



EFFECT OF BLACKCURRANT RAISINS ON BLOOD GLUCOSE LEVELS AMONG AGE GROUP 18 TO 24 YEARS OF PARUL UNIVERSITY STUDENTS.

Krushna Rajput¹, Asst. Prof. Gayatri Parma²

Student, PIAS(MSC), Parul University, Vadodara-391760, India, krushnarajput909@gmail.com.

Assistant Professor, Parul institute of applied science (PIAS), Parul University, Vadodara-391760, India.

ABSTRACT :

Blackcurrant's polyphenol profile gives it a number of health-promoting qualities. Recent research has shown that it has therapeutic promise for treating a range of illnesses. Blackcurrants include a variety of bioactives with a range of pharmacological and functional characteristics, such as antioxidant, antibacterial, and anti-inflammatory effects. Blackcurrant (BC) is a popular and highly valued berry fruit. Poland is the top producer of BC in the European Union and the second-largest producer globally, after Russia. Because BC has a

limited shelf life and is not often consumed fresh, the berries are processed into alcoholic drinks, jams, jellies, juices, and freeze-dried goods. The high concentration of bioactive substances (such as vitamin C, anthocyanins, pectins, organic acids, and polyunsaturated fatty acids) in the fruit's seeds accounts for the high nutritional value of BC. The main category of all the polyphenolic chemicals found in BC are called anthocyanins (ANTs). Raisins are dried grapes that are eaten all around the world and include health-promoting ingredients. Both fiber and phytochemicals like phenolic compounds are abundant in them. Objective of the study is to develop recipes incorporated with blackcurrants and to analyze the effect of blackcurrant recipes on the blood-glucose levels. In this research two Blackcurrant recipes were made (Blackcurrant brownie and Blackcurrant Halwa) both the recipes were given to the seven participants age group between 18-24 years. The recipes were incorporated to the participants at 15 minutes, 45 minutes and 1 hour 45 minutes interval. Moreover t-test, Chi-square test and Correlation were carried out to find significant association between the Sugar recipe and Blackcurrant recipe on blood-glucose level. The results obtained for the above mentioned test were more than 0.05 which means null hypothesis will be accepted that there is no significant association between blackcurrant raisins and blood-glucose levels. From the above results obtained it can be concluded that we fail to accept alternate hypothesis that there is significant association between blackcurrant raisins and blood-glucose levels.

1. Introduction:

Dried grapes known as blackcurrant raisins are eaten all for the duration of the arena. Their predominant aspect is a number of *Vitis vinifera* L. The form of raisin is determined by means of the grape's size, coloration, and range. Black raisins are the maximum widely fed on kind, and they may be usually prepared from Thompson seedless grapes. Muscats are normally prepared from white Muscat grapes, that are regularly known as golden raisins. Sultanas are fashioned from yellow grapes without seeds and are typically softer and sweeter than different varieties. Zante currants, on occasion called Corinthian raisins due to their smaller size, are comprised of black Corinth grapes [1]. Because host microorganisms use blackcurrants selectively and because they may be excessive in fibre, they've prebiotic results and are beneficial to health. One sort of fiber produced during the dehydration system that transforms some grape sugars into raisins is referred to as fructan. According to [2], grapes don't have any fructans in any respect, however raisins will have up to eight% of them. In plants, a mixture of or more exclusive fructosyltransferases convert sucrose into fructans. Over 1.9 billion humans have been decided to be obese in 2016, and thirteen% of grown up worldwide population (those over the age of 18) turned into obese, according to body mass index (BMI) measurements. The World Health Organization (WHO) has certain weight problems particularly because the epidemic of the previous few many years. Diabetes mellitus (DM) is a dangerous scientific situation that modifies how the frame makes use of blood glucose. It can be brought on via a deficiency of the anabolic hormone insulin, a loss of sensitivity to insulin in cells, or both. The resulting hyperglycemia interferes with the blood's capacity to metabolize proteins, lipids, and carbohydrates. The aforementioned disruptions may additionally arise from insufficient production of insulin [3] [4]. Diabetes is a normal ailment that influences a extensive portion of the global population. It has prompted a intense public health emergency because of its excessive quotes of morbidity and mortality. It turned into estimated that in 2021, greater than half 100000000 individuals would suffer from diabetes globally. Globally, 783.2 million people are predicted to expand diabetes via 2045. This range will likely hold to rise. Diabetes is one of the global's top 5 most dangerous ailments. Among the primary signs and signs of diabetes encompass accelerated blood sugar, thirst, common urination, blurred vision, hyperphagia, weight reduction, nausea, and vomiting [5]. Another kind of diabetes that is associated with increased fetal maternal problems and glucose intolerance during pregnancy is called gestational diabetes [6].

The blooming plant referred to as blackcurrant, or *Ribes nigrum* L., produces deep pink, bittersweet berries which could grow up to at least one cm in diameter [7]. Berries (pores and skin, flesh, and seeds) and other plant components may additionally have fitness benefits. The culmination are every now and then eaten uncooked and different instances they're processed to create jellies, juices, and jams. Due to its substantial anthocyanin properties and ability, blackcurrant [8], a richly coloured berry local to northern and crucial Europe and northerly Asia, has turn out to be a popular fruit to plant in many US areas. Up till now, the number one goal of studies has been to separate, isolate, and classify anthocyanins and other phenolic chemicals [9]. The darkish red fruit of the blackcurrant, also known as "Blackcurrant *Ribes Nigrum*," is carried by medium-sized woody shrubs. Poland is the primary dealer of blackcurrants; those shrubs thrive better in regions with cooler climates, which are located in northern Europe, northern Asia, and critical Asia. The two essential variables that decide the excellent conditions for blackcurrant production are the temperature of the surroundings and the genetics of the cultivar [10]. Because blackcurrants are high in polyphenolic additives along with anthocyanins and ascorbic acid, they've antioxidant properties. Additionally useful for treating rheumatic ache, blackcurrant has diaphoretic and diuretic qualities. It has been referred to that the presence of polyphenolic chemical substances in blackcurrant contributes to its anti-inflammatory traits. (Raudsepp, 2010). Ninety-eight percentage of blackcurrant's chemical composition is made up of four main anthocyanin types: cyanidin-three-rutinoside, delphinidin-3-glucoside, cyanidin three-rutinoside, and delphinidin-three-glucoside. Additionally, polyunsaturated gamma linolenic acid and nitrile-containing substances which includes nigroamin-5-p-coumarate and nigroamin-5-ferulate are discovered in blackcurrant seeds. Agly-cone is the number one flavonoid determined in blackcurrant species. There become a difference in the percentage of flavanols and kaempferol glycosides from 38% to 75%. [13] [14]. Blood glucose degree studies is essential for a number of motives, which include coping with blood glucose stages in humans with diabetes or at-threat people. These conditions can worsen other continual illnesses like retinopathy, nephropathy, neuropathy, and continual kidney disorder, as well as cardiovascular ailment. By imparting nutritional interventions to healthful men and women, those health problems may be addressed and the disease may be prevented and managed more successfully. Because blackcurrant has a low glycemic index, it could be a easy choice for controlling blood glucose levels. Additionally, it possesses anti-diabetic residences due to the presence of polyphenolic chemical substances referred to as anthocyanins, which also enhance insulin resistance and protect β cells.

2. Review of Literature

2.1 EXPERIMENTAL STUDIES

In Finland, a crossover trial with randomization became conducted on healthful people elderly 25-sixty five who did now not have diabetes or some other continual infection, did no longer smoke, did not have celiac sickness, and so on. There have been four check merchandise: fermented quinoa, candy water, pureed blackcurrant, and blackcurrant product. Participants had been given goods to consume, and the investigators stored track of them. After a ten- to 12-hour night time of fasting, the checks have been administered in the morning. There had been four visits general for the postprandial investigation. Over the route of the trial, the individuals' weight did not alternate. The foregoing method produced the following effects: after ingesting black currant with sugar, 75 g of blackcurrant puree turned into capable of lessen the glycaemic reaction. (Shahidi, 2013) Novel snack item Quinoa supported the reduction in glucose visible with blackcurrant by myself. Only 26 healthy female subjects confirmed those consequences [15]. A mouse model with cardiovascular fibrosis, inflammation, and cardiovascular effects from type 2 diabetes became utilized in an experimental research. The 400 g of black currants that the investigators accrued have been powdered into sixty four g. The mice had been given blackcurrant every day for ten weeks, and the effects have been cited. ANOVA and the check were used for the statistical evaluation. [16] Insulin resistance and cardiovascular dysfunction—metabolic diseases associated with diabetes—have been ameliorated within the mice by means of the Black currant extract. It also decreased cardiovascular fibrosis and cardiac infection. These findings validated that Blackcurrant extract may additionally, either immediately or not directly, enhance blood sugar in diabetes situations and so avoid cardiovascular fibrosis, infection, and the following diabetic coronary heart sickness.

In Japan, a molecular stage experiment the usage of mice was conducted. Amp protein kinase and glucagon-peptide 1 are thought to be the most effective goals for stopping type 2 diabetes. Mice were administered blackcurrant for seven weeks after blackcurrant berries have been accumulated. The glucose C2-check became used to gather and analyze blood samples. Two manner ANOVA changed into used for statistical evaluation, and a students t-check was used to assess the variations in blood glucose concentrations. In kind-2 diabetic mice, anthocyanin- rich black currant dramatically diminished blood glucose tiers and enhanced glucose tolerance. [17]. Another in-vivo research was performed on mice, taking into account the danger of metabolic syndrome as a result of excessive fructose consumption, which influences insulin sensitivity, low HDL stages, dyslipidemia, hypertension, and other situations. In order to create four agencies, 10 male rats per institution, 6 week antique rats were recruited. The low-dose blackcurrant organization acquired 60% fructose combined with a 100 mg/kg of blackcurrant in line with day, at the same time as the control group had an ordinary diet. The high fructose organization acquired a weight-reduction plan that contained 60% fructose. A

variety of blood tests, biochemical estimate techniques, statistical evaluation, and result recording have been accomplished at the side of the experiment. Blackcurrant changed into determined to enhance plasma degrees of triglycerides and HDL after the operation became finished. It additionally lessened insulin resistance and improved glucose tolerance. [18] The motive of the observe was to assess the protective houses of blackcurrant extracts in opposition to the onset of hyperglycemia. Male mice that were 6 weeks old had been used for the complete research. For eight weeks, the mice were given a food regimen together with low fats and excessive-fats items and have been similarly given blackcurrant powder as a complement. After performing the OGTT take a look at and recording the readings, one manner ANOVA changed into used for statistical analysis. After measuring baseline blood glucose ranges, it became observed that the high-fat food regimen institution had appreciably higher ranges at 30, 60, 90, and one hundred twenty minutes after consumption, while the low-fat weight loss program institution supplementing with blackcurrant extract skilled extensively lower blood glucose stages and improved insulin sensitivity. Thus, it could be stated that extracts from blackcurrant powder are related with improved insulin resistance [19]. The reason of the observe became to investigate the hypothesis that, in a dose-established way, beverages containing blackcurrant would lower postprandial glucose concentrations after a meal high in carbohydrates.

The look at blanketed 9 ladies and fourteen men inside the 20–60 age range who were all in desirable fitness. The members' BMI, medical traits, and clinical records were also referred to. In addition to four take a look at beverages with higher concentrations of blackcurrant extract, members additionally had a combined carbohydrate lunch following their drink. The members were advised to abstain from alcohol, caffeine, excessive-fats meals, oily fish, and meals high in polyphenols. After inserting a cannula into 16th forearm, blood changed into drawn. The two-manner ANOVA, SPSS software, and paired t-test have been used for the statistical examine. According to the aforesaid technique, it turned found that a high dose of blackcurrant slowed down the rate at which insulin and plasma glucose concentrations increased over the first thirty minutes. Blackcurrants are responsible for lowering postprandial glucose levels, which may lessen the vascular load of glucose-induced oxidative stress and endothelial dysfunction, according to the results above. [20] To investigate the bioactive capability of blackcurrant pomace in preventing the signs of metabolic syndrome in rats, every other test changed into performed. Forty eight male wister rats were used for the entire trial. There had been six businesses of rats. Corn starch, soy protein isolate, and blackcurrant pomace have been added to the weight loss plan at some stage in the remedy. Caudal vein blood samples had been acquired. Certain organs, along with the liver, kidney, coronary heart, and small gut, had been eliminated following a laparotomy and stored for added studies. Mucosa sample was used to degree the hobby of the enzymes lactase, sucrase, and maltase. Additionally, mixes were treated with microbial enzymes and analytical procedures including centrifugation had been completed. Two-way ANOVA became used within the statistical take a look at to evaluate the effect of the blackcurrant product. The multiple variety take a look at through Duncan changed into used to achieve the imply. Rats fed fructose had been proven to develop metabolic sicknesses such oxidative stress, dyslipidemia, and hyperinsulinemia. Blackcurrant eating turned into related to an boom in antioxidants in the blood and an development inside the blood lipid profile. [21] Another trial the usage of randomized control became carried out on overweight workplace people who took three hundred mg tablets of blackcurrant. After that, blood samples have been taken every 15 mins for the primary hour and every half-hour for the next two. An oral glucose tolerance take a look at became administered, and the results have been referred to. Additional examination of the blood pattern become accomplished with an ELISA take a look at and centrifugation. Statistical evaluation with the traditional trapezoid rule applied. Insulin sensitivity became decided with Matsuda and the homeostatic assessment index. ANOVA become used to assess the time-structured variables, and the t-take a look at changed into used to observe the final variables. According to the process, blackcurrant extract facilitates overweight human beings's publish-prandial glucose levels and overall body insulin sensitivity. [22]. Using Elastica Van Gieson staining, the outcomes of blackcurrant have been evaluated in an experimental research conducted on diabetic mice. The number one intention of the research was to elucidate the fine influences of blackcurrant at the fitness of blood vessels. Histological traits had been applied to evaluate the dosages of blackcurrant. In this observe, a excessive-fats meal supplemented with blackcurrants presented defense against vascular reworking, foam cellular manufacturing, and elastic lamina. The blackcurrant's potential to reduce atherosclerosis turned into the main attention of the entire investigation. Excel model 3.10's bell-curve became used for statistical analysis. Blackcurrant has been determined to have advantageous influences at the degree of lipid abnormalities and vascular fitness. [23]

2.2 Blackcurrants

There are many methods for extracting anthocyanins from blackcurrants. Moreover, it is challenging to assess extraction efficiency across many methods since anthocyanin yield is influenced by a variety of parameters, including varieties and storage duration [24]. (*Ribes nigrum* L.) include a variety of biological substances, including polyphenols, organic acids, polyunsaturated fatty acids, and phenolic acids. [25] Because of its many alleged fitness advantages, such as the capacity to alleviate persistent illnesses related to oxidative pressure, blackcurrants at the moment are considered "high quality end result". Studies have proven the health-selling houses of blackcurrant components, which include immunomodulatory, antimicrobial, and anti-inflammatory properties; they have additionally been related to a discount in cardiovascular illnesses and a drop in low-density lipoprotein tiers [26]. Blackcurrant juice and extract have also been proven to significantly gradual the boom of Ehrlich carcinoma in vivo and to dramatically lower the proliferation of breast, prostate, stomach, intestinal, and colon cancer cells in vitro. [27]

2.3 BC Berries' NUTRITIONAL VALUE

BC berries are wealthy in a number of bioactive and flavorful compounds, consisting of soluble sugars, vitamins, minerals, polyphenols, natural acids, polyunsaturated fatty acids (PUFA), soluble and insoluble dietary fiber, and tannins [28]. The unique flavor of blackcurrant berries is nicely identified; it has a touch of tanginess and sourness [29]. Dark-hued berries contain lots of anthocyanins (ANT) [30]. Because BC berries are a rich supply of sugars, pectin, and unstable compounds, they are processed into a extensive range of products (which include juices, fruit nectars, jams, jellies, alcoholic and non-alcoholic drinks, and dry fruits) [31]. Particularly, plant secondary metabolites with sturdy antioxidant features referred to as polyphenolic chemical substances are in charge. Flavonoids and anthocyanins are the two most significant polyphenols found in BC berries.

3.0 Research Methodology:-

3.1 Specific Objectives of the study:-

- To develop 2 recipes incorporated with blackcurrant raisins.
- To Feed the developed products to the participants between age group 18-24 years.
- To determine blood-glucose reading and carryout statistical analysis.

3.2 Hypothesis

H1- There is significant difference between Blackcurrant Raisins and Blood-glucose levels.

H0- There is no significant difference between Blackcurrant Raisins and Blood-glucose levels.

3.3 The study was carried out in 3 phases.

- PHASE 1- Development of Brownie and Halwa incorporated with Blackcurrant raisins.
- PHASE 2- Feeding of both the recipes to the participants.
- PHASE 3- Determining the blood-glucose reading at different intervals and statistical Analysis

BLACKCURRANT HALWA:-

The recipe was prepared using Blackcurrant Raisins, procurement of Blackcurrant Raisins was done through Farmley.com and other ingredients were procured from general stores.

Preparation of recipes and nutritional compositions are mentioned in the above section.

Nutrition compositions of each ingredient of blackcurrant halwa were determined with the help of NIN, 2019 composition tables. The analysis was carried out based upon serving size of single person. The calorie count of blackcurrant halwa is 135.83 kcal, carbohydrates- 15.25g, proteins-3.97g, Fat- 6.16g the net weight of recipe is 43g. The recipe is easy to make and preparation time is 20-25 minutes.

Significance of each ingredients:-

1. **Blackcurrant Raisins**- They are rich in anthocyanins and other polyphenolic compounds, like flavonoids etc and provide benefits in prevention metabolic disorders, diabetes, cardiovascular diseases etc.
2. **Cashews and Almonds**- Nuts contain mono-unsaturated and poly-unsaturated fats like omega-3-fatty acids which are important for body heart health, cognitive function and weight management.
3. **Khoa**- As like milk it is rich in calcium, vitamin b12 and beneficial for bone health, muscle development etc.
4. **Ghee**- It is beneficial to provide protective effects against inflammation, digestive health when consumed in moderation.

BLACKCURRANT BROWNIE

The recipe was prepared using Blackcurrant Raisins, procurement of Blackcurrant Raisins was done through Farmley.com and other ingredients were procured from general stores.

Preparation of recipes and nutritional compositions are mentioned in the above section.

Nutrition compositions of each ingredient of blackcurrant halwa were determined with the help of NIN, 2019 composition tables. The analysis was carried out based upon serving size of single person. The calorie count of blackcurrant brownie is 131.76 kcal, carbohydrates- 19.35g, proteins-4.17g, Fat- 4.2g the net weight of recipe is 62g. The recipe is easy to make and preparation time is 40-45 minutes.

Significance of each ingredients:-

1. **Blackcurrant Raisins**- They are rich in anthocyanins and other polyphenolic compounds, like flavonoids etc and provide benefits in prevention metabolic disorders, diabetes, cardiovascular diseases etc.
2. **Curd**- It acts as a probiotics, boosts immunity and acts as good aeration to the batter.
3. **Coco powder**- It imparts flavour and dark colour, it is rich in theobromine and other phytonutrients which helps to reduce inflammation.
4. **Wheat Flour**- It provides structure in baking products.
5. **Milk**- It is rich in calcium and imparts browning reactions and gives a soft texture to the product.
6. **Chocolate**- It acts as a flavour and taste.
7. **Ghee**- It is beneficial to provide protective effects against inflammation, digestive health when consumed in moderation.

PHASE 2- Feeding of both the recipes to the participants.

- Data collection- Healthy participants were enrolled for the study. For data collection, blood-glucose reading were taken in four visits. Two study were used to consume reference food (Sugar Recipe) and other two were used to consume standard food (Blackcurrant recipes). The Sample size of the population was n=6, age group between 18-24 years.

- Data collection was done using capillary-blood glucose test using glucometer.
- Participants were given specific amount of sample for consumption, blood-glucose readings were taken on 15 minutes, 45 minutes, and 1 hour 45 minutes interval.

Phase 3- Statistical analysis.

The data was entered into SPSS Software, verified and subjected to statistical analysis. Appropriate segregation of the data was done and the following calculations were performed.

- Chi-square Test
 - Correlation
 - 't' test were used to find out statistical significance between or within groups.
- A result was declared significant only if p- value of any analysis was less than 0.05.

4. Result and Discussions

The whole experimental study was carried out on Parul university students in Vadodara between age group 18-24 years. The Study was conducted in four visits. The study is based on Blackcurrant Raisins, in this study four recipes were developed that are Sugar Halwa, Sugar Halwa, Blackcurrant Halwa and Blackcurrant halwa. Therefore, the recipes were developed and their nutritional composition was calculated based on single serving of recipe the net weight of Blackcurrant halwa is 43 g and the net weight of Blackcurrant Halwa was 62g. The mentioned portion size were given to the 6 participants. Two males and one female consumed sugar halwa and blackcurrant halwa and 2 females and one male consumed sugar Halwa and blackcurrant Halwa of the above mentioned portion size. The whole methodology was carried out using capillary glucose test using glucometer. The above mentioned portion size of the recipes were given to the participants and reading were taking by pricking the finger with the needle at 15 minutes, 45 minutes and 1 hour 45 minutes intervals.

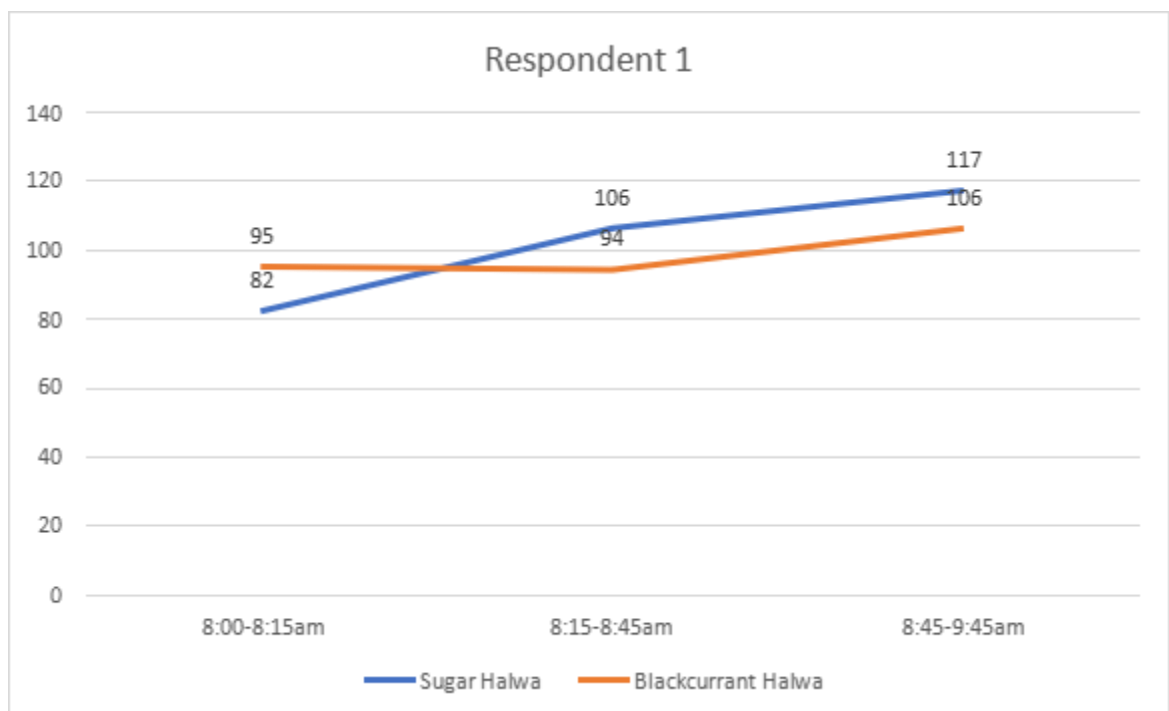


Figure 4.1

This graphical representation states that after consumption of sugar halwa there was spike in blood glucose level, at 15 minutes the readings obtained were 82mg/dl after 45 minutes reading were 106mg/dl and after 1 hour 45 minutes readings obtained were 117mg/dl. Similarly, after consumption of Blackcurrant halwa, readings obtained for 15 minutes were 95mg/dl, after 45 minutes 94mg/dl and after 1 hour 45 minutes 106mg/dl.

From the above readings the after consumption of sugar halwa there was significant spike in blood-glucose levels by 35mg/dl and after consumption of blackcurrant halwa there was spike in blood glucose levels by 13mg/dl.

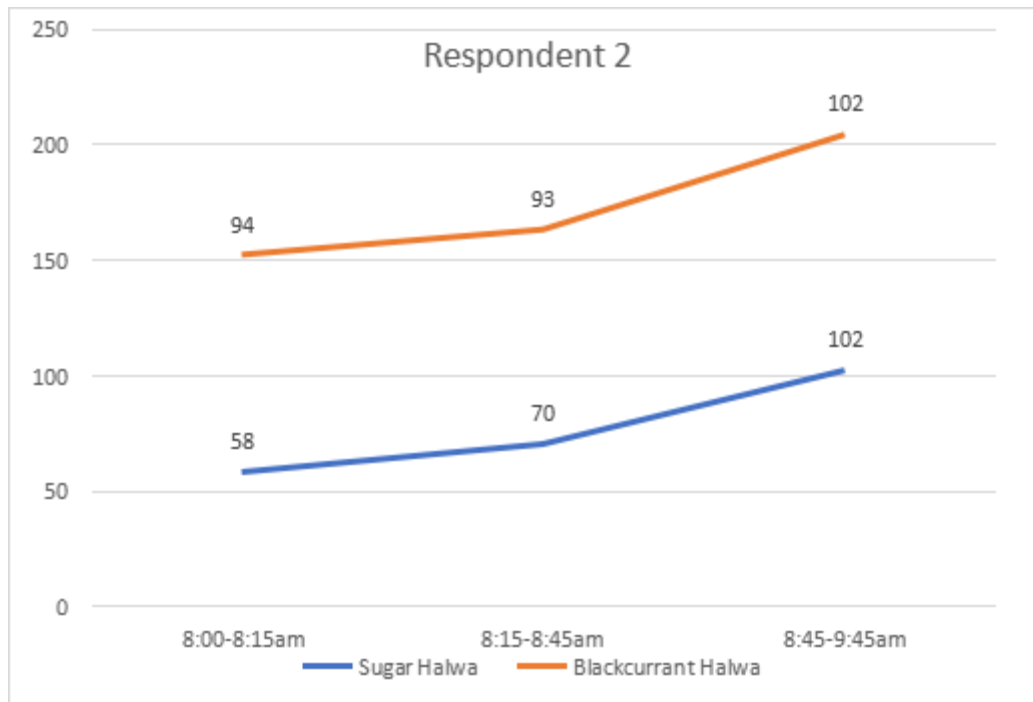


Figure- 4.2

This graphical representation states that after consumption of sugar halwa there was spike in blood glucose level, at 15 minutes the readings obtained were 58 mg/dl after 45 minutes reading were 70mg/dl and after 1 hour 45 minutes readings obtained were 102mg/dl.

Similarly, after consumption of Blackcurrant halwa, readings obtained for 15 minutes were 94mg/dl, after 45 minutes were 93mg/dl and after 1 hour 45 minutes were 102mg/dl.

From the above readings the after consumption of sugar halwa there was significant spike in blood-glucose levels by 42mg/dl and after consumption of blackcurrant halwa there was spike in blood glucose levels by 10mg/dl.

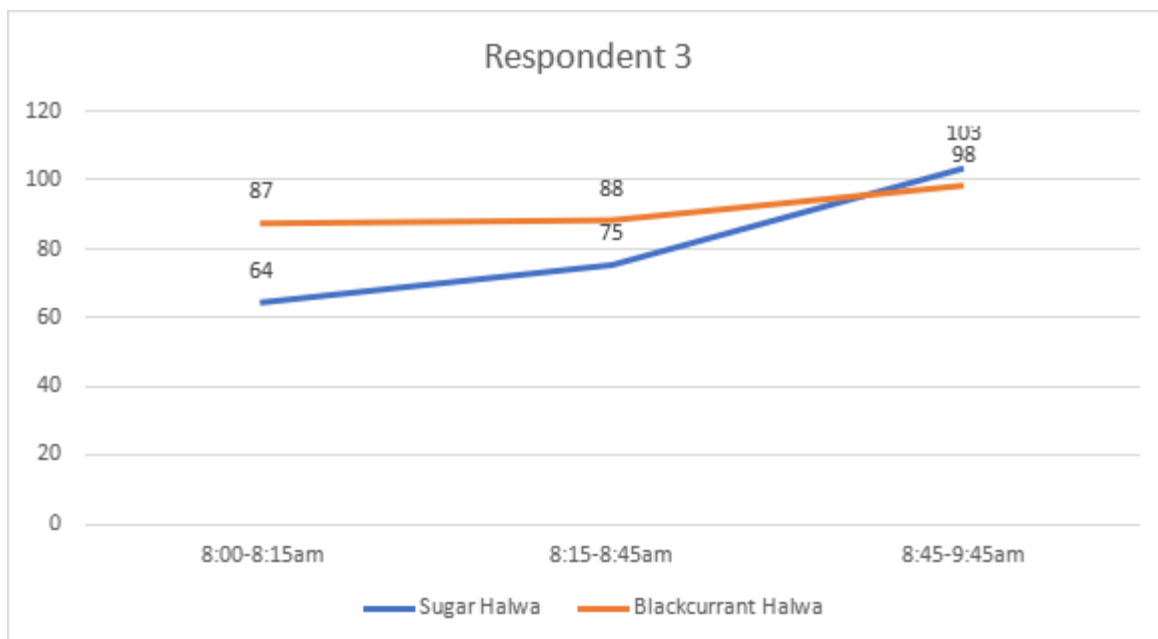


Figure- 4.3

This graphical representation states that after consumption of sugar halwa there was spike in blood glucose level, at 15 minutes the readings obtained were 64 mg/dl after 45 minutes reading were 75mg/dl and after 1 hour 45 minutes readings obtained were 103mg.dl.

Similarly, after consumption of Blackcurrant halwa, readings obtained for 15 minutes were 87mg/dl, after 45 minutes 88mg/dl and after 1 hour 45 minutes 98mg/dl.

From the above readings the after consumption of sugar halwa there was significant spike in blood-glucose levels by 39mg/dl and after consumption of blackcurrant halwa there

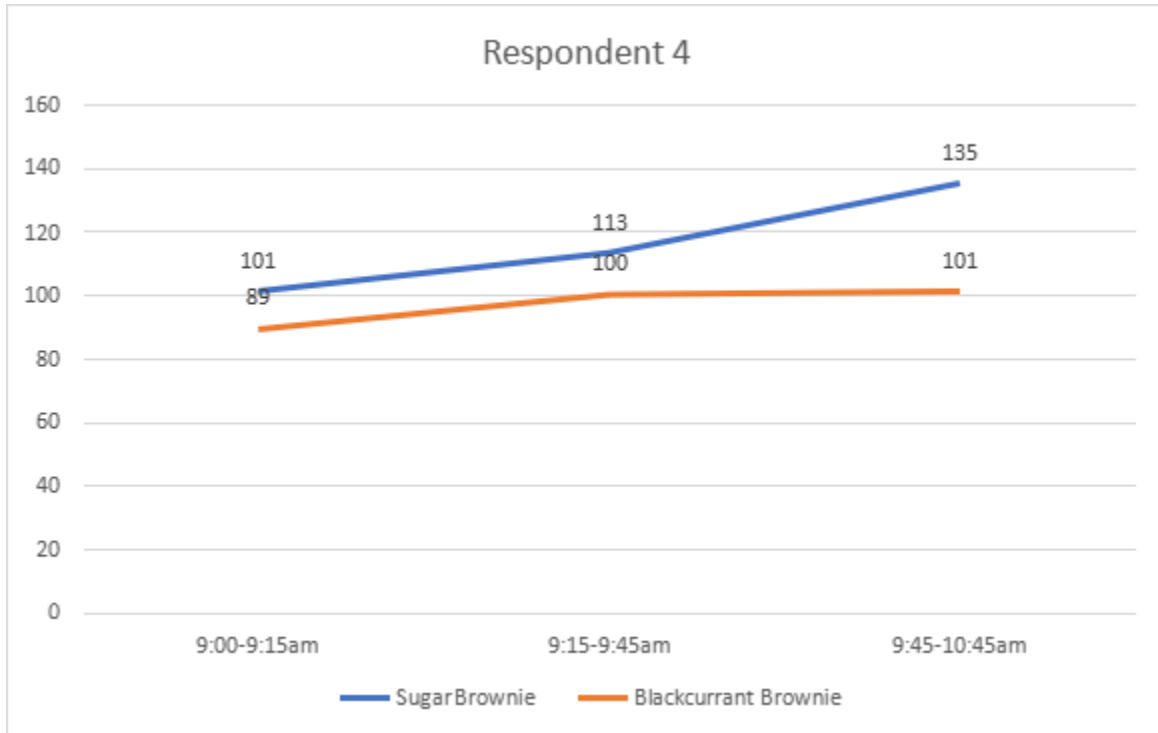


Figure-4.4

This graphical representation states that after consumption of sugar Halwa there was spike in blood glucose level, at 15 minutes the readings obtained were 101mg/dl after 45 minutes reading were 113mg/dl and after 1 hour 45 minutes readings obtained were 135mg/dl.

Similarly, after consumption of Blackcurrant Halwa, readings obtained for 15 minutes were 89mg/dl, after 45 minutes 100mg/dl and after 1 hour 45 minutes 101mg/dl.

From the above readings the after consumption of sugar Halwa there was significant spike in blood-glucose levels by 34mg/dl and after consumption of blackcurrant Halwa there was spike in blood glucose levels by 12mg/dl.

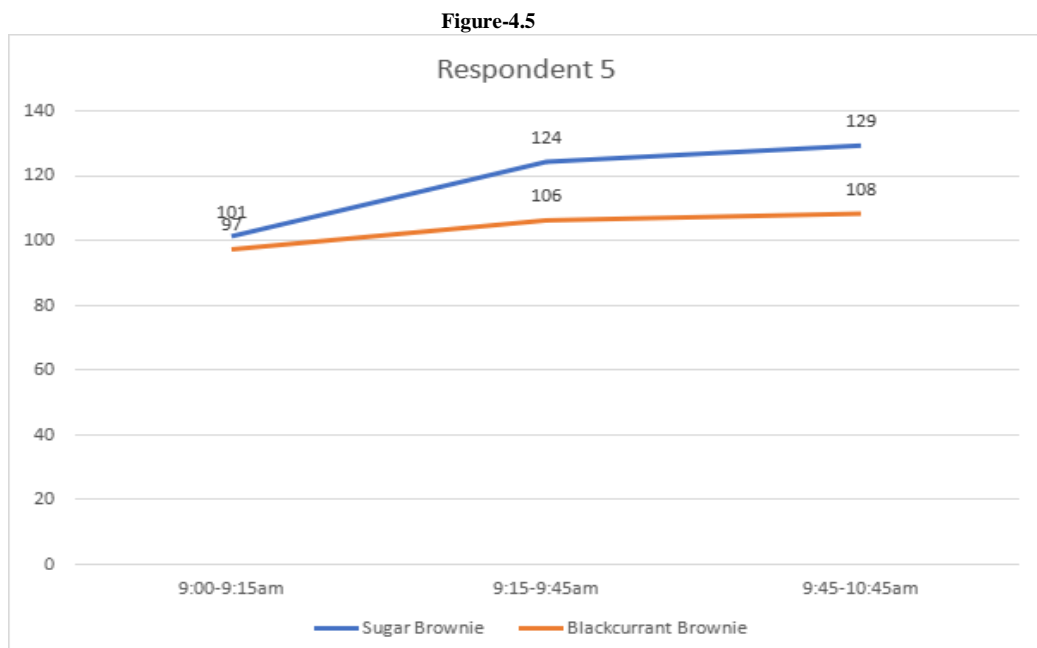


Figure-4.5

This graphical representation states that after consumption of sugar Halwa there was spike in blood glucose level, at 15 minutes the readings obtained were 101mg/dl after 45 minutes reading were 124mg/dl and after 1 hour 45 minutes readings obtained were 129mg/dl.

Similarly, after consumption of Blackcurrant Halwa, readings obtained for 15 minutes were 97mg/dl, after 45 minutes 106mg/dl and after 1 hour 45 minutes 108mg/dl.

From the above readings the after consumption of sugar Halwa there was significant spike in blood-glucose levels by 28mg/dl and after consumption of blackcurrant Halwa there was spike in blood glucose levels by 11mg/dl.

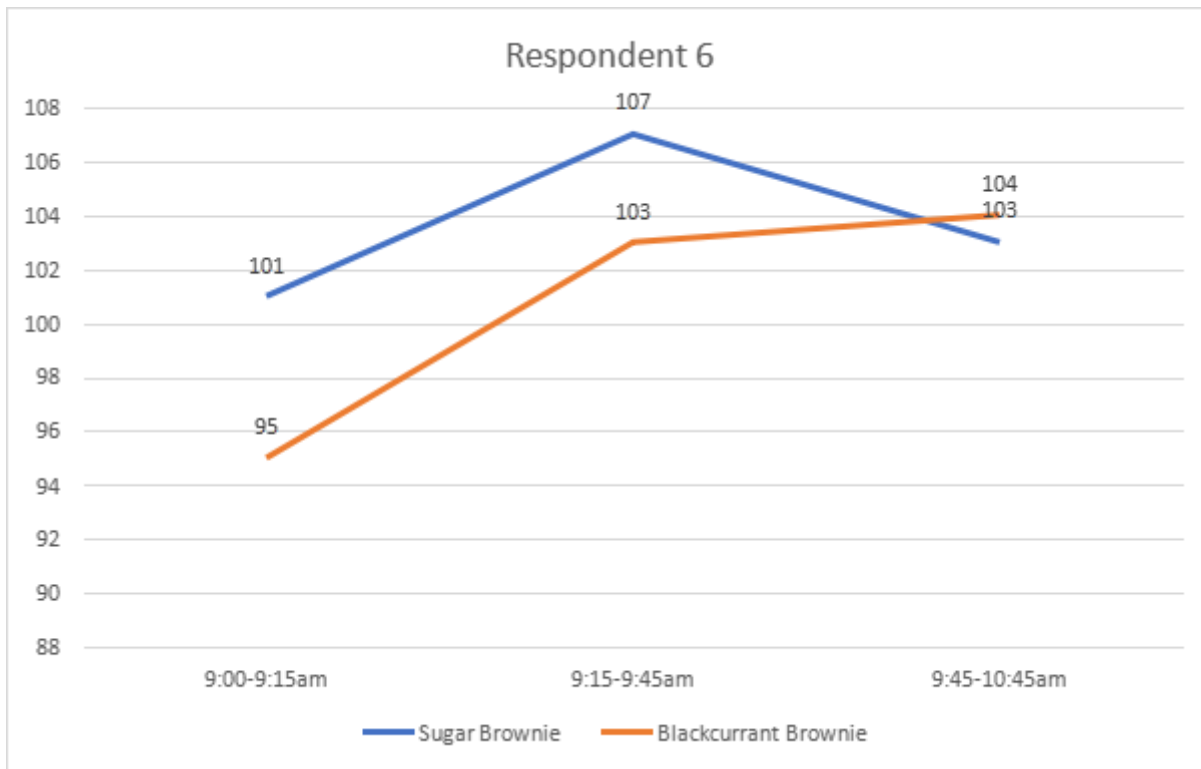


Figure-4.6

This graphical representation states that after consumption of sugar Halwa there was spike in blood glucose level, at 15 minutes the readings obtained were 101mg/dl after 45 minutes reading were 107mg/dl and after 1 hour 45 minutes readings obtained were 103mg/dl.

Similarly, after consumption of Blackcurrant Halwa, readings obtained for 15 minutes were 95mg/dl, after 45 minutes 103mg/dl and after 1 hour 45 minutes 104mg/dl.

From the above readings the after consumption of sugar Halwa there was significant spike in blood-glucose levels by 5mg/dl and after consumption of blackcurrant Halwa there was spike in blood glucose levels by 9mg/dl.

Sr No.	Name	Age	Sugar Halwa Blood Glucose Reading(mg/dl)			Blackcurrant Halwa Blood Glucose Reading (mg/dl)		
			8:00-8:15am	8:15-8:45am	8:45-9:45am	9:00-9:15am	9:15-9:45am	9:45-10:45am
1	Siddhesh Kamble	24	82	106	117	95	94	106
2	Yash Naik	23	58	70	102	94	93	102
3	Trushti Tandal	22	64	75	103	87	88	98

Table 4.1 represents blood-glucose of respondents after consumption sugar halwa andblackcurrant halwa.

Sr No.	Name	Age	Sugar Brownie Blood Glucose Reading(mg/dl)			Blackcurrant Brownie Blood Glucose Reading (mg/dl)		
			9:00-9:15am	9:15-9:45am	9:45-10:45am	9:00-9:15am	9:15-9:45am	9:45-10:45am
1	Khushi Mandal	18	101	113	135	89	100	101
2	Tanvi Pawar	22	101	124	129	97	106	108
3	Virendra Patel	20	101	107	103	95	103	104

Table 4.2 represents blood-glucose of respondents after consumption sugar brownie and blackcurrant brownie.

The above mentioned tables represents blood-glucose levels of all the six participant, who consumed 4 different recipes, sugar halwa, sugar brownie, blackcurrant halwa, and blackcurrant brownie. The readings were obtained at 15 minutes, 45 minutes and 1 hour 45 minutes interval are mentioned in the above table. For respondent 1 after consumption of sugar halwa there was a steady spike in blood-glucose level by 35mg/dl and when respondent 1 consumed blackcurrant halwa there was moderate spike in blood-glucose levels by 13mg/dl. For respondent 2 after consumption of sugar halwa there was a steady spike in blood-glucose level by 42 mg/dl and when respondent 3 consumed blackcurrant halwa there was moderate spike in blood-glucose levels by 10 mg/dl. For respondent 3 after consumption of sugar halwa there was a steady spike in blood-glucose level by 39 mg/dl and when respondent 3 consumed blackcurrant halwa there was moderate spike in blood-glucose levels by 11 mg/dl. For respondent 4 after consumption of sugar halwa there was a steady spike in blood-glucose level by 34 mg/dl and when respondent 4 consumed blackcurrant halwa there was moderate spike in blood-glucose levels by 12 mg/dl. For respondent 5 after consumption of sugar halwa there was a steady spike in blood-glucose level by 28 mg/dl and when respondent 4 consumed blackcurrant halwa there was moderate spike in blood-glucose levels by 11 mg/dl. For respondent 6 after consumption of sugar halwa there was a steady spike in blood-glucose level by 5 mg/dl and when respondent 6 consumed blackcurrant halwa there was moderate spike in blood-glucose levels by 9 mg/dl. From the above mentioned observation it can be stated that as compared to sugar recipe, blackcurrant recipes showed positive effect on blood-glucose levels by inducing a moderate spike in blood-glucose levels.

Respondent	Time interval	Sugar Halwa	BlackcurrantHalwa	p value	T-value	F-value	R-value
1	15 min	82mg/dl	95mg/dl	0.306	-3.142	3.904	0.844
2	15mins	58mg/dl	94mg/dl	0.306	-3.142	3.904	0.844
3	15mins	64mg/dl	97mg/dl	0.306	-3.142	3.904	0.844
1	45mins	106mg/dl	94mg/dl	0.306	-0.701	9.446	0.331
2	45mins	70mg/dl	93mg/dl	0.306	-0.701	9.446	0.331
3	45mins	75mg/dl	102mg/dl	0.306	-0.701	9.446	0.331
1	1 hr 45 mins	117mg/dl	87mg/dl	0.406	-0.994	3.302	-0.445
2	1 hr 45 mins	102mg/dl	88mg/dl	0.406	-0.994	3.302	-0.445
3	1 hr 45 mins	103mg/dl	98mg/dl	0.406	-0.994	3.302	-0.445

Table 4.3 Represents data obtained through statistical analysis in SPSS Software for Sugar and Blackcurrant Halwa.

The readings obtained after methodology were inserted into SPSS Software for data analysis. Chi-square test, t-test and Correlation test were carried out to obtain significant difference between blackcurrant raisins and blood-glucose levels. For chi-square test, after consumption of sugar halwa and Blackcurrant halwa by 3 respondent at 15 minutes interval, 45 minutes interval and 1 hour 45 minutes interval, the p-value obtained are 0.306, 0.306 and 0.406. After carrying out t-test the t-value obtained for 3 respondent at 15 minutes, 45 minutes and 1 hour 45 minutes interval are -3.142, -0.701 and -0.994. Similarly, after carrying out correlation test the f-value obtained for 3 respondents at 15 minutes, 45 minutes and 1 hour 45 minutes are 3.904, 9.446, 3.302 and R-value obtained for 3 respondents at 15 minutes, 45 minutes and 1 hour 45 minutes are 0.844, 0.331, and -0.445. For Chi-square the p-value obtained is greater than 0.05 which means that the null hypothesis will be accepted that there is no significant association between Blackcurrant halwa and Blood-glucose levels. For t-test the values obtained are -3.142, -0.701 and -0.994. F-values obtained are 3.904, 9.446, 3.302 which states that there is no significant association between blackcurrant halwa and blood-glucose levels. For Correlation test the R-value obtained were 0.844, 0.331 and -0.445. At 15 minutes interval and 45 minutes interval it can be stated that there is a moderate correlation between the effect of blackcurrant halwa and blood glucose levels, but at 1 hour 45 minutes there is a perfect negative correlation between the effect of blackcurrant halwa and blood-glucose

Respondent	Time interval	Sugar Brownie	Blackcurrant Brownie	p value	T-value	F-value	R-value
1	15 min	101mg/dl	89mg/dl	0.112	3.051	10.316	-0.836
2	15mins	101mg/dl	97mg/dl	0.112	3.051	10.316	-0.836
3	15mins	101mg/dl	95mg/dl	0.112	3.051	10.316	-0.836
1	45mins	113mg/dl	100mg/dl	0.306	2.214	2.777	-0.742
2	45mins	124mg/dl	106mg/dl	0.306	2.214	2.777	-0.742
3	45mins	107mg/dl	103mg/dl	0.306	2.214	2.777	-0.742
1	1 hr 45 mins	135mg/dl	101mg/dl	0.306	1.795	7.52	-0.668
2	1 hr 45 mins	129mg/dl	108mg/dl	0.306	1.795	7.52	-0.668
3	1 hr 45 mins	103mg/dl	104mg/dl	0.306	1.795	7.52	-0.668

Table 4.4 Represents data obtained through statistical analysis in SPSS Software for Sugar and Blackcurrant Brownie.

The readings obtained after methodology were inserted into SPSS Software for data analysis. Chi-square test, t-test and Correlation test were carried out to obtain significant difference between blackcurrant raisins and blood-glucose levels. For chi-square test, after consumption of sugar brownie and Blackcurrant Brownie by 3 respondent at 15 minutes interval, 45 minutes interval and 1 hour 45 minutes interval, the p-value obtained are 0.112, 0.306 and 0.306. After carrying out t-test the t-value obtained for 3 respondent at 15 minutes, 45 minutes and 1 hour 45 minutes interval are 3.051, 2.214 and 1.795. Similarly, after carrying out correlation test the f-value obtained for 3 respondents at 15 minutes, 45 minutes and 1 hour 45 minutes are 10.316, 2.777, 7.52 and R- value obtained for 3 respondents at 15 minutes, 45 minutes and 1 hour 45 minutes are -0.836, -0.742, and -0.668. For Chi-square the p-value obtained is greater than 0.05 which means that the is null hypothesis will be accepted that there is no significant association between Blackcurrant Brownie and Blood-glucose levels. For t-test the values obtained are 3.051, 2.214 and 1.795 . The F-values obtained were 10.316, 2.777, and 7.52 which are greater than 0.05 eventually states that there is no significant association between Blackcurrant brownie and blood-glucose levels. For Correlation test the R-value obtained were are -0.836, -0.742, and -0.668. It states that there is negative correlation between blackcurrant brownie and blood-glucose levels.

5. Limitations-

The whole study should be carried out in larger population size.

Different variety of blackcurrant raisins recipes should be developed to obtain precise results.

The study should be carried out among diabetic patients with the appropriate consents provided by medical professionals.

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