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FORMULATION AND EVALUATION OF POULTRY EGG SHELL POWDER CHEWABLE TABLETS AS A NATURAL SOURCE OF CALCIUM SUPPLEMENT

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ABSTRACT:

Poultry Egg shell is a great natural resource of calcium as it contains high proportions of calcium carbonate containing which can be used as an excellent calcium supplement.
Nowadays physicians and researchers
are using egg shell powder to treat a host of conditions like osteoporosis, arthritis and loss of dental enamel and also helps to increase the bone
mineral density. In this research project using direct compression method, achewable tablet is formulated as a natural resource of calcium supplement using fine egg shell powder as calcium carbonate resource along with ascorbic acid to increase the bioavailability of the calcium as well as an antioxidant. We have efficiently blended the formulation with flavouring and sweetening agents to address the palatability characteristics. We managed to compress good tablets with desired objectives. The tablets are very stable over a period of time.

KEYWORDS: *Eggshell powder, calcium supplement, ascorbic acid*.

INTRODUCTION:

There is an enormous source of egg shell like poultry farms, Restaurants, Egg factories, home where the egg shell was treated the waste product of the egg, In case of food industry egg shell was treated as the waste product [1]. Recycled from the waste egg shell into tablet excepients is very much challenging and it will have Environment friendly, economical and natural excepients also. Fine egg shell powder was prepared from the raw egg shell and it takes several process and time also. Egg shell powder uses as a substitute source of raw material in the tablet Manufacturing. Poultry egg shell is a good natural source of calcium in human as it contains high proportion of calcium carbonate(94%) which can be used as a worthy calcium supplement in solid dosage formulation[1].

THEORY:

Tablet is a unit solid dosage form**,** containing API and excepients to treat, alleviate or prevent any disease. Direct compression is a tablet manufacturing method where all the excepients are added and compressed directly. Poultry egg shell is the waste material usually remains after the removal of egg white and egg yolk contains calcium carbonate (94%), magnesium carbonate (1%), calcium phosphate (1%) and organic 3 matters (4%) [3]. It has been conclusively proven that eggshells have nutritional value and exhibit a higher bio-availability compared to commercial calcium carbonates. This could be a good resource of calcium supplement [7].For the maintenance of a normal and balanced diet supplements are great to take alongside. Human body needs calcium to build and maintain strong bones as well as for the proper functioning of heart muscle and nerves. Though it has significant amount of essential components and nutritional value of human diet, but it is considered to have no economical value. Calcium supplements from eggshell are a really cheap and an easy way of getting a much-needed nutrient in to human body [6]. Eggshell contains high amount of calcium carbonate which can be used as a replacement of calcium carbonate used as pharmaceutical excepients in solid dosage form [4,5]. Moreover, calcium carbonate obtained from egg shell has an advantage of containing no toxic elements (aluminum, cadmium, mercury) like other natural resources of it [2].

OBJECTIVES:

1. To formulate poultry egg shell powder chewable tablets as a natural source of calcium supplement.
2. To study the evaluation testes of the tablets.
3. To formulate the cheap and easily available supplements of calcium in the tablet dosage form.
4. To determine the nutritional value of poultry egg shell as a calcium supplement.

Material and Methodology:

At first collection of crushed raw egg shell and then make it fine powder by the help of mixer grinder and then treated with vinegar solution to remove the bad smell of egg shell. After that dried it in hot

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air oven until the desirable moisture content attained. Thenadded coffee syrup and chocolate syrup with the egg shell powder for flavoring purpose. Poultry egg shell powder used as Diluents for preparing chewable tablets as natural source of calcium supplement and several excepients were there. Formulation of chewable tablets by using poultry Egg shell powder as a natural source of calcium supplement was done MINIPRESS 8 STATION, by direct compression method.

FORMULATION:

Each ingredient adding very carefully one by one & blend it Formulation for 500 tablet. This tablet is making by using this formulation. The following formulation is used:

TABLE NO-1

Trial batch F1

SR NO	INGREDIENTS	Per Tablet weight(mg)	For 500 Tablet(gm)
1	Egg shell powder	200	100
2	MCC	150	75
3	HPMC	50	25
4	CCS	50	25
5	TALC	10	5
6	Magnesium Stearate	10	5
7	EDTA	2	1
8	Aerosil	2	1
9	Ascorbic acid	50	25
10	Bura Sugar	150	75
11	Chocolate syrup	QS	QS
12	Coffee syrup	QS	QS

TABLE NO 2

Trial Batch F2

SR NO	INGREDIENTS	Per Tablet weight(mg)	For 500 Tablet(gm)
1	Egg shell powder	200	100
2	MCC	120	60
3	HPMC	70	35
4	CCS	50	25
5	TALC	10	5
6	Magnesium Stearate	10	5
7	EDTA	2	1
8	Aerosil	2	1
9	Ascorbic acid	50	25
10	Bura Sugar	160	80
11	Chocolate syrup	QS	QS
12	Coffee syrup	QS	QS

TABLE NO 3

SR NO	INGREDIENTS	Per Tablet weight(mg)	For 500 Tablet(gm)
1	Egg shell powder	200	100
2	MCC	135	67.5
3	HPMC	60	30
4	CCS	50	25
5	TALC	10	5

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6	Magnesium Stearate	10	5
7	EDTA	2	1
8	Aerosil	2	1
9	Ascorbic acid	50	25
10	Bura Sugar	155	77.5
11	Chocolate syrup	QS	QS
12	Coffee syrup	QS	QS

Trial Batch F3

The formulation of Chewable tablets using the Poultry egg shell powder is done using the direct compression method. The egg shell power, microcrystalline cellulose, HPMC and cross carmellose sodium and bura sugar are sieved and mixed properly.

Then aerosil, talc, Magnesium Stearate, EDTA and Ascorbic acid are added. It is then blend in a double cone blender for 20 minutes.

Then the blended power is compressed directly using a tablet compress machine to formulate Oral Chewable tablets as a natural source of calcium supplement.

PREFORMULATION STUDIES:

Preformulation studies is generally designed as laboratory or pilot plant studies to determine the characteristics of API and Excepients that may influence pharmaceutical formulation(dosage form) and the overall process design and performance.

The prime objectives of these studies are to establish the physiochemical parameters of the new drug entity and to establish the compatibility with common excepients.[8]

BULK DENSITY:

Bulk density is defined as the mass of the material divided by the total volume occupy.

Bulk Density= Mass of the Material/ Total Bulk Volume

It is expressed as gm/ml.

Practical Observation:

Weight of Powder = 20gm

Volume = 43ml

Bulk Density = 20/43

= 0.465gm/ml

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TAPPED DENSITY:

It is defined as the total mass of the material divided by the total tapped volume of the sample.

Tapped Volume = Mass of the material/ Total tapped volume.

Practical Observation:

Number of taps is 30.

Weight of the powder is 20gm

After tap, Tapped volume of powder is 33.5ml

Tapped Density = Weight of the powder/Tapped Volume

= 20/33.5

= 0.597gm/ml

POWDER FLOW PROPERTIES:

According to the density, particle size, shape the powder flow properties can be classified as free flowing and cohesive.

Carr's Index, Hausner ratio, Angle of repose is the suitable indicator to measure the powder flow properties.

Angle of Repose:

The Angle of repose is the process of estimating the flow ability of the powder. It can be determined by permitting the powder flow through a funnel and simultaneously fallen onto the surface.

It is the maximum angle between the surface of the pile of powder and the horizontal plane.

Angle of Repose (θ) =tan-1(h/r)

Where,

θ = Angle of Repose

h = Height of the pile

r = Radius of the pile.

Practical Observation:

(θ) = tan-1(h/r) Height (h) = 2cm, Radius(r) = 4cm

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= tan-1(2/4)

= 25.56

ACCORDING TO USP:

ANGLE OF REPOSE	FLOW PROPERTY
25-30	Excellent
31-35	Good
36-40	Fair
41-45	Passable
46-55	Poor

Compressibility Index/ Carr's Index:

It is the Indicator of the compressibility of a powder of granules. It can be calculated by the formula:

Carr's Index (%) = (Tapped density-Bulk density)/Tapped Density x 100

Practical Observation:

Carr's Index (%)=[(Tapped density-Bulk density)/Tapped Density] x 100

= [(0.597-0.465)/0.597] x 100
=22.14%

ACCORDING TO USP:

Carr's Index(%)	Type of flow
5-15	Excellent
12-16	Good
18-21	Fair- passable
23-35	Poor
33-38	Very poor

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<40	Very, Very poor

Hausner Ratio:

Number that correlated to the flowability of a powder or granules material can be calculated as;

Hausner Ratio= Tapped Density/Bulk Density.

Practical Observation:

Hausner ratio = Tapped density/Bulk density

= 0.597/0.465
= 1.28

Hausner Ratio	Flow character
1.00-1.11	Excellent
1.12-1.18	Good
1.19-1.25	Fair
1.26-1.34	Passable
1.35-1.45	Poor
1.46-1.59	Very poor

RESULTS:

After formulating the oral Chewable egg shell tablets we get the following results:

General Appearance: Bi concave

Color:

Odor:

Taste: Sweet

Size of tablet: 11mm (diameter),(thickness)

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HARDNESS:

The hardness of the tablets was determined by using Monsanto hardness apparatus. To perform this test, a tablet is placed between two anvils and force is applied to it, and the crushing strength that just causes the tablet to break is recorded. Thus sometimes hardness is termed as tablet crushing strength also.

FRIABILITY:

Friability (F) test was determined by using Roche friabilator apparatus. First ten tablets were weighed (Initial,W1) and placed into friabilator. The friabilator was set at 25 RPM for 4 minutes. Then final weight (W2) was measured and % friability was determined using the following formula

%F = W1 (Initial)-W2(Final)/W1(Initial)x100

Acceptance Range: 0.5- 1% as per IP.

WEIGHT VARIATION:

Twenty tablets were taken randomly and average weight was calculated.

As per IP the Weigh variation Table:

Serial Number	Average weight of tablet(mg)	Maximum % weight variation Allowed
1	80mg or less	10
2	More than 80mg but less than 250 mg	7.5
3	More than 250 mg	5

Acceptance range: As per IP not more than 2 tablets should be out of range.

DISINTEGRATION TEST:

The drug will properly breakdown or not in time in our Physiological system, so the disintegration test was carried out in disintegration apparatus.

For disintegration test USP type apparatus used. Six glass tubes used one tablet isplaced in each glass tubes and thebasket attached 250 ml water, gastric fluid at 35-39 degree centigrade.[8]

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ASSAY OF CALCIUM FROM EGG SHELL POWDER:

By the help of acid- base back titration method calcium content of egg shell can be determined. A strong acid (Hydrochloric acid, 1.0(M) will react calcium carbonate in egg shells and rest amount of unreacted acid will be determined by the titration with a strong base Sodium Hydroxide, 1.0(M).

PROCEDURE:

1) First prepared 100 ml of 1.0(M) NAOH and take 25 ml of 1.0(M)NAOH in burette.
2) Then prepared 100ml of 1.0(M) HCL.
3) Take 0.4 gm of Egg shell sample in 100 ml water and heat in 60 degree Celsius after that cooled.
4) It and added 20ml of 1.0 (M) HCL in the solution and add phenolphthalein indicator 4-5 drops in conical flask.
5) In conical flask there was egg shell sample and 20 ml of 1.0 (M) HCL and titrated with 1.0(M)NAOH, adding NAOH drop by drop and see in which drop the color will changes to faint pink color and determined the end point of the titration.

CALCULATION:

Amount of non reacted acid = 1.7 ml

Used amount of HCL= (20-1.7) ml

= 18.3 ml

The amount of calcium = 18.3/2 ml

= 9.15 ml

1000 ml calcium = 1 mole ca2+

9.15 ml calcium = (9.15/1000) mole ca2+

= 0.00915 mole ca2+

= (0.00915*40) gm

= 0.366 gm of ca2+

% of ca2+ = (0.366/0.4*100)

= 91.5

RESULT: By the help of back titration method we can conclude that in Eggshell powder calcium contain is 91.5%.

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Evaluation of Tablets:

FOR Trial Batch F1

Sr.No	Evaluation Test	Experimental Value	Acceptable Limit	Remarks
1	Weight Variation test	Avg. wt. of the tablets = 700mg. Range: 665mg-735mg 2 Tablet is out of the range.	As per IP Not more than 2	Pass
2	Friability Test	0.44%	Not more than 1%	Pass
3	Hardness Test	4 kg/m^2	NA	Pass
4	Disintegration Test	1.5 mins	1-2 min	Pass

FOR Trial Batch F2

Sr.No	Evaluation Test	Experimental Value	Acceptable Limit	Remarks
1	Weight Variation test	Avg. wt. of the tablets = 690 mg. Range: 655.5mg-724.5mg 1 Tablet is out of the range.	As per IP Not more than 2	Pass
2	Friability Test	0.38%	Not more	Pass

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			than 1%	
3	Hardness Test	4.2 kg/m^2	NA	Pass
4	Disintegration Test	2 mins	1-2 min	Pass

For Trial batch F3

Sr.No	Evaluation Test	Experimental Value	Acceptable Limit	Remarks
1	Weight Variation test	Avg. wt. of the tablets = 685mg. Range: 650.75mg-719.25mg 4 Tablet is out of the range.	As per IP Not more than 2	Failed
2	Friability Test	0.4%	Not more than 1%	Pass
3	Hardness Test	4.5kg/m^2	NA	Pass
4	Disintegration Test	2 mins	1-2 min	Pass

APPLICATIONS:

1. This formulation can be used as an excellent calcium supplement.
2. It can help to treat a host of conditions like osteoporosis, arthritis and loss of dental enamel.
3. It can also help to increase the bone mineral density.
4. This formulation is also a great source of vitamin C.

CONCLUSIONS:

This formulation is a great source of calcium supplements as well as vitamin C. It can be easily predict that eggshell will be more available and accessible to all in a minimal cost, particularly the rural poor who are most at risk of low calcium intakes. Using ground eggshell to develop this formulation will increase dietary calcium could be a highly equitable nutritional recommendation. It will be a novel formulation where Egg shell powder prepared from waste

material of poultry farm, Egg factories, Restaurants with a very minimal risk of microbial contamination and heavy metal contamination for used as a natural pharmaceutical excepients [1]. It is also used as a potential direct compressible vehicle in tablet formulation.

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Conflict of interest:

The research was purely carried out in our Institute lab with academic interest. The data obtained are purely observational. We declare that there is no conflict of interest in our work.

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