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Formulation And Evaluation Of Anticancer Capsule From *Moringa Oleifera*

(Drumstick Leaves)

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Abstract

The present study focuses on the formulation and evaluation of an anticancer herbal capsule derived from the leaves of ***Moringa oleifera*** belonging into ***moringaceae*** family**.** A plant widely recognized for its potent medicinal properties. *Moringa oleifera* is rich in bioactive compounds such as flavonoids, alkaloids, and phenolic acids, which possess significant antioxidant and anticancer activities. In this research, dried and powdered *Moringa oleifera* leaves were subjected to extraction using suitable solvents to obtain the phytochemical-rich extract. The extract was then formulated into hard gelatin capsules using appropriate excipients to ensure content uniformity and stability .The prepared capsules were evaluated for various physicochemical parameters including weight variation, pH, disintegration time, drug content, and *in-vitro* dissolution profile. Additionally, preliminary phytochemical screening confirmed the presence of compounds associated with anticancer activity. ***In-vitro*** cytotoxicity testing was performed using selected cancer cell lines to assess the anticancer potential of the formulation. The results indicated that the *Moringa oleifera* capsule exhibited satisfactory pharmaceutical characteristics and demonstrated promising anticancer activity ***in vitro***.

Keywords: *moringa oleifera* , anticancer capsule, moringaceae

1.INTRODUCTION:-

Cancer is a group of diseases characterized by the uncontrolled growth and spread of abnormal cells. It occurs when there is a disruption in the normal process of cell division and growth, leading to the formation of cancerous cons that can invade and damage surrounding tissues and organs.

Cancer can occur in almost any part of the body, and there are over 100 different types of cancer. Some of the most common types of cancer include:

Carcinomas: These are cancers that arise from epithelial cells, which are the cells that line the sumace of organs and glands.

E.g. Breast cancer, lung cancer, and colon cancer.

Sarcomas: These are cancers that arise from connective tissue cells, such as bone, cartilage, and fat cells.

E.g. osteosarcoma (bone cancer) and soft tissue sarcoma.

Leukemias: These are cancers that arise from blood cells, such as white blood cells, red blood cells, and platelets.

E.g. Acute myeloid leukemia (AML) and chronic lymphocytic leukemia (CLL).

Lymphomas: These are cancers that arise from immune cells, such as lymphocytes.

E.g. Lymphomas Hodgkin lymphoma and non-Hodgkin lymphoma.

What is anticancer?

Anticancer refers to any substance, treatment, or intervention that helps prevent, inhibit, or treat cancer.

Types of anticancer agents

1. Chemotherapy: uses chemical agents to kill cancer cells

2. Targeted therapy: targets specific molecules involved in cancer growth and progression.

3. Immunotherapy: stimulates the immune system to recognize and attack cancer cells.

4. Hormone therapy: blocks or removes hormones that fuel cancer growth.

5. Radiation therapy: uses high-energy radiation to kill cancer cells.

- **Anticancer agents work by targeting various stages of cancer development and progression**
  - Targeting Cancer Cells

1.Killing cancer cells: Chemotherapy, radiation therapy, and some targeted therapies directly kill cancer cells.

2. Inhibiting cell growth: Hormone therapies, targeted therapies, and some chemotherapy agents slow down or stop cancer cell growth.

3. Preventing cell division: Some anticancer agents, like taxane, prevent cancer cells from dividing.

  - Interfering with cancer cell signaling

1. Blocking growth factor receptors: targeted therapies, such as monoclonal antibodies, block receptors that promote cancer cell growth.

2. Inhibiting signaling pathways: some targeted therapies, like kinase inhibitors, block specific signaling pathways that cancer cells use to grow and survive.

  - Stimulating the Immune System

Activating immune cells: Immunotherapies, such as checkpoint inhibitors, activate immune cells to recognize and attack cancer cells. Enhancing immune response: Some immunotherapies, like cancer vaccines, enhance the immune response against cancer cells.

  - Preventing Angiogenesis

Blocking blood vessel formation: Some targeted therapies, like angiogenesis inhibitors, prevent the formation of new blood vessels that feed cancer cells.

  - Inducing apoptosis
  - Triggering cell death: Some anticancer Inducing agents, like chemotherapy and targeted (herapies, trigger apoptosis (programmed cell death) in cancer cells.

Examples of anticancer agents :-

1.Doxorubicin

2.Cisplastin

3.Paclitaxel

4.Trastuzumab

5.Avastin

Benefits of anticancer agents:

1. Improved survival rates
2. Reduced symptoms
3. Reduced tumor size and growth
4. Reduced risk of recurrence & Better quality of life.
6. Reduced risk of metastasis- decreased risk of cancer spreading to other parts of the body

2.PLANT PROFILE :

The drumstick tree sceintifically known as moringa oleifera . it can consist of dried long slender, triangular seed –pods ***moringa oleifera*** belonging into the family ***moringaceae.***It is called *hyperanthera* moringa, *moringa pterygosperma gareth.*

Chemical constituents:-

cardiac glycosides , steroids, glycosides, anthraquinones, tannins saponins, alkaloids :- marumoside A ,marumoside B , pyrrolemarumine-4"-o-α-l-rhamnopyranoside

flavonoids :-rutin, quercetin apigenin ,

phenolic acids:- gallic acids caffeic acid, o-coumaric acids, chlorogenic acids

terpenes:- lutein 15-z-β- carotenes.

Scientific classification:-

Synonyms:- Hyperanthera moringa , moringa pterygosperma gareth.

Scientific name :- *moringa oleifera*.

Genus:- moringa.

Species:- *M. Oleifera.*

Family:- *moringaceae.*

Colour :- green.

Odour:- delicate fresh smell.

Taste:- pungent, slightly bitter.

Property :- warm in nature .

Size:- height 10 to 12 m and diameter 45m

Nature:- slightly dry

Fig .1. Moringa oleifera plant

3. Capsule:

A capsule is a type of container that is commonly used in the medical and pharmaceutical industries. It is usually made of two parts: a shell and a cap. Capsules are used to hold medications, supplements, or other substances in a convenient and easy-to-swallow form. They come in different sizes and can be made from various materials, such as gelatin or vegetarian alternatives. Capsules are designed to dissolve or break down in the body, releasing the contents for absorption.

Fig. 2. Capsule

- **Types of capsules :**
    1) Hard gelatin capsule
    2) Soft gelatin capsule

1). Hard Gelatin Capsules:

A hard gelatin capsule is a type of capsule that is usually used to contain medicine in the form of dry powder or very small pellets. Oral medications include tablets and hard gelatin capsules that are filled with powder. Hard gelatin capsules are usually filled with powders, granules, or tiny pellets.

Fig. 3. Hard Gelatin Capsule

2). Soft Gelatin Capsule:

A soft gelatin capsule is a type of capsule that is usually used to contain medicine in the form of liquid or powder, and which dissolves more quickly than a hard gelatin capsule. Soft gelatin capsules dissolve readily in the gastric juices of the stomach, and may work faster than other capsules.

Fig. 4. Soft Gelatin Capsule

• **Advantages** :

1. Capsules are tasteless, odourless and can easily be administered.

2. Combination of powders we can use.

3. There are attractive in appearance.

4. The drugs having un-pleasant odour and taste are enclosed in a tasteless shell.

5. They can be filled quickly and conveniently.

6. Physician can change the dose and combination of drug according to patient requirement.

7. They are economical.

• Disadvantages :

1. Hygroscopic drugs are not suitable for filling into capsules, because they absorb water present in capsule shell makes shell very brittle and ultimately lead to crumble into pieces.

2. The concentrated solutions which require previous dilution are unsuitable for capsules because if administered as such lead to irritation into stomach.

3. Moisture Sensitivity: Gelatin capsules can absorb moisture, which can cause them to become soft or stick together, affecting stability and shelf life.

4. Heat Sensitivity: Capsules may deform or melt under high temperatures.

5. More Expensive: Compared to tablets, capsules are generally more costly to produce.

6. Size Limitations: Capsules have size constraints, which may not be suitable for drugs requiring high doses.

7. Shorter Shelf Life: Capsules typically have a shorter shelf life than tablets, especially in humid conditions.

- **SIZE OF CAPSULES**

Different size of capsule

SIZE OF CAPSULES	SIZE OF CAPSULES	SIZE OF CAPSULES
000	800 ~ 1600	1.37 ml
00	600 ~ 1100	1.00 ml
0	400 ~ 800	0.68 ml
1	300 ~ 600	0.48 ml
2	200 ~ 400	0.36 ml
3	162 ~ 324	0.27 ml
4	120 ~ 240	0.20 ml

Table no.1

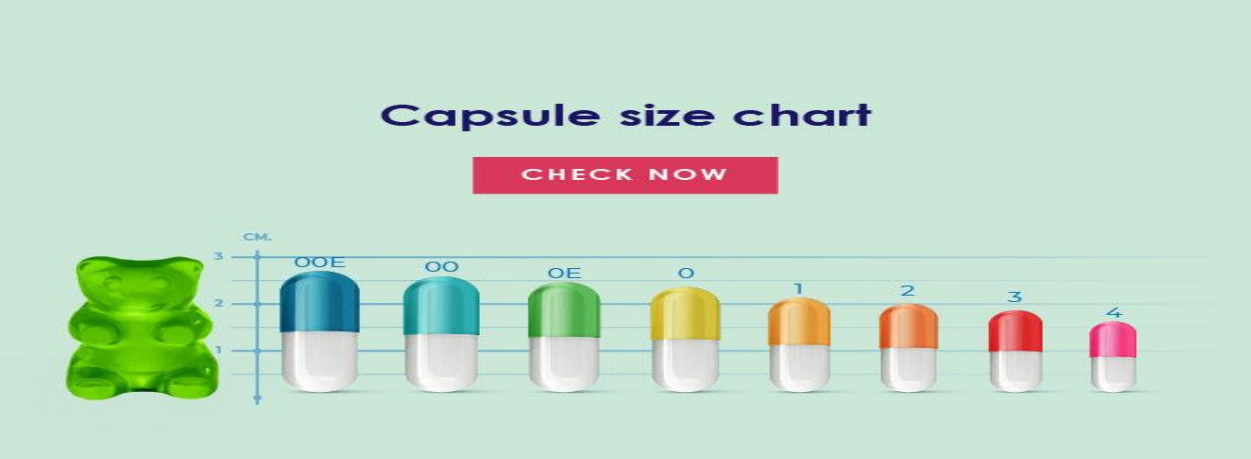


Fig. 5. Different size of capsule

4.MATERIALS AND METHODS :

A) Materials :

- Drumstick leaves powder
- Binding agent
- Wetting agents
- Coloring agents

B) Apparatus :

1. Tray dryer
2. Weighing balance
3. Capsule filling machine
4. pH meter
5. Hot air oven
6. Disintegrator

- **Ingredients:**

Sr.No.	Ingredient	Picture	Uses
1	Moringa oleifera powder		Anti-Cancer Agent
2	Lactose Powder		Diluent
3	Starch		Thickening agent
4	Talc Powder		Diluent lubricant, Glidant
5	Magnesium Stearate		Lubricant

Table no.2

- **PREPARATION METHOD OF CAPSULE:**

The process typically involves the following steps:

1. **Selection of ingredients**:
   Choose the active ingredient(s) and any necessary excipients or fillers.
2. **Mixing**:
   The ingredients are carefully blended together to ensure uniform distribution.
3. **Encapsulation**:
   The mixture is then filled into empty capsule shells using specialized equipment.
4. **Capsule sealing**:
   The two halves of the capsule shells are joined together, usually by mechanical or heat-sealing methods.
5. **Quality control**:
   The finished capsules undergo quality testing to ensure they meet the required standards for potency, purity, and uniformity.

4.PREFORMULATION STUDY :

1. Bulk density
2. Tapped density
3. Porosity
4. Carr's index
5. Hausner's ratio
6. Angle of repose
7. % Ash Value
8. Solubility

- **Bulk density**

The bulk density of a powder is the ratio of the mass of an untapped powder sample and its volume including the contribution of the inter-particulate void volume.

Formula: $\text{Bulk density} = \frac{\text{Mass}}{\text{Bulk volume}}$

- **Tapped density**

The tapped density is an increased bulk density attained after mechanically tapping a container containing the powder sample.

Formula: $\text{Tapped density} = \frac{\text{Mass}}{\text{Tapped volume}}$

- **Porosity**

Porosity or void fraction is a measure of the void (ie. "empty") spaces in a material, and is a fraction of the volume of voids over the total volume, between 0 and 1, or as a percentage between 0% and 100%.

Formula: $\text{Porosity} = (\text{volume of voids})/(\text{total volume}) \times 100$

- **Carr's index**

Carr's Index of any solid is calculated for compressibility of a powder which is based on true density and bulk density.

Formula: $\textbf{Carr's index} = \frac{\textbf{Tapped density} - \textbf{Bulk density}}{\textbf{Tapped density}} \times \textbf{100}$

- **Hausner's ratio**

Hausner ratio is defined as the ratio of a powder's tapped bulk density to its poured (loose) bulk density.

Formula: $\text{Hausner's ratio} = \frac{\text{Tapped density}}{\text{Bulk density}}$

- **Angle of repose**

Angle of repose powder poured from a vessel forms a cone-like pile. The angle of repose- the angle between the slope of the pile and the horizontal correlates with the strength of particle- particle interactions and, therefore, is

measured to infer flowability.

Formula: $\emptyset = \tan^{-1}\frac{h}{r}$

Where,

h : the height in cm

r : the radius in cm

∅: the angle of repose

- **% Ash value**

The ash values usually represent the inorganic residues such as phosphates, carbonates and silicates present in herbal drugs

Formula: $\%\ \text{ASH} = \frac{W_2 - W_O}{W_1} \times 100$

- W_2: weight of crucible + ash
- W_O: weight of crucible
- W_1: weight of sample

- **Solubility**

Solubility is the ability of a solid, liquid, or gaseous chemical substance (referred to as the solute) to dissolve in solvent (usually a liquid) and form a solution. We are going to check solubility of our sample in water, acidic and alkaline solution.

- **Antimicrobial study**

We have check the antimicrobial property of sample by using different antimicrobial agents like E coli & S. Aureus.

5.PREPARATION OF GRANULES:

Firstly, taken moringa leaves powder. 25 gm and magnesium stearate+ lactose+ talcum powder.

↓

Add binder (starch)

↓

Grind in mortar and pestle (until paste formation)

↓

Paste pass with 40 number sieve

↓

Fine granules are formed

↓

Dry in oven for drying

Fig.6. Granules

6.RESULT AND DISCUSSION:

A. Preformulation Table:-

BATCH	F1	F2	**F3**	F4
1. Bulk density	0.30g/ml	0.31g/ml	**0.32g/ml**	0.32g/ml
2. Tapped density	0.40g/ml	0.39g/ml	**0.35g/ml**	0.35g/ml
3. Carr's index	00.25 %	00.20%	**00.08 %**	00.08 %
4. Hausner's ratio	1.33	1.25	**1.09**	1.09
5. Angle of repose	$42^0$75'	$47^0$7'	42^0**76'**	$43^0$07'
6. % Ash value	18 %	18 %	**18 %**	18 %

Table no.3

B. Solubility :-

Batch	Solubility in water	Solubility in HCL	Solubility in Ethanol
A	Slightly soluble	Freely soluble	Moderately soluble
B	Slightly soluble	Moderately soluble	Sparingly soluble
C	**Slightly soluble**	**Freely soluble**	**Sparingly soluble**
D	Slightly soluble	Moderately soluble	Freely soluble

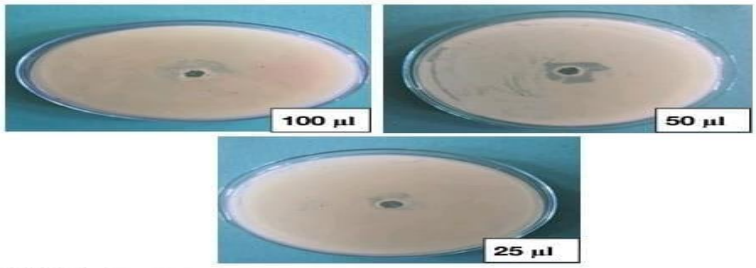
Table no.4

In this study of Moringa Oleifera sample we observed that Batch C Sample was Slightly Soluble in water, HCL and Ethanol. While other batches are Freely soluble or Sparingly soluble

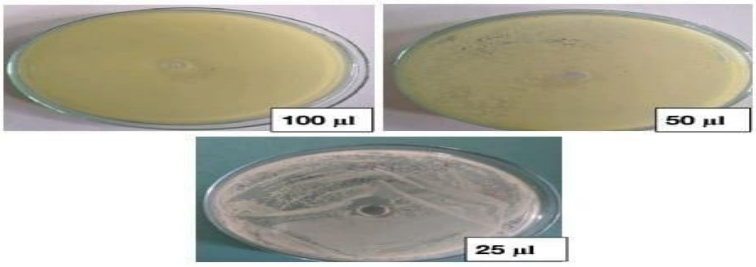
C. Antimicrobial study:-

Fig. 1. Antimicrobial activity of *Moringa oleferia Ext* extract against *E.Coli* and *Staphylococcus aureus*

A) *E. coli*



B) *Staphylococcus aureus*



➢ **Zone of inhibition of moringa oleifera Ext against E.coli & Staphylococcus aureus**

E .coli			
Sample conc.	25ul	50ul	100ul
Moringa extract	3.5mm	4.2mm	5.3mm

Table no.5 (a)

Staphylococcus aureus			
Sample conc.	25ul	50ul	100ul
Moringa extract	3.4mm	3.8 mm	5.4mm

Table no. 5 (b)

D.FORMULATION TABLE:-

Ingredient	F1	F2	**F3**	F4
Moringa Oleifera	250mg	240mg	**230mg**	225mg
Lactose Powder	36mg	37mg	**38mg**	40mg
Starch	10mg	20mg	**30mg**	40mg
Magnesium Stearate	0.5%	1%	**1.5%**	2%
Talc Powder	1%	1%	**1%**	1%

Table no.6

Fig.7. Prepared Batches of capsules

7. EVALUATION PARAMETERS OF CAPSULE:

A. Official test

1. Weight variation test
2. Disintegration test
3. Moisture content
4. pH test

B. Unofficial test

1. General appearance

2. Size

3. Shape

4. Colour

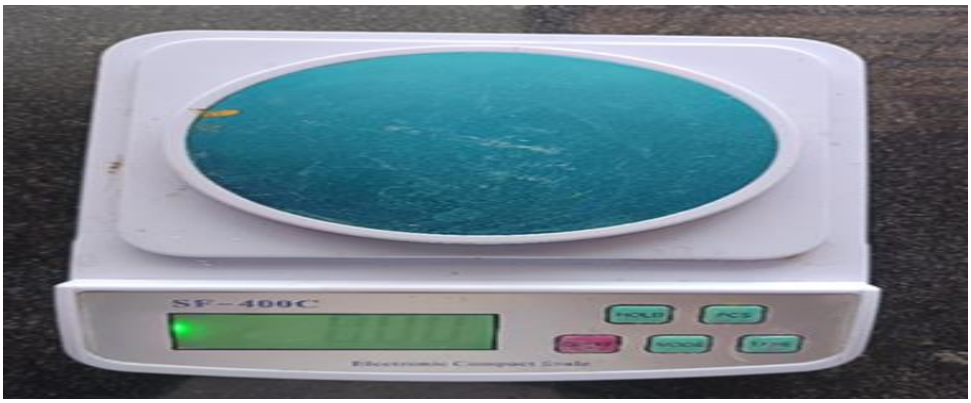


Fig.8. Weighing balance

Fig.9. Digital pH meter

Fig.10.Disintigrator

- **EVALUTION TABLE:**

Organoleptic character:-

Parameter	Observation
Size	0
Shape	Cylindrical
Colour	Dark green colour
Odour	Slightly bitter and (Aligant aroma or earthy odour)

Table no.7

Evaluation test:-

TEST	F1	F2	**F3**	F4
Disintegration test	9.35sec	8.85sec	**8.79sec**	9.40 sec
Weight variation test	Fail	Fail	**PASS**	Fail
Moisture content	8.57%	9.74%	**7.90%**	10.32%
pH test	6.83	6.80	**6.87**	6.87

Table no.8

8.CONCLUSION:

The *moringa oleifera* capsule have shown promise in cancer prevention and treatment due to their rich content of bioactive compounds with anti-cancer properties. *Moringa oleifera* shows antioxidant and anti-inflammatory properties may help prevent cancer cell growth and proliferation and the plant's bioactive compounds have been shown to induce cytotoxicity and apoptosis (cell death) in various cancer cell lines. *Moringa oleifera* extracts have been found to inhibit cancer cell growth and proliferation in vitro and in vivo study. The *moringa oleifera* is more effective to reduce the hair fall and effective to boost the immunity power.

- **Future prospective**

1. Further research: More studies are needed to fully understand the anti-cancer effects of *moringa oleifera* capsules and their potential therapeutic applications.

2. Clinical trials: Clinical trials are necessary to evaluate the safety and efficacy of *moringa oleifera* capsules in cancer prevention and treatment.

3. Standardization and quality control: Standardization and quality control of *moringa oleifera* capsules are essential to ensure their safety and efficacy.

13. REFERENCE :

1. Pandey A, Pandey RD, Tripathi P, Gupta PP, Haider J, Bhatt S, Singh AV. Moringa Oleifera Lam(Sahijan)-A Plant with a Plethora of Diverse Therapeutic Benefits: An Updated Retrospection. Medicinal Aromatic Plants. 2012;1(1):1-8
2. Ferlay J, Soerjomataram I, Dikshit R, et al. Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. Int J Cancer. 2015;136:E359–E386.
3. Ravikkumar VR, Patel BD, Rathi S, Parthiban S, Upadhye MC, Shah AM, Rehan SSA, Samanta S, Singh S. Formulation and Evaluation of Drumstick Leaves Tablet as An Immunomodulator. Zhongguo Ying Yong Sheng Li Xue Za Zhi. 2024 Jun 21;40:e20240004. doi: 10.62958/j.cjap.2024.004. PMID: 38902996.
4. Zarina, Wani AW, Rawat M, Kaur H, Das S, Kaur T, Akram N, Faisal Z, Jan SS, Oyshe NN, Khan MR, Shah YA. Medicinal utilization and nutritional properties of drumstick (Moringa oleifera)-A comprehensive review. Food Sci Nutr. 2024 Apr 8;12(7):4546-4568. doi: 10.1002/fsn3.4139. PMID: 39055230; PMCID: PMC11266908.
5. Aliyu R. S., 2Lawal A. M., 1Chasta P. and 1Sharma G. K, CAPSULES: TYPES, MANUFACTURING FORMULATION, QUALITY CONTROL TESTS AND, PACKAGING AND STORAGE - A COMPREHENSIVE REVIEW, World Journal of Pharmaceutical and Life Sciences, published by August 2020, Vol. 6, Issue 8, 93-104.
6. Roy PS, Saikia BJ. Cancer and cure: A critical analysis. Indian J Cancer. 2016 Jul-Sep;53(3):441-442. doi: 10.4103/0019-509X.200658. PMID: 28244479.
7. Birendra Kumar Paikra , Hemant Kumar J Dhongade , Bina Gidwani , Phytochemistry and Pharmacology of Moringa oleifera Lam,gernal of pharmacopnuture ,30.sep 2017,page n0. 194.200
8. Murdiana H E1, Revika E1, Rahmawati D1, Puspitasari T R1, Putri A D2, Murti B T2" Moringa oleifera Lam.-
9. Based Effervescent Tablets: Design, Formulation and Physicochemical Evaluation "International Journal of Drug Delivery Technology 2018; 8(4); 222-228.

10. Suhartini a, Vein Hadju b, Samricard R a, Alimuddin Unde a, Nurjaqin a, Burhanuddin Bahara, Moringa oleifera capsule and diet in young women with dropout school, journal of pharmaceutical and life science, published by 17 December 2021, page no 94-to 100.

11.Crawford JM. "Robbin's Pathologic Basis of Disease". New Del-hi, India, Saunders (2003): 787-802.

12.Dalla Rosa KR. "Moringa oleifera: a perfect tree for home gar-dens". Agroforestry Species Highlights, Agroforestry Species Highlights 1. Paia Hawaii, USA- Nitrogen Fixing tree Association (1993).

13. Jed Fahey, January 2005, Moringa oleifera: A Review of the Medical Evidence for Its Nutritional, Therapeutic, and Prophylactic Properties, Trees for Life Journal, volume part 1.

14.Sandra Stranzinger a b, Eva Faulhammer a, Jingyi Li c, Runqiao Dong c, J. Axel Zeitler c, Stefano Biserni d, Vittorio Calzolari d, Johannes G. Khinast a b, predicting c

15. Birendra Kumar Paikra , Hemant Kumar J Dhongade , Bina Gidwani , Phytochemistry and Pharmacology of Moringa oleifera Lam,gernal of pharmacopnuture ,30.sep 2017,page n0. 194.200 capsule fill weight from in-situ powder density measurements using terahertz reflection technology, 2019 The Authors. Published by Elsevier B.V., pageno pp. 151-165.

16. Patel P, Patel NM, Patel PM. WHO Guidelines on Quality Control of Herbal Medicines, IJRAP2011;2(4):1148-1154.

17.Ebere Innocent Okoy, T.O. Awotunde,T.G, T.G. Morales's Formulation and characterization of Moringa oleifera leaf granules. I: Micromeritic properties, published by January 2013, Research Journal of Pharmacy and Technology, page no (6) 1 66-74.

18. Murdiana H E1, Revika E1, Rahmawati D1, Puspitasari T R1, Putri A D2, Murti B T2" Moringa oleifera Lam.-Based Effervescent Tablets: Design, Formulation and Physicochemical Evaluation "International Journal of Drug Delivery Technology 2018; 8(4); 222-228.

19. Moringa oleifera: A review of its nutritional and pharmacological properties (Journal of Ethnopharmacology, 2018).

20. Antioxidant and anti-inflammatory activities of Moringa oleifera leaves (Journal of Food Science, 2017).

21. Cytotoxicity and apoptosis-inducing activity of Moringa oleifera extracts on cancer cell lines (Journal of Medicinal Food, 2019).

22.Moringa oleifera:A comprehensive review of its nutritional and pharmacological properties (Book chapter, 2020).

23. The Moringa oleifera tree: A source of nutrition and medicine. (Book, 2019).

24. A potential oral anticancer drug candidate, Moringa oleifera leaf extract, induces the apoptosis of human hepatocellular carcinoma cells.Jung IL, Lee JH, Kang SC.Published in: Oncology Letters, 2015.