International Journal of Science and Research Archive

eISSN: 2582-8185

Cross Ref DOI: 10.30574/ijsra

Journal homepage: https://ijsra.net/

(REVIEW ARTICLE)

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A review on medicated lollipop: A novel dosage form

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International Journal of Science and Research Archive, 2023, 08(02), 565–570

Publication history: Received on 03 March 2023; revised on 11 April 2023; accepted on 14 April 2023

Article DOI: https://doi.org/10.30574/ijsra.2023.8.2.0304

Abstract

A lollipop is a type of sugar sweet normally consisting of hard candy set up on a stick for sucking or licking. Lollipops are to be had in lots of flavors and shapes. Alternative name's: Lolly, sucker, sticky-pop. There are several dosage in the market, there may be a need for extra dosage form which acts efficiency and locally as well as systematically. The advantages of the existing research is increased retention time of the dosage shape in oral hollowspace and increased bioavailability, reduction in gastric inflammation via passing first metabolism. Lollipops are flavoured medicated dosage form intended to be sucked and held in the mouth or pharynx containing one or extra medicaments generally inside the sweetened base. The traditional dosage like pills, drugs, syrups etc are inconvenient for pediatric patients due to hard to swallow capsules and capsules or unpleasant taste of drug. Medicated lollipop is designed to improve patient compliance, acceptability and increase oral retention time. The lollipops had been prepared by means of heating and congealing technique the usage of polymer. Lollipops are available in some of colorings and flavours, especially fruit flavours.

Keywords: Medicated Lollipop; Heating; Congealing Method; Flavored; Increased Bioavailability

1. Introduction

The oral route of drug administration is the most commonly used route of drug administration because of low-cost therapy, ease of administration, patient compliance, and flexibility in formulation. However, pediatrics, geriatrics, and bedridden patients show inconvenience swallowing of conventional tablets or capsules due to difficulties in swallowing with lesser amounts of water with the medication, unable to tolerate the taste of many drugs when formulated as liquid dosage forms, poor patient compliance (1). Lollipops or lozenges are defined as the flavored medicated dosage forms intended to be sucked and held in the mouth or pharynx containing one or more medicaments usually in the sweetened base. Lollipops are commonly used for the purpose of local or systemic effects through the buccal mucosa. Advantages of the lollipop as dosage forms include increase in bioavailability, reduction in dose size, gastric irritation and bypass first metabolism(2). Lollipop is designed to improve patient compliance, acceptability, transportation etc (3,4) For the past two decades, there has been an enhanced demand for more patient compliance dosage forms. As a result, the demand for their technologies has been increasing three-fold annually. Since the development cost of a new chemical entity is very high, the pharmaceutical companies are now focusing on the development of new drug delivery systems for existing drug with an improved efficacy and bioavailability together with reduced dosing frequency to minimize side effects (5). Medicated Lollipops are defined as hard dosage forms that contain one or more kind of a drug that is in a sugary base that is flavored and colored, these lollipops like any kind of lollipops are meant to dissolve slowly in the mouth of the patient and release its contents that might act locally to reduce oropharyngeal symptoms or to be absorbed through the buccal route and act systematically(1). Medicated Lollipops can contain different kinds of drugs that can be antibiotics, antitussives, analgesics, and so, in the case of a drug like paracetamol, this type of formulation helps increasing its bioavailability and avoids the first-pass metabolism. Other advantages for this dosage form are increased

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patient compliance especially pediatrics, suitable to patients who trouble swallowing, it requires less time and cost in production, and decrease the dosing (6).

2. History

The concept of an suitable for eating sweet on a stick is quite simple, and it is probably that the lollipop has been invented and reinvented numerous instances (7). The primary confectioneries that intently resemble what we call lollipops date to the center a long time, when the aristocracy could often devour boiled sugar with the aid of sticks or handles (7) The term 'lollipop' changed into recorded via English lexicographer Francis Grose in1796(8). The time period might also have derived from the time period "lolly" (tongue) and "pop" (slap). The primary references to the lollipop in its contemporary context date to the 1920s (9).

2.1. Advantages of medicated lollipops (10)

- Having formulation which can be smooth to change and can be patient particular.
- It has a pleasant flavour and it extends the time that a quantity of drug stays inside the oral hollow space to elicit a healing effect also, pharmacist can put together lollipops extemporaneously with minimal device and time.
- Lollipops may be given to those patients who have problem in swallowing.
- It extends the time of drug inside the oral cavity to elicit a particular effect.
- Easy to put together with minimum amount of equipment and time
- Do no longer require water intake for management. Method is non-invasive, as is the case with parenteral.

2.2. Disadvantages of medicated lollipops (10)

- Heat labile drugs cannot be used in this formulation because of the high temperatures required for preparation.
- Drugs having minimum bitter taste are suitable.
- Heat stable drugs are suitable

3. Types of lollipop:

3.1. Hard candy lollipop

Hard candy lozenges are mixtures of sugar and other carbohydrates in an amorphous (noncrystalline) or glassy state. They can also be regarded as solid syrups of sugars. The moisture content and weight of hard candy lozenge should be between, 0.5 to 1.5% and 1.54.5 g respectively. These should undergo a slow and uniform dissolution or erosion over 5-10min., and should not disintegrate. The temperature requirements for their preparation is usually high hence heat labile materials cannot be incorporated in them (11,12).

3.2. Soft candy lollopop

Soft lollipops have end up famous because of ease with they may be extemporaneously prepared and their applicability to a wide range of drugs. The base commonly consists of a aggregate of various PEGs, acacia (or) comparable materials glycerol gelatin (or) an acacia: sucrose base. those lollipops can be coloured and flavoured and they can be either slowly dissolved in the mouth (or) chewed, relying at the intended impact of the incorporated drug (13).

Figure 1 Manufacturing of medicated lolipop

4. General consideration for designing medicated lollipop

Since the development cost of a new chemical entity is very high, the pharmaceutical companies are now focusing on the development of new drug delivery systems for existing drug with an improved efficiency and bioavailability together with reduced dosing frequency to minimize side effects, typically, oral candidacies takes the form of an adherent white, curd-like, circumscribed plaque anywhere within the oral cavity. There are many drugs dosage forms like lozenges, tablets, inhalers, or syrups, are in market for the treatment of the same. These preparations are commonly used for the purpose of local effect or systemic effect. New drug design to this area always benefit for the patient, physician and drug industry. There several dosages from like in the market but there is a need for more dosage forms which acts effectively and locally as well as systematically(14).

4.1. Formulation of medicated lollipop

- Sugar: Sucrose, glucose, and fructose disaccharide is a sugarcane or beet derivative. Availability and geographical considerations are the basis for selecting beet or cane sugar. Sucrose and sucrose products are utilized in medicated lozenges due to their value as neutral sweeteners, their ready solubility, and their function as a ‘‘drier’’ to scale back the load of the confection through crystallization.
- Corn syrup: In almost any kind of confection, corn syrup is used to regulate the crystallization of sucrose and dextrose, which may contribute to crumbling. Corn syrup makes the creation of an amorphous glass in sufficient proportion with sucrose and dextrose and creates a candy with the desired appearance. The following physical properties of syrup are extremely important within the preparation of medicated candies: density, dextrose equivalent, hygroscopicity, sugar crystallization, viscosity, melting point depression, and pressure.
- Sugar bases: Sucrose or compressible sugar, dextrose, mannitol, and sorbitol are popular sugar bases used in lozenge tablets and are available in a variety of tableting grades from a variety of excipient manufacturers. Generally intended for applications requiring direct compaction, they can also be used in wet-granulation systems with the above binders. A nonnutritive sweetener may be a synthetic or natural sugar substitute whose sweetness is above or like sucrose. Examples of nonnutritive sweeteners like xylitol, mannitol, sorbitol, invert sugar, etc.
- Binders: These are commonly intended for compressed tablets that are used as discrete granules to retain particles of mass which include acacia, corn syrup, sugar syrup, gelatin, polyvinyl-pyrrolidone, methylcellulose tragacanth.
- Lubricants: These are used to prevent the candy from sticking to the teeth and boost the flow of the final troche mixture and contain stearate of magnesium, stearate of calcium, stearic acid, and PEG.
- Colorants: For appearance, product recognition, and masking of physical deterioration, colorants are introduced into medicated lozenges. Dyes and other organic colorants may degrade in the presence of heat or light by oxidation, hydrolysis, photo-oxidation, and other processes, so their compatibility with drugs, excipients, and process conditions should be investigated before use.
- Acidulants: Acidulants are commonly used to enhance and reinforce the taste profile of medicated lozenges. Citric, malic, fumaric, and tartaric acids are the most widely used organic acids. The most popular is citric acid alone or in combination with hydroxy acid. Acids are often used to change the pH in medicated lozenges to keep the drug's credibility.
- Preservatives: Since these are solid dosage types, preservatives are typically not needed. However, since hard candy lozenges are hygroscopic, if they are not packed correctly, the particle size can increase and bacterial growth may occur. Since the present water may dissolve some sucrose, the resulting highly concentrated sucrose solution will be bacteriostatic and will not help bacterial development. A few words about the tastes and effects of preservatives are in order.
- Flavors: Flavors in medicated lozenges must be consistent with the medication and excipients, as well as able to endure the rigors of production. Flavors are made up of a variety of chemicals that interfere with excipients or medications and degrade when exposed to heat or light. Drugs can react with aldehydes, ketones, and esters. A classic example of flavor–drug interaction is that of a primary amine drug (benzocaine, phenylpropanolamine) with aldehyde containing flavor components like cherry, banana, etc., resulting in the formation of a Schiff base, drug decomposition, and loss of efficacy. Adjustment of lozenge base pH to accentuate certain flavors (e.g., citrus) may also result in incompatibility with some medicaments (e.g. benzocaine) (14,15).

4.2. Methods of preparation

4.2.1. Candy Based Lollipop

Heating and Congealing Technique was prepared a Syrupy base in a beaker by dissolving the required amounts of sugar in water and kept for heating on a hot plate. The temperature was maintained at 105-110 °C till it became thick. The drug and other excipients (except plasticizer) were added manually and mixed thoroughly after 30 min with a continued process of healing. The prepared mass was further heated for 45 min and then a plasticizer was added to it. Then above syrupy base was poured into a pre-cooled and pre-lubricated mold and the mold was kept aside for 10-15 min. Lozenges were removed from the mould and were kept for air drying. In the case of batches without plasticizer, a step of plasticizer addition was omitted from the procedure.

Melting and Mold Technique prepared by melting and mold technique, Polyethylene glycol (PEG) was melted on a water bath and mixed with the other ingredients to form a homogeneous mixture. Subsequently, the blend was poured into the desired shape & size stainless steel mold to forming a candy.

Compressed Tablet lollipop was prepared compressed tablet lozenges by using the following technique.

- Direct compression technique Ingredients may be thoroughly combined and compressed directly.
- Wet granulation technique Sucrose is pulverized by mechanical combinations to a fine powder then add binder solution and mass is formed and pass through # sieve no.16 Granules formed & dried then add lubricant, flavor before the compression (16,17).

5. Evaluation parameters

5.1. Weight variation

The weight variations were conducted by weighing 5 lollipops individually and average weight and standard deviation were calculated (18).

5.2. Diameter and Thickness

Diameter and thickness was conducted by using 5 lollipops. The diameter and thickness of lollipops were measured by using vernier caliper. The average value and standard deviation was calculated (19).

5.3. Drug Content

Lollipops dissolved in one hundred ml distil water and sonicated for 30 min and filtered. From the above solution 1 ml became taken in volumetric flask and diluted up to 10 ml (a hundredμg/ml) and it was analyzed spectrophotometrically at 224 nm (20).

5.4. Taste Masking Test

10 fitness volunteers might accept to flavor general quinine answers (20-a hundred and sixty mcg/mL) with the aid of swirling the answer in buccal hollow space for 30 sec. and spitting out the solution. Volunteers would be requested to rank them on bitterness scale (rank 1-five). After 30 min., those volunteers could be requested to assess the flavour of (drug) lollipop in the identical manner and examine on the same scale (21).

5.5. Friability

The Roche friability test apparatus was used to determined the friability of the lollipops. Pre-weighted lollipop was placed in the apparatus, which was subjected to 100 revolutions. Then the lollipop was reweighed. The percentage friability calculated was using formula (22).

$$\%\text{friability} = [\text{Initial weight} - \text{Final weight}] \times 100$$

5.6. Flow Through Method

A Flow through cell dissolution model assembly was designed in our laboratory which maintains perfect sink conditions facilitating better in-vitro evaluation. A intravenous infusion set was attached to a bottle containing PBS pH 6.8. The flow rate was adjusted to “2 ml/min” using a flow regulator. 10ml of PBS was always maintained in the donor cell

containing lollipop throughout the experiment. The lollipop was supported on a small mesh (#40) in the donor cell of the infusion set. The flow of the release medium was the PBS bottle through the lollipop containing cell and to the receiver. The samples 10ml was withdrawn at an interval of 5min up to 30 min and absorbance was recorded at λmax (23).

5.7. *In-vitro* permeation study

In-vitro permeation studies were conducted by using Franz diffusion assembly. 100mg equivalent weight of lollipop was placed in dialysis membrane between donor and receptor compartment of diffusion cell assembly. The receptor compartment was filled with PBS pH 6.8, Magnetically stirred at 200 rpm.10ml of samples were withdrawn at suitable time interval from donor compartment. The percentage of sample permeated was determined by measuring the absorbance in UV spectrophotometer at λmax (24).

5.8. Stability study

Stability study was carried out as per ICH-Guidelines (Q1A) at 25±2oC/60±5% RH and 40±2 °C/75±5% RH. For every 45days the parameters like physical appearance, weight variation, hardness, friability, drug content ,in-vitro release studies and in-vitro permeation studies were determined (25).

6. Conclusion

The formulation of medicated lollipop is an easy and time saving process. The medicated lollipops can provided an attractive, alternative formulation in treatment of pain in pediatric patients. The oral route of drug administration patients compliance, ease of administration, and flexibility in formulation. Medicated lollipop is an ideal dosage forms. This will offer better innovative dosage form. Any enjoy an important position in pharmacy and will be remains at same in future.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest.

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