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UNLOCKING THE HEALING POWER OF MALT: FORMULATION AND COMPREHENSIVE EVALUATION AS A TRADITIONAL AYURVEDIC REMEDY FOR DIABETES

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ABSTRACT

In the present study cost effective malted mixes were prepared by using millets which are very nutritious for diabetic patients. Millets are processed by traditional processing techniques to improve the bioavailability of micronutrients, decrease anti nutrient factors. Ragi, Bajra, Jowar, Barley based premixes were developed as alternative health mix for people having type 2 diabetes mellitus. The premixes were prepared into two formulations with variations. The premixes were prepared with some powders of medicinal plants like amla, bitter guard, jamun seeds, bitter almond along with millets (ragi, bajra, jowar) and some cereals (mung bean, soyabean). Formulation contains germinated millets mixes with variation in number of herbs. Sensory evaluation of the samples was carried physiological and chemical malt quality parameter. The superior products were packed in a packaging material. The physico chemical characteristics and nutritional quality characteristics along with microbial quality the shelf life of the superior products at ambient and accelerated conditions were studied.

Keywords: Germination, Ragi, Bajra, Jowar, Soyabean, Mung, herbs

INTRODUCTION:

MALT (Maha Amritam Leham Treatment) is a traditional Ayurvedic remedy that holds promise in the management of diabetes mellitus. This study delves into the formulation and comprehensive evaluation of MALT, aiming to unlock its healing potential for diabetes. Drawing upon ancient Ayurvedic principles and contemporary scientific methodologies, the formulation of MALT is elucidated, highlighting the selection and combination of herbs, minerals and natural substances. Furthermore, an in-depth evaluation encompasses phytochemical analysis, efficacy studies, safety profile assessment and patient perspectives. Through rigorous experimentation and analysis this research seeks to provide valuable insights into the therapeutic benefits of MALT as a traditional Ayurvedic remedy for diabetes, thereby contributing to the advancement of diabetes management strategies. It is poly herbal and grains formulation is popular for its nutritional value and is widely used as tonic, rejuvenator, immunomodulator and enhancer. Millets are the first grains consumed by man because it contains lots of nutritive value. Malt is prepared using bajra, ragi, jowar, soyabean, green grams as a base formulation for malt preparation. The process of malting involves three main steps first soaking the millets and it is also known as steeping (to awaken the dormant grains),

second step is germination or sprouting, and finally heating or kilning the barley to produce its final colour and flavour. After formation of base of grains and cereals, antidiabetic herb powders like amla, bitter guard, bitter almond, jamun seeds, liquorice(natural sweetner) are mixed in the base of grains in boiling water and semisolid preparation is formulated with accurate thickness. After the formulation, evaluation of malt will be processed by determination of carbohydrates, protien, carbohydrates, tannin, flavanoid and microbiological study [1].

OBJECTIVES:

To produce an effective malt from millets and herbs which control blood sugar level. Malting quality is determined by the complex interaction of several traits express during grain development and the malting process.

MATERIALS AND METHODS:

Source of grain samples

various millets were obtained from the bhatiya sons liladhar, amreli. The grains were sorted and screened by hand to remove broken or damaged millets and foreign materials before being used for preparation. The grains were sorted and screened by hand to remove broken or damaged kernels and foreign materials before being used for formulation.

Material used

Germinated powder (Ragi, Bajra, Jowar, Soyabean, Mung), Herbs powder (amla,

bitter guard, bitter almond, liquorice), almond, cinnamon, cardamom.



Figure a: Ingredients used in MALT

Table a: Malt ingredients

Name of Drug	Botanical name	Part used	Typical role in MALT
Ragi	<i>Eleusine coracana</i>	seed	Low GI food, Maintain blood sugar level
Bajra	<i>Pennisetum glaucum</i>	seed	Used as a base ingredient, regulate blood sugar level
Jowar	<i>Sorghum Bicolor</i>	seed	Low GI, averts blood sugar spikes
Mung	<i>Vigna radiata</i>	seed	Vitexin and isovitexin can lower blood sugar level
Almond	<i>Prunus amygdalus</i>	seed	decrease insulin resistance
Soyabean	<i>Glycine max</i>	seed	Low in carbohydrate and calories
Bitter Almond	<i>Prunus dulcis</i>	seed	Improve metabolic parameters, oxidative stress
Amla powder	<i>Phyllanthus emblica</i>	fruit	Rich In Vit.C , Antioxidant
Bitter guard powder	<i>Momordica charantia</i>	fruit	Act like insulin which helps bring glucose into the cells for energy.
Jamun powder	<i>Syzygium cumini</i>	seed	Low glycemic index, enhance insulin activity
Liquorice	<i>Glycyrrhiza glabra</i>	root	Antiinflammatory, Antioxidant
Cinnamon	<i>Cinnamomum zeylanicum</i>	root	Aromatic herb, flavor enhancement
Cardamom	<i>Elettaria cardamomum</i>	seed	Aromatic herb, flavor enhancement

PROPERTIES OF MALT BASE INGREDIENTS [4][10]

- **Finger Millet (Ragi - *Eleusine coracana*)**

Nutritional value per 100 gms

Protein 7.3gm, Fat 1.3g, Minerals 2.7gm, Crude fibers 3.6gm, Carbohydrate 72.0gm, Energy 328kcal, Calcium 344mg, Iron 3.9mg, Phosphorus 283mg, Zinc 2.3mg, Vitamins Carotene 42 microgram, Thiamine 0.42 mg, Riboflavin 0.19mg, Niacin 1.1mg.

- **Mungbean (Green gram-*Vigna radiata*)**

Nutritional facts of green gram per 100 gms

Green gram (Mudga) is known for its high nutritional value. 100 grams of it produces 334 Kcal of energy. It is rich in carbohydrates (56.7g/100g) and is very good source for minerals like potassium (843 mg/100g), magnesium (127 mg/100g), calcium (124 mg/100g), phosphorous (326

mg/100g) and Iron (4.4 mg/100g). Vitamins like carotene, thiamine, niacin, riboflavin, ascorbic acid, and folic acid are also present in green gram.

- **Pearl Millet (Bajra –*Pennisetum glaucum*)**

Nutritional facts of pearl millet per 100 gms

Protein 11.8 Gm, Fat 4.8 Gm, Ash 2.2 Gm, Crude Fiber 2.3gm, Carbohydrate 67.0 Gm, Energy 363.0kcal, Ca 42.0 Mg, Fe 11.0mg, Thiamine 0.38 Mg, Riboflavin 0.21 Mg, Niacin 2.80 Mg [7].

- **Sorghum Millet (Jowar-*Sorghum bicolor*)**

Nutritional facts of pearl millet per 100 gms

Every 100g of Sorghum contains a total of 339 kcal of energy, 74.3 grams of Carbohydrates, 6.3 grams of dietary fibre, 11.3 grams of protein, 3.3 grams of total fat out of which saturated fat is 0.5 grams, monounsaturated fat is 1.0 grams, polyunsaturated fat is 1.4 grams, Omega-3 fatty acids is 65 milligrams.

- **Soyabean (Soyabean - *Glycine max*)**

Nutritional facts of pearl millet per 100 gms

Every 100 g of soyabean contains a total of Calories 172 kcal, Water 63%, Protein 18.2 grams, Carbs 8.4 grams, Sugar 3 grams, Fiber 6 grams, Fat 9 grams, Saturated 1.3

grams, Monounsaturated fat 1.98 grams, Polyunsaturated fat 5.06 grams

- **Almond (Badam - *Prunus amygdalus*)**

Nutritional facts of pearl millet per 100 gms

Every 100 g of almond contains a total of 586 Kcal energy, 21 gm protein, 22gm carbohydrate, g sugars, 46 gm total fat, 4 gm saturated fat, 1 mg sodium, 12 gm dietary fiber [3].

PROPERTIES OF HERBS [4]

- **Amla (Goosebary- *Phyllanthus emblica*)**

Nutritional facts of amla per 100 gms

Every 100 g of amla contains a total of Energy 58 kilo calories Fiber 3.4% Proteins 0.5% Fat 0.1% Carbohydrates 13.7g Calcium 50% Iron 1.2 mg Carotene 9 microgram Thiamine 0.03mg Riboflavin 0.01mg Niacin 0.2mg Vitamin 600mg

- **Bitter gourd (Karela - *Momordica charantia*)**

Nutritional facts of bitter guard per 100 gms

100 grams of raw bitter gourd contains Calories – 16 Dietary Fiber – 2.6 g Carbohydrates – 3.4 g Fats – 158 mg Water – 87.4 g Protein – 930 mg

- **Jamun seeds (Jamun - *Syzygium cumini*)**

Nutritional facts of jamun seed per 100 gms

100 grams of Jamun contain just 62 calories, 18 mg of vitamin C, 15 mg of calcium, 15 mg of phosphorus, 26.5 mg of sodium, 55 gm of potassium, 5 mg of magnesium, and low levels of thiamine, riboflavin, carotene, folic acid, fiber, and fat.

- **Liquorice (Sweet Wood - *Glycyrrhiza glabra*)**

Nutritional facts of liquorice per 100 gms

Every 100 g of liquorice contains a total of 100 kcal calories, 2gm fat, 0 g fat, 100 mg sodium, 21 g carbohydrate, 1 g dietary fiber, 14 g sugar, 1 g protein 2 % iron

- **Cinnamon (Dalchini - *Cinnamomum zeylanicum*)**

Nutritional facts of cinnamon per 100 gms

Every 2.6 g of cinnamon contains a total of energy 6.42 calories carbohydrates: 2.1 g. calcium 26.1 milligrams (mg) iron 0.21 mg magnesium: 1.56 mg phosphorus 1.66 mg potassium 11.2 mg vitamin A 0.39 micrograms.

METHODS [2]

Steeping

Five hundred grams each of millets were weighted out and washed twice in pure water to remove dust. A 24 hr steeping regime was used, 12 hr water steep, 2 hr air rest and 10 hr water steep. Steeping was done with 1: 2 grain/water ratio. 0.1% of formaldehyde was added in steep water to reduce microbial load on the grains.

Germination

Germination was carried out at 37° C for a period of 3 days in a dark place, with twelve 12 hourly spray of distilled water to prevent drying out.

Kilning

The germinated grains were kilned under sunlight for 24-48 hours.

De-culming

After kilning, the grains were detached from the rootlets and stored for use.

Flow sheet

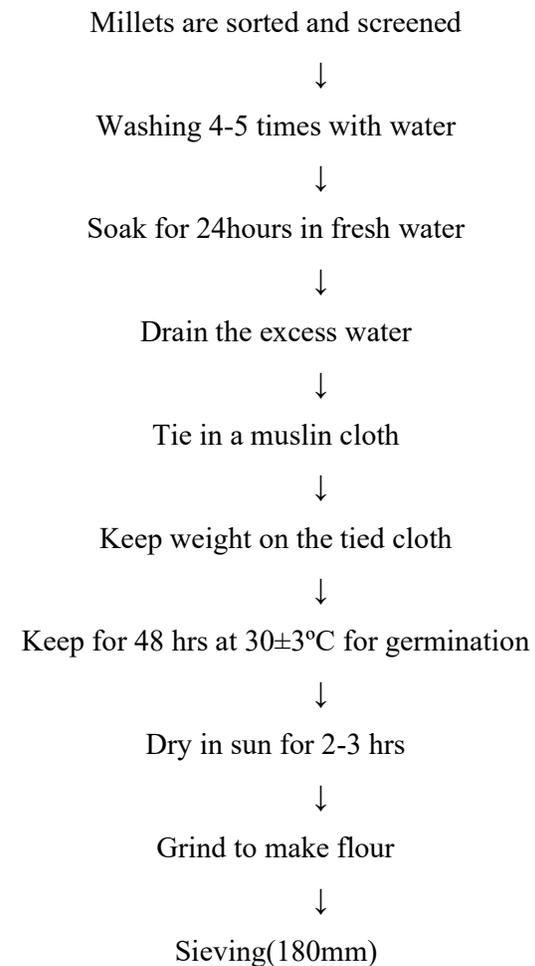


Figure 2: Preparation of Malted powders

INGREDIENTS:

While the malt formula is made up of 5 herbal powder, its main functions can be understood by grouping several of herbs by similar therapeutic actions. The main functions of formula are to improve metabolic parameters, enhance insulin activity and maintain blood sugar level.

Digestive system effect

- *Cinnamon zeylanicum*, *emblica officinalis* helps correct hyperacidity, increases the action of gastric juices for the decomposition of food.
- Various millets like *Finger millet* (ragi), *Pearl millet* (bajra) and *Sorghum millet* (jowar) supports good bacteria in digestive system and rich in dietary fiber which also act as “prebiotic”.
- *Syzygium cumini* possesses natural astringent properties that promote healthy digestion. *prunus amygdalus* act as a prebiotic which acts as a food for the healthy bacteria found in the gut.
- *Glycyrrhiza glabra* helps in increasing mucus production in the stomach, soothing the stomach lining and use as a dietary supplement for digestive problems [6].

Endocrine system effect

- *Emblica officinalis*, *Syzygium cumini* and *Momordica charantia* supports healthy digestion and metabolism that prevents excess sugar from depositing. It stimulate activity of the pancreas gland and enable insulin production.
- Various millets that help in the management of body weight and excellent source of fiber and nutrients. It has low glycemic index and regulate blood sugar level.
- *Prunus amygdalus*, *Glycine max* helps to reduce a spike in blood sugar and insulin level. They helps to manage body weight and regulate blood sugar level [6].

Pharmacological activity

- MALT traditional herbal formulation, is widely used as a tonic, anabolic, immunomodulator and manage blood sugar level.in the morden time it is used to cure diabetes, hyperlipidemia and tonic. It promotes body growth and increase insulin production.
- Amla fruit also offers calcium, phosphrus, iron, carotene, carbohydrates, thiamine and riboflavin. It has ascorbic acis conjugated to gallic acid and reducing sugars forming a tannoid complex which is to be more stable.

The observation made in the study also that the antioxidant profile of amla and other herbs shows antidiabetic effects also improve diabetic status by regulating glucose metabolism, improving insulin secretion and decreasing insulin resistance.

- MALT has been used as a *Ramayana* (health tonic), helps in manage diabetes and immune builder.

Does It Need To Be Refrigerated ?

- No. MALT does not need refrigeration. The jar is about a 1 month supply. If you plan on keeping it open longer than 1 month, it should be refrigerated.
- According to the Charaka Samhita, the ideal way to use MALT is to first undertake cleansing of the body, perform meditation and religious ceremonies, and develop a cheerful disposition. The herbal preparation should be consumed in a place where the room is clean, the temperature is mild, and one is out of direct sun

(during the hot season). While the herbal honey helps correct the problems that have been caused by poor habits, correcting improper diet, in particular, is an important aid to the effects of all the rasayana.

Dosage and Consumption

- It is recommended to consume 1 tablespoon of the antidiabetic malt twice daily, preferably before meals. However, it is always advisable to consult with a healthcare professional before starting eating any herbal medication to determine the appropriate dosage for your specific condition.
- Please note that while herbal remedies can have beneficial effects, they should not replace prescribed medication or professional medical advice. It is essential to consult with a healthcare provider to ensure that this herbal malt is suitable for you and does not interfere with any existing medication or condition.

Lable claims of MALT

Malt HANDMADE SUGAR FREE	AYURVEDIC MEDICINE	ALL NATURAL RAW INGREDIENTS
Dosage : 1 or 2 tablespoons twice a day Can be taken with water or milk.	Nutrients Values : Total Calories – abc kcal/gm Total protein - abc gm/kg Total free tannin- abc % Total acidity - abc % Fat - abc % Total fibers – abc %	Each nearly about 100 g of malt is prepared from: Finger Millet, Pearl Millet Sorghum, Mung Bean, Almond, Bitter Almond, Amla Powder, Bitter Guard Powder, Jamun Seeds Powder, Liquorice, Cinnamon, Cardamom.
Net weight : 1 kg Mfd.on : April 3, 2024 Mfg by : C.V.G.P.C	Container should be store in cool place.	Caution : To be taken under Medical supervision
Usage precautions : avoid during preganancy or nursing.	Best use within one month from the date of packing.	
Uses : Anti diabetic, Anti-stress, antioxidant, Immunity support, anti hyperlipidemic		

Evaluation of MALT

- Physical evaluation of the drugs can be carried out with reference to moisture content, Solubility, alcohol and water soluble extractives and ash values. The moisture contents of the final product of MALT ranges from 6-9 per cent. If it is so then there no need to added preservative in MALT [7].
- Chemical evaluation comprises of different chemical tests and chemical assays. For eg. presence of total carbohydrates, tannin, and saponin. The isolation, purification and identification of active

constituents are chemical methods of evaluation.

- Microbiological evaluation is done using plate count method to check microbial growth and stability of malt. The total viable aerobic count of the material being examined. Thus, comprehensive evaluation of malt done by various method and ensure safety and stability of malt for antidiabetic patients.

Evaluation of nutrient content of powders

The nutritional evaluation like moisture, protein, fat, fiber and ash content of malt were determined [7].

Tests	Colour If positive	Aqueous extract of Malt
ALKALOIDS		
Dragendroff's test	Orange red precipitate	No red precipitate
Wagners test	Reddish brown precipitate	No Brown precipitate
Mayers test	Dull white precipitate	Yellow colour
Hager's test	Yellow precipitate	No yellow precipitate
STEROIDS		
Liebermann- buchard test	Bluish green colour	Bluish green colour

Salkowski test	Bluish red to cherry red colour in chloroform layer and green fluorescence in acid layer	Bluish red to cherry red color in chloroform layer and green fluorescence in acid layer
CARBOHYDRATE		
Molish test	Violet ring	Violet ring
Fehling's test	Brick red precipitate	Brick red precipitate
Benedict's test	Red precipitate	Red precipitate
TANNIN		
With FeCl ₃	Dark blue or green or brown	Green colour
FLAVANOIDS		
Shinoda's test	Red or pink	Light pink colour
SAPONINS		
With NaHCO ₃	Stable froth	No stable froth
TRITERPENOIDS		
Tin and thionyl chloride test	Pink	Brown colour
COUMARINS		
With 2 N NaOH	Yellow	Yellow colour
PHENOLS		
With alcoholic ferric chloride	Blue to blue black	Light buff colour
CARBOXYLIC ACID		
With water and NaHCO ₃	Brisk effervescence	No brisk effervescence
AMINO ACID		
With ninhydrin reagent	Purple colour	No purple colour
RESIN		
With aqueous acetone	Turbidity	No turbidity
QUINONE		
Conc. sulphuric acid	Pink/purple/red	Yellow colour

Physicochemical studies

Physicochemical parameters were determined as per guidelines of WHO. Total ash value, loss on drying, water soluble ash, acid insoluble ash, alcohol soluble extractive value and water soluble extractive value were determined.

Loss on drying at 105 °C

10g of sample was placed in tarred evaporating dish. It was dried at 105 °C for 5 hours in hot air oven and weighed. The drying was continued until difference between two successive weights was not more than 0.01 after cooling in desiccator. Percentage of moisture was calculated with reference to weight of the sample.

Total Ash

2g of sample was incinerated in a tarred platinum crucible at temperature not exceeding 450 °C until carbon free ash is obtained. Percentage of ash was calculated with reference to weight of the sample.

Acid insoluble Ash

To the crucible containing total ash, add 25ml of dilute HCl and boil. Collect the insoluble matter on ashless filter paper (Whatmann 41) and wash with hot water until the filtrate is neutral. Transfer the filter paper containing the insoluble matter to the original crucible, dry on a hot plate and ignite to constant weight. Allow the residue to cool in suitable desiccator for 30 mins and weigh without delay. Calculate the content of acid insoluble ash with reference to the air dried drug.

Alcohol soluble extractive

Weigh accurately 4g of the sample in a glass stoppered flask. Add 100 ml of distilled Alcohol (approximately 95%). Shake occasionally for 6 hours. Allow to stand for 18 hours. Filter rapidly taking care not to lose any solvent. Pipette out 25ml of the filtrate in a pre-weighed 100 ml beaker. Evaporate to dryness on a water bath. Keep it in an air oven at 105°C for 6 hours, cool in desiccator for 30 minutes and weigh. Calculate the percentage of Alcohol extractable matter of the sample. Repeat the experiment twice, and take the average value.

Water soluble extractive

Weigh accurately 4g of the sample in a glass stoppered flask. Add 100 ml of distilled water, shake occasionally for 6 hours. Allow to stand for 18 hours. Filter rapidly taking care not to lose any solvent. Pipette out 25ml of the filtrate in a pre-weighed 100 ml beaker. Evaporate to dryness on a water bath. Keep it in an air oven at 105 °C for 6 hours. Cool in a desiccator and weigh. Repeat the experiment twice. Take the average value.

Microbial Testing [9]

This test checks for the presence of harmful microorganism like bacteria, molds and yeast. Malt should meet microbiological safety standards to ensure its free from contamination.

Bioburden level: It is based on determination of microbial contamination limits in medicinal plant materials. Different limits are set according to the use of the material. A large number of bacteria and fungi forms the naturally occurring microflora of herbs and aerobic spore forming bacteria. Bioburden level may indicate the quality of an herbal formulation. The total viable aerobic count of the material being examined is determined by using plate count method. Sample after treatment with sodium chloride-peptone buffer solution (pH 7.0) was inoculated on liquified casein-soybean digest agar. The samples are incubated at 30 – 35 °C for 5 days and the numbers of colonies formed were counted after 5 days.

RESULT AND DISCUSSION

Table 1: Organoleptic evaluation of malt

Parameter	Characteristic	Evaluation result
Colour	Typical color	Within acceptable range
Odour	Sweet, little bitter	Characteristic
Taste	Sweet, little bitter	Characteristic
Texture	Smooth and homogenous	Characteristic

Table 2: Results of preliminary phytochemical screening of Malt

Test	Inference
Alkaloid	-
Steroid	+
Carbohydrate	+
Tannin	+
Flavonoids	-
Saponins	-
Triterpenoid	-
Coumarins	+
Phenols	+
Carboxylic acid	-
Amino acids	-
Resin	+
Quinone	+

(+) – present; (-) – negative

Table 3: Results of standardization parameters of malt

Parameter	Results
	Malt
Loss on drying	2 %
Total Ash	5 %
Acid Insoluble Ash	0.1 %
Water soluble Ash	3.58 %
Alcohol soluble extractive value	9.30
Water soluble extractive value	14.20

Table 4: Microbiological testing of MALT

Parameter	Testing Method	Acceptable limit	Test result
Total aerobic plate count	Standard agar plate	< 10 ⁴ CFU/g (colony forming units per gram)	Within limit
Yeast and Mold count	Standard agar plate	< 10 ³ CFU/g	Within limit

CONCLUSION

The present study was carried out with an aim of authenticity of the drug along with physiochemical analysis of malt nutrition's and acceptable foods. Addition of malt in food improve functional and nutritional qualities. This malt will be beneficial to all age group as it is more digestible and rich in fiber content, calcium, iron, sodium, potassium, magnesium and phosphorus. Germination of millets grain prior to raw, increased protein, ash, iron, calcium and phosphorous levels of malted mixes. From the study, it may be concluded that locally

available low cost ingredients in developing countries have a great potential.

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