A new drug delivery strategy targeting mass population in combating epidemic crisis

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ABSTRACT

Ultrasound as an alternative model for mass prophylaxis to check outbreaks in epidemics is being proposed in this paper. The outbreak of communicable diseases and mass gathering are certainly related through the obvious risk of transmission of infectious agents. Either as the source or being susceptible, the gathering makes the disease spread rapidly challenging the medical community. To combat the steady rise in the incidence of disease, appropriate control measures need to be adopted. An alternative drug delivery model utilizing the potential of ultrasound through percussion – as medicated drumming is hence presented here taking the reference from Indian traditional system of medicine. In this model the herbal or herbo-mineral drugs applied over drum surface followed by drumming releases biochemicals of high bioavailability. Studies have shown the simultaneous production of ultrasound with audible frequency while playing musical instruments and the high affinity of herbal and herbo-mineral drugs towards it. The particle reduction technology through Bhasmikarana (producing herbo-mineral-metallic compounds in nano dimensions) and Bhavana (liquid-assisted trituration of drug powders) incorporates nanotechnology for better stability, bioavailability and targeted delivery. Sonication as such enables production of herbal drugs in sub-micron and nano-sized dimensions. Hence, this novel approach of medicated drumming integrating nanotechnology along with ultrasonic sound (corresponding to the nanotechnology coupled sonodynamic therapy with improved pharmacokinetics) could function as an efficient drug delivery strategy to check outbreaks.

INTRODUCTION

The spread of communicable disease and resultant burden of mass intervention is always a concern for the health sector. Many outbreaks of such communicable diseases occur at mass gatherings resulting in its spread. Here comes the need to tackle such a huge gathering altogether with mass drug administration strategy for disease prevention and control. As per the World Health Organization Recommended Strategies for the Prevention and Control of Communicable Diseases, some prevention and control tasks at the peripheral level is mentioned which includes the mass chemopro-
Ultrasonic frequency (in gamelan music about the perception of music in range. There are several studies done by Oohashi produces ultrasonic sound along with sound in audible it is quite interesting to know that drumming produces herbal compounds have high affinity towards ultrasonic sounds and antiviral properties. Recent studies have shown that herbal compounds disease-causing pathogens with their antimicrobial and antiviral properties.

Medicated drumming

In case of epidemics mass drug administration modalities come to play for the faster distribution of drugs to a large population. To combat this issue, an un-identified drug route from Indian traditional system of medicine could be experimented by applying herbal or herbo-mineral drugs over drum surface followed by drumming which release biochemicals of high bio availability. We have scattered references from Ayurvedic classics where drums and other musical instruments smeared with paste of anti-poisonous compounds are beaten and sounded as an alternative way of drug administration (Kunja et al., 2020a). Few combinations specified in this context include Ksharagada - alkaline preparation of herbo-mineral-metallic compounds (Kunja et al., 2020b), formulation prepared with metals like silver, mercury, gold, processed with cow’s bile. The vibrations caused by the beating would then scatter the fine powder of these drugs all around which helped to counteract even the most dreadful poison. In today’s scenario, this could be correlated with the disease-causing pathogens with their antimicrobial and antiviral properties.

Ultrasound and herbal drugs

Recent studies have shown that herbal compounds have high affinity towards ultrasonic sounds and it is quite interesting to know that drumming produces ultrasonic sound along with sound in audible range. There are several studies done by Oohashi in gamelan music about the perception of music in ultrasonic frequency (Petrosino and Canalis, 2016) (between 20KHz and 50KHz). He states that even though not audible, these ultrasonic components along with audible frequency sound produces significant change in the brain activity of subjects. Hence establishing the existence of ultrasonic sounds from musical instruments. Ultrasound with its higher frequency, shorter wavelength and directional wave-form are easily absorption by materials. This ultrasonic acoustic absorption of herbal drugs is evident from the high yielding and rapid ultrasonic extraction of ayurvedic herbs (Hielscher, 2020) releasing biochemicals with high-quality and extraordinary bioavailability. Based on sound intensity and frequency, the ultrasonic sound usable in food processing is of two types; high-frequency ultrasound (in the range 2–20 MHz) and power ultrasound (high-intensity ultrasound in the range 20–100 kHz). The ultrasonic sound from musical instruments comes under the power ultrasound and have been found to enable bioactive - compound extraction, surface decontamination, as well as microbial inactivation. (Bimakr et al., 2017). Dried substrates (dried herbal drugs) when exposed to ultrasound cause swelling and hydration thereby enlarging the pores of the cell wall resulting in its disruption and thus facilitate the release of contents. (Soria and Vil-lamiel, 2010).

Ultrasound applicability in medicine

The minimally-invasive approach of sonodynamic therapy (SDT) for solid cancerous tumors is a popular application of ultrasonic sound in medicine. In the counterpart, studies have been carried out to find the effects of ultrasound on herbal drugs like the sonodynamic effect of Curcumin on THP-1-derived macrophages. (Wang et al., 2013). The application of nano particle technology in SDT has addressed many shortcomings of traditional SDT. Similarly, herbal and organo-metallic/organo-mineral nanoparticles coupled with ultrasound have been used to check the low bioavailability of these drugs. (Jiang et al., 2019). Bhavana – liquid assisted trituration of drug powders (Yadav et al., 2017) and Bhasmikarana - producing drug particles in nano dimensions in the range of 5-50 nm results in improved stability, bioavailability and targeted drug delivery (Sharma and Prajapati, 2016) which could serve as an excellent model for the incorporation of nanoscience with ultrasound for effective drug delivery and better therapeutic cure. By controlling the ultrasound intensity, sonication becomes the ideal method of manufacturing modern ayurvedic drugs in sub-micron and nano-sized dimensions ensuring highest bioavailability. This also supports the effective and novel approach for the extensive drug delivery through ultrasound emitted from
drumming.

CONCLUSIONS

Percussion through medicated drumming – an unexplored drug delivery route with the application of ultrasound emitted from drums could be a novel approach to combat the crisis of mass chemoprophylaxis during epidemics. It could target the asymptomatic subjects as well as the asymptomatic carriers in the community to prevent the outbreak. The ultrasonic sounds emitted from drumming the medicated drums aids in the release of biochemicals from the drum surface. It also enables the release of these compounds in nano dimension thereby facilitating better stability, bioavailability and targeted delivery. This technique is akin to the nanotechnology coupled SDT used in contemporary science targeting improved pharmacokinetics. Hence this technique of medicated drumming could be an efficient and simple drug delivery system to check outbreak during epidemics. Further studies should be carried out to check the level of transmission of pathogens and its impact in the community.

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Conflict of Interest

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