

Vol.13, No.1 August, 2021



ISSN 0975-5101

STAR RESEARCH REACH

Inter-Intra Disciplinary Journal



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Volume 13

Number 1

August 2021

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BIOGEOCHEMISTRY OF SURFACE SEDIMENTS IN THE TROPICAL MANGROVE ECOSYSTEM

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ABSTRACT

The variability of nature, composition, and trophic status of organic matter in three mangrove sediments of the Cochin estuary were examined. Assessment of biochemical compositions of the sediments was employed for this. The Dominance of lipids and proteins in the study region provided evidence for high nutritional values. Also, the tannin and lignin in mangroves are higher, giving an idea regarding the amount of plant debris accumulated in the sediments. The PRT: CHO and LPD : CHO ratios are higher. Except the site M3, all the other sites are found to be mesotrophic while the exceptional case comes under the category of oligotrophic region.

Key words: Biochemical compounds, carbohydrate, protein, lipid, Bio polymeric Carbon

INTRODUCTION

Coastal ecosystems and mangrove ecosystems are widely recognized as biogeochemically active regions in which intense biogeochemical processes occur. There are many sources of organic matter in these ecosystems and they play an important role in the global carbon cycle as large fluxes of carbon and carbon-related tracers move between the land, ocean, and atmosphere in these regions. Coastal environments are considered by high carbon burial ability (Duarte et al., 2005) and these are also observed as “hotspots” in terms of mineralization (Middelburg et al., 2007). Deposition of organic matter and its protection is better in coastal sediments than for any other sedimentary pool (Romankevich, 1984; Hedges and Kiel, 1995). In marine and mangrove environments, the flux, conservation, and accretion of organic carbon are governed by significant features such as primary production, sedimentation rate and supply of terrigenous organic matter from the surroundings (Woodroffe et al., 2016). Understanding the operative of these varied biomes and limiting their carbon and nutrient budgets is hence of prime status.

Mangrove environments are a dynamic intertidal territory generally present in tropical and subtropical coasts, and they cover about 65%-70% of the tropical coast. Mangrove forest play an essential role in coastal environment located at the interference between land and sea. Mangroves store large amount of organic carbon to several meters of depth (Fugimoto et al.,1999;Chumura *et al.*,2003).Sediments are consistent source recorders for water column methods and collects autochthonous and allochthonous organic matter inputs (Fabiyano and Danoyaro ,1995) and its study is a valuable device in the calculation of ecological pollution(Rini and Jacob .,2006) . Organic carbon in sediment is a vital pointer of the productivity of coastal zone (Hasrizal *et al.*,2009). It is an important descriptor for ecological quality valuation due to its complex configuration of its organic molecules (Middelburg and Herman ,2007). The relations of mangrove sediments are significant since such transportations are definite in flexible tidal water flow ,sediment transference and element cycling within waterways, as well as in the middle of mangroves and adjacent coastal waters. The sediment characteristics not only control the circulation of mangrove species, but they also have a major consequence on the distribution and richness of the benthic funa of the area .This reliability of species alignment and wealth of benthic funa on sedimentary features has been highlighted by various workers (Chandran *et al.*, 1982; Gray *et al.*, 2009).Thus ,a familiarity on the sedimentary characteristics ,together physical and chemical is an essential for a better understanding of every benthic ecosystem including mangroves.

MATERIALS AND METHODS

2.1 Description of the study area

Around the Cochin estuarine system, a large number of mangrove habitats can be seen. Three habitats are selected studied in this present work. The exact geographical location of sampling points and their characteristic features are depicted in Table1. The stations are, Mangalavanam (M1), Cherai (M2) and Kannamali (M3)

Table 1
Geographical Location of Sampling Sites (Mangroves)

Location	Latitude	Longitude
M1 (Mangalavanam)	9 ⁰ 57'38	76 ⁰ 17'27
M2 (Cherai)	10 ⁰ 13'91	76 ⁰ 18'17
M3 (Kannamali)	9 ⁰ 87'58	76 ⁰ 26'36

2.2 Sample Collection Methods

The sediment samples were collected using Van Veen grab and preserved at very low temperature (4°C). The samples were freeze dried for 72 hours, ground to a fine powder using an agate mortar and kept in desiccators until analysis. Spectrophotometric methods were employed for determination of biochemical compounds

2.3. Analytical Methods

The mangrove Frozen sediments were freeze dried, homogenized in an agate mortar and stored in a desiccator till analysis was to be done. Biochemical analysis was done by Spectrophotometric methods. Protein (PRT) analysis was done after extraction with NaOH (1M, 2h) and determined by Lowry procedure (Lowry et al., 1951) as modified by Rice (1982) which takes into consideration the absorption of phenolic compounds and uses Albumin as standard. Total carbohydrate (CHO) concentrations were considered colourimetrically by phenol - sulphuric acid method. The concentration was measured at 480 nm and using D-glucose as equivalents (Dubois et al., 1956). Lipid (LPD) extraction was done by direct elution with chloroform and methanol and assayed using Barnes and Blackstock (1973) procedure using Cholesterol as the standard. Tannin and lignin was estimated using the sodium tungstate phosphomolybdic acid method (APHA, 1995) method. The sediment sample were extracted with 0.05M NaOH for 90 minutes and filtered. Folin reagent was added and absorbance was taken at 765nm (APHA, 1995). Bipolymeric (BPC) fraction of organic carbon was calculated as the sum of PRT, CHO and LPD carbon (Fabiano *et al.*, 1995). To obtain carbon equivalents, each fraction was multiplied with 0.49, 0.4 and 0.75 μg of C μg^{-1} respectively ((Fabiano and Pusceddu, 1998). Total organic carbon (TOC) was analyzed using Skalar PrimacsMCS total organic carbon analyzer.

RESULTS

Protein concentrations varied from $425 \pm 16.8 \mu\text{g/g}$ to $2208 \pm 11.7 \mu\text{g/g}$ in the mangrove sediments. The highest protein concentration was exhibited by station Kannamaly (M_3) whereas the lowest was by Cherai (M_2). The quantity of protein nitrogen can be estimated by multiplying the protein content with the factor 0.16 (Mayer *et al.*, 1993). For mangrove sediments, it varied from 68 to 353 $\mu\text{g/g}$. The ranges of total carbohydrates at these stations $660 \pm 14.1 (M_2)$ and $1119 \pm 33.4 \mu\text{g/g} (M_3)$. The Tannin and lignin content in this stations exhibited variation from 766 ± 16.2 to $1852 \pm 12.8 \mu\text{g/g}$

with an average of 1309 $\mu\text{g/g}$ respectively. The Spatial variations of biochemical components in mangrove sediments are shown in Table 2.

Table 2
Spatial variations of biochemical components in mangrove sediments

Parameters in $\mu\text{g/g}$	M1	M2	M3
Proteins	1626 \pm 16.4	425 \pm 16.8	2208 \pm 11.7
Carbohydrates	1051 \pm 10.4	660 \pm 14.1	1119 \pm 33.4
Lipids	2119 \pm 125.4	2249 \pm 112.8	3455 \pm 144.6
Tannin and Lignin	1127 \pm 17	766 \pm 6.8	1852 \pm 12.4
Labile Organic Matter	4796	3334	6782

The LPD/CHO ratio in sediments ranged from 2.01 (M1) to 3.40 (M2) and the PRT:CHO ratio in these sediments ranged from 0.64 to 1.97. PRT/CHO < 1 was reported in station M2 (Cherai) and PRT/CHO > 1 was found to be in stations Mangalavanam (M1) and M3 (Kannamali). The biopolymeric carbon fraction of sedimentary organic carbon content in mangrove system ranged between 2159 to 4120.77 μgCg^{-1} . The highest concentrations of BPC, 4120.77 μgCg^{-1} , were found in M3 sampling site and the lowest concentration of BPC, 2159 μgCg^{-1} , were found in M2 station. In the present study TOC values ranges from 1.26% to 14.09% with a mean value of 7.67% in Mangrove ecosystem. The highest, 14.09%, was found in M3 and the lowest, 1.26%, were found in M2 station. Table 3 shows the Spatial variations of biochemical indices in the selected study area

Table 3
Spatial variations of biochemical indices in mangrove sediments

Parameters	M1	M2	M3
PRT/CHO Ratio	1.54	0.64	1.97
LPD/CHO Ratio	2.01	3.4	3.08
Bio Polymeric Carbon (μgCg^{-1})	2806.39	2159	4120.77
Total Organic Carbon (%)	5.25	1.26	14.09

DISCUSSION

The biochemical composition of sedimentary organic matter in the study region showed a dominance of lipids followed by proteins and carbohydrates. It seems to be

quite different from other coastal systems, which is usually characterized by dominance of proteins and carbohydrates over lipids (Fabiano and Danovaro, 1995). The high concentrations of sedimentary lipids, proteins and carbohydrates recorded in the study area could be related to the morphodynamic, hydrological and physicochemical characteristics of mangrove systems. The shallow water depth and high sedimentation rate of mangrove ecosystems assist the settling of organic matter without significant degradation. Significantly higher values of total lipids in the study region might be due to its preservation under highly anoxic conditions.

Labile organic matter, the sum of three biochemical compounds, varied from 3334 to 6782 $\mu\text{g/g}$ in the mangrove sediments. On annual basis, lipids were dominant class among labile organic compounds, followed by protein and carbohydrates. LPD contribution to the labile organic matter pool in sediments at stations M1, M2 and M3 44.18%, 67.45% and 50.94% respectively of labile organic matter. PRT contribution to the labile organic matter pool at stations M1, M2 and M3 were 33.9%, 12.74%, and 32.55% respectively of labile organic matter. CHO contribution to the total organic matter pool at stations M1, M2 and M3 were 21.91%, 19.79% and 16.49% respectively of labile organic matter.

Tannin and lignin, well known aromatic polycyclic phenolic compounds biosynthesised by higher plants (Field and Lettinga, 1987; Hernes and Hedges, 2000), have been delivered to aquatic environment through terrestrial run off. These form a major fraction of refractory organic matter and its quantitative determination provides valuable information on the input of terrestrially derived organic detritus in to the sediments (Lin et al., 2006). The enhanced levels of tannin and lignin observed in the sediments of mangrove ecosystem, seemed to be originated from vascular plant debris, accumulated in sediments.

The content of lipid and lipid to carbohydrate ratio (LPD: CHO) have been used as proper indices to define the active (food) quality of the organic substances in the sediments (Grémare *et al.*, 1997; Fabiano and Pusceddu, 1998; Grémare *et al.*, 2002). Also, lipid concentration has been connected with the best labile fraction of sedimentary organic matter composition (Gremare *et al.*, 1997,2002). The low LPD:CHO ratio is attributed to the poor quality of labile organic matter in the respective

stations. Whereas, the higher LPD:CHO ratios estimated indicates high quality of labile organic matter.

The variation of PRT:CHO ratio can be justified by the fact related to dead organic matter accumulation, probably due to the strong hydrodynamic condition prevailing in the ecosystems. On the contrary, the low hydrodynamic condition favors the accumulation of sedimentary organic matter. In productive areas such as estuaries and coastal regions including mangrove systems, values of PRT: CHO indices are high (Galois *et al.* 2000; Pusceddu *et al.* 2000). The accumulation of phytodetritus and anthropogenic activities may also contribute to the prevalence of PRT. The study reveals the presence of aged organic matter along the sampling stations.

The $PRT/CHO > 1$ represents the fact that a principal fraction of bio polymeric carbon contains of recently produced labile organic matter (Pusceddu *et al.*, 2000). A decrease in this ratio shows the occurrence of aged organic detritus (Denovero *et al.*, 1993; Pusceddu *et al.*, 2000) and may be related with less availability of organic matter for consumers (Pusceddu *et al.*, 2005, 2009). The PRT/CHO ratios were detected to be < 1 in the whole study region which indicated that mangrove sediment contained huge amounts of aged and/or lifeless organic matter. It also recognized the influence of heterotrophic environments of the study area. Microbes use proteins more readily than carbohydrates (Newell and Jordan, 1983). Heterotrophic microorganisms play a significant role in the environmental and biogeochemical cycles of marine sediments (Benner, 2011). Heterotrophic action explanations for most of the organic matter remineralisation (Jorgenson 2000). All the mangrove stations has almost all the values with $PRT/CHO > 1$ which has been ascribed to fresh material of recent formation, whereas only the M2 station exhibited $PRT/CHO < 1$ which attributes to more degraded organic matter. It implies that carbohydrates are dominating in the organic pool which is a salient feature of detrital heterotrophic environment.

Descriptions of trophic state in marine environments are essential for understanding food web connection along with biogeochemical features of the study area (Smith 2003). Usually, the trophic status is characterized as oligotrophic (unproductive), mesotrophic (intermediate productivity), and eutrophic (highly productive). This can be influenced by light, external carbon sources, nutrients, hydrology, and food web structure (Dodds and Cole 2007). The determination of trophic status was carried out based on the biopolymeric carbon (BPC) and the algal

contribution in BPC (Pusceddu et al., 2011). This procedure categorizes the mangrove stations as: eutrophic (BPC > 3 mg C/g, algal fraction of < 12% of BPC), mesotrophic (BPC = 1-3 mg C/g, algal fraction = 12-25% BPC) and oligotrophic (BPC < 1 mg C/g, algal fraction 25% of BPC) (Pusceddu et al., 2011; Manju et al., 2016). In the present study, the variation in the BPC values might be attributed to the changes in organic matter deposition in sediments associated with mangrove and estuaries. The strong river discharge in upper reaches of the estuary provides a criterion for classifying the study areas into eutrophic, mesotrophic or oligotrophic regions. Regions with BPC > 3000 μgCg^{-1} are called eutrophic regions. In this study the eutrophic characteristics is shown by only one station viz. M3 with a BPC value of 4120.77 μgCg^{-1} . All other stations come under the category of mesotrophic with BPC ranging in between 1000-3000 μgCg^{-1} .

Higher concentration for organic carbon in certain stations of both the ecosystem could be attributed to the organic matter present with the sedimentary particles. Lower contents for TOC might be attributed to the dilution effects associated with river discharge which has effects on both marine and mangrove systems. M3 mangrove site exhibited highest TOC value of 14.09% whereas the lowest value was given by the M2 station. Organic carbon in sediments may be derived from autochthonous or allochthonous processes.

CONCLUSION

Biochemical composition of sedimentary organic matter in mangrove sediments had higher concentration. The Dominance of lipids and proteins in the study region provided evidence for high nutritional values. Also, the tannin and lignin in mangroves are higher which give an idea regarding the amount of plant debris accumulated in the sediments. High variation of biochemical constituents is observed in different sampling stations. Also, there is a huge variation in between the biochemical components itself.

The higher PRT: CHO ratios in sediments indicated that there is low dead organic matter accumulation, probably due to the strong hydrodynamic condition prevailing in both the ecosystems. On the contrary, the low hydrodynamic condition will favor the accumulation of sedimentary organic matter. The higher LPD:CHO ratios were estimated in some estuarine stations whereas the other stations exhibit a comparable values with respect to others. Mangrove system exhibits a greater value of BPC than

the estuarine system. Except one site, all the other sites are found to be mesotrophic while the exceptional case comes under the category of oligotrophic region.

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A STUDY ON THE DIETARY HABITS AND RISK FACTORS IN HYPERURICEMIA

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ABSTRACT

Hyperuricemia is a metabolic disorder marked by an excess of uric acid in the blood, which is the product of a disorder in purine metabolism. Although hyperuricemia is not a disease, if uric acid levels remain high, over time they can lead to several diseases which includes a painful type of arthritis called gout. Elevated uric acid levels are also associated with health conditions such as diabetes, heart disease and kidney disease. A high uric acid level occurs when kidneys do not eliminate uric acid efficiently. These days its prevalence is increasing due to changes in lifestyle. The study aims at assessing the anthropometric indices, food consumption pattern and the influence of risk factors on hyperuricemic subjects.

Key words : Hyperuricemia, Uric acid, Purine, Diabetes, Cardiovascular , Kidney disease.

INTRODUCTION

Hyperuricemia is an elevated uric acid level in the blood stream. This elevated level is the result of increased production, decreased excretion of uric acid or a combination of both processes. The body produces uric acid as a byproduct of the breaking down of purines, which are chemical compounds that are found in certain foods and also made by our body. Hyper uricemia is a common disorder that affects individuals of all ages and gender. Overtime hyperuricemia can lead to more serious conditions such as gout, an increasingly common condition world wide. In addition it is also associated with diabetes, hypertension, metabolic syndrome, kidney and cardiovascular diseases and decrease the overall quality of life.

For years, hyperuricemia has been identified with or thought to be the same as gout, but uric acid has now been identified as a marker for a number of metabolic and hemodynamic abnormalities.

Human beings have higher levels of uric acid, because of a deficiency of the hepatic enzyme uricase, and a lower fractional excretion of uric acid. Approximately two thirds of total body urate is produced endogenously, while the remaining one third is accounted for by dietary purines. Approximately 70% of the urate produced daily is excreted by the kidneys, while the rest is eliminated by the intestines. The blood levels of uric acid are a function of the balance between the breakdown of purines and the rate of uric acid excretion. Theoretically, alterations in this balance may account for hyperuricemia, although clinically defective elimination accounts for most cases of hyperuricemia.

Hyperuricemia is a result of multifactor interactions including gender, age, genetic and environmental factors. The most common causes of hyperuricemia are diet, alcohol consumption, and physical activity excesses. Obesity is also a strongly associated factor. The incidence of hyperuricemia has been increasing and has been related to modernization. Needless to say, hyperuricemia needs careful and regular monitoring. The present study entitled “A study on risk factors and complications in hyperuricemia” was undertaken with the following **objectives**:

1. To study the socio- economic profile in hyperuricemic patients
2. To assess the anthropometric indices
3. To assess the food habits
4. To analyze the influence of risk factors on hyperuricemia.

MATERIALS AND METHODS

The area selected for the study was Pookottur panchayath belonging to Eranadu taluk in Malappuram district. The selected panchayath contains 19 wards and each ward consists of an average of 300 families. 200 samples of hyperuricemic patients in the age group of 15 years and above were selected deliberately using purposive sampling method.

Interview method was used with the help of structured and pretested schedules to collect information about the socioeconomic background, food consumption pattern, and health problems of the selected subjects. The information obtained was organized in a systematic manner using various statistical tools to interpret it scientifically.

RESULTS AND DISCUSSION

The results obtained were consolidated under the following headings.

1) Socio Economic Profile

Figure 1 and Figure 2 represents the gender and age of the samples respectively.

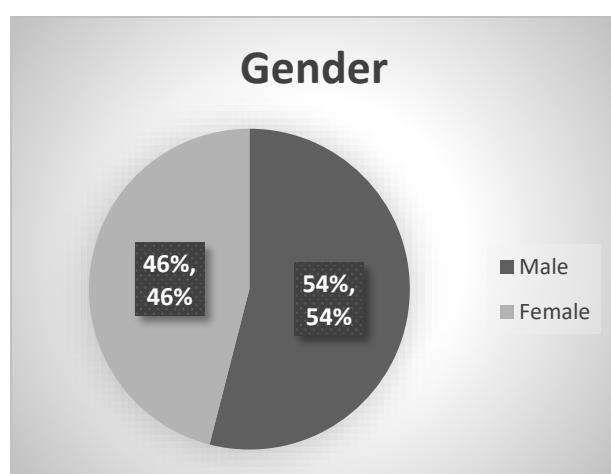


Fig 1 Gender

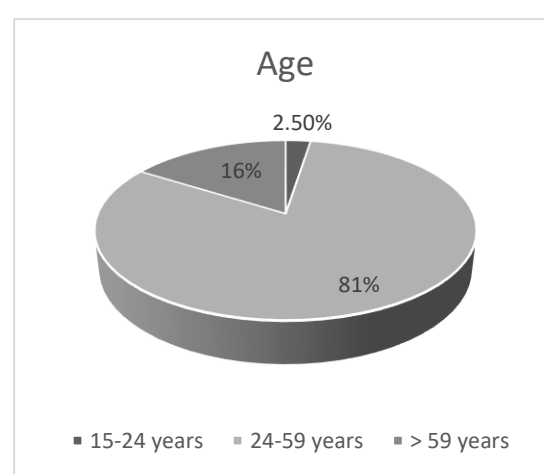


Fig 2 Age

Out of 200 sample, 54% of samples were males and 46% were females. 81% of samples belonged to the age group of 25- 59 years. Majority (50%) of the samples had high school level education. Only 8.5% of samples had qualification above degree. 56% of samples were employed and 43% were unemployed indicating possibility for sedentary life style.

2) Anthropometric Indices

Anthropometric indices like Body Mass Index (BMI) and Waist-hip measurements are given below.

a) Body Mass Index (BMI)

Hyperuricemia has been associated with obesity. It is likely that higher BMI increases the risk of gout by increasing the serum uric acid level.

Table 1
BMI of selected samples

N=200

Parameters	Category	BMI* %			Chi Square	p Value
		Below 18.5	18.5- 25	>25		
Sex	Male	0	18.5	81.5	4.131	0.127
	Female	1.1	9.8	89.1		
Age in yrs	15- 24	0.0	40.0	60.0	4.723	0.317
	25- 59	0.7	15.3	84.0		
	>59	0.0	6.3	93.7		

*NIH publication, 1998

It is clear that majority of samples both males (81.5%) and females (89.1%) were found to be overweight or obese. Only a single individual had a BMI below 18.5. Also, 18.5% of males had BMI in between 18.5 and 25. 93.8% of sample with BMI above 25 are in age group above 59 years. From the above it can be seen that as one of the reasons, obesity might increase hyperuricemia through increased urate production and decreased renal clearance.

b) Waist-hip measurements

Waist circumference and waist- hip ratio of selected samples are given below.

Table 2
Waist-hip measurements

Body measurements	Category ***	%	
		Male	Female
Waist circumference	Below normal (M* <100cm; F**<85cm)	9.3	2.2
	Normal (M: 100- 102cm; F: 85- 88cm)	11.1	6.5
	Above normal (M >102cm; F >88cm)	79.6	91.3
Waist to hip ratio	Normal (M<1cm; F<0.8cm)	16.7	3.3
	Above normal (M>1cm; F>0.8cm)	83.3	96.7

M- males; F- females; ***Srilakshmi, 2012

The results indicates that 79.6% of males and 91.35 % of females were at high risk with raised waist circumference indicating that majority of them were having intra-

abdominal obesity. 83.3% of males and 89% of females also had a waist hip ratio above normal.

3) Frequency of Food Intake

a) Frequency of intake of cereals, pulses, vegetables and fruits

A purine rich diet is a common but minor cause of hyperuricemia. Foods high in purines, adenine and hypoxanthine may aggravate symptoms of hyperuricemia.

Table 3
Frequency of intake of cereals, pulses, vegetables and fruits

Foods	Parameters	% of frequency of food intake***							Chi Square	p value
		D	OW	TW	Tr W	F	M	O		
Cereals	Male	97.2	1.9	-	-	0.9	-	-	2.594	0.273
	Female	100	-	-	-	-	-	-		
	15- 24	100	-	-	-	-	-	-	1.976	0.740
	25- 59	98.8	0.6	-	-	0.6	-	-		
	>59	96.9	3.1	-	-	-	-	-		
Pulses	Male	12	32.4	12	13	30.6	-	-	6.536	0.257
	Female	12	35.9	14.1	12	21.7	-	-		
	15- 24	-	80	20	-	-	-	-	13.62	0.191
	25- 59	13.5	31.9	13.5	10.4	28.2	-	2.5		
	>59	6.3	37.5	9.4	25	21.9	-	-		
Vegetables	Male	89.8	0.9	0.9	1.9	6.5			6.855	0.144
	Female	92.4	4.3	-	2.2	1.1				
	15- 24	100	-	-	-	-	-	-	9.311	0.317
	25- 59	89.6	3.1	-	2.5	4.9	-	-		
	>59	96.9	-	3.1	-	-	-	-		
Fruits	Male	9.3	4.6	9.3	38	38	0.9	-	14.64	0.02*
	Female	2.2	9.8	7.6	23.9	55.4	-	1.1		
	15- 24	-	-	-	20	60	20	-	47.14	0.00**
	25- 59	7.4	8	9.8	31.3	42.9	-	0.6		
	>59	-	3.1	3.1	34.4	59.4	-	-		

*significant at 5% level; **significant at 1% level

***D-daily; OW-once in a week; TW-twice in a week; TrW-thrice in a week; F-fortunately; M-monthly; O-occasionally

Cereals were included in the daily diet of majority of selected samples. In most of the families, there was the usual habit of consuming rice based preparations in the three major meals of a day. Only few persons used other cereals like wheat, ragi or oats in any one meal of a day.

Generally, the consumption of pulses and legumes were low in the selected area. Their major source of protein in diet was animal protein foods since all the samples selected were non vegetarians.

b) Frequency of consumption of fish, meat, poultry, egg and milk products

Higher uric acid levels have been found to be positively associated with consumption of meat and inversely associated with dairy food consumption.

Table 4

Frequency of intake of fish, meat, poultry, eggs and milk products

Foods	Parameters	% of frequency of food intake**							Chi Square	p value
		D	OW	TW	TrW	F	M	O		
Fish	Male	47.2	16.7	6.5	24.1	1.9	0.9	2.8	4.90	0.557
	Female	57.6	8.7	6.5	19.6	3.3	2.2	2.2		
	15- 24	20	20	20	20	20	-	-	16.3	0.180
	25- 59	49.1	13.5	6.1	24.5	2.5	1.8	2.5		
	>59	71.9	9.4	6.3	9.4	-	-	3.1		
Meat	Male	0.9	37	9.3	2.8	16.7	0.9	32	25.2	0.00*
	Female	2.2	18.5	1.1	2.2	26.1	12	38		
	15- 24	-	20	-	-	40	-	40	4.75	0.97
	25- 59	1.8	27.6	6.1	2.5	21.5	6.7	33.7		
	>59	-	34.4	3.1	3.1	15.6	3.1	40.6		
Poultry	Male	2.8	24.1	32.4	21.3	12	5.6	1.9	21.7	0.001*
	Female	1.1	16.3	19.6	15.2	39.1	7.6	1.1		
	15- 24	-	20	40	20	-	20	-	10.9	0.54
	25- 59	2.5	20.9	27	15.3	25.8	6.7	1.8		
	>59	-	18.8	21.9	34.4	21.9	3.1	-		
Egg	Male	2.8	4.6	5.6	16.7	59.3	4.6	6.5	15.1	0.19
	Female	4.3	10.9	10.9	8.7	48.9	14	2.2		
	15- 24	-	20	-	40	20	-	20	13.1	0.36
	25- 59	3.1	6.1	9.2	12.9	54.6	9.8	4.3		
	>59	6.3	12.5	3.1	9.4	59.4	6.3	3.1		
Milk products	Male	15.7	-	-	1.9	17.6	13	51.9	27.8	0.000*
	Female	2.2	-	1.1	1.1	2.2	15	78.3		
	15- 24	20	-	-	20	-	-	60	6.32	0.79
	25- 59	8	-	0.6	1.2	11.7	14	63.8		
	>59	15.6	-	-	3.1	3.1	12	65.6		

*significant at 5% level

**D-daily; OW-once in a week; TW-twice in a week; TrW-thrice in a week; F-fortunately; M-monthly; O-occasionally

47.2% males and 57.6% of females had daily consumption of fish. 49.1% of samples belonging to the age group of 25- 59 years consume fish daily.

In the selected samples among 37% males and 18.5% females, there was a habit of consuming meat once in a week. The frequency of meat consumption in the selected samples were significantly high ($p=0.05$). 32.4% of male and 19.6% of female consume poultry twice a week. Daily servings of meat and sea foods were associated with significantly increased risk of incident hyperuricemia, while dairy products were protective.

59.3% males had consumption of egg fortnightly. Frequency of intake of egg is thrice in a week by samples of 15- 24 year age group.

It is clear from above table that sex of the samples and intake of milk is highly significant. It is noted that both males (51.9%) and females (78.3%) use milk and milk products only occasionally. Milk consumption is comparatively less in all age groups.

4) Risk Factors

a) Age and gender

Table below depicts age categorization of selected samples.

Table 5
Age and Gender wise distribution

Variable	Category	%		Chi Square	p value
		Male	Female		
Age in yrs	15-24	1.9	3.3	1.426	0.490
	25-59	79.6	83.7		
	>59	18.5	13		

1.9% males and 3.3% females belonged to the age group of 15-24 years. Major portion of selected samples were under the age group of 25- 59 years. 18.5% males and 13% females were above 59 years of age. Hence, no significant relationship between age and sex in selected samples.

b) Obesity

Hyperuricemia has been associated with obesity via both increased production and decreased renal excretion of urate.

Table 6
Obesity among subjects

Obesity	Category	%		Chi Square	p value
		Male	Female		
Presence of obesity	Yes	79.6	88	2.553	0.110
	No	20.4	12		
Types of obesity*	Over weight; BMI: 25.0- 29.9	45.3	56.8	2.295	0.317
	Obesity class I; BMI: 30.0- 34.9	45.3	37		
	Obesity class II; BMI: 35.0- 39.9	9.3	6.2		
	Class III (extreme obese) BMI >40	-	-		

* NIH publication, 1998

There is no significant relationship between obesity and gender in samples. From the selected samples 20.4% of males and 12% of females are not obese and had BMI less than 25. Majority of selected samples were obese with BMI more than 25. Class III obesity (BMI > 40) is not present among selected samples. Higher percentage of samples were overweight, out of which 45.3% were males and 56.8% were females. Excess body fat may be the most important nutritional factor for hyperuricemia.

c) Diabetes

Hyperuricemia is a risk factor for type 2 diabetes.

Table 7
Presence of Diabetes

Variable	Category	%		Chi Square	p value
		Male	Female		
Diabetes	Yes	23.1	16.3	1.454	0.228
	No	76.9	83.7		

There is no significant relationship between sex category and diabetes among selected samples. Majority of selected samples (76.9% males and 83.7% females) did not have diabetes. 23.1% males and 16.3% females were diabetic.

d) Consumption of alcohol, soft drinks, fatty diets and organ meat.

Sugar sweetened soft drinks contain large amounts of fructose which may increase serum uric acid levels. Too much fat consumption may reduce the body's ability to excrete uric acid.

Table 8
Consumption of alcohol, soft drinks, fatty diets and organ meat

Variable	Category	Gender		Chi Square	p value
		Male	Female		
Consumption of alcohol	Yes	2.8	0	2.594	0.107
	No	97.2	100		
Consumption of soft drinks	Yes	75.9	15.2	73.356	0.000*
	No	24.1	84.8		
Consumption of fatty diets	Daily	62	29.3	25.001	0.000*
	Weekly	29.6	53.3		
	Monthly	5.6	7.6		
	Occasionally	1.9	9.8		
	Not at all	0.9	0		
Consumption of organ meat	Daily	0.9	0	29.661	0.000*
	Weekly	13	3.3		
	Monthly	49.1	21.7		
	Occasionally	37	75		

**significant at 1% level*

Drinking alcohol was rare (2.8%) among the samples. 75.9% of males had the habit of consuming soft drinks. Hence soft drink consumption was found to be significantly ($p < 0.05$) high among males.

Sugar sweetened soft drinks in increasing amounts are associated with higher odds of hyperuricemia. Excessive intake of fat can be a risk factors for hyperuricemia.

Almost all the samples had a habit of consuming fatty foods. All the samples were non vegetarians and they consumed fish or meat usually in fried forms. Fried pappad was found to be a vital part of their diet. Daily consumption of fatty diets was found to be higher in males. Hence, the consumption of fatty diets is significantly ($p < 0.05$) related with sex category.

Daily consumption of organ meat is less among selected samples. However, the frequency of organ meat consumption is significantly high ($p < 0.05$) in males compared with females. Daily fatty meals can be a reason for increased uric acid levels.

CONCLUSION

Hyperuricemia being a health hazard must be monitored at regular intervals. The elevated level of uric acid among the subjects may be due to factors like the sedentary life of some of the samples, obesity, high consumption of meat and fat. Obesity can be a risk factor for several of the comorbidities. To avoid more serious conditions, a better approach is to adopt a healthy way of eating.

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A BENEFICIARY BASED STUDY ON THE EFFECTIVENESS OF MODULAR KITCHENS

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ABSTRACT

Readymade kitchens have taken the world by storm. Scrupulously designed to fulfil individuals needs and adapt to available space, modular kitchen that have become the way of life. Standardized modules, prefabricated in a varied range of materials, colours and finishes graciously fit the bill to fare to suit the modern kitchen. With the convenience and comfort of ready modules, one can avail of modern facilities and maintain a consistency in décor that defines one's personal statement of style. This has placed the modern homemaker and working women on the threshold of hand convenience where all that one needs to do is order for a modular kitchen and in no time, the kitchen is ready to use. The Modular kitchen is no longer about maximizing the use of a small space. Even a relatively large area is more effectively organized. It can change the character and personality of a conventional kitchen in no time, along with the provision of convenience and ergonomics. Also today, it is a style statement and status symbol. Style and looks are key components and well recognized that bring in the zing factor.

The purpose of this project is to evaluate the effectiveness of modular kitchen among the households, which adopted it from the city of Ernakulam. Since there is wide disparity among the income levels of people regarding the standard of living, there will be differences in the various factors considered during the installation of modular kitchen among the families with high, middle and low-income levels. The study is done mainly to evaluate the effect the modern kitchens has made in the lives of people, the materials they used during its construction, modes of possession and how well it relieves the working burden of homemakers etc.

Key Words: Modular, Effectiveness, Ergonomics

INTRODUCTION

A **kitchen** is a room or part of a room used for cooking and food preparation in a dwelling or in a commercial establishment. A modern residential kitchen is typically equipped with a stove, a sink with hot and cold running water, a refrigerator, counters and kitchen cabinets arranged according to a modular design. The main function of a kitchen is serving as a location for storing, cooking and preparing food and doing related tasks, but it is also used for dining, entertaining and laundry. Before and after the beginning of the 20th century, kitchens were frequently not equipped with built-in cabinetry, and the lack of storage space in the kitchen became a real problem.

The urbanization in the second half of the 19th century induced other significant changes that would ultimately change the kitchen. Out of sheer necessity, cities began planning and building water distribution pipes into homes, and built sewers to deal with the wastewater. Gas pipes were laid; gas was used first for lighting purposes, but once the network had grown sufficiently, it also became available for heating and cooking on gas stoves. At the turn of the 20th century, electricity had been mastered well enough to become a commercially viable alternative to gas and slowly started replacing the latter. However, like the gas stove, the electric stove had a slow start.

Modular kitchen is a term used for modern kitchen furniture layout consisting of modules of cabinets made of diverse materials, which hold accessories inside, and can facilitate the effective use of available space in a kitchen. Normally the units which are kept on the floor are called 'floor units' or 'floor cabinets' on which a counter made of granite, marble, tile etc., is laid for creating spaces for varied activities in a kitchen. The units, which are held on the wall for storage purposes, are termed as 'wall units' or 'wall cabinets'. In a small area such as in an apartment even, a tall storage unit on an entire wall called 'kitchenette' is available for effective storage. Modular kitchen normally constitute wooden cabinets, counter-tops, electro-domestic gadgets like chimney, hob, built-in-oven, sink with or without drain board and in some cases a refrigerator, dishwasher and/or other gadgets.

The interiors of traditional homes are getting used to Modular kitchen in the recent decade. As far as the old kitchens are concerned, they are very dingy and

unorganized. Modular kitchen of today is sleekly designed to suit individual needs and preference as well as the available space in any home. Modular system is stylish elegant and latest as you have an array of materials for counters shelves, storage units and finishes.

The Modular kitchen is no longer about maximizing the use of a small space. Even a relatively large area is more effectively organized. It can change the character and personality of a conventional kitchen in no time, along with the provision of convenience and ergonomics. Also today, it is a style statement and status symbol. Style and looks are key components and well recognized that bring in the zing factor.

MATERIALS AND METHODS

The purpose of this project is to evaluate the effectiveness of modular kitchen among the households, which adopted it from the city of Ernakulum. The sample size consists of 21 families purposely selected. The tool for the present study was a questionnaire consisting relevant questions regarding modular kitchens. The subjects were purposely selected from middle and high-income strata. Since there is wide disparity among the income levels of people regarding the standard of living, there will be differences in the various factors that are considered during the installation of modular kitchen among the families with high, middle and low-income levels. The study is done mainly to evaluate the effect the modern kitchens has made in the lives of people, the materials they used during its construction, modes of possession and how well it relieves the working burden of homemakers etc.

RESULTS AND DISCUSSIONS

The results of the study entitled “A beneficiary based study on the effectiveness of modular kitchen” are presented under the following headings;

1. **General Information**
2. **Specific Information**

1. General Information

The personal and socio economic details of selected households are included in Table 1.

Age, education etc.

1.1. Details of the Age of the respondents

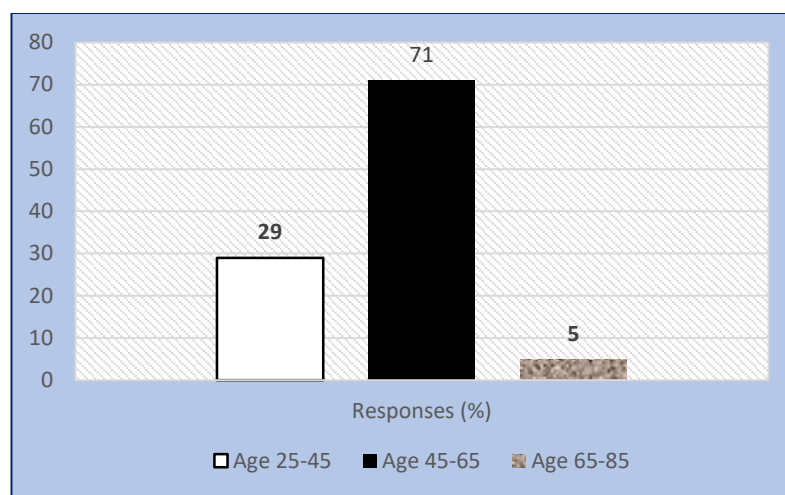


Figure 1

Age of the respondents

The age of the subjects chosen for this study ranges from 25-85 and majority (71%) of the respondents is from the age group 45-65.

1.2. The Socio Economic Details of Selected Households.

The jobs and income of the respondents clearly depict the socio-economic status of the households.

Table 2

Socio economic details of selected households

SI. No	Parameters	Specifications	Responses (%)
1.	Occupation	Business	19
		Professional jobs	33
		Other jobs	48
2.	Annual Income	₹ 1,00000- ₹ 5, 00000	43
		₹ 5,00001- ₹ 1000000	43
		₹ 1000001- ₹ 1500000	14

Purposive selection of the subjects from upper middle and high-income strata of Ernakulum city was done and the tabled data confirm that. Among the 21 households under study most of the respondents were involved in other jobs, such as government service, bank officer etc. and many were professionals and a few were businesspersons. Majority (86%) of the subjects studied were in the group with income levels between 1 lakh-10lakh/year. The rest of the subjects came under the group of people with income ranging between 10lakh-15lakh/year.

2. Specific Information

All the houses were owned and occupied for within the past 10 years. The specific details of the households studied are given below.

2.1. Details of the households selected for the study

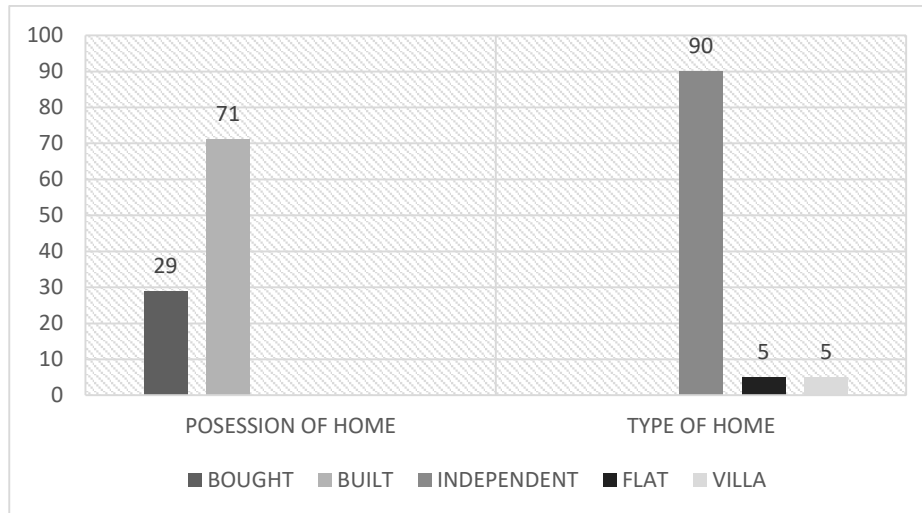


Figure 2

Details of the selected Households

Majority of the subjects studied had built their houses while the rest (29%) had bought homes. Almost all (90%) has their own independent house while the rest stay in villas or flats. Nearly half the households renovated their homes and kitchen modification was the major activity.

2.2. Details about modular kitchen in the selected households

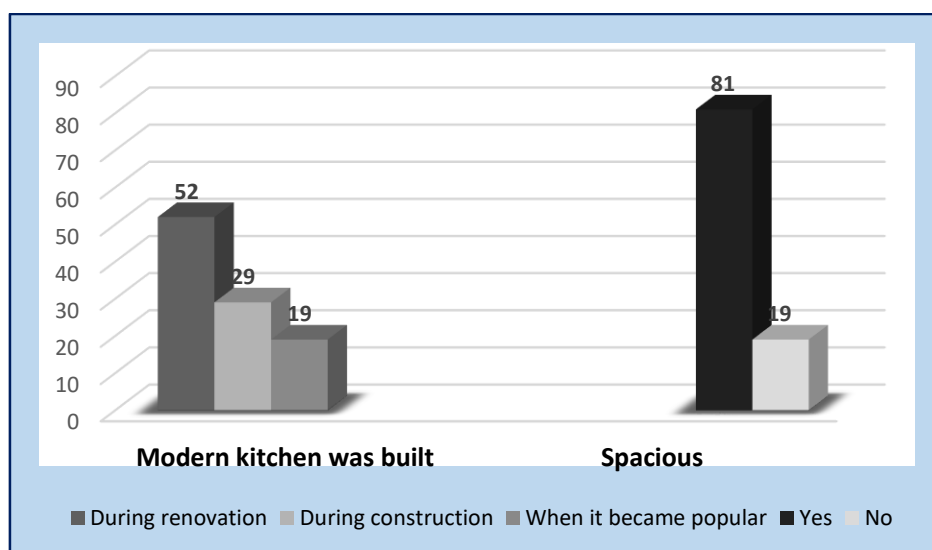


Figure 3

Details of the kitchen

It was interesting to note that even though the houses were constructed or occupied in the past decade majority of the subjects (52%) has installed Modular kitchen during renovation, which means it was an afterthought. Less than half (29%) only installed it during construction and some (19%) installed it when it became popular.

Most (81%) of the respondents stated that their Modular Kitchen was spacious enough for all their activities and had all the workspaces.

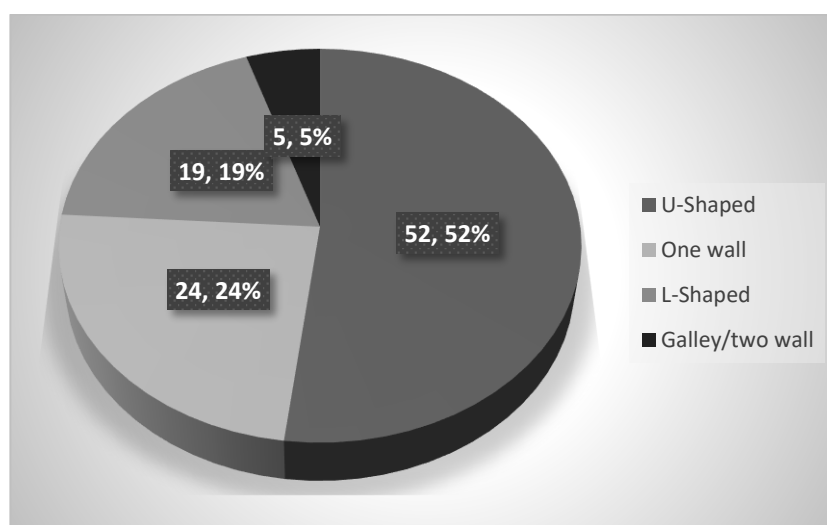


Figure 4

Details of kitchen layout

More than half (52%) the subjects have installed U-shaped layout in their kitchen which was considered to be ergonomical, mostly based on the suggestions by designers and space availability, followed by one wall and L shaped kitchen. Only a few (5%) has Galley / two-wall layout in their kitchen mostly due to space constraints.

2.3 Materials used for counter-tops and splash backs or Dados

Selection of materials for Counter tops should be considering many factors such as durability, stain resistance, appearance, cost etc. Splash back or Dados are essential part of a modern kitchen design to protect the walls from getting stained or damp.

Table 2

Details of material used for counter-tops

SI. No	Particulars	Specifications	Responses (%)
1.	Material for counter	Granite	95
		Marble	5
		stainless steel	Nil

Granite was the favourite material for countertop as it was opted by almost all (95%) and a few used marble. Nobody used any other material. Regarding the splash back the entire kitchen had splash back on the wall adjacent to the counter with tiles, which was easy to clean and install.

2.4. Hoods and Hobs used in Modular Kitchen

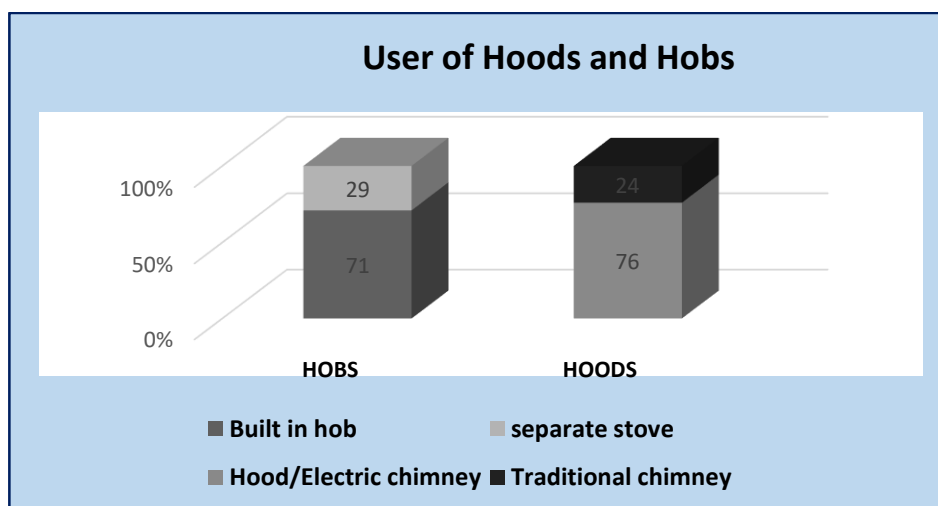


Figure 5

Details of Hoods and Hobs

Majority of the selected households had Hi-tech Hobs (71%) and Hoods (76%) in their modular kitchen. The rest either considered them unnecessary or continued to use the traditional appliances used previously. The frequently used brands of hood and hob were Planet, Elica, Siemen, Gilma, Glenn and Pigeon. These were the common brands available in Kochi.

2.5. Mode of Cooking used in Modular Kitchen

Table 3

Details of cooking method used

SI. No	Particulars	Responses (%)
1.	LPG Alone	24
2	Electric Alone	-
3	Both	76

Though the cooking fuel used mostly in the kitchen was LPG, due to shortage of this fuel majority of the households had both electric appliances such as induction cooker installed and used in the modular kitchen.

2.6. Brands of Hardware and Accessories used in Modular Kitchen

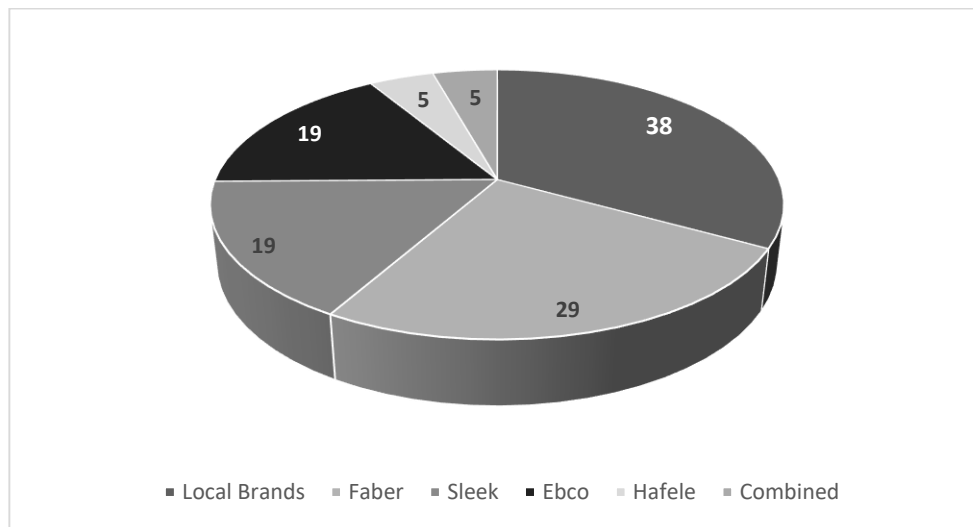


Figure 6

Details of Brands of Hardware and Accessories

Though many brands of hardware and accessories flooded the market, many (38%) households installed local brands due to both economy and easiness to procure. Faber was the next sought after brand (29%) followed by Sleek and Ebco (19% each) some used Hafele, the German brand which is a comparatively new entrant in the market. An interesting fact was that some conveniently combined many brands in for modular hardware or accessories.

2.7. Materials of Cupboards installed in Modular Kitchen

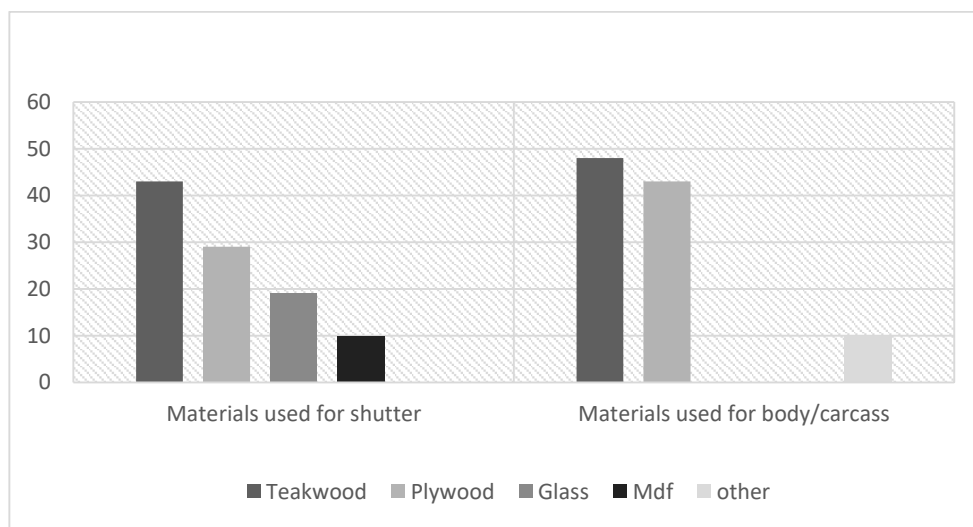


Figure 7

Cupboard details of the Modular Kitchen

Most of the subjects (43%) used teakwood the most preferred material for shutters. Very few households preferred M.D.F and glass for the shutters. This could be due to the traditional mind-set of the people and affordability, even though the wood is expensive.

Nearly half (48%) of the households used teakwood for the body and very less has used other materials like MDF for the body (10%).

2.8. Details of major storage facilities included in the modular kitchen

Table 4
Details of Storage

SI. No	Parameters	Specifications	Responses (%)
1.	Type of storage	Cutlery tray and cutlery holder	90
		Crockery Tray	71
		Pull-out and Trolleys	67
		D-tray	47
		Pie- tray	38
2.	Additional storage facilities	Work Area	71
		Utility	52
		Pantry Space	38

*** Responses more than 100 due to multiple-choice*

Almost all (90%) of the households had cutlery tray and cutlery holder in the Modular Kitchen followed by crockery tray(71%), pull outs and trolleys(67%) and D-Tray(47%). Pie-tray seems to be the least (38%) popular mode of storage in the selected kitchens.

Since the mode of typical modular storage was not adequate for the traditional Kerala style of cooking additional storage facilities were provided in work area for most (71%) of the households along with attached utility or pantry space if these spaces existed.

2.9. Details regarding interior design of modular kitchen

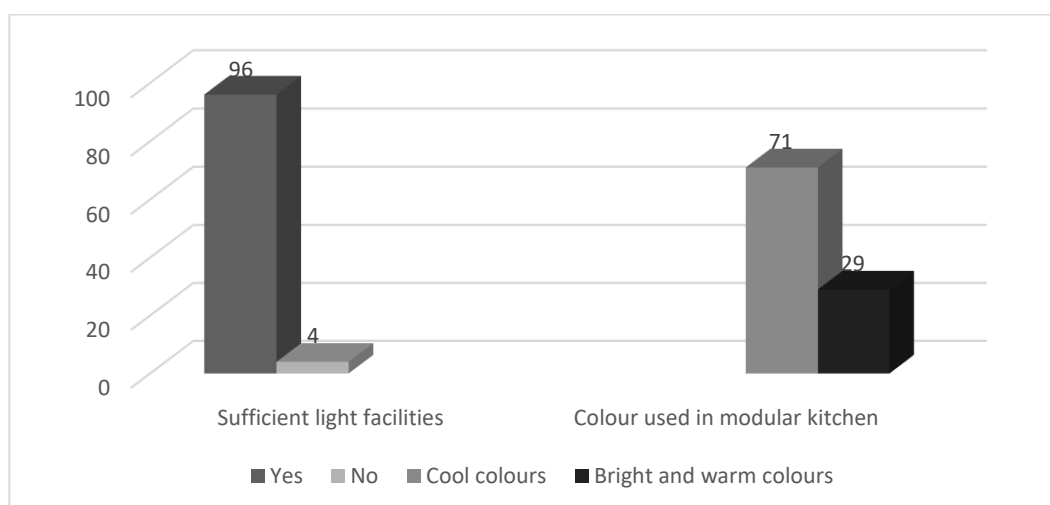


Figure 8

Assessment of Major Interior Design features

Almost all (95%) the households provided sufficient lighting facilities in the kitchen for general ambience as well as carrying out tasks and the source was CFL and fluorescent lamps in general for saving of energy. Most(71%) of the households used light, cool and pleasing colours like white, beige, pastel green etc in their kitchen because they are soothing to the eye; but a few (29%) preferred bright colours in their kitchen to make it attractive and trendy.

Table 5

Additional Facilities provided in the modular kitchen

SI. No	Particulars	Specifications	Responses (%)
1.	Additional Features	Water purifier	95
		Exhaust fan	90
		Pest control features	14

Study revealed that almost all the households had water purifiers and exhaust fans as both these were essentials and not luxuries in the urban set up, but only very few (14%) have got pest control features in their kitchen mainly due to ignorance about it.

2.9.1. Waste Disposal

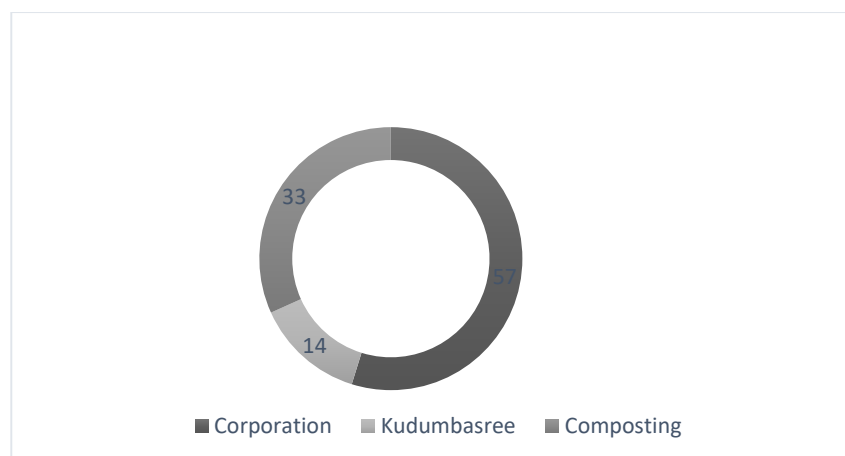


Figure 9

Waste disposal

Regarding the waste disposal features like pulverisers, it seems that all are depending on manual disposal with the help of various agencies. A few (33%) even made compost out of organic waste.

2.10. Details of Cost and Time for Installation of Modular Kitchen

The main accusations against modular kitchens were that they are very expensive. The table 6 discusses the opinion of the respondents.

Table 6

Cost Incurred and Time taken

Sl. No	Parameters	Specifications	Response (%)
1.	Time taken for installation	Very less (upto2 months)	10
		moderate (6 months)	81
		delayed (up to 1 year)	9
2.	Amount spent for kitchen installation between	Rs.1lakh-Rs.2lakh	33
		Rs.2lakh-Rs.3lakh	24
		Rs.3lakh-Rs.4.lakh	10
		Rs.4lakh-Rs.5lakh	24

In most (81%) of households it took a moderate time i.e. up to 6 months for the installation. The delay occurred was mainly due to the hardship to get the labourers.

Many (33%) of the households have spent up to 2 lakhs for the kitchen installation and an equal percentage (24%) of the households had spent an amount between 2 to 3 or 4 to 5 lakhs for the kitchen installation.

2.11. Satisfaction derived from the installation and use of Modular kitchen

Table 7

Satisfaction derived from the installation and use of Modular kitchen

SI. No	Satisfaction derived	Description
1.	Worthy Decision	Almost all (95%) of the households have the opinion that the decision to install modular kitchen was worthy.
2.	Remedy and relief	Most of (90%) of the households suggested that the modular kitchen is indeed a remedy and relief to them.
3.	Simplified Work	Almost all (95%) of households, modern kitchen has simplified their cooking mode.
4.	Improved and made work easy	The modern kitchen installation had made their life improved and easy for most (95%) of the households.

The results confirmed that all the respondents were satisfied with their Modular Kitchen and considered it a boon in comparison with the Traditional kitchen.

The major advantages found were that

- 1) It was neat and easy to maintain
- 2) Manageable for the busy working woman
- 3) Highly ergonomical, and avoids extreme bending and stretching
- 4) Highly accommodating by providing maximum storage.

2.12. Additional requirements

A few identified the need for Pantry space and some even required more space for traditional utensils.

2.13. Suggestions for improvement of Modular kitchen by the subjects

The quality of local brands is not dependable as they easily broke down or rusted. Many of the existing brands were imported and were beyond the reach of middle income and low-income families.

CONCLUSION

Modular Kitchen is indeed ergonomical as it reduces a lot of bending and stretching by providing much storage spaces. It can be managed easily as it is neat and can be handled efficiently. Time savings, convenience and energy efficiency found to be the main protagonists in the evolution of modern kitchens. The modular kitchen gave more emphasis on work triangle (the easy movement between sink, refrigerator and hob) and intelligent use of light (artificial and natural).

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DIFFICULTIES FACED BY PARENTS OF AUTISTIC CHILDREN

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ABSTRACT

Autism is a neurological disorder characterized by impairments in communication and social development. Raising a child with autism is challenging to most of the parents. Developing self-care skills among them, guarding them from danger and preparing their child for adult life are concerns of the parents with autistic children. Behavioural problems exhibited by these children also cause stress and negative impact on parents. The poor social acceptance and limited support of family members also leads to stress among parents. The study was conducted among mothers of 58 autistic children selected from special schools in Thiruvananthapuram district and a self structured interview schedule was used for the study. Results highlighted that majority of the parents of autistic children faces many challenges and difficulties like imparting discipline and education to their children, training self-care skills, difficulty in travelling with their children, handling their behaviour problems and social isolation. Many of them also have no family support and have financial problems.

Key words: Autism, Self-care skills, Behaviour problems

INTRODUCTION

Autism Spectrum Disorder is a neurological and developmental disorder that begins early in childhood and lasts throughout a person's life. It affects how a person acts and interacts with others, communicates and learns. The condition is highly variable and may be accompanied by certain behavioural features as well as severe learning difficulties. The child with disability has low quality of life but it is very low in autistic children (de Vries & Geurts, 2015). ASD is challenging for both the child and the care taker (Volkmar *et al.*, 2014). Care givers of both normal and autistic children have problems, but it is very high in case of autistic children (Eapen and Guan, 2016).

Behavioural problem and absence of language among autistic children lead to increase in stress level of parents (Pisula, 2007). Regulatory problems like eating, sleeping and emotion regulation are frequently reported in young children with autism which also cause stress and negative impact in parents (Degangi *et al.*, 2000; Dominick *et al.*, 2007). Co-occurring problems like finance, time burden of medical treatment and other therapeutic treatment, restriction in social activities, changes in the family goal and achievement can lead to stress (Lecavalier *et al.*, 2006). If a family has a child with autism, there occur so many problems because of behavioural issues. It has adverse effects on the siblings, marital relationships, family socialization practices and normal family routine (Greeff and Walt, 2010). The poor acceptance of society or other family members and low level of family support leads to parental stress. Chronic sorrow and sense of failure is also exhibited by the parents of autistic children (Kourkoutas *et al.*, 2012). The aim of the present study was to find out the difficulties faced by parents of autistic children and coping strategies used by the parents to overcome the difficulties.

MATERIALS AND METHODS

The area selected for the study was Thiruvananthapuram district. The study was conducted among mothers of 58 autistic children selected from different special schools in Thiruvananthapuram district, by snowball sampling method. Interview method was adopted and a structured interview schedule prepared by the investigator was used to collect adequate and relevant data from the subjects. Data was analyzed to obtain frequency distribution and percentages pertaining to various variables.

RESULTS AND DISCUSSION

Challenges faced by the respondents

The data furnished in Table 1 is regarding the challenges faced by the respondents in raising their autistic children.

Table 1
Challenges faced by the respondents

Challenges	Frequency(N=58)	Percentage%
Feeding the child	17	29
Communication with the child	24	41
Dressing up	27	47
Toilet training	35	60
Travelling with your child	34	59
Brushing up the child	19	33
Imparting discipline	53	91
Educating the child	47	81
Financial problems	30	52

**Multiple responses*

A close perusal of data focused that 91% of the respondents face challenges in imparting discipline among their wards. 81% of them face challenge in imparting education to their children. More than 50% of the respondents face difficulty in travelling with their child and have financial problems. Most of the parents face difficulty in developing self help skills among their children, such as giving toilet training (60%), dressing up (47%) and brushing the teeth (33%). 41% of them face difficulty in communicating with the child.

Social isolation faced by the respondents

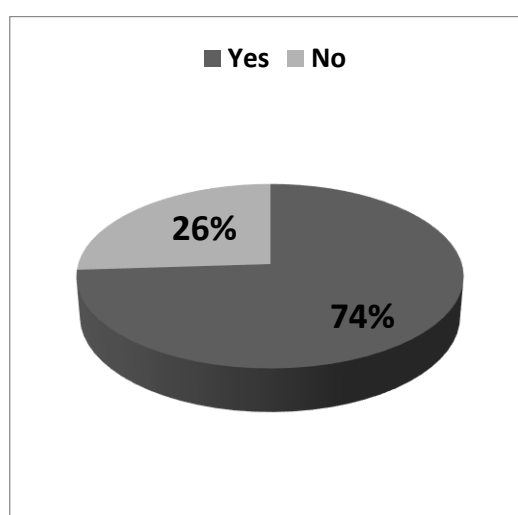


Figure 1
Social isolation

The figure 2 shows the percentage of respondents with autistic children who face social isolation. 74% of the respondents have the opinion that they face social isolation or lack of social connections because of having autistic children in their family.

Behaviour problems of the autistic children

The data provided in Table 2 show the details about the problem behaviour exhibited by the autistic children of the respondents.

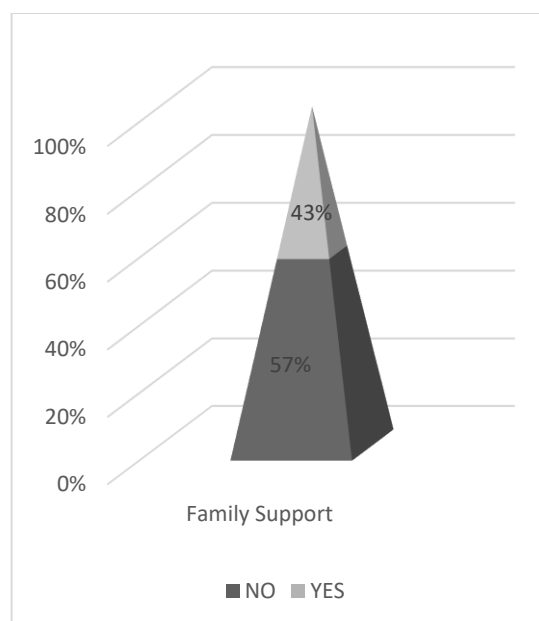
Table 2
Behaviour problems of the autistic children

Behaviour problems	Frequency (N=58)	Percentage %
Affect isolation	53	91
Unrelatedness to others	41	71
Twiddling behaviour	39	67
Inconsistent development continuity	44	76
Self-destructive behaviour	23	40
Temper tantrum	47	81
Anxiety	33	57
Physical incoordination	19	33

**Multiple responses*

It is evident from the data presented in Table 2 that 91% of the autistic children of the respondents exhibit the behaviour of affect isolation, 81% shows temper tantrum, more than 70% of them shows inconsistent development continuity and unrelatedness to others. More than 50 to 60% of the children exhibit twiddling behaviour and anxiety. 40% of them show self-destructive behaviour and 33% has physical incoordination.

Support of the family members

**Figure 2****Support of the family members**

The figure 2 shows the percentage of respondents getting support of their family members for fostering their children. It reveals that 57% of them are not getting the support of their family members for fostering their children.

Support of other social agencies

The data provided in Table 3 show the details about the percentage of respondents getting support from social agencies such as educational institutions and social organizations to overcome the difficulties in raising their autistic children.

Table 3**Support of other social agencies**

Sl. No.	Agency	Frequency (N=58)	Percentage %
1	Special school	6	11%
2	Social organizations	13	22%
3	Both	39	67%

It is evident from the data presented in Table 3 that 67% of the respondents get support from both social organizations and special school for fostering their children. 22% of them get support only from social organizations and 11% get support only from special school.

CONCLUSION

From the findings of the study, it can be concluded that difficulty in imparting discipline and educating the child are the major challenges faced by the parents of autistic children. Most of them also face difficulty in developing self help skills among their children, such as giving toilet training, dressing up and brushing the teeth. Travelling with their children, financial problems, social isolation and not getting enough support from their family members for fostering their children are other challenges faced by them. The parents also find it hard to handle the behaviour problems exhibited by their children such as affect isolation, temper tantrum, inconsistent development continuity and unrelatedness to others. Most of the parents get support from special schools and social organizations to overcome the difficulties in raising their autistic children.

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COMPARISON BETWEEN EARLY AND LATE MARRIAGE

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ABSTRACT

Family is a social unit, where two or more people who have an intimate relationship live together. Love is the essence of a family life, for a better life each member of a family want to support each other. The existence of a family being possible through a marriage as it is a union between two people in all aspects. Early and late marriage is a two types of marriage. Even though the age of both bride and groom is 18 and 21 years respectively, the age accepted by our society is 25-26 for male 22-24 for female. Beyond the common nature the common trend is there either early or late marriage, they seems many causes for that. The sample of 150 were randomly selected. The study shows early marriage is better than late marriage as the education and the career have a definite role in one's life. New generation are very keen for financial security in future.

INTRODUCTION

Family is social group of two or more people who has an intimate relationship, care and share each other. Family has an important role in the future of children .A family is a group of people living under a shelter and it includes father, mother, children and other relations. In a family, unity is strength. Family includes many important functions such as economic, educational, religious and emotional functions. After all family is keystone of the society. Family provides financial security. The family plays a major role in the character formation of an individual and at this same time it is considered as the nucleus of the society.

Marriage is a union between two people, mentally and physically and it is based on cultural, religious and personal factors, it helps to build a social and emotional relationship between two individuals. They want to love and realize each other. Marriage is unavoidable in our life. People have their own views about the pros and cons of early marriage and late marriage. Early and late marriages are two kinds of marriage. The mindset is more important than the age in marriage. Sometimes, early marriages are just because of the environment, culture and social issues in the life of people. In marriage character is more important. Marriage is an inevitable part in our society. The person, who gets married, wants to have their children and their houses. So there is a contrast between early marriage and late marriage. The correct time of male is 25-26 and female is 22-24 there in the age preferred generally for marriage.

Considering the family environment main issues which seen is adjustment problems, because of these reason causes conflict among themselves: Nowadays, early marriage is common in our society. Early marriage is considered as a trend among the new generation.. There are many reasons for young people getting married early. They think that they can achieve more wealth than their parents during that age. Another reason for early marriage is related to pregnancy. Having children at youth is one of the advantages of early marriage.

OBJECTIVES

- To identify the emotional aspects of early and late marriage.
- To find out the common reason for early and late marriage.
- To identify common health issues and different barriers by late and early marriage
- To find out the opinion regarding both early and late marriage.

METHODOLOGY

The study was carried out in Kerala among the early and late married people between the age group of 18-21 years (45 Nos.)for females and 21-25 years (30Nos) for males, above 25 and above for females were in 39 Numbers and above 29 year and above for males . The sample consisted of 150 people between the age group of 16-29 years from urban and rural area .The sample was random sampling. The tool

used to collect information was questionnaire. The collected data was consolidated, calculated and the results were tabulated and analysed

RESULTS AND DISCUSSION

The result of this study was discussed under the following tables discussed below:

General Information

Table 1
Age of respondents

Marriage age	Number of respondents	Percentage
16-21 years females	45	30%
21-25 years males	30	20%
25 and above years females	39	26%
29 and above years males	36	24%

Between the age periods of 16-21, 30% of females respond to this. There are 20% of males respond in the age period 21-25, 26% females in the age of 25 and above and 24% of males respond in the age 29 and above.

Table 2
Working status

Working status	Early marriage (N=75)	Percentage	late marriage (N=75)	Percentage
Working	32	21.3%	34	22.6%
Non-working	24	16%	38	25.3%
Studying	19	12.6%	3	2%

21% of early marriage respondents and 22.6% of late marriage respondents are working people. 16% of early marriage respondents and 25.3% late marriage respondents are non-working and 12.6% of early marriage respondents and 2% late marriage respondents are students. Most of the people are working category.

Table 3
Type of family

Type of family	Number of respondents	Percentage
Joint family	16	10.6%
Nuclear family	134	89.3%

10.6% of respondents live in joint families and 89.3% of respondent's live in Nuclear families. So nuclear families were more in this study.

EMOTIONAL ASPECTS

Table 4
Experience of freedom Before Marriage

Freedom feel before marriage (Early marriage)	Number of respondents (N=75)	Percentage
Yes	52	34.6%
No	23	15.3%
Freedom before (late marriage)		
Yes	30	20%
No	45	30%

34.6% of respondents experienced freedom before early marriage and 15.3% respondents have not experienced the same. Considering late marriage, around 20% of the respondents experienced freedom before late marriage and 30% of the respondents had not experienced it.

Table 5

Stress level before and after among early and late marriage sample

Stress before marriage (early marriage)	Number of respondents (N=75)	Percentage
Normal	68	45.3%
High	7	4.6%
Very high	-	-
Low	-	-
Very low	-	-
Stress before (late marriage)		
Normal	65	43.3%
High	10	6.6%
Very high	-	-
Low	-	-
Very low	-	-
Stress after marriage (early marriage)		
Normal	68	45.3%
High	9	6%
Very high	-	-
Low	-	-
Very low	-	-
Stress after marriage (late marriage)		
Normal	72	48%
High	3	2%
Very high	-	-
Low	-	-
Very low	-	-

45.3% of respondents had normal level of stress before early marriage and 43.3% of respondents had normal level of stress before late marriage. 4.6% of respondents had high level of stress before early marriage and 6.6% respondents experienced high level of stress before late marriage. 45.3% of respondents experienced normal level of stress after early marriage and 48% of respondent had normal level of stress level after late marriage. 6% of people had high level of stress after early marriage and 2% of people had high level of stress after late marriage. Most of the people have normal stress level before and after marriage.

Table 6
Loneliness before marriage and after marriage

Loneliness before early marriage	Number of respondents(no:75)	Percentage of respondents
Yes	6	4%
No	45	30%
Sometimes	24	16%
Loneliness before late marriage		
Yes	8	5.3%
No	52	34.6%
Some times	15	10%
Loneliness after early marriage		
Yes	7	4.6%
No	54	36%
Some times	14	9.3%
Loneliness after late marriage		
Yes	12	8%
No	48	32%
Sometimes	15	10%

From the above table it is clear that 4% of respondents have experienced loneliness before early marriage and 5.3% of respondents have experienced loneliness before late marriage. 30% of early marriage couples does not experience loneliness before marriage and 34.6% late marriage couples does not experience loneliness before marriage. 16% of sample feel loneliness at sometimes before early marriage and 10% of respondents feel loneliness before late marriage. So, most of the people don't experience loneliness before marriage. 4.6% of respondents have experienced loneliness after early marriage and 8% of respondents after late marriage have experienced loneliness. 36% of people do not experienced loneliness after early marriage and 32% of do not experienced loneliness after late marriage. 9.3% of respondents experience loneliness at sometimes after early marriage and 10% of respondent experience loneliness after late marriage. From this, we can prove that most of the people don't experience loneliness after marriage.

Common Health Problems

Table 7

Health problems before marriage

Health problems	Early marriage (N=75)	Percentage of respondents	Late marriage (N=75)	Percentage of respondents
Yes	17	11.3%	30	20%
No	58	38.6%	45	30%

If yes,

Health problems	Early marriage (N=75)	Percentage of respondents	Late marriage (N=75)	Percentage of respondents
Sleeplessness	7	4.6%	12	8%
Back pain	5	3.3%	8	5.3%
Diabetics	3	2%	4	2.6%
Any other	2	1.3%	6	4%

31.3% of respondents have health problems before marriage. 68.6% of respondents doesn't have health problems before marriage. Out of the sample those who have the health problems 11.3% of respondents affected health problems. 4.6% of respondents of early marriage couples and 8% of late marriage couples affected by sleeplessness. 3.3% of early marriage couples and 5.3% of late marriage couples affected by back pain and 2% of early marriage respondents and 2.6% of late marriage respondents affected by diabetics. 1.3% of early marriage respondents and 4% of late marriage couples affected by other health problems before marriage.

Table 8
Health problems after marriage

Health problem	Early marriage (N=75)	Percentage of respondents	Late marriage (N=75)	Percentage of respondents
Yes	28	18.6%	45	30%
No	47	31.3%	30	20%

If yes,

Health problems	Early marriage (N=75)	Percentage of respondents	Late marriage (N=75)	Percentage of respondents
Sleeplessness	6	4%	10	6.6%
Back pain	8	5.3%	12	8%
Diabetics	5	3.3%	17	11.3%
Any other	9	6%	6	4%

48.6% of respondents has experienced health problems after marriage. 51.3% of people doesn't have health problems after marriage. 4% of early marriage respondents and 6.6% of late marriage respondents affected by sleeplessness, 5.3% of early marriage respondents and 8% of late marriage respondents affected by back pain, 3.3% of early marriage respondents and 11.3% of late marriage respondents were affected by diabetics, 6% of early marriage respondents and 4% of late marriage respondents were affected by other problems after marriage.

Experience of different barriers by marriage

Table 9

Experience of any barrier in educational status by marriage

Consequences in education by marriage	Early marriage (N=75)	Percentage	Late marriage (N=75)	Percentage
Yes	21	14%	48	32%
No	54	36%	27	18%

14% of early marriage respondents and 32% of late marriage respondents experienced barrier in their education by marriage. 36% of early marriage respondents and 18% of late marriage respondents do not experienced any barrier in their educational status. So, most of the people were not affected by problems in education by marriage.

Table 10

Experience of barrier in working sector by marriage

Consequences in work by marriage	Early marriage (N=75)	Percentage	Late marriage (N=75)	Percentage
Yes	16	10.6%	13	8.6%
No	59	39.3%	62	41.3%

10.6% of early marriage and 8.6% of late marriage respondents experienced barrier in their work by marriage. 39.3% early marriage and 41.3% of late marriage respondents do not experienced any barrier in their work. So, most of the people, marriage don't create any problem in their working sector.

Reason to get married

Table 11

Reason to get married

Reasons	Early marriage (N=75)	Percentage	Late marriage (N=75)	Percentage
Obedience	28	18.6%	27	18%
Willingness	37	24.6%	32	21.3%
Forcefully	10	6.6%	16	10.6%

Obedience is the reason for 18.6% of early marriage respondents and 18 % of respondents to get married. Willingness is the reason for 24.6% of early marriage respondents and 21.3% of late marriage respondents .6.6% of early marriage respondents and 10.6% of late marriage respondents were forcefully married.

Table 12
Emotional support in married life

Supporting factor	Early marriage (N=75)	Percentage	Late marriage (N=75)	Percentage
Family	6	4%	3	2%
Partner	60	40%	69	46%
Friends	9	6%	3	2%

From above table it is clear that 4% of early marriage respondents and 2% of late marriage respondents had the supporting factor in their married life is family. Partner is the emotional support for 40% of early marriage and 46% of late marriage respondents. 6% of early marriage respondents emotional support is friends and 2% of late marriage respondents emotional support is friends. So partner is the supporting factor of most people

Table 13
Opinion of couples about appropriate age to a girl/boy for marriage

Acceptance of Appropriate age	Frequency	Percentage
Yes	90	60%
No	60	40%

If yes Opinion regarding age for marriage

Appropriate age	Number of respondents	Percentage of respondents
16-21	38	25.3%
21-25	20	13.3%
25 and above	19	12.6%
29 and above	13	8.6%

According to 60% respondents, there is a perfect age for marriage. 40% of people disagree with this. The sub table below describe that 25.3% of people from the agreed sample (60%) says that 16-21 is the perfect age for marriage. 21-25 is the

appropriate age for marriage to 13.3% of respondents. 25 and above is the perfect age for marriage in 12.6% of respondents and 29 and above is 8.6%.

Table 14
Opinion about early and late marriage

Goodness of early and late marriage	Number of respondents	Percentage of respondents
Early marriage	80	53.3%
Late marriage	70	46.6%

53.3% of respondents agree with early marriage and 46.6% of respondents agree with late marriage. So early marriage is more preferred.

If early marriage,

Reason for early marriage	Number of respondents	Percentage of respondents
For early settlement	69	46%
Any other	11	7.3%

The above table reveal that 53.3% of respondents, early settlements is the reason for early marriage to 46% of respondents and 7.3% of people have other reasons.

If late marriage,

Reason for late marriage	Number of respondents	Percentage of respondents
Maturity to take decision	66	44%
Any other	4	2.6%

In late marriage group, around 44% of respondents the reason for late marriage was maturity and 2.6% of people had other reasons.

Importance of education in married life

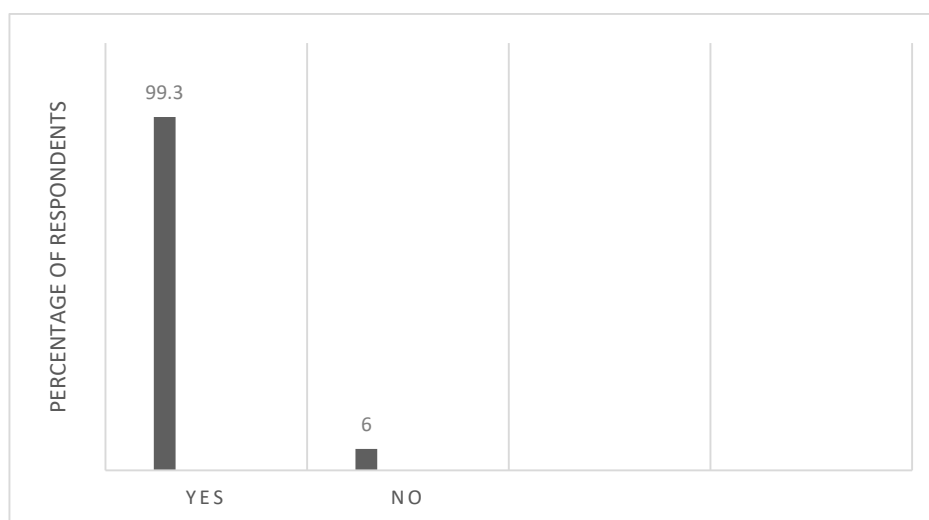


Figure 1

Importance of education

From figure 1 it is clear that education has a vital role in marriage but for 6% people, it is not much important.

Table 15

Willingness to work after marriage

Willingness to work	Number of respondents	Percentage of respondents
Yes	135	90%
No	15	10%

90% of respondents are willing to work after marriage and 10% of respondents don't want to work after marriage.

CONCLUSION

This study concludes that age is one of the basic factor for getting marriage, and at the same time the generation considers education and career have equal importance in one's life. Considering the factor freedom the respondent who marry in early age experiencing more freedom. Stress level in both groups seems almost similar not having more changes. Late marriage group suffer more health issues than other group of sample. Even though all considering education as an important factor, it was one of the barrier they face during their life after marriage. The most common reasons to get marry

was willingness for both group followed by reason obedience, only a few was done forcefully. The study was concluded that early marriage is better than late marriage

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BREAKFAST CONSUMPTION PATTERN OF WORKING WOMEN COMPARED TO HOUSEWIVES IN ALAPPUZHA

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ABSTRACT

The purpose of the study was to investigate the breakfast consumption pattern of working women to housewives, and its correlation to adolescent eating habits. Breakfast skipping is considered as a public health issue among adults worldwide. Breakfast is a critical meal because it influences practically every dimension of our being including how we perform physically and mentally. The samples were selected from Alappuzha district by random sampling. Anthropometric measurements, breakfast consumption pattern and its correlation to adolescent eating habits of working women were compared to housewives. 12% of working women and 16% of housewives were irregular in breakfast consumption pattern. Dietary diversity was found to be poor in breakfast intake among housewives and working women. Adolescent breakfast consumption pattern influenced the adult breakfast consumption pattern.

Key words: Breakfast, Consumption Pattern, Working Women, Housewives, BMI, mutual supplementation

INTRODUCTION

Breakfast is the first meal of a day, most often eaten in the early morning before undertaking the day's work. With breakfast commonly referred to as "the most important meal of the day", particularly for children, some epidemiological research indicates that having a breakfast might lower risk of metabolic disorders and cardiovascular diseases. Current professional opinions are largely in favor of eating breakfast (Maki , Phillips-Eakley , Smith , 2016). Unhealthy dietary pattern increases the risk of obesity and metabolic disorders in growing children and adolescents. Infrequent breakfast consumption is associated with higher body adiposity and abdominal obesity. Adult women are responsible for the health of a whole family. They should take care of themselves for a better society and maintaining good quality of life.

Breakfast, indeed the first meal immediately raises the energy level of the body, increasing vigor and vitality. It reduces blood cortisol levels and helps control appetite, which over the long-term, can produce significant impact on body composition. Breakfast also increases cognitive function and the ability to concentrate and skipping breakfast during early years may be the reason for increasing incidence of metabolic syndrome during later adult years. With this study we are trying to know much about the breakfast consumption pattern among adult women and the relation to adolescent breakfast pattern. The breakfast consumption pattern among working women and housewives and the factors influencing health problems may vary due to difference in working situation and financial status. In this context we undertook the study **“Breakfast consumption pattern of working women compared to housewives in Alappuzha”** with the following objectives:

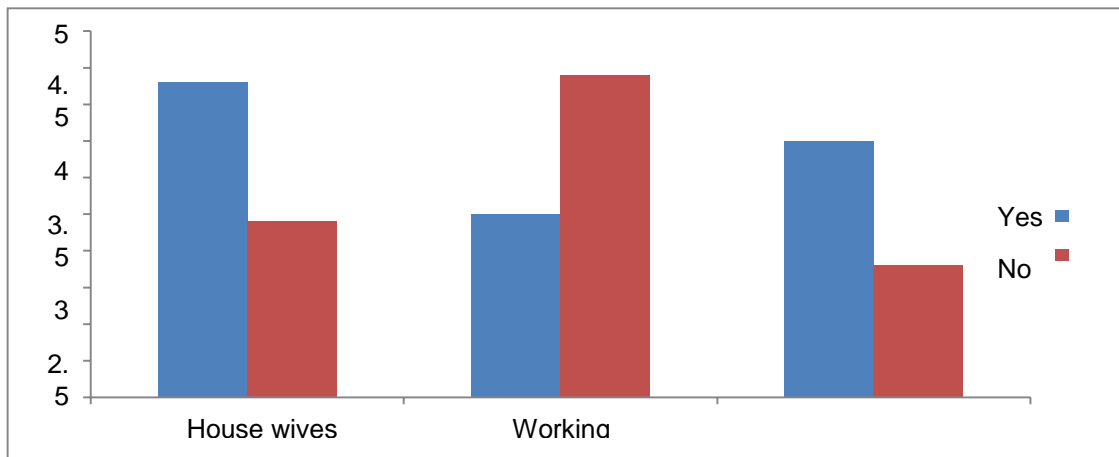
OBJECTIVES

- To compare the breakfast consumption pattern in working women and housewives
- To analyze the correlation of adult breakfast consumption pattern to their adolescent consumption pattern

MATERIALS & METHODS

The areas selected for the study were Punnapra, Kattakuzy and Cherthala in Alappuzha district. The samples selected for the study was 50 adult women of age group 30- 40 years.25 working women and 25 housewives by random sampling. Using pre tested Questionnaire information on types of breakfast items, the time, place, and the influence of adolescent breakfast eating pattern on adult eating pattern was collected. Food frequency of breakfast items viz cereals, pulses, vegetables, leafy vegetables, roots and tubers, beverages and fruits consumed was recorded to find out the frequency of its intake of food items daily, weekly, monthly and occasionally versus junk foods viz noodles, refined foods, bakery foods and processed foods. Height and weight were measured in triplicate according to the procedures proposed by the WHO(2000). BMI was calculated as body weight (in kilograms) divided by the square of height (in metres). The WHO reference was used to determine weight status in adults: underweight (BMI < 18.5 kg/m²), normal weight (BMI = 18.5–24.99 kg/m²), overweight (BMI = 25.0–29.99 kg/m²) and obesity (BMI ≥ 30.0 kg/m²). The data collected were tabulated and analyzed. Percentage analysis was carried out to find the differences in breakfast consumption pattern among housewives and working women.

RESULTS AND DISCUSSION



N=50

Figure 1
Regularity of breakfast consumption

From Figure 1 it is inferred that 16% of housewives were irregular in breakfast consumption and 84% were regular in breakfast consumption. In case of working women only 12% were irregular in breakfast consumption and 88% had regular breakfast consumption. In short breakfast skipping was more and erratic among housewives compared to working women which may be due to the low awareness of breakfast consumption on health among housewives. As years of education go up, breakfast-skipping appears to go down, according to an analysis of CSFII 1994-1996 data. Nineteen percent of adults with an educational level below 12th grade skipped breakfast, compared to 15 percent of those with a college degree (Siega-Riz *et al*, 2000). Breakfast skipping can be improved with nutrition knowledge Matsumoto, *et al* (2019).

Table 1
Types of breakfast preferred (N=50)

Types of breakfast preferred	Fermented		Non fermented		Both		Junk food	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
House wives	5	20%	7	28%	10	40%	3	12%
Working women	6	24%	9	36%	6	24%	4	16%

Table 1 depicts that 20% housewives consumed fermented food items whereas 28% preferred non-fermented foods. 10% housewives preferred both fermented and non fermented foods.

Only 12% housewives preferred junk foods whereas 16% working women preferred junk foods. In case of working women, 24% preferred fermented foods and 36% preferred non-fermented foods. 24% preferred both fermented and non -fermented foods and 16% preferred junk

Table 2
Mutual supplementation in breakfast

Incorporation of pulses and cereals in breakfast	Yes		No	
	Number	Percentage	Number	Percentage
House wives	5	(20%)	20	(80%)
Working women	1	(4%)	24	(96%)

N=50

From Table 2 it is inferred that only 20% of housewives incorporated pulses and cereals in breakfast and only 4% working women followed mutual supplementation for breakfast. It was found that majority (96%) of working women and 80% of housewives were not aware of importance of mutual supplementation. Several studies have reported that people with higher nutrition knowledge level practice better dietary behaviors such as higher consumption of vegetables, fruits, fiber and micronutrients and less fat than those with lower nutrition knowledge level Dickson-Spillmann & Siegrist (2011)

Table 3
Preference of iron rich foods in breakfast

Iron rich food Intake (N=50)	Yes		No	
	Number	Percentage	Number	Percentage
House wives	5	(20%)	20	(80%)
Working women	1	(4%)	24	(96%)

From table 3 it is inferred that only 20% of house wives and 4% working women included iron rich foods in their breakfast. Majority of working women (96%) and 80% of housewives not incorporated iron rich foods in their breakfast.

Table 4
Vegetable intake in breakfast meal

Vegetable Intake	Yes		No	
	Number	Percentage	Number	Percentage
House wives	10	40%	15	60%
Working women	21	84%	4	16%

Table 4 shows that 84% of working women included vegetables in their breakfast and 40% house wives had vegetables in their breakfast recipe. Majority (60%) of house wives not included vegetables in their menu. The WHO (2015) defined a poor diet as one with low consumption of fruits and vegetables, legumes and whole grains, and with high intakes of saturated fats, sodium and added sugars.

Table 5
Types of beverage consumed during breakfast

Beverage consumption (N=50)	Tea		Coffee		Milk		Juice		Water	
	No.*	%	No.	%	No.	%	No.	%	No.	%
House wives	15	60%	4	16%	3	12%	1	4%	2	8%
Working women	10	48%	8	32%	4	16%	1	4%	1	10%

No-Number*

Table 5 points that 60% of housewives preferred beverages like tea, 16% preferred coffee, 12% milk, 4% juice and 8% water. In the case of working women 48% preferred tea, 32% coffee, 16% milk, 4% juice and 10% water. Among both housewives and working women tea was preferred over coffee, milk and juices.

Table 6
Place of intake of breakfast

Place of eating breakfast	Bus		Home		Office		Food stall		Car	
	No.	%	No.	%	No.	%	No.	%	No.	%
House wives	0	0	25	100	0	0	0	0	0	0
Working women	2	8%	10	40	11	44%	2	8%	0	0

No-Num*

Table 6 depicts that all housewives ate breakfast at home. In the case of working women 8% ate at bus, 40% at home, 44% at office and 8% at food stall. Results indicate that only 40% of working women ate breakfast at home. The intake of food from outlets were less among both housewives and working women indicating their awareness on junk foods and lack of time. The habit of eating food from outside has increased tremendously irrespective of gender, education, profession, income etc. This routine habit will lead to a deadly and nutrients deficiency diseases like non communicable diseases, obesity among men and women, increased number of heart diseases because of the consumption of fatty and junk foods, deep fried items by reusing the oils may lead to cancerous diseases. Taking food from outside may even lead to premature hypertension, lipid and diabetic problems in early stage of life Ambily (2019).

Table 7
Timing of eating breakfast

Timing of breakfast N=50	6-8 am		8-10 am		10-12pm	
	No.	%	No.	%	No.	%
House wives	6	24%	14	56%	5	20%
Working women	5	20%	17	68%	3	12%

Table 7 reveals that 24% of house wives ate breakfast at the time interval of 6-8 am, 56% at time interval of 8-10 am, and 20% at the time interval of 10-12pm. In the case of working women, 20% ate at the time interval of 6-8am, 68% at the time interval of 8-10 am and 12% of working women at the time interval of 10-12 pm. 8- 10 am was found to be the convenient time for having breakfast both for working women and housewives.

Table 8
BMI status

BMI	Normal		Under weight		Over weight		Obese	
	No.	%	No.	%	No.	%	No.	%
House wives	15	60%	4	16%	3	12%	3	12%
Working women	16	64%	1	4%	6	24%	2	8%

Table 8 indicates the BMI of both working and house wives. Among house wives

60% were normal, 16% underweight, 12% overweight and 12% were obese. Among working women 64% were normal, 4% underweight, 24% overweight and only 8% were obese. Obesity was profound among housewives which may be due to consumption of leftover food and lack of exercise. Moreover most of them were following the adolescent breakfast consumption pattern. A pilot study on the BMI status of working and non-working mothers found that skipping breakfast was a common habit among the working mothers. Also frequency of consumption of fast-foods with higher caloric and fat content was significantly more among the working mothers as compared to non-working mothers (Hetal Damania, 2014).

Table 9
Factors affecting skipping of breakfast

Factors affecting skipping of breakfast (N=50)	Don't like		Not feeling hungry		Munching		Snacking		Don't have time	
	No.	%	No.	%	No.	%	No.	%	No.	%
House wives	0	0	0	0	0	0	0	0	4	14
Working women	0	0	0	0	0	0	3	12	0	0

Table 9 points that 14% housewives do not find time for eating breakfast due to continuous household duties. In the case of working women 12% skipped breakfast due to snacking. Factors associated with breakfast skipping among urban adults were habit, work pressure, lack of awareness and unable to prepare.

Table 10
Breakfast consumption pattern during adolescence

Following same food pattern as that of adolescence	Yes		No	
	Number	Percentage	Number	Percentage
House wives	6	24%	19	76%
Working women	10	40%	15	60%

Table 10 shows that 24% of housewives followed same food pattern followed during adolescence and 76% were not following this. In the case of working women 40% were following same food pattern they were following during adolescence whereas 60% were not having diet followed during adolescence. Among housewives majority (76%) were not following same food

pattern as that of adolescence. 72% of housewives and working women skipped breakfast in adolescence age. Majority were having erratic dietary pattern during adolescence and following adolescent consumption pattern during adulthood was found to be reason for increased BMI due to less energy expenditure.

CONCLUSION

Breakfast skipping was more and erratic among housewives compared to working women which may be due to the low awareness of health benefits of breakfast consumption among housewives. Working women were having more junk foods due to travel as part of job. Adolescent breakfast consumption pattern influenced the adult breakfast consumption pattern. To conclude breakfast skipping may be improved by nutrition knowledge.

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CALCULATION OF PROTON AFFINITY OF AMINO ACIDS USING COMPUTATIONAL CHEMISTRY METHODS

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INTRODUCTION

Amino acids are a group of important biomolecules that contains two functional group included both amino group, carboxylate group and a side chain. so amino acids in hundreds of different side chains have been identified or synthesized in nature and only 20 amino acids are used for building blocks of proteins. There are 20 different amino acids normally occur in proteins, by enzyme reactions such as phosphorylation methylation, and acetylation and important part as an intermediate in a biosynthetic pathway. Amino acids can be divided into three groups and it included essential amino acids, nonessential amino acids and conditional amino acids.

Protonation or de protonation of protein amino acid residues is one of the most fundamental process in most of the bio-chemical ractions.it is a crucible step in many chemical rearrangements and in most enzymatic reactions. The tendency of a molecule to accept a proton in the reaction has long been of interest to chemists. Proton affinity (PA) is the most important properties playing a crucible role in a number of biological reactions. Knowledge of these properties provide important information about the participation of these molecules in proton transfer reactions.

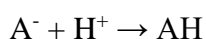
The specific function of an enzyme requires polar amino acid side chain as key reactant at the active site or as mediators in the transport molecular channels. For example, a proton may be transported through a predominately non polar channel of an enzyme via hydrogen bonded networks formed by polar amino acid side chains and water molecules. The protonation state of amino acid chain in all these cases turns out to a crucible factor in determining the mechanism. However, in presence of several amino acid side chain with suitable protonation states, several competing pathways may

appear reasonable and their relative efficiencies in the overall mechanism need to be evaluated. For any such evaluation, it may be required to compare relevant reactivity parameters of competing side chains when present, for example, confined within a buried active site as being opposed to the bulk solvent.

Proton affinity is widely studied in order to elucidate the relationship between structure and function of organic molecules. Most of the organic reactions taking place in solution phase. It is therefore of importance to understand the variation of proton affinity not only in the gas phase. Proton affinity is one of the parameters that give information about the mechanism of latter reactions.

Experimental determination of proton affinity is not a preferable method as it involves the calculation of properties in the molecular level. With the phenomenal growth in computer power in recent years, much attention has been given to the possibility of calculating the proton affinity by computational chemistry methods. The recent progress in density functional theory (DFT) approaches make this method for reliable calculation of proton affinities. This field prompted used to analyze and its performance on a few representative molecules spanning a wide range of proton affinity values. It was found that DFT methods used in conjunction with 6-31TG-(d,p) basis sets provide accurate proton affinity values within about one Kcal/mol of the experimental results. In the current project focused on the proton affinity of seventeen amino acids.

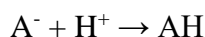
Proton affinity is the heat associated with reverse chemical process with the removal of the proton, which has a positive enthalpy. Proton affinity of an anion in an atom or molecule is the negative of the enthalpy change in the reaction between the given atoms or molecule and proton in the gas phase. Proton affinity is the measure of acidity of a molecule, so it reflects the thermodynamic gradient between a molecule and the anionic form of the molecule upon removal of a proton from it. The higher the proton affinity, formed base will be strong and conjugate acid will be weak in the gas phase. The reaction for proton affinity is given below



The proton affinity of A^- is defined as the negative of the enthalpy of the change of the process, and the gas phase basicity of A^- is defined as the negative of the Gibbs free energy change in the reaction. Is the conjugate base associated with acid AH.

The Proton transfer reactions are great importance in chemistry and biomolecular processes of living organisms. The latter include most enzymatically catalyzed reactions, like ATP hydrolysis /synthesis.

The deprotonation of a given chemical compound can be represented as



A measure of the probability of a chemical group to be protonated /deprotonated is given by pK_a value and pK_a value of a protonable atom depends on its molecular environment. It is possible to measure pK_a value experimentally, but proton affinity is hard to determine experimentally.

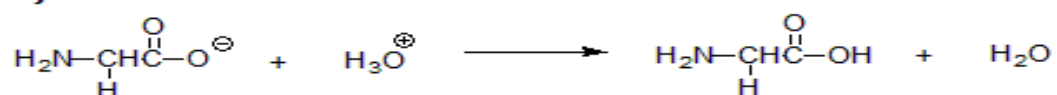
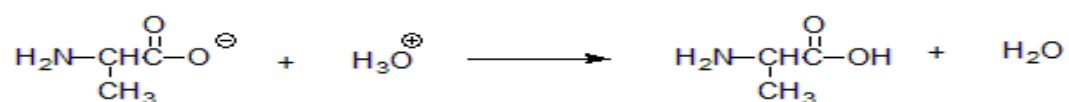
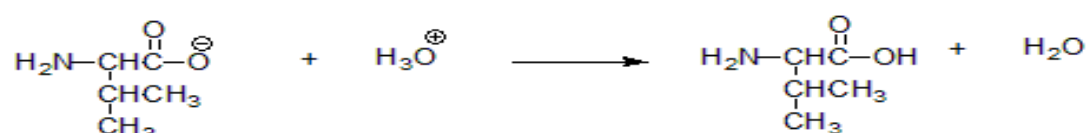
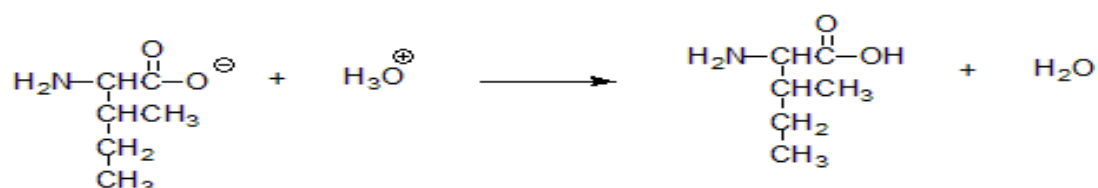
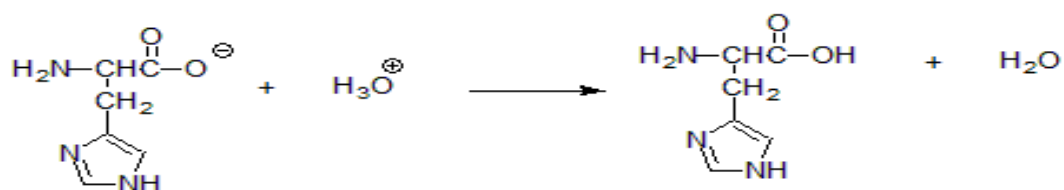
Quantum chemistry method has been used to calculate the gaseous proton affinities values of common organic compounds by using an isodesmic reaction. An isodesmic reaction is a chemical reaction with take place the type of chemical bonds broken in the reactant are the same as the type of bonds formed in the reaction product. This type of reaction is sometimes used as a hypothetical reaction in thermochemistry. This isodesmic reactions having no unusual bonding can be used for the determination of proton affinities. In the isodesmic concept, a reaction is select with the same of number of chemical bonds of each formal type on both sides of the reaction. The isodesmic reactions used for the calculation of proton affinities of amino acids using total energies and zero-point energies are determined.

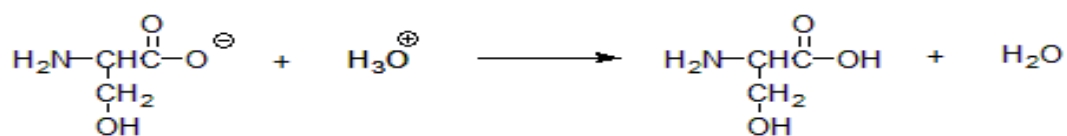
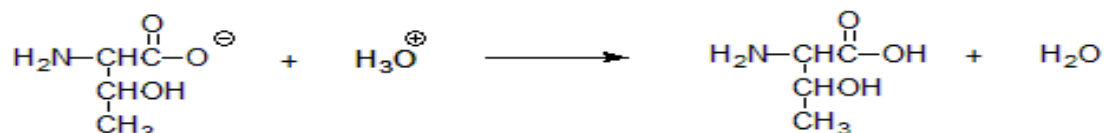
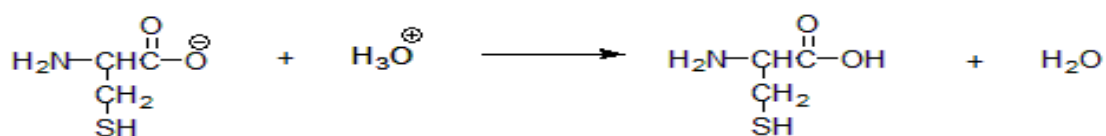
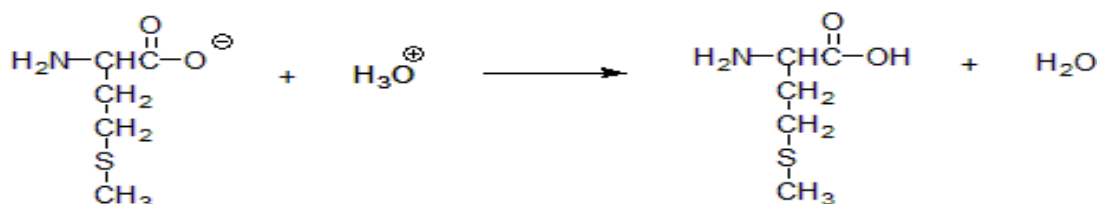
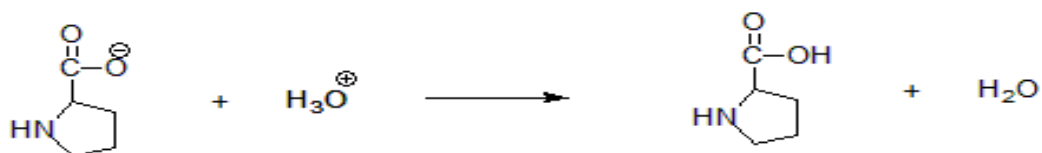
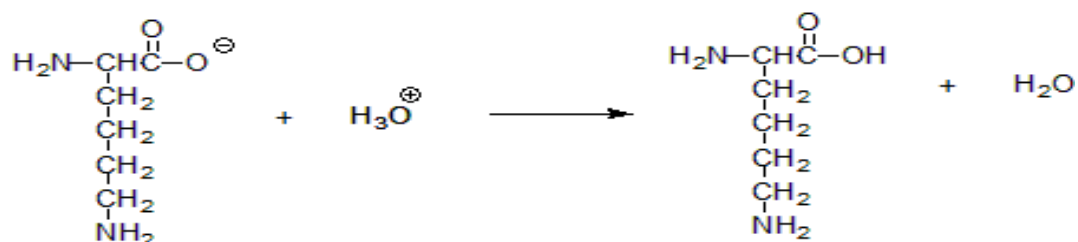
METHOD

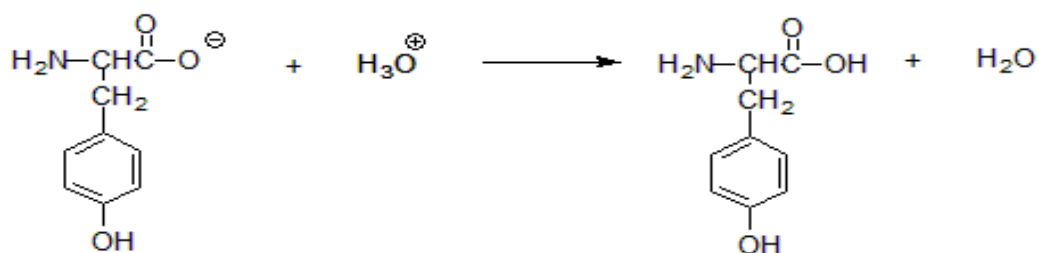
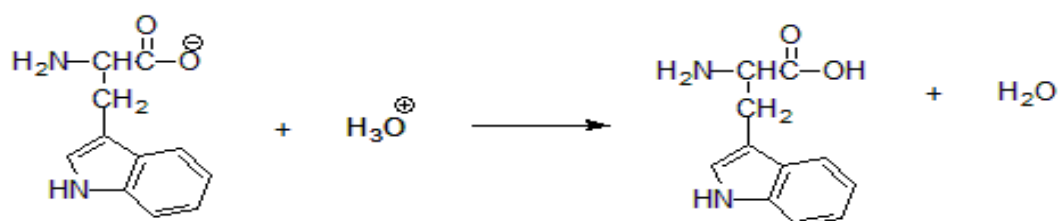
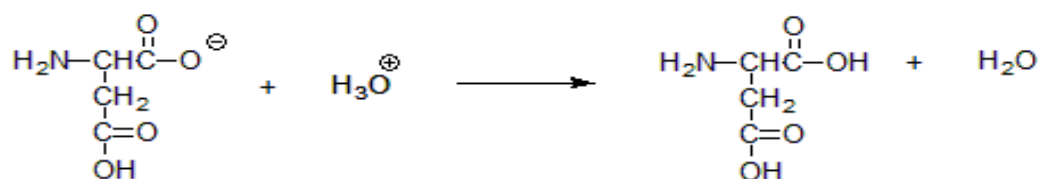
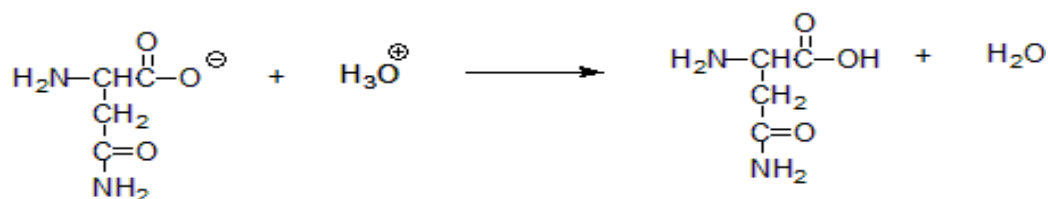
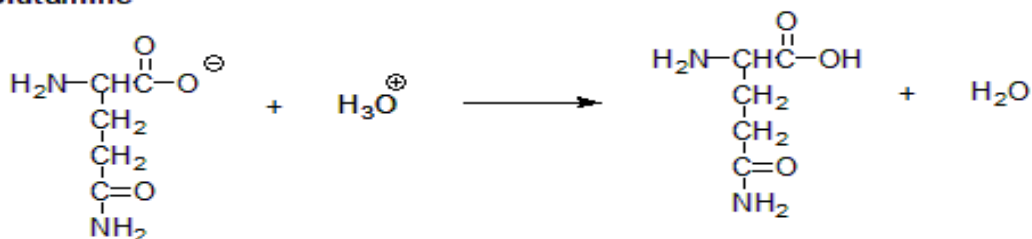
The current work focused on the investigation of proton affinities of functional groups present in amino acids such as alanine, glycine, valine, leucine, isoleucine, serine, threonine, cysteine, methionine, proline, tyrosine, tryptophan, aspartic acid, asparagine, glutamine, histidine and lysine using free software using GAMESS, Avogadro, Facio and Firefly. In this project we have employed an advanced computational quantum chemistry method and it is called density functional (DFT) method which is in conjugation with 6-31G(d,p) basis set to calculate total energy and zero point energy of the amino acids to find proton affinity. In particular we have studied in detail total energy and zero-point energy of the alanine, glycine, valine, leucine. isoleucine, serine, threonine, cysteine, methionine, proline, tyrosine,

tryptophan, aspartic acid, asparagine, glutamine, histidine and lysine amino acids, proton affinity of the above amino acids and analysis of computational data in comparison with experimental data. It is performed with the energy calculations of these amino acids using DFT-B3LYP functional in conjugation with 6-31g(d, p) basis set. Then their zero-point energies using the same method and proton affinity is calculated using the isodesmic reactions. These values are compared with the reported experimental values. The calculated values are more or less equal to the experimental values even though some variations are observed.

Isodesmic reactions for calculation of proton affinities using total energies and zero-point energy of amino acid are given below;

Glycine**Alanine****Valine****Leucine****Isoleucine****Histidine**

Serine**Threonine****Cysteine****Methionine****Proline****Lysine**

Tyrosine**Tryptophan****Aspartic Acid****Asparagine****Glutamine**

The total energies are defined as the energy difference between reactants and products. (sum of energies of products)- (sum of energies of reactants).

The zero-point energies are defined as the zero-point energy difference between reactants and product. i.e. (sum of zero-point energies of products)- (sum of zero-point energies of reactants)

For example, to calculate the proton affinity of Aspartic acid, first generate the structure of aspartic acid using Avogadro software and optimize the structure and generate GAMESS input. Then generate the Cartesian coordinates using facio software. Energy calculations are done by Firefly. Zero-point energy calculated for all the moieties. Similarly, we can find out the total energy and zero-point energy of alanine, glycine, valine, leucine, isoleucine, serine, threonine, cysteine, methionine, proline, tyrosine, tryptophan, asparagine, glutamine, histidine, lysine and its anions. Values of water and hydronium ion are same in all.

RESULTS AND DISCUSSION

In this area discussed the results of computational calculations outlined above. The total energies of each reaction and zero-point energies are noted and the enthalpy of reaction and proton affinity are calculated using appropriate equations. The results are contrast with experimental data.

Proton affinity of Amino Acids

Proton affinity of base = $(-\Delta H)$ protonation

$$\Delta H = \Delta E + (\Delta ZPVE)$$

ZPVE is the zero-point energy

Calculation of Total energy

Aminoacid	E(BH) (Hartree units)	E (H ₂ O) (Hartree units)	E(BH+H ₂ O) (Hartree units)	E(B ⁻) (Hartree units)	E(H ₃ O ⁺) (Hartree units)	E(B ⁻ +H ₃ O ⁺) (Hartree units)	ΔE (Hartree units)
Alanine	-323.7546	-76.4197	-400.1743	-323.1815	-76.7056	-399.8871	-0.2872
Glycine	-284.4348	-76.4197	-360.8545	-283.8601	-76.7056	-360.5657	-0.2888
Valine	-402.3866	-76.4197	-478.8063	-401.8167	-76.7056	-478.5223	-0.284

Leucine	-441.7032	-76.4197	-518.1229	-441.1328	-76.7056	-517.8384	-0.2845
Isoleucine	-441.7013	-76.4197	-518.121	-441.1324	-76.7056	-517.838	-0.283
Serine	-398.9627	-76.4197	-475.3824	-398.4138	-76.7056	-475.1194	-0.263
Threonine	-438.2906	-76.4197	-514.7103	-437.7287	-76.7056	-514.4343	-0.276
Cysteine	-721.9334	-76.4197	-798.3531	-721.3812	-76.7056	-798.0868	-0.2663
Methionine	-800.5744	-76.4197	-876.9941	-800.0072	-76.7056	-876.7128	-0.2813
Proline	-401.1701	-76.4197	-477.5898	-400.5990	-76.7056	-477.3046	-0.2852
Tyrosine	-630.0319	-76.4197	-706.4516	-629.4652	-76.7056	-706.1708	-0.2808
Tryptophan	-686.3844	-76.4197	-762.8041	-686.8114	-76.7056	-762.517	-0.2871
Aspartic Acid	-512.3241	-76.4197	-588.7438	-511.7609	-76.7056	-588.4665	-0.2773
Asparagine	-492.4583	-76.4197	-568.878	-491.9114	-76.7056	-568.617	-0.261
Glutamine	-531.7715	-76.4197	-608.1912	-531.2039	-76.7056	-607.9095	-0.2817
Histidine	-548.7525	-76.4197	-625.1722	-548.2303	-76.7056	-624.9359	-0.2363
Lysine	-497.0512	-76.4197	-573.4709	-496.4779	-76.7056	-573.1835	-0.2874

Calculation of Zero-point energy

Aminoacid	Z(BH) (Hartree units)	Z (H ₂ O) (Hartree units)	Z(BH+ H ₂ O) (Hartree units)	Z(B ⁻) (Hartree units)	Z(H ₃ O ⁺) (Hartree units)	Z(B ⁻ +H ₃ O ⁺) (Hartree units)	ΔZ (Hartree units)
Alanine	0.1083	0.0212	0.1295	0.0948	0.0342	0.129	0.0005
Glycine	0.0798	0.0212	0.101	0.0664	0.0342	0.1006	0.0004
Valine	0.1648	0.0212	0.186	0.1513	0.0342	0.1855	0.0005
Leucine	0.1934	0.0212	0.2146	0.1798	0.0342	0.214	0.0006

Isoleucine	0.1934	0.0212	0.2146	0.1799	0.0342	0.2141	0.0005
Serine	0.1134	0.0212	0.1346	0.1007	0.0342	0.1349	0.0003
Threonine	0.1417	0.0212	0.1629	0.1285	0.0342	0.1627	0.0002
Cysteine	0.1078	0.0212	0.129	0.0950	0.0342	0.1292	0.0002
Methionine	0.1665	0.0212	0.1877	0.1530	0.0342	0.1872	0.0005
Proline	0.1456	0.0212	0.1668	0.1319	0.0342	0.1661	0.0007
Tyrosine	0.1939	0.0212	0.2151	0.1807	0.0342	0.2149	0.0002
Tryptophan	0.2193	0.0212	0.2405	0.2053	0.0342	0.2395	0.0001
Aspartic Acid	0.1241	0.0212	0.1453	0.1106	0.0342	0.1448	0.0005
Asparagine	0.1360	0.0212	0.1572	0.1238	0.0342	0.1574	0.0002
Glutamine	0.1638	0.0212	0.185	0.1503	0.0342	0.1845	0.0005
Histidine	0.1609	0.0212	0.1821	0.1481	0.0342	0.1823	0.0002
Lysine	0.2120	0.0212	0.2332	0.1983	0.0342	0.2325	0.0007

Proton affinity is calculated as follows

Aminoacid	ΔH (Hartree units)	PA= (H \times 627.509) Kcal/mol)	Experimental value (Kcal/mol)
Alanine	-0.2867	179.9	215.5
Glycine	-0.2884	180.9	211.8
Valine	-0.2835	177.9	217.6
Leucine	-0.2839	178.2	218.6
Isoleucine	-0.2825	177.3	219.3
Serine	-0.2633	165.2	218.6
Threonine	-0.2758	173.1	220.5
Cystein	-0.2665	167.3	215.9
Methionine	-0.2808	176.2	223.6
Proline	-0.2845	178.5	220.0
Tyrosine	-0.2806	176.1	221.0

Tryptophan	-0.287	180.0	226.8
Aspartic Acid	-0.2768	173.7	217.2
Asparagine	-0.2612	163.9	222.0
Glutamine	-0.2812	176.4	224.1
Histidine	-0.2365	148.4	236.0
Lysine	-0.2867	179.9	238.0

We dedicated on validating the computational chemistry methods in the area of calculation of proton affinity values. The proton affinity of amino acids is found to be correlated well the experimental and theoretical values. From the results least proton affinity for Histidine (148.4kcal/mol) and highest for Glycine (180.9kcal/mol). Expect Histidine and Asparagine, difference between experimental and calculated values are in the range 0-50 kcal/mol. There has been regarded interest in the proton affinities and site of protonation of the amino acids. The amino acids such as Tryptophan (180.0kcal), Lysine(179.9kcal/mol) and Glutamine(176.4kcal/mol) contain more than nitrogen atom present for protonation. These three amino acids are high proton affinity than the other amino acids. The proton affinity value for glutamine (176.4kcal/mol) is high than methionine (176.2kcal/mol) due to the presence of methyl carbon bonded to the sulfur atom, which is power full electron withdrawing group. Proton affinity of value of sulfur containing amino acids such as Cysteine (167.3kcal/mol) is less than the Methionine (176.2kcal/mol) because methylene carbon atom bonded to the sulfur atom. The proton affinity value of proline (178.5kcal/mol) lower than Tryptophan (180.0kcal/mol) and it contain α -amnio group. Similarly, the proton affinity value for Tyrosine (176.1kcal/mol) is large than Threonine (173.1kcal/mol) due to Tyrosine have delocalization is possible in the substituted aryl group and increase the resonance effect. Proton affinity value of branched chain amino acids such as Leucine (178.2kcal/mol), valine (177.9 kcal/mol) and Isoleucine (177.3kcal/mol) are less proton affinity than the Lysine (179.9kcal/mol) due to the steric effect. The proton affinity value of hydroxy amino acids such as Threonine (173.1kcal/mol) is high value than Serine (165.2kcal/mol) due to the presence of methyl group. Since R group in the amino acids are affected in the proton affinity, the change in proton affinity can be explained using steric effect, inductive effect and resonance effect. The proton affinity also the some of the value are very close to experimental value but some compound shows very large

difference. This because of that we have carried out in this equation in gas phase and we do not include the solvent model the system. Geometry optimization is very important to find the accurate energies for calculating proton affinity.

CONCLUSION

Isodesmic reactions are effectively used to determine the proton affinity of some natural amino acids in the current project. The practical implementation of the project is performed using computational electronic structure calculations using the DFT method in conjugation with 631G-(d,p) basis set. All computational chemistry calculations were performed using firefly, facio and Avogadro are free software. The value of proton affinity are in excellent agreement with the experimental data and good comparison is observed between calculated and experimental proton affinities values. Hydrogen bonds present in amino acids largely controls the conformational arrangement of hetero atoms. The use of recently developed basis sets may provide more accurate results which may attribute to this complexity in the electronic structure of the molecules and further improve the accuracy of computational calculations. Further, the influence of the environment on the proton affinity can also be embedded in a solvent environment to improve the accuracy. The credibility of computational chemistry methods and utility of the theory of isodesmic reactions is proved in the current project. Moreover, computational chemistry methods can be utilized by researchers in the calculation of chemical properties such as resonance energy, ring strain energy, ionization energy and electron affinity before doing or using sophisticated experimental methods.

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A STUDY ON THE BIODIVERSITY OF BUTTERFLIES OF THURUTHISSERY VILLAGE, KERALA

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ABSTRACT

Butterflies are part of life on Earth and an important component of its rich biodiversity. They are a highly diverse group comprising over 250,000 species and make up around one quarter of all named species. Butterflies are indicators of a healthy environment and ecosystems. The study on biodiversity of butterflies was carried out from December 2020 to March 2021, in Thuruthissery village of Nedumbassery panchayath, Ernakulam District. Butterflies were observed, photographed, and identified with the help of field guides. 15 species of butterflies were identified, and they fall under three families, namely, *Nymphalidae* (8 species), *Papilionidae* (4 species), *Pieridae* (3 species). Among this, dominant taxon was family *Nymphalidae* with highest number of species and individuals followed by *Papilionidae* and *Pieridae*. Butterflies are sensitive to the changes in the habitat and climate, which influences their distribution and diversity and species diversity generally increase with increase in vegetation. The host plants are crucial for maintaining butterfly diversity, it is vital to conserve them and their landscapes.

INTRODUCTION

Insects are pan crustacean hexapod invertebrates and the most diverse group of animals within the arthropod phylum. They include more than a million described species and represent more than half of all known living organisms (*Chapman A.D.,2006*). There are many references to butterflies in literature, from the Bible through Shakespeare to modern day literature, and from poetry to musical lyrics. Butterflies are often portrayed as the essence of nature or as representing freedom, beauty or peace. Like all insects, they have six jointed legs, 3 body parts such as head, thorax and abdomen, a pair of antennae, compound eyes, and chitinous exoskeleton. Butterflies are found all over the world and in all types of environments: hot and cold, dry and moist, at sea level and high in the mountains. Butterfly adults are characterized by their four scale-covered

wings and these scales give butterfly wings their colour: they are pigmented with melanin that give them blacks and browns, as well as uric acid derivatives and flavones that give them yellows, but many of the blues, greens, reds and iridescent colours are created by structural coloration produced by the micro-structures of the scales and hairs (Culin, Joseph, 2015.; Mason C.W., 1927; Vukusic P. et.al., 2000; Prum R. et.al., 2006). Butterflies play an important role in the natural ecosystem as pollinators and integral participants in the food chain; conversely, their caterpillars cause damage to vegetation in agriculture. Larvae and pupae are links in the diets of birds and parasitic entomophagous insects. The adults are included in food webs in a much broader range of consumers including birds, small mammals, reptiles, etc. (Resh. et.al., 2009). India's diverse and varied fauna include a rich variety of butterflies. Brigadier William Harry Evans recorded approximately 1439 species of butterfly from British India, including Ceylon and Burma. (Evans W.H.; 1932).

OBJECTIVES OF THE STUDY

- Identification and classification of the butterflies of Thuruthissery village, Kerala
- To assess species diversity of butterflies of Thuruthissery village, Kerala

METHODOLOGY

The study on biodiversity of butterflies was carried out from December 2020 to March 2021, in Thuruthissery village of Nedumbassery panchayath, Ernakulam District. Study area is a village having diverse habitats such as grasslands, paddy fields, different agricultural vegetation, urbanized areas etc. Time chosen for the study is morning 7-9am and evening 4-6 pm as they were mostly seen during morning and evening time. Mostly herbs, shrubs, flowers, trees, building walls. were observed to find out the butterflies and recorded. Collecting live specimens was avoided during the study. Many of the species were photographed in the wild using mobile camera in order not to disturb and harm them. Identification was done with the help of field guides [Varshney R.K & Savela Markku., 2010; Evans W.H, 1932;] and internet.

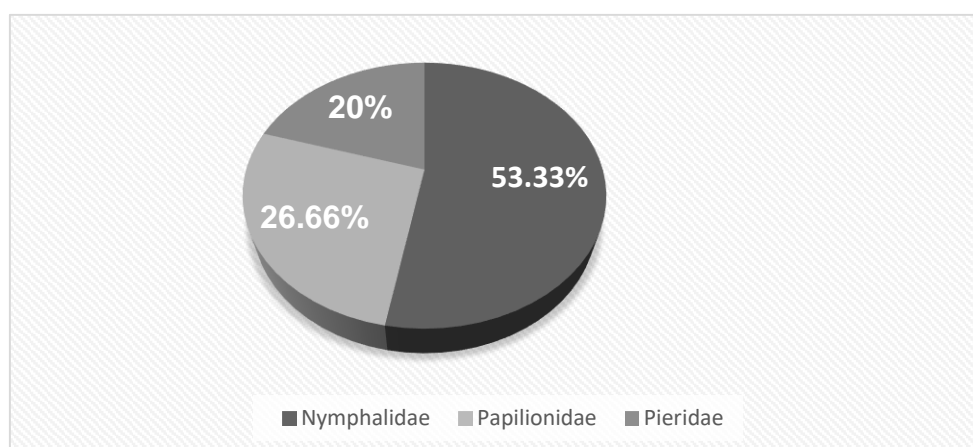
OBSERVATIONS AND RESULTS**Table 1**

Name of family	Name of the species
I. Family- Nymphalidae	
	1. Eupolea kluge
	2. Tanaecia lepidea
	3. Tirumala septentrionis
	4. Cupha erymanthis
	5. Moduza Procris
	6. Cirrochroa thais
	7. Hypolimnas misippus
	8. Melanitis brown
II. Family- Papilionidae	
	9. Papilio polytes
	10. Papilio clytia
	11. Papilio polymnester
	12. Pachliopta hector
III. Family- Pieridae	
	13. Delias eucharis
	14. Pieris canidia
	15. Eurema blanda

Checklist Of Butterflies Observed And Identified During The Study

Table 2**Number and relative abundance of butterflies of different families identified from Thuruthissery village**

Sl.No.	Family	No. of species	Relative abundance(%)
1.	Nymphalidae	8	53.33
2.	Papilionidae	4	26.66
3.	Pieridae	3	20
	Total	15	100

**Figure 1****Pie diagram showing the percentage distribution of butterflies of different families identified from Thuruthissery village****DISCUSSION**

Butterflies are a highly diverse group comprising over 250,000 species and make up around one quarter of all named species. In the present study, 15 varieties of butterflies were photographed and identified from Thuruthissery village up to Species level. They fall under three different families, namely, *Nymphalidae* (8 species), *Papilionidae* (4 species), *Pieridae* (3 species) and were recorded. Among this, dominant taxon was family *Nymphalidae* with a highest number of species and individuals. followed by *Papilionidae* and *Pieridae*.

The study on the richness and diversity of butterflies at Kariavattom Campus, University of Kerala reported 105 species of butterflies. The highest number of butterflies was recorded belonging to the *Nymphalidae* (40 species), followed by *Lycaenidae* (23 species), *Hesperiidae* (18 species), *Pieridae* (13 species) and *Papilionidae* (11 species). Dominance of these species can be explained by the presence of their larval and host plants species, whose occurrence impacts distribution of butterflies in the campus. (A. D. Tiple, A. M. Khurad, and R. L. H. Dennis, 2007).

Being extremely responsive to any changes in their environment, namely, temperature, humidity, light, and rainfall patterns, these insects are identified as useful bioindicators. They have different requirements for different habitat types for mating, breeding, and nectaring and are in sync with the diversity and quality of their habitats. Butterflies have been widely used by ecologists as model organisms to study the impact of habitat loss and fragmentation, and climate change. Fragmentation of natural landscapes for crop area could certainly destroy the host plant and could greatly reduce the biodiversity of butterflies. At the same time, human interferences result in more gaps, edges which provide more light and space, and diversity in plant structure to support more butterfly species than natural forest. (K. C. Hamer, J. K. Hill, L. A. Lace, and A. M. Langan, 1997)

CONCLUSION

Butterflies are sensitive to the changes in the habitat and climate, which influences their distribution and diversity and butterfly species diversity generally increase with increase in vegetation. The host plants are crucial for maintaining butterfly diversity, it is vital to conserve them and their landscapes. This type of study could contribute to educate the younger generation about the importance of identification, documentation and conservation of butterflies and their host plants. Therefore, further research on the biodiversity of butterflies in each village with special reference to their host plants and factors that affect their distribution, diversity and abundance will be recommended. There is further scope for scientific research in identification and documentation of butterflies in different seasons and from different locations of Thuruthissery village. An understanding of the diversity assumes paramount importance in conservation.

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JACKFRUIT- A VERSATILE FRUIT OF NATURE- REVIEW

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ABSTRACT

Jackfruit scientifically known as *Artocarpus heterophyllus* Lam. is a monoecious plant that belongs to the Moraceae family. It is the largest tropical endemic fruit from the western ghats of India and is found in various other parts of the world also. Jackfruit receives several acknowledgments like poor man's food, "miracle food" and is popularly known as "Chakka" among Keralites. The whole part of the plant is either medicinally or nutritionally important. Research studies have shown that jackfruit is a storehouse of abundant phytochemical and nutritional compounds. Several *in vitro* and *in vivo* studies reveal the anticancer, antimicrobial, antifungal, antiplatelet, antiarthritic, anti-inflammatory, and antioxidant potential of jackfruit. But still, jackfruit is unexploited to a very extent. Hence this review focuses on the phytochemical, nutritional and health aspects of jackfruit to highlight the benefits.

Key words: Jackfruit, phytochemistry, nutritional composition, health benefits

ORIGIN AND MORPHOLOGY

Jackfruit scientifically known as *Artocarpus heterophyllus* Lam came from the Moraceae family is a tropical endemic fruit from western ghats of India and found in some parts of South America, Asia, and Africa (Ranasinghe *et al.*, 2019). It is considered as the national fruit of different countries like Bangladesh, Sri Lanka, and Indonesia and the state fruit of Kerala and Tamilnadu (Ashok Madala, n.d.; Mondal *et al.*, 2013; Waghmare *et al.*, 2019).

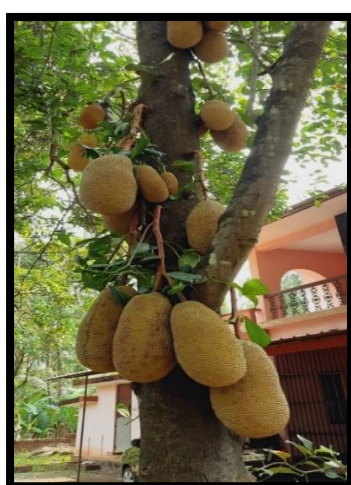
It is one of the largest evergreen trees, reaches a height of 10-15m, widely cultivated in different parts of India especially in South India (Prakash *et al.*, 2009; Wangchu *et al.*, 2013). This is a monoecious tree, produces male and female flowers on the same plant, cross pollination is adopted for fertilization and seeds are the means of propagation (Sadhu, 1989). As the largest edible fruit in the world, it takes 3 to 7

months for fruit maturation after pollination. (Baliga *et al.*, 2011; Ranasinghe *et al.*, 2019)

Many researchers granted status like “poor man’s”, “miracle food “and “nutrient of giant” for jackfruit as it is widely cultivated and available in villages and local people largely depend on it for their food during its season ((Ashok Madala, n.d.; Jagadeesh *et al.*, 2007; Prakash *et al.*, 2009; Swami & Kalse, 2018). Among Keralites it is known as “chakka” was a seasonal fruit begins from the month of December and ends in June-July ((Moke *et al.*, 2017; Vazhacharickal *et al.*, 2015). But development of new varieties like AyurJack converted it into a non-seasonal fruit and contributes largely to the diet of Keralites.

(Swami *et al.*, 2012a) reported that the shape of Jackfruit is oblong-cylindrical and it reaches a length of up to 90 cm with an average length of 30-40 cm. They also stated that the normal weight of fruit is 3.5 to 10 kg but can reach up to a weight of 25 kg. It is a kind of aggregate fruit with yellow to green rind with horny spikes in the exterior and a central core, bulbs and seeds in the interior. The central core consists of latex which is sticky in nature which in turn helps to keep the fruit intact. When the fruit matures the color of the fruit exterior change from yellowish green to yellow or brown due to the changes in the pigments present in it, spines flattens, spaces between spines increases and decreased production of latex (Kishore, 2018; Tiwari & Vidyarthi, 2015). The bulbs are white in color in the immature stage, off white to white in the mature stage and yellow, white, deep yellow, deep saffron, saffron according to the variety in the ripened stage (Jagadeesh *et al.*, 2007). Enclosed with a light brown seed yellow ripened bulbs are sweetish with acidic nature and possess tasty flavor. (Moke *et al.*, 2017; Prakash *et al.*, 2009). A wide variety of jackfruit can be distinguished in nature with difference in fruit length, fruit diameter, fruit shape, fruit colour, fruit weight, fruit rind weight, fruit rind thickness, number of flakes per fruit, flake length, flake width and flake thickness, biochemical characters like amount of reducing sugars, non-reducing sugars, total soluble solids and β carotene content (Chandrashekar, 2014).

Two main varieties of jackfruit are available in India. One is soft, small, fibrous and mushy pulp variety which is known as Koozha in Kerala. The name of koozha is differently called in different parts of India according to the vernacular language such as Ghula, Vela, Ghila and Kappa. The other variety is firm pulp but not much sweet which is popularly known as Varikka in Kerala where it is commonly seen. Varcha, Karcha, Kujja are some other names of Varikka jackfruit (Saxena *et al.*, 2013; Swami *et al.*, 2012b; Swami & Kalse, 2018)



Jackfruit plant with jackfruit



Cut section of jackfruit



Jackfruit seeds



Jackfruit bulbs

Figure 1

Images of jackfruits and its various parts

Phytochemistry and Nutritive Composition

Nutrition is an inevitable part of health which in turn depends on the food we consume. Fruits and vegetables are nature's gift to the human being as it is a bountiful source of vitamins, minerals and phytonutrients, among which jackfruit occupies a leading role. (Tiwari & Vidyarthi, 2015) reported that nutritive composition of jackfruit differs according to the maturity stages and variety of the fruit.

Jackfruit supplies a plenty of nutrients in good proportion which is equal or superior to the nutrients present in avocado, apple, mango, pineapple and banana and almost equal to the nutrient content of mother's milk. It is a repertory of an array of nutrients like carbohydrate, proteins, and vitamins such as vitamin B, vitamin C, β -carotene and minerals like potassium, calcium, iron and magnesium (Devi *et al.*, 2014a; Khakimov *et al.*, 2016; Tiwari & Vidyarthi, 2015).

Ojwang *et al.*, 2018 opined that jackfruit is one of the underutilized crops but can be used as a substitute for carbohydrate and protein rich foods. Moreover, it is a rich source of moisture and abounding with minerals like sodium, magnesium, calcium, zinc, potassium and iron.

Khakimov *et al.*, 2016 stated that jackfruit contains 62% carbohydrates, 11 % fatty acids, 35% organic acids, and 2% amino acids which are higher when compared to other commonly used fruits like mango and pine apple.

Table. 1

Comparison of nutrients in jackfruit and other commonly used fruits

Sl.No.	Compounds (%)	Fruits		
		Jack fruit	Mango	Pineapple
1.	Carbohydrates	62	30	21
2.	Fatty acids	11	6	8
3.	Organic acids	35	63	71
4.	Amino acids.	2	1	0

(Khakimov *et al.*, 2016)

Jackfruit is a rich source of moisture, dietary fiber, carbohydrate, calorie, protein and vitamin C. Ripened fruit is accumulated with simple sugars like fructose, glucose,

galactose, mannose and sucrose which provides instant energy.(Khakimov *et al.*, 2016; Rudrawar & Kale, 2017; Shafiq *et al.*, 2017). Amino acids alanine, proline, valine, leucine and lysine are also present in jackfruit.(Khakimov *et al.*, 2016; Peng *et al.*, 2013; Sharma *et al.*, 2015). Shafiq *et al.*, 2017 reported a moisture content of 71.6 and ash content of 1.89 in ripened jackfruit pulp.

Singh *et al.*, 2015 reported that jackfruit contains phenolic acids such as gallic acid, ferulic acid and tannic acid, but when ripe the concentration of ferulic acid is low. The most abundant organic acid in jackfruit is citric acid followed by malic acid .It is also rich in palmitic acid, lauric acid, oleic acid , arachidic acid, linoleic acid and stearic acids are the main fatty acids isolated from different section of jackfruit. (Hari *et al.*, 2014; Khakimov *et al.*, 2016).

It is a store house of B-complex vitamins. Plenty of pyridoxine (B-6), folic acid (B-9), riboflavin (B-2), and thiamine (B-1) and niacin (B-3) are found in it. Another attraction of jackfruit is the presence of high mineral content. It is a rich source of important minerals like potassium, iron, magnesium, manganese, phosphorous and calcium.(Hari *et al.*, 2014; Sidhu, 2012).

Table 2
Nutritional Composition of jackfruit (100 g edible portion)

Sl.No	Composition	Young Fruit	Raw fruit	Ripened fruit
1	Water (g)	76.2 - 85.2	73.46	72-77.2
2	Protein (g)	2.0 - 2.6	1.72	1.2 - 1.9
3	Fat (g)	0.1 - 0.6	0.64	0.1 - 0.4
4	Carbohydrate (g)	9.4 - 11.5	23.25	16.0 - 25.4
5	Fibre (g)	2.6 - 3.6	1.5	1.0 - 1.62
6	Total sugars (g)	-	19.08	20.6
7	Total minerals (g)	0.9		0.87 - 0.9
8	Calcium (mg)	30.0 - 73.2	24	20.0 - 37.0
9	Magnesium (mg)	-	29	27.0
10	Phosphorus (mg)	20.0 - 57.2	21	38.0 - 41.0
11	Potassium (mg)	287-323	448	191-407
12	Sodium (mg)	3.0-35.0	2	2.0-41.0
13	Iron (mg)	0.4-1.9	0.23	0.5-1.1
14	Vitamin A (IU)	30	110	175-540
15	Thiamine (mg)	0.05-0.15	0.105	0.03-0.09
16	Riboflavin (mg)	0.05-0.2	0.055	0.05-0.4
17	Vitamin C (mg)	12.0-14.0	13.7	7.0-10.0
18	Energy (KJ)	50-210	397	88-410

Source: (Food Data Central, n.d.; Love & Paull, 2011; Shafiq *et al.*, 2017)

Jackfruit is rich in different phytonutrients and antioxidants. Several degenerative diseases can be prevented by natural foods rich in functional nutrients. (Jagtap *et al.*, 2010) evaluated the scavenging activity of Jackfruit pulp obtained from western ghat of India using 1,1-diphenyl-2-picrylhydrazyl (DPPH), ferric reducing power assays and N, N-dimethyl-p-phenylendiamine (DMPD) radical cation decolorization assay and found out that it was rich in antioxidants and it is correlated with the presence of high levels of phenols and flavonoids.

(Ojwang *et al.*, 2018) reported that Methanolic extract of the fruit and seed were rich in phenols and flavanoids. With the help of DPPH (“1, 1-Diphenyl-2-picrylhydrazyl”) radical scavenging activity and “reducing power assay test” antioxidant potential was found out and that showed that jackfruit pulp and seed was a good source of natural antioxidants.

Table 3
Phytochemical Composition of Jackfruit

Sample	Oxalate (mg/100 gm)	Phytic acid (mg/100g m)	Tannins (mg/100g m)	Alkaloids (mg/100g m)	Total flavonoids (mg CEg ¹ dry weight)	Total polyphenols (mg GAEg ¹ dry weight)	Total Antioxidant capacity mM GAEg ¹ of extract
Jackfruit Pulp	3.69±0.13	6.14±0.08	0.03±0.01	7.88±0.06	0.11±0.03	1.27±0.33	3.25±0.25

Source: (Amadi *et al.*, 2018; Shrikanta *et al.*, 2015)

“Review study on Potential Activity of *Artocarpus Heterophyllus*” by (Haleel *et al.*, 2018) stated that various parts of the jackfruit plant like leaf, bark, fruit contain different bioactive compounds such as “Jacalin, and flavonoids, stilbenoids, colouring matters, Morin, Dihydromorin, Cynomacurin, Artocarpin, Isoartocarpin, Carotens, Some Essential Amino Acids”.

Antioxidants protect our body from the attack of free radicals and infections. Carotenoid pigment found in fruits and vegetables is one of the functional nutrients and a powerful antioxidant soluble in fat which produce yellow or reddish colour to the food items (Sidhu, 2012; Stahl & Sies, 2005). Ripened jackfruit is rich in β -carotene which

has the power to protect lungs and oral cavity from cancer. Vitamin C is another important antioxidant abundantly present in jackfruit which constitutes 23% RDA. (Sidhu, 2012).

Using high-performance liquid chromatography connected to photodiode array and mass spectrometry detectors (Arora & Parle, 2016; de Faria *et al.*, 2009) identified the following carotenoids in jackfruit.

Table 4
Carotenoids in jackfruits

Sl.No.	Types of carotenoids	Concentration (g/100 g fresh weight)
1	All-trans-neoxanthin	8.85
2	9-cis-Neoxanthin	6.87
3	All-trans-neochrome	0.88
4	All-trans-luteoxanthin	2.06
5	cis-Antheraxanthin	1.12
6	9-cis-Violaxanthin	7.05
7	cis-Luteoxanthin	0.34
8	All-trans-lutein	37.02
9	All-trans-zeaxanthin	0.96
10	All-trans-zeinoxanthin	1.72
11	cis-Zeinoxanthin	0.90
12	All-trans- α -cryptoxanthin	0.35
13	All-trans- β -cryptoxanthin	1.21
14	15-cis- β -Carotene	0.18
15	13-cis- β -Carotene	2.45
16	All-trans- α -carotene	1.24
17	All-trans- β -carotene	29.55
18	9-cis- β -Carotene	0.79
19	Total carotenoids	107.98
20	Vitamin A value	2.84

Source:(Arora & Parle, 2016; de Faria *et al.*, 2009)

Jackfruit especially ripened jackfruit is rich in several volatile compounds. The specific aroma of jackfruit is due to the presence of a variety of volatile compounds (Grimm & Steinhaus, 2019) reported that approximately 200 volatile compounds are identified so far through various studies. From that the important compounds and its odor include ethyl butanoate (fruity), hexane (green, grassy), nonanal (citrusy, soapy), 3-isobutyl-2-methoxypyrazine (bell pepper), 4-hydroxy-2,5-dimethylfuran-3(2H)-one (caramel), 2-phenylacetic acid (floral, honey), 2-methoxyphenol (smoky), ethyl hexanoate (fruity), acetic acid (vinegar), 2-acetyl-1-pyrroline (popcorn), octanal (citrusy, soapy), ethyl 2-methylpropanoate (fruity), vanillin (vanilla), hexanoic acid (sweaty), methyl hexanoate (fruity), methyl 3-methylbutanoate (fruity), 3-methylbutyl acetate (fruity, banana), 2-methylbutan-1-ol (malty), butanoic acid (cheesy, sweaty), 2-phenylethanol (floral), 3-hydroxy-4,5-dimethylfuran-2(5H)-one (seasoning), phenylacetaldehyde (floral, honey), ethyl 3-methylbutanoate (fruity), ethyl (2E)-3-phenylprop-2-enoate (fruity), ethyl 3-phenylpropanoate (fruity), butane-2,3-dione (buttery), 3-(methylsulfanyl) propanal (cooked potato), 4-methylphenol (fecal, horse stable), (2E,6Z)-nona-2,6-dienal (cucumber), 3-methylbutanoic acid (cheesy, sweaty), 1-octen-3-one (mushroom), Butan-1-ol (malty), γ -octalactone (coconut), ethyl 2-methylbutanoate (fruity), 3-hydroxybutan-2-one (buttery), decanal (citrusy, soapy), (2E)-non-2-enal (fatty), 3-methylbutan-1-ol (malty), butyl acetate (fruity, banana) and few unknown compounds with different odours. (Grimm & Steinhaus, 2019; Maia *et al.*, 2004; Ong *et al.*, 2006, 2008; Rasmussen, 1983; Selvaraj *et al.*, 2002; Swords *et al.*, 1978; Wong *et al.*, 1992).

Jackfruit is a stockroom of number of nonvolatile compounds also. Among that alcoholic nonvolatile include 2,3-Butanediol, 1-Propanol, 2-methyl-, myo-Inositol, Butanol, 3-methyl-, 1-Octanol, 1-Butanol, 2-methyl-, acidic compounds are Dodecanedioic acid, (ethyl), Citric acid-1,2,3-trimethyl ester, 2-hydroxy, Gallic acid, 1-Alanine ethylamide, (S)-, Oleic acid, Butanoic acid, 3-methyl-, Proline, 9,12,15-Octadecatrienoic acid, ethyl, Pentanoic acid, ethyl, 1,2-Benzenedicarboxylic acid, bis (2-methylpropyl), Gluconic acid, γ -lactone, e, 2-methoximine-3, 3-methoxy-3-OH-2-propenoic acid, -methyl ester, Boronic acid, ethyl-, dimethyl, Benzenepropanoic acid, methyl(ethyl), Tricosadiynoic acid, Oxalic acid, monomorpholide, Acetic acid, Stearic

acid, Palmitic acid, 3-hydroxybutyric acid, Malic acid, dimethyl ester, Pyruvic acid, Palmitic acid, methyl ester, Lactic acid, Tetra decanoic acid, ethyl, Malonic acid, Octadecanamide, n-Hexadecenoic acid, Malonic acid, esters are Linoleic acid ethyl ester, Butanoic acid, 3-methyl-, butyl ester, Dibutyl phthalate, Butyrolactone, Octadecadienoic acid (Z,Z)-,methyl ester, n-Amyl isovalerate, Hexadecanoic acid, ethyl ester, Stearic acid, 2-hydroxy-1-methylpropyl ester, 1-Methoxy-2-propyl acetate, Ethyl Acetate and Ketones/Aldehyde/Alkane include Heneicosane, 2,3-Butanedione, Benzaldehyde, 2,5-bis[(trimethylsilyl)oxy], 2-Furancarboxaldehyde, 5-methyl-, Decanal and Nonanal (Khakimov *et al.*, 2016; Peng *et al.*, 2013).

Health Benefits

Plant based phenolic compounds are rich in antioxidants and it is effective in treating oxidative stress mediated disorders such as atherosclerosis, cancer, myocardial infarction, rheumatoid arthritis, and neurodegenerative diseases due to its chemo protective effect (Soobrattee *et al.*, 2005).

Health benefits of jackfruit are colossal. Phytochemical composition of jackfruit is responsible for its health benefits (Chikkanna, 2021). Jackfruit is rich in variety of phytonutrients. “Jacalin” a compound present in it is important for preventing cancer and AIDS. Besides, the presence of lignants, saponins and isoflavones make it an anti-degenerative food source which helps to eliminate free radicals from human body consecutively prevents cancer and aging .Furthermore it improves our digestive system, boost immunity, support the health of eye, bone ,skin, maintain Hb levels, thyroid function, asthma management and prevents cardiovascular diseases (Devi *et al.*, 2014b).

(Baliga *et al.*, 2011) in his review on “Phytochemistry, nutritional and pharmacological properties of *Artocarpus heterophyllus* Lam (jackfruit)” stated that jackfruit is blessed with different compounds like prenylflavones, sterols and flavonoids which has restorative properties. Jackfruit is a good laxative and helps to prevent colon cancer because of its high fiber content. (Rudrawar & Kale, 2017).

(Shukla & Kashaw, 2019) reported several health benefits of jackfruit. They have stated that it protects our body from the attack of microbes, virus, bacterial agents and asthma. Besides it has the capacity of wound healing and anti-leukemic, anti-ulcer, antioxidant, anti-malarial, anti-diabetic properties. Jackfruit consumption leads to

improved glucose tolerance, decreased total and LDL cholesterol and it has anti diabetic activity also revealed by (Jain *et al.*, 2010).

(Baliga *et al.*, 2011) in his review on “Phytochemistry, nutritional and pharmacological properties of *Artocarpus heterophyllus* Lam (jackfruit)” reported manifold positive features of jackfruit like it helps to prevent the development of tumor, reduce blood sugar, and fight against fungus, infections and bacterial attack, as well as fight against oxidation. Chikkanna, 2021 also reported that jackfruit have been attributed with inflammatory, antifungal, antimicrobial, antioxidant, anti-inflammatory and anticancer activity.

(Hettiaratchi *et al.*, 2011) opined that the presence of beneficial dietary fiber and slowly available carbohydrate make jackfruit as a low glycemic index food. (Chackrewarthy *et al.*, 2010) in their study to “investigate the hypoglycemic and hypolipidemic effects of an ethylacetate (EA) fraction of the mature leaves of *A. heterophyllus*” showed the presence of lipid and blood glucose lowering agents in the jackfruit leaves.

A cytotoxic activity test study by (Burci *et al.*, 2019) on jackfruit seeds revealed that it has anti tumoral effect and it is useful in different cancer cell lines such as “T47D, TH29 and B16F10.” A natural anticancer agent artocarpin chemically known as “6-(3-methyl-1-butenyl)-5,2',4'-trihydroxy-3-isoprenyl-7-methoxyflavone” present in jackfruit wood revealed cytotoxic potential on human T47D breast cancer cells found out by Arung *et al.*, 2010.

A study by Patel & Patel, 2011 on “Cytotoxic activity of methanolic extract of *Artocarpus heterophyllus* against A549, Hela and MCF-7 cell lines” by using MTT & SRB assay revealed that methanolic extract had anti-cancer effect and it is nontoxic on normal cells. They also found out that Hela & MCF cell lines were non active to methanolic extract.

Varughese *et al.*, 2020 through a retrospective study revealed that “Chemotherapy-Induced Leukopenia (CIL)” among patients who undergoing chemotherapy can be prevented through the dietary inclusion of green jackfruit flour with pegfilgrastim.

Haleel *et al.*, 2018 in his “Review study on Potential Activity of *Artocarpus Heterophyllus*” by reported that jackfruit is used for the treatment of diverse ailments in traditional medicine. Gastrointestinal disorders, malaria fever, tape worm infection and some metabolic disorders are some examples. They also opined those various parts of the jackfruit plant contain different bioactive compounds which possess different health benefits like “antibacterial, antitubercular, antiviral, antifungal, antiplatelet, antiarthritic, tyrosinase inhibitory and cytotoxicity”.

Theivasanthi & Alagar, 2011 developed nano sized particles from jackfruit seeds and FTIR analysis identified the presence of sulphur compounds which possess anti-microbial activity. Microbiological assay of the product shown that it had the potential to fight against *E. coli* and *B.megaterium*. (Jadhav *et al.*, 2021) list down the benefits of jackfruit which include good for healthy eye and skin, helps to control asthma, improves bone health, anaemia prevention, aids in digestion, cancer prevention, boost the immune system, maintain the health of thyroid gland

Gupta *et al.*, 2011 analyzed the different compounds of present in jackfruit seed and effect of these compounds in human health. He found out that jackfruit seeds are nutritionally rich and fat free and abundant in phytonutrients. Reducing power assay and free radical scavenging shown that jackfruit seeds are rich in antioxidants also. All these results revealed that jackfruit seed also had the potential to fight against life style diseases, cancers and degenerative diseases.

CONCLUSION

Jackfruit is nature's gift to human beings as it is a storehouse of a wide variety of nutrients and phytochemicals. Jackfruit helps us to prevent lifestyle diseases and other degenerative and chronic diseases. But still, it is unexploited and underutilized. More efforts are needed to popularize this fruit and this article might be an inspiration.

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APPLICATION OF MIND MAPPING IN DIVERSE FIELDS - A SCOPING REVIEW

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ABSTRACT

The Mind Map is a natural function of the human mind because it is a manifestation of Radiant thinking, or associative thinking processes that proceed from or link to a central point. It's a powerful graphic technique that can help learn more and think more clearly. This paper attempts to discuss the application of mind mapping in diverse fields like medical sciences ,education and research. Clearly, mind mapping may be a useful technique for deciphering a variety of educational phenomena, particularly when it comes to information transmission. Newer techniques that keep up with the growing times are necessary .So Mind mapping can be explored in various other fields like Health and Nutrition Education.

Key Words: Mind Mapping , Medical Education ,Research

INTRODUCTION

The human brain is the most advanced object known to science. It is extremely complicated; it is in charge of everything our body does, from regulating motions to storing memories and keeping our hearts functioning (Harrison & Hobbs, 2010).The brain has two hemispheres left and right. The brain's primary language is not verbal nor written words; instead, it integrates all of its senses to create connections between pictures, colours, important words, and key concepts. These are connected to whole-brain activity, engaging both hemispheres of the brain. Creativity and associations develop by using senses ,colours, images and pictures, numerals, words, symbols ,orders and patterns . All of them are used in the mind map (Buzan, 2006). It was Tony Buzan who developed mind mapping as early as in the 1960's. A mind map is a visual, networked technique of storing, organizing and prioritising information, that uses key or trigger phrases and pictures to 'snap on' certain memories and promote new thoughts and ideas. Mind Map is a crucial component to uncovering knowledge, thoughts, and

facts, as well as unleashing mind's true potential. The Mind Map's efficacy stems from its dynamic form or shape, which matches the structure of a brain cell; as a result, the brain will be stimulated to operate in a rapid, quick, and spontaneous manner (Buzan, 2006).

(Buzan *et al.*, 2010) presents Mind Mapping as an organic flow, which is a visual depiction of radiant thought process starting in the center and radiating throughout—which the author defines as "the technique through which the brain reasons and creates concepts." The Mind Map's effectiveness is based on the idea that it is an outward projection of radiant thinking that replicates and improves the entire brain's inherent creative proclivities, rather than limiting learning to the sequential and analytical processes that are mostly found in the left hemisphere. Mind Maps has found its application in various fields. This paper explores the use of mind maps in medical education, research, mathematics and counselling.

Mind Mapping in medical Education

Mind mapping is a technique that has been utilized in a variety of fields, including medicine (D'Antoni *et al.*, 2010); (Mollberg *et al.*, 2011). Mind maps is used as a pedagogical tool to encourage analytical reasoning among medical students so that they integrate information across disciplines and comprehend links between the basic and clinical sciences in medical education (McDermott and Clarke, 1998). (Farrand *et al.*, 2002) was one among the first to research on the role of mind mapping in medical education. Researchers attempted to find whether mind map learning approach was better than standard note taking in terms of short- and long-term factual recall in medical students. It was found that the mind map approach greatly enhanced long-term retention of factual information. The second group of researchers, to look at the usefulness of mind maps in medical education was (Wickramasinghe *et al.*, 2011). Using a study design identical to that of Farrand *et al.*, (2002) these researchers divided newly admitted medical students into two groups: mind map and self-selected study groups. There was no significant difference between the two groups but it could be established that mind maps could help in memorizing. After the evidences from these two studies many research has been carried out in the medical field. A summary of the research is shown in Table 1.

Table 1
Studies using mind mapping in health care sector

Author	Year	Country	Title	Aim	Sample Size	Result
Yang et .,al	2020	China	The use of mind mapping in health education in extended care for children with caries	To investigate the application of mind mapping-based health education in extended care for children with caries	159	Caries knowledge was significantly greater in the observation group than in the control group. The observation group had a significantly greater number of follow-up visits in 12 months than the control group.
Hang-Zhou Wu1 and Qiu-Ting Wu	2020	China	Impact of mind mapping on the critical thinking ability of clinical nursing students and teaching application	To analyze the impact of mind mapping on the critical thinking ability of clinical nursing students and its use as a teaching	64 Convenience sampling	The critical thinking inclination of nursing students was significantly improved after intervention compared with that before the intervention ($t = 1/4$ 0.74). The four dimensions of open-mindedness, inquisitiveness, cognitive maturity, and systematicity among nursing students after the intervention were also significantly improved compared with before the intervention.
Kalyanasundaram et.,al	2017	India	Effectiveness of Mind Mapping Technique in Information Retrieval Among	To assess the impact of mind mapping technique in information retrieval among medical college	64 medical students	On Day 7, the mean score in mind map group is significantly more than the text group (8.9 Vs 8.5; $p = 0.03$). The mind mapping technique is an innovative and effective method in

			Medical College Students in Puducherry -A Pilot Study	students in Puducherry		remembering things better than the routine way of reading texts.
Keman et.,al	2017		Using Mind Mapping to Identify Research Topics: A Lesson for Teaching Research Methods	The aim of this article is to illustrate how the mind mapping technique was used to assist undergraduate health education students in developing topic ideas for a descriptive research study.		After the construction of the mind map, students developed structured research questions and a list of key search terms that served as the foundation for a review of the literature and the development of a questionnaire for a descriptive research study
Guerrero and Ramos	2015	Barcelona Spain	Mind mapping for reading and understanding scientific literature	The study attempts to prove that the mind mapping technique is an effective way of increasing the productivity of both research and clinical teams when reading and understanding scientific literature	-	In this study, it was found that nurses and physicians who use mind mapping when reading scientific literature could increase their productivity by up to 50%
Samaga et.,al	2014		Mind Map: Medical	The objective of our study	56 MBBS Students	Out of 56 students who participated in the study, all of

			Student's Views	was to know if the students liked or disliked mind map as a study tool and know the reasons for the same		them except 2 students liked mind mapping method of teaching. Multiple reasons were quoted by the students for liking mind mapping. The most common reason cited by 34 students(60.71%) was that mind mapping could enable them to study vast topic in short time
D'Antoni	2010		Does the mind map learning strategy facilitate information retrieval and critical thinking in medical students	The purpose of this study was to investigate whether a relationship existed between mind mapping and critical thinking, as measured by the Health Sciences Reasoning Test (HSRT), and whether a relationship existed between mind mapping and recall of domain based information	-	There were no significant differences in mean scores on both the pre- and post-quizzes between notetaking groups. And, no significant differences were found between pre- and post-HSRT mean total scores and sub-scores.

Mind maps in research

Qualitative research focuses on the "experiences, perceptions, and narratives" of study participants to give an understanding of their social environment (Liamputtong, 2013). Although traditional data collection methods for research involving human subjects such as participant observation, interviews, and focus groups remain essential (Wolcott, 2002), mapping allows individuals to create a visual depiction of their own experiences (Wheeldon, 2010). Research can be planned using maps. Researchers can more readily see the many tasks and activities necessary by describing the various phases in a research endeavour. Maps can help researcher to think and plan their studies (Wheeldon & Ahlberg, 2011). According to Wheeldon (2011) Mind maps might be a novel way to collect unsolicited data in qualitative research designs. Participants claimed that creating a mental map before hand helped them recall, organise, and remember information better. (Kotcherlakota *et al.*, 2013) showed that Students can benefit from mind mapping paired with the fishbowl approach to help them establish their research focus and organise complex information. As reported by (Crowe & Sheppard, 2012) mind maps may be used to instruct, guide, and design a path through research processes, perhaps resulting in more robust research.

Mind maps can be used to get participant verification of an evolving theoretical framework and to build confidence between the research and the participants (Whiting & Sines, 2012). The outcomes of this investigation into the use of mind maps justify a more in-depth investigation into the value of mind maps in qualitative research designs.

Mind Mapping in mathematics

Mathematics is one of the subjects in schools that students still find challenging, because it needs pupils to comprehend the concepts and formulae in the subject. Mathematics stresses concepts, which implies that students must grasp concepts in order to answer problems and apply them, according to the statement (Arifin & Herman, 2018). In the work entitled 'Mind Mapping: A Technique for Mathematical Creativity,' (Vijayakumari & Kavithamole, 2014) investigated the influence of mind mapping on mathematical creativity. A total of 100 children (girls and boys) from Higher Secondary Schools participated in the study. The Test-Retest Method was used to determine the reliability coefficient. The study's main conclusion was that the Mind

Mapping approach aids in the development of mathematical creativity. (Thangarajathi, 2008) conducted a research on effectiveness of Mind Mapping in Mathematical Instructions. Sixty ninth-grade students from Tuticorin District participated in the study. For this study a two-group pre- and post-test experimental design was used. According to the findings, the mind mapping approach is more successful than the traditional methods.

Mind Mapping in Counselling

Counselors and mental health professionals might benefit from adding Mind Maps into their counselling arsenal in a number of ways. The Mind Map, at its core, reflects the brain's organic and radiant character and offers a thorough clinical portrait of the client. Colors, pictures, phrases, curvilinear branches, and connecting lines engage the counselor's full brain and give an extra tool to help conceptualize the client and choose the best treatment choices. Pillay *et al.* ,(2020)performed a pilot research with 50 master's level counselling students who were taught the principles of Mind Mapping and encouraged to apply the skill in consumer conceptualization to determine the usefulness of Mind Maps in mental health counselling . In the study 90 percent of the participants said Mind Mapping was a valuable complement to client conceptualization, and 46 percent said they would use it again in the future, similar to the outcomes of research in other disciplines (Cross *et al.*, 2012; Kernan *et al.*, 2018; Pollitt, 2003).

CONCLUSION

The mind mapping technique is an example of an inventive method which uses graphical presentation of data. The colourful presentation of data has a lasting effect on the learners . It has found its application in various field .To gauge the efficiency o mind maps more research is needed to determine the impact of this novice method in other fields of study .

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ANETHUM GRAVEOLENS (DILL) LEAVES: IMPACT ON HEART

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ABSTRACT

Dill (*Anethum graveolens*) is an herb that's found throughout European and Asian cuisine. Also called dill weed, the plant has slender stems with alternating soft leaves and brown, flat, oval seeds. Dill is rich in several nutrients and has traditionally been used to treat various ailments. It has a good nutrition profile including carbohydrates, sugar, soluble and insoluble fiber, sodium, vitamins, minerals, fatty acids, amino acids and more. Direct food substance affirmed as generally recognized as safe as per food and drug administration section 184. Cardiovascular diseases are the leading cause of death worldwide. Herbs play a major role in reducing the risks by lowering the cholesterol levels. Dill is such herb that helps in reducing the lipid levels. Flavonoids, found in dill, protect the heart health due to their potent antioxidant and anti-inflammatory properties. The main purpose of the study is to introduce the herb and to indicate their cardiac activity in humans as it could be introduced in our future dietary intake.

Key words: dill leaves, cardiovascular diseases, flavonoids

INTRODUCTION

Cardiovascular disease is the leading cause of morbidity and mortality among the population of India. It contributes to nearly one quarter of the deaths in the working age group of 25–65 years in the country (Gupta R, 2008). The total serum cholesterol level is considered to be an important modifiable risk factor for cardiovascular disease (Nelson RH, 2013). Studies from different parts of India show that the prevalence of hypercholesterolaemia is high among Indians (Joshi SR *et al.*, 2014). Hyperlipidemia is considered one of the major risk factors causing cardiovascular diseases (CVDs). Hyperlipidemia is an increase in one or more of the plasma lipids, including triglycerides, cholesterol, cholesterol esters and phospholipids and or plasma

lipoproteins including very low-density lipoprotein and low-density lipoprotein and reduced high-density lipoprotein levels (Shattat GF, 2014).

Hyperlipidemia is highly prevalent disorder and is a major cause of atherosclerosis; it is closely related to coronary heart disease which is the most common cause of death worldwide. The recent studies showed that many plants contain ingredients possessed cardiovascular effects. Several herbs offer potential for cardiovascular conditions including hyperlipidemia, hypertension and congestive heart failure through a variety of mechanisms such as antioxidant, antiplatelet, fibrinolytic, anti-atherosclerotic, anti-hyperlipidemic, antiarrhythmic and vasodilatory actions (Rouhi-Boroujeni H, 2015). Many plant extracts have been shown to have hypolipidemic effect in experimental animals. Dill leaves have been selected for the present study. *Anethumgraveolens*(AG) Umbelliferae, known as Dill, is an annual herb growing in the Mediterranean region, Europe, central and southern Asia; the plant is used both as medicinal agent and as food spice (Heamalatha S *et al.*, 2011).

OBJECTIVES OF THE STUDY

- ❖ To overview the prevalence of cardiovascular diseases among people
- ❖ To determine the role of *Anethum graveolens* (dill leaves) in hyperlipidemic state

RELEVANCE OF THE STUDY

***Anethum graveolens* description**

The generic name of “*Anethum*” comes from the Greek word “anethon” and the colloquial name of dill is derived from the Old Norse word “dilla” that possibly means “to soothe.” *Anethum graveolens* is the only species of the genus *Anethum*, still classified by several botanists related to *Peucedanum* genus as *Peucedanum graveolens* (L.). *Anethum Graveolens* is an annual vertical plant with 50–150 cm stem belonging to the Apiaceae family. The fruits of *Anethum graveolens* are brown, flat, tiny, and oval in shape (Figure 1). This plant is cultivated in Mediterranean countries, in Asia, and in Europe. *Anethum graveolens* contains 36% carbohydrates, 15.68% proteins, 14.80% fiber, 9.8% ash, and 8.39% moisture as well as essential oils, fatty oil, minerals, and vitamins (S. Jana and G. Shekhawat, 2010).



Figure 1
Dill- seeds, flower, leaves

Uses of *Anethum graveolens*

Anethum graveolens is used in the traditional herbal medicine for the management and prevention of digestive disease, breath problem, motivation of lactation, and also reduction of cholesterol and glucose. Currently, many studies have established these properties; also, *anethum graveolens* is recently known as anticancer, antimicrobial, antigastric irritation, anti-inflammatory, and antioxidant agent. In this respect, dill is produced as a hypolipidemic drug (*Anethum* tablet) in Iran which consists of *anethum graveolens* (68%), *Cichorium intybus* (5%), *Fumaria parviflora* (5%), and lime (*Citrus aurantifolia*) (4%) (E. A. OshaghiI *et al.*, 2016).

Hypolipidemic Properties of *Anethum graveolens*

The crude extract of *Anethumgraveolens*L. showed antihypercholesterolaemic and antihyperlipidemic activities. The crude extracts of *anethumgraveolens* L. besides having strong antihyperlipidemic effects, it improved the biological antioxidant status by reducing lipid peroxidation in liver and modulating the activities of antioxidant enzymes in rats fed with high fat diet (Yazdanparast R and Bahramikia S, 2007).

Administration of different extractions of *anethum graveolens* seed and leaf, as well as its essential oil, in diabetic models significantly reduced triglycerides, total cholesterol, low-density lipoprotein cholesterol (LDL-C), very-low-density lipoprotein cholesterol (VLDL-C), and glucose levels, whereas it increased high density lipoprotein (HDL-C) level. On the other hand, many studies reported that *Anethum graveolens* has hypoglycemic and antioxidant activity. Some primary mechanisms have been proposed for hypolipidemic effects of *Anethum graveolens*. Inhibition of intestinal cholesterol absorption, binding to bile acids in the intestine, an increase in fecal excretion, and

increasing production of bile acids might be the main mechanisms by which *Anethum graveolens* exerts its antidiabetic functions (S. Jana and G. Shekhawat, 2010).

R. Yazdanparast and S. Bahramikia, (2008) proposed that some components of *anethum graveolens* such as carvone, limonene, or α -phellandrene are responsible for the hypolipidemic properties of *Anethum graveolens* likely through reducing acyl CoA carboxylase or 3-hydroxy-3-methylglutaryl-CoA (HMG-CoA) reductase, the key enzymes in fatty acid and cholesterol metabolism. Other studies have suggested that *Anethum graveolens* components might rise liver low density lipoprotein receptors, decrease fatty acid synthesis, and impact lipoprotein homeostasis mainly through improvement in lipoprotein metabolism. The antioxidant activity of *Anethum graveolens* is due to its phenolic proanthocyanidins and flavonoids constituents.

METHODOLOGY

The researcher collected the review articles related to cardiovascular diseases that explains the CVDs prevalent state. The researcher also collected review articles that determines the potential factors of *Anethum graveolens* (dill leaves) impact on heart diseases.

RESULTS

H. Edziri, *et al.*, (2012) stated that some studies suggest that *Anethum graveolens* may improve the lipid profile by its antioxidant properties. HPLC analysis showed that *Anethum graveolens* has high amounts of quercetin which may be responsible for the suppression of HMG-CoA reductase activity. Abbasi Oshaghi E *et al.*, (2015) observed that administration of 100 and 200 mg/kg of *Anethum graveolens* tablet and hydroalcoholic extract of *Anethum graveolens* in hypercholesterolemic hamsters resulted in significantly reduced HMG-CoA reductase activity and mRNA levels. It also showed that *Anethum graveolens* normalized the lipid profile by decreasing HMG-CoA reductase in the hypercholesterolemic hamsters and type 2 diabetic rats.

Abbasi Oshaghi E *et al.*, (2015) also stated in another study that *anethum graveolens* at the dose of 300 mg/kg had potential antioxidant and hypolipidemic effects. However, Piri M *et al.*, (2010) demonstrated that 3-week administration

of *Anethum* extract at the doses of 50, 100, and 200 mg/kg normalized blood lipid, and the change in blood glucose was not significant. The safe and effective dose in human studies is reported as 650 mg/kg by Kojuri J *et al.*, (2007).

Mobasserri *et al.*, (2014) showed that administration of *Anethum graveolens* powder in type 2 diabetic patients reduced fasting blood glucose and normalized insulin resistance and lipid profiles.

SUMMARY AND CONCLUSION

As mentioned above cardiovascular diseases are increasing daily and are often due to the improper lifestyle activity patterns, dietary intake and lack of exercise.

Anethum graveolens possess the properties such as antioxidant, antihyperlipidemic, antihypercholesterolemic, antidiabetic, anticancer, antioxidant, antistress, antisecretory, cardioprotective, antispasmodic, and diuretic effects. Few studies have also proven the dill leaves potential in the cardiovascular disorders. The studies proved the cardioprotective activity of dill leaves with their extracts. Many studies should be included with the dill leaves natural and dried forms.

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CHILDHOOD MALNUTRITION IN THE DEVELOPING WORLD

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ABSTRACT

In developing countries malnutrition still remains one of the major public health challenges and also attributes to major reasons of child mortality during the first five years of life in developing countries. Major risk factors associated with malnutrition are inadequate breast feeding and improper infant feeding practices which leads to macro and micronutrient deficiencies which are responsible for more than one third of all under five child deaths and disease burden globally. In addition effective interventions like nutrition, health education and good accesses and utilization of healthcare facilities with an integrated approach by the concerned departments can bring a desired change in the society to eradicate malnutrition from our society.

Key words: Malnutrition, Barker's hypothesis, Adequate nutrition

INTRODUCTION

Children of today are the world's greatest resources and they are tomorrow's citizens and leaders. The most vulnerable segment of a country constitutes children under five years. The major sensitive indicators of community health and nutrition are nutritional status and mortality rates of under five children. More than half of the under five deaths are attributable to undernutrition globally (UNICEF, 2014).

About 5.3 million children under five age group due to different reasons were majority of the diseases were preventable or curable where malnutrition attributes to the half of child deaths among them (WHO, 2019). According to report of UNICEF-WHO (2011) globally 165 million children under five years were stunted, 101 million were underweight and 52 million were wasted. Globally there is a high occurrence of childhood malnutrition in form of underweight, stunting and wasting in India. India

contributes 61 million (37 %) of the 165 million stunted children in the under five age group.

Global burden of malnutrition have medical, social, economic and developmental impacts on the society and are serious and long lasting for individuals as well as families and also for communities and countries. Under nutrition in children paves greater risk of dying from infections which in turns aggravates the frequency and severity of infections which attributes to world's half of all deaths under five year children (Gupte. S, 2004).

The prevalence of malnutrition in India was 43 % according to NFHS – 2 survey and 42.5% of children of under five years of age were underweight 19.8% were wasted and 48% were stunted according to NFHS-3 survey. The survey results of NHFS-3 show that prevalence of 22.9% underweight, 24.5% stunting and 15.1% of wasting under the category of under five year children in Kerala. A study conducted by Radhamani and Rajeev (2017) based on WHO criteria shows that 14.6% of children were underweight, 10.6% were stunted and 16.6% were wasted. The study also shows the prevalence of underweight and wasting was highest in the age group of 4-5 years. Age group of 2-3years found out to be having maximum of stunting and minimum in 3-4 year age group.

The first thousand days (from conception until two years) are very important as human development is most rapid during the child's course of life especially the development of immune system and cognitive ability. Hence adequate nutrition is important throughout the childhood. Hence maternal nutrition is very important which is very well link with the child malnutrition. Among pregnant women micro nutrient deficiencies are likely to be even in higher rates (Reilly *et al.*, 2017). As per Barker Hypothesis adverse nutrition in early life increases the risk of obesity, diabetes, insensitivity to insulin, hypertension, higher level of cholesterol and complications include coronary heart diseases and stroke and also during the anti-natal period as measured by low birth weight (below 2.5kg) which is an important predictors of malnutrition in childhood and primary challenge to be faced by the caregivers (Wilson, 1999). WHO recommends the early initiation of breast feeding i.e. within one hour of birth. The major causes of neonatal mortality are prematurity and asphyxia is related to

health and nutrition status of mother and sepsis to the infant's immune status (Dorrington *et al.*, 2019).

The key protective factor for child survival, cognitive development and protection against non-communicable diseases in the adult years is exclusive breast feeding during the first six months following birth. Inadequate or poor feeding practices contribute to higher levels of stunting during the first six months of age. Overweight and obesity in childhood and later in puberty are associated with inadequate feeding practice and also identified that formula feeding is the possible cause of subsequent overweight (Victoria *et al.*, 2016).

The important determinants of malnutrition in children during the current decade are poor infant and young child feeding and poor utilization of health care facilities. The effective interventions which would result in substantial reduction in malnutrition in children are nutrition, health education and good access and utilization of healthcare facilities. Growth faltering and under nutrition should be identified, counselled and provided with supplements regularly and monitor for improvements among the said children. Severe acute malnourished children should be referred to primary health care for care and counselling. Considering the results after observation the parents should get nutrition education and counselling thereby providing energy rich, nutritionally balanced locally available food items to the children (Sahu *et al.*, 2019).

Studies show that the causes of malnutrition are multifactorial and the improvement in one aspect does not give the desired change an integrated approach by concerned departments as well as families makes improvement in nutritional status in children. As the nutritional status in children is the result of many interrelated factors only the integrated approach can make changes in the society.

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THE ROLE OF EMOTIONAL INTELLIGENCE IN ADOLESCENTS

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ABSTRACT

Adolescence is the developmental period between childhood and adulthood and is a time of significant physical, social, and emotional development. It is also a time of increased risk-taking and emotional reactivity, combined with comparatively poor decision-making abilities, and impulse control. Adolescent period has been generally described as a period of “storm and stress” as they go through different mood swings and often tends to change their temperaments. In this context, adolescents should have a desirable level of emotional intelligence in order to balance their emotions in all the situations of life as well as to be successful and productive in all their future endeavours. Adolescents who are emotionally intelligent will be able to display their emotions suitably based on circumstances while adolescents who are not emotionally intelligent get easily affected by negative situations. This review aims to provide an outline of the importance of emotional intelligence in adolescents, the measures used to assess them and the intervention studies that has been done to enhance emotional intelligence.

Key words: Emotional intelligence, adolescents, measures

INTRODUCTION

Salovey and Mayer (1990) coined the term ‘emotional intelligence’. Emotional intelligence can be defined as the capacity to recognize, understand, manage our own emotions and influence the emotion of others. Goleman (1998) states that emotional intelligence has five core components: Self-awareness, self-regulation, self-motivation, empathy and social skills. The term emotional intelligence comprises two components: Emotion and Intelligence. The term emotion is being used to designate “a state of consciousness having to do with the arousal of feelings” and Intelligence is the ‘ability to learn or understand from experience’. So, emotional intelligence refers to the ability of a person to recognize, control and use their feelings and of others

Emotional intelligence is a basic requirement at the adolescent stage of life. It is required to live as a good human being and to be sensitive towards the society. This quality helps us not to be self-centred and to have a feeling of empathy towards other people. High emotional intelligence would help an individual to treat others with equal respect and care for them. Students who have a good EQ have a good relationship with their teachers and parents which ultimately help them to perform well in their exams. An emotionally intelligent adolescent will not have conflicts with their peer group and do not fall into bad habits like using drugs and alcohol.

Significance of emotional intelligence

Studies have described that Children with high EQ are more confident, are better learners, have higher self-esteem, have few behavioural problems, are more optimistic and happier, handle their emotions better and even to be successful entrepreneur one needs to have a high emotional intelligence. (Gill, 2003; Ghosh, 2003). Educational organizations are picking up this concept of EI, in hope of achieving a systemic solution to improve outcomes - academically and socially as well. Finn and Rock in 1997 stated that high school students who exhibit behaviours consistent with social and emotional competency are more apt to be successful in school. Another study using a cross-sectional approach explored the relationship of emotional intelligence and mental health in adolescents and found that emotional intelligence can help improve mental health when fostered through school-based programs.

Several studies have demonstrated that students with high IQ do not necessarily succeed in their adolescents and adult lives. While individuals with purely high IQ possess a great range of intellectual interest and abilities, they have difficulty dealing with their own emotions and with the emotions of others. Other intangible characteristics and abilities, such as self-motivation, impulse control, the ability to regulate one's own emotions, and empathizing with others clearly influence a person's accomplishments in life; these qualities have been collectively termed "Emotional Intelligence". People with high emotional intelligence levels excel socially, are outgoing and cheerful, are rarely fearful or worried, and are sympathetic and caring in their relationships (Gupta, Navita 2018).

Students who are described as emotionally literate can master emotional abilities and to control themselves when faced with pressure during life transitions (Finn, 1993;

Goleman, 1995; Sinclair, Christenson, Evelo, & Hurley, 1998.) Emotional intelligence is important in predicting academic success (Lam & Kirby, 2002). It appears that some dimensions of emotional intelligence (intrapersonal abilities, adaptability, and stress management) predict academic success among university students (Lam & Kirby, 2002). Goleman (1995) stated that students who have emotional competency can better deal with the pressure of peer politics, the higher demands required for academics, and the temptations of alcohol, drugs and sex. Research show that emotional intelligence of adolescents was moderately correlated with well-being (De Lazzari, 2000, Adeyemo and Adeleye, 2008). A variety of inferences can be drawn as to why adolescents who are high in emotional intelligence also score high in psychological well-being. One explanation is that adolescents with high scores in emotional intelligence have a good knowledge of their emotions and this is characterized by self-awareness which is critical to self-acceptance which has been operationalised as a domain of psychological well-being (Ryff, 1989a).

Emotional intelligence enables the adolescent to develop very good interpersonal relationships and to have better social support. It is a highly desirable and personally valuable attribute to possess. Through life skills training and scientific guidance, we can improve the emotional intelligence of adolescents and thus we can lead them towards a very successful future life (Bagga, Manpreet Kaur 2016). Emotional intelligence is also positively correlated with self-concept, which means that the higher the emotional intelligence of a teenager, the better of the self-concept he builds. A teenager often can recognize the emotions of others so that it affects the formation of adolescent self-concept. It is because sensitivity is created among adolescents (Indrayana & Hendrati, 2013).

MEASURES OF EMOTIONAL INTELLIGENCE

There are several assessment tools purporting to measure EI that have been developed. As noted by Ciarrochi, Chan, Caputi, and Roberts (2001), these assessment tools differ based on their different conceptual frameworks and their use of different measurement approaches that include performance tests, self-report inventories, and observer ratings.

MSCEIT

The MSCEIT is an update of the Multifactor Emotional Intelligence Scale (MEIS) that was first developed by Mayer and Salovey, and Caruso in 1999 in an intelligence testing tradition. The MSCEIT is an ability test in which the person being tested performs a number

of tasks designed to test various dimensions of EI. The most recent version of the MSCEIT is Version 2 (V.2), which was designed to measure the four branches of Mayer and Salovey's (1993, 1997) EI ability model. The MSCEIT V.2 provides a total EI score and four component scores on (a) perception of emotion, (b) integration and assimilation of emotion, (c) knowledge about emotions, and (d) management of emotions. The instrument has 141 items and is shorter and quicker to administer than the first version of the test. The instrument also provides both consensus and expert scores for all the four dimensions' scores. Each task uses a different item, and different response scales are used by different scales. Reliabilities for the test at both the total and dimension levels are said to be greater than .75, and the internal consistency reliability is .71 for expert scoring and .68 for consensus scoring (Mayer, Salovey, Caruso, & Sitarenios, 2003).

ECI

Like the MSCEIT V.2, the ECI is also new, having been updated from the original version of "360-degree assessment" that included self-ratings, peer ratings, and supervisor ratings. The ECI is designed to assess an individual's emotional competencies and positive behavior. The inventory consists of 110 items that assess 20 competencies that are organized into the following clusters: (a) self-awareness, (b) social awareness, (c) self-management, and (d) social skills (Boyatzis, Goleman, & Rhee, 2000). The internal consistency of the ECI scales ranges from .61 to .85 for self-assessment and from .80 to .95 for peer and supervisor rating scales (Sala, 2002).

EQ-i

The EQ-i is a 133-item self-report instrument that asks individuals to answer a series of questions about how they feel, think, and behave most of the time as far as their emotional and social competencies are concerned. The assessment takes approximately 30 min to complete, and the measure yields an overall EQ score and scores on five composite scales: (a) intrapersonal, (b) interpersonal, (c) adaptability, (d) stress management, and (e) general mood (Bar-On, 1997; Cherniss, 2004; Conte, 2005). The EQ-i demonstrates adequate reliability and validity evidence. For example, Bar-On (1997, 2000) reported internal consistency of the overall EQ-i to be .76, and then test– retest reliabilities of .85 after 1 month and .75 after 4 months; in terms of discriminant validity, EQ-i correlated .12 with the Wechsler Adult Intelligence Scale

SSEIT

The Schutte Self Report Emotional Intelligence scale was developed with items based on the Salovey and Mayer (1990)'s model of emotional intelligence. The SSEIT is a self-report questionnaire developed by Schutte et al. (1998). The instrument has **33** items whose responses are indicated on a 5-point Likert scale ranging from 1 representing strongly disagree to 5 representing strongly agree. SSEIT is also referred to as the **Assessing Emotions Scale** (AES), the Emotional Intelligence Scale (EIS), the Self-Report Emotional Intelligence Test (SREIT), the Self-Report Emotional Intelligence Scale (SREIS), or the Schutte Emotional Intelligence Scale (SEIS). The test measures four factors: expression of self's emotions, understanding of others' emotions, regulation of emotions, and utilization of emotions. The SSEIT yields a total score ranging from 33 to 165 with higher scores indicating greater emotional intelligence (Schutte et al., 1998).

Intervention studies done to develop emotional intelligence

Recognizing the need of enhancing emotional intelligence of adolescents, various research has been conducted where in different strategies and methods have been developed for enhancing the emotional intelligence for making better academic achievement.

Value Based Intervention Program is playing significant role in enhancing the Emotional Intelligence of adolescents. Through this VBIP adolescents level of emotional intelligence has been promoted. In other words, this program has been responsible for the uplifting the level of empathy, understanding own and other emotions, managing emotions and establishing social relationships. Besides this, through this program adolescents' level of self-concept specifically awareness of the self, his /her attitude pertaining to his/her worth, how one define one self, self-observation, person's thoughts, feelings, hopes and individual understanding of oneself especially during crises have been advanced and upgraded (Gupta, Navita 2018). Comprehensive Value means that assess those values which are helpful for adolescents to make their life happy and comfortable. Comprehensive values included all values which are useful for present life, for future generation to nourish high ideals and contribute to the development of the society.

Emotional learning is important for everyone. Dealing effectively with emotions helps individuals to develop more positive relationships and provide a sense of mental or psychological well-being. Those adolescents who are 'emotionally developed' are deemed

to be better able to live with or cope with difference. A continuous and on-going program on emotional literacy for students will help address many of the issues. Looking at the dearth of such programs available, the present study is an attempt to develop the core competences of emotional literacy in school children. The study is an intervention program, developed on an experiential paradigm and designed to enhance the skills that come under emotional literacy. It intends to help children become aware of their own emotions, accept their emotions, become motivated to achieve, become empathic towards others and to develop positive and healthy relationships. The results of the study show that the subjects benefited from the intervention program and there was an improvement in almost all the dimensions of Emotional Intelligence. (Kushwaha, Sukriti,2005)

Life skills play an important role not only in improving the academic performance of students but also its influential role in non-academic aspects such as strengthening coping strategies, developing self-confidence and emotional intelligence. Thus, life skills should be integrated into the regular school curriculum to enhance the mental health of students, equip them with better adapted skills to face the challenges of changing life situations and empower them to become fully functioning contributors to the host society in particular and the world in general (Yankey,Tsering 2011)

Adolescent stage is often referred to as the “stage of storm and stress” (Hall,1904). In this period of adolescents, the balance of mental, physical and social strength is often lost. Emotional expressions fluctuate frequently and quickly, and it is very difficult to put a check on the emotion during the peak of adolescence. In this stage of life, yoga plays a vital role and helps in balancing the life of adolescent students. In the present study, yoga practices were positively significant with emotional intelligence of adolescence students. Therefore, it is deduced that through yoga practices, the emotional intelligence would improve and control mind fluctuations. It is concluded from the study that there was no difference between the Experimental and Control group of adolescent students (Boys and Girls) in relation to Emotional Intelligence and Academic Stress scale before the intervention of yoga practices. At the same time, after the intervention of yoga practices, a significant difference was noticed between the Experimental and Control group of student’s scores in the factors of Emotional Intelligence and Academic Stress. (Sah, Sapna 2017)

Yet another study conducted out was to develop a Self-science Curriculum Package for adolescents in Juvenile Homes for enhancing their Emotional Intelligence. Findings of

the study revealed that SSCP is very effective in enhancing Emotional Intelligence of adolescents in Juvenile Homes. Emotional learning in schools is the need of present day, as the prevalent educational system only focuses on the academic outcomes. This leads to social disintegration. Nurturing heart is must to build up toleration among people. Social expectations are very high, that the developing generation should meet those expectations as they are the next framers of the world. Educational materials like SSCP may be used to serve the above purpose. Emotional Intelligence education through Self science enables human potential development and fosters interpersonal relation. It may, therefore, be included as separate subject in the school curriculum or as integrated study. (Marar, Sreevidya 2015)

CONCLUSION

The paper sought to review the existing literature on emotional intelligence. Significance of emotional intelligence, different measures of emotional intelligence and intervention studies done to develop emotional intelligence have been discussed in the paper. High emotional intelligence has a great impact on the lives of adolescents. Emotional intelligence predicts future success in relationships, health and quality of life. It's been shown that children with high EQs earn better grades, stay in school longer and make healthier choices, more co-operative and make better leaders in the classroom. So, the role of emotional intelligence has to be stressed and should be included in the school curriculum of adolescents.

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