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Formulation of multifaceted Spirulina health drink with the aim of targeting diabetic population

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ABSTRACT

An attempt was made to formulate spirulina health drink after overcoming the drawbacks of the existing dry syrup preparation with sole aim of targeting the diabetic population who are in great need of a balanced high protein diet without much carbohydrate and fat, as well as to carryout the physical evaluation and stability studies of the product. . Ingredients were mixed in various proportions and respective flavor was selected, since the product is to taken internally and evaluated using various qualitative and quantitative process of measurement. The spirulina health drink was evaluated for the properties of bulk density, degree of mixing, and angle of repose, flow ability and loss on drying etc. All the results comply with in the limits. We have succeeded in obtaining the proposed formulation after overcoming the defects of the existing formulation. It is our aim to further study the effect of this as a nutrient supplement in the diabetic population in our locality.

Key words: Spirulina, health drink, formulation, Diabetic.

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INTRODUCTION

Spirulina is blue green algae. It is simple, one celled form of algae that thrives in warm, alkaline fresh water bodies. The name spirulina is derived from the Latin word for helix or spiral; denoting the physical configuration of the organism when it forms swirling, Microscopic strands spirulina is being developed as the food of the future because of its amazing ability to synthesize high quality concentrated food more efficiently than any other algae [1,2]. Most notably, Spirulina is 65 to 71 percent complete protein, with all essential amino acids in perfect balance. In addition, spirulina is one of the very few plant sources of Vit B12, usually found only in animal tissues [3,4]. A teaspoon of spirulina supplies 21/2 times recommended daily allowance of vitamin B12 and contains more than twice the amount of this vitamin found in an equivalent serving of liver [5,6], Spirulina also provides high concentrations of many other nutrients- amino acids, chelated minerals, pigment ions, rhamnose sugars (complex natural plant sugars), trace elements, enzymes in an easily assimilable form [7].

Cardiovascular diseases are the major cause of death in diabetes. A risk factor for cardiovascular disease is dyslipidaemia. Both hypertension and lipid disorder should be actively sought and treated in patients with diabetes [8]. It has been found by research that dietary hyperlipidemia caused by high fructose diet was improved by spirulina feeding, accompanied by significant increase in the lipoprotein lipase activity in post heparin plasma in rats [9]. The control of blood glucose, lipids and body weight are the three major factors in diabetes management.Spirulina is a boon for diabetics. Spirulina on regular intake is found to reduce the incidence of diabetic retinopathy [10]. It is also found that on regular intake of spirulina non insulin diabetes mellitus responds on a long term basis. Spirulina will be helpful in controlling the long term cardiovascular complications and retinopathy as revealed by research. It becomes therefore necessary for a diabetic patient to supplement his diet with spirulina. Taking into account the various advantages that spirulina offers to diabetic patients it becomes important for spirulina to be taken by all diabetic patients [11]. Taking spirulina as tablets or capsules has a low compliance level among patients due to psychological reasons and so our product stands to provide an advantage over the other existing formulations [12].

MATERIALS AND METHOD

Dibasic calcium phosphate was mixed with lactose; Mannitol was added to this mixture by geometrical proportion. To this final mixture spirulina powder was added little by little and flavoring agent quantity sufficient to remove the messy smell of spirulina. The whole product was mixed well till a light brown uniform color was obtained giving a strong smell of chocolate. Different flavors like strawberry, pineapple, orange, vanilla and chocolate were tried and chocolate was found to make the health drink more compatible to everybody's taste. The health drink was given to 50 persons to select the choice of the flavour.

Ingredients	Quantities per 100gms.
Spirulina powder	5gm
Mannitol	50gm
Dibasic calcium phosphate	10gm
Lactose	35gm
Flavoring agent	Quantity sufficient

RESULTS

The bulk density of the formulation was found to be 0.5903gm/cc and it was concluded that the powder is very closely packed hence the porosity is less. Packing arrangements of uniform spheres of solids ranges from 0.53 per cubic to 0.74 for tetrahedral lattices. Porosity of irregularly shaped particles can be nil when the powder bed is said to be non-porous. Being non porous is advantageous for a powder formulation. The porosity has been reduced by the addition of dibasic calcium phosphate. The reformulated powder has an average angle of repose of 39.58''. the reformulated powder showed improved flow properties. The degree of mixing of the formulation was found to be in the ratio of approximately 1:20. it complies with the master formula indicating that the amount of spirulina present with respect to the other ingredients was maintained in the ration 1:20.the loss on drying of the formulation was found to be 1.45%W/W. it shows that the preparation is less hygroscopic and will be more stable. Weight gained by samples at different humidity's was almost negligible. After performing the stability study the reformulated sample was found to be non hygroscopic.

DISCUSSION

Spirulina powder was evaluated for qualitative and quantitative measurements for understanding the powder behavior, properties at two levels, namely those associated with an individual particle and those typical at bulk powder were done. The spirulina health drink was evaluated for the properties of bulk density, degree of mixing, angle of repose, flow ability and loss on drying. Bulk density largely depends on particle shape. As the particle become spherical in shape, bulk density decreases. Packing may be expressed in terms of porosity, percent voids or fraction of solids by volume. Packing arrangements of uniform spheres of solids ranges from 0.53 per cubic to 0.74 for tetrahedral lattices. The smaller granules are able to form a clear more intimate packing than larger granules. The reading of bulk density is tabulated in table number-1.

The manner in which stresses are transmitted through a bed and the beds response to applied stress are reflected in various angles of friction and response. The most commonly used of these is angle of repose. Angle of repose ranges from 23^0 for smooth uniform glass beads to $64^0$for granular lime stones. Cohesive material behaves in an anomalous manner yielding value in excess of $90^{0.}$ An angle of repose less than 30^0 usually indicate a free flowing material and angle greater than 40^0 suggest a poorly flowing material. The readings for angle of repose of the formulation are tabulated in table -2.

Flow ability is done through the powder flow meter. It consists of an aluminium pan attached to a beam equipped with four strain gauges capable of measuring weight differences in micro seconds. A strain gauge activation and measuring unit which convert the strain gauge signal to electric impulse, measurable by a 10 inch strip chart recorder with variable speed. The sample to be evaluated is placed in a cone (70^0) suitably held above the pan equipped with an electrically triggered trap door. The strip chart recorder is adjusted so that 250gm would be represented by 100% of scale. The sample is allowed to flow on the pan and time required for the sample to empty from the funnel is recorded. The rate of flow is determined from the strip chart recorder and expressed as a flow rate in Gms per second. The reading of the flow ability of the formulation is tabulated in table number- 3.

Loss on drying is the loss in weight in % wt/wt resulting from water and volatile matter of any kind that can be driven off under specific condition, the test is carried out on a well mixed sample of a substance. The degree of mixing is a mixing operation in which the objective is the production of a bulk mixture, and that the mixture is subdivided into individual doses. The assessment of degree of mixing and checking the final product involves the analysis and sampling of the mixture. The reading for degree fo mixture of the formulation are tabulated in table number -4.

Effect of humidity was done by taking a known weight of each material (10gm) maintained in a labeled 10ml beaker and was stored in a desiccator which contains a saturated salt solution to control the relative humidity in a 25^0 oven. The beaker was reweighed periodically and the weight gain was calculated as the % total water uptake at that relative humidity. This procedure was repeated after storage in each higher relative humidity chamber and then back again through each lower relative humidity chamber to identify any hysteresis effect. The readings of relative humidity when different salt solutions were used are tabulated in table no-5.

CONCLUSION

Spirulina is being developed as the food of the future' because of its amazing ability to synthesize high quality concentrated food more efficiently than any other algae. We have made a modes attempt to

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reformulate the existing spirulina formulation as a suitable powder formulation with the sole aim of targeting the diabetic population who are in great need of a balanced high protein diet without much carbohydrate and fat.

We have succeeded in obtaining the proposed formulation after overcoming the defects of the existing formulation. It is our aim to further study the effect of this as a nutrient supplement in the diabetic population in our locality.

TABLE- 1: BULK DENSITY

SL NO	MASS(gms)	VOLUME(ml)	BULKDENSITY gm/cc
1	50	84	0.595
2	50	86	0.581
3	50	84	0.595
	TOTAL	254	1.771
	AVERAGE	84.6	0.5903

TABLE- 2: ANGLE OF REPOSE.

SLNO.	HEIGHT	RADIUS	ANGLE OF REPOSE
1	5	6.17	39.7’’
2	4	4.93	39.7’’
3	4.5	5.48	39.35’’

TABLE -3: FLOW ABILITY

SL NO	QUANTITY IN gms	TIME REQUIRED FOR FLOW IN (sec)	FLOWABILITY IN (g/sec)
1	250	40	0.5
2	250	38	0.66
3	250	40	0.5

TABLE- 4: DEGREE OF MIXING

FIELD	NUMBER OF SPIRULINA PARTICLES(A)	NUMBER OF DILUENTS(B)	% A	% B
1	11	189	5.5	94.5
2	12	188	6.0	94
3	9	191	4.5	95.5
4	11	189	5.0	94.5

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TABLE- 5: EFFECT OF HUMIDITY

SALT USED	RELATIVE HUMIDITY (%)	WEIGHT OF THE SAMPLE	
		Initial	Final
LITHIUM CHLORIDE	10.2	20gm	20.001
MAGNESIUM CHLORIDE		.	
	33.0	20gm	20.002
SODIUMCHROMATE			
SODIUM CHLORIDE	54.0	20gm	20.007
POTASSIUM NITRATE.	75.3	20gm	20.01
	92.5	20gm	20.01

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