

# **PREPARATION AND EVALUATION OF LOW COST DIET DRINK**

**Dissertation Report**

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## CERTIFICATE

This is to certify that Miss. Shareen Banga has personally completed M.Sc. dissertation entitled, “**Preparation and Evaluation of low cost diet 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 in any University.

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

Signature of Supervisor

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## **DECLARATION**

I hereby declare that the work presented in the dissertation report entitled “**PREPARATION AND EVALUATION OF LOW COST DIET DRINK**” is my own and original.

The work has been carried out by me at the School of Agriculture, Lovely Professional University, Phagwara, Punjab, India under the guidance of **Dr. Vikas Chopra**, 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 Nutrition and Dietetics.

**Date : 11.05.2018**

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

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## **INTRODUCTION**

Diet Drinks (DDs) are the non-alcoholic and carbonated beverages which have been popularized as health drinks among many population groups such as athletes, diabetics, people who want to lose weight, improve physical fitness and other health conscious people.

The first Diet Drink was introduced in 1952 and it prominently grabbed the attention of youth. The chief ingredients of diet drinks are caffeine, sugar, artificial sweeteners, vitamins, minerals, amino acids, and certain herbs like ginseng, guarana etc. A wide variety of Diet Drinks are available in the market such as Diet Rite Cola, Diet Mountain dew, Sprite zero, Powerade zero, Diet Snapple and Zero calorie Fruit punch drink. These are advertised globally in order to attract the consumers especially the adolescents and adults. Marketing has been particularly directed towards teenagers, with manufacturers sponsoring or advertising at extreme sports events and music concerts, and targeting a youthful audience through social media channels. Switching from sugary drinks to diet drinks promotes short term weight loss, it is unclear whether continuing consumption leads to weight loss, weight maintenance or weight gain. At the same time it also pose some health risks including dehydration, caffeine intoxication and others. Due to this, different health policies have been formulated by the regulatory bodies of the respective countries regarding the composition, labelling, distribution and sale of Diet drinks. Therefore, it is the need of the present hour to make the general public aware regarding the consequences of consuming these drinks either positive or negative.

## **PROBLEM BACKGROUND**

Diet drink is a type of beverage containing caffeine which acts as a stimulant. They may or may not be carbonated and may also contain sugar or other sweeteners such as aspartame, acesulfame, stevia, herbal extracts, taurine and amino acids. The drinks are marketed for their role in provide health and other weight maintenance benefits. Till date very few diet drinks have been prepared using either fruit or vegetable blends or herbs, fruits and vegetables are sources of many essential nutrients including vitamins, minerals, dietary fiber and certain bioactive compounds. They promote overall health of an individual by lowering the risk of heart diseases. And also tea is an evergreen shrub and its consumption is beneficial to health owing to its antioxidant, flavonols, flavonoids, polyphenols and cathakine content. Tea cathakine has been known to have anti-inflammatory and neuroprotective activities. Thus, the highly nutritious properties of fruits and tea make its incorporation a unique aspect in the food industry that will be beneficial for people. But much work has not been done to develop a health promoting diet drink by making use of tea extracts. So, the development of diet drink using tea extract and fruit and vegetable blends would be beneficial for promoting health as it is helpful in diseases condition. Therefore, the prime objective of this research is to develop a diet drink that has functional properties and is beneficial for promoting the health of consumers.

## **RESEARCH OBJECTIVES**

To conduct a survey to determine the trend of consumption of Diet Drink among adolescents at University level by developing a questionnaire.

1. Development of Diet drinks using different factors.
  - a) Tea (Black tea, Green tea, Herbal tea) + Blending with fruits and vegetables + Blending with herbs
  - b) Compare with the standard Diet drinks
2. Shelf life estimation of the developed product.
3. Application and evaluation of the product.

## REVIEW OF LITERATURE

### **Introduction**

Diet drinks are calorie free and low calorie versions of sodas, sports drinks, energy drinks, carbonated water, fruit drinks, low calorie flavored waters, and do not include 100% fruit juices or unsweetened tea or coffee.

In the recent past, Diet beverages ( DBs ) fairly a new class of beverage, under the brand name diet refreshment, was first introduced in 1952, is rapidly becoming a prominent part of partying subculture among all age groups. These drinks have been popularized as health drinks among many population groups such as athletes, diabetics, people who want to lose weight, improve physical fitness and other health conscious people. DBs, the non-alcoholic functional beverages comprise of caffeine, sucralose, cyclamates, saccharin, acesulfame potassium, aspartame, phosphoric acid and citric acid, stevia, erythritol as chief components and mainly act as stimulants. Numerous DBs such as diet coke, diet coke-caffeine free, zero coke, diet pepsi, diet mountain dew, diet rite, pepsi next, sprite zero, diet soda, tab , low calorie sports drink such as Gatorade, artificially sweetened flavor waters such as Sobe and lifewater contains zero calories and zero sugar, (Foreyt et al., 2012; Fowler et al., 2008). are popular in the Indian market as low calorie drinks and dietary supplements. These sweetened drinks are generally served cold and contain high levels of caffeine and other artificial sweeteners, which based on dosage has been known to be beneficial as well as harmful. Diet drinks/beverages and sports drinks are confused to be alike however, owing to the fact that the latter are devoid of any kind of stimulants they are class apart (Dennis et al 2009.: Malik et al. 2013) but evidence that using LCs results in weight loss has been limited (Shankar et al 2013). But the ingestion of these drinks over a course of time can pose multiple deleterious effects including behavioural changes, also the chief ingredient of DBs i.e, caffeine a known diuretic , leads to increased fluid loss from the body in the form of urine when taken in excess amount, caffeine intoxication which in



turn causes heart palpitations, elevated blood pressure, nausea, vomiting, convulsions which under certain circumstances can even prove to be lethal and life threatening. Diet beverages contain a component called aspartame which is known to cause brain damage because of its component called phenylalanine in people with disorder phenylketonuria.

### **Consumption Pattern**

Diet drinks have continued to gain admiration and the consumption rate has also increased from 1999-2000, the percentage of consuming diet drinks increased from 17.8% to 21.2% for females and from 13.9% to 19.0% for males in United States. As compared to previous years, 17% hike was observed in the consumption of DDs globally in the year 2006. The percentage of people who consumed diet drinks was about 20% during 2009-2010, among the all the highest consumption of diet drinks was in age group 12-19 (adolescents). . A survey conducted by Nancy D. brener and Caitlin Merlo among 11,429 respondents of District of Columbia, U.S showed the prevalence of consumption of these beverages like 100% fruit juices, regular soda or pop, regular sports drink, energy drinks, other SSB coffee, low calorie drinks during 7 days among different age groups i.e., adults, adolescents and children. Fruit drink consumption is associated with overweight in preschool children and may lead to obesity as children grow older (Sanigorski et al; 2007; lim et al., 2009). Low calorie flavored waters sweetened with erythritol and stevia, support the effectiveness of artificially sweetened flavored waters, as well as other artificially sweetened beverages is lacking, and some studies with adults and children show that non-nutritive sweeteners may alter hunger-signaling pathways and encourage compensatory energy intake (Foreyt et al., 2012; Fowler et al., 2008).

**Table 1.**Surveys to determine the trends of Diet drink consumption.

S.no.	Country/ university	Total no. of participants	Remarks/ Significant findings	Author
1.	United States, US department of Agriculture	285	<ul style="list-style-type: none"> <li>• 22.6% of the participants consumed low calorie drinks, low calorie energy drinks and diet sports drink per serving for the reasons that will help control energy intake and promote weight control.</li> <li>• 6.3 % of the participants consumed Calorie-free drinks.</li> </ul>	Maurissa S ( 2014)
2.	United States 2009-2010	1050	<ul style="list-style-type: none"> <li>• 18.3% of children and adolescents consumed diet drinks, and 11.5% out of them were not the regular consumers.</li> </ul>	CDC/NCHS, National Health and Nutrition Examination Survey, 2009-2010.
3.	University of surrey, Guildford, UK	1590	<ul style="list-style-type: none"> <li>• Adolescents and adult aged 19-64 years of age.</li> <li>• The different measures were estimated including</li> </ul>	M.Stephen.,(2016)

			<p>prevalence, excessive daily use as well as the perspective of use.</p> <ul style="list-style-type: none"> <li>• 32% of the adults consumed low calorie beverages over several weeks and months which resulted in modest weight loss.</li> <li>• 19% of children consumed low calorie beverages for the reason it satisfies both thirst and an innate desire for sweetness.</li> </ul>	
4.	UNC-Chapel Hill, North Carolina.	318	<ul style="list-style-type: none"> <li>• 84% of the female participants substituted non caloric beverages (water or DBs) for caloric beverages.</li> <li>• Replacement of caloric beverages with non caloric beverages as a weight loss strategy resulted in average weight loss of 2% to 2.5%.</li> </ul>	Tate et al;2012.

5.	School of Psychology, University of Birmingham, London	125	<ul style="list-style-type: none"> <li>• The survey was carried out during the University's open days.</li> <li>• Most of the respondents i.e 33% of participants consumed more diet drinks .</li> <li>• Women were more likely to choose a low calorie drink than men (6%).</li> <li>• 25% of the females and 58% of the males did not approve the use of DDs</li> </ul>	Freeman.,(2008)
6.	Balearic Island, Spain	415	<ul style="list-style-type: none"> <li>• The survey was conducted to determine the consumption pattern of DBs by the students along with its associated health risks.</li> <li>• 2.3% of the adolescent boys and 0.8% of the adolescent girls were more likely to consume diet soda for good physical activity</li> </ul>	Josep A. Tur., (2016)

			<p>performance.</p> <ul style="list-style-type: none"> <li>• Reasons behind DD consumption were to decrease dehydration, heart rate and cardiac strain.</li> <li>• 60% of the boys, and 30% of the girls were more likely to consume diet soda during the cold season than in warm season.</li> </ul>	
7.	National Institute of Health Clinical Centre, Bethesda, Maryland.	61	<ul style="list-style-type: none"> <li>• The prevalence as well as frequency of DD consumption was determined according to the gender, degree programs and social condition.</li> <li>• It was found that 31% of the respondents consumed diet drinks at least once daily, less than one daily but atleast once per month.</li> <li>• Reasons behind consuming DD were energy, satiety,</li> </ul>	Sylvetsky et al., (2016)

			<p>hunger and palatability.</p> <ul style="list-style-type: none"> <li>• Side effects linked were Type 2 diabetes (4.6%) and fatty liver disease ( 2.4%).</li> <li>• 40% of the female respondents never consumed any DB.</li> </ul>	
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### Major components of Diet drink

The main active ingredients of DDs are caffeine, taurine, guarana, ginseng and artificial sweeteners. Most of the drinks contain nearly 80 mg of caffeine per serving, equalling almost eight ounce of coffee, whereas some may even supply approximately 200 mg caffeine per serving (Reid et al., 2017)

Another important component of DDs is sugar, but due to the fear of weight gain from its excess consumption, most of the DDs are sweetened with artificial sweeteners such as aspartame and acesulfame potassium (Anonymous, 2015).

Another important component of diet drink is Stevia ( *Stevia Rabaudiana* ) is a small shrub native to the region of South America is a naturally sourced plant based high intensity sweetener that dos not impact blood glucose levels (Goyal et al.,2010) which is known to reduce the calorie intake and is helpful in weight loss management.(Fatima,2018). It is also known to offer some therapeutic benefits as they have anti-diabetic, anti-hypertensive and anti-inflammatory properties (Chatsudthipong & Muanprasat 2009).

**Table 2.** General composition of DDs

Nutrient	Range	
	Non-fruit based DD	Fruit based DD
Calories	0-89 Kcal	0-50 Kcal
Carbohydrates	0 – 38 g	32 – 46 g
Caffeine	35-90 mg	50-80 mg
Protein	0 g	0 – 0.3 g
Sugar	-	0-13 g
Fats	0.0 g	0.0 g
Sodium	18-52 mg	75-140 mg
Potassium	0-4 mg	4-7 mg
Vitamin B2	-	0.1-0.2 mg
Vitamin B3	-	0.0-0.08 mg

Vitamin B5	-	0.0-0.1 mg
Vitamin B6	-	1.9-4.9 mg
Vitamin B12	-	NA

Stevia extract	Not present	May or may not be present
Phosphorous	4-52 mg	12- 24 mg

Source ; , Temple et al.;2017 , Toscano et al., 2015 , Diamantini et al., 2015 , Trombold et al., 2011, ,

Seifert et al., 2011 N.J.



**Table 3.**Composition of various brands of EDs

Brand of DB Serving	Calories (kcal)	Sugar (g)	Caffeine (mg)	Potassium (mg)	Vitamin B2	Vitamin B3	Vitamin B5	Stevia extract	Phosphorous (mg)	Sodium (g)	CHO(g)	Protein (g)	Fat (g)
Diet Coke (per 8 oz)	<1	0	31	18	-	-	-	Absent	27	30	0	0	0
(per 12 oz)	110		46.3										
Coke Zero (per 8 oz)	2	0	23	47	-	-	-	Absent	54	27	0	0	0
(per 12 oz)			35.8										
Diet Mountain Dew (per 8 oz)	<1	0	36	63	-	-	-	Absent	<1	35	0	0	0
(per 12 oz)			55.2										
Diet Pepsi (per 12 oz)	<1	0	36.7	25	-	-	-	Absent	33	25	0	0	0
Diet Dr. Pepper (per 12 oz)	<1	0	44.1	<1	-	-	-	Absent	50	35	0	0	0
Sprite Zero	3.6	0	0	110	-	-	-	Absent	<1	46	0	0	0
Diet Soda	0	0	0	25				Absent	0	28	0.84	0.39	0.07

Brands of DB	Calories (Kcal)	Sugar (g)	Caffeine (mg)	Potassium (mg)	Vitamin B2(mg)	Vitamin B3(mg)	Vitamin B5(mg)	Stevia extract	Phosphorus (mg)	Sodium (gm0)	CHO(g)	Protein (g)	Fat (g)
Glaceau Vitamin water : Multi V Zero	1.5	0		140	-	20	10	Present	0	0	13	0	0
Powerade Zero(per 12 oz)	1	0	120	350	150%	150%	150%		0	40	0.13	0	0
Diet Snapple	10	0	0	0	-	-	-		0	16	1	0	0
Celsius	5.0	0	200	0	0%	100%	0%		0	6.0	0	0	0
Zevia (Zero Calorie Soda) per 12 oz	0	0	45					Present	0	0	0	0	0
Cascade	2								0	3	0	0	0
Sunrype Slim	10	1		14					0	19	8	0	0
Zero Calorie Fruit Punch	0	0	0	0	20%	20%	20%	Present	0	30	0	0	0
Sodastream diet energy drink	0	0	0	80	35.0	30.0		Present	0	45	3	0	0
AMP Energy drinksugarfree	10	0	72	4.8	0.3408	1.9992	1.0008		40.8	150	2.472	0	0

Source : Popkin et al.,2006, USDA National Nutrient Database for Standard Reference , 2015

## Beneficial and harmful effects of EDs

**Table 4.** Positive effects of DDs on human health.

S.No.	Component of Diet drink	Positive health effects	Authors (year)
1.	Ginseng	<ul style="list-style-type: none"> <li>• It helps to prevent certain types of cancer as well as inhibit tumor growth and metastasis.</li> <li>• It is known to reduce blood glucose and prevent development of type 2 diabetes.</li> <li>• It has a positive health effect on memory and neurodegeneration by reducing cell death and facilitating the formation and retrieval of memory.</li> <li>• Possibly effective for the prevention of cold and flu symptoms.</li> </ul>	<p>(Wee, Park, &amp; Chung, 2011)</p> <p>Clauson et al (2008)</p> <p>,</p> <p>Park et al (2014) ,</p> <p>Kim et al (2017).</p>
2.	Guarana	<ul style="list-style-type: none"> <li>• Guarana helps improve cognitive performance, mental fatigue and mood at physiologically relevant doses.</li> <li>• It is known to provide antioxidant properties and contain flavonoids</li> </ul>	Esther et al.2018

		which can reduce blood platelet aggregation.	
3.	Caffeine	<ul style="list-style-type: none"> <li>• Caffeine acts as psychostimulant in brain, enhances attention, causes alertness, improves memory and increases the ability to process degraded stimuli.</li> <li>• Daily caffeine intake lowers the risk of neurodegenerative diseases like Parkinson's disease.</li> <li>• Caffeine consumption has been linked to show beneficial effects on body even in people with hypertension.</li> <li>• It is primarily used as a stimulant in fatigue and somnolence.</li> </ul>	<p>Persad,2011.</p> <p>Fredholum 2011.</p> <p>CanoMarquinaa et al., 2013.</p> <p>Fredholum 2011.</p>
4.	Stevia	<ul style="list-style-type: none"> <li>• It has been linked to have increasingly anti diabetic, antihypertensive and antioxidant effects could have beneficial impact in metabolic syndrome.</li> <li>• Stevioside , one of the stevia glycosides is</li> </ul>	<p>A.Talevi;2018</p> <p>Ghanta et al; 2007</p>

		<p>particularly beneficial to those suffering from diabetes, obesity, heart disease and dental caries.</p> <ul style="list-style-type: none"> <li>• It is also known to offer some therapeutic benefits as they have anti-hyperglycemic, anti-hypertensive, anti-inflammatory, anti-tumor, anti-diarrhoeal and anti-diuretic effects.</li> <li>• It is used in liver diseases, stomach aches, gastric hyperacidity, and as a mild agent stimulating the nervous system.</li> <li>• It is known to have anticancer and antineoplastic properties.</li> <li>• Stevia is known to reduce the calorie intake and therefore is helpful in weight loss management.</li> <li>• Stevia helps prevent cavities and dental plaque when combined with fluorine.</li> </ul>	<p>Chatsudthipong &amp; Muanprasat, 2009.</p> <p>Atteh et al 2011.</p> <p>Kedari 2014, Mann et al;2014.</p> <p>Fatima.2018.</p> <p>Das et al. 2018.</p>
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5.	Taurine	<ul style="list-style-type: none"> <li>• High levels of taurine may be protective against coronary heart diseases.</li> <li>• It has the ability to conjugate bile acids, regulates blood pressure and acts as anti-inflammatory agent.</li> <li>• It helps to lower B.P</li> <li>• It has been shown to increase capacity or physical performance.</li> <li>• It has its role in neuro modulation of CNS, development of retina.</li> <li>• It promotes proper development of body, hence used as supplement in infant formula.</li> <li>• It has its role in treating diabetes, seizures, and hepatitis.</li> </ul>	<p>Wójcik et al.2010</p> <p>Seifert et al. 2011.</p> <p>Higgins et al. 2010.</p> <p>Rotstein et al; 2013</p> <p>Chen et al. 2016</p>
6.	Sugar	<ul style="list-style-type: none"> <li>• High consumption of sugar causes weight gain and can also lead to diabetes mellitus type 2.</li> <li>• It is associated with increasing the capacity</li> </ul>	<p>Depkes RI, 2014</p> <p>R.Murray 2014.</p>

		during vigorous exercise.	
7.	Sodium	<ul style="list-style-type: none"> <li>• Sodium intake is linked to accelerate the cardiovascular and thermoregulatory adaptations.</li> <li>• It also improves performance, endurance and exercise.</li> <li>• Ingestion of sodium fluids maintains circulation vasopressin levels and prevents the diuretic effects.</li> <li>• It stimulates thirst.</li> <li>• Helps maintain physiological homeostatis.</li> </ul>	<p>Luetkemeier et al.</p> <p>Leiper.2007</p> <p>Snell et al. 2010.</p>
8.	Potassium	<ul style="list-style-type: none"> <li>• Helps in reducing the risk of stroke, hypertension, and cardiac arrhythmias.</li> <li>• Helps in lowering B.P.</li> <li>• Plays a key role in skeletal and smooth muscle contraction.</li> <li>• It has a role in treating age-related bone loss and reduction in kidney</li> </ul>	<p>Lobo et al. 2017</p> <p>Maleki et al.2016</p> <p>Murray 2013</p> <p>Weaver 2013</p>

		stones.	
9.	B-Vitamins	<ul style="list-style-type: none"> <li>• Vitamin B1 and B2 serves as a coenzyme in carbohydrate metabolism. It is required for the normal body functioning.</li> <li>• Vitamin B3 converts fats, carbohydrates and starches into energy.</li> <li>• B3 stimulates the production of certain neurotransmitters such as dopamine, serotonin and norepinephrine.</li> <li>• Vitamin B5 has its role in fatty acid oxidation.</li> <li>• Vitamin B6 is required for DNA synthesis and production of amino acids. Its deficiency may lead to skin lesions, photosensitivity and gastrointestinal symptoms like nausea and heartburn.</li> <li>• B7 is involved in fatty acid oxidation and gluconeogenesis.</li> </ul>	<p>Higgins et al 2010.</p> <p>Matinuzzi et al 2012.</p> <p>Higgins et al.2010</p> <p>Higgins et al.2010</p> <p>Higgins et al.2010</p> <p>Matinuzzi et al. 2012.</p> <p>Higgins et al 2010.</p> <p>Matinuzzi et al.2012</p>



		<ul style="list-style-type: none"> <li>• Vitamin B12 prevents anemia by forming red blood cells.</li> </ul>	
10.	Ascorbic acid	<ul style="list-style-type: none"> <li>• It is essential for collagen, carnitine and neurotransmitters biosynthesis.</li> <li>• It acts as an antioxidant, anti-atherogenic, anti-carcinogenic, immunomodulator and prevents cold.</li> </ul>	Naidu 2003. Naidu 2003.
		<ul style="list-style-type: none"> <li>• Vitamin C reduces skin damage , wrinkles by soaking up harmful free radicals.</li> </ul>	L.Badole.2012 Zanwar.2012
		<ul style="list-style-type: none"> <li>• Vitamin C is an effective depigmenting agent and is known to inhibit synthesis of melanin.</li> </ul>	Saini2012.
		<ul style="list-style-type: none"> <li>• Vitamin C promotes wound healing, controls inflammation and reduces erythema.</li> </ul>	

**Table 5.** Adverse effects of DDs on human health.

S.No.	Component of diet drink	Adverse effects	Author (year)
1.	Ginseng	<ul style="list-style-type: none"> <li>• Ginseng consumption has to linked with alleviated menstrual irregularity,</li> </ul>	Yang et al.2014

		menstrual pain and constipation.	
		<ul style="list-style-type: none"> <li>• Overconsumption of ginseng may lead to elevated blood pressure, nervousness, insomnia, skin eruptions, headaches, vomiting, oedema and diarrhea.</li> </ul>	Yang et al.2014
		<ul style="list-style-type: none"> <li>• Other adverse effects are mastalgia, cerebral arthritis, vaginal bleeding and Stevens- Johnson syndrome.</li> </ul>	Yang et al 2014.
2.	Guarana	<ul style="list-style-type: none"> <li>• It causes low birth weight, birth defects as well as mutagenic effects.</li> <li>• It also causes insomnia, nervousness, restlessness, angina, anxiety, dysrhythmia, tachycardia, and stomach upset.</li> <li>• It may inhibit platelet aggregation.</li> </ul>	Emst 2002 , Clauson et al.2008  Heneman and Cherr 2007  Clauson et al 2008.
3.	Caffeine	<ul style="list-style-type: none"> <li>• Caffeine intake is associated to cause sperm DNA damage may negatively effect male reproductive system.</li> <li>• As a diuretic, caffeine causes the kidney to remove extra fluid from your body leading to</li> </ul>	Ricci et al.2017  Kumar et al.2017.

		<p>dehydration.</p> <ul style="list-style-type: none"><li>• Increased level of caffeine can be dangerous for people with increased B.P.</li><li>• As a stimulant, caffeine can make you suffer anxiety attacks, palpitations and insomnia.</li><li>• Caffeine toxicity can cause vomiting, abdominal pain, and CNS symptoms like agitation, alerted state of consciousness, muscle rigidity and at time seizures.</li><li>• Common features include nervousness, anxiety, psychomotor agitation and in rare cases, death.</li><li>• The symptoms of caffeine toxicity can mimic those of anxiety and other mood disorders.</li></ul>	
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4.	Sugar	<ul style="list-style-type: none"> <li>• Excessive consumption of sugar may lead to hypercholesterolemia, weakened immunity, hyperactivity, anxiety, hypoglycemia, hypertension, difficulty concentrating and impaired DNA structure.</li> <li>• Overconsumption is also linked to high risk of obesity and insulin resistance resulting into diabetes.</li> </ul>	<p>Matinuzzi et al 2012</p> <p>Higgins et al 2010, Breda et al 2014.</p>
5.	Taurine	<ul style="list-style-type: none"> <li>• Taurine has been shown to worsen hypoglycemia.</li> <li>• Consumption of taurine by patients with chronic renal haemodialysis leads to severe dizziness.</li> </ul>	<p>Akinmolusun et al.2012</p>
6.	B-Vitamins	<ul style="list-style-type: none"> <li>• Overconsumption of B3 may lead to stomach upset, dizziness, pain in mouth, irregular heartbeat, increased blood glucose levels, hypotension or allergy.</li> <li>• High intake of vitamin B3 may cause GI disturbances such as occasional diarrhea and water retention.</li> </ul>	<p>Matizunni et al 2012</p> <p>Rotstein et al 2013.</p>

7.	Sodium	<ul style="list-style-type: none"> <li>• Overconsumption of sodium is associated with rising blood pressure in adults, even in children and adolescents.</li> <li>• It is also related to the risk of cardiovascular problems.</li> <li>• High urinary sodium excretion was associated with low BMD(bone mineral density) and osteoporosis in lumbar spine in post-menopausal women.</li> </ul>	Kim et al.2011 Remer 2015.
8.	Potassium	<ul style="list-style-type: none"> <li>• Overconsumption of potassium is associated with gastrointestinal toxicity followed by abdominal pain, nausea, vomiting, diarrhea and ulceration of esophagus.</li> <li>• Individuals with pre-existing renal disease, hyperkalemia , acidosis or insulin deficiency were vulnerable to potassium.</li> <li>• Potassium in sodium chloride substitutes also resulted in chest tightness, shortness of breath and heart failure.</li> </ul>	Aburto et al ;2013.



- 12) How frequently do you consume Diet drink?
- A) Everyday
  - b) Few times a week
  - c) Once a week
  - d) Once a month
  - e) Never
- 14) What type of diet drink you consume or the brand name?
- 15) At what time of the day do you usually consume DD?
- a) Morning
  - b) Evening
  - c) Free time
  - d) Before or after exercise
- 16) What motivates you to consume DDs?

- a) Experiment/ trial
- b) Flavour/ taste
- c) After effects
- d) Packaging
- e) Advertisements
- f) Peer pressure
- g) Fashion
- h) Availability

17) Are you aware of composition of diet drink?

Yes/No

18) How do you feel after consuming diet drink?

- a) Normal
- b) Good
- c) Bad
- d) Overexcited
- e) Tired
- f) Discomfort/ Indigestion
- g) Insomniac
- h) Haven't noticed

19) Did you ever suffer any discomfort after consuming an DD?

Yes/ No

20) Have you experienced any of the side effects out of the following soon after the consumption of DDs?

- a) Anxiety
- b) Insomnia
- c) Frequent urination
- d) Dehydration
- e) Heart palpitations
- f) Diarrhoea/ constipation



**Experiment 2-** Development of Diet drinks using different factors.

Tea (Black tea, Green tea, Herbal tea) + Blending with fruits and vegetables +

Blending with herbs

## **EXPECTED OUTCOMES**

The fruit and vegetable low cost diet drink that is made from various blends of tea extract (Green tea, black tea and herbal tea) will be rich in anti-oxidant and anti-cancer properties. The products made from blend of tea extract have properties to provide protective health benefits to the consumers. As blend of tea extract possesses medicinal properties, thus the product made out with its incorporation will have both functional and nutraceutical properties and will be beneficial in enhancing the health of a consumer. It will have good amount of antioxidants and thus play a vital role in prevention of cancer. Along with its nutraceutical properties it will provide balanced composition of carbohydrates, vitamins and minerals and certain bioactive compounds. With its high antioxidant and bioactive component the product made from blend of fruit, vegetable and various tea extract is expected to have low calories and at the same time it will improve physical performance as it contains caffeine.

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