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Antioxidant effects of Homoeopathic Medicines: Review Based on Preclinical and Clinical Research

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Authors' contributions

This work was carried out in collaboration among all authors. Author ADP wrote the first draft of the manuscript, designed the paper and explored the available literature and research work already done in the field. Author PA guided about the whole study, edited the draft and contributed by giving valuable inputs to make the paper impactful. Author DBS managed the literature searches, helped in designing the study and gave valuable inputs in relation to homoeopathic literature. All authors read and approved the final manuscript.

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ABSTRACT

Background: Antioxidants are rampantly studied due to their ability to trap the free radicals. Due to excessive stress these free radicals take part as fundamental components in oxidative damage leading to changes in SOD, CT, GSSH, GPx, GSH, LPO, GGT, LDH. High Dilution Medicines (HDM) are also being investigated in deciphering their antioxidant properties.
Methodology: The database for the research paper was screened from Google scholar, PubMed, and Web of Science. The search keywords used were Antioxidant, Homoeopathy, Homeopathy, In-vitro, In-vivo, Clinical trial in various permutation and combinations. The research article in original full text with English language is included in this manuscript. Score for assessment of biological experiment on homeopathy (SABEH) was referred for screening the research articles.
Results: Around 14 research manuscript showed the research conducted on HDM with respect to their antioxidant properties. Four In-vitro, Eight In-vivo studies and two Clinical studies were used in

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assessing the antioxidant activity. Out of 14, only 12 studies were included in SABEH criteria scores above 5/9. SOD, CT, GSH, GPx, LPO, GSSH, GGT, LDH, 2,2 DPPH were found to be explored with HDM with their antioxidant properties.

Conclusion: HDM can further be studied at to what extent they provide preventive role, interception role and repair role pertaining with their antioxidant properties, also comparing the efficacy of antioxidant properties through oral route and injectable in various stages of disease.

Keywords: Antioxidant; free radicals; homoeopathy; Reactive Oxygen Species (ROS).

ABBREVIATIONS

X : Decimal scale
C or cH : Centesimal scale
DP : Drug proving
HDM : High Dilution Medicines
Q : Mother Tincture
2,2 DPPH : 2,2-Diphenyl-1-picrylhydrazyl
HPBV : Homeopathic Preparation of Berberis Vulgaris
SOD : Superoxide Dismutase
GPx : Glutathione Peroxidase
Bw : Body weight
CT or CAT : Catalase
GST : Glutathione-S-transferase
GR : Glutathione Reductase
G6PD :Glucose-6-Phosphate Dehydrogenase
LPO : Lipid Peroxidation
STZ : Streptozotocin
DC : Disease Control
NC : Normal Control
NS : Not Significant
BA : Bronchial Asthma
AOA :Total Antioxidant Activity
DOCA : Deoxycorticosterone Acetate
OA : Osteoarthritis
RLM : Rat Liver Mitochondria
Ca2+ : Calcium
Fe2+ : Ferrous
LDH : Lactate Dehydrogenase
AST : Aspartate Aminotransferase
ALT : Alanine Aminotransferase
AcP : Acid Phosphatase
AlKP : Alkaline Phosphatase
GGT : Gamma Glutamyl Transferase
DNA : Deoxyribonucelic Acid
AGE's : Advanced Glycation End Products
TBARS :Thiobarbituric Acid Reactive Substances
PMF : Post Mitochondrial Fraction
MF : Mitochondria
NO : Nitric Oxide free radical.
ORAC :Oxygen Radical Absorbance Capacity
MDA : Malondialdehyde
TNBS : 2,4,6-Trinitrobenzenesulfonic Acid

1. INTRODUCTION

Antioxidants are rampantly studied due to their ability to trap the free radicals. Highly reactive free radicals formed due to imbalance in the molecular fragments of unpaired electrons in molecular orbit leads to many cascade changes in cellular structures. [1] These free radicals can cause degenerative diseases by oxidizing proteins, lipids, nucleic acids, and DNA [2] Due to excessive stress these free radicals take part as fundamental components in oxidative damage leading to changes in SOD, CT, GSSH, GPx, GSH, LPO, GGT, LDH. [3] To counteract these changes naturally present antioxidant like enzyme (glutathione) and non-enzymatic antioxidant (Vitamin A, E, C) plays a vital role in bringing the homeostatic changes in cells (Fig. 1). [4] Antioxidants are well known for their various benefits to human health in concerns of improving quality of sleep, preventing neurodegenerative changes, lowering blood pressure and reduced obesity, improves eye vision, protects liver toxification, supports immune system, anti- aging effects and protects renal toxification. Depending upon the stressor's embedding the cellular responses antioxidants have different mechanism of actions like preventive role (which stops the production of Reactive Oxygen Species), interception role (which protects the radical scavenging activity caused by impaired electron of oxygen) and repair role (which brings repair mechanism cellular components caused by free radical molecule). [5-7]

Homeopathy also known as High dilution medicines (HDM) are used in research for exploring its concealed properties and understanding its pharmacology. There seems to be a paradigm shift in understanding the literature evidence of the HDM and correlating it with preclinical (In vitro & In vivo) and clinical research pertaining to antioxidant activity. This review highlights the role of homeopathic medicines as an antioxidant activity investigated in preclinical and clinical studies.

2. METHODOLOGY

The database for the research paper was screened from Google scholar, PubMed, and Web of Science. The search keywords used were Antioxidant, Homoeopathy, Homeopathy, In-vitro, In-vivo, Clinical trial in various permutation and combinations. The research article in original full text with English language is included in this manuscript. Score for assessment of biological experiment on homeopathy (SABEH) was referred for screening the research articles. [8]

2.1 Score for Assessment of Biological Experiment on Homeopathy (SABEH) [8]

To identify the quality of research paper for inclusion and exclusion criteria, SABEH was designed. SABEH mentions 9 parameters like a) Defined Objectives b) Control c) Blinding of measurement of outcomes d) Randomization e) Consistency f) Experiment standardization g) Statistical analysis h) Result. Each parameter gives score of 1 mark. Experimental standardization mentions 2 marks. SABEH score is calculated based on presence of above-mentioned parameter in selected research paper for review. SABEH score higher than 5 marks are included in for further analysis. Each parameter in SABEH criteria has its relevance when implemented in screening the research paper.

1. Defined Objectives (1 mark) – Research paper defining problems or questions based on relevant theory or empirical theory exploring potentials of hypothesis needs to be taken into consideration. Research paper defining the parameter will be scored as 1 mark, if in case no relevance found will be scored 0.

2. Control (1 mark) – Research paper defining the relevance of control used and its interpretation need to be taken into consideration. Research paper defining the parameter will be scored as 1 mark, if in case no relevance found will be scored 0.

3. Blinding of measurement of outcomes (1 mark) – Research paper defining the blinding measurement as to avoid several biases are present when a study is insufficiently blinded, to avoid confirmation bias (based on existing belief). Research paper defining the parameter will be scored as 1 mark, if in case no relevance found will be scored 0.

4. Randomization (1 mark) - Research paper defining randomization method ensures accidental bias and prevents selection bias. Research paper defining the parameter will be scored as 1 mark, if in case no relevance found will be scored 0.

5. Consistency (1 mark) - Research paper defining consistency for any research work, to which similar findings are reported using similar and different study designs and based on clear chains of inferential reasoning supported and justified by a complete coverage of the relevant literature. Research paper defining the parameter will be scored as 1 mark, if in case no relevance found will be scored 0.

6. Experiment standardization (2 marks) - Research paper defining experiment standardization based on quality and quantity of data interpreted. Quality (1 mark) is scored if the aggregate of quality ratings for individual studies, predicated on the extent to which bias was minimized in the study designs is validated. Quantity (1 mark): the number of studies, the sample size, the study design's statistical power to detect meaningful effects, and magnitude of the effects found or the effect size. Research paper defining the parameter will be scored as 2 marks, if in case no relevance found for either quality or quantity a score of 1 mark will be imposed, while no relevance found for both quality and quantity it will be scored 0.

7. Statistical analysis (1 mark) - Research paper defining correlation of statistical data of text and figures/graph interpreted in research paper need to screen cautiously. Research paper defining the parameter will be scored as 1 mark, if in case no relevance found will be scored 0.

8. Result (1 mark) - Research paper defining correlation of statistical results interpretating with precise term of biological response need to be cross verified. Research paper defining the parameter will be scored as 1 mark, if in case no relevance found will be scored 0.

3. RESULTS AND DISCUSSION

Around 14 research manuscript showed the research conducted on HDM with respect to their antioxidant properties. Four In-vitro, Eight In-vivo studies and two Clinical studies were used in exploring antioxidant activity highlighted in Table 1. Out of 14, only 12 studies were included in SABEH criteria explained in Table 2. SOD, CT, GSH, GPx, LPO, GSSH, GGT, LDH, 2,2 DPPH were found to be explored with HDM with their antioxidant properties.

The quality of research manuscript was assessed by SABEH criteria modified through previous conducted systematic review. The SABEH criteria include details (Objectives, Controls, Blinding, Randomization, Consistency, Experiment Standardization, Statistical analysis, Results interpretation.), each representing score of 1, which gives sum of 9. Paper's having SABEH score higher than 5 had been included in the review study. [7]

3.1 Perspective on Pharmacology of Antioxidants of Homeopathic Medicines Based on Biological Studies (Preclinical)

Saeed Ahmad et.al explored the antioxidant activity of Mother Tinctures (Q) through 2,2Diphenyl1picrylhydrazyl free radical scavenging Assay and further demonstrated the phenolic content in the Q's. The medicines used were *Syzygium jambolanum, Damiana, Cinchona officinalis, Chelidonium majus, Convallaria majalis* and *Coca* (All Q's had 90% alcohol as a solvent base). The comparator used was Quercitin and the phenolic content was compared with gallic acid as to explore the antioxidant activity through 2,2DPPH. *S. jambolanum* (5 µl) showed 87.2% inhibition and *S. jambolanum* (1.25 µl) showed 39.9% inhibition of DPPH. *Damiana, C. officinalis, C. majus, C. majalis,* and *Coca* inhibited DPPH 81.6%, 69%, 68.5%, 65.1%, and 61%, respectively, at 5 µl volume. There was decreased in percent inhibition with the decrease of volume against DPPH. [9]

Celso Fernandes Batello studied antioxidant activity of Homeopathic medicines through Lipid peroxidation inhibition assay in-vitro in Rat Brain. The medicines used were *Arsenic album, Cuprum metallicum, Zinc metallicum* and *Magnum* in 6C, 12C & 30C potencies respectively. *Melatonin* in its different concentration was used as comparator. Lipid peroxidation inhibiting effect in *Melatonin* 1M was superior, followed by *Melatonin* 0.5M, *Cuprum metallicum* 12C, *Cuprum metallicum* 30C, *Arsenicum album* 30C, *Melatonine* 0.25M, *Manganum* 30C and *Arsenicum album* 12C. The inhibitory effects of the lipidic peroxidation for *Melatonin* 1 molar (30%), *Melatonin* 0.5 molar (16.7%), *Cuprum metallicum* 12C (13.4%), *Cuprum metallicum* 30C (11.7%), *Arsenicum album* 30C and *Melatonin* 0.25 molar (8%) and *Manganum* 30C (7.5%) [10]

Vasavan Jyothilakshmi et.al investigated the antioxidant activity of Homeopathic preparations of *Berberis Vulgaris* (HPBV) against the oxidative stress induced in renal tissues of experimental rats. Group I (G1) rats were untreated control. Group II (G2) received ethylene glycol (EG 0.75% in drinking water) for induction of a chronic low-grade hyperoxaluria and further to generate CaOx deposition in kidneys. Group III (G3) rats received oral administration of HPBV, (20 ul/ day/100 mg body weight) concomitant with EG administration as in group II. Group IV (G4) rats served as drug controls and were given HPBV (20 ul/day/100 mg body weight, oral gavage) for 28 days. *Berberis vulgaris* 200C (20ul/100mg bw) and Ethylene glycol (EG 0.75% in drinking water) as comparator was investigated through assay of Enzymatic Antioxidants i.e. *Superoxide Dismutase (SOD)*, *Catalase (CT)*, *Glutathione peroxidase (GPx)*. Another assay of Estimation of Nonenzymatic Antioxidants i.e. *reduced glutathione*, *Ascorbic acid or vitamin C*, *alpha-Tocopherol or vitamin E*. Assay of Glutathione-Metabolizing Enzymes i.e. *Glutathione-S-transferase (GST)*, *Glutathione reductase (GR)*, *Glucose-6-phosphate dehydrogenase (G6PD)*. Cellular Macromolecular Damages was studied through assay of *lipid peroxidation (LPO)*. Further determination of *protein carbonyl* content and estimation of Intracellular Thiols i.e. *Total sulfhydryl groups* & *Nonprotein sulfhydryl groups* was also studied. Enzymatic antioxidant SOD 4.55 ± 0.2 (G1), 2.8 ± 0.1 (G2), 4.0 ± 0.5 (G3) & 4.12 ± 0.4 (G4). CAT 467.2 ± 43.1 (G1), 198.2 ± 15.9 (G2), 460 ± 40.1 (G3) & 459.0 ± 39.2 (G4). GPx 47.92 ± 3.9 (G1), 28.52 ± 2.9 (G2), 46.2 ± 4.8 (G3) & 45.64 ± 4.6 (G4). GR 0.69 ± 0.05 (G1), 0.41 ± 0.02(G2), 0.63 ± 0.06 (G3) & 0.61 ± 0.05 (G4). GST 0.35 ± 0.03 (G1), 0.21 ± 0.02 (G2), 0.33 ± 0.03 (G3) & 0.36 ± 0.03 (G4). G6PD 0.48 ± 0.01 (G1), 0.29 ± 0.02 (G2), 0.43 ± 0.05 (G3) & 0.48 ± 0.05 (G4). Non-enzymatic antioxidant Vitamin E 20.1 ± 2.1 (G1), 10.98 ± 1.1 (G2), 19 ± 1.7 (G3) & 20.6 ± 1.7 (G4). Vitamin C 9.56 ± 0.8 (G1), 4.23 ± 0.39 (G2), 8.79 ± 0.68 (G3) & 9.2 ± 0.9 (G4). Glutathione 3.95 ±

2.8 (G1), 2.55 ± 0.2 (G2), 3.88 ± 0.3 (G3) & 3.9 ± 0.5 (G4). HPBV showed strong defensive antioxidant activity against oxidative stress and could provide a novel therapy for the management of oxidative stress-related disorders by protecting the renal tissue from oxidative stress. [11]

Lalit Kishore et.al in turn, investigated *Cephalendra indica* (CI) Q, 6C & 30C potencies in *Streptozotocin (STZ)* induced rats in exploring the antioxidant activity. Antioxidant activity was studied in two experimental conditions i.e. diabetic nephropathy & diabetic neuropathy of STZ induced rats. In the experiment of diabetic nephropathy, tissue antioxidant enzymes *(SOD, GSH, LPO)* level was sedated to assess the oxidative stress with *Glimepiride* used as comparator. Normal SOD (U/mg protein) 4.87 ± 0.083, GSH (mM/mg protein) 74.93 ± 0.621, TBARS (nmol/mg protein) 0.55 ± 0.01. Diabetic control SOD (U/mg protein) 1.23 ± 0.049, GSH (mM/mg protein) 38.60 ± 0.481, TBARS (nmol/mg protein) 2.98 ± 0.017. C. indica MT SOD (U/mg protein) 2.05 ± 0.017, GSH (mM/mg protein) 43.46 ± 0.520, TBARS (nmol/mg protein) 2.51 ± 0.015. C. indica 6 C SOD (U/mg protein) 2.80 ± 0.027, GSH (mM/mg protein) 54.25 ± 0.477, TBARS (nmol/mg protein) 1.95 ± 0.009. C. indica 30 C SOD (U/mg protein) 3.73 ± 0.040, GSH (mM/mg protein) 66.04 ± 0.668, TBARS (nmol/mg protein) 1.32 ± 0.014. Glimepride 10 mg/kg SOD (U/mg protein) 3.86 ± 0.018, GSH (mM/mg protein) 67.83 ± 0.535, TBARS (nmol/mg protein) 1.19 ± 0.03. *Cephalendra indica* Q, 6C & 30C showed protective effect against diabetic nephropathy via inhibition of Oxidative stress and Advanced Glycation End product's (AGE's). In experiment of diabetic neuropathy, tissue antioxidant enzymes *(SOD, GSH, LPO)* level was sedated to assess the oxidative stress with *Gabapentine* used as comparator. *Cephalendra indica* Q, 6C & 30C significantly showed reduction of Oxidative stress and AGE's level in sciatic nerve. SOD (U/mg protein) 20.54 ± 0.55(NC), 8.08 ± 0.30 (DC), 9.42 ± 0.17 (ClQ), 14.56 ± 0.36 (Cl6C), 16.23 ± 0.33 (Cl30C) & 14.08 ± 0.20 (Gabapentine). GSH (lM/mg protein) 0.51 ± 0.02 (NC), 0.22 ± 0.01 (DC), 0.24 ± 0.006 (ClQ), 0.32 ± 0.012 (Cl6C), 0.42 ± 0.0006 (Cl30C), 0.41 ± 0.01 (Gabapentine). TBARS (nmol/mg protein) 1.92 ± 0.08 (NC), 6.58 ± 0.33 (DC), 5.85 ± 0.11 (ClQ), 4.65 ± 0.091 (Cl6C), 2.84 ± 0.14 (Cl30C) & 4.08 ± 0.20 (Gabapentine). [12-13]

Gagan Bihari Nityanand Chainy et.al investigated Antioxidant activity of *Rauwolfia serpentine* Q, 6C, 30C in Deoxycorticosterone Acetate (DOCA)-Salt-Induced Hypertensive Rat Model. Antioxidant activity was investigated through *SOD*, *CT*, *GPx* and *GR*. *Rauwolfia serpentina* reduce systolic blood pressure in DOCA-salt-induced hypertensive rat and modulated serum clinical parameters and renal antioxidant defences. Table 1 provides the details of experimental design. [14]

Rosana Catisti et.al in turn, investigated Antioxidant activity of *Arnica Montana* 6C, 12C, 30C in Rat Liver Mitochondria (RLM) in-vivo where in ethanol 30% was used as comparator. Antioxidant activity was assessed by Oxygen uptake measurements, Lipid peroxidation measurements, Mitochondrial oxidative stress measurements. *Arnica Montana* 30C protects against hepatic mitochondrial membrane permeabilization induced by Ca2+ and/or Fe2+-citrate-mediated lipid peroxidation and fragmentation of proteins due to the attack by reactive oxygen species. *Arnica Montana* 6cH 23.51 ± 8.851 nmoles mg^{-1} min^{-1}, 12cH 20.81 ± 10.24 nmoles mg^{-1} min^{-1} & 30cH 16.02 ± 9.292 nmoles mg^{-1} min^{-1} showed decrease in O2 consumption than Control 39.23 ± 6.678 nmoles mg^{-1} min^{-1}, providing protective role against ROS generation. [15]

Anisur Rahman Khuda-Bukhsh et.al investigated Antioxidant activity of Homoeopathic medicines in Hepatotoxicity Induced by Carcinogens in Mice. *Natrum Sulph* 30C, *Natrum Sulph* 200C, *Cholestirum* 200C in 0.06 ml was induced in mice. Antioxidant activity was assessed with GSH, LDH, LPO, SOD, CT, and GR. Increased activities of AST, ALT, GGT, AcP, AlkP, LPO and LDH, and decreased activities of CT, GR, G6PD, GSH and SOD was observed in the intoxicated mice. Combined therapy showed an additional anti-hepatotoxic and anti-cancer effects. [16]

Shifa Shaffique et.al investigated Antioxidant activity of *Baptisia tinctoria*, *Berberis aquifolium*, *Echinacea angustifolia*, *Hydrangea arborescens*, *Hydrastis canadensis*, *Kreosotum*, and *Thuja occidentalis* in their respective Q's. *Ascorbic acid* was used as comparator. 2,2DPPH was used for assessing the antioxidant activity. Q's of plant origin showed antioxidant activity due to presence of phenolic content. Antioxidant activity of *Ascorbic acid* 92.7±0.3, *Baptisia tinctoria* 83.6±0.3, *Berberis aquifolium* 74±0.03, *Echinacea augustifolia* 76.6±0.6, *Eucalyptus globulus* 84.2±0.4, *Hydrangea arborescens* 31.4±0.5, *Hydrastis canadensis* 83.03±0.03, *Hypericum perforatum* 82.5±0.4, *Kreosotum* 38.8±1.4, *Pulsatilla nigricans* 85±0.3 and *Thuja occidentalis* 84.8±0.6. [17]

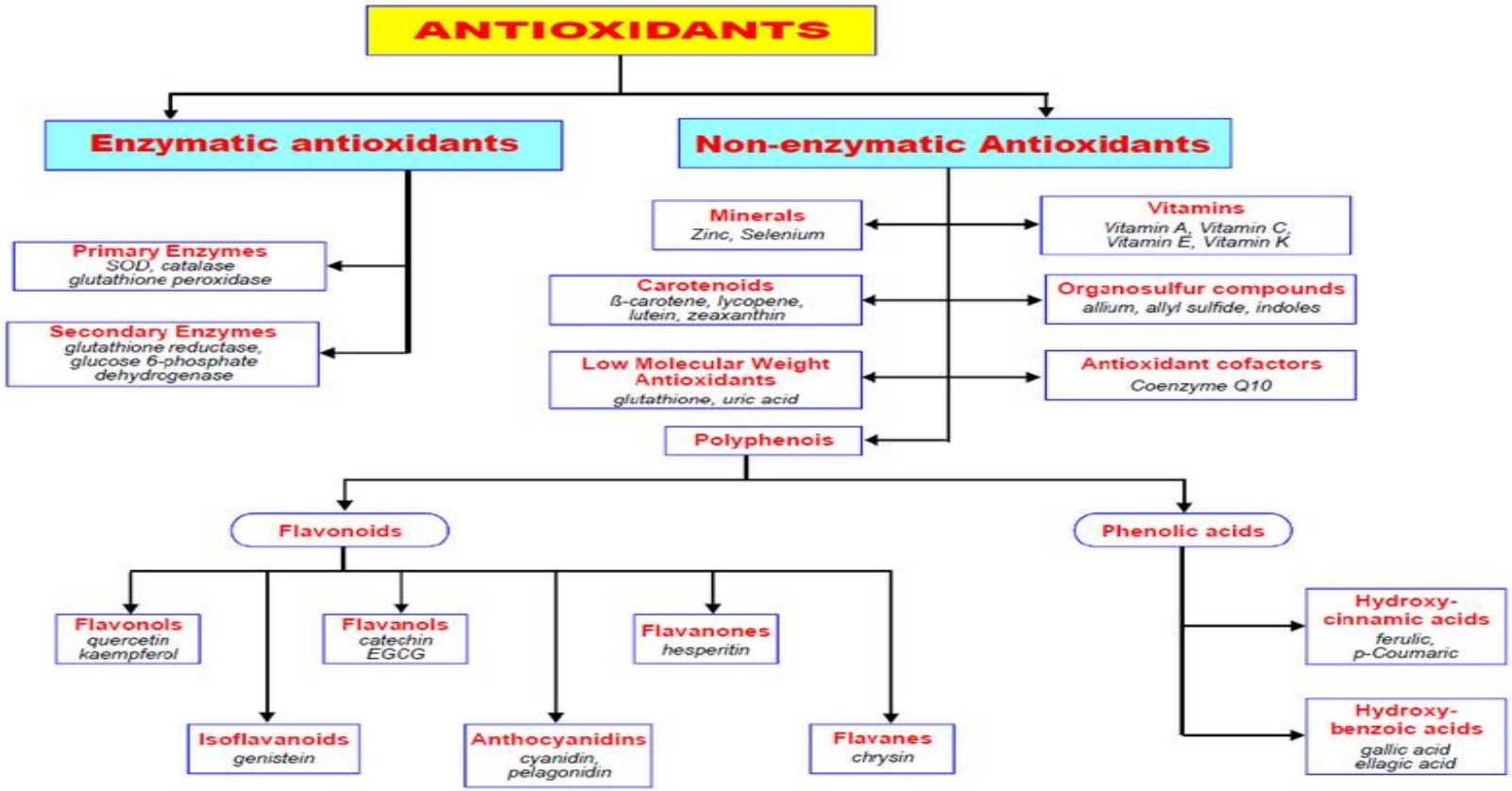

Fig. 1. Flow chart [4]

Table 1. Research studies in exploring antioxidant activity of homeopathic medicines

S. No	Name of Author	Study type	Homoeopathic medicine	Methodology/Assay	Control/Comparators	Statistics	Inference	Reference
1.	Saeed Ahmad et.al	In-vitro	Syzygium jambolanum, Damiana, Cinchona officinalis, Chelidonium majus, Convallaria majalis, Coca. (All Mother tincture 90% alcohol)) (5, 2.5, and 1.25 µl volumes)	2,2DPPH	Quercetin	One-way analysis of variance followed by *post hoc* test was applied for checking statistical significance of results. Pearson correlation coefficient test.	Antioxidant activity	[9]
2.	Celso Fernandes Batello	In-vitro	Ars alb, cuprum metallicum, Zinc metallicum and magnum (6C, 12C, 30C) 200ul.	LPO	Melatonine	The kruskal-wallis (ANOVA) and Dumn's multiple comparison's tests was. applied.	Antioxidant activity	[10]
3.	Vasavan Jyothilakshmi et al	In-vivo	Berberis vulgaris 200C (20ul/100mg Bw) for 28 days.	SOD, CT, GPx, GR, Ascorbic acid or vitamin C, alpha-Tocopherol or vitamin E, GST, Glucose-6-phosphate dehydrogenase..etc	G1 – Untreated control G2 – Ethylene glycol (EG 0.75% in drinking water) G3 –EG + HPBV (20ul/100mg Bw) G4 –HPBV (20ul/100mg Bw).	ANOVA Post-hoc testing was performed. for intergroup comparisons using the least significance difference (LSD) test.	Antioxidant activity	[11]
4.	Lalit Kishore et.al	In-vivo	Cephalandra indica Q, 6C & 30C. for 45 days	SOD, GSH, LPO	G1- NC, G2 – DN, G3 – DN + CIQ 2ml/kg, G4 – DN + CI6C 2ml/kg, G5 – DN + CI30C 2ml/kg, G6 – DN + Glimepride (10 mg/kg)	Mean ± Standard Error Mean and ANOVA was followed by Tukey's as post hoc multiple comparison test.	Antihyperglycemic and Antioxidant activity	[12]
5.	Lalit Kishore et.al	In-vivo	Cephalandra indica Q, 6C & 30C. for 30 days	SOD, GSH, TBARS.	G1- NC, G2 – DN, G3 – DN + CIQ 2ml/kg, G4 – DN + CI6C 2ml/kg, G5 – DN + CI30C 2ml/kg, G6 – DN + Gabapentine (30 mg/kg)	Mean ± Standard Error Mean and ANOVA was followed by Tukey's as post hoc multiple comparison. test.	Antihyperglycemic and Antioxidant activity	[13]
6.	Gagan Bihari Nityanand	In-vivo	Rauwolfia Serpentina Q, 6C, 30C.	SOD, CAT, GPx and GR.	G1 (Shame Operator) – Seasame oil (0.1 ml/100 g body weight) for 65	Mean ± Standard Error Mean. One-way analysis	Antihypertensive and Antioxidant	[14]

	Chainy et.al				days, G2 – (Unilaterally Nephrectomized) UNX drinking water +1%NaCL for 65 days, G3 UNX (Deoxycorticosterone actate) DOCA – vehicle of medicine + 1%Nacl for 35 days DOCA further 30 days HM. G4 UNX (Deoxycorticosterone actate) DOCA – RS Q 35 days DOCA further 30 days HM. G5 UNX (Deoxycorticosterone actate) DOCA – RS 6C 35 days DOCA further 30 days HM., G6 UNX (Deoxycorticosterone actate) DOCA – RS 200C 35 days DOCA further 30 days HM.	of variance (ANOVA) followed by Fisher LSD test.	activity	
7.	Rosana Catisti et.al	In-vivo	Arnica Montana 200 uL of 6C, 200 uL of 12C, 200 uL of 30C. (For 21 days)	LPO measurements, Mitochondrial oxidative stress measurements,	Ethanol 30% 200 uL (For 21 days)	KruskaleWallis tests.	Antioxidant activity	[15]
8.	Anisur Rahman Khuda-Bukhsh et.al	In-vivo	Natrum Sulph 30C, Natrum Sulph 200C, Chol 200C. 0.06 ml of stock solution [1 ml of each drug or alcohol (vehicle) was diluted separately with 20 ml of double distilled water	GSH, LDH, LPO, SOD, CAT, and GR.	G1 -Normal, G2 -Normal + Alc, G3 -DAB+PB, G4 -DAB+PB+Alc, G5 -DAB+PB+Nat Sulph-30, G6 -DAB+PB+Chol-200, G7 -DAB+PB+Nat Sulph30+Chol-200, G8 -DAB+PB+Nat Sulph-200, G9 -DAB+PB+Nat Sulph 200+Chol-200.	Mean ± Standard Error Mean	Antioxidant, Antihepatotoxic and Anticancer activity	[16]
9.	Shifa Shaffique et.al	In-vitro	Baptisia tinctoria, Berberis aquifolium, Echinacea angustifolia, Hydrangea arborescens, Hydrastis canadensis, Kreosotum, and Thuja occidentalis (All in Q) (1.25, 5, 2.5 µl volumes)	2,2DPPH	Ascorbic acid	Mean ± Standard Error Mean	Antioxidant activity	[17]
10.	Ekta Kundra Arora et.al	In-vitro	Allium cepa extract and homoeopathic	2,2DPPH	Gallic acid, Quercitin	Mean ± Standard Error Mean	Antioxidant activity	[18]

			formulations Q, 30C and 200C.					
11.	Shiefa Pinto et.al	Clinical	Individualized therapy	LP, GSH, GR, SOD, CT, GST, vitamin C, AOA.	G1 – NC 53 participant, G2 – Bronchial Asthma 41 patients, Comparative before and after patient data of 23 patients.	Paired t test, Mann Whitney test, Wilcoxon signed ranked test.	Antioxidant activity	[19]
12.	Shiefa Pinto et.al	Clinical	Individualized Homoeopathy	LP, GSH, GR, SOD, CT, GST, vitamin C, AOA.	G1 – OA 81 patients, out of which 47 patient's Rx HM G2 – NC 53 participant	Paired t test, Mann Whitney test, Wilcoxon signed ranked test.	Antioxidant activity	[20]
13.	Anca Hermenean et.al.	In-vivo	Thuja occidentalis Q	2,2DPPH, Oxygen radical absorbance capacity (ORAC), GSH, Malondialdehyde (MDA).	(a) Control; (b) 2,4,6-trinitrobenzenesulfonic acid (TNBS); (c) TNBS + 5 mg Thuja occidentalis MT/kg of body weight; (d) TNBS + 25 mg Thuja occidentalis MT/kg of body weight; (e) TNBS + 50 mg Thuja occidentalis MT/kg of body weight	Mean values ± standard deviation (SD), Student's t-test or one-way analysis of variance (ANOVA)	Antioxidant activity, Anti-inflammatory activity.	[21]
14.	Tayyeba Rehman et.al	In-vitro	Cinchona officinalis, Allium sativum, Nux-vomica, Pulsatilla nigricans, Atropa belladonna, Hamamelis virginiana, Rhus toxicodendron, Berberis vulgaris, Chamomilla, Thuja occidentalis, Achillea millefolium all in Q's.	2,2DPPH	Human pathogenic bacteria (Salmonella typhi, Escherichia coli, Bacillus subtilis, Staphylococcus aureus, and Pseudomonas aeruginosa), Ciprofloxacin	One-way analysis of variance (ANOVA)	Antioxidant activity, Antibacterial activity.	[22]

Table 2. Score for assessment of biological experiment on homeopathy (SABEH) included studies

S.No	Author	Objectives (1)	Controls (1)	Blinding (1)	Randomization (1)	Consistency (1)	Experiment Standardization (1,1)	Statistics (1)	Result Interpretation (1)	SABEH (9)	References
1.	Saeed Ahmad et al.	1	1	0	0	1	1,1	1	1	7/9	[9]
2.	Celso Fernandes Batello	1	1	0	0	1	0	1	1	5/9	[10]
3.	Vasavan Jyothilakshmi et al.	1	1	0	0	1	1,1	1	1	7/9	[11]
4.	Lalit Kishore et al.	1	1	0	0	1	1,1	1	1	7/9	[12]
5.	Lalit Kishore et al.	1	1	0	0	1	1,1	1	1	7/9	[13]
6.	Gagan Bihari Nityanand Chainy et al.	1	1	0	0	1	1,1	1	1	7/9	[14]
7.	Rosana Catisti et al.	1	1	0	0	1	1,1	1	1	7/9	[15]
8.	Anisur Rahman Khuda-Bukhsh et al.	1	1	0	0	1	1,1	1	1	7/9	[16]
9.	Shifa Shaffique et.al	1	1	0	0	1	1,1	1	1	7/9	[17]
10.	Ekta Kundra Arora et al.	1	1	0	0	1	1,1	1	1	7/9	[18]
11.	Anca Hermenean et al.	1	1	0	0	1	1,1	1	1	5/9	[21]
12.	Tayyeba Rehman et al.	1	1	0	0	1	1,1	1	1	5/9	[22]

Ekta Kundra Arora et.al in turn, investigated Antioxidant activity of *Allium cepa* extract and its homoeopathic formulations (*Allium cepa* Q, *Allium cepa* 30C and *Allium cepa* 200C). Antioxidant activity was investigated by 2,2DPPH assay. Gallic acid and Quercitin was used as standard comparator. The experiment showed positive qualitative and quantitative results with respect to presence of phenols in dilutions of 30C and 200C when compared with Q and crude extract. *Allium cepa* extract (1000 ppm) and Q showed percentage inhibition of 55.6±0.14 & 39.8±0.09 respectively against 2,2DPPH. *Allium cepa* 30C and 200C show limited antioxidant potential. [18]

Anca Hermenean et.al. investigated Antioxidant activity of *Thuja occidentalis* Q. Antioxidant activity was investigated by 2,2DPPH, Oxygen radical absorbance capacity (ORAC), GSH, Malondialdehyde (MDA) in-vitro and in-vivo. 2,4,6-trinitrobenzenesulfonic acid (TNBS) was used as comparator. Antioxidant activity of *Thuja occidentalis* Q was observed in-vitro and in-vivo due to presence of phenolic content, also Anti-inflammatory activity was confirmed. *Thuja occidentalis* Q exhibited 88.3% DPPH scavenging activity and almost 78% NO radical scavenging capacity, confirming that this tincture can react with DPPH and NO radicals, acting as free radical scavengers, as assessed by hydrogen donating ability. [21]

Tayyeba Rehman et.al in turn, investigated Anti-bacterial and Antioxidant activity of Homoeopathic mother tincture's namely *Cinchona officinalis*, *Allium sativum*, *Nux-vomica*, *Pulsatilla nigricans*, *Atropa belladonna*, *Hamamelis virginiana*, *Rhus toxicodendron*, *Berberis vulgaris*, *Chamomilla*, *Thuja occidentalis* and *Achillea millefolium*. Antioxidant activity was investigated by 2,2 DPPH assay. Ciprofloxacin was used as comparator in investigating Anti-bacterial activity. Human pathogenic bacteria (*Salmonella typhi, Escherichia coli, Bacillus subtilis, Staphylococcus aureus* and *Pseudomonas aeruginosa*) was investigated and the above stated Homoeopathic Q's showed Antibacterial and Antioxidant activity. *Thuja occidentalis* showed percentage inhibition of 82.34 ± 2.08 against DPPH at highest concentration tested (10 µL). *Pulsatilla nigricans* showed the highest inhibition of DPPH (85%) among other tested plant Q's, *Chamomilla* Q showed 71.17 ± 2.80% inhibition of DPPH. *Hamamelis* Q antioxidant activity was 68.10 ± 3.66. *Belladonna* Q showed 15.02 ± 3.24 percentage inhibition of free radical. *Nux vomica* Q antioxidant activity was 47.64 ± 4.49. *Allium sativum* had insignificant percentage inhibition of DPPH in current study, i.e., 14.61. *Cinchona officinalis* had percentage inhibition of 84.61 ± 3.98. *Millefolium* Q antioxidant activity was 77.81 ± 3.98. *Berberis vulgaris* Q antioxidant activity was 98.43%. [22]

3.2 Perspective on Pharmacology Of Antioxidants Of Homeopathic Medicines Based On Clinical Studies

Shiefa Pinto et.al conducted clinical trial on Homeopathic medicines exploring its antioxidant effects in bronchial asthma patients. The trial had 53 participants' untreated (NC) and 41 patients with bronchial asthma (BA), of which 23 patients before and after data was analysed. Random blood samples from both the groups of NC & BA were collected. Antioxidant activity was assessed through erythrocyte LP, erythrocyte antioxidants., Catalase, GSH, Superoxide Dismutase, Glutathione Reductase, and plasma antioxidants viz., Glutathione S Transferase, ceruloplasmin, vitamin C, antioxidant activity. *Arsenic alb, Pulsatila nigricans, Natrum sulphuricum, Antim tartum, Ammonium carb* and *Kali carb* were found to be prescribed at a dilution of 30C & *Ferrum Phosphoricum* at 6X. 54% of the 41 patients had received *Arsenic album* and 29% received *Pulsatilla nigricans. Antim tart,* (24%). *Nat sulph* (17%), *Kali carb* (19%), *Ferrum Phos* (14%) and *Ammonium carb* (13%) were prescribed to the patients. 11 homeopathic medications most prescribed for 23 patients whose follow up blood sample was taken. *Ars alb, Puls nigrican, Nat sulph, Ferrum phos* and *Antim tart* was observed to be prescribed for the patients for treatment. LP had decreased in the erythrocyte which showed that homeopathic treatment had some effect in reducing oxidative stress. Further it was confirmed with plasma vitamin C and erythrocyte SOD levels which interpreted to be normal, but oxidant stress had not resolved completely within the period of study as plasma AOA had still not returned to be in its normal control levels. Pre-treatment levels of GSH µmol/g Hb), SOD (units/g Hb), Catalase (Units/g Hb) & GR (Units/g Hb) were 6.02+0.470 (1.46-10.38), 13276+1527.8 (3274 – 36053), 283221+35677 (77978 -881356) & 2.02+0.0300 (0.28- 5.79) respectively. While Post-treatment levels of GSH µmol/g Hb), SOD (units/g Hb), Catalase (Units/g Hb) & GR (Units/g Hb) were 4.73 + 0.278 (2.82 – 8.70), 9991 + 999.9 (2340 – 23545.2), 260732 + 17343 (117935– 390472) &

1.34 + 0.259 (0.00 – 5.10) respectively. Pre-treatment levels of Vitamin C (µmol/L), Ceruloplasmin (g/L), GST (IU/L) & AOA (mmol/L) were 13.1 + 2.12 (3.1- 42.3), 0.597 + 0.8300 (0.150 – 2.140), 3.84 + 0.485 (0.50 -10.41) & 0.47 + 0.043 (0.22-1.02) respectively. While post treatment level of Vitamin C (µmol/L), Ceruloplasmin (g/L), GST (IU/L) & AOA (mmol/L) were 26.0 + 2.55 (4.2 – 46.6), 0.519 + 0.0875 (0.75 – 2.300), 4.62 + 0.612 (0.31 – 11.45) & 0.53 + 0.045 (0.22 – 1.04) respectively. [19]

Shiefa Pinto et.al conducted clinical trial on Homeopathic medicines exploring its antioxidant effects in Osteoarthritis patients. The trial had 53 participants' untreated (NC) and 81 patients with Osteoarthritis (OA), of which 47 patients before and after data was analysed. Random blood samples from both the groups of NC & BA were collected. Antioxidant activity was assessed through erythrocyte LP, erythrocyte antioxidants viz., GR, GSH, CT, SOD, and plasma antioxidants viz., GST, vitamin C, ceruloplasmin, total antioxidant activity (AOA). *Rhus toxicodendron, Calcarea flur, Pulsatilla nigrican, Natrum muriaticum, Thuja occidentalis* and *Bryonia alba* was observed to be prescribed in *30C,* whereas *Calcarea flur* in *6X and Thuja occidentalis* in *200C* was prescribed. 65.4% of the 81 patients received *Calcarea flur* & 43% received *Rhus toxicodendron, Pulsatilla nigricans* (25%)*, Natrum mur* (19%)*, Bryonia alba* (17%) and *Thuja occidentalis* (15%) were prescribed to the patients. 10 homeopathic medications most prescribed for 47 patients whose follow-up blood sample was taken. *Rhus toxicodendron, Calcarea flur, Bryonia alba* and*, Pulsatilla nigrican* was prescribed to the patients. LP had decreased in the erythrocytes and showed reduction in oxidative stress. Further confirmed by returning of plasma vitamin C and erythrocyte SOD to its normal levels, plasma AOA remained low after treatment. Before treatment baseline characteristics for 47 enrolled patients of TBARS (*Thiobarbituric Acid Reactive Substances)* as nmol MAD/g Hb showed 110.1 ± 8.43 (13.4–259.9) 0 hour, 480.6 ± 30.70 (134.6–887.6) 2 hour, while susceptibility for LP was 370.5 ± 27.98 (56.6–774.9) & after treatment 81.3 ± 5.80 (16.10–182.7) 0 hour, 362.0 ± 26.52 (91.90–782.0) 2 hour, while susceptibility for LP was 280.7 ± 22.81 (32.70–599.4) % change 26.15% < before treatment, 24.67% < before treatment & 24.23% < before treatment. Before treatment for enrolled 53 normal control (NC) GSH (mmol/gHb) was 4.8 0.21 (2.4–10.3) & for enrolled 81 OA patients 4.9 ± 0.23 (1.3–10.0). SOD (units/gHb) for enrolled 53 patients NC was 9214 ± 492.5 (4046–21990) & for enrolled 81 OA patients was 11331 ± 589.2 (1168–26716). Catalase (units/gHb) for enrolled 53 patients NC was 245996 ± 10410.2 (27920–413385) & for enrolled 81 OA patients was 276936 ± 16859.0 (91962–848860). GR (units/gHb) for enrolled 51 patients NC was 1.8 ± 0.15 (0.1–4.09) & for enrolled 73 OA patients was 2.0 ± 0.21(0.1–10.36). After treatment GSH (mmol/gHb) in NC 5.1 ± 0.30 (2.0–10.0) & OA patients 5.0 ± 0.36 (1.9–13.4) for enrolled 47 patients. SOD (units/gHb) for NC was 12208 ± 752.9 (3920–26716) & for OA patients (n=47) 9378 ± 657.7 (1347–25851), where Not Significant (NS) 23.18 < before treatment. Catalase (units/gHb) for NC was 284827 ± 227673.0 (102042–848860) and for OA patients (n=47) was 240474 ± 16103.4 (107356–583728) NS 15.57 < before treatment. GR (units/gHb) for NC was 1.7 ± 0.22 (0.1–5.8) & for OA patients (n=44) was 2.3 ± 0.40 (0.0–10.5) NS 35.00 < before treatment. Before treatment, Vitamin C (mmol/L) for NC (n=53) was 22.5 ± 12.3 (3.5–49.5) and for OA patients (n=81) was 16.9 ± 1.28 (0.7–43.6). Ceruloplasmin (g/L) for NC (n=53) was 0.5 ± 0.03 (0.2–1.4) and for OA patients (n=81) was 0.5 ± 0.20 (0.1–1.1). GST (IU/L) for NC (n=53) was 4.3 ± 0.45 (0.4–15.4) and for OA patients (n=81) was 4.0 ± 0.37 (0.0–15.8). AOA (mmol/L) for NC (n=53) was 1.0 ± 0.06 (0.3–2.2) and for OA patients (n=70) was 0.6 ± 0.03 (0.1–1.2). After treatment, Vitamin C (mmol/L) for NC was 18.4 ± 1.79 (0.7–43.6) and for OA patients (n=47) was 20.7 ± 1.78 (2.2–48.6). Ceruloplasmin (g/L) for NC was 0.5 ± 0.23 (0.1–1.0) and for OA patients (n=47) was 0.5 ± 0.03 (0.1–0.9). GST (IU/L) for NC was 3.8 ± 0.44 (0.6–13.5) and for OA patients (n=47) was 3.6 ± 0.45 (0.3–13.3). AOA (mmol/L) for NC was 0.6 ± 0.04 (0.1–1.2) and for OA patients (n=41) was 0.6 ± 0.04 (0.2–1.2). [20]

3.3 Future Perspective

Homeopathy also known as HDM was discovered by German physician Samuel Hahnemann through a process named as drug proving (DP) which is performed on healthy volunteers. [23] DP comprises of interpretation of drug action of homeopathic medicines in the form of subjective analysis or perception explained by the volunteer to whom the homeopathic medicine was administered. [24] As per the empirical sources homeopathy is safe for human consumptions. Recent appraisal of presences of physical entity in this HDM had made a remarkable change in perspective of understanding its pharmacology, as the HDM earlier was questioned about its efficacy (Safety & Mechanism of action) and controversy of

Avogadro's equation (pertaining to presence of any physical entity in HDM preferably above 12C as it crosses the limit of Avogadro constant i.e 6.024×10^{23}) researched and now explored in a domain of nanoscience. [25-27] From the above cited research these HDM from various preclinical studies have shown antioxidant properties which might provide an essential guide in predicting dose for first in human or initial phase studies or in drug proving trial, which might be used as standard protocol in chronic disease conditions wherein these free radicals are targeted to be researched.

4. CONCLUSION

Homoeopathic medicines used in Q's namely *Syzygium jambolanum, Damiana, Cinchona officinalis, Chelidonium majus, Convallaria majalis*, *Coca, Berberis Vulgaris, Cephalendra indica, Baptisia tinctoria*, *Berberis aquifolium*, *Echinacea angustifolia*, *Hydrangea arborescens*, *Hydrastis canadensis*, *Kreosotum*, *Thuja occidentalis, Allium cepa*, *Allium sativum*, *Nux-vomica*, *Pulsatilla nigricans*, *Atropa belladonna*, *Hamamelis virginiana*, *Rhus toxicodendron*, *Rauwolfia serpentine, Berberis vulgaris*, *Chamomilla* and *Achillea millefolium* showed antioxidant activity. Homoeopathic medicines in dilutions namely *Arsenic album, Cuprum metallicum, Zinc metallicum* and *Magnum* in 6C, 12C & 30C, *Cephalendra indica* 6C & 30C, *Rauwolfia serpentine* in 6C, 30C, *Arnica Montana* in 6C, 12C, 30C, *Natrum Sulphuricum* 30C, *Natrum Sulphuricum* 200C, *Cholestirum* 200C, *Allium cepa* 30C (NS) and *Allium cepa* 200C (NS) had also shown antioxidant activity. HDM can further be studied at to what extent they provide preventive role, interception role and repair role pertaining with their antioxidant properties, also comparing the efficacy of antioxidant properties through oral route and injectable in various stages of disease. This review also confirms that the HDM's have no toxicity and provides antioxidant properties when compared with standard control and vehicle control.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Valko M, Leibfritz D, Moncol J, Cronin MT, Mazur M, et al. Free radicals and antioxidants in normal physiological functions and human disease. Int J Biochem Cell Biol. 2007;39(1):44-84.
2. Abe J, Berk BC. Fyn and JAK2 mediate Ras activation by reactive oxygen species. J Biol Chem. 1999; 274(30):21003-10.
3. Barnett YA, King CM. An investigation of antioxidant status, DNA repair capacity and mutation as a function of age in humans. Mutat Res. 1995;338(1-6):115-28.
4. Bunaciu Andrei A, Danet Andrei, Fleschin Serban, Aboul-Enein Hassan. (2015). Recent Applications for in Vitro Antioxidant Activity Assay. Critical reviews in analytical chemistry / CRC. 46. 10.1080/10408347.2015.1101369.
5. Bauerova, K.,&Bezek, S. Role of reactive oxygen and nitrogen species in etiopathogenesis of rheumatoid arthritis. *Gen.* Physiol. Biophys. 1999;(18):15–20.
6. Becker LB. New concepts in reactive oxygen species and cardiovascular reperfusion physiology. Cardiovasc Res. 2004;61(3):461-70.
7. Bergendi L, Benes L, Duracková Z, Ferencik M. Chemistry, physiology and pathology of free radicals. Life Sci. 1999;65(18-19):1865-74.
8. Wakte M et al. A review on preclinical studies conducted with Homeopathic medicine Cephalandra indica as an Antihyperglycemic agent. International Journal of High Dilution Research. 2019; 18 (3-4):35-46.
9. Ahmad S, Rehman T, Abbasi WM, Zaman MM.Analysis of antioxidant activity and total phenolic content of some homoeopathic mother tinctures. Indian J Res Homoeopathy. 2017; 11(1):21-25.
10. Batello CF. Antioxidante Effect In Vitro Of The Homeopathic Medicine Arsenicum Album, Cuprum Metallicum Manganum And Zincum Metallicum.

Available:http://www.homeoint.org/portugues/batello/english.htm
11. Jyothilakshmi V, Thellamudhu G, Chinta R, Alok K, Anil K, Debadatta N, Kalaiselvi P. Beneficial antioxidative effect of the homeopathic preparation of Berberis vulgaris in alleviating oxidative stress in experimental urolithiasis. Forsch Komplementmed. 2014;21(1):7-12.
12. Kishore L, Singh R. Ameliorative effect of Cephalandra indica homeopathic preparation in STZ induced diabetic nephropathy rats. J Ayurveda Integr Med. 2019;10(4):255-261.
13. Kishore L, Singh R. Effects of different homeopathic potencies of Cephalendra indica in treatment of neuropathic pain in streptozotocin induced diabetes, Bulletin of Faculty of Pharmacy, Cairo University 2017;(55):273–280.
14. Kumar S, Dandapat J, Chainy GBN, Hati AK, Nanda L, et al. Homeopathic Medicine Rauwolfia Serpentina Ameliorate Blood Pressure and Oxidative Stress Parameters of Kidney by Modulating Expression of Antioxidant Enzymes in Deoxycorticosterone Acetate (DOCA)-Salt-Induced Hypertensive Rat Model. J Drug Res Dev. 2016;2(1).
15. Camargo RA, da Costa ED, Catisti R, Effect of the oral administration homeopathic Arnica montana on mitochondrial oxidative stress, Homeopathy. 2013; 102(1):49-53.
16. Bhattacharjee N, Khuda-Bukhsh AR. Two homeopathic remedies used intermittently provide additional protective effects against hepatotoxicity induced by carcinogens in mice. J Acupunct Meridian Stud. 2012;5(4):166-75.
17. Shaffique S, Anwer H, Asif HM, Akram M, Rehman A, et.al, In Vitro Evaluation of Antioxidant Activity of Homeopathic Mother Tincture and Total Phenolic Content. RADS J Pharm Pharm Sci. 2020;8(1):1-12.
18. Arora EK, Sharma V, Khurana A, Manchanda A, Sahani DK, et al. Phytochemical analysis and evaluation of antioxidant potential of ethanol extract of *Allium cepa* and ultra-high homoeopathic dilutions available in the market: A comparative study. Indian J Res Homoeopathy. 2017;(11):88-96.
19. Pinto S, Rao AV, Rao A Erythrocyte and Plasma Antioxidants in Bronchial Asthma Before and After Homeopathic Treatment. J Homeop Ayurv Med. 2011; 1:103.
20. Pinto S, Rao AV, Rao A. Lipid peroxidation, erythrocyte antioxidants and plasma antioxidants in osteoarthritis before and after homeopathic treatment. Homeopathy. 2008;97(4):185-9.
21. Anca Hermenean et.al, Antioxidant and Anti-Inflammatory Properties of a Thuja occidentalis Mother Tincture for the Treatment of Ulcerative Colitis, Antioxidants 2019;8:416. DOI: 10.3390/antiox8090416.
22. Rehman T, Ahmad S. Evaluation of antibacterial and antioxidant potential of some homoeopathic mother tinctures. Indian J Res Homoeopathy. 2019;13:100-6.
23. Lockie A, Geddes N. In: Blanche S (ed). The Complete Guide to Homeopathy, London, NewYork: Dorling Kindersley. 1995;11–19.
24. Lockie A. In: Stephanic F (ed). Encyclopedia of Homeopathy, London, NewYork: Dorling Kindersley. 2000;12–25.
25. Upadhyay RP, Nayak C. Homeopathy emerging as nanomedicine. Int J High Dilution Res. 2011;(10):299310.
26. Bellavite P, Marzotto M, Olioso D, Moratti E, Conforti A. High‐dilution effects revisited 1. Physicochemical aspects. Homeopathy. 2014;103(1):4‐21.
27. Chikramane PS, Suresh AK, Bellare JR, Kane SG. Extreme homeopathic dilutions retain starting materials: A nanoparticulate perspective. Homeopathy. 2010;99(4):231-42.

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