ISSN No:-2456-2165

Formulation and Evaluation of Poly Herbal Chewable Tablets from Ayurvedic Ingredients having Cough Relieving Activity

Vinayak Dasharath Gaikwad*
Shri. Santkrupa College of Pharmacy,
Ghogaon, Karad, Satara,
Shivaji University, Kolhapur,
Maharashtra 415111, India.

Priyanka A. Thorat (Assistant Professor)
Department of Pharmaceutics,
Shree Santkrupa College of Pharmacy,
Ghogaon, Satara,Shivaji University, Kolhapur,
Maharashtra 415111, India

Abstract:- In recent years, there is a spurt in the interest regarding use of Ayurvedic forms of medication. Glycyrrhiza Glabra (Liquorice), Zingiber Officinale (Ginger), Curcuma longa (Turmeric) has been used as medicine from ancient times for treating the cough. These herbal drugs use was mentioned in Ayurveda. Cough affects patients of every age, so it is the common disease condition. Because of better patient compliance, flexible design of dosage forms, ease of administration and least sterility requirements, oral route of drug administration is the well liked route. The goal of this research work is to develop Polyherbal chewable tablets of various Ayurvedic Drugs by wet granulation method and to evaluate the formulations for various pharmaceutical parameters. The purpose of this study was to produce polyherbal chewable tablets using Liquorice, Ginger, Turmeric. These polyherbal chewable tablets were formulated by technique of wet granulation method by utilizing binder that is acacia gum (5% w/v). Quality of final polyherbal chewable tablet was evaluated for pre formulation and post formulation parameter. Bulk and tapped densities, angle of repose, Carr's index, and Hausner's ratio are the pre-formulation tests evaluated for the prepared powder mixture (blend). Polyherbal chewable tablets were examined for general appearance, tablet size and shape, hardness, friability, weight variation as well as duration of disintegration.

Keywords:- *Polyherbal Chewable Tablet; Glycyrrhiza Glabr; Liquorice; Zingiber Officinal; Ginger; Curcuma longa; Turmeric; Wet granulation method; Cough; Anti-tussive; Demulcent; Expectorant; Cough relieving activity; Disintegration Test.*

I. INTRODUCTION

Several pharmacological cough relievers are sold in the medical stores and generally taken for the cough treatment. Now a days, the herbal cough relieving agents use are increasing day by day due to the high quality effectiveness with less side effects. Chewable tablets are a convenient dose form that have multiple good factors that is the strength and firmness of solid medications with the convenience of consuming and medication administration with no necessity for water.

Ayurvedic medicines have been used for several centuries for both the avoidance and cure of coughing. Although many over-the-counter medications are accessible in all medical stores, neither antiviral nor antibiotic therapy has been demonstrated to be treatable in the absence of initial lung infection.

These formulated polyherbal chewable tablets contains herbal Crude drugs such as Liquorice (Glycyrrhiza Glabra), Turmeric (Curcuma longa) and Ginger (Zingiber Officinale). Chewable tablets are available in several different kinds of sizes and shapes. Chewable tablets are an oral delivery system commonly utilised for pharmaceutical and nutraceutical products. Chewable tablets that are chewed can have complete weights that are higher than those formulated as ordinary swallowing tablets, that are typically lower weight than 1 g. Before swallowing, chewable tablets are crushed in the oral cavity. Biting of the chewable tablets starts in the mouth, the tablet is squashed or crushed into mouth and converted to the littler particles from where increment dissolution and ensuing better availability occurs to give the ideal therapeutic or pharmacological activity.

Chewable tablets is an fast releasing medication that are taken orally and chewed by the patient's teeth before being engulfed completely.[1]

The chewable tablets have an even, flat surface and a mild flavor without harsh and terrible taste; they are recommended to be disintegrating in the oral cavity more gradually, whether chewing is occurring or not. These chewable tablets not contains any flavouring agent and sweetener. The successful formulation development depends on the appropriate excipients selection. Chewable tablets are of the large size which are hard for gulping accordingly, chewable tablets bit in buccal cavity before swallowing.[2]

The expanded bioavailability of chewable tablets occurs because of expanded absorption characteristics. Its disintegration or being bitten in the mouth forms littler molecules, for example, expanded surface zone of drug molecules of tablet into Gastrointestinal tract. Chewable Tablets have this advantage over ordinary capsules or strong (swallowing) tablets which are ingested predominantly after dissolution and breaking down. Chewable tablets are defined as palatable medicines that can be broken down and

consumed with or without liquid when only a small quantity is actually required.

A. Ideal characteristics of chewable tablets[2]

- Simple to bite.
- Tasteful (Palatable).
- Proper size and shape.
- Break down fastly and enhance dissolution.
- Like all easy to understand dosage forms.
- Helpful for patients who experience challenges while swallowing ordinary tablets and capsules for them chewable tablets are simple to swallow (once broken down).
- Risk of esophagitis is reduced in chewable tablet. Esophagitis is caused when ingested tablet medication is trapped in the esophagus and dissolve while staying in contact with the touchy esophagus lining.
- Taste make it palatable and scope of flavors.
- Are simple and helpful to take.
- Are provided as a single unit dose so estimation of dose is not required.
- Improve consistence[4]
- This dosage forms do not need water are:
- Easy to take 'on the go'
- Convenient to take, anywhere and at any time.

B. Advantages of Chewable Tablets[3]

- Patient convenience
- Better absorption characteristics
- Enhanced bioavailability is achieved because of expanded ingestion rate, because of its disintegration or being bitten in the mouth into the increased dissolution.
- Improved understanding acknowledgment through lovely taste Child friendly version.
- Chewable tablets offers more preferences over the greater size of dosage forms that are hard to swallow particularly kid and who aversion gulping.
- Effectiveness of therapeutically active agent is improved by the decrease in size through biting in mouth to bypassing disintegration before a swallowed.

C. Disadvantages of Chewable Tablets[3]

- Formulation of chewable tablets is not for the bitter tasting drugs.
- There is possibility to cause ulcer in the oral cavity due to the use of more quantity of flavor enhancing agent in chewable tablet.
- Chewable tablets utilize numerous excipient to give mass and inhance characteristics of tablets yet some excipient have unsafe to body, for example, sorbitol which causes the diarrhea and flatulence.
- Chewing of chewable tablets for prolong times cause the pain in facial muscles.
- Many chewable tablets needed dry conditions and accurate packing for storage because many of them have hygroscopic properties.
- The chewable tablets have lower mechanical quality than other swallowing tablets, so cautious dealing and care required during packaging and transportation.
- They show the fragile, effervescence granules property.

Table 1: Synonyms, biological sources and family of Ingredients

Sr. No.	Ingredients	Synonyms	Biological Source
1	Liquorice (Leguminosae)[a]	Mulethi, Radix glycyrrhizae, Licorice, Jethi Madh, Yashtimadhu, Jeshtamadh	Stems along with roots of Glycyrrhiza Glabra.
2.	Ginger (*Zingiberaceae*)[a]	Zinziber Soonth, Saunth	Dried rhizomes of Zingiber officinale.
3.	Turmeric (Zingiberaceae)[a]	Haldi, Halud, Haridra, Halad.	Turmeric consists of the dried rhizomes of Curcuma Longa.

[a.] Family of Ingredients

Table 2: Chemical Constituents of Ingredients

Sr. No.	**Ingredients**	**Chemical Constituents**
1	Liquorice (Glycyrrhiza Glabra)	Glycyrrhetic acid while glycyrrhizin are saponin glycosides. Liquiritin, isoliquiritin, liquiritigenin, isoliquiritigenin are examples of flavonoids. Glyceramarin is a bitter principle. Herniarin and umbelliferone are coumarin derivatives. Starch, resin, asparase, β-sitosterol, and malic acid.
2.	Ginger (Zingiber Officinale)	5 to 8% pungent material, 1 to 2 % volatile oil, starch as well as resinous mass. The volatile oil, which contains sesquiterpene alcohol, besaabolene, zingiberene, and 6% sesquiterpene hydrocarbon zingiberol, is the substance that gives the aroma. A yellow, oily material with a strong aroma called gingirol produces gingirone, aliphatic aldehyde and a ketone. Shagaol occurs when water from gingerol is vanished. Gingirone as well as shagaol have little pungency. When ginger, gingerol are heated along with 5% KOH or other bases, their

		pungent odour and taste is removed.
3.	Turmeric (Curcuma longa)	Colouring non-volatile substance is curcuminoids. Differentially spelt as curcumin, bidesmethoxy curcumin, and desmethoxy dicinnarmoyl methane. L-cycloisoprenmyrcene, zinziberene, sabinene, cineole, borneol, turmerone, a and y-atlantones, phallandrane, and curcumone are among the volatile oils. Glucose, fructose, arabinose are sugars.

II. MATERIALS AND METHODS

A. Materials :

(Liquorice (Glycyrrhiza Glabra) Powder, Ginger (Zingiber Officinale) rhizomes and Turmeric (Curcuma longa) were obtained from the Medical Store, local market and Shop, (respectively) of Karad, Satara.

Excipients Magnesium Stearate, Starch, Lactose, Talc, Magnesium Stearate taken from Practical Store House of Shri. Santkrupa College of Pharmacy, Ghogaon, Satara. Every ingredient used for formulation was of a laboratory quality.

B. Formulation and Development :

Polyherbal chewable tablets containing Liquorice (Glycyrrhiza Glabra), Turmeric (Curcuma longa), Ginger (Zingiber Officinale) were formulated by technique of wet granulation method. Excipients ingredient such as starch, lactose, talc, magnesium stearate and acacia gum having properties of disintegrator, filler, glidant, lubricant and binder, respectively.

Table 3: Role of Ingredients

Sr. No.	Ingredients	Role
1.	Liquorice	Expectorant, Demulcent, Anti-inflammatory, treats Bronchial problems such as Catarrh bronchitis, cold flu and coughs. Sweetening Agent, Antiviral, Antibacterial.
2.	Ginger	Antitussive, Antiviral, Antiemetic, Anti-inflammatory.
3.	Turmeric	Relieving the symptoms of cough and cold by its Antiviral, Antibacterial, Anti-inflammatory properties.
4.	Starch	Disintegrator
5.	Lactose	Filler
6.	Talc	Glidant
7.	Magnesium Stearate	Lubricant
8.	Acacia Gum	Binder

C. Wet Granulation Method:

For small scale preparations and formulation of chewable tablet, Wet granulation method is convenient. The each ingredients in formulation were weighed, pulverized, and screened individually by using sieve no. 80. All the components in the formula were thoroughly blended together with the exception of the magnesium stearate and talc, which were crushed in a pestle and mortar and then again sieved using sieve no. 80. The acacia gum solution (5% w/v) was added gradually while this material was blended.

Following this mixing procedure, the powder mass was repeatedly passed through sieve no. 18 to obtain the granules, and it was then dried at 35°C in a vacuum dryer. The dried granules were rescreened using sieve number 18 to eliminate bigger granules after drying, and they were then placed in desiccators for storage. Magnesium stearate along with talc were combined with the granules prior to punching. On a single rotary punching machine, tablet compresses with the proper compressing pressure, powder mixtures were compressed to 750 mg tablets. The final powder mixture were pressed into tablets once the die cavity was set for the necessary weight. [27]

Chewable tablets of Liquorice (Glycyrrhiza Glabra), Turmeric (Curcuma longa), Ginger (Zingiber Officinale) is prepared by wet granulation technique as per the composition.

Table 4: Composition of Polyherbal Chewable Tablet

Sr. No.	Ingredients	Quantity Taken
1.	Liquorice	650 mg
2.	Ginger	13 mg
3.	Turmeric	7 mg
4.	Starch	10 mg
5.	Lactose	50 mg
6.	Talc	10 mg
7.	Magnesium Stearate	10 mg
8.	Acacia Gum	5% w/v solution (used while mixing)

Fig. 1: Powder Blend

D. Pre-compressional studies of powder mixture:

Preformulation studies serve as the first stage in developing a dosage form for a potential drug formulation. In order to learn more about the recognised qualities of constituents and the suggested formulation schedule, a primary study is being conducted in the drug development process. Therefore, this preformulation study has the advantage of verifying that there are no numerous challenges to developing the medication or formulating the dosage form.

There was study done on pre-compressional factors such as Hausner's ratio, angle of repose, tapped density, bulk density, and compressibility indices.

- *Angle of repose[7] :*

Angle of repose is the greatest angle that can be formed between the unsupported surface of powder pile and the surface of the ground employing the fixed funnel method, it was identified. The appropriate amount of powder drugs was added to the funnel by covering the funnel hole with the finger. After the powder was properly eliminated from the funnel, its angle of repose was determined and defined in θ.

$$\text{Angle of repose } (\theta) = \tan^{-1} \text{height / radius}$$

Here, θ = angle of repose, height is denoted as h and radius is denoted as r.

- *Bulk density[8] :*

Bulk density is defined as the proportion ratio of a powder's bulk mass and bulk volume. It is referred to as uniformity. The symbol for it is ρ_b. uniformity is determined using the density of the bulk.

$$\text{Bulk density } (\rho_b) = \text{Mass / Bulk Volume}$$

Here, mass of the sample is denoted by M and Bulk volume is denoted by Vb.

- *Tapped density[9] :*

Tapped density is defined as the weight of the powder mixture divided by the smallest volume that is filled by it in a measurement cylinder. A graduated cylinder consisting of an estimated amount of a drug powder mixture or the preparation is placed on an automated electronic tapper equipment to find out the density of the substance after being tapped. The electrically powered tapper device is run for a predetermined number of taps (1000) once the powder bed has achieved its lowest capacity.

Tapped density = Weight of powder mixture / lowest volume filled by cylinder

- *Carr's index :*

Based on the apparent bulk density and the tapped density, Carr's index (which measures the percentage of the powder mixture's capacity to compress) is calculated. The percentage compressibility of the powder mixture is calculated applying the formula below:

$$\text{Carr's index} = Td - Bd \times 100 / Td$$

where, Td is Tapped Density and Bd is Bulk Density.

- *Hausner's ratio[10] :*

The Hausner's ratio is a proximate indicator of what a simple task it is to determine the flow properties of powder. Higher flow qualities are determined by a smaller Hausner's ratio value (< 1.25) than by a larger value (> 1.25).

$$\text{Hausner's ratio} = Td / Bd$$

where, Td is the Tapped Density and Bd is the Bulk Density.

Table 5: Pre-compression parameters of powder blend

Parameters	Result
Moisture content (%)	4.31
Angle of repose (θ)	24 ± 0.35
Bulk density (g/ml)	0.385 ± 0.021
Tapped density (g/ml)	0.502 ± 0.031
Carr's index (%)	23.31 ± 1.04
Hausner's ratio	1.30 ± 0.021

Fig. 2: Polyherbal Chewable Tablets

E. Post-compression study (Estimation of Prepared Polyherbal Chewable Tablets) :

➢ *General appearance :*

The distinctive look and general refinement of tablets are determined by their overall physical appearance, which is essential for the satisfaction of customers. The polyherbal chewable tablets were examined regarding colour consistency, the presence of imperfections, tablet polish, depressions, pores and pinholes.

➢ *Uniformity of thickness and diameter[11] :*

The Vernier Calliper was used to determine and calculate the tablet size in millimeters. In all of the instance, the average value of five determinations was noted.

➢ *Weight variation test[12] :*

Each of the twenty tablets was weighed separately and collectively. The average weight of all the tablets was determined from their combined weight. The mean weight was contrasted with each tablets weights. The weight variation's percentage disparity must stay within allowed ranges.

The formula given below was applied for estimating the percent difference:

Percentage difference = [(Individual weight - Mean weight) / Mean weight] × 100

Small or large deviation in tablet weight results in low dosing of drugs or over dosing of drugs for the individual receiving treatment. Thus, each batch of tablets is supposed to include tablets of equivalent weight. To achieve the identical weight, modifications were performed while compressing the tablets. The IP has established standards for the mean weight of tablets which are uncoated and compressed.

Example a tablet is considered to have weight variation when it contains 250 mg or more of the active ingredient or whenever that tablet or dosage form involves (+ or -) 5 % or greater, by weight of the tablet. 20 tablets were weighed one by one and then the mean weight of tablets was determined. The weights of each tablet are then contrasted with the mean weight.

➢ *Hardness test[13] :*

The amount of stress required to break a tablet in a particular plane are usually employed to quantify hardness. The chewing effort scale can be calculated using the tablet hardness. Using the approved Pfizer Hardness Tester, the hardness durability of six formulated polyherbal chewable tablets was randomly picked and assessed. As a result, the average of the six assessments was used. The characteristics were conveyed in Kg / cm^2.[14]

➢ *Friability test[15] :*

When a tablet loses weight in a package or container due to the removal of tiny particles from its outer layer of tablet, then it is termed as ‘friability’. To assure that tablets capacity to tolerate vibrations during manufacturing, operating, shipment, and transportation, friability test is done. Maximum 1.0 % friability is the allowed. Roche friabilator was employed to evaluate the degree of friability of tablet. Together, 5 tablets were weighed, and then these were put into the friabilator compartment. The tablets were subjected to rolling in the friabilator, leading to the dropping of tablets from a height of 6 inches inside the friabilator compartment. The Friabilator compartment was rotated during the Friability Test at an average speed of 25 rpm (rounds per minute). The tablets were removed from the friabilator after 4 minutes (or 100 revolutions). Then all of the tablets were once more weighed. The % friability of the tablets was estimated using the equation.[16]

By using the following formula, the percent friability was determined :

$$F = (1 – X) / X_0 \times 100$$

where, X = Weight of the tablets after test and X0 = Weight of the tablet before test.

➢ *Disintegration test[17] :*

For a drug, to be absorbed from a solid dosage form after oral administration, it must initially be in solution, and the most crucial step for achieving this outcome is typically breaking up the tablet. This term is referred as Disintegration. The duration needed for a tablet to disintegrate into tiny particles is known as the disintegration time. If the patient does not fully chew the chewable tablet then there is chances of GI obstruction, therefore to prevent this situation disintegration time of chewable tablet should be short. The disintegration test measures the amount of time needed for a group of tablets to break up into tiny particles and pass through a 10 mesh screen under a specific set of circumstancesWith the use of the disintegration tester, the disintegration test is conducted. A basket rack carrying six plastic tubes that are open at both the upper and lower and have a 10 mesh screen across the bottom is known as the disintegration tester. That basket was submerged in a suitable liquid bath of 37°C temperature, preferably in beaker of a 1000 mL. Water heated to 37°C was typically used as the testing liquid for compressed uncoated tablets.[18, 19] The test was carried out on 12 tablets if one or two of the tested tablets failed to disintegrate. The required disintegration time has to take place based to each drug's monograph in order for it to comply with pharmacopoeial specifications.

In artificially created saliva, the disintegration time was estimated.(Phosphate buffer solution pH 5.8). As per the USP method, at 37 ± 0.5°C the disintegration time of six each tablets was measured.

For each batch, the average of six measurements was taken.[20, 21]

Table 6: Post-compression Parameters of Polyherbal Chewable Tablets

Parameter	Result
Colour	Pale Brownish Yellow (Khaki)
Odour	Characteristics
Taste	Sweet
Texture	Smooth
Shape	Round flat plain both sides (Flat Faced)
Thickness (mm)	4.4
Diameter (mm)	15.91
Weight Variation (%)	0.0282 (Under + / – 0.5 %)
Friability (%)	0.48
Hardness Test (Kg/cm^2)	5.1 ± 0.32
Disintgration Test (Minutes)	14

III. RESULTS AND DISCUSSION

This formulation study was an attempt for design, create and to assess a polyherbal chewable tablets by wet granulation method using Glycyrrhiza Glabra powder, Zingiber Officinale powder, Curcuma Longa powder. In this method, the formulated tablets were prepared by adding excipients that are starch in the role of disintegrator, Lactose in the role of filler, talc in the role of glidant, magnesium stearate in the role of lubricant and acacia gum in the role of binder.

The pre-compression as well as post-compression studies were tested and compared with the previous studies performed on chewable tablets and its result showed within the pharmacopoeial limits.

The Powder blend produced however showed better flow property (Table No. 5).

Chewable tablets are meant to disintegrate within 15 minutes.[29] Since, these are the most commonly used solid dosage form, compressed tablets must comply to a variety of physical standards in regards to hardness, uniformity and friability.

The results for size that is regularity of diameter and regularity of thickness are given in Table No. 6. These parameters are very important to select packaging material. The analysis of chewable tablet were showed the satisfactory results (Table No. 6). And organoleptic characters of both powder and tablet also satisfactory. Liquorice (Glycyrrhiza Glabra), Ginger (Zingiber Officinale), Turmeric (Curcuma longa) can all be effectively utilised to tablet preparation by wet granulation technique.

IV. CONCLUSION

Liquorice (Glycyrrhiza Glabra), Ginger (Zingiber Officinale), Turmeric (Curcuma longa) are very effective and essential Ayurvedic (herbal) drugs and recommended by physicians for treatment of cough. And finally, the study demonstrated that these drug powders can be suitably tableted into chewable tablets. The formulated tablets gives acceptable results according to all of the pre compressional and post compressional tests assessed.

The formulation containing Liquorice (Glycyrrhiza Glabra), Ginger (Zingiber Officinale), Turmeric (Curcuma longa) could be more beneficial for treatment of cough due to there antitussive, expectorant and demulcent effects.

According to this poly herbal chewable tablet study, this same information and methods can be produced for other natural medications or Ayurvedic preparations in order to satisfy demands and customer preferences and industry needs. Therefore, it is concluded that the formulated chewable tablets may be better alternative to the conventional uses of the herbal substances.

Moreover, this research work may enlighten the field of herbal technology in future.

ACKNOWLEDGMENT

I would like to express my sincere gratitude to my guide Miss. Priyanka A. Thorat (Dept. of Pharmaceutics) for her active guidance, creative ideas, ongoing inspiration, constant supervision, helpful suggestions, and support in helping me to successfully complete this research work.

I sincerely thank Dr. Vijayanand R. Aralelimath Sir [Principal, Shree Santkrupa College of Pharmacy, Ghogaon (SNTK)] for his continuous support and for making the necessary arrangements and facilities to make it possible for me to finish my research work.

REFERENCES

[1.] Khokra SL, Parashar B, Dhamija HK, Purohit R, Chandel A., "Formulation Development and Evaluation of Chewable Tablet of Albendazole by different Techniques," Int Journal Pharm. Pharm Sci., 2012; 4(1): 461-464.
[2.] Lachmann L, Liberman HA, Schwartz JB., Pharmaceutical Dosage Forms. New York: Marcel Dekker Inc, 1989, 2(1).
[3.] Tablets dosage forms advantages and disadvantages of tablet dosage forms: Tablet coating and manufacturing. available at URL : http:\\tablets dosage form.Com//.
[4.] L. Lachman, H. A. Liberman and L. J. Kanig. Theory and Practice of Industrial Pharmacy. 3rd edition. Vargese publication house, New Delhi, 1990; 231-234.
[5.] V. Kumaran, D. Sathyanarayana, P. K. Manna and G. Chandrasekar., "Formulation development of acetaminophen tablets by direct compression and its pharmacoeconomics," Indian drugs, 2004; 41(8): 473-477.
[6.] B. Haritha, "Journal of formulation science and Bio availability," Research and Reviews, 2017; 1(1): 1-7.
[7.] V. V. Prasanth and Sidhyartha Sarkar., "Formulation and evaluation of orodispersible tablets of Salbutamol sulphate," Research and Reviews: Journal of Pharmacy and Pharmaceutical Sciences, 2013; 2(3): 26–36.
[8.] Martin, J. Swarbrick and A. Cammarata. Physical Pharmacy. 2nd edition, Wolters Kluwer, USA, 1983; 532-533, 513- 51.
[9.] Nitin and S. Govind., "Formulation and evaluation of orally disintegrating tablets of Ondansetron hydrochloride using natural superdisintegrants," International Journal of Pharmaceutical Technology and Research, 2011; 3(3); 1616-1621.
[10.] Gregory E. Amidon, Pamela J. Secreast and Deanna Muddie. Practical, powder and compact characterization. In: Yihong Qui, Yisheng chen, Geoff GZ Zhang, editors. Developing solid oral dosage forms. 1st ed. Publisher name USA: 2009; pp.168-169.
[11.] K. Sahoo, A. A. Reddy and V. Kethavath., "Designing of orodispersible tablet of metformin hydrochloride for the treatment of type II diabetes mellitus," World Journal of Pharma Res. 2013; 2(3): 156-164.
[12.] K. Yoshio, K. Masazumi, A. Shuichi and N. Hiroaki; "Evaluation of rapidly disintegrating tablets manufactured by phase transition of sugar alcohols," Journal of Controlled Release, 2005; 105(1-2): 16-22.
[13.] C. K. Sahoo, T. K. Sahoo and A. K. Moharana; "Designing of orodispersible tablet of diethyl carbamazine citrate for the treatment of filariasis," International Journal of Applied Biological Pharmacy Technology, 2011; 2: 70-74.
[14.] Rippe E, Swarbrick J; Encyclopedia of Pharamaceutical Technology, Marcel Dekker Inc. Newyork; 1990, 3,149-166.
[15.] Priyanka Nagar and Kusum Singh; "Orally disintegrating tablets: formulation, preparation techniques and evaluation," Journal of Applied Pharmaceutical Science,2011; 01(04):35-45.
[16.] The Indian Pharmacopoeia , Ministry of Health and Family welfare ,Govt. of India, Controller of Publications, New Delhi. 2007, 1996, 2, 973, 1377,144,736].
[17.] V. V. Prasanth and Sidhyartha Sarkar; "Formulation and Evaluation of Orodispersible Tablets of Salbutamol Sulphate," Research and Reviews: Journal of Pharmacy and Pharmaceutical Sciences, 2013; 2(3): 26-36.
[18.] Farheen F, Bharadwaj S.; "Formulation and evaluation chewable tablets of mebendazole by different techniques," PharmaTutor 2014;2:183-9.
[19.] Indian Pharmacopoeial Commission. Indian Pharmacopoeia: Ministry of Health and Family Welfare, Government of India. Ghaziabad: Indian Pharmacopoeial Commission; 2010. p. 751-75.
[20.] Prashar D, Saklani S. "Formulation and evaluation of anthelmintic chewable tablets," 2012; IPS 2: 13-16.
[21.] Khandelwal KR (2007) Practical Pharmacognosy Techniques & Experiments. 18th edn. Nirali Prakashan, Pune, India.
[22.] Pharmacognosy by C.K. Kokate 54th edn. ; Page No. 9.66.
[23.] Monica Damle; Glycyrrhiza Glabra (Liquorice) - A Potent Medicinal Herb", HM 2014; 2(2): 132-136; SVKM's Dr. Bhanuben Nanavati College of Pharmacy, Vile Parle (West), Mumbai 400 056, India.
[24.] Krup V, Prakash LH, Harini A (2013), "Pharmacological Activities Of Turmeric *(Curcuma Longa Linn*)" : A Review. J Homeop Ayurv Med 2:133. DOI: 10.4172/2167-1206.1000133
[25.] Mahewash Sana Asadulla Pathan; "Formulation And Evaluation Of Chewable Tablets Containing Aqueous Extract Of Zingiber Officinale"; World Journal Of Pharmacy And Pharmaceutical Sciences; Vol 8, Issue 3, 2019.
[26.] Upendra Nagaich1, Ashok Kumar Pal, Charu Bharti, Neha Gulati "Formulation And Evaluation Of Nutraceutical Tablet Using Herbal Drugs By Direct

Compression Method", Journal of Drug Delivery & Therapeutics; 2014, 4(2), 47-51
[27.] Ghiware NB, Gattani SG, Chalikwar SS; "Design, development and evaluation of oral herbal formulations of Piper nigrum and Nyctanthesarbortristis," Int J Pharm Tech Res, 2010; 2(1):171-176.
[28.] Sumalatha And Jayapal Reddy; "Formulation And Evaluation Of Polyherbal Chewable Tablets For Reducing Nicotine Dependence," International Journal Of Pharmacy And Biological Sciences, Volume 7, Issue 1, JAN-MAR, 2017, 115-120
[29.] M. Rajesh, G. Hariharaputhraayyanar, R. Venkatesh babu; "Formulation and Evaluation of Sugar Free Chewable Tablets of Montelukast Sodium"; Int. J. Pharm. Sci. Rev., 56(1).