A PROJECT SUBMITTED TO

## **NIRMA UNIVERSITY**

In partial fulfillment of the requirements for the degree of

## **Bachelor of Pharmacy**

## MEHTA RUSHABH D. (16BPH085)

**B. Pharm. Semester VII** 

UNDER THE GUIDANCE OF

Dr. CHARMY S. KOTHARI

Associate Professor Department of Pharmaceutical Analysis



INSTITUTE OF PHARMACY NIRMA UNIVERSITY SARKHEJ-GANDHINAGAR HIGHWAY AHMEDABAD-382481 GUJARAT, INDIA May\_20

### CERTIFICATE

This is to certify that "REVIEW ON EFFECT OF HERBAL DRUGS IN TREATMENT OF ALZHEIMER'S DISEASE" is the bonafide work carried out by RUSHABH MEHTA (16BPH085), B.Pharm semester VIII under our guidance and supervision in the Institute of Pharmacy, Nirma University, Ahmedabad during the academic year 2019-2020. This work is up to my satisfaction.

Guide: Cliptu

Dr. Charmy S. Kothari M. Pharm., Ph.D., Associate Professor, Department of Pharmaceutical Analysis, Institute of Pharmacy, Nirma University

**Prof. Priti J. Mehta** M. Pharm., Ph.D., Head, Department of Pharmaceutical analysis, Institute of Pharmacy, Nirma University

**Prof. Manjunath Ghate** M. Pharm., Ph.D., Director, Institute of Pharmacy, Nirma university

Date: 6/7/2020

## **CERTIFICATE OF SIMILARITY OF WORK**

This is to undertake that the B.Pharm. Project work entitled "REVIEW ON EFFECT OF HERBAL DRUGS IN TREATMENT OF ALZHEIMER'S DISEASE" Submitted by RUSHABH MEHTA (16BPH085), B.Pharm. Semester VIII is a bonafide review/research work carried out by me at the Institute of Pharmacy, Nirma University under the guidance of "Name of a Guide and Co-guide". I am aware about the rules and regulations of Plagiarism policy of Nirma University, Ahmedabad. According to that, the review/research work carried out by me is not reported anywhere as per best of my Knowledge.

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Rushabh Mehta (16BPH085), Institute of Pharmacy Nirma University Sarkhej - Gandhinagar Highway Ahmedabad-382481 Gujarat, India

Guide:

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Dr. Charmy S. Kothari M. Pharm., Ph.D., Associate Professor, Department of Pharmaceutical Analysis, Institute of Pharmacy, Nirma University

Date: 16 |7 | 2020

## **DECLARATION**

I, RUSHABH MEHTA (16BPH085), student of VIII<sup>th</sup> Semester of B.Pharm at Institute of Pharmacy, Nirma University, hereby declare that my project entitled "REVIEW ON EFFECT OF HERBAL DRUGS IN TREATMENT OF ALZHEIMER'S DISEASE" is a result of culmination of my sincere efforts. I declare that the submitted project is done solely by me and to the best of my knowledge, no such work is done by any other person for the award of degree or diploma or for any other means. I also declare that all the information was collected from various primary sources (journals, patents, etc.) has been duly acknowledged in this project report.

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Rushabh Mehta (16BPH085), Institute of Pharmacy Nirma University Sarkhej - Gandhinagar Highway Ahmedabad-382481 Gujarat, India

Date: 16/7/2020

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### <u>1. ABSTRACT</u>

Alzheimer's disease is a common cause of dementia the distinctive features includes 'neurofibrillary tangles' and 'amyloid beta plaques' in the intracellular atmosphere, 'neuronal death' and 'loss of synapses', all of which contribute to cognitive decline in a progressive manner. In 2019 Alzheimer's disease International (ADI) gauges that there are over 50 million individuals living with dementia worldwide, a figure set to increment to 152 million by 2050. Current therapies induces FDA approved 5 drug works on Acetylcholine inhibitors and NMDA antagonist to treat its symptoms that demonstrated modest benefits, but likely does not alters disease progression. However, there is an urgent need for the development of new lead inhibitor compounds with least toxicity. A vast studies have been so far carried on preclinical & clinical studies among this natural plants showed Cholinesterase Inhibitors, Modification of monoamines, Anti-amyloid aggregates, Antioxidant and Phosphodiesterase Inhibitors (Flavonoids, Alkaloids, Saponins, Lignans, Coumarins and essential oil). This review highlight the pharmacological basis of Tinospora Cordifolia and Garlic to control oxidation stress, amyloid beta plaques and protective effects in the treatment of AD, which will benefit to the biological scientists in understanding and exploring the new in-site of natural chemical compound in combating Alzheimer's disease.

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#### <u>ALZHEIMER DISEASE</u>

#### 2. INTRODUCTION:

"Alzheimer's disease" is the most frequent form of the senile dementia, which influences 10% of patients more established than 65 and almost half of those more than 85. The wide spread nearness of AD in the United States is determined to about almost 4.5 million and is anticipated to ascend to 13.2 million in the following 5 decades. Albeit basic research in AD has gained extraordinary ground over the most recent 20 years, right now economically available medications are able just to improve cognitive symptoms for a brief timeframe period, and no treatment can opposite, stop, or even moderate the extreme neurodegenerative procedure. The pathophysiology of Alzheimer's malady is related with an assortment of components, which incorporates the extracellular collection of 'beta-amyloid (Ab) plaques', accumulation of intracellular 'neurofibrillary tangles', 'oxidative neuronal harm', and inflammatory falls. Morphologically, the brain atrophy and furthermore by broadened cerebral ventricles describes the aliment(illness). From a biochemical perspective, a shortage of the choline acetyltransferase, diminished degrees of cholinergic systems, and other cholinergic markers are the most common findings. Dr. Alois Alzheimer announced the 5-years clinical report of a 51-years of age lady with dynamic dementia and postmortem discoveries of neuronal misfortune, neurofibrillary tangles, and miliary amyloid plaques upon light infinitesimal assessment of Bielshowsky silver-recolored brain segments. Hence, Dr. Alzheimer was the first to propose a connection, between a dynamic dementia and these unusual proteinaceous totals found on brain segments. Which is currently known as Alzheimer's illness.

#### 2.1.- EPIDEMIOLOGY OF ALZHEIMER'S DISEASE

The danger of "Alzheimer's" ascend with expanding age and generally pervasive in ladies. The predominance of "Alzheimer's" ranges from 1% at ages 65-70 to approx. 4% over age 85. In US the quantity of cases significantly increased as contrast with 2000. 420,000 cases in 2000 and 1.3 million out of 2050.(Anil Kumar, Arti Singh, 2015)



Fig 1. Graphical representation of people suffering from dementia from different years.

The number of patient's every-year are increasing at very high rate. And an prediction of 2050<sup>th</sup> year is made which shows 131.5 million patients suffering from dementia.



Fig 2: Graph of patient vs prevalence of Alzheimer's disease and dementia at different years.

## 2.2- PATHOPHYSIOLOGY OF ALZHEIMER'S DISEASE:

Generally, the main distinguished gene causing Alzheimer's sickness was that encrypting the substrate (APP), from which the Ab peptide is produced. With RUSHABH MEHTA INSTITUTE OF PHARMACY, NIRMA UNIVERSITY 3

pathophysiology of AD, discussion comes back to the Alzheimer's time 1907 when he viewed the neuropathological features of the contamination for instance amyloidal-plaques and over phosphorylated NFTs. The cause for the autosomal dominant form of

AD was because of the mutation that had taken place in amyloid precursoe in preseniline-1, preseniline-2 and protein, not occurring artificially but naturally with onset of presenile.

Two pathological pathway of the 'Alzheimer's Disease':

- 1) Extra-cellular  $\beta$ -amyloid deposites (in-senile)
- 2) Intra-Cellular Neurofibrillary Tangles(Paired Helical-fragment)

Death of neuron and synapse is caused by the gathering or accumulation of the  $\beta$ amyloid and neurofibrillary tangles, which give growth to gross atrophy of injured tissue of brain, originating from mesial temporal lobe.

The exact mechanism of severe damage caused by amyloid and neurofibrillary tangles in the brain is still not completely known. There are several assumptions to the mechanism theory:

According to the **AMYLOID HYPOTHESIS**: The neuronal cell death is the result of complex events in the brain due to the accumulation of the  $\beta$ -amyloid palques. In other words gathering of  $\beta$ -amyloid plaque leads to damage and shows symptoms of dementia.

In 'Alzheimer's disease' **PRION MECHANISM** is also been identified. Prion Protein- brain-protein present on normal cell's surface which gets incorrectly bound into pathogenic form called 'Prion'. Thus unfolding of other protein occurs due to prion and also the accumulation of various prion protein occurs which leads to the dysfunction of the brain and causes damage. In Alzheimer the  $\tau$ -neurofibrillary tangles have prion like properties.



#### 3. GARLIC:

### 3.1- INTRODUCTION:

Botanical source-*Allium sativum* is a species in the onion genus, Family-Amaryllidaceae. Garlic was first found in Central Asia and northeastern Iran, and has a background marked by a few thousand years of human use. Old Egyptians it is so called, and has been used both as a nourishment seasoning and as a conventional medication. In the regular serving size of I-III cloves (III–IX grams), garlic gives no huge healthy benefit, with the substance of every single basic supplement underneath Daily Value (DV) = 10%. At the point when communicated in 100 grams, garlic contains different supplements which have rich sums (20% or a greater amount of the DV), including the dietary minerals manganese and phosphorus and vitamins C and B6. For 100 gram= garlic moderate source of containing thiamin + pantothenic acid + vitamin b + dietaryminerals iron, calcium & zinc.

The composition of raw garlic is 2% dietary fiber, 59% water, 6% protein, 33% carbohydrates, and less than 1 percentage of fat.(Anil Kumar, Arti Singh, 2015)

### 3.2- USES OF GARLIC

Since ages Garlic is used as a medicinal plant. Garlic is used in Cardiovascular disease as it helps in reducing the platelets concentration. The people consuming anticoagulant medication have to take care during consumption of Garlic. Garlic is also used in Cancer. It was found that the risk of stomach cancer was reduced in patients consuming Garlic. Also in some studies Garlic helps in reducing Prostate Cancer. Used in Neurological Disorders like Alzheimer's, Parkinson's, etc. Various Garlic Plant parts are used for various purpose. Further uses of garlic are during high cholesterol, allergies, diabetes, coughing, athlete's foot, respiratory problems, poor digestion, blood cholesterol, colon cancer, chronic bronchitis, toothaches, anti-fungal, breast cancer, cold and flu and lastly yeast infections.

### 3.3- TYPES OF GARLIC

- 1) Softneck Garlic
- 2) Silverskin Garlic
- 3) Artichoke Garlic
- 4) Hardneck Garlic
- 5) Rocambole
- 6) Porcelain Garlic
- 7) Purple stripe

### <u>4. TINOSPORA CORDIFOLIA</u>

### 4.1- INTRODUCTION

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Since ancient times **Guduchi, heart-leaved moonseed** is the commonly used name of *Tinospora cordifolia* and belonging to family Menispermeaceae. Initially found from Sri Lanka, India, and Bangladesh. It is a climbing shrub, leaves are alternate, simple along with long petioles. Flowers are small and unisexual and appears when the plant losses its leaves. Flowers have 6 sepals, 3 in each series. Phytochemicals such as polysterols, alkaloids, glycosides and some other compounds. Also Tinosporic acid, columbine, berberine, Tinosporaside, palmatine, Tinocordifolioside, choline, steroids, diterpenoid lactone, tinosporon, and tembeterine. Extract of various parts of the plant are used for medicinal use.(Saha, Ghosh, & Marg, 2020)



## 4.2- USES OF TINOSPORA CORDIFOLIA

- Tinospora is used for high cholesterol, diabetes, gout, lymphoma, hay fever, hepatitis, rheumatoid arthritis, peptic ulcer disease, syphilis, and to strengthen the immune system.
- Tinospora cordifolia is also one of the ancient plant used for the treatment of various disorders. A disadvantage of Tinospora cordifolia is that there is no record of the potency of the plant in treatment of the drug. Now a days any marketed product of the drug are available.
- Mainly tinospora is used for the Neurodegenerative disorders such as "Alzheimer disease", "Parkinson disease", ageing, etc.
- Tinospora cordifolia also helps in the blood formation by removing the impurities present in the human blood and also promote the blood formation. Also promotes the digestive system and boosts the process of digestion.
- Considered as the most potent drug in cancer treatment, as an Immunomodulator, anti-toxic effect, anti-osteoporotic effect, anti HIV effect, anti-microbial activity, anti-oxidant activity.(Other et al., 2020)

### 5. TABLE OF GARLIC AND ITS EFFECT ON TREATMENT OF ALZHEIMER DISEASE

Sr.	Title	Which Part of Plant	Which Test	Result	Journal
No		Used	Performed		
1	"Effect of aged	Aged garlic extract.	Elisa,	Results showed reduced cerebral	(Chauhan,
	garlic extract on	Produced by prolong	Tissue searation,	plaque, resistant fibrillary,	2006)
	APP processing and	drying of fresh garlic	Western Blot analysis,	decrease detergent solubility and	
	tau	for a longer time.	Neuroanatomy and	further cleaved the sAPP and	
	phosphorylation in		immunocytochemistry	reduction of inflammation and	
	Alzheimer's"	Invivo-		conformation change in TAU	
		Cortex, Hippocampus		(GSK3 and not in CdK5)	

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2	"Amelioration of	"2 % Aged Gralic	(1)Transgenic	Results show that the watched	(Sandoval
	Early Cognitive	Extract"	breeding	behavioural disintegration is	, 2007)
	Deficits by Aged		(2) "Morris water	associated with detergent insoluble	
	Garlic Extract in	Invivo- Brain	maze" test	fibrillar A $\beta$ , yet on addition with	
	Alzheimer's		(3) "Y-Maze" test,	detergent dissolvable A <sub>β</sub> . The	
	Transgenic Mice"		(4)E.L.I.S.A.,	outcomes additionally recommend	
			(5)Retention Memory	a solid relationship between's the	
			test	higher quantity of A $\beta$ 42 species	
				and also the memory loss.	
3	"Garlic Extract	"Boiled garlic extract"	(1) Assay of protease	The outcomes exhibit that both	(Gupta &
	Exhibits	(BGE) and "aqueous	activities	Fresh GE and Boiled GE hinder	Rao,
	Antiamyloidogenic	fresh garlic extract"	(2) Dis-aggregation	amyloid-fibril formation and Fresh	2009)
	Activity on	(FGE). The	and inhibition of $A\beta$	GE even causes disaggregation of	
	Amyloid-beta	concentration of extract	aggregation with FGE	fibrils in arrangement. These	
	Fibrillogenesis:	$= 100 \mu g/mL.$	(3) Thioflavin-T assay	discoveries recommend the	
	<b>Relevance to</b>		for observing Aβeta	conceivable utilization of garlic for	
	Alzheimer's		40 aggregation.	hindrance of accumulation and	
	Disease"		(4)Electrophoresis	statement of $A\beta$ in the human-	
				brain. In outline, as per the reports	

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				accessible, GE applies a mixture of	
				antiapoptotic, antioxidative &	
				antiamyloidogenic impacts.	
4	"Garlic and its	Aged Garlic Extract,	In the " <b>middle</b>	Garlic Extract- stop cognitive	(Farooqui
	Effects in		cerebral artery	decay by shielding neurons from	&
	Neurological	Invivo- Brain	occlusion" (MCAO)	A-β neurotoxicity, just as blocking	Farooqui,
	Disorders"	In vitro- Rat, Mouse	model,	apoptotic cell dying brought about	2017)
			Neuro-chemical	by oxidative pressure and	
			events and	neuroinflammation.	
			pretreatment with	Further garlic with recognized	
			aqueous Aged Garlic	active components are important to	
			Extract for 30 minutes	understanding the valuable	
			before the incubation	impacts of garlic in stroke, HD,	
			in MCAO.	AD, and Parkinson Disease.	
5	"Aged Garlic	Aged Garlic extract	1) "A-β (1-42)	In the principal maintenance	(Nillert et
	Extract: Cognitive		Injection and Drug	period (defer 5 min), just the test	al., 2017)
	Dysfunction and	In Vitro- Male Wistar	Treatments"	animals that got AGE125 and A $\beta$	
	Neuroinflammation	rat	2) "Novel Object	(1-42) despite everything	
	Induced by β-		Recognition" (NOR)	demonstrated shortfalls in memory	

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	Amyloid in Rats		test	retention. Interestingly, the test-	
	(Neuroprotective		3) Tissue Processing	animals were administered AGE at	
	effects)"		4)Immunohistochemis	dosages of 500 and 250 mg/kg BW	
			try	investigated the novel article	
			5) Western Blotting	essentially more than the	
				recognizable item demonstrating	
				memory recovery. The past	
				information show that the AGE is	
				one, of the agent to decend the	
				severeness of AD.	
6	"S-Allyl cysteine	Aged Garlic Extract.	(1) Cell Cultures	Information exhibit that SAC	(Kosuge
	selectively protects		(2) Cell viability	uniquely affects the ER, and could	et al.,
	cultured rats		Assessment	shield against the neuronal cell	2003)
	hippocampal	In Vitro- Rats	(3) Reduction Assay-	loss that is because of ER	
	neuron from	In vivo-	MTT	dysfunction. SAC, one of the	
	amyloid protein	(1)"Hippocampal	(4) Intracellular GSH	organo-sulfur mixes having a	
	and tunicamycin	neurons"	and ROS analysis	thioallyl bunch in AGE, secures	
	induced neuronal	(2)"Cerebellar granule	(5) Western Blotting	neurons against A-induced toxicity	
	death."	neurons"	(6) Assay of Total	based on the conc. dependent	

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			Antioxidant Activity.	manner, whereas it doesn't stop	
				HNE-initiated cell decrease in	
				hippocampal neurons.	
7	"Ameliorative	Aged Garlic Extract.	Test for Motor	The body mass and Learning of	(Nishiyam
	Effect of S-		activity, Test for	control P8-and P10-treated mice =	a,
	Allylcysteine, a	Diet = 40 mg SAC/kg	Passive / Conditioned	lower than the R1-control mice.	Moriguchi
	Major Thioallyl	diet. SAC dosage- 2	avoidance tests [step-	The conditioned shirking response	,
	Constituent in Aged	g/100 g AGE diet.	through and-step	of R1-control mice in the shuttle	Morihara,
	Garlic Extract, on		down] / [shuttle-box	box test continuously expanded,	& Saito,
	Learning Deficits in		and lever-press] and	coming to 95% at last. The	2001)
	Senescence-		the Morris water maze	measure of anxiety is done by	
	Accelerated Mice"		test,	elevated plus maze test, it likewise	
			Elevated plus maze	mirrors the capacity of the mice to	
			test, Antibody	identify the circumstance. Hence,	
			productionability	these outcomes may show that	
			assay.	SAC encouraged memory.	

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8	"S-allyl-L-cysteine,	Aged Garlic Extract.	Cell Culture method	SAC specifically shield this cell	(Ito et al.,
	a garlic compound:		& cell vialbility	from Ab-initiated neurotoxicity,	2003)
	protective effect on	Propidium iodide, HNE,	assessment	and that contrasts toxicities	
	amyloid b-protein-	Amyloid b-protein140,		prompted by A-b and initiated by	
	induced cell death	"Dulbecco's modified		[HNE-and NGF] deprivation in	
	in nerve growth	Eagle's medium"		PC12 cells.	
	factor-	(DMEM) and fetal		Information demonstrate that SAC	
	differentiated PC12	bovine serum and SAC		may uniquely affect Ab-and	
	cells"			tunica-mycin-induced cell demise	
				which might be activated by ER	
				disturbance in PC12 cells.	
9/	"S-Allyl cysteine	Aged Garlic Extract, S-	(1) ROS Assay	Results showed= positive findings	(Pérez-
	prevents amyloid-h	Allylcysteine = reaction	(2) Lipid fluorescent	and the properties of S-allyl-	Severiano
	peptide-induced	of L-cysteine + allyl	Assay	cysteine in different experimental	et al.,
	oxidative stress in	bromide and	(3) Estimation of	models of central and systemic	2004)
	rat hippocampus	Purified= ethanol-water	glutathione	diseases, So aged garlic extract	
	and ameliorates		peroxidase activity	compound – positive clinically in	
	learning deficits"	In vivo- Male Wistar	(4) Superoxide	neurological degenerative	
		Rats	dismutase activity	diseases.	

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			evaluation		
			(5) Spatial learning		
			and memory		
			Evaluation		
10	"Structure Activity	(+)-S-Allyl-L Cysteine-	(1) Oxygen-Glucose	Neuroprotective activity (presence	(Kim,
	Relationship of	sulfoxide and SAC,	Deprivation (OGD)	of the alanyl group and absence of	Hyun,
	Neuroprotective	diallyl sulfide, diallyl	(2) Global Cerebral	the oxo group) against ischemic	Kim,
	And Reactive	disulfide, diallyl	Ischemia Model.	abuse and scavenging of OH	Chang, &
	Oxygen Species	trisulfide	(3) Trolox Equivalent	radicals, with SAC = intense	Hyang,
	Scavenging		Antioxidant Capacity	neuroprotectant. Especially, SAC	2006)
	Activities for		(TEAC)	is effortlessly invested in the GI-	
	Allium		4) Scavenging of O2	tract and be distinguished with	
	Organosulfur		5) Scavenging of	liver, kidney & plasma after oral	
	Compounds"		Hydroxyl Radicals	admission And have less toxicity	
			(OH-)	quality in Mice/ Rats	
			6) Scavenging of		
			ONOO-		

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11	"Amyloid- Protein	The most rich	1)Drug Treatment and	A potentiates ER stress-prompted	(T. Imai,
	Pontentiates	organosulfur (SAC) of	assessment: Neuronal	neuronal passing evoked by TM at	Kosuge,
	Tunicamycin-	aged garlic extract	death	focuses that potentiate ex-citotoxic	Ishige, &
	Induced Neuronal		2)Assay for release of	neuronal loss in OHCs. The	Ito, 2007)
	Death in	In vivo-hippocampal	Lactate	critical neuroprotective impact	
	Organotypic	tissue	Dehydrogenase	against ER stress-instigated	
	Hippocampal Slice		3)Western-Blot Assay	neuronal passing in special zones	
	Culture"			in OHCs and its potentiation by	
				Ca2+ – calpain connection is given	
				by SAC.	
12	"Antioxidative and	Aged Garlic Extract,	(1)Preparation of	Results showed that the capacity	(Park,
	antigenotoxic effect	Raw Garlic Extract,	Extracts from Garlic	of ordinary human leukocytes to	Park, &
	of Garlic prepared	Heated Garlic Extract	(2)Measurement of	oppose H2O2 is improved by	Park,
	by Different		Total Phenolic	Garlic and also HNE inciated	2009)
	Processing		Content (TPC)	oxidative harm under ex vivo	
	Methods"		(3) DPPH Radical	conditions, crushing the heated	
			Scavenging Activity	garlic-decrease phenolics by	
			measurement	enzymatic oxidation, the high	

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			4)Measurement of	antioxidant exercises of RGE and	
			SOD-like Activity	HGE may be because of	
			(5) Alkaline-Comet	antioxidant mixes other than the	
			Assay(DNA damage)	absolute phenolic substance.	
13	"S-Allyl L-cysteine	S-allyl-L-cysteine	(1)Drugs and	The SAC restored mitochondrial	(Atif,
	diminishes cerebral	(SAC). SAC (300	chemicals	glutathione (GSH) and glucose	Yousuf, &
	ischemia-induced	mg/kg)	(2)evaluation of brain	6phosphatedehydrogenase (G6-	Agrawal,
	mitochondrial		edema	PD) with high decrease in	2009)
	dysfunctions in	In vivo- Male wistar	(3)Cerebral ischemia	Mitochondria Lipid Peroxidation,	
	hippocampus"	rats	(I/R) induction	carbonyl protein and H-peroxide	
		In vitro-Cerebral Artery	(4)Cytosolic partition	content. SAC has improved	
			and PMS	neurological shortages surveyed	
			(5)Non-synaptic	by various strategies when	
			mitochondria isolation	contrasted with MCAO group.	
			from hippocampus	Additionally, the mind edema was	
			(6)Mitochondrial-	diminished. SAC causes loss of	
			Lipid peroxidation	mitochondrial function and shows	
			(LPO)	its neuroprotective impact against	
			(7)Mitochondrial	cerebral ischemic harm in	

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			(GSH)	hippocampus	
14	"Garlic active	S-allyl cysteine (SAC)	(1) "Y-maze task"	In this study lipopolysaccharide	(Zarezade
	constituent s-allyl	is the active and main	(2) "Novel object	(LPS) was induced which cause	h,
	cysteine protects	component of aged	determination(NOD)	neuroinflammation and memory	Baluchnej
	against	garlic extract	test"	impairment and treated with S-	admojarad
	lipopolysaccharide		(3) "Passive	allyl cysteine (SAC) which inhibits	,
	induced cognitive	In Vivo-Male albino	avoidance test"	LPS induced disorders.	Kiasalari,
	deficits in the rat:	Wistar rats	(4) Oxidative stress		Afshin-
	Possible involved		determination		Majd, &
	mechanisms"		(5) Assess the		Roghani,
			Hippocampal AChE		2017)
			(6) Hippocampal		
			Nrf2, TLR-4, IL1β &		
			GFAP		
			(7) Immunoblotting		
15	"S-allyl cysteine	S-allyl cysteine form	(1) Evaluate effect of	Results showed that there was no	(Javed et
	attenuates oxidative	aged Garlic Extract	SAC extract on DNA-	change in TBARS. Reduction of	al., 2011)
	stress associated		fragmentation,	GSH Level in hippocampus of rats	
	cognitive	In Vivo- Swiss albino	immunostainig histo-	that are been treated as compared	

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	impairment and	mice	pathological analysis	to that of the untreated rats. The	
	neurodegenration		(2)Intracereboventricu	capacity of antioxidant activity got	
	in mouse model of		lar (ICV) infusion of	reduced. The test used to evaluate	
	atreptozotocin-		streptozotocin	learning and memory of the rats	
	induced		(3)Morris-water maze	was Morris-maze test, also	
	experimental		test	reduced latency and path length.	
	dementia of		(4) Biochemical	The data demonstrated loss of	
	Alzheimer's type"		analysis (TBARS	memory and hence garlic (SAC) is	
			content, Reduction in	used to cure the disease.	
			GSH, Estimation of		
			Glutathione		
			Peroxidase		
			(5)Immunohistochemi		
			stry		
16	"Ameliorating	Aged Garlic Extract	(1)PC12 cell culture	Highest level of in vitro	(Jeong et
	effects of aged		(2)Radicalscavenging	antioxidant activity is of ethyl	al., 2013)
	garlic extracts	In Vivo-Mice	activity ABTS	acetate fraction. Also	
	against Aβ-induced	In Vitro-Brain	(3)Malon-Di-	neuroprotective effect against the	
	neurotoxicity and		Aldehyde (MDA)	A $\beta$ -induced cytotoxicity in PC-12	

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	cognitive		assay using mouse	cells. Biochemical examinations	
	impairment"		brain	utilizing brain tissues obviously	
			(4)Measurement of	demonstrated brought down levels	
			cellular oxidative	of oxidative stress, and ethyl	
			stress	acetate division- matured extract	
			(5)Determination of	separate constricted memory and	
			Cell Viability	subjective capacity against Aβ-	
			(6)Y-maze test	instigated deficiencies.	
			(7)Passive avoidance		
			test		
17	"Protective effect of	aged garlic extract	(1)Preparation of	Presentation of the HPNs to TM	(Toru
	S-allyl-L-cysteine	constituent S-allyl-L-	culture of	(10lg/mL) for 24 h achieved a	Imai et al.,
	against	cysteine (SAC)	hippocampal neurons	basic decrease (53 %) of neuronal	2014)
	endoplasmic		(HNPs) of rats	continuance in the MTT reduction	
	reticulum stress-		(2)MTT reduction	assay. Application of the HPNs	
	induced neuronal	In Vitro- Hippocampal	assay,	with TM (24 h) realized a 63 %	
	death is mediated	Tissue	(3)Western blotting,	decrease a-spectrin levels, and the	
	by inhibition of		(4)In vitro calpain	reducing in the verbalization was	
	calpain"		activity assay	basically turned around by	

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r					
				concurrent usage of 1 mM SAC.	
				The SAC has therapeutic means of	
				curing ischemic disorders and	
				calpain overactivation.	
18	<b>"Protective Effects</b>	Aged Garlic extract	Water maze test, PD	Results showed remarkable	(Qu,
	of AGE and Its		mouse model, used in	neuroprotective activity of AGE	Mossine,
	<b>Components on</b>		treatment of various	and to reduce the effect of	Cui, Sun,
	Neuro-	In Vivo- mice	disease such as	pathophysiological deficit. SAC	& Gu,
	inflammation &		Parkinson Disease,	and AGE may provide shielding	2016)
	Neuro		stroke, Alzhimer, HD	effects and blocks the development	
	degeneration"		and lateral sclerosis.	of AD	
19	"Molecular	Aged Garlic extract	(1)Determination of	The pyrene substituted SAC can	(Sun &
	detection and in		free radical	be used as a natural antioxidant to	Wang,
	vitro antioxidant		scavenging capacity	scavenge active free radicals	2016)
	activity of S-allyl-L-		of DPPH,	produced by normal or regular	
	cysteine (SAC)		(2)Determination of	metabolism of human body to	
	extracted from		free radical	avoid various disease that body	
	Allium sativum"		scavenging capacity	can suffer from the improper	
			of hydroxyl free	balance of the free radicles in the	

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			radical (•OH)	body	
			solution, (3)Synthesis		
			of Py-SAC, Steady-		
			state fluorescence of		
			Py-SAC,		
			(4)Free radical		
			scavenging capacity		
			of DPPH by PySAC		
			and VC.		
20	"S-allyl-L-cysteine	Aged garlic extract	(1)Cell culture,	Three (SFN, SAC and iso) out of	(Denzer,
	and		(2)Determination of	seven nourishment determined test	Münch,
	isoliquiritigenin	In Vitro- PC12 cells	cell viability,	compounds, emitted an impression	Pischetsri
	improve		(3)Determination of	of being promising in the exact	eder, &
	mitochondrial		anti-proliferative	mitochondrial work in PC12 cell	Friedland,
	function in cellular		activity via crystal	bearing complex I loss of function	2016)
	models of oxidative		violet assay	affected by rotenone or complex	
	and nitrosative			IV function loss activated by SNP.	
	stress"			The nourishment inferred	
				compound in protecting	

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				mitochondrial function, related	
				with developing neurodegenerative	
				ailments.	
21	"Effects of different	Aged Garlic Extract,	(1)Solid-state	At the moisture content (50%)	(Daliri et
	processing methods	Raw Garlic Extract,	optimization and	population of bacteria increased as	al., 2019)
	on the antioxidant	Heat Dried Garlic	fermentation,	compared to that of lower moisture	
	and immune	powder	Analysis of bioactive	level. The fermented extract of	
	stimulating abilities		compounds,	garlic have high phenolic	
	of garlic"		(2)Antioxidant	compound and also have high	
			activity (DPPH /	antioxidant activity. Heat dried	
			ABTS radical	extract have more activity as	
			scavenging activity)	compared to that of the freeze	
			(3)Immune	dried compound. Such extract are	
			stimulation ability	used for the improvement of the	
			(Peripheral blood	immune system.	
			mononuclear cells,		
			Cell proliferation		
			enhancement ability,		
			Cytokine assay,		

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			Production		
			measurement of nitric		
			oxide (NO)		
22	"The vivo	Aged Garlic Extract	(1) Self-made AGE	Consequences of gene expression	(Wang,
	antioxidang activity		preparation	profile array indicated that, the	Yang, &
	of self made aged	In Vivo- Mice	(2) Biochemical	independent AGE can shield mice	Zhang,
	garlic extract on	In Vitro-Brain, Liver	analysis in brain,	from D-galactose caused damage	2019)
	the D-galactose-		serum, liver.	by various perspectives, for	
	induced mice and		(4) Histological	example, starch digestion, lipid	
	its mechanism		analysis	digestion, immunomodulatory, cell	
	research via gene		Gene chip analysis	cycle guideline, (NH3) corrosive	
	chip analysis"		(5) RT-PCR	digestion and apprehensive	
			verification, &	guideline pathways. AGE-I and	
			Metabolic Pathway	AGE-II could keep the mice from	
			Analysis.	maturing by controlled stability of	
				gene, proteiasis, mitochondrial	
				working, epi-genetics, supplement	
				detecting, and intercellular	
				correspondence & cell senecence	

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### 6.- TABLE FOR TINOSPORA CORDIFOLIA AND ITS EFFECT IN TREATMENT OF ALZHEIMER DISEASE

Sr.	Title	Which Part of		Result	Referenc	es
No.		Plant Used	Which Test Performed			
1	"Antioxidant activity	Aqueous root	(1)Thiobarbituric-acid reactive	Results shows that on injection of	(Prince	&
	of Tinospora	extract of TC	substances determination.	TCREt, decreased the blood glucose	Menon,	
	cordifolia roots in	(TCREt)	(2)Estimation of reduced	level and also lowered the a-	1999)	
	experimental		glutathione and alpha-tocopherol	tocopherol and ceruloplasmin as		
	diabetes"	In-Vivo= Male	(3)Ceruloplasmin Estimation and	compared to that in the <b>diabetic</b>		
		Albino rats	Vitamin C Evaluation	rats. Thus TCREt has antioxidant		
				property when administered in		
				alloxan diabetes rats.		
2	"Antioxidant Action	Tinospora	(1)Determination of blood glucose	For all the methods the result overall	(Prince	&
	of Tinospora	cordifolia root	level	showed the highest antioxidant	Menon,	
	Cordifolia Root	extract	(2)Determination of TBARS	activity at dose 5.0 g/kg body	2001)	
	Extract in Alloxan	(TCREt)	(3)Determination og GSH	weight, and the activity gradually		
	Diabetic Rats"	Aqueous	(4)Assay of SOD	decreased as the dose of the drug		
		extract	(5)Assay of Catalase (	incresed (7.5 g/kg body weight) did		
		In Vivo-	(6)Estimation of protein	not show any significant effect.		
		Diabetic Rats				

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3	"Free radical	Dried Stem of	1) Assay for Estimating	The direct and indirect mechanism	(Goel &	ζ
	scavenging and metal	Tinospora	Antioxidant activity	are important in the severe	Kumar,	
	chelation by	Cordifolia	(2)Lipid Peroxidation	pathological conditions. By various	2002)	
	Tinospora		(3)Direct antioxidant defence	test it is proved that tinospora		
	Cordifolia, a possible		system	cordifolia extract have a much larger		
	role in		(4)Scavenging of Superoxide	potential and hence can be used for		
	radioprotection"		anions (5)Indirect defence System	clinical purpose.		
			(6)Single cell gel electrophoresis			
4	"Effect of Tinospora	Alcoholic	(1) Learning and memory test:	No toxicity was obseverd till	(Agarwal,	
	Cordifolia on	Extract: Whole	(a) Hebb-William Maze	3gm/Kg dose. Rats treated by	Malini,	
	learning and	Plant and	(b) Two compartment passive	Cyclosporine showed a dose	Bairy, &	ζ
	memory in Normal	Aqueous	avoidance apparatus (2)	dependent increase in learning score.	Rao, 2002)	
	& Memory deficit	extract of dried	Assessment of Motor Activity: By	Rats treated, with alcohol and		
	Rats"	coarse powder	open field chamber	cyclosporine had tendency to remain		
			(3)Assessment of cell mediated	in dark area. Locomotar activity was		
		In Vivo- Rats	immunity: (a) Dinitro Chloro	increased and skin sensitivity was		
			benzene skin sensitivity test (b)	decreased. In hippocampus no		
			Brain Histopathological Studies	structural changes were found. The		
				dual property of tinospora cordifolia		

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				bears a potential use.	
5	"Effect of Rubia	Plant extract	(1)Biochemical studies	Result shows, that there is increase	(Rawal,
	cordifolia, Fagonia	was used	(2)Ion selective electrode analysis	in antioxidant property by increasing	Muddeshwar
	cretica linn, and		(3)Electron paramagnetic	the GSH level by inducing GCLC	, & Biswas,
	Tinospora cordifolia	In-Vitro-	resonance measurement	expression and also decrease iNOS	2004)
	on free radical	Hippocampal	(4) Polymerase chain reaction-	expression. The herb further shows	
	generation and lipid	tissue	Reverse-transcriptase (RT-PCR)	protective property and hence has	
	peroxidation during			pharmacological applications	
	oxygen-glucose				
	deprivation in rat				
	hippocampal slices"				
6	"Tinospora	In vivo- Swiss	(1)Estimation of cytochrome P450	Tinospora promotes the activities of	(Singh,
	cordifolia induces	albino male	(2)Determination of NADPH-	phase-I and - II enzymes, and	Banerjee,
	enzymes of	mice	cytochrome P450 reductase and	enzymes associated with mitigating	Kumar,
	carcinogen/drug		NADPH- reductase activity of	oxidative stress. Tinospora	Raveesha, &

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	metabolism and		Cytochrome b5	Treatment brought about striking	Rao, 2006)
	antioxidant system,		(3)Determination of glutathione-	enlistment in the particular activities	
	and inhibits lipid		S-transferase	of detoxifying enzymes, in liver,	
	peroxidation in		(4)Determination of superoxide	kidney, lung and stomach, which	
	mice"		dismutase and catalase activity	emphatically proposes a potential of	
			(5)Estimation: lipid-peroxide	malignancy chemo-preventive	
				potential of Tinospora.	
7	"Screening of	Stem of the	1)Acetyl Cholinesterase inhibitory	The methanolic Extract of tinospora	(Vinutha et
	selected Indian	plant used.	assay	cordifolia was found to be 15.7%	al., 2007)
	medicinal plants for	(methanolic	2)TLC bioautography for	more potent in the inhibition of	
	acetylcholinesterase	and aqueous	acetylcholinesterase inhibition	AChE. And hence by the study it	
	inhibitory activity"	extract)		was found that it can be used for	
				medical purpose.	
8	"Studies on Anti-	Fresh, Healthy	(1)Abolute Flavanoid Content	The Results proved, the leaves	(Anilakumar
	oxidant activity of	Leaves of	(2)Total Phenolic Content	extract have excellent anti-oxidant	KR
	Tinospora cordifolia	Tinospora	(3)Antioxidant activity assays:	property. From the above various	Anilakumar
	Leaves using in-vitro	Cordifolia	Total Reducing Power, Ferrous	tests it was also observed that	KR, 2010)
	models"		Reducing Antioxidant Power	extract inhibits lipid peroxidation.	

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			assay, Lipid-Peroxidation	Thus by the results it can be	
			inhibitory activity, DPPH and	considered useful for the medical	
			superoxide radical scavenging	use of the neurodegenrative disease	
			activity		
9	"Evaluation of	Dried Stem-	(1) DPPH, DMSO, ABTS Radical	The present study proved Tinospora	(Sanjay Jain,
	Antioxidant Potential	Tinospora	Scavenging Activity respectively	sinensis to be as potent as Tinospora	2010)
	of Tinospora	cordifolia	(2)Nitric oxide Radical	cordifolia thereby confirming its	
	Cordifolia &		Scavenging Activity	traditional assumptions and its use in	
	Tinospora Sinensis"		(3)Superoxide dismutase	the present time system of medicine.	
			Scavenging Activity		
			(4)Reduction of Ferric ions by		
			orthophenanthroline color Method		
			(5)Total Antioxidant Capacity		
			(6)Lipid Peroxidation Assay		
10	"In Vitro	Stem of	(1)Antioxidant activity by free	The herb include rich composition	(Bhawya D
	Antioxidant Potency	Tinospora	radical scavenging method	of Vitamin C, E and carotene. Also	and
	of Tinospora	Cordifolia was	(2)Superoxide anion scavenging	mineral analysis resulted in good	Anilakumar
	cordifolia (gulancha)	used for the	activity	amount of potassium. High Radical	KR, 2010)
	in Sequential	study	(3)Hydroxl Radical scavenging	Scavenging activity was observed in	

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	Extracts"		activity	methanol and ethanol extract.	
			(4)Site-specific hydroxyl radical	Mostly results shows as the	
			mediated 2- deoxy-D-ribose	concentration increases the	
			degradation	scavenging activity increases.	
			(5)Reducing Power	Except in water extract as the	
			(6)Metal Chelating Activity	concentration increase reducing	
				power increases. These showed high	
				antioxidant activity of the herb	
11	"Spray drying of	Stem and leaf	1)Radical Scavenging Activity	Leaf extract demonstrated higher %	(Velu,
	Tinospora cordifolia	of the plant		Total polyphenols just as antioxidant	Chinnaswam
	stem and leaf extract	used		action. Owing from different	y, & Singh,
	and evaluation of			valuable and restorative properties	2011)
	antioxidant activity"			of Tinospora cordifolia and also	
				more solubility of spray-dried	
				Powder tests from Stem and Leaf,	
				the arrangements might be utilized	
				in the detailing of the various	
				nourishment items with different	
				medical advantages.	

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12	"Tinospora	Various plant	Due to presence of	Tinospora cordifolic have	(Mutalik &
	Cordifolia: Role in	parts	arabinogalactam polysaccharide	multivitamins and consists of	Maitreyee,
	depression, cognition		and epicatechin. Ethanolic Extract	multiple properties. tinospora	2011)
	and memory"	In-Vivo-	of plant use to restore normal level	cordifolia has many health benefits	
		Mouse	of lipid peroxidase, nonenzymatic	along with the Alzheimers diease	
			and enzymatic-antioxidants.	and hencewidely used	
13	"Antioxidant activity	Fresh Mature	1) DPPH radical scavenging	Results showed that the methanolic	(A. Kumar,
	and pharmacological	stem of	activity (2) Superoxide radical	extract activity increases as the	Kumar,
	screening of	tinospora	scavenging activity	concentration increase as compared	Dandapat, &
	tinospora cordifolia"	cordifolia	(3) Lipid peroxidation activity	to that of the aqueous extract. These	Sinha, 2012)
			(4) Reducing power	showed good anti-oxidant property	
			(5)Total antioxidant capacity	of the plant. Also it could be	
				concluded that the crude extract of	
				the tinospora cordifolia can be used	
				as potential source.	
14	"Evaluation of	Leaves-	(1)Total Phenolic Content	From the results it is found that the	(Praveen,
	Antioxidant activity	Tinospora	(2)Determination of total	methanolic extract consist of the	Thiruvengad
	of Tinospora	Cordifolia	flavanoid content	phenolic constituent which are very	am, Kim,
	cordifolia leaf	were used	(3)Assay of DPPH- radical-	essential for tne anti-oxidant	Kumar, &

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	extracts through		scavenging activity	property of the drug. Test were	Chung,
	non-enzymatic		(4)Assay of reductive potential	performed invitro. Following is the	2012)
	method"		(5)Evaluation of antioxidant	order of decreasing activity of the	
			capacity by phosphomolybdenum	test mentioned "methanol > ethyl	
			method	acetate > butanol > water extract"	
			(6) Chelating effect on ferrous ion		
15	"Evaluation of	Giloy Satva	(1)DPPH Assay	Results showed that the isolated	(Onkar,
	Antioxidant activity		(2)Determination of reducing	extract showed efficacious and	Bangar, &
	of traditional		power	excellent scavenging activity when	Karodi,
	formulation Giloy		(3)Hydrogen peroxide scavenging	compared to standard butylated-	2012)
	satva and		activity	hydroxy toluene. It consists of	
	hydroalcoholic			Flavonoids, glycosides, saponins	
	extract of the			and phytosterols. Due to these active	
	Curculigo orchioides			constitutents there is an remarkable	
	gaertn"			antioxidant property.	
16	"Scientific Validation	Stem Extract	1)Determination of Total	Results states that the extract	(A. Mishra,
	of the Medicinal	of Tinospora	Phenolics (2) Evaluation of	consists of various groups of	Kumar, &
	Efficacy of	Cordifolia	Antimicrobial Activity	phytochemicals. Polyphenols have	Pandey,
	Tinospora		(3) Determination of Minimum	been shown to have antimutagenic	2013)

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	cordifolia"		Bactericidal Concentration	and antimalignant effect. The	
			(4)Reducing Power Assay	presence of various phytochemical	
			(5) Metal Ion Chelating Activity	in the extract give a good amount of	
			(6)Cell Lines, Growth Conditions,	antioxidant property, antibacterial	
			and Treatment	and anticancer activities	
			(7)Cytotoxic Assay		
17	"Evaluation of	Crude	(1)Antinociceptive activity	From the antinociceptive activity	(Laboni,
	Antinociceptive and	ethanolic	(2)Free radical scavenging activity	test it is found that the extract is an	Akhter, &
	Antioxidant	extract of Stem	by DPPH Method	effective analgesic.Due to presence	Batul, 2013)
	Properties of the	of Tinospora		of phytoconstituent like tannins,	
	Ethanolic Extract of	cordifolia		phenolics, etc there is antioxidant	
	Tinospora cordifolia			effect in the stem extract of	
	Stem from			tinospora cordifolia	
	Bangladesh"				
18	"Antioxidant activity	Stem Extract	(1)Radical Scavenging Activity	Attempt has been made to remove	(Pushp,
	and detection of		(2)Reducing Power	methanolic stem extract which has	Sharma, &
	(–)epicatechin in the		(3)Antioxidant Capacity	large amount of antioxidant	Joseph,

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	methanolic extract of		(4)Deoxyribose degradation assay	activity.as shown by DPPH Method.	2013)
	stem of Tinospora		(5)Silica Gel column	Presence of epicatechin was also	
	cordifolia"		chromatography	found out. Epicatechin has a strong	
			(6)HPLC	antiviral property. Thus stem extract	
			(7)LC-MS	is considered beneficial.	
19	"Antioxidant	Aqueous	(1)Lipid hydroperoxides	Results of the study suggests that it	(Subramania
	properties of a	extract of Stem	assay(2)1,1-Diphenyl-2-	can perhaps be possible to attribute a	n et al.,
	Tinospora cordifolia		picrylhydrazyl (DPPH)	fraction to the effective value of the	2013)
	polysaccharide		scavenging assay (3)Superoxide	plant to the anti-oxidant and anti-	
	against iron-		radical scavenging (4)2-	radical properties of its constituent	
	mediated lipid		Deoxyribose assay	(polysaccharide). Also the plant	
	damage and γ-ray		(5)Hydrogen peroxide scavenging	stops the iron initiated lipid damage	
	induced protein		assay	and also damage to protein present	
	damage"		(6)Protection of protein oxidation	in the body. Hence can be	
				considered as the the potential drug	
				for the use in medicinal preparation.	

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20	"Tinospora	50% Ethanolic	(1)Proliferation Assays	Since cancer improvement is firmly	(R. Mishra
	cordifolia Induces	extract of stem	(2)LDH Assay	connected to disappointment of cell	& Kaur,
	Differentiation and	of Tinospora	(3)Cellular and Nuclear	separation, the momentum	2014)
	Senescence Pathways	Cordifolia	Morphological studies	perceptions of TCE - 300µg/ml	
	in Neuroblastoma		(4)Immunostaining	intervened separation of IMR-32	
	Cells"		(5)Protein Assay and Western	cells recommend, TCE or the	
			Blotting	phytochemicals obtained from	
			(6)mRNA Expression by	respective plant might be utilized as	
			Quantitative Real-Time PCR	protected biological operators	
			(7)Wound Scratch Assay	alongside conventional	
			(8)Gelatin Zymogram Study	/radiotherapies /chemotherapies for	
				the dangerous neuro-blastoma	
				treatment.	
21	"Determination of	Leaf extract	'Antioxidant' activity evaluation:	Present results indicated the activity	(Taylor,
	Chemical		1)DPPH Radical Scavenging	of oils extracted form the leaf.It	Naik,
	Composition and		2)Reducing power test	demonstrates the chemical	Dandge, &
	Evaluation of		3)Calculation of total phenolic	composition and its antioxidant	Rupanar,
	Antioxidant Activity		content	activity. The antioxidant activity is	2014)
	of Essential Oil from			much more high of the herb and	

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	T. cordifolia (Willd.)			hence can be naturally used. It can	
	Leaf"			also retard aging and also age	
				related oxidative stress disorders.	
22	"Effect of	In Vivo-Rats	Experimental Protocol:	Results indicate (at Day 15) the	(H. O.
	combination of		(1)Test Drug: Learning and	error in increasing order,	Malve, Raut,
	Phyllanthus emblica,		memory performances in normal	cyclosporin treated, diazepam	Marathe, &
	Tinospora cordifolia,		animals.	treated, non-treated & lastly	Rege, 2014)
	and Ocimum		(2)Test Drug: Learning and	scopolamine. After the further	
	sanctum on spatial		memory performances in rats	evaluation on treatment with the	
	learning and		(scopolamine-induced memory	tinospora codifolia the memory loss	
	memory in rats"		impairment /diazepam-induced	was reduced and hence is a suitable	
			memory impairment	drug for the treatment of memory	
			/cyclosporine-induced memory	loss.	
			impairment respectively).		
23	"Comparative	Dried Fruit	Elevated Plus Maze( exteroceptive	Observation of the tests were found	(H. Malve,
	evaluation of the	extract, Dried	and interoceptive model)- (e.g.	out to be such that the plant drug	2015)
	effects of Tinospora	Stem Extract,	EPM, Hebb Williams maze,	used proved improvement in the	
	cordifolia and	Fresh Leaves.	T-maze, Y-maze, radial arm maze,	learning and memory and had	
	Phyllanthus emblica		Morris water maze etc.), passive	larger therpeutc effect than the	

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	combination on	In-Vivo- Swiss	lack of activity (e.g., two	newly developed medicinal agents.	
	learning and	albino mice	chambered box including dark and	Thus tinospora Cordifolia is a	
	memory		light chambers) and active lack of	remarkably good agent for treatment	
	performance of mice		activity (e.g. Cook's pole	of the Alzhiemer Disease.	
	exploring Bhavana		apparatus). Interoceptive stimuli		
	samskara effects"		model- electroshock induced		
			amnesia		
24	"Anti-oxidant and	Stem Ethanolic	Antioxidant Assays	Result of first test demonstrate	(Suresh
	Anti-	extract	(1)Assay on Ferric-reducing	concentration dependent antioxidant	Kumar* and
	butyrylcholinesterase		ability of plasma (FRAP)	property of the extract. In Trolox	Swati
	activity of an		(2)Assay on Trolox-equivalent	test the antioxidant property was	Sharma,
	ethanolic extract of		antioxidant capacity (TEAC)	concentration dependent and	2015)
	tinospora cordifolia."		(3)Cholinesterase inhibitory assay	maximum at trolox concentration.	
				And the result of third test indicate	
				the maximum inhibition of enzyme	
				BuChE. Thus tinospora can be	
				considered as a potent drug as it has	
				medicinal properties such are	
				antioxidant, anti-diabetic,	

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				immunomodulatory,etc.	
25	"Antioxidant activity	Whole dried	(1)Assay of Lipid peroxidation	The test were performed to find out	(Jayaprakash
	of ethanolic extract	plant	(2)Assay of enzymic antioxidants	efficacy of herbal plant against	, Ramesh,
	of Tinospora		(3)Assay of Nonenzymic	cancer. As the enzymatic and non-	Sridhar, &
	cordifolia on	In-Vivo-	antioxidants	enzymatic antioxidants values were	Sasikala,
	N-nitrosodiethylamin	Wistar Albino		decreased in liver cancer bearing	2015)
	e	Rats		animals, the levels of LPO was	
	(diethylnitrosamine)			increased. The presence of alkaloid	
	induced liver cancer			may contribute in the antioxidant	
	in male Wister albino			property of the the herb. Vitamin E	
	rats"			is one of the least toxic and more	
				potent antioxidant present in the	
				plant extract. Thus, tinospora	
				cordifolia can be used as medicinal	
				plant	
26	"Evaluation of effect	Stem Extract	(1)Elevated plus maze	Alcoholic extract at conc 140mg/kg	(Jyothi,
	of alcoholic extract of	of Tinospora	(2)Step-Down type Passive	showed significant decrease in	Shashikala,
	Tinospora cordifolia	Cordifolia	avoidance test	transfer latency and at 280mg/kg it	Vidya, &
	on learning and		(3) Novel Object Recognition	showed highly significant results.	Shashikala,

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	memory in	In-Vivo-	(NOR) test	Alcoholic extract of Tc has	2016)
	alprazolam induced	Albino Mice	Grooming behaviour	enhanced cognition in both test.	
	amnesia in albino		Rotarod Test	Alprazolam have been use as an	
	mice"		Immunohistochemical analyses	amnesic agents(Benzodiazepine).	
			Immunoblotting analyses	Tinospora can be used in treatment	
				of defective learning and other	
				gastric disease.	
27	"Assessment of free	Different	(1)Folin-Ciocaltue Method-	Ethanolic extract proved to be of	(Polu,
	radical scavenging	extract of stem	(Phenolic Content)	superior quality in their scavenging	Nayanbhira
	and anti-proliferative	of Tinospora	(2)Al-Chloride Colorimetric	activity. n-Butanol fraction showed	ma, Khan, &
	activities of	Cordifolia was	Method (3)Antioxidant Activity-	antioxidant activity. Extracts were	Maheswari,
	Tinospora cordifolia	used	DPPH radical Scavenging activity	found to have passed various assay	2017)
	Miers (Willd)"		/ ABTS Radical scavenging	and hence can be considered as	
			activity / Nitric Oxide Scavenging	potent for its medicinal use.	
			Activity / Iron Chelating activity		
			(4) Cell Vialbility by MTT Assay		
			/ SRB Assay		
			(5) Quantitative analysis by		
			HPTLC		

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28	"Neuroprotective	Ethanolic	(1)Locomotar activity	Loss in Body weight, Locomotar	(Ramya &
	activity of Ethanolic	Extract of	(2)Step Through Passive	activity, passive avoidance test and	Dhivya,
	Extract of Tinospora	TinoSpora	avoidance Test	antioxidant level, GSH,CAT, SOD	2017)
	cordifolia on LPS	Cordifolia	(3)Estimation of GSH	level and increased rectal temp. The	
	induced		(4)Estimation of Superoxide	ethanolic concentrate of Tinospora	
	Neuroinflammation"	In-Vivo-Male	dismutase	cordifolia may evoke	
		wistar rat	(5)Assay of thio-barbituratic acid	neuroprotective action because of	
			reactive substance	the nearness of phytochemical	
			(6)Estimation of Catalase Level	constituents, for example, saponins,	
				glycosides, alkaloids, berberine,	
				diterpenoid lactones,flavonoids.	
29	"Separation and	Tinospora	1)SDS-PAGE Analysis	Stem showed excellent trypsin	(Pachaiappa
	identification of	cordifolia stem	(2)Determination of radical	inhibitory activity and also $\alpha$ -	n et al.,
	bioactive peptides	protein	scavenging activity	chymotrypsin blocking. The strong	2018)
	from stem of		(3)Determinng ferrous chelating	gastrointestinal enzyme and high	
	Tinospora cordifolia	InVitro-	activity	antioxidant activity proves the plant	
	(Willd.) Miers"	Enzymes	(4)Liquid Chromatography of	to be proper for mediinal use.	
			Papain Digest		

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			(5)MALDI-TOF-MS		
			(6)Peptide sequencing		
30	"Measurement Of	Powder of the	(1)MMSE (mini-metal state	The results confirmed the effect of	(Alagendran,
	Dementia Using	plant	examination)	the plant in curing of the alzheimer	Pushpa, &
	Medicinal Plants For		(2)Enzymatic Assay	disease. The tests performed showed	Bala-, 2018)
	Cognitive		(3)Total phenolic assay	positive results and hence can be	
	Impairment"			used for the treatment of disease and	
				as antioxidant.	
31	"Phytochemical,	Ethanolic	Determination of Antioxidant,	In current investigation, hydro-	(V. Kumar
	Antioxidant,	Extract of	antiinflammatory, total flavanoid	alcoholic concentrate of TC	et al., 2018)
	Antimicrobial, and	Tinospora	content, portein binding assay,	displayed better cancer prevention	
	Protein Binding	Cordifolia	Antimicrobial Assay	agent and protein restricting	
	Qualities of Hydro-			exercises and poor antimicrobial	
	ethanolic Extract of			exercises.	
	Tinospora				
	Cordifolia"				

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32	"Tinospora	Plant extract of	(1)Cell culture and treatments	B-TCE was distinguished as	(Sharma &
	Cordifolia as a	TC using	(2)Cellular and nuclear	advancing the recovery, of	Kaur, 2018)
	potential	Chloroform,	morphological studies	cerebellar neurons, migration which	
	neuroregenerative	Hexane, Ethyl	(3)Immunostaining	was significantly hindered by	
	candidate against	acetate, and	(4)Western blotting	glutamate treatment. These	
	glutamate induced	Butanol extract	(5)Pro-inflammatory cytokine	outcomes demonstrates that B-TCE	
	excitotoxicity: an in	respectively	ELISA based determination	can have neuroregenerative and	
	vitro perspective"		(6)Wound scratch assay	neuroprotective potential against	
			(7)Gelatin zymogram study	catastrophic reason for glutamate-	
			(8)UPLC/MS analysis of B-TCE	induced ex-citotoxicity and maybe	
				be a potential remedial operator for	
				neurodegenerative illnesses.	
33	"Dry leaf extracts of	Leaf Extract of	1)MTT Assay	Leaf extract hepls in blocking of	(K. Kumar
	Tinospora cordifolia	tinospora	2),Reactive Oxygen Species'	ROS which is been induced by	& Tetali,
	(Willd.) Miers	cordifolia	Measurement	arachidonic acid, by activating the	2019)
	attenuate oxidative		3)Quantitative real time PCR	antioxidant enzymes CAT & anti-	
	stress and		4)Catalase enzyme Assay (THP-1	inflammatory activity, blocking of	
	inflammatory		cells)	proinflamatroy cytokines TNF-	
	condition in human		5)Tumor quantification-by ELISA	alpha. Also the drug doesnot show	

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	monocytic (THP-1)		a-factor	any side effect and hence is used in	
	cells"		6)Immuno-blotting	treatment of AD	
34	"Butanol Extract	Stem used	In Vitro Studies:	Tinospora was effective at very less	(Sharma,
	of Tinospora		(1)Immunostaining	concentration during the in-vitro	Kalotra,
	cordifolia	In-Vivo-	(2)Mitotracker Staining	studies.In-vivo the animal spent	Bajaj, Singh,
	Ameliorates	Wistar albino	(3)Wound Scratch Assay	more time in closed arm in	& Kaur,
	<b>Cognitive Deficits</b>	female rats	In Vivo Studies:	glutamate treated animal and in	2019)
	Associated		(1)Novel Object Recognation Test	rotarod test the glutamate induced	
	with Glutamate-Indu		(2)Elevated plus maze test	rats showed high frequeny of fall.	
	ced Excitotoxicity:		(3)Rotarod test	The current study indicated that B-	
	A Mechanistic Study		(4)Western Blotting	TEC prevented neurotoxicity	
	Using Hippocampal		(5)mRNA Expression	induced by glutamate.	
	Neurons"				
35	"Anti-	Powdered	(I)Determination of	On comaring IC50 values it was	(Acharya
	Acetylcholinesterase	formulation	Acetylcholinesterase inhibitory	proved that methanolic extract of	Balkrishna
	Activities of Mono-		activity	tinospora was most superior and in	2019)
	Herbal Extracts and		(II)IC50 Determination	HPLC components of tinospora	
	Exhibited Synergistic		(III)HPLC Analysis	were more active against AChE.	

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	Effects of the		(IV)Evaluation of Synergistic	Molecular docking indicate the	
	Phytoconstituents: A		Effects Molecular Docking	partial blocking during drug release	
	<b>Biochemical and</b>			whereas it was minimum in	
	Computational			tinospora. Hence it is proved safe for	
	Study"			the cure of Alzheimer disease	
36	Medicinal plants	Plant parts	System for improvement is by	Herbal plants mimics an essential	(Saha et al.,
	with a potential to		immunostimulation and	role in treatment of "Alzheimer's	2020)
	treat Alzheimer and		furthermore by synthesiss of	disease" having almost zero toxicity	
	associated symptoms		acetylcholine, this	as compared to modern medicinal	
			supplementation of choline	drug. There is no reason why plant	
			magnify the cognitive functions	parts should not be used.	

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### 7. CONCLUSION:

From the above overall review the herbal plants Garlic and Tinospora cordifolia were selected for the study. As the development of ayurvedic industry is seen the selected plants were selected. The main advantage of this plant drug is that they are non-toxic and do not have any side effects on human beings. The herbal drugs used can only stop the growth of disease and cannot cure it completely. Also they have excellent antioxidant property and are proven potent for the treatment of "Alzheimer disease". These can be easily isolated from nature. Various plant extract are used for the treatment of "Alzheimer's disease". Many modern medication are available which on frequent use are harmful to the human being. Due to its potency and efficacy these herbal drugs are now a days most widely used for the treatment of Alzheimer disease and also other neurodegenerative disorder.

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