TO STUDY THE EFFECT OF VARIOUS STABILIZERS ON THE STABILITY OF OATS AND FINGER MILLET BASED FUNCTIONAL DRINK

Dissertation Report

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CERTIFICATE

This is to certify that **Manjot Singh** (Registration No. 11709381) has personally completed M.Sc. Dissertation entitled "*TO STUDY THE EFFECT OF VARIOUS STABILIZERS ON THE STABILITY OF OATS AND FINGER MILLET BASED FUNCTIONAL DRINK*" under my guidance and supervision. To the best of my knowledge, the present work is the result of her original investigation and study. No part of dissertation has ever been submitted for any other purpose at any University.

The project report is appropriate for the submission and the partial fulfillment of the conditions for the evaluation leading to the award of Master of Nutrition and Dietetics.

Date: 12 MAY, 2018

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DECLARATION

I hereby declare that the work presented in the dissertation report entitled **"**TO STUDY THE EFFECT OF VARIOUS STABILIZERS ON THE STABILITY OF OATS AND FINGER MILLET BASED FUNCTIONAL DRINK**"** is my own and original. I have carried out the work at School of Agriculture, Lovely Professional University, Phagwara, Punjab, India under the guidance of **Dr. Ashwani Kumar,** Assistant Professor (Food Technology) of School of Agriculture, Lovely Professional University, Phagwara, Punjab, India, for the award of the degree of Master of Science in Food Technology.

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I certified that the above statement made by the student is correct to the best of my knowledge and belief.

Place: Phagwara, Punjab (India) **Dr. Ashwani Kumar**

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INTRODUCTION

India is a country where most of the people living under poverty line and is also the home to largest hungry people in the world. India rank 65 among 79 countries according to the 2012 global hunger index. 42% of children in India are underweight, 58% are suffering from stunted by 2 years of age, according to the recent global study. 75% of Indians are suffering from hunger and 50% of them are acutely effective. (AVARD, 2012). This is due to the poor purchasing power of the nutritious products like milk and meat as they are out of their reach. Their energy requirements are met by cheap carbohydrates resources and because of their imbalanced diet intake they suffer from malnutrition. With the increasing urbanization the lifestyle and eating habits are changed. There is a great dramatic lifestyle change in India from Agrarian diet and active lifestyles to sedentary lifestyles. Thus, the mortality rates increased related to Cardio Vascular Diseases, Coronary Heart Diseases, Diabetes and Strokes have increased rapidly (Chauhan and Bery, 2015). With the addition of these problems another group of people suffering from intolerance of lactose, gluten has increased. Development of new trend has taken place i.e. Energy and nutrient dense foods that can also prevent foods related problems have also been discovered. The cattle milk has been undergone a lot or researches to replace with other cereals or pulse based milk. (Eleusine Corocana) Finger millet is also known as Ragi which is one of the important millet in India. The nutrient content of Finger Millet is very much higher to major cereals grains like Wheat, Rice and Maize (Fao, 2005). The mineral and dietary fiber of Ragi is higher than wheat, rice and fairly well-balanced protein. Finger Millet is also enriched with calcium and other minerals (Thapliyal and Singh, 2015). In this investigation of the review Finger Millet is added to milk to enhance the nutrients and hence biofortification should be done and then with this incorporation of Finger Millet in the milk a drink is prepared. This drink is not only nutritious to consume but is also a cheaper source for the local people to consume

2. PROBLEM BACKGROUND

People are becoming health conscious and hence an increase in the demand of health foods/drinks which contains less fat, are instant source of energy, full of vitamins, minerals and have health promoting phytochemicals is increasing. A variety of such products have been developed and are available in the market. Despite of being rich in nutrients these drinks have lower acceptability due to the sedimentation of cereals on prolonged storage. Stabilization of such products can improve their overall acceptability and storage life

3. REVIEW OF LITERATURE

The demand of ready to eat convenience foods has increased the demand of food stabilizers. A variety of stabilizers *viz.* plants, animals and microorganisms are used in food industry (Tsaneem et al. 2014). The functional properties of these stabilizers vary according to their origin and interaction with food. Food companies are always in hunt of a perfect food stabilizer which can improve the acceptability of their product as compared to the product of rival company. Increasing trend of composite foods has further increased the demand for stabilizers as these play an important role in enhancing the acceptability of these products by preventing the separation of food components on storage (Milani et al. 2012). The development of composite foods will continue in the upcoming future and so will be the demand of stabilizers.

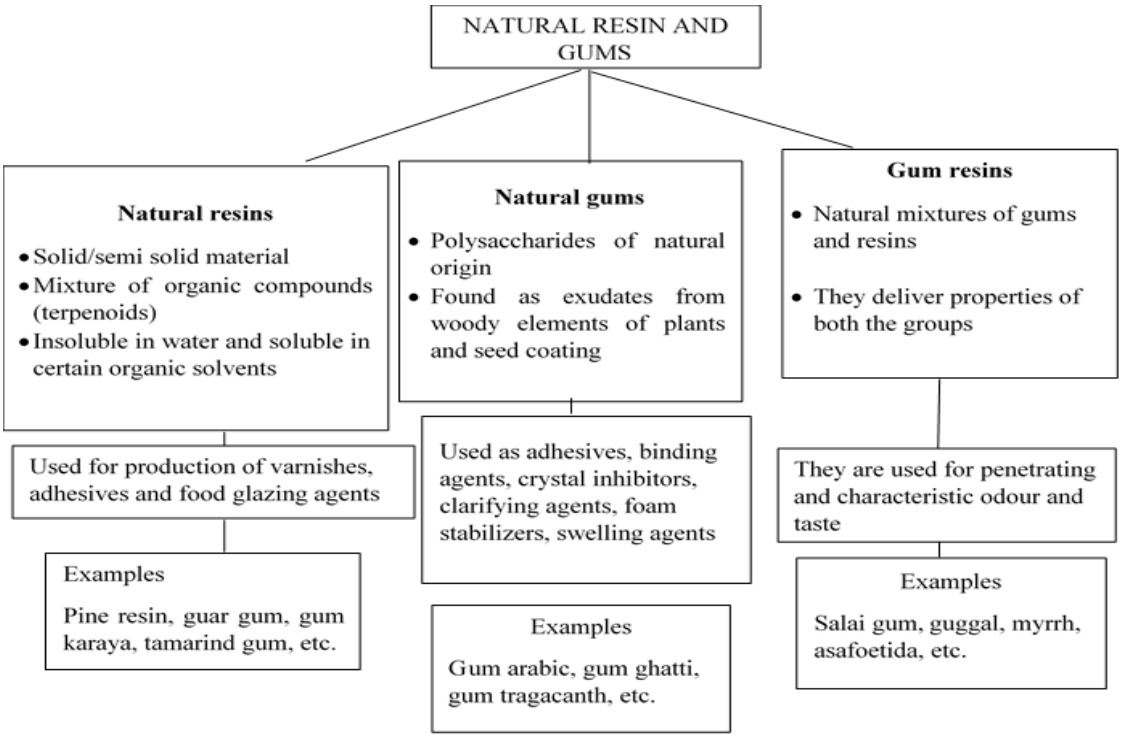
In the world production natural resin gum (NRG) of 92% India is the second largest producer in global market in which India contributes about 16.8%followed by the USA which has 6.5%of share in global market, France is the leading producer of NRG which contributes about 25.8%. Among the 80% share of NRGs importers in international market India being the leading importer holds 14.8% share in global market followed by USA (11.7%) followed by the leading supplier France (11.2%) (ICAR KK sharma 2017). As gums are the production of living organisms, so they are complete renewable source and they do not show any ill effect on human beings and environment. Natural gums and mucilage's are non-irritant in nature, are free from toxic components, have low cost and wide availability. Gums are widely used in many ways as in food industries they are used in ice creams, meat products, dairy, confectionaries, beverages, sauces. In pharmaceutical industries they are used as binder in tablets, disintegrates, emulsifiers, suspending agents, film forming agents. In industries gums are used in cosmetics, textiles, adhesives, paints, paper manufacturing (M. deagade et al.,2012)

One of the most nutritious cereal is Eleusine grain as it has good quality protein (Shimelis and Mulugeta, 2009). A good amount of protein is present in the finger millet of high biological value as it has methionine, lysine and cysteine and hence they are of vital importance to those who depend upon plant sources for protein. According to the studies of FAO (2005), the protein content present in the millet is same as that of wheat, sorghum, rice and maize grain. Also, it contains good amount of phosphorous, vitamin B1, B2 and B3 (Bashay,1996). Also the seeds have good amount of phytochemicals and phytic acid, also they are regarded as blood cholesterol lowering agent and are anti-carcinogenic (Burton et al,1972., Burton and Froston, 1966). It has anti-oxidant properties as well as prevents formation of ROS which is higher than wheat, rice and other millets(Mathangi and Sudha,2012)

3.1 Nutritional Value to finger millet (Ragi)

Finger millet is having excellent nutritional value. As it contains 6% to 8% protein, 1% to 1.7% fat, starch 65% to 75%, minerals 2% to 2.25% and dietary fiber 18% to 20%. Its proximate composition is superior to wheat, maize, sorghum and rice with regard to dietary fiber, calcium and few micronutrients. The seed coat of this millet is rich source of phenolic compounds, minerals and dietary fiber.

Figure 1



3.2 Gums in food industry

There are many substances that are being used in the food industries. Gums and gelatin are widely used as food additives in the food industries now days.In the European Union (EU), all food additives, whether approved or not in the EU, are labeled with the letter “E” (representing Europe) and a specific number. This nomenclature was extended to the Codex Alimentarius Commission to easily identify food additives worldwide.

Table 3.1 Natural gums used in the food industries which we can use as stabilizers

E 409	Arabinogalactan Larch Gum
E 410	Locust bean gum, Carob bean gum
E 411	Oat gum
E 412	Guar gum, guaran
E 414	Acacia gum, gum arabic
E 415	Xanthan gum
E 416	Karaya gum
E 417	Tara gum
E 418	Gellan gum
E 419	Gum guhati
E 424	Curdlan gum
E 427	Cassia gum

3.3 Oats

Within cereals, oat ranks sixth in world production. Annual world production of oats was 23.82 million MT in 2013 (FAO 2014). Russia had the highest oat production in the world at 4.93 million MT followed by Canada (3.88 million MT) and Australia (1.12 million MT). In India, almost 1.0 lakh hectares of land is under oats cultivation as a fodder crop with an average yield of 42 t ha^{-1} (ICAR 2006).

Nutritionally oats are an excellent source of soluble fiber in the form of beta-glucans, alpha tocopherols, B vitamins, minerals, proteins and plant fats. Oats also contain more lipids (5-9 percent) than other cereal crops and are rich in unsaturated fats, including the essential fatty acid linoleic acid. About 80 percent of total oat lipids are unsaturated fat lipids. Oats contain unique antioxidants, called avenanthramides, as well as the vitamin E-like compounds, tocotrienols and tocopherols (Young 1986). Oat protein contains considerable quantities of essential amino acids in comparison to wheat (Butt *et al* 2008; Gambus *et al* 2011).

Table 3.2 Effect of different gums on sensory properties of different products

PRODUCT	GUM USED	EFFECT ON PRODUCT			STORAGE	REFERENCES
		TASTE	EFFECT ON APPEARANCE	OVERALL ACEPTIBILITY		
Ice cream	Locus bean gum	does not produce any taste or flavor-masking properties to the mix.	Cools uniformly	Increases	This cools with uniformity and permits good whipping	Bahramparvar and Tehrani, 2011
Fruit juice	Xanthan gum	it provides good texture, odor and flavour	xanthan gum helps with the suspension of insoluble components	Increases	no precipitate was observed after storage for 1 week	http://www.aditivosalimentarios.es/php_back/portada/archivos/Xantana_ingles.pdf https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4431789/
Yogurt	Xanthan gum, carrageenan gum	Had no effect	Textural changes	Increases	21days	Hematyar et al 2012
Bakery products from sorghum flour	Guar gum & gum arabic	Flavour good	Textural changes	Increases	-	Elkhalifa et al 2007
Sauces (desserts)	Xanthan gum	Flavour good	Textural changes	Increases	stable sensory and textural properties of	Sikora et al 2001

					the sauces for at least 3 months.	

Table 3.3 Natural gums selected to be used in drink

Gums	Used in	Function	Reference
1. Xanthan gum	• Ice cream • Yogurt • Milk	• Xanthan gum increases the viscosity and synersis. • Improve texture, increase firmness. • Increase the gel strength and water binding capabilities.	Hematyer et al. 2012
2. Locus bean gum (LBG)	• Ice cream	• This cools with uniformity and permits good whipping.	Bahramparvar and Tehrani, 2011
3. Guar gum	• Ice cream	• Guar gum is more soluble and a better emulsifier as it has more galactose branch points. • Does not form gel but show good stability to freeze	Naresh and Shailaja 2006
4.Carrageenam gum	• Yogurt • Ice cream • Flavoured Milk	• Carrageenan gums increases the viscosity and synersis. • Carrageenan often is used for its gel forming functionality and its reactivity with casein, which prevents whey separation. • Excellent suspending characteristics.	Hematyer et al. 2012 Naresh and Shailaja 2006 Tasneem et al. 2014

		• Homogenous texture and appearance of the product.	

3.3 Stabilizers used in the milk and milk products

Carrageenan and k-carrageenan are widely used as a stabilizer in milk as carrageenan form a colloid network. The stabilizers had good flavoring compounds which are well dispersed in solution helps prevent collapsing of air bubbles and encourage good release of flavors (Guinard et al. 1994). In ice cream locus bean gum and casein are widely used. They both help in decreasing the growth of ice crystals whereas when gelatin and xanthan gum used with sucrose corn syrup it slows the ice re crystallization. In yogurt, the common stabilizers used are natural and modified gums, carrageenan, alginates and gelatin. The addition of these stabilizers in yogurt increases

4. PROPOSED RESEARCH OBJECTIVE

1. To optimize the concentration of stabilizers to obtain a uniform drink.
2. To study the effect of selected stabilizers on the physical parameters and chemical composition of the drink.
3. To study the changes in drink on storage at various temperature time intervals.

5. PROPOSED RESEARCH METHODOLOGY

Experiment 1: To optimize the concentration of stabilizers to obtain a uniform drink.

The various possible combinations are selected on the basis of bases of Response surface methodology (RSM) design using software design expert 6.0.10

Table 1 Experimental plan to stabilize the finger millet and oats based functional drink as per the RSM design

Std	Run	A:Carageenan	B:Xanthan	C:Locust bean gum	D:Guar gum	Viscosity	Sedimentation value	Flowability	Taste	Odour	Mouthfeel	Overall acceptability
		%	%	%	%	cP	%	(seconds)				
8	1	0.05	0.04	1	0.3							
20	2	0.025	0.0525	0.65	0.65							
7	3	0	0.04	1	0.3							
9	4	0	0.015	0.3	1							
18	5	0.075	0.0275	0.65	0.65							
13	6	0	0.015	1	1							
27	7	0.025	0.0275	0.65	0.65							
1	8	0	0.015	0.3	0.3							
10	9	0.05	0.015	0.3	1							
30	10	0.025	0.0275	0.65	0.65							
12	11	0.05	0.04	0.3	1							
15	12	0	0.04	1	1							
19	13	0.025	0.0025	0.65	0.65							
21	14	0.025	0.0275	-0.05	0.65							
22	15	0.025	0.0275	1.35	0.65							
29	16	0.025	0.0275	0.65	0.65							
24	17	0.025	0.0275	0.65	1.35							
23	18	0.025	0.0275	0.65	-0.05							
14	19	0.05	0.015	1	1							
6	20	0.05	0.015	1	0.3							
2	21	0.05	0.015	0.3	0.3							
5	22	0	0.015	1	0.3							
25	23	0.025	0.0275	0.65	0.65							
11	24	0	0.04	0.3	1							
28	25	0.025	0.0275	0.65	0.65							
4	26	0.05	0.04	0.3	0.3							
17	27	-0.025	0.0275	0.65	0.65							
3	28	0	0.04	0.3	0.3							
26	29	0.025	0.0275	0.65	0.65							
16	30	0.05	0.04	1	1							

Experiment 2: To study the effect of selected stabilizers on the physical parameters and chemical composition of the finger millet and oats based functional drink

Process parameter	**Control (without stabilizer)**	**Test sample (stabilizer selected as per RSM)**
Viscosity		
Flowability		
Sedimentation		
pH		
Acidity		
Ash Content		
Protein		

Sensory Evaluation

Final product will be evaluated for the sensory characteristics on the basis of 9 Point hedonic scale and composite sensory scale.

A. Sensory analysis:

A 9-point hedonic scale will be used to evaluate the experimental samples using 100 semi trained panelists. Healthy male and female of suitable age will be selected for the evaluation.

a. Color and appearance

b. Flavor and sweetness

c. Body and texture

d. Mouth feel

e. Overall acceptability

Expression	Points to be assigned
Liked extremely	9
Liked very much	8
Liked moderately	7
Liked slightly	6
Neither liked nor disliked	5
Disliked slightly	4
Disliked moderately	3
Disliked very much	2
Disliked extremely	1

Sample code	Colour and appearance	Flavour and sweetness	Body and texture	Mouth feel	Overall acceptability	Remarks (if any)

Optimized product will be obtained using the above experimental setup.

A. Effect of stabilizers on the sensory parameters of finger millet and oats based functional drink:

Sensory attributes	**Possible score**	**Mean Score ± SD**	**Number of Judges**
Appearance			
Consistency			
Flavour			
Absence of defects			
Total Score			

EXPERIMENT 3: Storage study

STORAGE	Physical	Viscosity Flowability Sedimentation
	Chemical	pH Acidity Ash content
	Microbiological	Total Plate Count Yeast Count Mould Count
	Sensory	Taste Odour Mouthfeel Overall Acceptability

6. EXPECTED RESEARCH OUTCOME

1. The best combination of stabilizers will be selected
2. The study will help to select the best combination of stabilizers to stabilize the and oats based functional drink. It will further help the researcher and industrialist to stabilize the cereal based drink

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