

# Formulation and Evaluation of vitamin D3 chewable tablet as Antihypertensive agent

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## Abstract-

The aim of this investigation was to develop vitamin D3 Chewable Tablet for Hypertension by wet granulation method using excipients. Tablet were put through variety of tests ( weight variation, Thickness, Hardness, Disintegration), and the result were in compliance with the pharmacopeial specification . All the physical properties studied shown that all excipient are suitable for tablet . Water is not necessary for administration since a substance is broken down into particle in the oral cavity, which facilitates swallowing The objective of this work was to present Vitamin D3 in granular and tablet form with improved dispensability, to minimise the complexity of formulation and to make cost effective product .

**Keywords-** Vitamin D3 and Gingerol, wet granulation, Chewable Tablet, antihypertension.



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## INTRODUCTION

The role of Vitamin D3 in maintain bone health is derived from 7-dehydrocholesterol . scientist now understand that lack of vitamin D3 directly contributes to condition such as depression , Back pain, Cancer, Insulin resistance, Hypertension, weekend immunity, and macular degeneration. Vitamin D3( cholecalciferol) is referred to as vitamin D. Low levels of Vitamin D3 have also been linked to other condition like high blood pressure, diabetes, multiple sclerosis, Rheumatoid arthritis. As Vitamin D, vitamin D3 was used. Osteomalacia, a painful bone disease , is brought on by vitamin D Deficiency where as Vitamin D enhances Bone Health. Muscle Deterioration and fractures are caused by Vitamin D deficiency. Reducing BMD loss is associated to lowering the risk of bone fracture. Additionally , vitamin D might stop the loss of Bone Mineral . Low mood is psychiatric and neurologic condition caused by vitamin D3 insufficiency. Bone mineral Density ( BMD) can change by combination of Gingerol and Vitamin D3.

Vitamin D Deficiency cause Bone Loss, Hair loss, Muscle pain, Depression, High Blood Pressure, Heart Attack, Breast Cancer. Vitamin D is important for Bone and Muscle Health, but it affects many other aspect of our health .

Vitamin D3 use for treating Hypertension .

## Hypertension-

Consistently elevated blood pressure is a symptom of the hypertension disease. Values for blood pressure are represented by two numbers. The highest reading, the systolic blood pressure, represents the pressure generated by each heartbeat. The bottom figure, known as diastolic blood pressure, represents the blood pressure in the vessels while the heart is at rest. High blood pressure levels over an extended period of time may produce abnormal cardiac changes.

Chronically high blood pressure causes a variety of abnormalities in the left ventricle and left atrium that are referred to as hypertensive heart disease. Unhealthy lifestyle decisions, such as not receiving enough regular

exercise, are Diuretics, beta-blockers, ACE inhibitors, calcium channel blockers, angiotensin receptor blockers, and vasodilators. Additionally, a lot of people delay starting their treatment even after being diagnosed. Only 30% of people who are diagnosed with hypertension start treatment, and only 15% are able to keep their blood pressure levels stable.

### Preformulation studies-

Preformulation studies are the first studies in the development of dosage form of any drug substance. The objective of preformulation studies are to developed a portfolio of information of drug substance, so that this information is useful to develop formulation. Preformulation investigation are designed to identify those physicochemical properties and excipients that may influence the formulation design, method of manufactured and pharmacokinetic -bio pharmaceutical properties of the resulting product. Preformulation studies include description of the substance, Taste, odour, colour, loss on drying, Bulk density, Tapped Density, Carr's index, Hausner ratio, angle of repose, incompatibility with other ingredients etc.



**Fig.no.1 Gingerol**

Kingdom : Plantae  
Family : Zingiberaceae  
Class : Liliopsida  
Genus : Z. Offinale  
Species: Zingiber officinale

### Chewable tablet –

Tablets that must be broken and chewed in between the teeth before being swallowed. These tablets are designed to dissolve evenly and gradually in the mouth, either with or without chewing. A palatable chewable tablet is one that can be consumed with little to no water after being chewed. Wet granulation or direct compression are typically used in the production of chewable tablets. Since mannitol is nonhygroscopic and moisture-sensitive medications require it, it is frequently utilized as an excipient in chewable tablets. The gum core of a chewable tablet, which may or may not be coated, makes up its composition. Fillers, waxes, antioxidants, sweeteners, and flavoring ingredients make up the core, which is made of an insoluble gum basis. Based on the base utilized and its characteristics, the percentage of gum base varies from 30 to 60%. To make it more appetizing, a flavoring agent is added.

### Advantages of Chewable Tablet-

Chewable tablets are generally chewed in the mouth prior to swallowing and are not expected to swallow intact. Main purpose of chewable tablet is to provide proper unit dosage form of medication which can easily be administered to children or to the elderly who have difficulty in swallowing a tablet intact. Chewable tablet have some specific advantages:

1. Better bioavailability through bypassing disintegration (that increase dissolution)
2. Improved patient acceptance (especially pediatric) through pleasant taste.
3. Patient convenience; need no water for swallowing.
4. Possible to use as a substitute for liquid dosage forms where rapid onset of action is needed
5. Absorption of drug is faster

6. Product distinctiveness through marketing prospective.
7. The large size of the dosage form is difficult to swallow.

#### Disadvantages of chewable Tablet:

There are, of course some limitations to the use of chewable tablets having bad tasting drugs and extremely high dosage level. Some common disadvantages of chewable tablet are:

1. It contains sorbitol which causes diarrhoea and flatulence.
2. Flavouring agents present in chewable tablet may causes ulcer in oral cavity
3. Prolonged chewing of chewable tablet results in pain in facial muscles
4. They are hygroscopic in nature, so must kept in dry place.
5. They show the fragile, effervescence granules property
6. Since these tablets have insufficient mechanical strength, so careful handling is required.
7. They require proper packaging for safety and stabilization of stable drugs

#### Material and methods –

Material that are used for formulation are Vitamin D3, Gingerol, starch, Honey, PVPK-30, Talc and Magnesium stearate. Gingerol powder was prepared. Other required ingredients were collected from laboratory.

**Table no.1 Amount of API and Excipients**

Sr.no	Chemical	Amount(per tablet)
1.	Vitamin D3	126 mg
2.	Ginger	130 mg
3.	Starch	50 mg
4.	Honey	100 mg
5.	PVPK-30	30 mg
6.	Talc	30 mg
7.	Magnesium stearate	54 mg

#### Preparation Method-

Wet granulation method was used to prepared the tablets .

- Tablet each containing 500 mg were prepared as per composition given in Table 1.
- The formulation was done by the wet granulation method
- Wet granulation method weigh all drug and excipient accurately are mix well and water was adding in sufficient amount
- Mix it well
- The prepared dump mass were passed through sieve no 14 to ensure the better mixing.
- Prepared granules are dried at hot air oven at 65 c .
- The dried powder was compressed using the tablet punching machine equipped with round punch.
- A minimum of 20 tablets was prepared for each batch.

#### Evaluation –

##### Pre-compression Parameters:

##### Angle of Repose:

Angle of repose was determined using funnel method. The blend was poured through funnel can be raised vertically until a maximum cone height (h) was obtained. Radius of the up was measured and angle of repose was calculated using the formula:

$$\theta = \tan^{-1}(h/r)$$

Where ,  $\theta$  is the angle of repose, h is height, r is radius.

##### Bulk Density:

Apparent bulk density ( $\rho_b$ ) was determined by pouring the blend into a graduated cylinder. The bulk volume ( $\rho_b$ ) and weight of powder (M) was determined. The bulk density was calculated using the formula,  
 $\rho_b = M/V_b$

#### Tapped Density:

The measuring cylinder containing known mass of blend was tapped for a fixed time. The minimum volume ( $\rho_T$ ) occupied in the cylinder and weight (M) of the blend was measured. The tapped density ( $\rho_b$ ) were calculate using the following formula.

#### $\rho_T = M/V_t$ Carr's index:

Carr's Index of any solid is calculated for compressibility of a powder which is based on Tapped Density and Bulk Density which is calculated by using the following formula:

$$\text{Carr's Index} =$$

$$\frac{\text{Tapped Density} - \text{Bulk Density}}{\text{Bulk Density}} \times 100$$

#### Tapped density

#### Hausner Ratio:

Hausner ratio is ratio of powder Tapped Density to its poured Bulk density. It is calculated by following formula-

#### Tapped Density

#### Bulk Density

**Table no.2 Pre-formulation parameter**

Formulation	Angle repose of	Bulk Density ( $\text{g/cm}^2$ )	Tapped Density ( $\text{g/cm}^2$ )	Carr's Index (%)	Hausner ratio
F1	32.21	0.5	0.75	33	1.5
F2	27.47	0.47	0.38	30.88	1.44
F3	35.75	0.48	0.73	34.24	1.52
F4	34.60	0.47	0.67	29.85	1.42
F5	36.12	0.51	0.68	25	1.33

#### Post Compression Factor-

##### Chewable Compressed Tablet Evaluation:

Pharmacopoeial and non-pharmacopoeial tests were used to assess the tablet's qualities. Organoleptic properties of Tablet – By looking at, chewing, and swelling the tablets, the color, flavor, and texture of the pills were manually assessed.

**Weight variation test** – The weight variation test was to be run on 20 tablets. 20 tablets were individually weighed on a digital scale to determine their average weight. The weight of each person was compared to the average.

**Length, width , and Thickness** – Each tablet's length, width, and thickness, which are measured in millimeters (mm), were determined using a micrometer screw gauge.

**Hardness** – Using a hardness tester, the strength of the tablet crushing was measured. Disintegration test – Six tablets were placed in a basket rack to track the rate of disintegration. In 900 ml of distilled water at 37°C, six disks were employed to keep the tablets from floating.

**Friability** – The friability of tablets was evaluated using the Friabilator, which has a chamber that rotates at 25 rpm..

**Table no.3 Post compression parameter**

Formulation	Average wt(g)	Diameter (cm)	Thickness (cm)	Hardness (kg/cm)	Friability (%)	Disintegration Time (sec)
F1	0.452	1.1 cm	0.3 cm	8 kg/cm	0.52%	10 min
F2	0.446	1.1 cm	0.3cm	9 kg/cm	0.31%	11 min
F3	0.428	1 cm	0.3cm	6kg/cm	0.14%	8 min
F4	0446	1 cm	0.4cm	10kg/cm	0.11%	6 min
F5	0.445	1.1cm	0.4cm	7kg/cm	0.2%	17 min

**Result and Discussion –**

Evaluation of powder blend was done before compression of tablet . Various parameter were calculated to determine the quality of granules which is responsible for good quality of tablets Bulk density, tapped Density, Carr's Index, Hausner Ratio and angle of Repose was calculated. These value are shown in table below

**Evaluation Result of powder blend –****Table no. 4 Evaluation result of powder blend**

Sr.no	Parameter	Result
1.	Bulk Density	0.48
2.	Tapped Density	0.73
3.	Carr's Index	34.24
4.	Hausner ratio	1.52
5.	Angle of Repose	35.75°

Wet granulation method was used to prepare the vitamin D3 Chewable Tablet by using different types of Excipients. Tablet properties were evaluated by performing various tests. All results are shown in table.

**Table no.5 Evaluation of tablet**

Sr.no	Tests	Specification	Result
1.	Average weight/ Tablet	500-530 mg	520 mg
2.	Diameter	10-11mm	10mm
3.	Thickness	3-3.4 mm	3 mm
4.	Hardness	4-10kg	6kg
5.	Friabilty	Not less than 1%	0.14%

**CONCLUSION**

In the present work, Vitamin D3 work an gingerol were manufactured .Successfully that fulfills all the pharmacopeial limits. This type of study not only for this combination but also be done on other drug. Present data would be used as reference for future work

**REFERENCES:**

1. Lachmann L, Liebermann H.A. and Kiang J.L. 1998 . The Theory and Practice of Industrial Pharmacy, third edition, Varghese Publishing House, Bombay.
2. Smith DV Margolskee RF 2001. Making sense of tasteScientific America. 284(3): 36.
3. Nanda AR, Garg KS. 2002. An update on taste masking technologies for Oral pharmaceuticals. Indian journal Pharma sci. 64(1).
4. Roche Roto1993. Granulations and taste masking coatings for preparation of chewable pharmaceutical tablets. US Patent.
5. Khar RK Sohi H, 2004. Taste masking technologies in oral pharmaceuticals: Recent development and approaches. Drug Dev. Ind. Pharma 30-429.
6. Patel H. Shah V. Upadhyay U, 2011. New pharmaceutical excipients in solid dosage forms, International Journal of pharmacy and life sciences, 2(8):
7. Orally Disintegrating Tablet and film technologies. Second edition, 2004, 177.
8. Vieth R, Ladak Y, Walfish PG. J, 2003. Clin Endocrinol Metab. 88(1): 185-91.
9. Perez-Lopez FR, 2007. Vitamin D and its implications for musculoskeletal health in women: an update Maturitas. Jun 28.
11. Bodnar LM. Catov JM, Simhan HN, Holick MF, Powers RW. Roberts JM. J Clin Endocrinol Metab. 2007.
12. Maghbooli Z, Hossein-Nezhad A, Karimi F, Shafaci AR, Larijani B,2007. Diabetes Metab Res Rev.
13. Wilkins CH, Sheline YI, Roe CM, Birge SJ, Morris JC. Am J Geriatr Psychiatry, 2006.14(12):1032-40.
14. Perez-Lopez FR. 2007. Vitamin D and its implications for musculoskeletal health in women: an update Maturitas.
15. Scientific Opinion of the Panel on Dietetic Products, Nutrition and Allergies on a request from Abtei Pharma Vertriebs GmbH on the scientific substantiation of a health claim related to Calcium plus Vitamin D3 chewing tablets and reduction of the risk of osteoporotic fractures by reducing bone loss. 2009. The EFSA Journal, 1180: 1-13.
16. Avenell A, Gillespie WJ, Gillespie LD, O Connell DL. 2005. The Cochrane Database of Systemic Reviews 3.
17. Boonen S, Lips P. Bouillon R, Bischoff-Ferrari HA, Vanderschueren D. Haentjens P. 2007. The Journal of Clinical Endocrinology and Metabolism, 92(4):1415-1423.
18. Homik J, Suarez- Almajor ME,Shea B. Cranney A, Wells G. Tugwell P. 1998. The Cochrane Database of Systemic Reviews 2.
19. Tang BMP, Eslick GD, Nowson C. Bensoussan A. Lancet 2007; 370(9588): 657-666. 20.
20. <https://www.nebraskamed.com/primary-care/9-vitamin-d-deficiency-symptoms-and-11-highvitaminfoods#:~:text=%22Most%20patients%20with%20vitamin%20D,Not%20sleeping%20well>
21. <https://www.mayoclinic.org/diseases-conditions/high-blood-pressure/diagnosis-treatment/drc20373417#treatment>.
22. <https://www.lybrate.com/topic/homeopathic-remedies-for-high-bloodpressureb436/ebaa8f3c2e100ace6a712121f18c4bd2>.
23. Solanki HK Bosuri T Thakkar JH. Patel 2010. CA Recent Advances in granulation technology International Journal of Pharmaceutical Sciences Review and Research. 5(3):48-49.
24. Surbhi G, Seema S, Singh G, Rana AC. 2012. Industrial Process Validation of Tablet Dosage Form: An Overview. International Research Journal of Pharmacy. 3(3):49-51
25. Ray C Arora V. Sharma V. Fast dissolving tablets-A Novel drug delivery system for pediatric and geriatric patient. International bulletin of drug research. 1(2), 55- 70.
26. [https://www.rxlist.com/high\\_blood\\_pressure\\_hypertension\\_medications/drugscondition.htm#:~:text=Mild%20hypertension%20can%20sometimes%20be,Chlorthalidone%20\(Hygroton\)](https://www.rxlist.com/high_blood_pressure_hypertension_medications/drugscondition.htm#:~:text=Mild%20hypertension%20can%20sometimes%20be,Chlorthalidone%20(Hygroton))
27. [https://www.rxlist.com/high\\_blood\\_pressure\\_hypertension\\_medications/drugscondition.htm#:~:text=Mild%20hypertension%20can%20sometimes%20be,Chlorthalidone%20\(Hygroton\)](https://www.rxlist.com/high_blood_pressure_hypertension_medications/drugscondition.htm#:~:text=Mild%20hypertension%20can%20sometimes%20be,Chlorthalidone%20(Hygroton)).
28. Lachmann L., Liebermann H.A. and Kiang J.L, 1998.The Theory and Practice of Industrial Pharmacy, third edition, Varghese Publishing House, Bombay.
29. Cooper J. Gun C, 1986.Powder Flow and Compaction, Tutorial Pharmacy, New Delhi, CBS Publishers and Distributors.211-233.Indian Pharmacopoeia; Vol.II, Calcium and Vitamin D3 Tablets, 4466-4467.