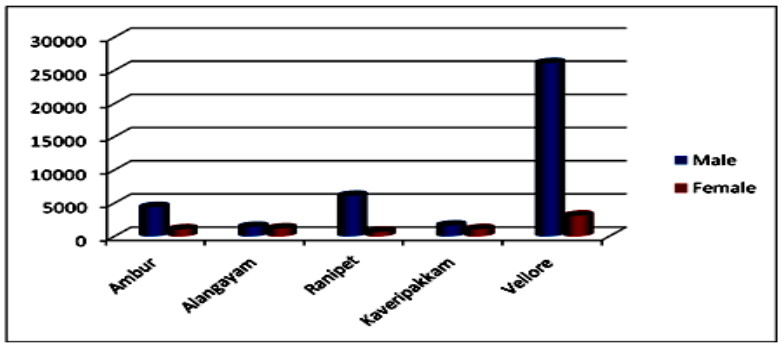

Figure 1: Registered members of the study libraries

It is observed that most of the male member registered in Ranipet library and most of the female members are registered in Alangayam library.

Frequency of the Respondents Visit

It is seen from the Table 3 that almost more than 70 percent of the respondents of the libraries are regular visitors of their respective library as they stated that they are daily, weekly, visiting their library. From these results, it can be interoperated that for their information need for their occupation and other reasons, they fully depending upon their libraries, More over a negligible percent of the respondents in all the libraries are irregular visitors.

Table 3: Frequency of the Respondents Visit

Sl.No	Frequency of the respondents visit	Alangayam		Ambur		K.pakkam		Ranipet		Vellore	
		No	%	No	%	No	%	No	%	No	%
1	Daily	43	43	34	34	55	55	32	32	21	21
2	Weekly	36	36	40	40	36	36	40	40	50	50
3	More than once in a week	6	6	14	14 ‘	2	2	18	18	8	8
4	Fortnightly	5	5	0	0	0	0	6	6	9	9

Opinions of the Collection Availability and Catalogue

Alangayam Public Library

It is seen from the Table 4 that the respondents of the Alangayam public library opined that there is in unavailability of OPAC and altogether 73 per cent of the respondents place third and fourth ranks for the availability of user friendly catalogue. Since there are no digital collections, none of the respondents opined or ranked this factor.

Table 4: Alangayam Public Library

Sl. No	Particulars	Ranks							
		1	2	3	4	5	6	7	8
1	OPAC stations are available	1	0	0	0	0	0	0	0
2	User friendly catalogue	0	0	15	58	0	0	0	0
3	Digital collection are accessible	0	0	0	0	0	0	0	0
4	Comprehensive multimedia resources	42	2	0	0	0	0	0	0
5	Comprehensive books collection	15	43	4	0	0	0	0	0
7	Complete relevant journals	17	20	23	13	0	0	0	0
8	Resources added to the collection regularly	11	2	24	0	0	0	0	0

And 63 respondents ranked first and second ranks for the availability of comprehensive collection. And nearly 60 respondents are gave first, second and third ranks for the availability of relevant journals. And less than 40 number of respondents ranked the regularity of the collection additions.

Ambur Public Library

Table 5: Ambur Public Library

Sl. No	Particulars	Ranks							
		1	2	3	4	5	6	7	8
1	OPAC stations are available	0	0	0	1	2	1	2	1
2	User friendly catalogue	13	11	15	6	5	7	10	2
3	Digital collection are accessible	0	0	5	0	8	3	1	6
4	Comprehensive multimedia resources	10	17	6	9	6	12	3	3
5	Comprehensive books collection	24	16	10	5	8	3	4	0
6	Comprehensive thesis collection	9	10	8	13	12	12	1	4
7	Complete relevant journals	6	16	15	10	4	5	6	1
8	Resources added to the collection regularly	7	1	13	12	7	3	3	3

It is seen from the Table 5 that the respondents of the Ambur public library opined that, there is in unavailability of OPAC and altogether 38 percent of the respondents place third and fourth ranks for the availability of user friendly catalogue. Since there are no digital collections, none of the respondents opined or ranked this factor and 60 respondents ranked first and second ranks for the availability of comprehensive book collection. And nearly 47 respondents are gave first, second and third ranks for the availability of relevant journals. And less than 40 numbers of respondents ranked the regularity of the collection additions.

Kaveripakkam Public Library

It is seen from the Table 6 that the respondents of the Kaveripakkam public library opined that there is in unavailability of OPAC and altogether 12 per cent of the respondents place third and fourth ranks for the availability of user friendly catalogue. Since there are no digital collections, none of the respondents opined or ranked this factor. And 27 respondents ranked first and second ranks for the availability of comprehensive book collection. And nearly 25 respondents are gave first, second and third ranks for the availability of relevant journals. And less than 20 numbers of respondents ranked the regularity of the collection additions.

Table 6: Kaveripakkam Public Library

Sl. No	Particulars	Ranks							
		1	2	3	4	5	6	7	8
1	OPAC stations are available	0	0	1	4	3	0	1	0
2	User friendly catalogue	6	2	4	10	0	0	0	1
3	Digital collection are accessible	3	8	4	6	1	2	1	0
4	Comprehensive multimedia resources	5	3	9	2	1	2	2	0
5	Comprehensive books collection	7	15	5	4	1	0	1	0
6	Comprehensive thesis collection	12	12	7	2	2	0	0	2
7	Complete relevant journals	14	7	4	0	1	3	1	0
8	Resources added to the collection regularly	15	3	2	3	1	1	0	2

Ranipet Public Library

It is seen from the Table 7 that the respondents of the Ranipet public library opined that there is in unavailability of OPAC and altogether 24 per cent of the respondents place third and fourth ranks for the availability of user friendly catalogue. Since there are no digital collections, none of the respondents opined or ranked this factor.

Table 7: Ranipet Public Library

Sl. No	Particulars	Ranks							
		1	2	3	4	5	6	7	8
1	OPAC stations are available	0	0	0	1	3	3	1	0
2	User friendly catalogue	10	9	5	44	2	1	4	1
3	Digital collection are accessible	4	3	4	2	1	3	4	0
4	Comprehensive multimedia resources	21	13	10	3	5	8	0	2
5	Comprehensive books collection	20	22	8	7	2	1	2	0
6	Comprehensive thesis collection	9	24	15	8	4	3	1	1
7	Complete relevant journals	15	14	16	10	3	2	6	1
8	Resources added to the collection regularly	13	7	21	1	7	4	4	3

And 60 respondents ranked first and second ranks for the availability of comprehensive book collection. And nearly 47 respondents are gave first, second and third ranks for the availability of relevant journals. And less than 41 numbers of respondents ranked the regularity of the collection additions.

Vellore Public Library

It is seen from the Table 8 that the respondents of the Vellore Public Library opined that there is in unavailability of OPAC and altogether 37 per cent of the respondents place third and fourth ranks for the availability of user friendly catalogue. Since there are no digital collections, none of the respondents opined or ranked this factor.

Table 8: Vellore Public Library

Sl. No	Particulars	Ranks							
		1	2	3	4	5	6	7	8
1	OPAC stations are available	0	3	0	6	1	1	0	2
2	User friendly catalogue	3	15	19	20	8	2	2	0
3	Digital collection are accessible	2	18	15	10	4	5	1	0
4	Comprehensive multimedia resources	1	8	1	8	10	2	0	0
5	Comprehensive books collection	29	17	9	8	1	1	0	0
6	Comprehensive thesis collection	11	9	16	3	4	2	0	0
7	Complete relevant journals	21	17	6	12	4	1	0	0
8	Resources added to the collection regularly	11	7	5	8	4	1	5	0

And 55 respondents ranked first and second ranks for the availability of comprehensive book collections. And nearly 44 respondents are gave first, second and third ranks for the availability of relevant journals. And less than 23 numbers of respondents ranked the regularity of the collection additions.

7. Findings

- A majority of the respondents of the study belongs to the age group between 15 to 30 years. The constituted 54 per cent. And also 60 to 70 years age group respondents are less participated in the study and they constituted lowest of 2 per cent. The middle age group i.e. 31 to 59 years age group constituted nearly 50 per cent.

- 37 per cent of male respondents are participated in the research and the remaining respondents are belongs to female category. The result shows that the male community is more than that of the female in the Indian context. Thus, the majority of the public library users belong to male community.

- A majority of the respondents of the survey belongs to the academic community. They constituted more than 30 per cent. The presented data is also revealed that

a quiet number of formers (22%) are the users of the library. The other type of respondents constituted to teachers and businessman are participated in equal percentage of 20 and labour are participated in lowest percentage of 8.

- It is identified that 28 per cent in Alangayam library and 41 per cent in Ambur library and 38 per cent and 21 per cent in Ranipet and Vellore libraries respectively are non member of these libraries. Life membership less than 30 in Kaveripakkam and Ranipet libraries respectively and 32 per cent in Vellore and 49 per cent in Alangayam library are participated in the survey.

- It is found that more than 70 per cent of the respondents of the libraries are regular visitors of their respective library as they stated that they are daily weekly, visiting their library.

- Unable to understand the IT related aspects such as OPAC, databases, internet etc. available in the library.

- Lack of knowledge about the basic organization of the library.

- Lack of awareness about services rendered by the library.

- Lack of awareness about various information sources and their coverage.

- Unavailability of OPAC is common requirement for all the libraries.

8. Suggestions

- The users opinioned that the library should have OPAC facilities.

- The library should have internet and Wi-Fi connectivity to access for latest information on the e-journal and e-book.

- The library should have UPS and Solar Lamp facilities in case of electricity power failure.

- Users need Xerox facilities to take important topics for their references.

- The users opinioned that the libraries should have sufficient number of vacuum cleaners and fire extinguish machines.

- To respondent feel that more number of library professionals should be appointed.

- The respondents demanded a separate room for reference section.

9. Conclusion

In this day to day life users thought desires new technological developments in public libraries and libraries also to save the time of the readers. According to that ICT application to enhance the library services effectively. The Government and other non Governmental organizations should support for the development of ICT infrastructure in public libraries. The Ministry of HRD, has taken many initiatives for the development of education and it should reach each nook and corner of the country. The Raja Ram Mohan Roy Library Foundation, Kolkatta assisting the public libraries throughout the country for the development of Public libraries. The public libraries and authorities should adopt latest technologies and create awareness about open access resources among the readers circle.

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EMOTIONAL INTELLIGENCE AND JOB SATISFACTION OF COLLEGE TEACHERS IN VELLORE DISTRICT

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Abstract

Keywords: EI, Social Awareness, Job Satisfication and Self Management.

1. Introduction

Emotional Intelligence In practical term means being aware that emotions can drive our behavior and impact people positively and negatively, and learning how to manage those emotions both our own and others especially when we are under pressure.

Emotional Intelligence EIis a term created by two researchers - Peter Salavoy and John Mayer - and popularized by Dan Goleman in 1996 through his book titled *Emotional Intelligence*. The Emotional Intelligence (EI) is the ability of individuals to recognize their own, and other people's emotions, to discriminate between dissimilar feelings and label them properly, to use emotional information to guide thinking and behaviour, and adjust emotions to adapt environments or achieve one's goal.

India is on the march of developing the nation in all spheres. The expectancy of every citizen is high, but the standard of living seems to be average and low. Any country can achieve overall development, only through the development of its human resources. The development of human resources ultimately falls on educational system of the country. Education to be meaningful should not only aim at the physical and mental growth of an individual but also take in to account the needs and aspirations of the development of the society. Any transformation in the society can be possible only through education, which in turn depends on teachers the providers of education. Further the role of teachers is very crucial in transforming, enlightening and empowering the society.

The development which took place in various fronts of the economy has been negated by very poor human development. Any country can achieve overall development, only through the development of its human resources. The development

of human resources ultimately falls on educational system of the country. Education to be meaningful should not only aim at the physical and mental growth of an individual but also take in to account the needs and aspirations of the development of the society. Any transformation in the society can be possible only through education, which in turn depends on teachers - the providers of education. Further the role of teachers is very crucial in transforming, enlightening and empowering the society.

Emotions are inner state of feelings of an individual that can neither be suppressed nor be stopped, will surface again and again till it is manifested into an action. Emotions are totally unpredictable and are unaware of its own strength and power. Emotions can be both positive and negative. Positive emotions give birth to positivists in life - like motivation, satisfaction, involvement, inducement, dedication, devotion, satisfaction and so on. Whereas negative emotions give birth to negativities in the life - like depression, frustration, dejection, jealousy, dissatisfaction, lack of motivation and so on.

As every individual is having emotions and his/her actions are guided by these emotions, teachers too have their own emotions and their deeds and actions are guided by their own emotions. Further these emotions are guiding and influencing job related variables like jobs satisfaction, job involvement, and motivations etc. Number of studies like Mousavi, H.S et. al, (2012), Shepherd-Osborne (2009), Dong, Q. (2006) and Hunter, Philip Edward (2006) have proved beyond any doubt that, emotions play a vital role on individual works life. Similarly emotional outburst will wreck havoc in work life. This complex nexus between emotions and satisfaction in educational system has given birth to this research idea where is the researcher attempts to examine the impact of emotional intelligence on job satisfaction among college teachers.

The real success and effectiveness of an educational system depends on the teachers, who are the torch bearers and providers of education to the society. Interestingly the efficiency and the performance of the teachers are guided by their Emotions.

The fruits of successful and effective educational system, lies in the hands of teachers who are the erecting pillars of the nation. Interestingly the efficiency and the performance of the teachers are guided by their Emotions. Emotions are inner state of feelings of an individual that can neither be suppressed nor be stopped, will surface again and again till it is manifested into an action. Emotions are totally unpredictable and are unaware of its own strength and power. Emotions can be both positive and negative. Teachers too have their own emotions and their deeds and actions are guided by their own emotions.

2. Emotional Intelligence

The Emotional Intelligence (EI) is the ability of individuals to recognize their own, and other people's emotions, to discriminate between dissimilar feelings and label them properly, to use emotional information to guide thinking and behaviour, and adjust

emotions to adapt environments or achieve one's goal. Emotional Intelligence, (here after in this study will be referred as EI) describes the skill, capacity or, a self-perceived grand ability to identify, assess, manage and control the emotions of one's self, of others, and of groups. It is also considered to play a important role in the contemporary work life. The EI principles help in evaluating employee behaviour, their attitudes, management styles, interpersonal skills and potentials and is considered to have great significance in areas like job profiling, planning, recruitment and selection. The main advantage of EI is that it allows people to have better understanding and manage emotions. Many psychological studies have shown that understanding and adjusting emotions play important role in gratifying one's life and work environment.

3. Importance of Emotional Intelligence

Effective management of emotional intelligence is a strong predictor of success both in our personal life and in the office. Teaching is an emotional practice which involves emotional relationships, emotional understanding and emotional labour. Lecturers have to value emotional bonds with students and educate students as emotional and social beings. It requires high level of emotional intelligence. Many researchers like Akomolafeet et. al (2011), Kirshnamurthy, M. & Varalakshmi, S. (2011), have concluded that people who manage their own feeling well and deal effectively with others are more likely to live content lives. Happy people are more apt to retain information and do so more effectively than dissatisfied people. Teachers are the main pillars of society, who help the students to grow to shoulder the responsibility of taking their nation ahead of others. They desire security, recognition, new experience and independence. When these needs are not fulfilled they become tense, and dissatisfaction among workers is undesirable and dangerous in any profession. The job is not only a main source of income but also an important component of life.

The College Teachers are arguably the most important group of professionals for our nation's future. But, it is disturbing to find that many of today's teachers in higher education are dissatisfied with their jobs. The government of India is highly anxious to provide quality education at college level. But without job satisfaction among the college teachers, the objective of providing quality education would not be materialized. Therefore, job satisfaction is needed among college teachers to promote quality education.

Lecturers have to value emotional bonds with students and educate students as emotional and social beings. It requires high level of emotional intelligence. It can greatly impact the work life and career, so it's important to understand exactly what it is and why it is so important. Every workplace is comprised of people with different strengths, personalities and emotions, which can greatly affect the way they work. Many researchers like Akomolafeet et. al (2011), Kirshnamurthy, M. & Varalakshmi, S. (2011), have concluded that people who manage their own feeling well and deal

effectively with others are more likely to live content lives. Happy people are more apt to retain information and do so more effectively than dissatisfied people. And in corporations, the inclusion of Emotional Intelligence in training programs has helped employees cooperate better and motivate more, thereby increasing productivity and profits (Goleman Daniel, 1994).

4. Job Satisfaction

Job satisfaction can be defined as an employee's attitude towards the job. It is not same as motivation, rather it is concerned with the attitude and internal state of an individual regarding a particular job. It could, for example, be associated with a personal feeling of achievement, and hence, shaped or determined by pay supervisory style and age factors. If the exdisting job fails to provide psychological or physiological need of an individual, satisfaction from the job might be low. More specifically, job satisfaction can be explained as an employees general attitude towards the job. It is a pleasurable feeling that results from an employees's perception of achieving the desired level of need or satisfaction. Job organizational process. It is multidimensional attitude which is made up of the attitude towards pay, promotions, co-workers, supervision, the work environment and so on. High job satisfaction implies that the employees like the job, whereas low job satisfaction relates to the disliking of the job by individuals. Job satisfaction is an intangible variable which is expressed through emotional feelings. Therefore , it can conclude that, job satisfaction is an employees positive response toward the various aspects of job. It helps to improve job performance and can be determined by the deviation between employees expectation about job outcome and what the job actually offers.

5. Significance of this Study

In this study, an attempt has been made by the researcher to examine the relationship between EI and JS. The present study has great significance because standardized emotional intelligence scale developed by Daniel Goleman(1995) was adopted in this study. Five points Likert Scale was used for the assessment of level of Emotional Intelligence of lecturers in Arts and Science Colleges that will provide EI index of college teachers working in Vellore District. The study will also contribute towards enhancing the capacity of lecturers not only at cognitive level but also at emotional intelligence level by giving them an insight into importance of one's emotional intelligence at work. This study will also help to understand factors contributing to job satisfaction of the lecturers.

6. Statement of the Problem

Indian higher educational system is the third largest system in the world next to United States and China. There are 43 central universities, 275 state universities, 130 deemed universities, 90 private universities, 33 institutes of national importance, 33,000 colleges, 1800 exclusive womens colleges in India.

7. Scope of the Study

Over the past several years, it is believed that success in life or at work place depends upon the individual level of intelligence or intelligence quotient as reflected in an individuals academic achievement, examination passed, mark obtained etc. But now, research on emotional intelligence has revealed that EQ is the most important determinant for both professional and personal success in life.

8. Objectives of the Study

The prime objective of the study is to examine the nature of relationship between EI and JS among college teachers.

1. To identify the important dimensions of Emotional Intelligence among College Teachers.

2. To identify the important dimensions of Job Satisfaction.

3. To identify the level of Emotional Intelligence and Job Satisfaction among College Teachers.

4. To compare the dimensions of Emotional Intelligence across demographic profile of the respondents.

5. To examine the relationship between job satisfaction and the demographic profile of the respondents.

6. To find out the impact of Emotional Intelligence on internal and external factors of Job Satisfaction.

9. Hypotheses of the Study

To carry out the above objectives of the study, the researcher has developed following. Null hypotheses, through which, findings can be statistically validated.

(i) There is no significant mean difference among the demographic profile of the Respondents with respect to the dimensions of EI i.e., Self Awareness, Self Management, Social Awareness and Relationship Management.

(ii) There is no significant association between type of institution and level of Job Satisfaction.

(iii) There is no significant association between location of college and level of Job Satisfaction of lecturers.

(iv) There is no significant impact of Emotional Intelligence on Job Satisfaction.

10. Limitations of the Study

This study may have certain limitation, which are typical to any research study. Firstly due to lack of time and financial resources this study confines to Vellore District alone. Secondly this study is based on the observations of respondents. Therefore it may suffer from biased information. Thirdly, out of total 2000 (approximately) of lecturers in Vellore District, only 350 could be taken for study, due to so many constraints like financial resources time, willingness of respondents etc.

11. Review of Literature

The studies related in this field are described below:

Sulaiman Ibrahim Kassim et al.,(2016), Emotional Intelligence and Job Satisfaction are two concepts of high interest in modern work environment. They serve as a competitive edge in personal and organizational life. The educational system or lecturing profession is one of those within which the individuals could reap great advantage from the knowledge of emotional intelligence owing to recurring human interaction that exists among the lecturers and between the lecturers and students.

Lee Bee Yoke and SitiAisyahPanatik (2016), the mediation effect of Job Satisfaction between Emotional Intelligence and perceived job performance. The participants were educators in both public primary and secondary schools in Malaysia. Questionnaire surveys were distributed to the participants to collect data. Bootstrapping approach was used to test mediation effects of Job Satisfaction in the study. The findings revealed that intrinsic factors of job satisfaction functioned as a mediator others emotional appraisal, use of emotion and regulation of emotion on perceived Job performance.

12. Methodology

In this study, the researcher has used the following methodology for her research. Samples were selected from 27 Arts and Science Colleges affiliated to Thiruvalluvar University, located in Vellore District. Quota cum Accidental Sampling Technique was used.

Table 1: Level of Emotional Intelligence

Level of Emotional Intelligence	Frequency	Percentage
Low	64	18.3
Medium	218	**62.3**
High	68	19.4
Total	**350**	**100**

From the above table, it is observed that out of 350 sample respondents, 218 (62.3%) were under the category of medium level of emotional intelligence, 68 (19.4%) respondents were under the category of high level of emotional intelligence and 64 (18.3%) of them come under the category of low level of emotional intelligence respectively.

Table 2: Level of Job Satisfaction

Level of Job Satisfaction	Frequency	Percentage
Low	044	12.6
Medium	208	**59.4**
High	098	28.0
Total	**350**	**100**

As per the above table, it has been observed that out of 350 sample respondents, 208 (59.4%) were under the category of medium level of Job Satisfaction, 98 (28%) respondents were under the category of high level of Job Satisfaction and 44 (12.6%) of them come under the category of low level of Job Satisfaction respectively.

Table 3: Impact of Emotional Intelligence and Job Satisfaction

Dependent Variable	Independent Variables	Standardized dβ	Sig.	R^2	F Value
Job Satisfaction	Self-Awareness	0.312	0.000	**0.421**	**23.123***
	Self-Management	0.267	0.000		
	Social Awareness	0.171	0.000		
	Relationship Management	0.154	0.000		

Here, $p < 0.05$; H_0 is Rejected and H_1 (i.e., Alternative Hypothesis) is accepted. Therefore, It is concluded that, there is a significant relationship found between Emotional Intelligence and job satisfaction.

13. Findings

(i) It is found from the study that 53.7 % of the respondents were female but 46.3 % of the respondents were male. It is nothing but, majority of the female respondents were eager in rendering their service under educational institution because of the convenient working time.

(ii) It is clear from the analysis that 39.4 % of the respondents fall under the age group of 36 to 45 years, 32.3 % comes under the age group of 26 to 35 years, 12.6 % of the respondents were up to 25 years of age, 9.4 % of the respondents belong to 46 to 55 years and finally, 6.3 % of the respondents were above 56 years of the age group.

(iii) It has been observed from the study that out of 350 sample respondents 218 (62.3%) were under the category of medium level of emotional intelligence, 68 (19.4%) respondents were under the category of high level of emotional intelligence and 64 (183.3) of them come under the category of low level of emotional intelligence respectively.

(iv) From the analysis, it has been observed that out of 350 sample respondents, 236 (67.4) were moderately satisfied towards their job, 58 (16.6%) respondents were highly satisfied towards their job and 56 (16.07%) of them were less satisfied towards their job.

(v) Self-Awareness: Gender, Age, Salary has a significant relationship towards Self-Awareness because $p < 0.05$; but there is no significant relationship found towards Self-Awareness in case of Marital Status because $p > 0.05$.

(vi) Self-Management: Gender, Age, Marital Status has a significant relationship towards Self-Management because $p < 0.05$; but there is no significant relationship found toward Self-Management in case of Salary because $p > 0.05$.

(vii) Social-Awareness: Gender, Age has a significant relationship towards Social-Awareness because $p < 0.05$; but there is no significant relationship found towards Social-Awareness in case of Salary and Marital Status because $p > 0.05$.

(viii) Relationship Management: Gender has a significant relationship towards Relationship Management because $p < 0.05$; but there is no significant relationship found towards Relationship Management in case of Age, Salary and Marital Status because $p > 0.05$.

14. Conclusion

Emotional intelligence is essential for teachers because they involved with student community. Happy people are always more apt to retain information and do so more effectively than dissatisfied people. Building one's Emotional intelligence has a lifelong impact. The Emotional Intelligence training programs has helped employees cooperate better and motivate more, thereby increasing productivity and profits. Unlike what is claimed of I.Q, we can teach and improve in any individual, some crucial emotional competencies, paving the way for increasing their emotional intelligence and thus making their life more healthy - enjoyable and successful in the coming days. The attainment of the end results in terms of better handling of mutual relationships is quite vital and significant in his life. It can only be possible through his potential of emotional intelligence and its proper development. Emotional Intelligence may be the best important influencer of success on the job, according to studies done over the last decade. A good and Effective management of emotional intelligence is a strong predictor of success in both our personal life and in the office. To conclude, The study has clearly proved beyond any doubt that, "there is a strong relationship between EI and JS". The findings of the study further indicates that "EI and JS are directly related to each other". The increase in the level of EI leads to increase in the level of JS and vice-versa. It is concluded that the level of EI among college teacher influences and impacts the level of JS.

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CONSUMER PERCEPTION TOWARDS DIFFERENT MEDIA OPTIONS: AN EMPIRICAL STUDY OF RURAL AND URBAN CONSUMERS

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Abstract

The field of advertising is going through fundamental changes in recent days. Primarily, rapid technological development has led to the digitalisation of media. This digitalisation has resulted in different types of media such as Newspapers, Magazines, Television, Radio, Internet, Mobile phone and so on, which offers richer possibilities to reach consumers and interact with them. However, in order to fully exploit the potential of the media as an advertising channel, marketers must understand the unique characteristics related to it and the way the consumers interact with this channel. The growth in conventional media has been quite significant; however, it has not been substantial. Rural India consist about 128 million households of which only 54% comes in contact with any one of the conventional media, like press, television, satellite, cinema or radio. That means roughly 238 million are waiting to be tapped by the conventional media. The researchers have undertaken the present study to know about the consumers' perception towards different media options in rural and urban areas. The researchers have done this research work during January 2016 to December 2017. Simple percentage, chi-square analysis, one-way ANOVA, factor analysis, paired sample t-test, and multiple regression analysis have been used to analyse the collected data. The results of the research work stress the need for the advertisers to be more cautious while designing the advertisements and also enlightens the organizations on the appropriate choice of media for advertisements to reach the targeted consumers.

Keywords: Consumer Perception, Media Options, Rural Consumers, Urban Consumers.

1. Introduction

The field of advertising is going through fundamental changes in recent days. Primarily, rapid technological development has led to the digitalisation of media.

This digitalisation has resulted in different types of media such as Newspapers, Magazines, Television, Radio, Internet. Mobile phone and so on, which offers richer possibilities to reach consumers and interact with them. However, in order to fully exploit the potential of the media as an advertising channel, given more importance to culture, values and care. The companies that touch such feelings through its media will find it easy to attract Indian consumers. Media is the most powerful tool of marketers must understand the unique characteristics related to it and the way the consumers interact with this channel. The growth in conventional media has been quite significant; however, it has not been substantial. Rural India consist about 128 million households of which only 54% comes in contact with any one of the conventional media, like press, television, satellite, cinema or radio. That means roughly 238 million are waiting to be tapped by the conventional media. The researchers have undertaken the present study to know about the consumers' perception towards different media options in rural and urban areas.

2. Operational Definitions

Media

Media refers to the channels through which news, entertainment, education, data or promotional messages are disseminated. The media includes every broadcasting and narrow casting medium such as newspapers, magazines, television, radio, billboard and internet. Advertisement are brought to individuals by the media.

Consumer

Consumer is a broad term and any person who uses a product (or) services (or) deals with it can be called a consumer. It is not necessary that the person should be a buyer of the product (or) services.

Rural Consumers

Rural consumers as a segment have several distinctive characteristics. The values, aspiration and needs of this vast heterogeneous culture of rural consumers are quite different from their urban counterparts.

Perceptions

Perception is "the process by which an individual selects, organizes, and interprets stimuli into a meaningful and coherent picture of the world". The term 'perception' can be defined as the ability to derive meaning. Derived from the word 'perceive', it refers to the ability of giving meaning to whatever is sensed by our sense organs. It is the process through which an individual interprets ones sensory impressions to give meaning to them.

3. Significance of the Study

The main significance of the study is to find out the research gap and to study in detail about the consumers perception towards different media options and their impact on rural and urban consumers. Indians are known to be one of the shrewdest consumers in the world. Indians are rural and urban consumers about the product, even though sometimes media are linked with spreading falsehood or exaggeration. Media has a constructive role to play for the society. Advertising is an important marketing communication strategy in marketing mix. It is an external stimulus that arouses dormant needs. It results in 'inner tension' among prospective buyers. Ultimately, it leads to different stages of decision-making process namely identification of alternatives, evaluation of alternatives and purchase perceptions. Generally speaking, advertising fills "consumer information gap". The need to exist in the current competitive business scenario drives the manufacturer / marketer to lean on advertising. Advertising is an effective communication tool to consumers. Viewer's perception towards advertising possesses significant influence on the purchase decision. Consumer's perception towards advertising tends to change from time to time. Liberalization of Indian economy has created a competitive environment for both native and foreign products. The changes in the lifestyle of Indian consumers, their technological awareness and multiple preferences have brought heavy competition in the Indian marketing scenario. In order to survive in the global competitive market, the manufacturer and marketers strive to attract the consumers towards their product and transform them into dynamic purchasing consumers. This transformation can be achieved only by advertising through powerful and magnetic media like television, radio, newspaper, magazines, mobile phone and internet. Hence this study assumes significance in this respect. The researchers felt it imperative to find out rural and urban consumers' perception towards different media options. So, this study has been carried out by selecting rural and urban consumers. Today's consumers are flooded with numerous advertisements from various sources. Repeated exposure to advertisements is expected to impact the consumers significantly. The main significance of the study is to relate consumer attitudes and preferences. This relationship exactly reveals the consumer perceptions towards advertisement.

4. Statement of the Problem

In modern civilization, every year a huge amount is being spent on advertisement to increase the degree or volume of sales by the company. The marketers have come to realize that their effectiveness in meeting the customers' needs directly influences their profitability. In recent years, relatively, few surveys have been published assessing the relationship between customer satisfaction and response to advertising messages, especially in the field of manufacturing industry. The rapid progression of technology

has filled the market with a wide variety of products or services for the consumers and they have to select the best alternative. The viewers and listeners are largely grouped under multiple media choices to get access to advertisements. The attitude and preferences of consumers constantly changing and it is of utmost importance for the traders and advertising agencies to choose appropriate elements of advertisement and the right media through which the advertisement can be broadcasted or telecasted. The present study attempts to analyse the rural and urban consumers' attitudes related to factors influencing the selection of different media. Hence, there is a need for comprehensive study on the influence of advertisement campaign environment. This approach ensures that participants have had at least some experience with different media and allows questions related directly to specific advertisements. In addition, this approach permits to analyse rural and urban consumers' attitudes related to factors influencing different media. In order to build a research framework, this study has been applied to the context of the attitudes towards media and consumer behaviour. This study is to answer for the following research questions.

1. What are the different factors influencing the attitudes of consumers towards media?

2. How do demographic variables influence consumers attitude towards different media?

3. How do media influence attitudes and the buying behaviour of urban and rural consumers?

4. Is there any difference in the attitude and buying behaviour of urban and rural consumers?

In this context, the present study aims at examining the rural and urban consumers perception towards different media options. Hence, this empirical study has been undertaken in Vellore district.

5. Objectives of the Study

The following are the main objectives of the present study.

1. To study the different factors affecting the choice and preference of different media among the rural and urban consumers.

2. To study and analyse the role of media in the purchase behaviour of consumers.

6. Hypotheses of the Study

Based on the research objectives, the following hypotheses have been framed.

1. There is no association between residential areas of rural and urban consumers with regard to gender.

2. There is no association between Rural and Urban consumers with regard to age of the respondents.

3. There is no association between Rural and Urban consumers with regard to occupation of the respondents.

4. There is no association between Rural and Urban consumers with regard to monthly income of the respondents.

5. There is no association between Rural and Urban consumers with regard to marital status of the respondents.

7. Research Methodology

The present study is based on the primary as well as secondary data. The study depends on the data collected through a well framed and structured interview schedule to elicit the well-considered opinion of the respondents. Convenient sampling method was adopted to obtain the responses from the rural and urban consumers of Vellore District. This study employs both analytical and descriptive type of methodology. The study is conducted in two stage format, with a preliminary pilot study followed by the main study.

7.1. Nature and Area of the Study

The study area taken up by the researchers is Vellore District of Tamilnadu, which consists of 9 taluks, of which both rural and urban areas are considered for this study. The nine taluks are Ambur, Arakkonam, Arcot, Gudiyattam, Katpadi, Tiruppattur, Vaniyambadi, Vellore and Walaja.

7.2. Primary Data

The study is undertaken with a well-structured interview schedule collected from the respondents with varying demographical background. The interview schedule started with the respondents demographic background and covered their media usage along with buying behaviour.

7.3. Secondary Data

The sources of secondary data include data from books, research papers, reports, journals, unpublished research works and website on consumer perception towards media options.

7.4. Sampling Size and Design

There are 9 taluks in Vellore district, the researchers by adopting convenient sampling method, selected 50 respondents from each taluk comprising 25 respondents from urban area and 25 respondents from rural area. So, the final sample for the present study was 450 respondents comprising 225 urban respondents and 225 rural respondents. The researcher collected the necessary information from the respondents by using a self-styled interview schedule.

7.5. Interview Schedule

The interview schedule was divided into four sections. Section-I of the interview schedule deals with general information about the respondents. Section-II cover with the objectives of media, Section-III was designed on the different types of media and its effectiveness, and Section-IV elaborately ascertains the factors influencing different media.

7.6. Scaling Technique in the Interview Schedule

The interview schedule used comprises both optional type and statements in Likerts 5 point scale. The responses for these sections were obtained from the respondents in 5 point scale, which ranges as follows. 5-Strongly Agree, 4-Agree, 3-Neither Agree nor Disagree, 2-Disagree and 1-Strongly Disagree.

7.7. Pilot Study

A pilot study was conducted to validate the interview schedule and to confirm the feasibility of the study. The filled-up interview schedules were collected from 60 respondents and Cronbachs Alpha Criterion was applied to test the reliability. The value determined was 0.825 (82.5%) proving the reliability of the instrument. The quality of the interview schedule was ascertained and the test showed high reliability. Based on the pilot study, the interview schedule was modified suitably to elicit responses from the sample group.

7.8. Tools Applied for Data Analysis

The primary data collected were analysed using the SPSS (Statistical Package for Social Sciences) (V.20) software package. The Statistical tools used for obtaining results were presented. Simple percentage analysis was applied to find out the demographic

profile details of the rural and urban consumers. Chi-squire analysis was used to identify the association between demographic variables and different media options. One way analysis of variance (ANOVA) was used as an instrument for analysing the association between demographic variables and perception, attitude and behaviour of rural and urban consumers about different media options. Factor analysis was used to determine predominant factors of media options. Paired sample t-test was used to find the mean values of various elements of respondents behaviour towards different media options. Multiple Regression Analysis was applied to identify the cumulative influence of independent variables such as demographic variables about different media options.

8. Review of Literature

Naeem Akhtar Rana and Asghar Tuba (2015)[1] have said that the growing business competition in the world has allowed the researchers to adopt different strategies to go ahead of their competitors. In the last two decades, especially, it has been seen to exploit the celebrities as their brand ambassadors to put a positive impact on the customers. The research has been conducted to strength the advertisement communication and its impact on the customers purchase intentions with the celebrity endorsement. The survey is conducted on the students of a business university who frequently buy and sell new mobile phones. The instruments was adopted and approved by the experts of the field in Pakistan.

Senthil. M, Prabhu. N.R.V and Bhuvaneswari. S (2013)[2] explored customers perceptions towards advertising in the online shopping and social networking websites by distributing both physical and online questionnaires as well as conducting in-depth interviews. Consumers believe that advertisements on the internet are more believable as compared to other media and very few people believe in magazine advertisements. The study suggested that most reputable and well-known companies may be more likely to meet these expectations, and may help to lend credibility to the medium.

Nikhil V P, Kavita Tiwari and Ravikumar V (2015)[3] have analysed and explored about the significance of various online advertisements and its impact on the buying decision of selected areas in United Arab Emirates. The study emphasized on the degree of exposure towards the online advertisement in day-to-day lives of individuals while purchasing any consumer durable products such as mobiles, laptops, automobiles and so on. It also analyses the internet usage behaviour in terms of accessibility and experience.

9. Analysis and Interpretation of Data

By using the earlier mentioned statistical tools, the collected data was analysed. By considering the space factor, the detailed analytical parts have not been intentionally incorporated. However, important tables along with their interpretations have been mentioned below.

9.1. Role of Media in Purchase Decision of the Respondents

Nowadays media influences the purchase decision of any customer. The media such as Television, Newspaper, Magazines, Internet, Radio and Mobile Phone play a vital role in any advertisement.

Table 1: Role of Media in Purchase Decision of the Respondents

Media	**Frequency**	**Percentage**
Television	220	48.9
Newspaper	93	20.7
Magazines	25	5.6
Internet	56	12.4
Radio	6	1.3
Mobile phone	50	11.1
	450	**100.0**

Source: Primary Data

It is inferred from table no.1 that 48.9% of the respondents purchase decision influenced by Television, 20.7% by Newspaper, 12.4% by Internet, 11.1% by Mobile Phone, 5.6% by Magazines and 1.3% by Radio. Thus, majority of the respondents are influenced by Television media.

Testing of Hypotheses

Table 2: Association between Age of the Respondents and Residential Area

Age Group	**Residential Area**		**Total**	**χ^2 Value**
	Rural	**Urban**		
Below 20 Years	50 (73.5) **(22.2)**	18 (26.5) **(8.0)**	**68 (100.0) (15.1)**	χ^2 = 56.927 Df = 4 P = 0.000
21 to 30 Years	101 (63.5) **(44.9)**	58 (36.5) **(25.8)**	159 (100.0) **(35.4)**	
31 to 40 Years	45 (39.5) **(20.0)**	69 (60.5) **(30.7)**	114 (100.0) **(25.3)**	
41 to 50 Years	22 (30.6) **(9.8)**	50 (69.4) **(22.2)**	72 (100.0) **(16.0)**	
Above 50 Years	7 (18.9) **(3.1)**	30 (81.1) **(13.3)**	37 (100.0) **(8.2)**	
Total	**225 (100%)**	**225 (100%)**	**450 (100.0)**	

Hypothesis no. 1

"There is no association between residential areas of rural and urban consumers with regard to gender".

Chi-Square test was conducted to find the significant association between residential area and gender. It is found that the $\chi^2 = 1.338$, $P = 0.247$ are statistically insignificant at 5% level. Hence, the null hypothesis is accepted and concluded that there is no association between residential areas and gender.

Cross-tabulation between age group and residential area was conducted. The result showed that 22.2% of the rural respondents were below 20 years of age group and 44.9% of the respondents were in the age group of 21 to 30 years. 30.7% of urban respondents were in the age group of 31 to 40 years and 22.2% were in the 41 to 50 years and 13.3% were above 50 years.

Hypothesis no. 2

"There is no association between rural and urban consumers with regard to age of the respondents".

Chi-Square test was conducted to find the significant association between age group of the respondents and the residential area. It is found that the $\chi^2 = 56.927$, $P = 0.000$ are statistically significant at 5% level. Hence, the null hypothesis is rejected and concluded that there is an association between age group of the respondents and residential area.

Cross-tabulation between occupation of the respondents and residential area was conducted. The result showed that 19.1% of the respondents from urban areas are in business, followed by government sector (30.2%), professional 7.1%, house wife 12%. Whereas, 31.1% of the respondents were from rural areas working in private sector and 20% of the rural areas are students.

Hypothesis no. 3

"There is no association between rural and urban consumers with regard to occupation of the respondents".

Chi-square test of association is conducted to find significant association between occupation and residential area. It is found that the $\chi^2 = 30.762$, $P = 0.000$ are statistically significant at 5% level. Hence, the null hypothesis is rejected and concluded that there is an association between occupation of the respondents and residential area.

Cross-tabulation is conducted between monthly income and residential area. The result revealed that 60.4% of the rural respondents were earning below Rs.10000 per month, 28.4% of the urban area respondents were earning between Rs.10,001-20,000, 15.6% of the urban respondents were earning between Rs.20001-30000 per month and 20.4% of the urban area respondents were earning above Rs.30000 per month. Hence, the majority of the respondents earnings were below Rs. 10,000 in the rural area.

Table 3: Association between Occupation and Residential Area

Occupation	Residential Area		Total	χ^2 Value
	Rural	Urban		
Business	39 (47.6) **(17.3)**	43 (52.4) **(19.1)**	**82 (100.0) (18.2)**	χ^2 = 30.762 Df = 5 P = 0.000
Private Sector	70 (54.7) **(31.1)**	58 (45.3) **(25.8)**	**128 (100.0) (28.4)**	
Government Sector	34 (33.3) **(15.1)**	68 (66.7) **(30.2)**	**102 (100.0) (22.7)**	
Professional	14 (46.7) **(6.2)**	16 (53.3) **(7.1)**	**30 (100.0) (6.7)**	
House Wife	23 (46.0) **(10.2)**	27 (54.0) **(12.0)**	**50 (100.0) (11.1)**	
Student	45 (77.6) **(20.0)**	13 (22.4) **(5.8)**	**58 (100.0) (12.9)**	
Total	**225 (50.0) (100.0)**	**225 (50.0) (100.0)**	**450 (100.0) (100.0)**	

Hypothesis no. 4

"There is no association between rural and urban consumers with regard to monthly income of the respondents".

Chi-Square test was conducted to find the association between monthly income of the respondents and residential area. It is found that the $\chi^2 = 31.408$, $P = 0.000$ are statistically significant at 5% level. Hence, the null hypothesis is rejected and concluded that there is an association between monthly income of the respondents and residential area.

Cross-tabulation is conducted between marital status and residential area. The result showed that 69.8% of the urban area respondents are married and 48.4% of the rural respondents are single. Hence, the majority of the respondents are married in urban area than rural area.

Hypothesis no. 5

"There is no association between rural and urban consumers with regard to marital status of the respondents".

Chi-Square test was conducted to find the association between marital status of the respondents and residential area. It is found that the $\chi^2 = 15.655$, $P = 0.000$ are statistically significant at 5% level. Hence, the null hypothesis is rejected and concluded

Table 4: Association between Monthly Income and Residential Area

Monthly Income	Residential Area		Total	χ^2 Value
	Rural	Urban		
Below Rs.10,000	136 (63.0) **(60.4)**	80 (37.0) **(35.6)**	**216 (100.0) (48.0)**	χ^2 = 31.408 Df = 3 P = 0.000
Rs.10,001 – Rs.20,000	45 (41.3) **(20.0)**	64 (58.7) **(28.4)**	**109 (100.0) (24.2)**	
Rs.20001 – Rs.30,000	26 (42.6) **(11.6)**	35 (57.4) **(15.6)**	**61 (100.0) (13.6)**	
Above Rs.30,000	18 (28.1) **(8.0)**	46 (71.9) **(20.4)**	**64 (100.0) (14.2)**	
Total	**225 (50.0) (100.0)**	**225 (50.0) (100.0)**	**450 (100.0) (100.0)**	

Source: Primary Data

that there is an association between marital status of the respondents and residential area of the respondents.

Table 5: Association between Marital Status and Residential Area

Marital Status	Residential Area		Total	χ^2 Value
	Rural	Urban		
Married	116 (42.5) **(51.6)**	157 (57.5) **(69.8)**	**273 (100.0) (60.7)**	χ^2 = 15.655 Df = 1 P = 0.000
Single	109 (61.6) **(48.4)**	68 (38.4) **(30.2)**	**177 (100.0) (39.3)**	
Total	**225 (50.0) (100.0)**	**225 (50.0) (100.0)**	**450 (100.0) (100.0)**	

Other important interpretations of the analysis is as follows.

1. It is found that 60.4% of the respondents are male and 39.6% of them are female. Thus, the majority of the respondents are male in the study area.

2. It is understood that 35.4% of the respondents are in the age group of 21-30 years, 25.3% of them are in the age group of 31-40 years, 16% are in between 41-50 years, 15.1% of them are below 20 years and the remaining 8.2% of them are above 50 years. Thus, the maximum numbers of the respondents are in the age group of 21-30 years.

3. It is revealed that 28.4% of the respondents are working in private sector, 22.7% of them are in Government sector, 18.2% are in Businesses, 12.9% are students, 11.1% are Housewives and 6.7% are Professionals. Thus, maximum number of the respondents are working in the private sector.

4. It is found that 48% of the respondents are earning less than Rs.10,000 per month, 24.2% of them are earning Rs.10,001 - Rs. 20,000 per month, 13.6% of them are earning Rs.20,001 - Rs. 30,000 per month and 14.2% are earning above Rs.30,000 per month. Thus, around half of the respondents are earning a monthly income of less than Rs.10,000.

5. It is found that 60.7% of the respondents are married and the remaining 39.3% of them are yet to marry.

6. It is inferred that 48.9% of the respondents purchase decision influenced by Television, 20.7% of them are influenced by Newspaper, 12.4% of the respondents are influenced by Internet, 11.1% of them are influenced by Mobile Phone, 5.6% of them are influenced by Magazines and 1.3% of them are influenced by Radio. Thus, almost half of the respondents are influenced by Television media.

7. It is inferred that 57.8% of the male respondents and 42.2% of the female respondents are from rural areas.

8. The analysis result showed that 22.2% of the rural respondents are below 20 years of age group and 44.9% of the respondents are in the age group of 21 to 30 years. 30.7% of urban respondents are in the age group of 31 to 40 years and 22.2% are in the age group of 41 to 50 years and 13.3% are above 50 years.

9. The analysis result showed that 19.1% of the respondents from urban areas are in business followed by government sector which amounts to 30.2% of them, professional by 7.1%, house wife by 12%. Whereas, 31.1% of the respondents are from rural areas working in private sector and 20% of them are students.

10. The analysis result revealed that 60.4% of the rural respondents are earning below Rs.10000 per month, 28.4% of the urban area respondents are earning Rs.10,001-20,000, 15.6% of the urban respondents are earning Rs.20001-30000 per month and 20.4% of the urban area respondents are earning above Rs.30000 per month.

11. The analysis result showed that 69.8% of the urban area respondents are married and 48.4% of the rural respondents are single.

12. It is found that majority (80.2%) of the respondents prefer Television for entertainment, 8.2% of respondents use TV for state updates and national updates and 5.1% of them for international updates, 4.9% of them for advertisement and awareness of products and 1.6% use TV for business, career and job updates.

13. It is found that 49.8% of the respondents give importance to Television advertisement. 23.8% of the respondents give importance to newspaper advertisements, 13.8% of them follow internet advertisements, 6.0% of them give importance to mobile phone advertisements, 5.8% of them give importance to magazine advertisements and 9.0% of the respondents give significance to Radio advertisements.

14. It is found that the respondents are influenced by consumable goods, domestic goods, industrial goods, luxury goods and other advertisement in Newspaper to derive purchase decision.

15. It is found that all the respondents subscribe for newspapers. 30.4% of the respondents subscribe Daily Thanthi, 24.4% of them subscribe for 'Dinamalar', 20.4% of them subscribe for The Hindu, 12% of them subscribe for Dinamani, 5.1% subscribe for Indian Express, 4.9% of them subscribe for Deccan Chronicle, 2.2% of them subscribe for Business Line and only 0.4% of them subscribe for Economic Times.

16. It is found that 62.2% of the respondents have computer / laptop with internet connection, whereas 37.8% of them do not have computer / laptop with Internet connection.

17. It is found that 40.4% of the respondents are disagreed with the usage of cell phone for marketing and personal use, 28% of them are neutral to the statement, 19.1% of them strongly disagreed and 2.4% agreed with the statement.

18. It is also found that the rural and urban customers are highly influenced by Television and Internet and moderately influenced by Newspapers, Magazines and Radio.

19. It is found that all the media has overall impact on the advertisement on consumable goods, followed by the other type of goods. Hence, it is clear that irrespective of rural and urban area, all type of media have an impact on consumable goods.

10. Suggestions

Based on the inferences of the analysed data, the researchers have made some suggestions as listed below.

1. Steps can be taken to improvise the radio advertisements as they are listened by a small sector and not popular among all the demographic groups. In order to create a favourable attitude towards advertising, the advertisers

should ensure the credibility, trustworthiness and the information content of the advertisement. Ensuring the presence of attractive elements such as fun, surprise and pleasure would create a favourable perception of respondents towards radio advertisements.

2. It is suggested that the designers of radio advertisement may concentrate more on the sound, background music and storyline to balance the absence of visual attraction in radio advertisements.

3. Advertisements shall be brief and attractive so that the avoidance attitude of the consumers may be minimised.

4. While designing an advertisement, the element of infotainment shall be given more preference so that the advertisement may be catchy and attractive.

5. To assess the viewers psychology, the advertisement shall focus on the perception of resonates and accordingly it shall be designed.

6. Advertisements have to be made with social consciousness as many of the respondents are students and Government employees.

7. Advertisement is a concept which has a direct correlation to the life style of higher income groups. So, it is suggested that advertisement should be designed in such a way so that it may become within the reach of different strata of the society.

8. To ensure transparency, exaggeration of facts and figures shall be avoided and which in turn will create confidence in the minds of the consumers.

9. It is suggested that the basic features of an advertisement, namely physical features, theme, music, eye capturing visuals, relevant information on product awareness and product comparison need to be given due importance by the manufacturer and advertisers so that the general public will become a prospective buyer.

10. Selection of proper medium and the slot are to be considered with due diligence as advertisements broadcasted / telecasted at inappropriate times / media may be avoided.

11. Now-a-days advertisements are powerful media through which both urban and rural consumers are attracted. So, it is the ethical duty of the advertisers to design advertisement in an effective way focusing on all important elements of the products to be advertised, and thus, they can create and retain both rural and urban customers.

12. Today, market is dictated by consumers and so the advertisers and marketers are need to be cautious about the perceptual impact of the advertisement on the society so that both the consumers and marketers may be delighted.

11. Conclusion

The dynamic growth of mass media has benefited the marketers with innumerable choice for medium of advertising. TV was found to be the most effective medium of advertising. Product information was perceived higher by the respondents and necessity was given least importance among the attitude factors. Among the factors of preference, consumers feel that attractive preference is the factor / feature that dominates their preference list and least importance was attached to the transitive qualities of the advertisements. Thus, advertisements do not create immediate intense desire for purchase but are successful tools in aiding the consumers to recollect/recall the advertisements and relate it to any product he/she realises. In parallel to this theory, consumer preferences and attitudes towards advertising determines the success of the advertisement and the product as well. The present study reveals the preferred media of advertisements from consumers' perspective. Dimension of preferences in advertisements and their attitudes towards advertising have thrown light on the trends and viewing patterns of consumers. The attractive slogans or captions, proper conveyance of information and creative storyline of the advertisements have the potential to convert the desire of the viewer into action of buying. The analysis reveals consumers' perception on the importance of advertisements and the potential threat to the economy as well. The present study aptly fits the concept as the findings reveal that consumer attitude towards the constituents of advertisements namely product information, memorable, economic goodness, necessity are greatly influenced by the demographic variables of the consumers. The potential of the advertisements to offer better lifestyle is well proved. At the same time the research work does not neglect the opinion of the consumers regarding the harmfulness of the advertising and the irritation it creates. The potential clash between perception and marketers objective leads to negative response of consumers towards advertising. This piece of research is expected to offer a valuable insight for the marketers and advertisers to strategically plan regarding the choice of medium of advertisement. Consumers are frequently confronted with many products and offers, but advertisements are the key medium to enable them to recollect it. Hence peoples attitudes and preferences must be given due importance while planning for advertising. The results of the research work stress the need for the advertisers to be more cautious while designing the advertisements and also enlightens the organizations on the appropriate choice of media for advertisements to reach the targeted consumers.

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GLIMPSES OF THE HISTORY OF TAMIL MUSLIMS

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Abstract

The Arabs had commercial contact with South India in general and Tamil Nadu in particular long before the birth of Prophet Muhammad (pbuh). Arabs were attracted to Sarandib (Ceylon) because of Adams peak and the local produce. They came in large number both as pilgrims and traders. It resulted in the establishment of Arab colonies and settlements in the Malabar coast and Tamil country. These Arabs started their missionary activity ever since the inception of Islam.

Keywords: AH, Guard Gate, Qalandars and Morco Polo.

1. Introduction

It is observed that these Arabs were treated by the native rulers with great consideration and deference, allowed to build mosques and madrasas and permitted to practice their religion without any hindrance. It is recorded that Hazarath Ukkasha, a Companion of Prophet Muhammad (pbuh) and a participant in the Battle of Badr is buried at Parangipettai in Cuddalore District of Tamil Nadu. This place was named as Mahmud Bandar by the Arabs and later renamed as Porto Novo by the Portugese [1]. Similarly Hazrath Tamimul Ansari, whose shrine is at Kovalam (Kollam) near Chennai is also reported to have been a companion of the Holy Prophet [2]. An inscription on the tombstone of the first century al-Hijra found in the old mosque near the seashore at Kilakkarai, a place called Pautria Manikka Pattinam in ancient times confirm the existence of Arab settlements quite early in the Islamic period.

Tara Chand, the famous historian in his work The Influence of Islam on Indian Culture refers to one of the tombstones in the Mayyat Kanu, the graveyard of Kollam belonging to one Ali ibn Uthman who died in 166 AH [3].

The arrival of Arab Muslims to Tamil country was indeed a turning point in 232 AH / 846 AD, a group of Muslim migrants from a hillside village called Qarafatul Kubra near Muqattam in Egypt under the leadership of one Muhammad Khalji, a descendent of Hazrath Abu Bakr Siddiq, the first caliph of Islam arrived by sea at a place called Kayalpattinam. Jaya Veera Raja Guru Buwich Chakkaravarthy, the then Chola king of Telugu origin who ruled over the Pandya Kingdom with Madurai as his capital

welcomed these Muslim migrants, gave them asylum, gifted an area and through the award of a document in a copper plate conferred on them property rights in respect of the area on which they were rehabilitated. This Tamil Copper Plate enumerates the number of persons, including slaves and the names of their tribes and also dates [4]. The descendants of Muhammad Khalji, who became permanent residents of Kayalpattinam and Kilakkarai played a prominent role in shaping the history of Tamil Muslims. They include Mahdiur Rasul both Tayka Sahib and Imamul Aruz.

A great Muslim missionary named Abdullah ibn Anwar arrived in Tamil Nadu when Cholas were ruling over with Uraiyur (modern Tiruchirapalli) as headquarters. There he built a mosque in 734 AD near the present Railway Station in the vicinity of the Main Guard Gate, Trichy. Now it is in a dilapidated condition [5].

Besides these migrations and settlements of Muslim families from the coastal regions, the spread of Islam in Tamil Nadu is attributed to the role of Sufi saints who arrived as early as 13^{th} century, and established their Khanqahs in various places and carried on their missionary work. These missionaries are venerated as holy saints and their tombs exist even today. Their seminaries are open to all, irrespective of caste and creed and they established contact with different classes of people. The primary objective in having such contact was to teach them the ways of God which are in no way different from the ways of humanity. They always kept in view the oft-quoted Quranic verse "Let there be no compulsion in religion" [6]. Islamic conversions in Tamil Nadu were the results of peaceful propaganda of the Sufis whose life was a living example of high spirituality and deep humanity [7].

The most notable among them are Shaik Nathar Vali (969-1039) of Trichiralapalli, Syed Ibrahim Shaheed (b.1162) of Ervadi, Shaik Baba Fakruddin (d. 1292), and Shaik Shahul Hameed Abdul Khadir Meeran of Nagore. These saints enjoined on their selected disciples to go over to different parts of Tamil Nadu to propagate the true message of Islam and diffuse the knowledge of Sufism among Muslims as well as non-Muslims. It is to be noted that the pious Khalifa of Nathar Vali sent on missionary work to Vellore district of Tamil Nadu was Hazrath Syed Shah Rahmathullah Quadri with a band of 500 Fakeers who was popularly known as Pahad Khan Vali, the holy saint of the hillock in the region. Allama Iqbal rightly said that the spread of Islam was not through the mighty rulers, who erected extremely high and vast entrances (Buland Darwazas) to their palaces but it was made possible only by the simple life of saints (Qalandars) who were no men of means.

The most powerful factor in the spread of Islam in Tamil country was Arab traders and merchants. Their contact existed ever since the Sangam age. With the dawn of Islam they continued their business and also missionary work in the Arwi region. The high standard of honesty and integrity found in these Arab Muslim traders made them unconsciously play the role of missionaries. It was the result of their peaceful contact and the impeccable and highly disciplined righteous life led by the Arab Muslim traders, the local inhabitants were attracted and willingly

embraced Islam and believed sincerely in its eternal values of truth and Islamic brotherhood. The Arab Muslim contact helped the Pandya rulers thrive in international trade. Arab merchants wielded much influence in the Pandya kingdom. Several ports of Muslim concentration such as Kilakkarai (Korkai), Adirampattinam, Cuddalore, Karaikal, Kayalpattinam, Nagapattinam, Nagore, Palwayrkadu, Poto Novo, Tondi and Tranquobar had commercial contacts with the Arabs since the second century.

Tara Chand rightly points out that the South India was greatly agitated by the conflict of religions, for neo-Hinduism was struggling with Buddhism and Jainism for upper hand. Politically too it was a period of unsettlement and upheavals. Cheras were losing power and new dynasties were emerging into power, naturally the minds of the people were perturbed and they were prone to accept new ideas from whatever quarter they may come. Islam appeared on the scene with a single formula of faith, well defined dogmas and right and democratic theories of social organization [8]. It produced a tremendous effect.

Before the first quarter of the 9^{th} century was over, the last of the Cheraman kings of the Malabar who reigned at Kodungalur had become a convert to the new religion. After his conversion he assumed the name Abdur Rahman Samiri. He left Malabar for Arabia and landed at Shahr where he died four years later. According to traditional accounts he sent home some Islamic scholars from Shahr. Most notable among them were Malik ibn Dinar, Habib ibn Malik, Sharif ibn Malik and Malik ibn Habib. When they arrived Malabar with their families they were received with great fervour by the local chieftains and were given lands and building sites for mosques [9]. Similarly the principal settlement on the east coast was Kayalpattanam on the banks of river Thamirabarani. Pope Caldwell collected a large quantity of broken pieces of pottery and a number of Arab coins bearing dates from the seventh century to the thirteenth century.

The early settlement of Muslims in Tamil Nadu in the eight century has, by the end of tenth century, grown into a large number by spreading its roots to many important commercial towns. Because of their commercial acumen they were held in high esteem by the native people.

The stone inscription found in the temple at Tirupullani near Kilakkarai explains the details of the grant to the Muslims made by Maravarman Sundra Pandiyan II who ruled from 1238 AD to 1251 AD. In 1050 AD. two great scholars Malikul Mulk and Ali Shah came to Tamil Nadu and became the residents of Madurai. They bought six villages from the king Sundra Pandiyan alias Kun Pandiyan by paying 10,000 gold coins [10].

Sittars, a class of intellectual reformers and physicians, embraced Islam. One of them was the famous Yaqub Sittar whose original name was Rama Devar. He lived during the 12th century. His poems speak about the lofty ideals of Islam and his Hajj pilgrimage. It is found that a large number of Jains embraced Islam, as a result of their vehement animosity with Saivites. The very fact that their terminology has great impact on the dialect and usage of the Tamil Muslims substantiate the argument. For example,

Masjid is called Palli, Pallivasal, prayer (Salath) as Thozhugai, fastings as Nonbu, Eid festivals as Perunaal etc. Hindus call the place of worship as Koil not Palli.

Sultan Syed Ibrahim Shaheed, a famous saint and missionary came from Arabia to Tamil Nadu and established a kingdom between Vaigaiaaru and Vaipparu with Powthira Manikka Pattinam as his capital. Wassaf, the famous traveller refers to this city as Fatan. These areas are near the present Kilakkarai. Sultan ruled for twelve and a half years (1188 to 1199 AD). He issued coins. He was martyred in 1199 AD in a fierce contested battle with Vira Pandiya otherwise known as Vikrama Pandiya. The main source of information is Shahadat Nama, a Persian work and a narrative of the martyrs by Abbas bin Abdullah. It is a unique source meticulously preserved and safely guarded by the descendents of Sultan Syed Ibrahim at Ervadi. Abbas bin Abdullah visited the Pandya country during the 16th century. He states that there was an academy of eminent scholars and poets at Madurai, when he visited. This academy helped him and gave all the necessary information about Sultan Syed Ibrahim of Ervadi. The Sultan is the hero of the Arwi epic Din Vilakkam written by Vanna Kalanjiya Pulavar. The name Ervadi is derived from Yarbad, which is a name of the locality in Madina, the native place of Sultan Syed Ibrahim.

Morco Polo (1254-1323 AD) and Ibn Batuta (1303-1327 AD) came to Tamil Nadu after visiting Sarandib. They visited Mabar (Madurai). Wassaf another Arab traveller calls Mabar the Gateway of India. He mentioned Kilakkarai as an important trade centre in the Pandya country. Sultan Taqiyuddin, a prince from Iran and his elder brother Sultan Jamaluddin were the prominent persons in Kilakkarai. Sultan Taqiyuddin had an agreement with Pandya king to supply high breed of horses. Although horse trade flourished in Tamil Nadu, rearing of horses proved to be failure. Both Marco Polo and Wassaf says that the conditions prevailing in South India were not suitable for the breeding of horses. Therefore Pandya kings solely depended on the Arabs for the horses.

During the 13^{th} century, horse trade became very vast. An agency was established at Kayalpattinam by Malikul Islam Jamaluddin, ruler of Kis. Wassaf says that 10,000 horses were annually exported from Fars to Mabar and the Indian ports. The total value amounted to 22 lakh dinars. Taqiuddin, the brother of Jamaluddin was the agent. He had the ports of Kayal, Fitan and Mali Fitan under his control [11]. According to Rashiduddin, on the death of Pandya King in 1293 AD, Jamaluddin succeeded him and his brother became lieutenant [12].

Marco Polo describes Taqiuddin as the Deputy Minister and advisor of Sundara Pandiya and after him his son Sirajuddin and then his grandson Nizamuddin were the advisors to the Pandiyan king. It is to be noted that the Pandiyan ambassador to Kublai Khan (1286-87) was Fakhruddin Ahmed, son of Jamaluddin who stayed for 4 years in China and died on board while he was returning. He lies buried in a tomb near that of his uncle [13].

Five Pandiyan brothers ruled over the country from five separate centres. During 1269-1310 the sixth person ruling the country was Sultan Taqiuddin. Amir Khusrau in

his accounts of the campaign of Malik Kafur mentions that the Muslims of Kannanur could repeat the Kalima and though they were worthy of death, yet they were pardoned because they were Muslims. Ibn Batuta travelled these regions immediately after the invasion. He states that Ghiyasuddin al Damghani was the ruler of Madurai in his time. Raja Vir Ballala had a contingent of 20,000 Muslims and the Muslim ruler of Honawar owed allegiance to the Viceroy Hariyappa Odayar.

Thus, before the arrival of Malik Kafur's army in the South, Muslims had established their settlements in the important centres of trade. They had entered into cordial relationship with the people around them and from this intercourse of Arabs and Tamils a number of communities of mixed descents had arisen namely Rawthars, Marakkairs and Labbais who are known as Arwi Muslims or Tamil Muslims.

In 1284 AD, Maravarman Kulasekaran invaded Ceylon, defeated King Parakrama Bahu III and made Arya Chakravarthi, an Arwi Muslim to rule over Ceylon. He was enthroned on the advice of Sultan Taqiyuddin, the ruler of Kilakkarai, who was ruling with the title 'Pandiyan'. K.V. Subramaniya Iyer says that Arya Chakravarthi was a Muslim based on Sinhalese epic Mahavamsa [14]. It may be noted that none of the Muslim rulers of Tamil Nadu till then was an Arwi Muslim but the relationship between Tamil Muslims and non-Muslims in Tamil Nadu was very cordial. This is reflected from various Tamil literature, for example, Manikkavasagar, one of the famous Siva saint authored Thiruvasagam in the praise of Lord Siva in which he mentions that Manikkavasagar was given the responsibility of the purchase of horses for the Pandya king and he did not discharge his duties as he was fully devoted in the praise of Lord Siva. It so happened that when the Pandya king wanted to verify whether Manikkavasagar had purchased horses for the Pandya country, Lord Siva appeared in guise as a horseman to protect Manikkavasagar like a Rawthar.

Similarly, Lord Muruga is praised as Rawthar by Saint Arunagiri Nathar in his work Kandar Alangaram.

It is to be noted that after the death of Maravarman Kulasekaran, his two sons, Sundra Pandya and Veera Pandya fought with each other. The defeated Sundra Pandya took refuge in Delhi and sought assistance from Sultan Alauddin Khilji. Sultan ordered his Naib named Malik Kafur to help Sundra Pandya to recapture Madurai. Subsequently, Madurai was brought under Muslim rule from 1323 to 1378 AD. It may be noted that none of the Muslim rulers of Tamil Nadu was an Arwi Muslim.

The years 1501 to 1575 AD witnessed a great tragedy of devastation and destruction in Tamil Nadu owing to the arrival and consolidation of Portuguese power. They perpetuated cruelties on Tamil Muslims. Their prime motive was the elimination and extermination of Muslims. The Muslims of Kilakkarai and Kayalpattinam became the worst affected victims of Portuguese atrocities. They unleashed terror among the Muslim community by resorting to robbery, rape and forced conversions. They did not spare the Hindus either. Rulers like Sethupathi showed resistance. Unfortunately others like Naiks of Madura were helpful to the Portuguese.

Three Muslim generals Kunjali Marakkayar, Patchai Marakkayar and Ali Ibrahim inspired by Hazrath Qadir Wali led the expeditions against the Portuguese. In the war of 1536, Kunjali Marakkayar inflicted heavy casualties on the Portuguese, destroyed many of their ships, chased them upon Tuticorin and took rest at Vedalai. They played a heroic role. Arwi Muslim society regained its lost spiritual vigour and religious fervour after the Portuguese onslaught. In this connection Hazrath Khadir Wali, Shaykh Sadaq Marakkayar, Shaykh Ibrahim, Shaykh Sulaiman and Madihur Rasul Shaykh Sadaqatullah Appa played a commendable role for the revival of Tamil Muslim society and culture.

The great contribution of Tamil Muslims was that they founded a new language called Arabu Tamil or Arwi or Lisanul Arwi. The commercial and social contact between Arabs and Tamilians and their interaction between them led to the emergence of this new language. It is the logical result of the joint efforts of Arabs and Tamil Muslims. Both played an equally significant role in the origin and development of Arwi language. The arguments of Prof. K. Abdul Gafoor that the Tamil speaking Muslims created it or the arguments of Hafiz Syed Ahmed that Arabs founded the language could not be accepted because it was a joint venture and natural evolution. Arwi was spoken and written by the Tamil Muslims during the 18th, 19th and the middle of 20th century. UNO has accepted Arwi as one of the approved languages of the world. It developed as a medium of religious instructions and also for day-to-day affairs including business, property dealings, correspondence and all other social transactions. It was an effective shield for the preservation of cultural identity. Arwi language was basically Tamil but it has words including those of Arabic origin. It was written entirely in the Arabic script with diacritical marks wherever necessary. The emphasis on Arabic script is given though the language and grammar are in Tamil.

Tamil Muslims had contributed substantially to the development of religious education, Arabic literature, Tamil literature and economic development. For example, when Aurangzeb wanted to compile a law of Islamic jurisprudence, he invited 500 experts in Islamic jurisprudence, 300 from South Asia, 100 from Iraq, and 100 from Saudi Arabia. After several rounds of deliberations, a core committee of 22 experts was constituted which compiled Fatwa-e-Alamgiri or Al Fatwa-e-Hindiya. It is to be noted that Sadaqatullah Appa of Kilakkarai played a very important role during the deliberations and codification of Shariah. When he became sick, he deputed his son Muhammad Appa Labbai to participate in the proceedings. The accidental meeting between Sadaqatullah Appa and Emperor Aurangzeb took place in the Jamia Mosque near Red Fort in Delhi when the Emperor was in rounds at night. The Emperor was very much impressed with the knowledge and expertise of Sadaqatullah Appa. Though the Shaykh never visited the Emperors palace, the Emperor maintained close contact with him. His contribution to the establishment of religious Madrasas in places like Kanpur and preparing the book of decisions on various points of Shariah called Fatwa-e-Alamgiri deserves special mention. When Aurangzeb wanted him to be the Chief

Qazi of South, Sadaqatullah Appa never accepted any favour from the Emperor.

The peace loving Arwi Muslims never had any communal clashes with Hindu Tamil majority or any other section before the arrival of Europeans. No one can show any proof either in Tamil literature or any record in the history of Tamil Nadu. When Hindu rulers like Nayaks and Sedhupathis were ruling Tamil Nadu the Muslims were assigned the portfolios of defence and finance between the 13th and 17th centuries. The British took over during the 18th century and they did nothing to compensate for the atrocities committed by the Portuguese.

The Tamil Muslims are great patriots. Their contribution to the Indian National Movement deserves special recognition. Their participation in Khilafat Movement, Non Cooperation Movement, Neill Statue Satyagraha and Civil Disobedience Movement was remarkable. For example, Mohammad Salih of Ramanathapuram went to Chennai along with his friends to break the statue of Col. Neill in August 1927. He claimed up the statue in Mount Road and broke the sheath of Neills sword and hoisted the National Flag earning the name the first to break the Neill statue. When Nethaji Subash Chandra Bose organized a meeting to enlist support for his army at Myanmar (Burma), a renowned Tamil Muslim merchant Mr. Habib Muhammad participated and donated all his properties, jewels and his entire wealth worth of one crore for the sake of the freedom of this nation (please note that the value of 1 sovereign of gold was just 24 paise at that time which means now it is worth of several lakh crores). More than 25% of men in Nethajis army were Muslims. Among them 15% were Tamil Muslims.

Another classic example of Tamil Muslims contribution to freedom struggle is worth mentioning. V.O. Chidambaram Pillai popularly known as Kappalottia Tamizhan, Tamil Helmsman, a great freedom fighter, a disciple of Bala Gangadhar Tilak and a leader of Indian National Congress launched the first indigenous Indian Shipping Service between Tuticorin and Colombo with Swadeshi Steam Navigation Company competing against the British ship. He was later charged with sedition by the British government and sentenced to life imprisonment. It is to be noted here that a trust was formed to purchase an indigenous ship. An appeal was made by the great people like Bharathiyar for donations. Finally they could collect a few hundreds of rupees only but one Haji Fakkir Muhammad donated one lakh of rupees for the purchase of the ship but for which the entire project would not have been carried out. It is unfortunate that his name is not mentioned in any of the history books. Similarly, Khader Mohideen Marakkayar led the Khilafat and Non Cooperation Movement at the instance of Mahatma Gandhi. Muhammad Abdul Khader Sahib of Tenkasi participated in the Non Cooperation Movement and boycott of foreign goods. Likewise a large number of Muslim leaders contributed their might and sacrificed their lives for the cause of Indian independence.

From the above discussion it is clear that Islam spread in the Tamil country not by force or compulsion but by peaceful missionary work carried out by Arab traders, Sufis, Ulema and others. In most cases, people willingly embraced Islam. Consequently,

Tamil Muslims are peace loving people who maintained cordial relations with all other communities in Tamil Nadu right from the beginning. They developed their own language called Arwi or Arabu Tamil which was a mixture of Arabic script and words and Tamil language. Their cultural identities are unique. Their contribution to Arabic language and literature, Tamil language and literature and Arwi language and literature is immense. They are very patriotic and contributed to the Indian National Movement substantially. Many of the leaders sacrificed their lives and properties for the sake of the liberation of our nation.

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DEVELOPMENT OF HORTICULTURE DURINIG QUTB SHAHIS PERIOD AS REFLECTED IN FOREIGN ACCOUNTS

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Abstract

The kingdom of Golconda came into existence after the fall of the Bahmani kingdom in 1518A.D.The sultans of kingdom who ruled eastern part of the Deccan for nearly two centuries i.e. from 1518 to 1687 A.D. During this period the Golconda kingdom achieved political unity and systematic administration. The main occupation of the people was agriculture, and main source of income of the kingdom also land revenue .Therefore the sultans know the importance of Agriculture so, they concentrated on the development of Agriculture and Horticulture. In this paper an attempt is made to highlight the contribution made by the Qutb shahi rulers to the Horticulture in the kingdom.

Keywords: Qutb Shahi, Dutch, Dry Fruits and Extended Trade.

1. Introduction

Fruits occupied a major place in Indian food system. We found the mention of fruits like Dates, Beal, bear mango, amalaka, etc. In Vedic period Jain and Buddhist literature also refer to coconut, banana, jackfruit, grapesetc. Fruit juice was used for cooking also. Wine was made of grapes and bananas as a matter of fact the Qutbshahis, their royal women, nobility and etc., were lovers of horticulture: hence they cultivated fruits and flower gardens throughout the kingdom.

In medieval Andhradesha the foreign traveller Domingo Paes writes that the country was full of grooves of fruits trees. On account of which abundant fruits were available everywhere and at cheap rate. He says that there were plantation of mangoes, jack fruits trees, tamarind andothers very large trees outside the towns and villages. The great poet of Qutb shahi court, Srinath refers to fruit garden of the Krishna-Godavari tract. He mentions the fruit gardens like panasa, Rose Apple, Banana, vine yards, etc. inscriptions also refer to the tax collected from the fruit gardens and to the fruits which formed part of the trading goods.

Especially the citrus fruits like madhipala and naranga which remains unspoiled for a long time formed part of the internal as well as external trade. Dry fruits and dried vegetables chips also were traded within the country[1]. Hamsavimsati mentions the names of the following fruits produced in Qutb shahi kingdomduring 17thcentury: Jack, Sitaphala, small lemon, big lemon, smooth lemon, bomta kittali, arikantu, pippali, rose Apple, velaga of greater size, gamaraka, cashew fruit. fruit, badangi, punuregu, palaphala, etc. the same work also inform that there were gardens of sugarcane of different varieties such as cittugottu, rasadali, erracheruku, nallacheruku, etc and the gardens of sirpidinusu (spices) karivepa betel, etc.

Inscriptions refer to the temple gardens consist a variety of trees like mango, coconut, areca, betel etc. in addition to some European accounts the other English factor also speak about the different varieties of fruits available during Qutb Shahis period. Methwold, in the early part of 17thcentury, said that "Golconda is fruitful country". The evidences he showed was the cultivation of garden crops along with other fruits, such as mangos, figs, oranges, lemon papaya, jambolon, banana and sapota.

An anonymous writer on Golconda also giving a list of garden produce mention that Mangoes, banana, lemon, grapes, pomegranates, pineapples, are in the abundance, the oranges and citrus fruits are available in great quantities. According to Methwold "though Masulipatnam" is having constant heat all trees continuously green, fruits ripe in their several seasons and the soil is fertile, and also mentions that every castle have furnished with great ponds of water, stores of trees as well as fruits as other.

Further he also writes about sherbat which mingled with water, juice of lemon and sugar to get alleviation from the heat. We had inscriptional evidences that witnesses the cultivation of mangos topes as Qutbshahis very much liked mangos. It is evidenced from the Jgarlamoodi (Guntur Dist.) inscription which confirms that a mango garden was planted in this village by the support and encouragement of QuliQutb shah in A. D. 1602[2]. A Farman of Mohammad QuliQutb shah issuing the order to the inhabitants of the village of Ainapur for non-interference with the reservoir, garden and mangotope, that were the property of Mohammad Ali Saeed, inhabitant of the said village[3].

This indicates the keen interest of the rulers about the gardens of private individuals. And another example gleaned from YyatiCharitra, Amine khan an officer of Patan cheru area under the Ibrahim Qutb shah was responsible to plantation of a garden in Ainapur[4]. Out of these gardens some of gardens were sponsored for temple maintenance and village Administration. Similarly Undavalli village temple had a fruit and flower garden for its maintenance[5].

In addition to this several inscriptional and Kaifiats mentioned about the garden attached to the temples and its maintenance, Kuvvam village inscription of Chengalpattu district (Tamil Nadu) records that this village had a banana tope and revenue from this tope should be spent to the maintenance of Tervikkoleswara Swami temple. Another is according to MunipalleKaifiats; an income from mango gardens of Munipalle village

would be spent to the maintenance of village administration. Yayati Charitra also registers some kinds of fruits like coconut, lemon: Areca nut, mango Jamoon and tamarind were there in all over the kingdom[6].

The contemporary Dutch official anonymous author of Relations of Golconda mention that the grapes were sowed in the month of April in great quantities in the country[7] according to Thevenot they were available in abundant during the month of January. An eminent historian Padmabhushan Prof H.K Sherwanis of the opinion that the Qutbshahis developed a very large lucid kind of grapes called Inab-I-Shahi or Royal grapes but it practically disappeared on the elimination of the dynasty and it is only recently that its cultivation has been revived[8].

Peru village, situated in Amalapuram sub- division of Godavari district was famous for its coconut grooves in all over Golconda kingdom. This tract still is known for its coconut plantation. The references in the contemporary epigraphs to the tax called ganugari or a tax on oil mill also indicates that oil pressing was an important industry and was regulated and taxed by the government[8] probably in every important village and in all the urban centres these mills existed besides, Golconda was also full of palm trees. The toddy makers obtain the toddy from palm trees.

Though it is an intoxicative it was full demand by the common people of Golconda kingdom[9] Palm trees which is known as Andhrulakalpavruksham in Andhra which uses by the man in multifarious needs. In one of them is toddy which was under the control of the Government and derived very considerable revenue from the tax imposed on it called kalali. The Government allowed to so many public women for its sale because they were the cause for the consumption of much tari and also for the work of spies to the Government and their shops was at their neighbourhood, during the period of Qutb shahi rule.

Generally Qutbshahis their royal women, upper class women and courtesans including prostitutes were also very fond of gulshan or flower gardens. They showed keen interest to lay out the flower gardens. Thevenot says that Hyderabad is called as Bagnagar the city of gardens.All sections of people enjoyed the fragrance of flowers. A big and beautiful garden outside the city of Hyderabad contained flower plant such as Gul-e-Daudi in addition to palm and areca-nut trees[10].

Tavernier says that Qutbshahis perfected the art of gardening including roof gardens maintained by the Government and individuals had several varieties of flowers. A number of royal and public gardens in the fort, which were extensive, were beautiful and celestially serene. The people of various walks and different pursuits, used to assemble here every evening for recreation. Poets and men of letters gatherd here and recited their new compositions to the merriment of other assembled on every Tuesday, a weekly holiday, then scholars used to discuss all subjects under the Sun.

Nageena bagh was a gem of a public recreation centre and a popular resort for enjoyment. The fatally wounded stallion of Mustafa khanAbdurRazzak lohri brought his grievously woundedand unconscious master to this NageenaBagh and collapsed

under a coconut tree. Lohri a synonym for patriotism and loyalty was found in unconscious state in this Bagh by the soldiers of Mughal commander Roohullah Khan. In addition to this there was a tradition that was followed to plant a fruit garden or a flower garden whenever a new village was constructed during the Qutb Shahi period.

According to Thevenot there was various kinds of flowers i.e. cypress, spikmard, box tree, millat, natures, louts, rose narcissus, lily flower which gave the smell of musk arid flower, Saffron, fragrant yellow flower, a flower having mustard seeds, renuti and sewanti. The author of Hamsavimsati listed the flowers reared during this period thus: Sampenga, molla, jaji, ganneru, verajaji, kuruvaka, sunflower Ponna, malle, (Jasmine), Parijata, Seventa, Tamara, suryakanta, Gondumalle, Lalli(Lily) Sandhyavartha, Ganneru, turai, gaddipulu, Pogada and kalva[12].

From the above information it is clear that there were many fruit gardens and flower gardens and sultans of Golconda developed and encouraged the people in the kingdom to grow fruits and flowers. We can say that the Sultans of Golconda and their queens, Sub ordinates of sultans and common people very much interested in the development of Horticulture in the Golconda kingdom.

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SIGNIFICANCE OF MUHRRAM CERMONY DURING THE PERIOD OF QUTBSHAHIS OF GOLCONDA (from 1518 to 1687 A.D)

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Abstract

The Sultans of Golconda assigned a prominent place in the history of Deccan. They ruled the eastern part of the Deccan for nearly 165 years from 1518 to 1687.

Keywords: Hijra, Muharram, Karbala and Golconda.

1. Introduction

The rulers (165 years from 1518 to 1687) played an important role in the evolution of the state by not only involving in wars for a greater period of their rule, but also envisaged the religious policy with the main aim of creating the social unification[1].

The Qutbshahis celebrated the religious festivals in the kingdom to create harmony in the society and tolerating each other customs, joys and sorrows. We saw complete understanding between two major sections of the people in the kingdom i.e Hindus and Muslims. In fact the cultural and religious policy of Qutb shahi rulers greatly contributed for the unity among the people despite of their constant involment in the wars.

The main purpose of this paper is, to highlight the importance of Muharram during Qutbshahis rule. The first month of Hijra Calendar is Muhrram. The word Muhrram derived from word Harram which means forbidden in Islam. But the importance of Muhrram is not because of this it was on the tenth of this month that the great tragedy of Karbala took place, in which Imam Hussein along with seventy two of his relatives and friends achieved Martyrdom on the battle field[2].

TheMartyrdom of Imam Hussein at the battle field of Karbala was a unique event, and its effect on humanity was great through the counties. Karbala in fact became symbol of courage, piety, honesty devotion and submission to the will of Allah. It was not just the followers, who assassinated themselves to Imam Hussain[3], but it became an identity of a mans choice of his path, and his wish to belong to the world of virtue, righteousness and courage.

Imam Hussein was the second son of HazaratAliandHazarat Fatima. After the death of MawiyahIbne Abu Sufiya his son Yazid ascended the throne[4]. He was the opinion that the will of the kings over and above covenants of Islam and hence started rejecting the covenants. He considered himself the Khalifaof Islam yet indulged in luxuries like drinking openly. Some of the couplets which he used to utter in the court would prove that he did not believe in Islam.

He appointed his relatives and friends, irrespective of merit, to higher posts of administration and gave them a free hand to indulge in atrocities prodigalitys. A reign of terror thus began in which the life and religion of the people was at stake. It was under these circumstances that the people of Kufa, wrote in large number, to Imam Hussein requesting him to come to their rescue and assured him their whole hearted support. Meanwhile the new Governor ObaidullahIbn-e-Ziyad had demanded Baiyat of Yazid from Imam Hussein the Baiyat means total unconditional submission, to which Imam Hussein could but have consented[5].

Therefore he left Madina along with his friends and family on 28th Rajab 60 A.H. with the intention of going to Kufa. He arrived at Mecca on his way to perform Haj. But finding that a party had been deployed by Yazid in the guise of Hajis to kill him at Mecca, he left the place. He arrived at the battlefield of Karbala under the pressure of the advance guard of the Yazid army led by Hurr-e-Rehaee on 3rdMuhram 61 A.H. From 5th onwards the Yazid army started coming to Karbala. The battle took place on 10thMuhrram, in which his relatives and followers were killed fighting bravely first. He then took out his sword, fought bravely and fell heavily injured[6]. Thus the battle of Karbala came to an end.The Shias are identified by the observance of Muhrram. The QutbShas were Shias and therefore Muhrram was of great importance to them. They celebrated it with great enthusiasm and devotion.

Fortunately we have accounts of Muhrram ceremonies of Abdullah Qutb Shahs period, recorded by MirzaNizamuddin Ahmed in Hadiquat-us-Salatin. Though he describes Muhrram as it was observed during one reign, yet we have enough evidences to believe that what Abdullah Qutb Shah practiced was the tradition of his predecessors. These traditions were also followed in perfect solemnity after him by his successors.

MirzaNizamuddin Ahmed confirms that right from the beginning of the reign of the Qutb shahs the traditions of Tazia and Azadari of Imam Hussein began and remained althrough the period. It was during Muhammad QuliQutb shahs period that the celebrations became more elaborate. Meer AbulQasim in Hadiqa-ul-Alam makes similar observations.

Therefore it can be believed that the descriptions of Muhrramproceedings as given by MirzaNizamuddin Ahmed remained as the normal practice of the Qutb shahs, may be with slight variations, althrough the period. According to him, the moment the moon of the month of Muhrram was sighted, the Sultan used to wear black costumes. Beating of Tabal, Naqaras, Dames and Koss were stopped[7].

The musical instruments were placed in their containers and no music was played and no dance performed People belonging to all the sections of the society abstained from eating meat or drinking liquor. Even Pan, so very common among the people, was not chewed. Black costumes were distributed to all the employees. Fourteen Alams made of Gold and studded with jewels were raised in Bad Shahi AshurKhana near the royal palace. The AshurKhana was decorated with 10,000 lamps decked in ten rows[8].

The Sultan used to light them, one row during each night, so that on 10th night the total number of 10,000 lamps got illuminated. Every evening the Sultan used to come to the AshurKhana accompanied by his nobles and offered flowers to the Alams. The Majlis was then conducted in which the Marcias written by the Sultan were recited. He then offered Fateha and returned to his palace. The people were served with excellent vegetarian food and Sherbat of roses[9].

This continued up to the seventh Muhrram. On seventh night the Sultan invited all the nobles and ambassadors in NadiMahal. Alam processions from Langer-e-FaizAsar and Hayat Nagar came to the palace where they were presented with Dhotis and cash. The Azadari continued up to the early hours of the next day, after which the Sultan returned to his palace.

On the eighth night, being the night of Ashura was considered to be very solemn. A number of Alam processions reached the ground of Darbar-e-Khusravi. The Sultan along with his nobles and relatives received them with great honour and respect. He distributed food with his own hands to the poor and the needy, irrespective of religion, sect or caste. He walked along with the Alam processions bare footed upto the mosque.

All through the way MarsiyaKhowns recited Marsiyas.On the tenth Muhrram, the Sultan came to the mosque once again bare footed. After the Mijlis, he performed Amal-e-Ashur and returned. People were served with a special type of food called Kunduri. Two hundred orphans were given clothes and a number of others cash, in the name of the martyrs of Karbala. The people throughout the Golconda Empire raise Alams during the Muhrram days, in accordance with the orders of the Sultan in their Chowries and DewanKhanas. Every such AshurKhana was paid for the expenditures by the imperial treasury.

It was due to this that all the people were kept busy in Azadari during the Muhrram days throughout the empire. It has become a custom that the people, poor and needy, used to sit in AshurKhanas silently praying throughout the night of Ashur. As a reward for this they got their wishes fulfilled[10].

The Majlis which was conducted in AshurKhanas was meant to mourn the tragedy of Karbala. The narration of the events which took place at Karbala was recited in a particular form of poetry called Marsiya .Marsiya was not a new innovation. It existed in Arabic as well as in Persian poetry. The word Marsiya is derived from an Arabic word Rasa which means to cry and grieve, Marsiy therefore, was written with the purpose of mourning over the dead people and to describe their deeds to make people realize their

loss. There are a number of Marsiyas in Arabic literature, but the Marcias written by MutumumIbnNavera and Hanfa are considered to be outstanding.

In Persian literature, Marsiya was borrowed from Arabic but it underwent many changes. It is believed that the first Marsiya was written by MuhtashamKashi during the Safawid period (1523 1578). But the Marsiya which became very famous and popular both in India and Iran was written by Mulla the Qutb shahs did not try to impose any restriction over the diversified ways of its celebration. They did not force the people to abide by the rules laid down for it in their religion. Instead they universalized the social customs associated with it.

They knew that neither the non Muslims could be brought into the mosque and invited to participate in the prayers, nor the Muslims could be brought together and allowed to participate in the ceremonies according to their own ways. The Alams in the AshurKhanas were made sacred not only to the Muslims belonging to Shia sect but to all the people of all religions. It was because of this that the non Muslims who did not believe in Islam, also paid their homage to the Alams and adorned them.

The celebrations of Muhrram founded by the Qutb Shahs and established in every part of their kingdom have become a tradition of the people, and still exist to this day as it used to be during the Qutb Shahi period. There is hardly any city, town, village ofTelangana where the Alams are not installed. Muhrram still is held as a pious ceremony not only by Muslims but also by Hindus all over the state.

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THE INCARNATION OF 'LIFE' AS 'THE LAST BURDEN' IN UPAMANYU CHATTERJEE'S THE LAST BURDEN AND WAY TO GO

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Abstract

Upamanyu Chatterjee, one of the rational novelists in Indian writing in English today portrays life as the Last Burden in his two works, The Last Burden (1993) and its sequel Way To Go (2010). The novelist depicts dying life in a philosophical way rather than literal. Life is represented in many characters and their different vibes in these two novels that is not unenthusiastic and without energy. The characters are detached with one another, emotionless to the problems of the other, and give due importance to money rather than relationship. The sons Burfi and the protagonist, Jamun behave with their parents indifferently that creates doubt in the mind of the reader whether they are the actual sons to Shyamanand and Urmila since they are completely away from any sort to familial responsibility. By creating these two characters, Chatterjee justifies the apathetic nature of today's modern youth that have different outlook towards Indian tradition and culture unlike the past generation. The life of Urmila, the mother and Shyamanand, the father in The Last Burden (1993) and Way To Go (2010) respectively is not less than a burden and so to their westernized sons.

Keywords: Death-Apathetic Nature-Modern Youth.

1. Life-as 'The Last Burden'

In The Last Burden (1993), Urmila, the typical Indian woman lives like a matron losing all her social and familial rights as a house wife and mother. Her husband Shyamannad and sons, the protagonist and his elder brother Burfi are too emotionless that they are not ready to share her medical expenditures together. Instead they fight with one another to contribute and tackle the expenses. Had they considered Urmila, their mother, they would have sacrificed everything for her, but they are modern and westernized Indians

of the middle class family, who are more selfish than sacrificial. She is a burden to them. Even her family is relieved to have shed its burden on her death. Her life is considered a burden in Way To Go by the protagonist Jamun who feels. '*—at the death of his mother sixteen years previously, he had felt that he had shed his first burden, that he would hardly mourn with comparable intensity the departure of his father—*' (p108 & 109).

In *The Last Burden*, death is a source of relief to the serving women Ayah and Urmila from life, the last burden. As long as Urmila was alive, she lived like a matron who worked without a salary. She borne all familial distresses still her position in the family was not more than the Ayah and Kasibai, the maids of the family. She dies in the hospital when her family was home. It seems that the family does not need her any more. There is no one to wish that she should recover and return home soon. She dies like an orphan, a widow and an issueless woman. Here it is obvious that her existence i.e. her life is considered a burden by the members of her family. Her services and sacrifices to the family are not accounted by anyone in the family because the sentiments and attachments have been dead long back.

She has had been serving and sacrificing for her husband and sons. She had been dormant to the captious and fault finding nature of her husband who always blamed her for having wrongly brought them up. "*Savour your handiwork, our sons. Fostered for decades to hate me. Like a perfect mother, youve kneaded them against me. Youre the saint and I the demon, but notice, they damn you too.*" (p52). Urmila strives for her husband and sons expecting nothing in return except love and affection from their side.

Outwardly it seems that Jamun, the protagonist in both these novels has soft corner for his mother, but his narcissism and attraction towards western way of life keeps him away from the familial responsibility of nursing his mother bed-ridden mother. Even no member of the family seems to be associative with the dying woman (Urmila) in the ICU. Jamun is overcome by his own feelings and personal life since his familial responsibility as a son is no more in him. Though Jamun stays home to take care of his ailing mother, yet his services do not prove his serviceable heart. He grows agitated on her every request. She often asks him to do certain works post by post for instance, she asks him to manipulate the fan or twin the window handle to the grille to stop the entry of a cat into her room. He turns intolerable and loses his patience. "*Blood swirls to his temples, and all at once he is set upon honorably concluding the matter without articulating even one syllable of acrimony. He battens down his teeth till he feels a sort of hardness against his eardrums and half-believes that one jaw will dislodge the other*" (p48).

Upamanyu Chatterjee, one of the rational novelists in Indian writing in English today portrays 'life' as 'the Last Burden' in his two works, The Last Burden (1993) and its sequel Way To Go (2010). The novelist depicts dying life in a philosophical way rather than literal. Life is represented in many characters and their different vibes in these two novels that is not unenthusiastic and without energy. The characters are detached with one another, emotionless to the problems of the other, and give due importance

to money rather than relationship. The sons Burfi and the protagonist, Jamun behave with their parents indifferently that creates doubt in the mind of the reader whether they are the actual sons to Shyamanand and Urmila since they are completely away from any sort to familial responsibility. By creating these two characters, Chatterjee justifies the apathetic nature of today's modern youth that have different outlook towards Indian tradition and culture unlike the past generation. The life of Urmila, the mother and Shyamanand, the father in *The Last Burden* (1993) and *Way To Go* (2010) respectively is not less than a burden and so to their westernized sons.

Similarly, in *Way To Go* the life of Jamun, the protagonist is a burden after the death of his mother and missing of his father. Life seems to him a meaningless process. His mother is dead, father paralyzed, his girl friend married to someone, his selfish and cunning brother has escaped tying him to the burden some familial responsibility of Shyamanand who is now missing under his custody. When he is overtaken by its restiveness, he intends to commit suicide but abstain from it thinking the return of his father one day or the other. He grows restless day by day. '*As the days passed, grew longer and warmer, Jamun, sleepless at midnight or helpless at dawn, in his head continued to catch quicksilver glimpses of Shyamanand limping along further down the same road*' (p109).

There is no sign of his existence. His life is the first burden and death, the last. Generally for a sensitive person, such life is a torturous burden and death seems to be a source of relief from the clutches of such saddened life where life is purposeless and the members of family more selfish than loving. In the two novels mentioned above, there is no room for sentiments and sympathy. Each member in the family is alien to the other. Chatterjee is successful in sketching the life of modern middle class Indians who are overtaken by culture of the west and stay away from one another, living like strangers under one roof.

In *Way To Go* Shyamanand's life is more dangerous than death. He knows that he has lost his family headship and either of his sons is not ready to take him along. One has played trick on the other; hence his younger son (Jamun, the protagonist) is reluctantly taking charge of him. The fact is that Shyamanand after the attack of paralysis and Urmilas death is half dead alive. Now he is left uncared and has lost his power and rest. His desolateness overtakes him in his own house '*Truth to tell, Shyamanand knew that nobody dead or alive was interested in him, alive or dead. Life was one habit and keeping secret from the world was another; the second was a mean by which a flagging interest in the first could be kept breathing*' (p65).

The life of Shyamanand and his presence is a burden to Jamun who has affairs with Kasturi and continues his relationship with her even in the presence of his paralyzed father. He goes missing without any sign. Jamun is lethargic in finding his missing father. Speaking to Monga, the builder, Jamun recklessly and without passion expresses his thought on the missing of Shyamanand saying, '*Exactly what I said. He's disappeared. I was sure he was dead and when I awoke; my first thought was that youd*

taken the body away to be cremated, quietly, to save us the bother. Or maybe he went out for a walk at three in the morning and hasnt returned yet' (p45).

The novels selected for study obviously bring out the apathetic approach of the anglicized Indian sons, who do not care parental sentiments but are selfish and anti-sentimental. As a result, life seems to be the last burden to Urmila and Shyamanand in *The Last Burden* and *Way To Go* respectively.

2. Conclusion

The outlook of today's modern youth like Jamun, especially the Indian middle class urbanized, has totally changed and he takes the responsibility of his aged parents a burden rather than a blessing. He pays no attention to their hearts but minds his own self and benefit because he is completely out of emotion. Thus the two novels taken for the study show the apathetic behavior of westernized sons, Jamun, the protagonist and his elder brother Burfi towards their parents. They are so towards their mother Urmila in *The Last Burden* and father Shyamanand in its sequel work, *Way To Go*. Obviously, life to such parents becomes the last burden.

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MANAGEMENT STUDENTS AWARENESS ON STOCK MARKET EFFICIENCY – A BIRD'S EYE VIEW

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Abstract

Market efficiency refers to the degree to which stock prices and other securities prices reflect all available, relevant information. Market efficiency was developed in 1970 by economist Eugene Fama, whose theory of efficient market hypothesis (EMH) stated it is not possible for an investor to outperform the market because all available information is already built into all stock prices. Investors who agree with this statement tend to buy index funds that track overall market performance and are proponents of passive portfolio management.

Keywords: EMH, IT, NSE, BSE and SENSEX.

1. Introduction and Concepts of Market Efficiency

When money is put into the stock market, the goal is to generate a return on the capital invested. Many investors try not only to make a profitable return, but also to outperform, or beat, the market. However, market efficiency - championed in the efficient market hypothesis (EMH) formulated by Eugene Fama in 1970, suggests that at any given time, prices fully reflect all available information on a particular stock and/or market. Fama was awarded the Nobel Memorial Prize in Economic Sciences jointly with Robert Shiller and Lars Peter Hansen in 2013. According to the EMH, no investor has an advantage in predicting a return on a stock price because no one has access to information not already available to everyone else.

The nature of information does not have to be limited to financial news and research alone; indeed, information about political, economic and social events, combined with how investors perceive such information, whether true or rumored, will be reflected in the stock price. According to the EMH, as prices respond only to information available in the market, and because all market participants are privy to the same information, no one will have the ability to out-profit anyone else.

In efficient markets, prices become not predictable but random, so no investment pattern can be discerned. A planned approach to investment, therefore, cannot be successful. This ”random walk” of prices, commonly spoken about in the EMH school of thought, results in the failure of any investment strategy that aims to beat the market consistently. In fact, the EMH suggests that given the transaction costs involved in portfolio management, it would be more profitable for an investor to put his or her money into an index fund.

Three identified EMH classifications aim to reflect the degree to which it can be applied to markets:

Strong efficiency This is the strongest version, which states that all information in a market, whether public or private, is accounted for in a stock price. Not even insider information could give an investor an advantage.

Semi-strong efficiency This form of EMH implies that all public information is calculated into a stock's current share price. Neither fundamental nor technical analysis can be used to achieve superior gains.

Weak efficiency This type of EMH claims that all past prices of a stock are reflected in today's stock price. Therefore, technical analysis cannot be used to predict and beat a market.

In the real world, markets cannot be absolutely efficient or wholly inefficient. It might be reasonable to see markets as essentially a mixture of both, wherein daily decisions and events cannot always be reflected immediately into a market. If all participants were to believe that the market is efficient, no one would seek extraordinary profits, which is the force that keeps the wheels of the market turning.

In the age of information technology (IT), however, markets all over the world are gaining greater efficiency. IT allows for a more effective, faster means to disseminate information, and electronic trading allows for prices to adjust more quickly to news entering the market. However, while the pace at which we receive information and make transactions quickens, IT also restricts the time it takes to verify the information used to make a trade. Thus, IT may inadvertently result in less efficiency if the quality of the information we use no longer allows us to make profit-generating decisions.

2. Statement of the Problem

Despite having many awareness programmes by Indian Stock Exchanges, investors associations and SEBI, there is a serious lack of awareness in the public and hence awareness to the information has remained a big challenge to the efficiency of the Indian Stock Exchanges and to the investors themselves. However the access to these programmes among students is very low due to either existence of attendance fees or timing or being selectively to some classes of audience especially to investors only.

Many researchers have been made in market efficiency in India by testing on either weak form of Efficient Market Hypothesis (EMH) or random walk hypothesis of stock prices and returns. They have been using daily closing data for the indices such as S&P NIFTY (NSE) and BSE SENSEX in a specific period of time. This study seeks to address this gap.

3. Significance of the Study

The need for the study is to examine the extent of awareness among management students towards efficiency of the stock market as far as they are daily exposed to various business concepts not only from college curriculum but also from social learning and education programmes run by various capital market participants.

4. Objectives of the Study

1. To examine the understanding of various concepts on stock market investments.
2. To evaluate the significance of information technology facilities on dissemination of stock market news.

5. Methodology

The data used for this study is accompanied by primary and secondary data. Primary data was obtained from management students from the selected sample list of educational institutions. Whereas Secondary data was elicited through journals, SEBI, BSE, NSE annual reports, News Papers, Brokerage Firms Reports, and Reports from World Federation of Exchanges.

Besides, the sample size for the study is 100. The respondents were selected using stratified sampling, simple random sampling. The sample size of 100 is divided equally to four colleges.

6. Review of Literature

Market Capitalisation is perhaps the most important criterion in assessing the size of a capital Market. Market Capitalisation equals to value of listed shares divided by nominal GDP. The ratio has been widely adopted in the literature as a stable measure of stock market efficiency for various reasons. First; it is a proxy of the sized of the stock market which is positively correlated with the ability mobilise capital and diversify risk. Secondly, it is presumed to include firms past retained profits and future growth prospects so that a higher ratio to GDP signified growth prospects and stock market development (**Levine and Zervos, 1998, Bekaert et al. 2001**).

The key weakness of this ratio is that a high ratio solely driven by appreciated value of few firms with little or no change in the amount of funds raised, and no change in the breadth of the stock market may be interpreted as Stock Market Efficiency. Growth in the market capitalisation as a share of GDP is associated with an increase in the number of listed firms (**Adelegan, 2008**).

7. Results and Discussion

Chi-Square test was applied to find the significant association between two variables by cross tabulating.

Table 1: Relationship of Age and Financial Instruments Traded in Stock Market Cross Tabulation

			Age of the Respondents				**Total**
			18-21	22-25	26-29	30 and above	
Financial Instrument Traded	Yes	Count	26	43	2	0	71
		% within respondent's College / University	81.3%	72.9%	100.0%	0.0%	76.3%
	No	Count	6	16	0	0	22
		% within respondent's College / University	18.8%	27.1%	0.0%	0.0%	23.7%
Total		Count	32	59	2	0	93
		% within respondent's College / University	100.0%	100.0%	100.0%	0.0%	100.0%

Source: Primary Data

H0: There is no association between age and awareness of instruments traded.

H1: There is association between age and awareness of financial instruments traded.

Table 2: Chi-Square Data

	Value	Df	Asymp.Sig.(2-sided)
Pearson Chi-Square	1.438[a]	2	.487

Interpretation

The above table indicates that the value of Chi-Square is 1.438; degree of freedom is 2 with P-Value 0.487 at 5% significance level. Since the P-Value is greater than 0.05. Null Hypothesis is accepted. Hence, there is no significant association between age and awareness of financial instruments traded in stock market.

Table 3: Relationship between Gender and Stock Market as easy way to Mobilise Funds Cross Tabulation

			Gender		Total
			Male	Female	
Stock Market is easy way to mobilise funds	Yes	Count	34	39	73
		% within gender	75.6%	92.9%	83.9%
	No	Count	11	3	14
		% within gender	24.4%	7.1%	16.1%
Total		Count	45	42	87
		% within gender	100.0%	100.0%	100.0%

Source: Primary Data

Table 4: Chi-Square Data

	Value	Df	Asymp.Sig.(2-sided)
Pearson Chi-Square	4.816[a]	1	.028

H0: There is no association between gender and awareness of stock market as easy way to mobilise funds.

H1: There is association between gender and awareness of stock market as easy way to mobilise funds.

Interpretation

The above table indicates that the value of Chi-Square is 4.816; degree of freedom is 1 with P-Value 0.028 at 5% significance level. Since the P-Value is less than 0.05.

Null Hypothesis is rejected. Hence, there is association between gender and awareness of stock market as easy way to mobilise funds.

Table 5: Relationship between Year of the Study and Stock Market Mews via Internet Services Cross Tabulation

			Year of Study		Total
			MBA 1st Year	MBA 2nd Year	
Follow stock market news on Internet	Yes	Count	40	13	53
		% within year of study	51.9%	72.2%	55.8%
	No	Count	37	5	42
		% within year of study	48.1%	27.8%	44.2%
Total		Count	77	18	95
		% within year of study	100.0%	100.0%	100.0%

Source: Primary Data

Table 6: Chi-Square Data

	Value	Df	Asymp.Sig.(2-sided)
Pearson Chi-Square	2.431[a]	1	.119

H0: There is no association between year of the study and awareness of stock market news via internet service.

H1: There is association between year of the study and awareness of stock market news via internet service.

Interpretation

The above table indicates that the value of Chi-Square is 2.431; degree of freedom is 1 with P-Value 0.119 at 5% significance level. Since the P-Value is greater than 0.05. Null Hypothesis is accepted. Hence, there is no association between year of the study and awareness of stock market news via internet service.

8. MANN-WHITNEY U-TEST

The Mann-Whitney U-test is a non-parametric test that allows two groups or conditions or treatments to be compared without making the assumption that values are normally distributed. It measures distribution of two groups of independent variable across dependent variable.

Table 7: Distribution of Level of Awareness across Gender

Ranks				
Gender		N	Mean Rank	Sum of Ranks
Level of Awareness	Male	49	43.09	2111.50
	Female	47	54.14	2544.50
	Total	96		

Source: Primary Data

H0: There is no difference between levels of awareness across categories of gender.

H1: There is difference between levels of awareness across categories of gender.

Table 8: Test Statistics

	Level of Awareness
Mann-Whitney	886.500
Asymp. Sig.(2-tailed)	0.051

Interpretation

The above table indicates that the value of Mann-Whitney U Test is 886.500 with P-Value 0.051 at 5% significance level. Since the P-value is greater than 0.05. Null hypothesis is accepted. This means that the distribution of level of awareness is the same across categories of gender.

H0: There is no difference between levels of awareness and attitude to follow stock market news on TV.

Table 9: Distribution of Level of Awareness across Attitude to follow Stock Market News on Television

Ranks				
Follow stock market news on TV		N	Mean Rank	Sum of Ranks
Level of Awareness	Yes	42	53.90	2264.00
	No	54	44.30	2392.00
	Total	96		

Source: Primary Data

H1: There is difference between levels of awareness and attitude to follow stock market news on TV.

Table 10: Test Statistics

	Level of Awareness
Mann-Whitney	907.000
Asymp. Sig.(2-tailed)	.093

8.1. Interpretation

The above table indicates that the value of Mann-Whitney U Test is 907.000 with P-Value 0.093 at 5% significance level. Since the P-value is greater than 0.05. Null hypothesis is accepted. This means that the distribution of level of awareness is the same with those who follow stock market news on TV.

9. Suggestions and Conclusion

So far as there is no significant association between variables such age, gender and years of the study of the respondents against knowledge and awareness on the ways to use to follow stock market news, knowledge of the common financial instruments traded, return on investment in the market in this study. Hence the study suggests that all Indian stock exchanges and SEBI as they have taken upon a mandate to promote financial literacy to use various methods and approaches of disseminating information in order to bring more people into the folds of the financial market.

In reality, investors do not receive all information freely; they have to decide whether and which information to Gather prior trading and investors end up staying afloat in a sea of uncertainty which in turn affects their level of awareness. This study reveals that majority of management students are more selective on ways to follow stock market news as they prefer newspapers and the use of internet services rather than financial news on TV. Also it has been revealed that they are aware of financial instruments traded, returns on the investment in the market and they realise that stock market is one way among easy way to mobilise funds for companies to operate although they are facing trouble to follow stock market news due to unaffordable expenses.

On the other hand the overall level of awareness is high though it has been contributed specifically by years of the study of the respondents, gender and respondent's college or University meanwhile age was not significant determinant on it. Therefore, the study reveals that management students are aware on the stock market efficiency concept. This is the best indicator that Indian stock markets will continue to grow and more important to be efficiency.

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