



Unique Journal of Engineering and Advanced Sciences

Available online: www.ujconline.net

Research Article

EFFECT OF PROBIOTIC HEALTH DRINK SUPPLEMENT ON DIABETES AND HYPERCHOLESTEROLEMIA

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Received: 31-08-2016; Revised: 29-09-2016; Accepted: 27-10-2016

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ABSTRACT

Probiotics are viable microorganisms that confer health benefits to the host once consumed in adequate amounts, primarily by promoting the proliferation of beneficial gastrointestinal indigenous microflora. Various microorganisms have been found to possess such properties, although *Lactobacillus* and *Bifidobacterium* are the most common probiotic bacteria used as food adjuvants. A number of gastrointestinal health benefits have been reported upon consumption of probiotic organisms, including the alleviation of diarrhea, improvement of irritable bowel syndrome, lactose intolerance and antibacterial properties. The gastrointestinal tract is thus a primary interface between us and our outside environment. The total mucosal surface area of the adult GI tract is about 300 square meters, and is by far the largest body exposed to “foreign” substances like pathogens, harmless bacteria and food. The gut-associated lymphoid tissue (GALT) makes the GI tract our largest immune organ. It is through this mechanism that Probiotics are thought to influence the immune response. Probiotic cultures have been shown in a variety of test systems to stimulate certain cellular and antibody functions of the immune system. Animal and some human studies have shown an effect of yogurt or probiotic bacteria on enhancing levels of certain immune reactive cells (e.g. macrophages, lymphocytes) or factors (e.g. immunoglobulin's, interferon). In addition, studies have also shown improved survival of pathogen-infected laboratory animals consuming probiotic cultures as compared to animals consuming a control diet. Thus the present study was conducted to analyze the significant role of Probiotic Health Drink in reducing Blood Glucose and Serum Lipid Levels.

Keywords: Probiotics, *Lactobacillus*, GALT, Blood Glucose and Serum Lipid Levels.

INTRODUCTION

The prevalence of increased total blood cholesterol in the developed and developing nations remains high and has increased in adults, children and adolescents. Hypertension is often associated with hypercholesterolemia or lipid abnormality and obesity¹. Patients with hypertension also frequently have low levels of high-density lipoprotein (HDL) cholesterol and higher levels of triglycerides. In other words, hypertension occurs more frequently for hypercholesterolemic subjects, as compared to normolipid men and women². The elevation of blood pressure has been found to be greatly induced when total cholesterol level exceeds 6.4 mmol/L. This may increase cardiac output and peripheral vascular resistance that causes an elevated blood pressure³. Therefore, lipid metabolism disorders are often the causes of hypertension. A variety of past *in vitro* experiments and *in vivo* trials have provided experimental evidence to support the roles of probiotics in lowering serum cholesterol and improving lipid

profiles, which subsequently leads to a reduced risk of hypertension^{4,5}.

Diabetes and hypertension are co-morbidity diseases that frequently occur together in the same patients. In a large prospective cohort study conducted by Gress *et al.* that involved 12,550 adults, the development of type II diabetes was almost 2.5 times more likely in those with hypertension than in their normotensive counterparts⁶. Similarly, recent data suggested that hypertension is approximately twice as frequent in patients with diabetes compared with patients without the disease⁷. The occurrence of hypertension tends to be relatively lower in patients with type I diabetes and affects 30% of type I diabetes patients⁸. Both diabetes and high blood pressure are risk factors for the development of macrovascular and microvascular complications. Therefore, rigorous control of blood pressure and glucose are paramount to decrease the morbidity and mortality of hypertensive diabetes individuals⁹. A wide range of antihypertensive drugs is available in the

market but not all offer beneficial effects in hypertensive diabetes. Therefore, the development of new therapy methods is needed in order to produce an efficient method for preventing or reducing the occurrence of diabetes and hypertension with the least side effects.

Hypercholesterolemia and obesity are strongly associated with primary hypertension. The over-activation of the sympathetic nervous system by the action of leptin could alter lipid profiles and increase blood pressure by causing peripheral vasoconstriction and by increasing renal tubular sodium reabsorption¹⁰. Insulin resistance has also been associated with impaired endothelium-dependent Vasodilation which contributes to increased blood pressure¹¹. Insulin resistance could raise blood pressure, either by preventing the vasodilatory effects of the hormone or, via the attendant hyperinsulinemia and by upregulating the sympathetic and the antinatriuretic tone¹². Primary hypertension has also been associated with renin, an acid proteinase generated from the inactive precursor prorenin by the action of kallikrein¹³. It is released whenever depletion of salt or stimulation of β_2 -receptors by aldosterone occurs. Renin plays a role in the renin-angiotensin system by hydrolyzing angiotensinogen to yield the inactive angiotensin I. Angiotensin I is further converted into angiotensin II by angiotensin-converting enzyme. Angiotensin II causes vasodilation and induces the release of aldosterone and therefore increases sodium concentration and elevates blood pressure. Additionally, an imbalanced profile of hormones such as estrogens, progesterone and aldosterone has also been found to induce hypertension. Thus the consumption of probiotics is a new therapeutic strategy in preventing or delaying the onset of

Diabetes and subsequently reducing the incident of Hypertension and Hypercholesterolemia.

SCIENTIFICALLY RESEARCHED HEALTHFUL EFFECTS OF PROBIOTICS

- Control of acute diarrhea - with *Lactobacillus casei* strain Shirota
- Prevention of traveler's diarrhea - via *Saccharomyces boulardii*, and *Bifido bacterium bifidum*
- Reducing high blood pressure & mild hypertension - *Lactobacillus helveticas*
- Immunity enhancement
- Maintenance of Crohn's disease - *S. boulardii*
- Reducing symptoms of IBS
- Treating Vaginitis and Vaginosis - with acidophilus supplements

PROBIOTIC HEALTH DRINK INGREDIENTS

The various health drink ingredients taken for the present study are oats, ragi, maize, jower, wheat, rice, barley, fried gram, soya bean, green gram, cashew nut, ground nut, badam, sago, cardamom, fenugreek seeds and starter culture (Figure 1). Thus this PROBIOTIC HEALTH DRINK is rich in cereals, nutrients and energy. The below given table shows the nutritive value of probiotic health drink taken for the present study (Figure 2 & Table 1).



Figure 1: Lactobacillus (*L. acidophilus*)

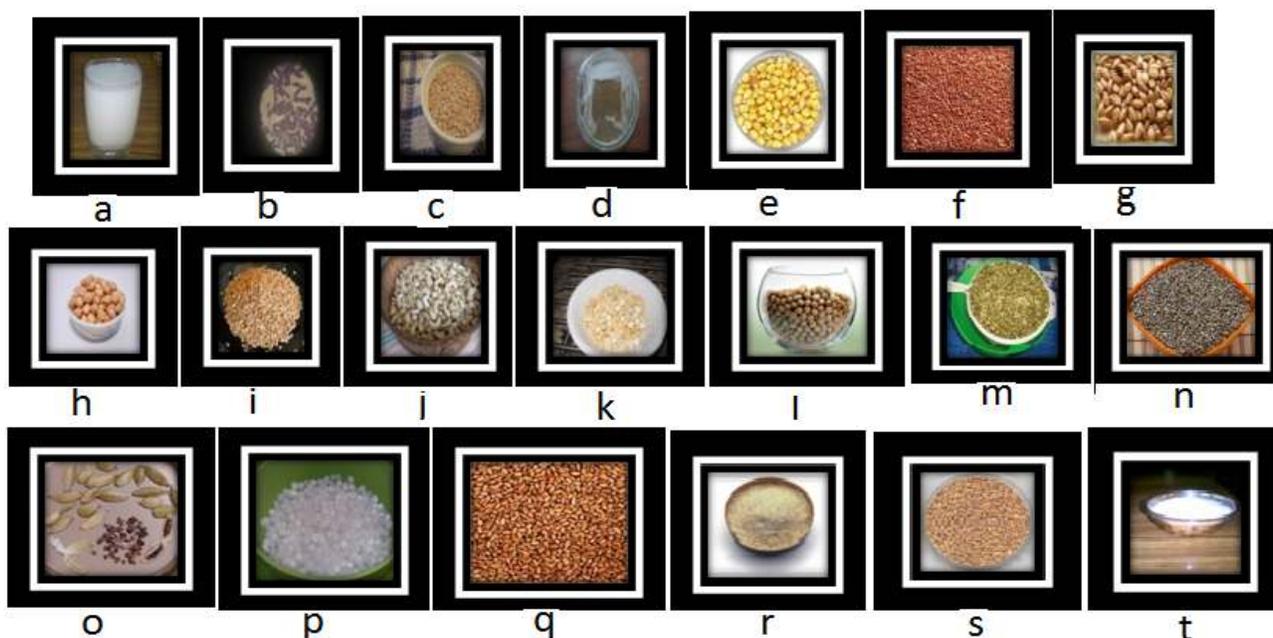


Figure 2: Probiotic Health Drink Ingredients (a-t)

- a: PROBIOTIC DRINK; b: *LACTOBACILLUS*; c: OATS; d: STARTERCULTURE; e: MAIZE; f: RAGI
 g: WHEAT; h: PEANUT; i: FENUGREEK; j: CASHEW NUT; k: FRIED GRAM; l: SOYA BEAN
 m: GREEN GRAM; n: BALJIRA; o: CARDOMOM; p: SAGO; q: JOWER;
 r: RICE s: BARLEY; t: POWDERED FORM

Table 1: Nutritive Value of Probiotic Health Drink

Materials	Values	Materials	Values
1. Energy	314.5 Kilo Calories (Approx)	10. Vitamin A	4.56 Mg/Gm
2. Carbohydrate	43.55 % W/W	11. Iron.	2.959 Mg/Gm
3. Protien	21.6856% W/W	12. Zinc	2.446 Mg/Gm
4. Fat	5.665% W/W	13. Potassium	6.78 Mg/Gm
5. Fibre	1.7867%W/W	14. Magnesium	4.4363 Mg/Gm
6. Vitamin B1	0.0081 Mg/Gm	15. Sodium	120.3mg/Gm
7. Vitamin B2	0.07726 Mg/Gm	16. Ash	1.88% W/W
8. Vitamin B6	0.1303 Mg/Gm	17. Calcium	25.6103 Mg/Gm
9. Vitamin C	29.8819 Mg/Gm	18. Phosphorus	12.11 G/Gm

MATERIALS AND METHODS

The present study aims to determine the effect of supplementation of probiotic health mix on the serum high density lipoprotein, serum low density lipoprotein, serum very low density lipoprotein, serum triglyceride, and blood glucose levels of the subjects. 30 grams of health mix was supplemented for 45 days, it was given daily before breakfast in empty stomach. After 45 days it was found that there was significant reduction in post prandial blood glucose levels and lipid profile levels. This study proposes to investigate whether the Inclusion of the mix before breakfast for the period of 45 days will have any protective effect on glycemia or lipidemia when added and taken with milk. Since the subjects volunteered to participate in the study the information obtained from them was reliable. The subjects consumed the supplement daily for the period of 45 days supplied to them. Soluble dietary fiber and other constituents have been shown to improve the control of blood glucose, serum lipid levels possibly. Studies conducted in previous years have revealed its significant role in reducing blood glucose levels and serum lipid levels.

The sampling method adopted is a purposive sampling method. The supplement was selected since it was known to have a Hypocholesterolemic and weight lowering effect. The present study was designed to determine the hypoglycemic effect and hypolipidemic effect of probiotic health drink on 202 subjects. Information from the subjects was collected. The experimental design selected for this study was a pretest-post test design, where the subjects acted as their own control. A purposive sampling technique was employed to select the subject for this study. 202 subjects were chose for the present study and the duration of the study was 45 days. However there was no restriction on the quantity of food eaten. During this study, non-vegetarian food was also taken by the subjects during specific days. On the first day blood sample was collected from the subjects. Sterile disposable syringes were employed for the drawing of blood from antecubial vein in the arm. 2 ml of blood was drawn from each subject. The estimation of the serum lipids were carried out at Premier Laboratory, Chennai. At the end of 45 days, fasting blood was taken from the same subjects to check the difference in the serum lipid profile and blood glucose level, due to the effect of probiotic supplementations. The serum was procured from the samples; and the blood was analyzed for the following parameters

- Serum total cholesterol
- CHOD-PAP method for LDL analysis by **Allian et. al, 1947**¹⁴
- CHOD-PAP method for HDL analysis by **Allian et al, 1947**
- Triglycerides by GPO-PAP by **Werner et al, 1981**¹⁵

The following parameters were calculated

- **Serum LDL cholesterol**
 - **Serum VLDL cholesterol**
 - **Serum total cholesterol**
- CRITERIA FOR SELECTION OF SAMPLES**
- Subjects of above 40 years of age were selected
 - Subjects who had serum cholesterol and blood glucose above normal levels were selected
 - Subjects who were not on any other hypoglycemic and hypocholesteremic drugs or supplementation were selected
 - The Willingness to co-operate in the study was an important parameter.

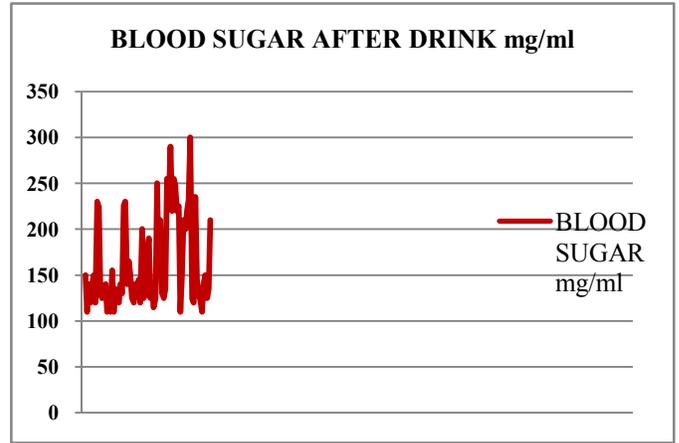
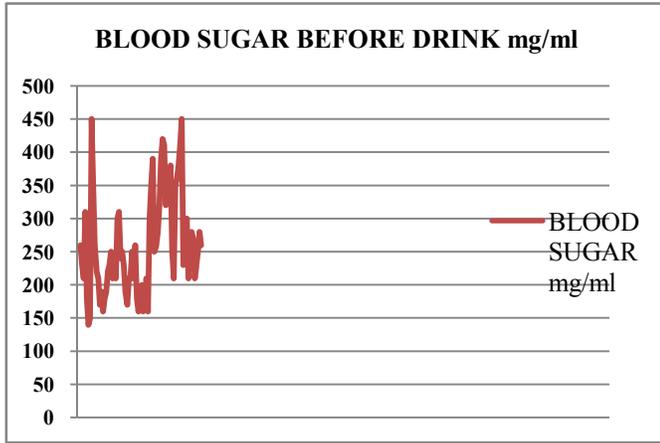
STATISTICAL ANALYSIS

The following statistical methods were employed for the analysis of data obtained

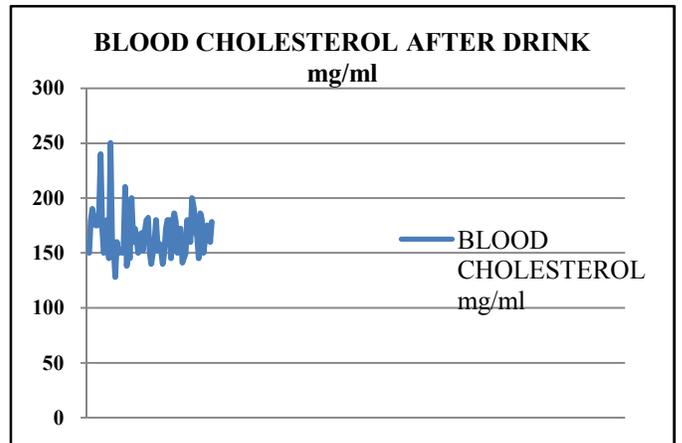
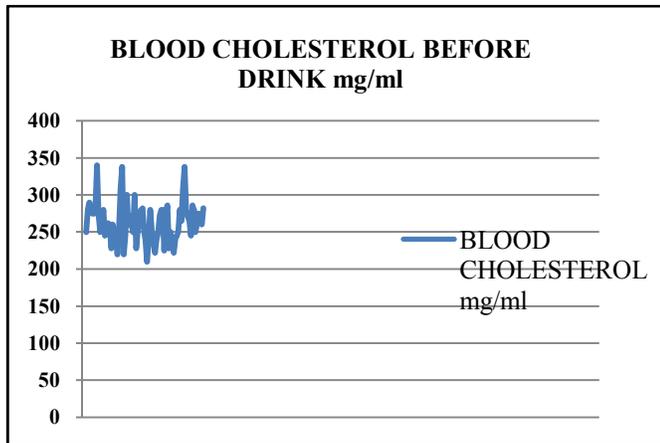
- **Arithmetic mean**
- **Standard deviation**
- **Students 't' test.**

RESULTS AND DISCUSSION

Probiotics are under tremendous research, as the concept holds promise for human health and well-being, and corresponding commercial opportunities. Protection of consumers requires health claims to be confirmed with sufficient scientific evidence. Overall scientific demonstration of probiotic effects requires defining a healthy microbiota and interactions between microbiota and host, and the difficulty to characterize probiotic effectiveness in health and disease. Recent developments of high-throughput sequencing technology and the consequent progresses of metagenomics represent a new approach for the future of probiotics research. Research into the potential health effects of supplemental probiotics has included the molecular biology and genomics of *Lactobacillus* in immune function, cancer, and antibiotic-associated diarrhea, travellers' diarrhea, pediatric diarrhea, inflammatory bowel disease and irritable bowel syndrome. The present study was aimed to determine the effect of supplementation of probiotic health mix on the serum high density lipoprotein, serum low density lipoprotein, serum very low density lipoprotein, serum triglyceride, and blood glucose levels of the subjects. (**Graphs 1 – 4**).



Graphs 1 & 2: Blood sugar level of experimental subjects before and after intake of probiotic health drink



GRAPHS 3 & 4 : Blood cholesterol level of experimental subjects before and after intake of probiotic health drink

STATISTICAL ANALYSIS

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	Bsugar & Asugar	202	.679	.000
Pair 2	Bcholesterol & Acholesterol	202	.204	.004

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Bsugar	222.87	202	68.230	4.801
	Asugar	144.96	202	40.684	2.863
Pair 2	Bcholesterol	261.64	202	27.066	1.904
	Acholesterol	165.87	202	20.857	1.467

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Bsugar – Asugar	77.911	50.414	3.547	70.917	84.905	21.964	201	.000
Pair 2	Bcholesterol - Acholesterol	95.777	30.616	2.154	91.530	100.025	44.461	201	.000

$t(201) = 21.964$, $p = .000$. FROM THE MEANS OF THE BLOOD SUGAR LEVELS and the direction of the t -value, we can conclude that there was a statistically significant REDUCTION IN BLOOD SUGAR LEVELS following THE PROBIOTIC DRINK from 222.87 ± 68.23 ($p = .000$); TO 144.49 ± 40.68 WITH an REDUCTION of 78.38 ± 27.55 .

$t(201) = 44.461$, $p = .000$. FROM THE MEANS OF THE BLOOD CHOLESTEROL LEVELS and the direction of the t -value, we can conclude that there was a statistically significant REDUCTION IN BLOOD CHOLESTEROL LEVELS following THE PROBIOTIC DRINK from 261.64 ± 27.05 ($p = .000$); TO 165.87 ± 20.857 WITH an REDUCTION of 95.77 ± 6.193 .

CONCLUSION

Probiotic organisms have wide range of health effects on the human body and these include

- Lowering cholesterol
- Lowering blood glucose
- Active against diarrhea
- Reducing inflammation
- Preventing harmful bacterial growth

Yogurt is a fermented food product in which *lactobacillus* is the major organism. Regular intake of yogurt can lead to increase in *lactobacillus* which can also be done on a large scale. From this study we can conclude that probiotic health drink which contains cereals have considerable effect on blood glucose and serum lipid profile. Cereals are most economic source of energy. They provide about 30 percent of total calories eaten in the West; however this figure rises dramatically in parts of rural Asia, Africa, and India where cereals supply 70 to 80% of energy requirements. Since cereals are the cheapest widely available source of energy their contribution in energy intake is highest among poor income families as all cereals are rich in starch and provides energy and heat. They provide both soluble and insoluble fibre such as pectin, cellulose and hemicelluloses which are mostly present in the pericarp and bran etc. and help to improve peristalsis in the intestine and bulk to the stools. Hence from the present study we can conclude that this probiotic health drink which contains a mixture of nearly 17 natural ingredients has a remarkable effect on blood glucose and serum lipid profile.

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Source of support: Nil, Conflict of interest: None Declared