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Homoeopathy: A nano-medicine

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Abstract

Homoeopathic drug dynamisation theory was introduced by Dr. Samuel Hahnemann in 5th edition of Organon of Medicine in 1926. Absence of modern technological aid to support this theory led to strong criticism from contemporary therapeutic system, until the use of new technologies like different electronic microscopes which demonstrated presence of nanoparticles in Homoeopathic ultra-diluted medicines. Ultra diluted Homoeopathic medicines demonstrate properties similar to nanoparticles like gene expression, electromagnetic, mechanical, optical, thermal, chemical, biological and quantum properties causing enhanced bioavailability, increased reactivity and adsorptive capacity resulting in adaptive changes of Hormesis. These technological evidences have bridged the wide gap between the Homoeopathic Philosophy and Modern Science.

Keywords: Homoeopathy, drug dynamisation, nanoparticles, hormesis.

Introduction

Homoeopathy has demonstrated good results over decades in decreasing morbidity as well as mortality in most of diseases and also in earlier pandemics [1]. Homoeopathy is also helpful in modifying the immunology of disease conditions [2] and can thus be used efficiently against the ongoing COVID-19 pandemic [3] and its sequelae. Homoeopathic drug dynamisation theory was introduced by Dr. Samuel Hahnemann in 5th edition of Organon of Medicine in 1926. The physical existence of even a minutest molecule of the original drug is said to be hypothetical as homoeopathic medicines are prepared at dilutions. The curing effect of each Homoeopathic potency is observed but not understandable by the conventional science. This statement is a highly debatable topic between rationalists and Homoeopaths. New insights into this issue are laid by latest research of the Nano particulate nature of Homoeopathic potencies. As it uses minute, including sub molecular, 'doses', homoeopathy might be perceived as 'Nano-medicine'.

Nano-perspective - As per National Nanotechnology Initiative, nanotechnology is defined as the manipulation of matter with at least one dimension sized from 1 to 100 nanometres. Nanotechnology deals with very tiny particles i.e. nanometre size [5]. Homoeopathic medicines when prepared at high dilutions with no particulate existence of even one molecule of the original drug is said to be impossible theoretically; but it has been noticed that there are apparent biological effects of these highly potentized Homoeopathic medicines [6]. With the use of new technologies like Transmission Electron Microscopy (TEM), Electron diffraction and chemical analysis by Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES) and energy dispersive spectroscopy reveals presence of physical matter in Homoeopathic higher dilutions, as nanoparticles of the starting metallic drug and its aggregate [7].

A study to evaluate High Dilutions of homeopathic drug Ferrum metallicum (Ferr) 6, 30, 200, 1M, 10Mc and 50Mc showed that all except for 6c crosses Avogadro's number. With use of high-resolution TEM and energy dispersive spectroscopy (EDS) it was shown that all high dilutions of Ferr contained plenty of nanoparticles and the size of NPs were within the quantum dots size range, except for 50Mc, in which larger particles of 12.61nm were found. Nano Particles possessed iron in different weight percentages; which was highest in HDs10Mc and 50Mc [8]. Another study to test the higher potencies of Homoeopathic drug Lycopodium to find a substantial evidence of the original drug substance was done with assistance of Field Emission Scanning Electron Microscopy (FESEM) and EDS which showed an existence of nanoparticles in all potencies tested of Lycopodium [9].

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A study aimed to find presence of nanoparticles in different potencies of *Hypericum perforatum* revealed with the help of modern technologies like FESEM & EDS analysis in all potencies of centesimal scale of *Hypericum* there proved to be an existence of Nanoparticles [10]. Another study was conducted to detect nanoparticles in different potencies of *Aurum Met & Carbo Veg* drug with the help of HRTEM, FESEM & EDS revealed presence of plenty of nanoparticles in nanometre & Quantum dots (QD – less than 10nm) with presence of particles of gold in all the potencies of *Aurum*. Plenty of NPs were identified in all the potencies of *Carbo-Veg* drug through nanometer scale of Carbon and Oxygen [11]. The presence of NPs of *Natrum Mur* from 6C to CM were detected which reveals that LM scale is richly filled with number of NPs. NPs in LM scale were much smaller than that in centesimal scale [12].

Nanotechnology has provided a scientific basis to the Homoeopathic therapeutic system by establishing a connection between the old unquantifiable effects and the latest quantifiable technology thus validating Homoeopathy under the domain of science [13]. Nanomedicine delivery methods have advantages over crude conventional medicines, like improved targeting the disease for intracellular pathogens, lower doses effective to get the same effect, can easily cross cellular membranes, act as highly catalytic, longer duration of drug action, lesser side effects and cost effective. In comparison to bulk forms, NPs have increased bioavailability, larger surface area to volume ratio which increases reactivity and adsorptive capacity; with unique electromagnetic, mechanical, optical, thermal, chemical, biological and quantum properties. NPs can differentiate which cells are healthy and which are not, while crude medicine cannot [14]. In few studies it was found out that the presence of the original source materials physical chemistry “fingerprint” properties retained in remedy solutions. Homoeopathic remedies contain detectable amounts of NPs, which are extremely smaller particles of drug material. NPs are similar in size to viruses, thus enters the cells very easily. Even though these drug substances are in so diluted form, still they have such individualized properties. These individual properties of NPs vary remarkably from the crude forms of same drug material [10]. Quantum physics shows that NPs can put an impact on our macro world, with respect to Homoeopathy it is observed that at the very highest prescription strength dilutions of a homoeopathic substance (50M), there are still nano particles of the original substance that exist [15]. Also, physical chemistry and biophysics studies infers those Homoeopathic remedies emits electromagnetic as well as optical signals confirmed by use of solvatochromic dyes. The smallest NPs are QDs, which contains 10 – 50 atoms. The sizes of the NPs range from QDs to larger nanostructures. QD sized NPs generates phenomenon like quantum coherence and entanglement. Extremely small QDs trap source material atoms and their electrons on the surface of particle, which emits photon [16].

Hormesis: Principles and applications of Hormesis states the beneficial effect of toxins in low doses, as a J or inverted U shaped dose response against the sigmoid S shaped curve assumed in pharmacology. Thus it signifies a relationship between Hormesis and Homoeopathy via Arndt-Schulz Law [17]. Homoeopathic prepared medicines stimulate a dose response which causes a specific hormesis which ensures

that homeostasis is maintained leads to cure [18]. Another virus like similar characteristic observed is Homoeopathic NPs can have virus like cell defence response (CDR) activation through various pathways/networks, thus secondary action of medicine. Different sizes of NPs of the same source material can exert different effects, this characteristic feature of nanoparticles thus emphasizes on how vital dosage of Homoeopathic and conventional pharmaceutical drugs can have different effects depending upon on its dosage. NPs act on genetic expression, cytokine release and signalling pathways as cell danger signals for the body by activating Danger Associated Molecular Pattern (DAMP) recognition receptors. The factors responsible for the endogenous response to NPs are either immune or inflammatory or metabolic mediator modulation, and nervous system that crosses sensitization and causes adaptive changes of hormesis. In a study, hormesis was demonstrated. The biological stress response was reversed to normal by giving homoeopathy form of the same source materials. NPs in Homoeopathic medicines follows adaptive biological pathways generating state dependent changes in living systems. Multiple studies demonstrate the ability of various nanomaterials that trigger the adaptive nonlinear dose type of response hormesis at lower doses [19]. It is known that NPs of sizes 1 – 7 nm, can affect the olfactory nervous system and triggers DAMPs of the immune system and thus hormesis [20]. NPs can cause hormesis. Therefore, it infers that Homoeopathically prepared remedies can stimulate a similar response, causing hormesis which, in turn maintains homeostasis and thus cures. With respect to Homoeopathic medicines it's always less that is more [21].

Modus operandi of Homoeopathy: Herbs and minerals containing nanoparticles can treat infections via enhanced bioavailability, anti-inflammatory, antioxidants and immunomodulatory effects [22]. Homoeopathic remedies modulate Nanoparticle-Allostatic Cross-Adaptation Sensitization (NPCAS) Model with multiple dynamic short and long term effects. Similimum remedy nanoparticles, act as novel mild stressor corresponding to the organism's dysfunction initiate time dependent cross sensitization, reversing the direction of dysfunctional reactivity to environmental stressors. In Homoeopathy, the appropriate homoeopathic remedy is a mild salient stressor (hormetin) for the organism as a whole [10]. The factors that particularly causes host adaptive response encompasses virulent properties of certain NPs and their triggering ability of DAMP's of the body as exogenous stressors or stimuli. Some larger NPs can exert bacterial effects on living systems as well. Homoeopathic medicines don't act locally on end organ tissue receptors but they act mainly via modulating adaptive biological pathways in the body involved in the stress response. These interconnected pathways include immune, inflammatory, hormonal, and metabolic and nervous system mediation. NPs triggers responses related to viruses, whereas larger micro sized particles affect like bacteria. Biologically small NPs have extremely high bioavailability and capacity to cross cell membranes [19]. For Homoeopathic dosing, very low doses of NPs mobilize hermetic adaptation mechanisms in complex living systems by serving as novel and foreign stressors stimulating beneficial response in the organism as a whole. The organism's adaptively grow and evolve gradually via nonlinear metaplastic and plastic sensitization

mechanisms in cells across the endogenous, self-organized network of the dynamical living system. The primary pathways involve adaptation rather than direct pharmacological actions [23]. Recent research work suggests that Homoeopathic remedies exist in a dual form, that is, molecular form at lower dilutions and a Nano particulate form at higher dilutions, and the remnants persisting in extremely higher dilutions. Literature confirms that both the odorants and the nanoparticles enters body through inhalation, digestive absorption, or through skin, NPs or viruses can directly reach brain through axons of the nerves. The Nano particulate form activates the immune system at multiple levels, induces systemic biological responses through the PNEI axis and inflammation factors or modulate gene expression at the cellular level. Assuming that the Nano particulate forms of higher dilutions of the Homoeopathic remedies possess similar properties as to the conventional NPs, they would exhibit much higher bioavailability, cellular membrane permeability and intracellular reactivity than the molecular form of lower dilutions of Homoeopathic remedies [24].

Silicate- during the process of succussion, information from starting material gets imprinted by epitaxy on silicone rich crystalline NPs present in thus resulting Homoeopathic medicine. Depending on degree of dilution the size of information encrypted on nanoparticles varies. Thus Homoeopathy can be a representative of Nano medicine system.²⁵Surface adsorbed materials from the surface of the container, during the process of Homoeopathic drug preparation, modifies silica NP bio-reactivity, potentially carrying the source fingerprints and amplifies the information of the original substance into higher potencies. A study concludes that increasing the number of succussions; reduces the particulate size of plant materials as per the nanoscale range [26].

Potentization: When Homoeopathic medicines dilute and potentize, the kinetic energy (in succussion) or mechanical energy (in trituration) is converted and stored as potential energy; this is in align with the equation $E=MC^2$; wherein it states that energy cannot be created nor destroyed, it can only be converted into one form to another [27]. During the process of drug potentization, the mechanical energy that is transferred reduces the size of the drug aggregates in all probabilities. Now, the drug can penetrate easily through the cellular membrane giving rise to eincreased activity of that medicine [26]. During the process of succussion, vital nanobubbles are produced along with very high forces and temperatures which remain consistent with the size and shape of the metal nanoparticles. This formation of nanoparticle-nanobubble complexes is used as a new initial material for the next dilution and through this process again succussions will lead to production of nanobubbles which later form the nanoparticle-nanobubble complex, hence as the process of succussion increases the nanoparticle-nanobubble complex increases [28]. These nanobubbles have some characteristic properties of low buoyancy, increased longevity and release of high energy when it collapses. Nanobubbles are associated with certain structures which increases in size when there is an increased dilution to the extent of ultramolecular range [17]. Depending upon the origin of nanoparticles the level of interaction with CT-DNA is varied reflecting the difference in their respective

binding capacities. Their cellular entry and biological action differs due to the different sizes of NPs [29]. Homoeopathy is a form of nano pharmacology where homoeopathic medicines, through the process of potentisation. A study states that homoeopathically prepared remedies from plant and metal sources contain 1-4000 pg/mm of NPs (5-100 nm size) in mother tincture and upto 200C potency. Dr. Jayesh Bellare, head of Chemical Engineering Department at IIT-B states that even the highest dilutions of homoeopathic remedies leave signatures of respective source molecules in their NP form. He also co related the succussion process to electromagnetic waves which breaks the quantum domain of a medical substance by accelerating and decelerating the protein activity. In a study conducted by IIT – Kharagpur with the help of Fluorescence Spectroscopy and Cyclic Voltammetry found the presence of biologically active digoxin like substance in Digitalis Purpurea 30C and 200C [13]. The hypothesis is that the original metals forms nanobubbles and floats on the surface of the highly diluted mixtures. The particle of the source material gets adsorbed on the surface of these nanobubbles and cavitations [30]. During the process of Homoeopathic medicine preparation like mechanical grinding results in virus like particle surface defects like cracks, fissures, roughness, folds and pores which increases bio-molecular binding and cell uptake. Nanoparticles are often more potent in relation to their crude form. One study states that during the process of Homoeopathic drug preparation, when number of succussions are increased it starts producing smaller sizes of NPs of source plant extract progressively up to approximately 14 nm. Exosomes are smaller vesicles that can contain lipids, adhesions, intercellular signalling molecules, proteins and RNAs of the original source cell interior. Homoeopathic investigators repeatedly found that during the process of Homoeopathic drug manufacturing the repeated agitation can release variable but measurable amounts of elemental silicon into solution in the ppm ranges. In a study by Ives *et al.* they showed that repeated succussions gradually lowers pH of a homoeopathically prepared solution from alkalinity to neutral buffering pH 7. A study states that, this change of pH value helps in converting a precursor monomer silicate of the solution into NPs forms of silica. Therefore, nano-silica is highly likely to be present in any homoeopathically prepared potency made in glass. The nature of NP interactions with the cell and resulting biological activity is based upon its size, shape, surface area, surface charge and surface chemistry. In contrast to the crude pharmaceutical drugs, NPs distinctly generate aging, causing pH sensitivity, giving electromagnetic, photoluminescence and producing quantum mechanical effects. Multiple studies have converged on the hypothesis of Homoeopathic nanoparticles as salient mild systemic stressors [19]. A study by Ramnarian Ruia College, Mumbai in 2013 stated that the dose of medicine required is inversely proportional to material aspect by orders of magnitude, i.e., in NP size causes increasing effect, this confirms the principles of Homoeopathy. Thus, Homoeopathy is a form of Nano pharmacology, as through the process of potentization there is breaking down of medicinal substance into NPs [21].

Variant Potency, Variant Effects: Homoeopathic medicines at very low potencies acts as enhanced micro and nanoscale forms of the original source material through the

mechanism of local ligand-receptor interactions whereas at higher potencies it acts through the systemic adaptive network producing dynamical effects through NPs based electromagnetic, optical and quantum physical properties. Hence it can be said that Homoeopathic medicine preparation process like potentization modifies the size, shape and surface charge of NPs thus causing varying physio-chemical properties and thus its biological effects^[31]. Ultra diluted Homoeopathic medicine contains NP and at very high potency it obeys the laws of quantum physics^[32]. As stated earlier, a study states that the dose of medicine required is reduced by orders of magnitude of the material when it is in NP size which exactly complies with the principles of Homoeopathy^[18]. Very low Homoeopathic potencies exerts direct pharmacological and/or hypersensitivity effects related to increased bioavailability, its drug delivering capacity and duration of action of nanomaterials of the natural source. Higher Homoeopathic potencies when given in water brings about their effects similar to viruses or systemic stressors. The concentration of the homoeopathic medicine in the pulsating doses can be very low but is capable of still triggering individual's bio-reactivity in nonlinear manner^[19]. In a study conducted on animals it was found that higher potencies of a medicine induces longer lasting effects in comparison to its lower potencies.²⁵ An exploratory randomized study conducted to observe NPs in Homoeopathically prepared *Argentum metallicum* 6/30/200 decimal solutions revealed that succussed solutions were significantly larger sized across potencies also Zeta potentials of succussed group were more negative relatively^[33].

Considering the inferences made by many controlled *in vivo* laboratory experiments a general conclusion can be made that homoeopathic remedies are able to modulate at molecular as well as sub-cellular, cellular and also physiological levels and they can efficiently improve the process of DNA repair, involving some specific genes active participation^[34]. An organisation of clinical research including RCTs suggests that Homoeopathy effectively not only cures the symptoms but also improves the quality of life of the patients.¹⁶ As working on the nanoscale level, Homoeopathy can be termed as 'Smart Medicine'.³⁵

Conclusion

Homoeopathy is a form of nanopharmacology where homoeopathic medicines, during the process of potentization, break down into nanoparticles. Ultra diluted Homoeopathic medicines demonstrate properties similar to nanoparticles like gene expression, electromagnetic, mechanical, optical, thermal, chemical, biological and quantum properties causing enhanced bioavailability, increased reactivity and adsorptive capacity resulting in adaptive changes of Hormesis. Thus the presence of nanoparticles is one of the evidence to support nano pharmacological nature of Homoeopathic drug action. These technological evidences have bridged the wide gap between the Homoeopathic Philosophy and Modern Science.

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