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Sertraline HCL solid lipid nanoparticles: Formulation and Evaluation

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ABSTRACT
In the present study, solid lipid nanoparticles (SLN) of Sertraline HCl were prepared. The method employed was hot homogenization. The Colloidal delivery system possesses advantages over conventional dosage forms like controlled and site specific drug delivery. These are made up of solid core and phospholipid shell and enhance bioavailability. The main objective of the work was to formulate SLNs, an antidepressant drug used for brain targeting. Poloxamer188 was used as surfactant and Glycerylmonosterate, as lipid. The combination of the surfactant and lipid was utilized for SLN, further that were subjected for different evaluation parameters like particle size, entrapment efficiency, viscosity etc. The results depicted that the F6 batch was to be an optimized formulation with good entrapment efficiency of 87.36 ±1.45% and drug release of 84.26 ±1.10%.
KEYWORDS: *Solid lipid nanoparticles (SLN), Sertraline hydrochloride, Depression, Poloxamer 188*

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INTRODUCTION

Depression has been the most common mental health problem, throughput the world. The features of it include – loss of appetite, interest, pleasure, guilt and feeling[1,2,3,4,5,6]. As per the reports conducted by Global Burden of disease study, depression is the 4th cause of disability and may lead to 2nd cause by 2021[7]. The episodes of depression lead to reduction in progress of work that leads to suicidal cases of people. Antidepressants are the choice of drugs for treatment of depression, wherein selective serotonin reuptake inhibitors (SSRIs) class plays a major role for the treatment [8]. Sertraline HCl belongs to this class, that is effective in crossing the tough blood brain barrier and render antidepressant effect [9, 10]. To have an effective drug delivery system, novel formulations are explored that possess the requisite advantages and can overcome the drawbacks of conventional dosage forms [11, 12]. Thus, solid lipid nanoparticles, are the novel lipid carriers, that can incorporate drugs with small size, high drug loading capacity etc. So, with this aim, the objective of the study was to formulate Sertraline HCL solid lipid nanoparticles

MATERIAL AND METHODS

Materials

Sertraline HCL a gift sample from Wockhardt, Aurangabad. Glycerylmonostearate obtained from Research lab Fine Chem Industries, Mumbai. Poloxamer 188 purchased from AnaLab Fine Chemicals. Triethanolamine and Tween 80 obtained from Loba Chemie Pvt. Ltd.

METHODS

Selection of solid lipid:

The solid lipid to be utilized was determined based on the solubility of the drug in that particular lipid. Different lipids were tried for the study like glyceryl mono stearate, stearic acid, cetylpalmitate. The required quantity of drug was taken and added to the melted lipid in water bath in 10ml glass vials and the solubility of the drug was determined.

Preparation of Sertraline HCl solid lipid nanoparticles

Hot homogenization method was used for preparation. Drug and glycerylmonosterate, were mixed together with ethanol, for formation of lipid phase. To form aqueous phase, the poloxamer 188 and tween 80 were mixed together. These both phases were heated up to 650C. Then the lipid phase added drop wise to aqueous phase, and later subjected to homogenization at 3000rpm for 30 minutes. The final pH was adjusted by using triethanolamine [13,14,15].

Table 1 :Composition of SLN for different batches

Ingredients	F1	F2	F3	F4	F5	F6	F7	F8	F9
Sertraline HCl (mg)	50	50	50	50	50	50	50	50	50
Poloxamer 188 (mg)	100	300	500	100	300	500	100	300	500
Glycerylmonosterate (mg)	200	200	200	500	500	500	350	350	350
Tween 80 (mg)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Triethanolamine (ml)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Ethanol (ml)	5	5	5	5	5	5	5	5	5
Water (ml)	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s

CHARACTERIZATION OF SLN:

pH Measurement:

pHmethod was used to determine the pH of the formulations wherein 1 gm of SLNs was dissolved in 100 ml of distilled water. After calibration was done the glass rod was inserted into the SLN solution and pH was recorded.

Viscosity:

Viscosity of formulation was calculated by using Ostwald Viscometer.

Particle size:

It was determined by use of Scanning electron microscopy as mentioned and digital micrograph and software of soft image viewer was used to capture the images.[16].

Drug entrapment efficiency:

The Entrapment efficiency of the drug in SLNs was determined by use of equation [17]:

EE (%) = Mass of drug in submicron particles/Mass of drug used in formulation X 100

***In vitro* drug release studies:**

In vitro drug release study of optimized Sertraline HCL loaded SLNs was carried out by using cellophane membrane. Vertical Franz diffusion cells were used. Apparatus consists of receptor compartment and donor compartment. Receptor compartment was filled with phosphate buffer of pH 6.8 up to the mark of cell. Cellophane membrane was dipped into hot water. Cellophane membrane was then placed into two halves of cell. Donor compartment is the upper part of the cell. Receptor compartment containing phosphate buffer of pH 6.8 was maintained at temperature 37±5° C. And it is subjected to magnetic stirrer. 5 mg of SLN dispersion was placed on cellophane membrane and sample was withdrawn from receiver compartment at pre-determined time interval. Receptor compartment was replenished with fresh water after every withdrawal. After every withdrawal sample was diluted upto 10 ml. Samples were analyzed by using UV Spectrophotomer at 273 nm. Drug release was then calculated and stated [18,19].

RESULTS AND DISCUSSIONS

Selection of lipid

Sertraline hydrochloride has highest solubility in glycerylmonostearate; therefore it was selected for formulation of solid lipid nanoparticles. Glycerin monostearate was selected as a excellent lipid for formulation of SLN.

pH

The pH of the nanoparticles was in range of 7.3 to 7.5. pH was measured with pH meter.

Particle size analysis

Figure 1 shows the effect of the lipid and surfactant concentration on the particle size distribution of sertraline hydrochloride-loaded SLN.As the concentration of lipid increases, the particles tend to aggregate and increase in the particle size was observed. The particle size was found in between 183 ±8 to 402±17 [20].All the batches were found to be in Nano scale range, which was observed form the values obtained. There was a significant difference in the size of the particles, with change in the lipids.

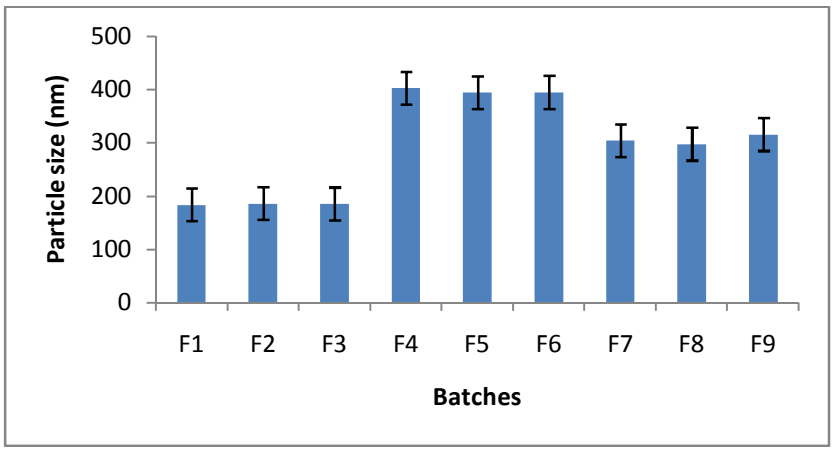

Fig.1: Particle sizes of formulations

Entrapment efficiency:

Entrapment efficiency is an important parameter for characterizing solid lipid nanoparticles. In order to attain optimal encapsulation efficiency, several factors were varied, including the type and concentration of the lipid and surfactant material used. The results indicated that the concentration of lipid has critical effect on the sertraline hydrochloride incorporation efficacy. The entrapment efficiencies was found be in the 41.6±6.72 to 84.3±4.02 %. The high concentration of lipid encapsulated more amount of the drug in the nanoparticles[11].The entrapment efficiency of drug depends on high solubility of drug in the lipid melt as well as on the amount of surfactant. The entrapment efficiency of all the prepared SLN formulations is shown in Figure2.

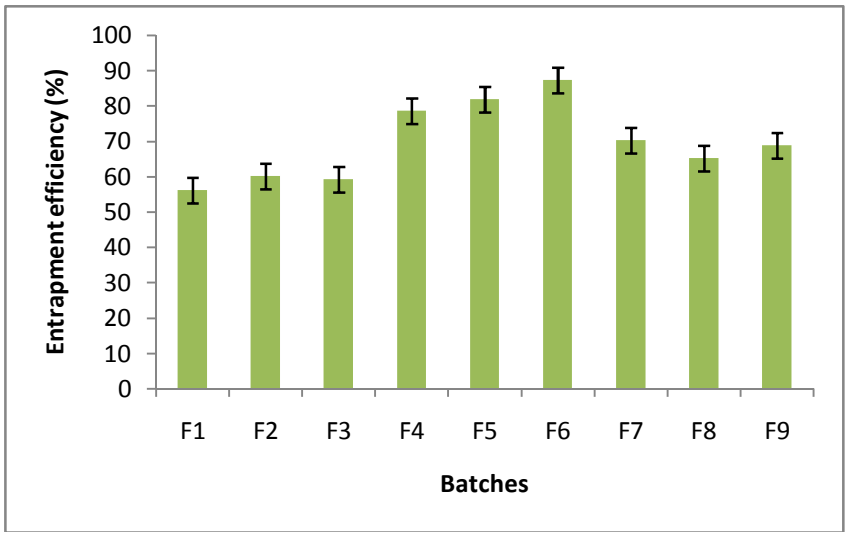

Fig.2: Entrapment efficiency of formulations

In vitro drug release

The *in vitro* drug release profile of sertraline hydrochloride from various SLN formulations is shown in Figure 3. The *in vitro* release of all the SLN formulation was found to be in the range of 52.4±0.91 to 84.26±1.10% at the end of 24 hours. The Optimized formulation was F6.Which has viscosity of 6.86 ±0.13cps [21].

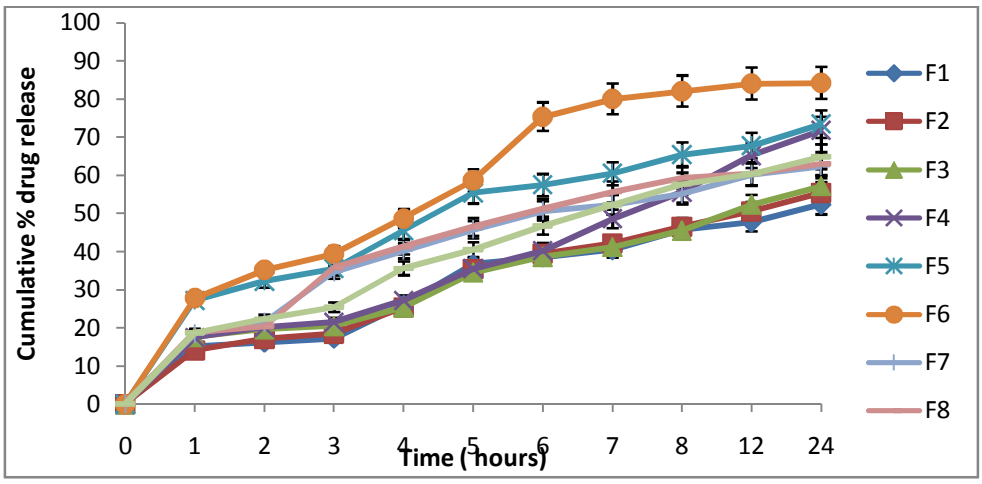

Fig.3: In vitro drug release for all formulations

Effect of surfactants on *in vitro* drug release

Formulations [F6, F5 and F4] prepared by using GMS as a lipid matrix, with Tween 80, Poloxamer 188, as stabilizers showed a higher drug release from sertraline hydrochloride-loaded SLN [84.26, 73.46, and 71.80%, respectively]. This showed that the increase in the concentration of the surfactant there was an increase in the drug release from the SLN. Thus the order of percentage of drug release was based on the basis of the stabilizer.

Viscosity of formulation

Figure 4 shows viscosity of all formulations was found in the range of 4.01 to 6.86 cps.

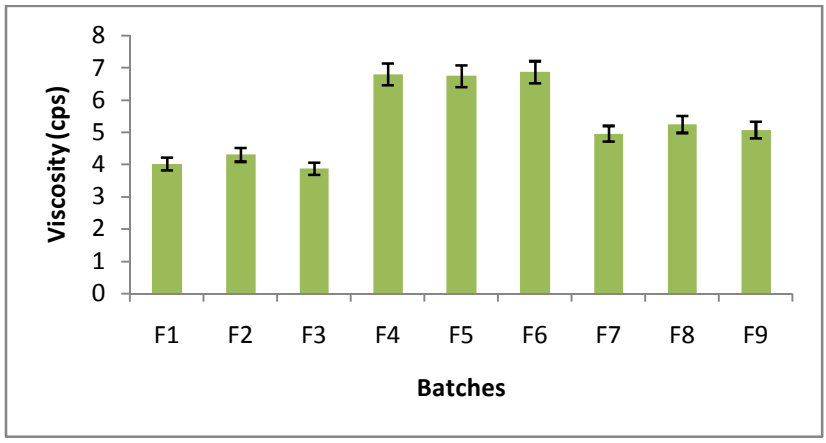

Fig. 4 : Viscosity of all the formulations

CONCLUSION

This study reveals that the formulations of solid lipid nanoparticles were successfully prepared for encapsulation of the drug, by the use of lipid glyceryl monostearate and surfactant poloxamer 188. Furthermore, it could be presumed that if the nanometer range particles were obtained, the bioavailability might be increased. Hence, we can conclude that solid lipid nanoparticles provide a controlled release of the drug. Lipids were able to exhibit sustained effect, that leads to minimize the frequency of dosing, reduce the side effects. These systems are used as drug carriers for lipophilic drugs, to enhance the bioavailability of poorly water-soluble drugs through nanoparticles, as a drug delivery system.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. Lu Y. (2014). A regressional analysis of maladaptive rumination, illness perception and negative emotional outcomes in Asian patients suffering from depressive disorder. Asian Journal of Psychiatry. 2, 69–76.
2. Ranuji Cui. (2015). A Systematic Review of Depression, Current Neuropharmacology. 13(4), 480.
3. Pavithra H Dave, V. Vishnupriya, R. Gayathri. (2016). Herbal Remedies for Anxiety and Depression- A Review. Research J. Pharm. and Tech ; 9(8):1253-1256.
4. Manan A Patel, Chetan M Patel, Dipen B Patel, IS Anand , CN Patel. (2010). A Review on Novel Strategies for Pharmacotherapy of Depression. Research J. Pharmacology and Pharmacodynamics. 2(2):153-159.
5. Indu Sharma, MandeepKaur, Bharat Parashar, Amrita Kainth. (2014). Depression: An Overview. Asian J. Res. Pharm. Sci. 4(1): Jan.-Mar. Page 28-31.
6. V. Anisha, P. Femila, SanthiAppavu. (2014). A Study to Assess the Effectiveness of Taichi Exercise on Depression among Senior Citizens in Selected Old Age Home. Asian J. Nur. Edu. and Research 4(4): Oct.- Dec., Page 403-407.
7. QingqingLiuHairong,HeJin Yang. (2020). Changes in the global burden of depression from 1990 to 2017: Findings from the Global Burden of Disease study Journal of Psychiatric Research. 134–140.
8. MalarkodiVelraj, V. Ravichandiran, S. Ramamoorthy, A. Vijayalakshmi, J Srikanth. (2010). Antidepressant-Like Effects of the Ethanolic Extract of Albizzialebbeck (Linn) Leaves in Animal Models of Depression. Research J. Pharmacognosy and Phytochemistry 2(1): 30-33.
9. VidyaBhagat, Nordin Bin Symbak, Rohayah Husain, KhairiChe Mat.(2019). The role of selective serotonin reuptake inhibitors and cognitive behavioral therapy in preventing relapse of Major Depressive Disorder. Research J. Pharm. and Tech ; 12(8): 3818-3824.
10. Murdoch D, McTavish D. Sertraline. (1992). A review of its pharmacodynamic and pharmacokinetic properties, and therapeutic potential in depression and obsessive compulsive disorder. Drugs. 44:604-24
11. Kushwaha AK, Vuddanda PR, Karunanidhi P, Singh SK, Singh S. (2013). Development and evaluation of solid lipid nanoparticles of raloxifene hydrochloride for enhanced bioavailability. BioMed Research International. 1-9. 2.
12. Ekambaram P, Sathali AA, Priyanka K. (2012). Solid lipid nanoparticles: a review. Scientific Reviews and Chemical Communications. 2(1): 80-102.
13. Krishna Sailaja, Gazi Ayesha. (2018). Preparation & evaluation of paracetamol solid lipid nanoparticles by hot homogenization method.Nanomedicine Research. 2018;7(2):152–154.
14. GanesanV ,LokeshMangalmurtiChitrivekar. Formulation and In-vitro Evaluation of Fast disintegrating Tablets using Sertraline Hydrochloride as a model Drug. Research J. Pharm. and Tech. 3(2): April- June 2010; Page 412-416.
15. DS Saindane, AS Kulkarni, AN Sagri, RB Pimprikar, SB Yeshwante, CP Suryawanshi, SD Firke, MK Kale. (2009). Physicochemical Characterization of Solid Dispersion of Cefexime with Poloxamer 188. Research J. Pharma. Dosage Forms and Tech. 1(2): 162-166.
16. MohdYasir, ItiChauhan, Misbahu J. Haji, Abdurazak J. Tura1, Prasoon K. Saxena. (2018). Formulation and Evaluation of GlycerylBehenate based Solid Lipid Nanoparticles for the Delivery of Donepezil to Brain through Nasal Route. Research Journalof Pharmacy and Technology. 11(7): 2836-2844
17. MamdouhGhorab, Ahmad Gardouh, Shadeed Gad. (2015). Effect of Viscosity, Surfactant Type and Concentration On Physicochemical Properties Of Solid Lipid Nanoparticles. International Journalof Pharmacy and Pharmaceutical Sciences. 7(3), 145-153.
18. NevesA, Queiroz J et al. (2016). Brain-targeted delivery of resveratrol using solid lipid nanoparticles functionalized with apolipoprotein. Journal of Nanobiotechnology. 14:27.
19. Vivek K, Reddy H, Murthy RSR. (2007). Investigations of the effect of the lipid matrix on drug entrapment, In vitro release, and physical stability of olanzapine-loaded Solid Lipid Nanoparticles. AAPS Pharm Sci Tech. ;8(4):83
20. LaithHamzaSamein. (2014). Preparation and Evaluation of Nystatin-Loaded Solid-Lipid-Nanoparticles for Topical Delivery. Asian J. Pharm. Res. 4(1): Jan.-Mar. 2014; Page 44-51.
21. Rohan R. Vakhariya, Swati S. Talokar, V. R. Salunkhe, C. S. Magdum. (2017). Formulation Development and Optimization of Simvastatin Loaded Solid Lipid Nanoparticles. Asian J. Res. Pharm. Sci. 7(1): 49-52.

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