Determining the effect of normal and diet soda on blood glucose level of 15 healthy female participants using a glucose meter

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Abstract:

Introduction: "Soft drink consumption has become a highly visible and controversial public health and public policy issue." Even though it is widely accepted that soft drinks contribute to osteoporosis, heart disease, dementia, obesity, and type II diabetes mellitus, soft drinks are among the nine most consumed drinks around the world. One type of soft drink that is being highly researched on is diet soft drink/soda. Diet sodas contain artificial sugars, such as aspartame and sucralose, instead of natural complex sugars to seemingly reduce the risk of developing diabetes and gaining weight. Soft drinks are very popular to female teenagers such as myself, especially diet sodas for those of us who would like to maintain a balanced non-caloric diet that would not increase the risk of developing type II diabetes mellitus. Aim: The aim of this experiment is to examine the effects that sugar sweetened soda and artificial sugar sweetened soda have on the blood glucose level of 15-18-year-old female participants, using their fasting blood sugar (FBS) as a baseline for the experiment. Conclusion: Either soda type had its own unique impact on each participant, but the general result attained suggests a rate of recurrence of BGL (Blood Glucose Level) raising remarkably after 30 minutes of normal soda consumption, and BGL staying tenacious after diet soda consumption. On the contrary, the fasting BGL of the participants did not stay unswerving throughout the study, the FBS of participants after drinking both diet and normal soda showed a 5.85% increase in 21 days. This raises concerns for those who drink either soda frequently. Diet soda, in fact, raised the mean fasting BGL of participants the highest in the third trial, suggesting that perhaps diet soda consumption may eventually lead to type II diabetes much faster in teenage girls.

Keywords: healthy participants glucose

Background information:

"Soft drink consumption has become a highly visible and controversial public health and public policy issue."[1] Even though it is widely accepted that soft drinks contribute to osteoporosis, heart disease, dementia, obesity, and type II diabetes mellitus, soft drinks are among the nine most consumed drinks around the world. One type of soft drink that is being highly researched on is diet soft drink/soda. Diet sodas contain artificial sugars, such as aspartame and sucralose, instead of natural complex sugars to seemingly reduce the risk of developing diabetes and gaining weight. Soft drinks are very popular to female teenagers such as myself, especially diet sodas for those of us who would like to maintain a balanced non-caloric diet that would not increase the risk of developing type II diabetes mellitus. I was intrigued to conduct this experiment to see whether our diet, which contains diet soft drinks, will effectively help us in the short-term without causing abominable impact on our blood glucose level. Also, many of my family members have type II diabetes because their lack of moderation in sugar consumption. I would like to reduce the risk of developing type II diabetes myself by educating myself in what I drink through a regular routine.

The blood glucose level (BGL), as the name suggests, demonstrates the amount of glucose in the blood. We consume glucose on daily basis, it is stored in our liver for future use and our cells cannot function cellular reparation without its presence. Hence, its existence in our bodies is vital to our survival, but within limits. Our bodies take extreme measures to ensure that our BGL does not exceed or fall short of a particular set point, called glucose homeostasis. Those with malfunctioning glucose homeostasis system, which is normally the inability of cells to respond to insulin, normally develop a chronic disease named type II diabetes mellitus. "Insulin is a hormone produced by the pancreatic β-cells when the BGL raises above the set point, as it stimulates the uptake of glucose by various tissues, particularly skeletal muscle and liver (Allott, Mindorff (330)." How natural sugar and the two types of artificial sugars found in diet Coca Cola, aspartame and sucralose, are absorbed by the body is elucidated in the discussion section.

Previous research by Bloomer, Peel, Moran and MacDonnchadh suggests that normal soda elevates BGL, while diet soda does not directly influence it. Other research suggest that "systolic blood pressure, fasting blood sugar, and low-density lipoprotein were found significantly lower in women"[2]. So this experiment is required to be systematized according to gender. Participants had a different demographic and age range in comparison to the previous research conducted; Middle Eastern teenage girls were employed to comply with the experiment. Also, in order to form a baseline for this experiment, I had my participants drink both diet Coca Cola and normal one.

Aim:

The aim of this experiment is to examine the effects that sugar sweetened soda and artificial sugar sweetened soda have on the blood glucose level of 15-18-year-old female participants, using their fasting blood sugar (FBS) as a baseline for the experiment.

Research Question:

1 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1829363/

2 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3894044/

What is the effect of diet (artificial sugar) and normal soda (natural sugar) on blood glucose level of 15 healthy female participants as determined by blood glucose monitoring meter?

Variables:

- Independent variables

Table 1: Independent variables of the experiment

Independent variable	***Method of control***
Type of soft drink **Type of sugar (artificial or natural)**	The diet or normal soft drinks were provided by one brand (Coca-Cola), containing the same type and amount of sugar
Time interval	Blood test was taken 30 minutes and 60 minutes after soda consumption

- Dependent variables

Table 2: Dependent variable of the experiment

Dependent variable	**Method of measurement**	**Unit**	**No. trials to ensure reliability**
Blood glucose level	Blood glucose meter	Milligram/ deciliter (mg/dL)	3

- Control variables

Table 3: control variables of experiment

Control variables		
Variable	**Reason for control**	**Method of control**
BMI of participants	Ensuring that they all are in the same BMI range (20-25 kg/m^2) to inhibit any effect it might have on BGL. The higher the BGL, "the higher the risk of developing a range of conditions linked with excess weight, including diabetes."[3]	The height and weight of all participants was measured and their BMI was calculated before experimentation. Only the participants with the 20-25 kg/m^2 were selected.
Medical background of participants	Ensuring that none of the participants had any history of diabetes (type I and type II), Hyperglycemia, and Hypoglycemia. Ensuring that the participants are not taking any medication.	All volunteers were asked of their medical history in regards to their BGL and if they take a certain medication that they feel I should know about.
Age of participants	All participants must be in the same age range since BGL tend to rise with age.	All participants were in the same age range (15-18 years old).
Gender of participants	The FBS of females is significantly lower than in males.	Only female volunteers were selected.

3 https://www.health.harvard.edu/blog/how-useful-is-the-body-mass-index-bmi-201603309339

Waist circumference	Fat stored in the waist could indicate risk of type II diabetes, thus having people within the same waist circumference limits the possibility of participants with varying BGL conditions.	The waist circumference of all participants were taken before experimentation. Waist circumference range: 62-80 cm. Mean=71.25cm
Food intake of participants during the experiment	Ensuring that the type of soda impacts the BGL and not any other food	The participants were fasting and only drank 100cm^3 soda during the 60 minutes time interval
The amount of soda consumed	Ensuring that the type of soda impacts the participant's BGL and not the amount of soda.	Use of measuring cylinder to measure 100cm^3 ± 1cm^3 of soda.
Equipment used	Use of different equipment for all experiments makes results unreliable and inaccurate.	Use of the same equipment or at least ones that are identical. Dry, clean, and sterilized apparatus were used.
Temperature and pressure of room	Uncertainty of glucose meter due to temperature change is unpredictable. So a stable environment was established. Also the test strips may be affected by minor temperature changes (this is, however, a general study of different brands of glucose meters. These precautions are taken for insurance, since accu-chek is one of the most reliable glucose meter provider).	AC was on a constant temp (27°C), all doors and windows were shut, and the experiment lasted for 21 days.
Expiry date of test strips	Check the expiry date of strips. "Strips have a finite lifetime, usually about 2 years under ideal storage circumstances."[4]	The expiry date and the date of production were checked.
Season	Season of the year may affect the BGL of participants.	Experiment was done in autumn.
Time of the day	FBS changes throughout the day. BGL in the morning is lower than BGL in the afternoon.	Experiment was done in the morning.
Time interval	Ensuring that the participants gave their blood glucose test on time.	A stopwatch was used to measure the time taken from when the participants drank soda and the two independent time interval.
Brand of soda	Different brands of soda contain different types and amounts of sugar, thusly the	Using only one brand of soda for the experiment (Coca-Cola)
Sleep of participants	The amount of sleep impacts the BGL	All of the participants were told to get at least 7 hours of sleep every night

Hypothesis:

4 www.faqs.org/faqs/diabetes/faq/part1/section-9.html

Previous research suggests that blood glucose level increases, because the type of sugar they contain is natural sugar. It is hypothesized that the blood glucose level of the participants stays constant or decreases after drinking diet soda because diet sodas contain artificial sugars. Also, it is hypothesized that the FBS of participant will not change considerably since the experiment takes place in a short period of time.

H_0= There is statistically no difference between the changes caused by both diet and normal soda to the blood glucose level.

H_1= Statistically there is a difference between the changes caused by both diet and normal soda to the blood glucose level, one causes the blood glucose level to raise higher.

Safety Precautions:

Ethics of this study relied on ensuring that the participants would not be harmed in any way throughout the experimentation process. Thus,

- Newly opened alcohol pads were used for sterilizing the apparatus and the finger of the participants
- Only a tolerable amount of soda was consumed daily by each participant
- Lancets were renewed per person and per blood glucose test
- All participants signed a consent form, giving consent to the experimental procedure, the experimental conditions, and gave consent to sleep for at least 7 hours
- The underage participant's parents signed a consent form

Materials/Apparatus:

Table 4: Materials and apparatus

Materials	Apparatus
○ $1.5cm^3$ Coca Cola (3 bottles) ○ $1.5cm^3$ Coca Cola zero (3 bottles)	○ Accu-chek active blood glucose monitoring system (±15%) ○ Accu-chek softclix lancing device ○ 270 Accu-chek softclix Lancets ○ 270 Accu-chek active Test strips ○ Alcohol pads (required amount) ○ $100cm^3$ measuring cylinder (1 cm^3) ○ Stopwatch (±0.001 seconds)

Procedure:

1. Massage the participant's index finger (or any finger used to collect blood)

→ This is done to help the rapid circulation of capillary blood.

2. Clean the participant's finger using an alcohol pad
3. Place the newly opened lancet in the lancet holder of the lancing device, and place it at the side of the index finger of the participant and puncture their skin

→ The side of the participant's finger was pricked since it causes less pain to the participant

4. Place the finger of the participant under pressure so blood would leak out
5. Place the finger (along with its blood) of the participant on the test trip after the device displayed a flickering, red light
6. Record FBS results
7. Measure $100cm^3$ of soda (either diet or normal) by a $100cm^3$ measuring cylinder

8. Ask the participants to drink 100cm^3 of soda on an empty stomach shortly after their FBS was measured
9. After 30 minutes, repeat steps 1 to 5
10. Record BGL results
11. After 60 minutes, repeat steps 1 to 5
12. Record BGL results

Figure 1: apparatus used to obtain the blood glucose level

Raw Data:

Three trials were conducted to decrease the variance and random error of the experiment. The mean of each individual during each time interval, drinking either normal or diet soda, was taken. This mean is presented in the table below.

Table 5: raw data of results

Normal soda			**Diet soda**		
Fasting BGL (mg/dL) ±15%	After 30 minutes (mg/dL) ±15%	After 60 minutes (mg/dL) ±15%	Fasting BGL (mg/dL) ±15%	After 30 minutes (mg/dL) ±15%	After 60 minutes (mg/dL) ±15%
95.667	104.330	95.667	95.667	94.333	90.000
94.667	110.330	96.333	89.667	89.333	86.333
94.333	97.667	96.667	99.000	93.333	93.333
90.667	130.670	104.667	92.667	90.667	89.000
89.000	98.333	89.333	90.000	91.667	91.667
93.000	111.670	95.333	95.000	90.333	88.667
93.667	103.000	95.333	96.000	92.330	88.000
91.000	109.330	94.667	94.333	94.667	92.333
95.000	136.330	103.000	93.667	91.330	87.667
88.000	120.000	93.333	92.667	94.000	90.333
93.333	91.667	87.667	87.667	92.000	89.333
94.667	95.000	90.333	93.333	92.000	90.333
88.333	96.333	87.000	90.667	87.667	89.667
106.000	117.330	104.000	93.000	91.667	91.333
95.000	105.667	93.333	100.67	101.670	99.333

Results:

- Quantitative results

Table 6:Quantitative results of normal soda and diet soda

Type of sugar	**Statistical values**	**Time Interval**

		Fasting (mg/dL) ±15%	**After 30 minutes** (mg/dL) ±15%	**After 60 minutes** (mg/dL) ±15%
Normal soda (natural sugar)	**Mean**	93.488	106.337	93.777
	Median	93.667	105.667	94.667
	Standard Deviation	4.314	9.459	4.185
Diet soda (aspartame and sucralose)	**Mean**	95.733	95.066	92.222
	Median	94.333	94.333	91.333
	Standard Deviation	4.525	4.014	3.407

- Qualitative Results

→ The participants who drank sugar-sweetened soda reported less hunger than when they drank diet soda

→ When the participants pressed their finger on the test strip, the color changed from green to a red-green color

→ The lancet punctured the skin very quickly

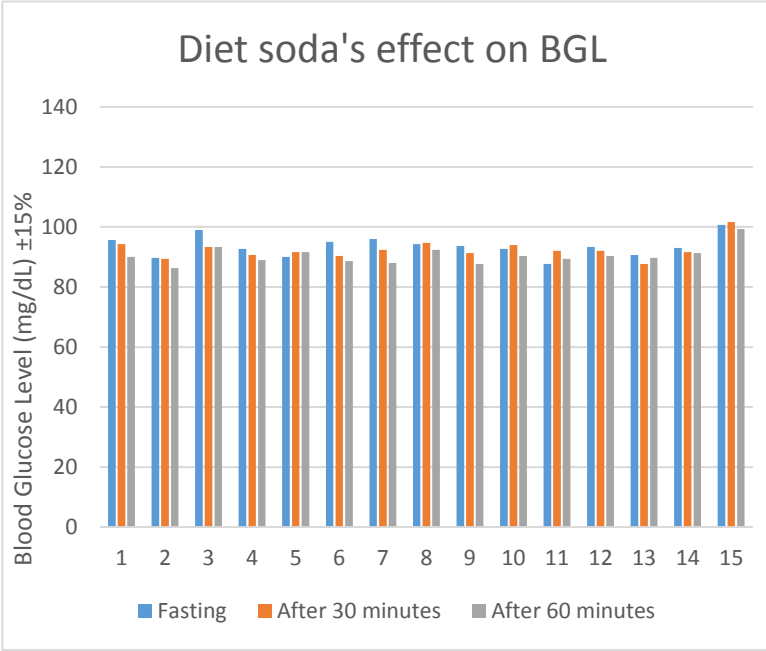
→ The puncture stopped bleeding in less than 10 seconds

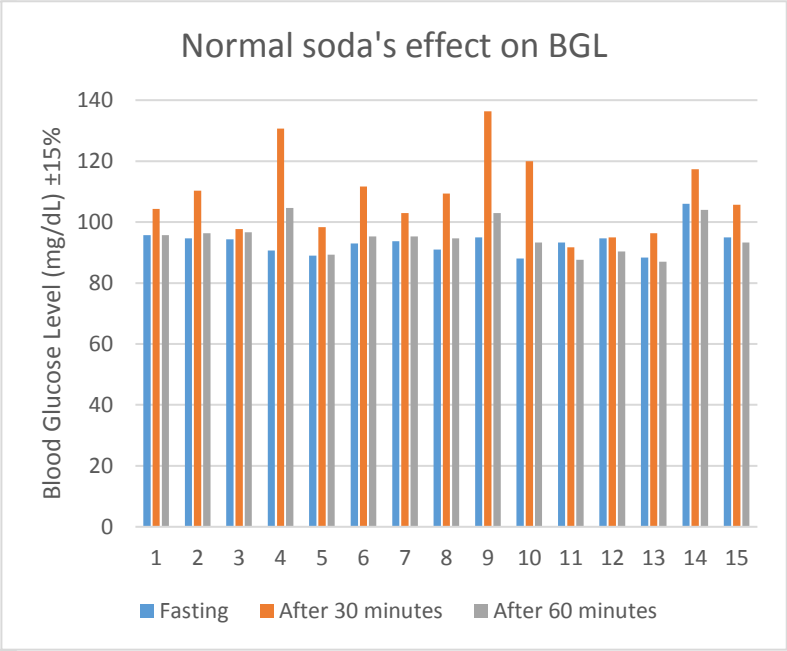
Data processing:

- Graphs/charts of results

Figure 2: normal soda's effect on individual participants while fasting, after 30 minutes, and after 60 minutes

Figure 3: diet soda's effect on individual participants while fasting, after 30 minutes, and after 60 minutes





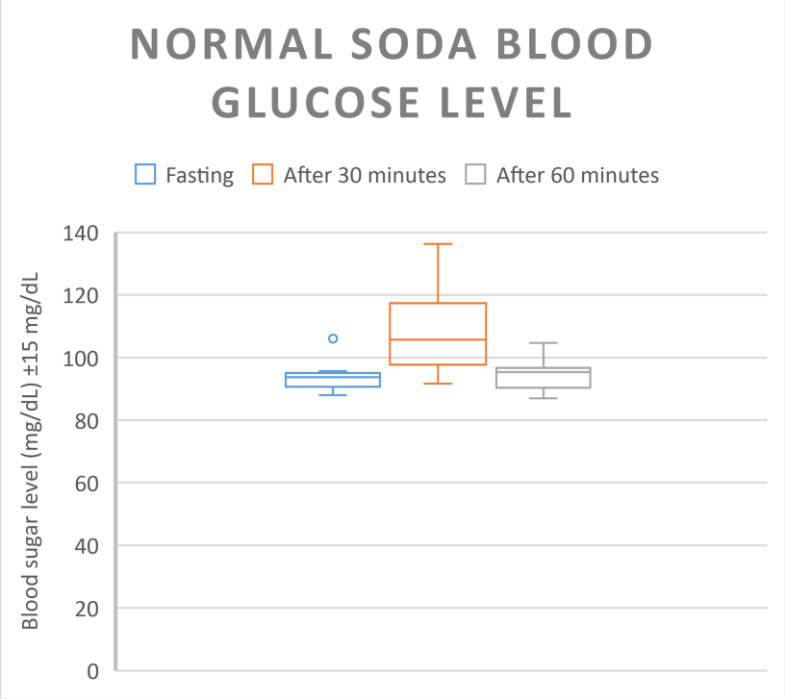


Figure 4: Box and whisker plot showing the blood sugar level in (mg/dL) after drinking

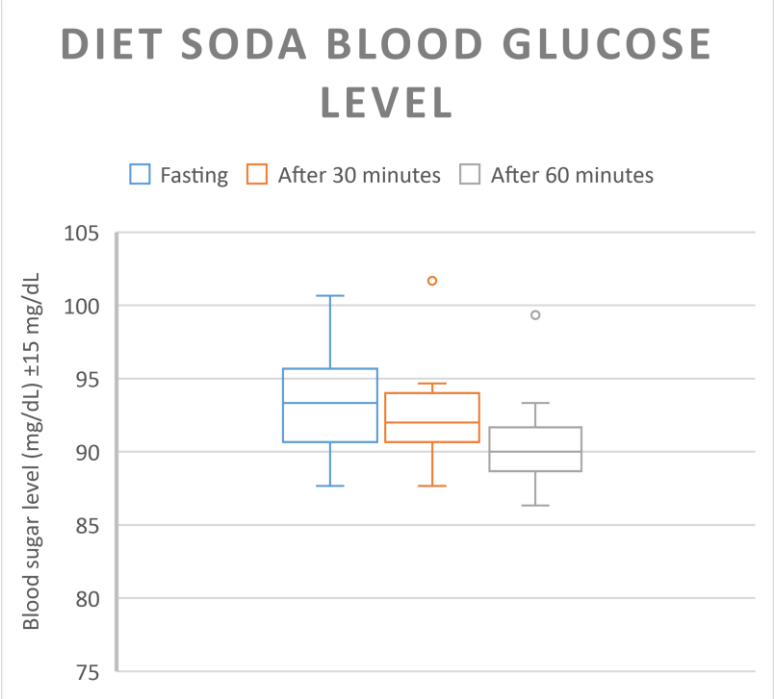
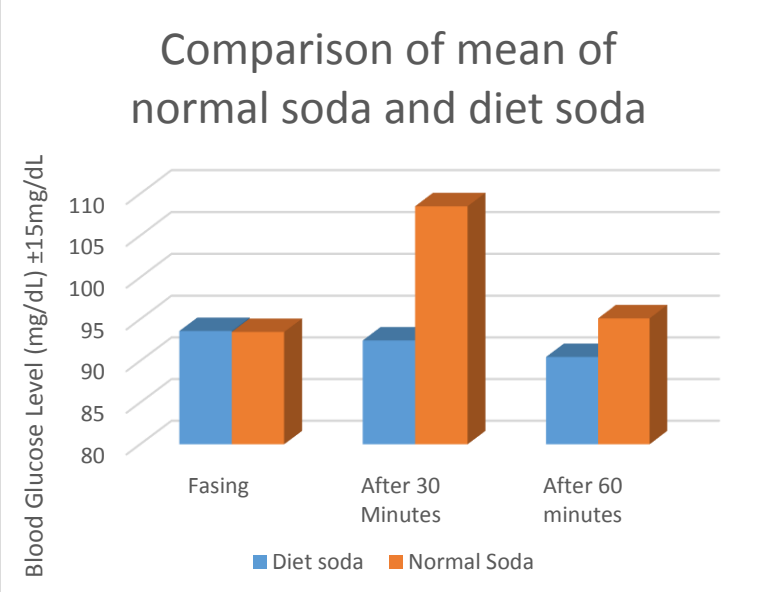
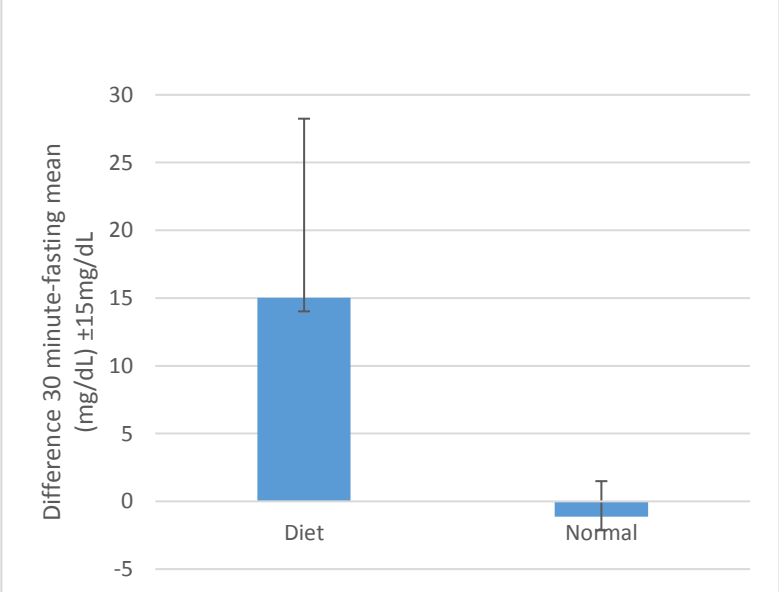


Figure 5: Box and whisker plot showing the blood sugar level in (mg/dL) after drinking



normal soda at fasting, 30 minutes, and 60 minutes



diet soda at fasting, 30 minutes, and 60 minutes

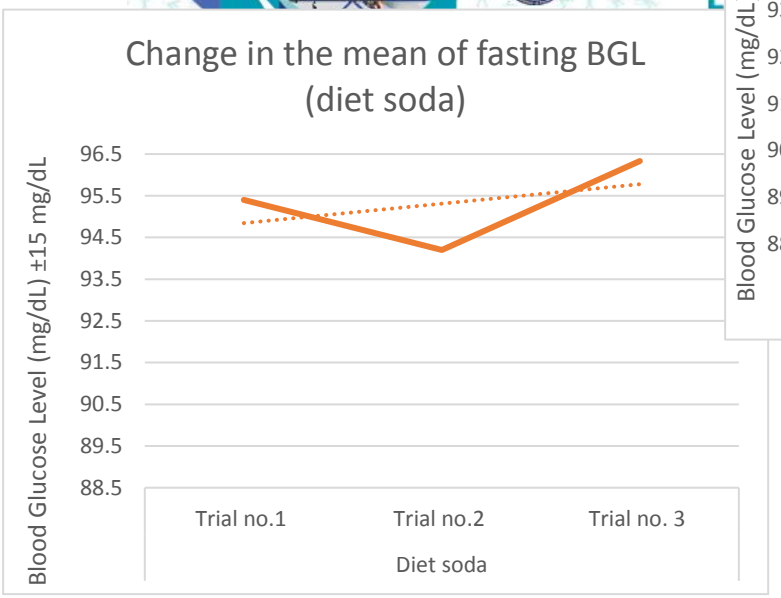


Figure 3: Change in the mean of fasting BGL (diet soda)

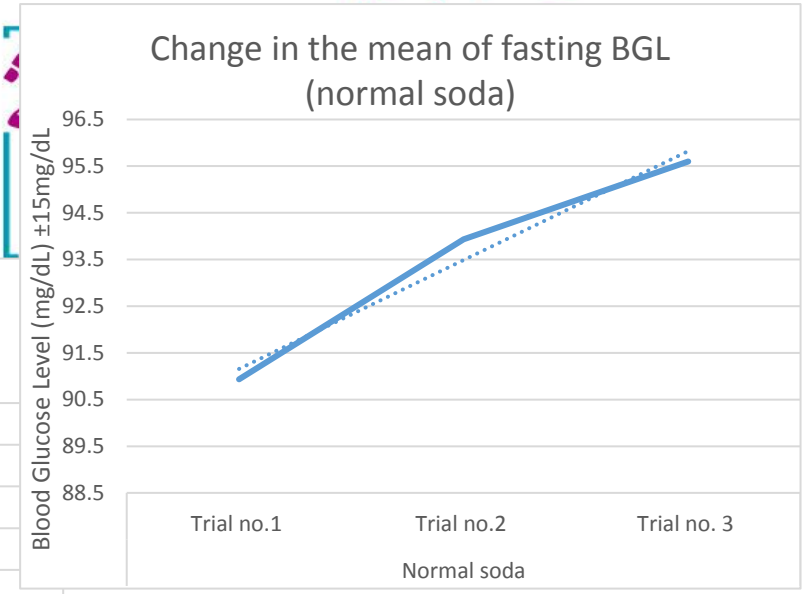


Figure 2: Change in the mean of fasting BGL (normal soda)

Figure 6: Bar chart comparing the mean of blood glucose level for normal and diet soda
Figure 7: comparing the mean of D1 and D2, including error bar of standard deviation

To obtain the data presented in the figure 7, the difference of BGL between the 30-minute time interval and fasting BGL was taken for each individual (who drank both types of soda). The mean and standard deviation of the calculation was taken. This calculation is further elucidated in the statistical t-test calculation and analysis section.

- Statistical t-test calculation and analysis:

"The paired-samples t-test, is used to determine whether the mean of a dependent variable is the same in two related groups."[5] In this experiment's case, the dependent variable is the BGL and the independent variable is the 2 different types of sodas and time. The results must be evaluated with a paired t-test because the group of participants who drank diet soda were also employed to participate in drinking normal soda.

To conduct the statistical calculation, the difference between the BGL obtained after 30 minutes and the fasting BGL (30 minutes BGL-fasting BGL) for both diet soda and normal soda (labelled D1 and D2 respectively). Since the most significant fluctuations in BGL were observed at the 30 minutes' time interval, the 60-minute time interval BGL is not taken into account in the t-test. Alpha levels are arbitrary, however, this experiment confides with the conventional alpha level 0.05. "Under the null hypothesis, this statistic follows a t-distribution with $n - 1$ degrees of freedom (Shier, 2004)."

Table 7: paired t-test results[6]

	p-value and statistical significance	**standard error of difference**	**t test statistic value (t)**	**Degrees of freedom (df)**

5 https://statistics.laerd.com/stata-tutorials/paired-t-test-using-stata.php

6 https://www.graphpad.com/quickcalcs/ttest2/

Paired t test value	= 0.0005 Extremely statistically significant	=3.548	=4.534	14

Discussion:

Data from the present study confirms two items of importance: firstly, the BGL of participants escalates significantly after 30 minutes from drinking normal soda and returns back to the original range of normal BGL (<100 mg/dL) after 60 minutes of normal soda consumption (figure 2). This pattern was, conversely, not seen in the participants after they drank diet soda. In 30-minute and 60-minute time interval the BGL did not elevate or lower significantly in any of the participants (figure 3 and figure 4). This is because natural sugar found in normal soda is metabolized by the body, while artificial sugar, like aspartame and sucralose, found in diet soda aren't. During digestion, natural sugars are broken down to monosaccharides and absorbed into the bloodstream of the consumer. However, the 2 types of artificial sugars found in diet Coca Cola, aspartame and sucralose, are completely different in chemical arrangement, thus, having different methods of absorption in the body that make it non-caloric or low-caloric. Aspartame, made of phenylalanine and aspartic acid, is fully broken down in our gut into amino acids then absorbed into our bodies. Sucralose is made of sugar, but due to the presence of chlorine atoms in its structure, it is a highly unreactive substance that is not absorbed into the body. Secondly, (as seen in figure 8 and 9) the fasting blood glucose level of participants increased throughout the study regardless of the soda type. This, in turn, proves that the consumption of either type of soda increases the fasting BGL when regularly consumed, normal soda raising it by 4.882% and diet soda by 0.968%. This can be very damaging to the metabolic processes of the body. "Imminent spikes in blood glucose appear more detrimental than chronically stable high glucose levels. These fluctuations cause increased oxidative stress and apoptosis of various cells, particularly pancreatic islet β-cells (Bloomer, Peel, Moran, MacDonnchadh, 4)". Changes to β-cells could potentially inhibit the β-cells to regulate the glucose homeostasis "ultimately leading to hyperglycemia and hyperinsulinemia. Thus, β-cell dysfunction becomes one of the main mechanisms for an individual to develop Type II diabetes (Bloomer, Peel, Moran, MacDonnchadh, 4)"

Total uncertainty

Table 8: sources of uncertainty

Main sources of uncertainties:	○ Residue of soda left in each cup ○ Residue of soda left in measuring cylinder ○ Blood glucose test being taken sooner or later than the designated time ○ The uncertainty of the measuring cylinder (± 1 cm^3) ○ The uncertainty of blood glucose meter (±15%) ○ The uncertainty of stopwatch (±0.001seconds) ○ Volume of soda used

Table 9: Fasting blood glucose level uncertainty calculation

100 cm^3 measuring cylinder	**Fasting blood glucose level**	
Volume of soda using 100cm3 volumetric flask (±1 cm3) ➔ $\frac{1}{100}$ x 100	Blood glucose level by blood glucose meter (±15%)	**Total uncertainty of fasting blood glucose level**
≈±1%	≈±15.0%	≈16.0%

Table 10: Blood glucose level after 30 minutes uncertainty calculation

100 cm^3 measuring cylinder	**Blood glucose level after 30 minutes**	**Stopwatch**	
Volume of soda using 100cm3 volumetric flask (±1 cm3) ➔ $\frac{1}{100}$ x 100	Blood glucose level by blood glucose meter (±15%)	Time taken from soda consumption using stopwatch ➔ $\frac{0.001}{1800}$ x 100	**Total uncertainty of blood glucose level after 30 minutes**
≈±1.00000%	≈±15.00000%	≈0.00003%	16.00005%

Table 11:Blood glucose level after 60 minutes uncertainty calculation

100 cm^3 measuring cylinder	**Blood glucose level after 60 minutes**	**Stopwatch**	
Volume of soda using 100cm3 volumetric flask (±1 cm3) ➔ $\frac{1}{100}$ x 100	Blood glucose level by blood glucose meter **(±15%)**	Time taken from soda consumption using stopwatch ➔ $\frac{0.001}{3600}$ x 100	**Total uncertainty of blood glucose level after 60 minutes**
≈±1%	≈±15.0%	≈0.00003%	16.00003%

Further investigation:

- Give the participants a regulated diet, or give them a list of foods to avoid consuming to improve upon the methodology of this experiment
- Change in blood sugar level of participants after consuming different types of artificial sugars, comparison of the effect of different artificial sugars on BGL
- Include how the consumption of natural and diet sodas can affect blood pressure of participants
- Preform the same experiment on both male and female participants and compare the collected data by gender

Conclusion:

The p-value attained to assess the statistical significance between the rise in BGL after 30 minutes of soda consumption is less than the alpha level established (0.0005<0.05) suggesting a notable statistical significance. This, in turn, rejects the null hypothesis made at the beginning of the experimentation, *there is statistically no difference between the changes caused by both diet and normal soda to the blood glucose level*. Either soda type had its own unique impact on each participant, but the general result attained suggests a rate of recurrence of BGL raising remarkably after 30 minutes of normal soda consumption, and BGL staying tenacious after diet soda consumption. On the contrary, the fasting BGL of the participants did not stay unswerving throughout the study, the FBS of participants after drinking both diet and normal soda showed a 5.85% increase in 21 days. This raises concerns for those who drink either soda frequently. Diet soda, in fact, raised the mean fasting BGL of participants the highest in the third trial, suggesting that perhaps diet soda consumption may eventually lead to type II diabetes much faster in teenage girls. As explained in the evaluation section, however, the results obtained in this experiment cannot be generalized into large population. On the other hand, the results do raise concerns in relation to the current diet soda rich diet in teenage girls.

There may be limitations to the results obtained. The diet and physical activity of participants outside the 60-minute time frame was not regulated throughout the study, which may make the fasting BGL observation unreliable. Regardless, the results recommend diabetics and young teenage girls to avoid drinking either soda, or at least control their soda consumption. Switching to diet sodas more recommended in this study framework, because diet soda does not provoke β-cells to imminently produce large sums of insulin in short time periods, damaging their pancreatic β-cells. Even though diet sodas seemingly aid various diets by having no calories and natural sugar, they tend to increase the fasting BGL of consumers that is positively correlated with weight gain.

Evaluation:

The participants are all students at the school where I study in. They are all from a similar geographic background, Middle East, Asia. Thusly, the results found cannot be generalized for large range of populations, or cannot be classified by their geographical background. Correspondingly, this longitudinal research, "a type of correlational research that involves looking at variables over an extended period of time", set a limitation to variance among the results by asking the same 15 participants to drink both diet soda and normal soda.

Table 12: limitations in design of experiment

	Limitations in design	***Method of improving them***
A	*The diet of participants was not controlled* *→ in the month of trial, only the food consumption of participants during the hour of soda consumption was strictly monitored* *→ Different diets can have a colossal effect on BGL. It can impact how fast*	*Place a strict diet for all participants to follow during the experimentation time period.*

	the body is at producing insulin, or how effective the insulin behaves to maintain a constant BGL leading to diabetes type II	
B	*The physical activity of participants was not controlled during the experimentation time period* *→ exercise can impact BGL*	*Have all participants workout for 20 minutes (or more) every day from a week before the experimentation and during the month of experimentation.*
C	*Taking the blood test of participants earlier or later than their designated time.* *→ Some participant's blood test was taken a bit sooner or later than 30minutes/ 60 minutes*	*1. Make a reminder for the participant, for instance text them or call them, so they will show up on time.* *2. Go pick them up on their time.*
D	*Squeezing the finger to enhance blood flow will dilute the blood with tissue fluid, and this could affect the measurements*	*The participants held their hands down according to the direction of gravitational energy. Doing so, the blood in their hands moved directly to the tip of their fingers. However, this didn't assist us with the experiment, and we were forced to squeeze the finger.*
E	*The physical activity of participants during the 60 minutes' time interval was not controlled* *→ Some participants had to work-out during the time interval*	*Monitor the participant's physical activity during the time interval, either set a limit or completely restrain the physical activity of participants*
F	*Alcohol not drying completely on the subject's finger*	*Could alter the results on the blood glucose meter*
G	*The temperature on the AC was once 29°C instead of the 27°C norm.*	*The temperature change can impact the accuracy of glucose meter*
H	*Misreading the meniscus of the measuring cylinder*	*It is probable that the meniscus has been misread despite that the conventions of reading the meniscus was followed.*

Bibliography:

Ginsberg, Barry H. "Factors Affecting Blood Glucose Monitoring: Sources of Errors in Measurement." *Factors Affecting Blood Glucose*

Monitoring: Sources of Errors in Measurement, PubMed Central (PMC) Site, July 2009, www.ncbi.nlm.nih.gov/pmc/articles/PMC2769960/.

Hollrah, David, et al. Question: In Patients with Type 2 Diabetes, Does Diet Soda Consumption Contribute to Decline in Blood Sugar Control? PubMed Central (PMC) Site, 2017, Question: In patients with type 2 diabetes, does diet soda consumption contribute to decline in blood sugar control?, www.ncbi.nlm.nih.gov/pmc/articles/PMC5484596/.Allott, Andrew. Biology: for the IB Diploma. Oxford University Press, 2014.

Anish, T. S., et al. Gender Difference in Blood Pressure, Blood Sugar, and Cholesterol in Young Adults with Comparable Routine Physical Exertion. PubMed Central (PMC) Site, 2013, Gender Difference in Blood pressure, Blood Sugar, and Cholesterol in Young Adults with Comparable Routine Physical Exertion, www.ncbi.nlm.nih.gov/pmc/articles/PMC3894044/.

Jarrett, RJ, et al. Screening Blood Glucose Values: Effects of Season and Time of Day. PubMed Central (PMC) Site, Screening blood glucose values: effects of season and time of day., www.ncbi.nlm.nih.gov/pubmed/6543350.

Vartanian, Lenny R., et al. "Effects of Soft Drink Consumption on Nutrition and Health: A Systematic Review and Meta-Analysis." Effects of Soft Drink Consumption on Nutrition and Health: A Systematic Review and Meta-Analysis, PubMed Central (PMC) Site, Apr. 2007, www.ncbi.nlm.nih.gov/pmc/articles/PMC1829363/.

Allott, Andrew. Mindorff, David. Biology: for the IB Diploma. Oxford University Press, 2014.

"Frequently Asked Questions About Sucralose." Sucralose, sucralose.org/faqs/

Obringer, Lee Ann. "How Artificial Sweeteners Work." HowStuffWorks Science, HowStuffWorks, 8 Mar. 2018, science.howstuffworks.com/innovation/edible-innovations/artificial-sweetener8.htm.

Scientific Opinion on Aspartame. EFSA, 2014

Jacob, Aglaee. "How Soon After Ingestion of Food Does Blood Sugar Rise?" Healthy Eating | SF Gate, SF Gate, 6 Dec. 2018, healthyeating.sfgate.com/soon-after-ingestion-food-blood-sugar-rise-1399.html.

Bloomer, Richard J, et al. Blood Glucose and Insulin Response to Artificially- and Sugar-Sweetened Sodas in Healthy Men. 268-272, 2016.

"Why Is My Waist Size Important?" NHS Choices, NHS, www.nhs.uk/common-health-questions/lifestyle/why-is-my-waist-size-important/.

Smith, Michael. "The Benefits of Soft Drinks!" Planet Naturopath, Planet Naturopath, 18 Dec. 2011, www.planetnaturopath.com/healthy-foods/the-benefits-of-soft-drinks/.

Maxine. "9 Most Consumed Beverages Around the World." Haley's Daily Blog, 15 Nov. 2017, www.haleysdailyblog.com/9-most-consumed-beverages-around-the-world/.

Rossman, Sean. "Diet Soda Can Increase Risk of

Dementia and Stroke, Study Finds." USA Today, Gannett Satellite Information Network, 21 Apr. 2017, www.usatoday.com/story/news/nation-now/2017/04/21/diet-soda-can-increase-risk-dementia-and-stroke-study-finds/100736786/.

Obringer, Lee Ann. "How Artificial Sweeteners Work." HowStuffWorks Science, HowStuffWorks, 8 Mar. 2018, science.howstuffworks.com/innovation/edible-innovations/artificial-sweetener8.htm.

Kirkwood, Caitlin. "Tricking Taste Buds but Not the Brain: Artificial Sweeteners Change Brain's Pleasure Response to Sweet." Scientific American Blog Network, 5 Sept. 2013, blogs.scientificamerican.com/mind-guest-blog/tricking-taste-buds-but-not-the-brain-artificial-sweeteners-change-braine28099s-pleasure-response-to-sweet/.

Policy Statement: The Use of Artificial Sweeteners. The British Dietetic Association, 2016, Policy Statement: The Use of Artificial Sweeteners, www.bda.uk.com/improvinghealth/healthprofessionals/policy_statements/sweetners.

"Managing Blood Sugar Levels: When Your Blood Sugar Is Too High or Too Low." WebMD, WebMD, www.webmd.com/diabetes/blood-sugar-levels#1.

Diabetes FAQ: General (Part 1 of 5) Section - What Are Mg/Dl and Mmol/l? How to Convert? Glucose? Cholesterol?, www.faqs.org/faqs/diabetes/faq/part1/section-9.html.

"When Blood Sugar Is Too High (for Teens)." Edited by Steven Dowshen, KidsHealth, The Nemours Foundation, May 2018, kidshealth.org/en/teens/high-blood-sugar.html.

Shmerling, Robert H. "How Useful Is the Body Mass Index (BMI)?" Harvard Health Blog, Harvard Health Publishing, 28 Mar. 2016, www.health.harvard.edu/blog/how-useful-is-the-body-mass-index-bmi-201603309339.

Appendix:

Table 13: Raw data BGL (mg/dL), trial no.1

ID	Normal soda Trial no.1			Diet soda Trial no.1		
	Fasting	After 30 minutes	After 60 minutes	Fasting	After 30 minutes	After 60 minutes
1	94	104	89	93	89	86
2	95	110	92	102	92	95
3	94	84	95	99	92	98
4	85	133	87	92	104	87
5	85	103	83	92	95	79
6	93	113	90	107	97	93

7	92	104	98	103	110	97
8	77	116	85	87	86	83
9	93	137	96	93	98	89
10	90	119	94	93	92	85
11	88	81	80	84	91	88
12	90	105	97	98	98	100
13	85	90	89	95	93	90
14	106	114	102	91	94	93
15	97	125	100	102	106	105
Mean	90.933	109.2	91.8	95.4	95.8	91.2
Standard Deviation	6.649	16.209	6.405	6.322	6.570	6.991

Table 14: Raw data BGL (mg/dL), trial no.2

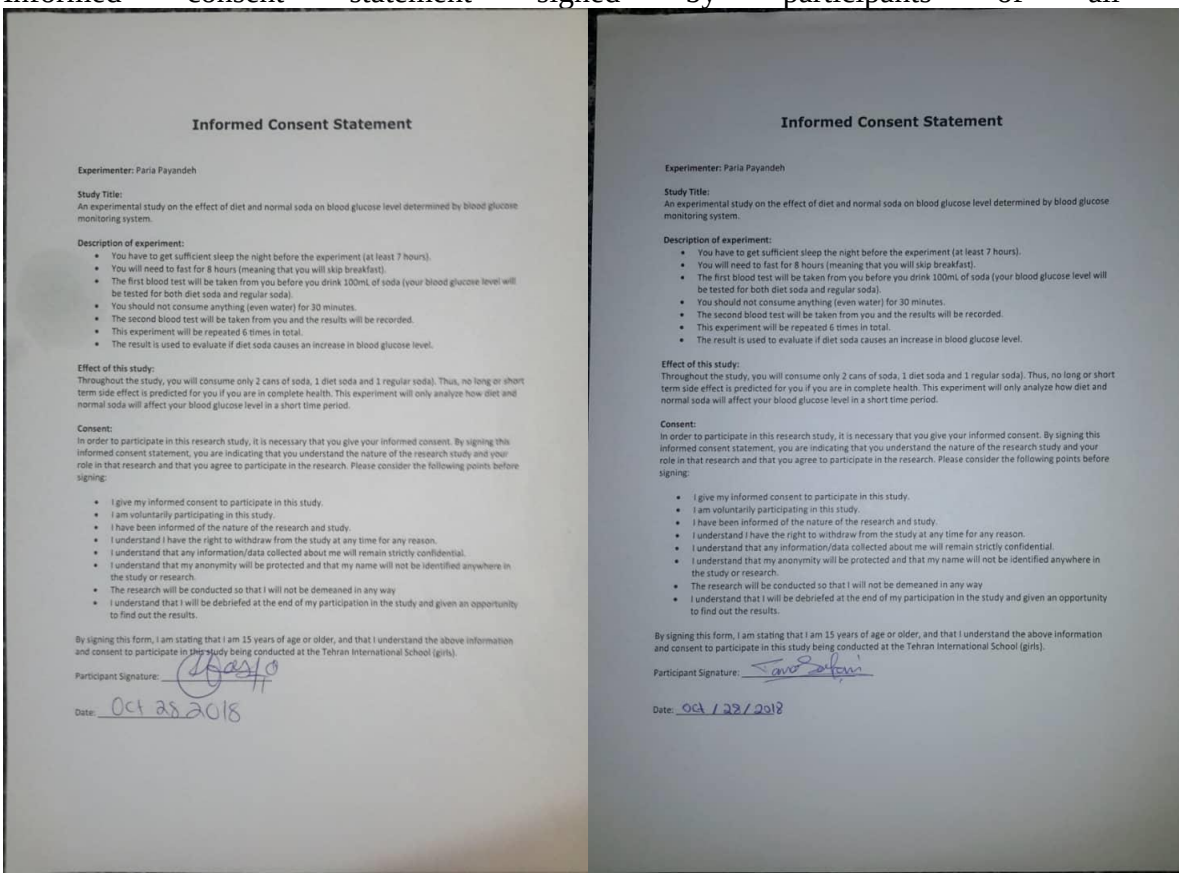
ID	Normal soda Trial no.2			Diet soda Trial no.2		
	Fasting	After 30 minutes	After 60 minutes	Fasting	After 30 minutes	After 60 minutes
1	91	99	93	93	89	86
2	92	111	95	102	92	95
3	93	102	97	99	92	98
4	92	106	90	92	104	87
5	92	99	94	92	95	79
6	92	110	93	107	97	93
7	93	98	89	103	110	97
8	89	99	92	87	86	83
9	101	117	98	93	98	89
10	86	109	89	93	92	85
11	96	99	91	84	91	88
12	100	81	78	98	98	100
13	91	109	87	95	93	90
14	106	119	100	91	94	93
15	95	105	97	102	106	105
Mean	93.933	104.200	92.200	94.200	95.133	93.133
Standard Deviation	5.063	9.267	5.401	6.315	7.558	6.140

Table 15: Raw data BGL (mg/dL), trial no.3

ID	Normal soda Trial no.3	Diet soda Trial no.3

	Fasting	After 30 minutes	After 60 minutes	Fasting	After 30 minutes	After 60 minutes
1	102	110	105	91	93	87
2	97	104	102	102	104	98
3	96	107	98	98	93	91
4	95	123	107	98	88	88
5	90	93	91	96	94	91
6	94	112	103	99	96	95
7	96	107	99	104	101	99
8	107	113	104	94	93	92
9	91	95	85	99	95	94
10	88	102	97	92	91	90
11	96	95	92	92	92	89
12	94	99	96	93	85	84
13	89	90	85	87	88	86
14	106	119	110	101	96	95
15	93	87	83	99	97	93
Mean	95.600	103.7333	97.133	96.333	93.733	91.466
Standard Deviation	5.654	10.626	8.425	4.700	4.891	4.307

Informed consent statement signed by participants of all ages:



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Participant Signature: [signature]

Date: Oct 28 2018

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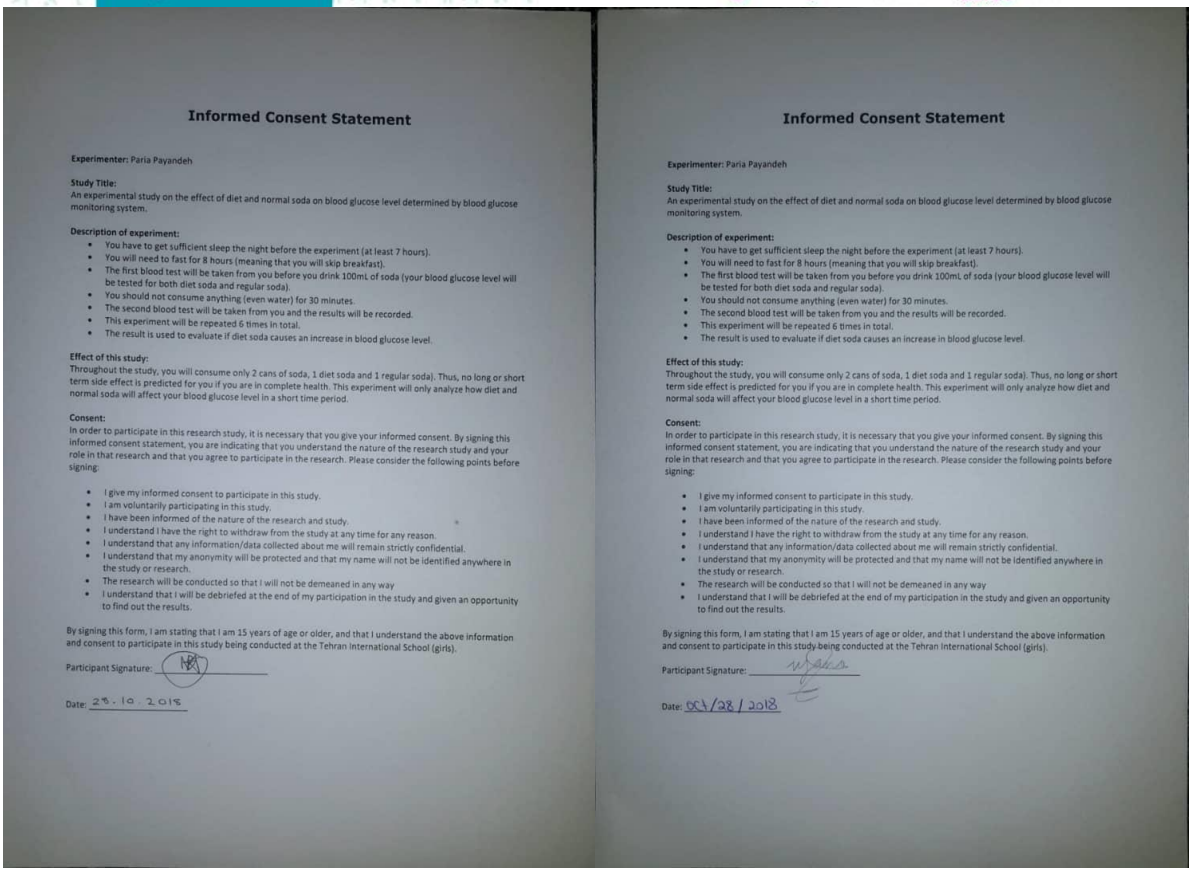

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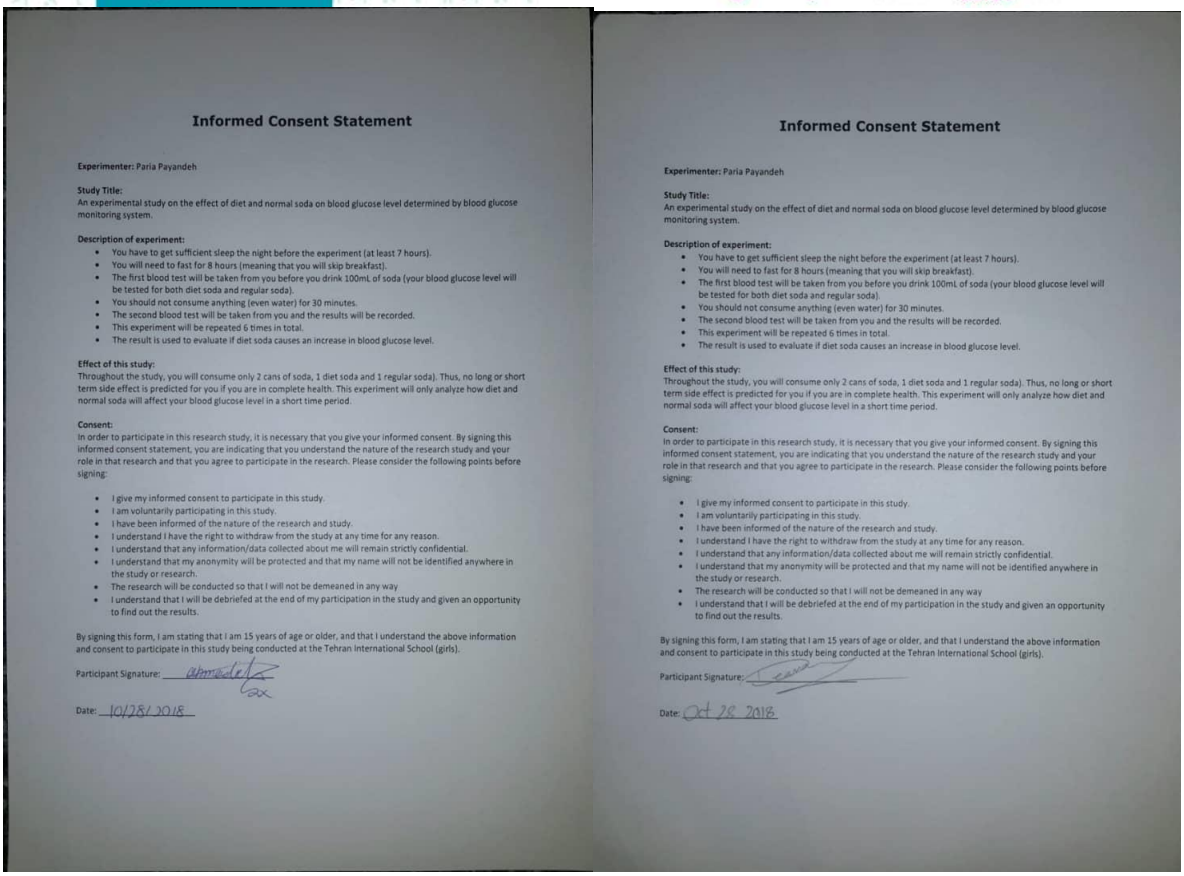

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Participant Signature: [signature]

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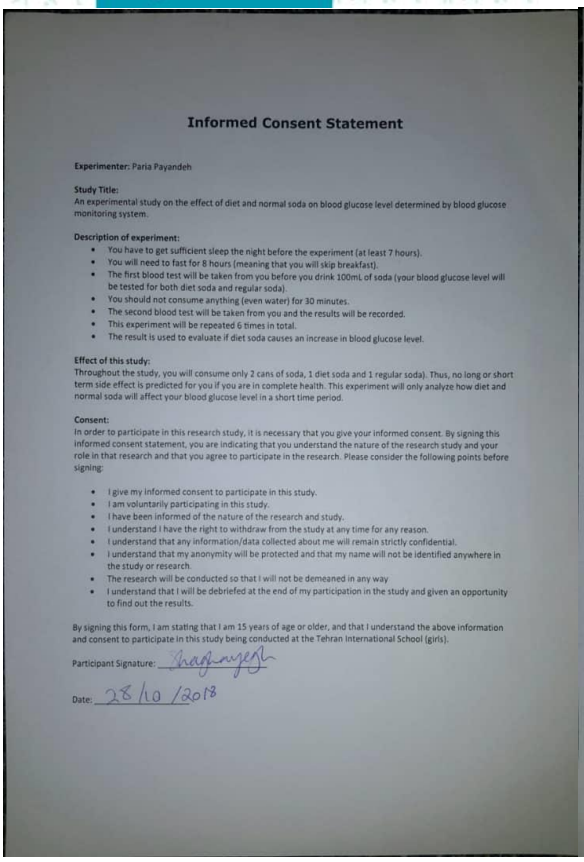

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Participant Signature: Shaghayegh

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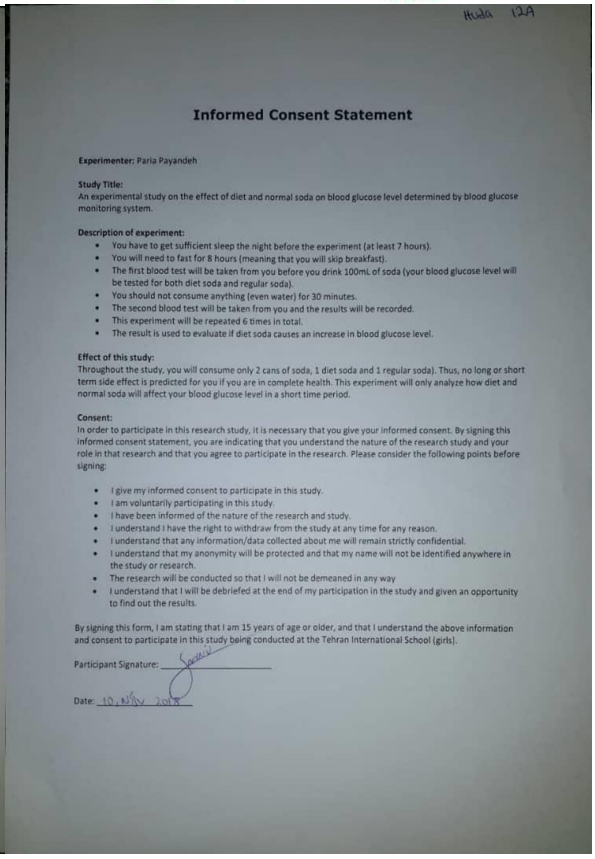

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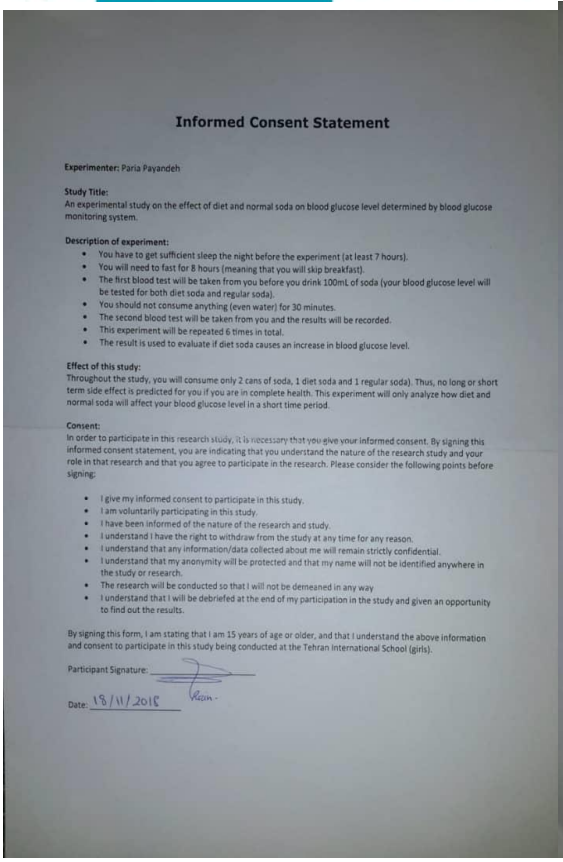

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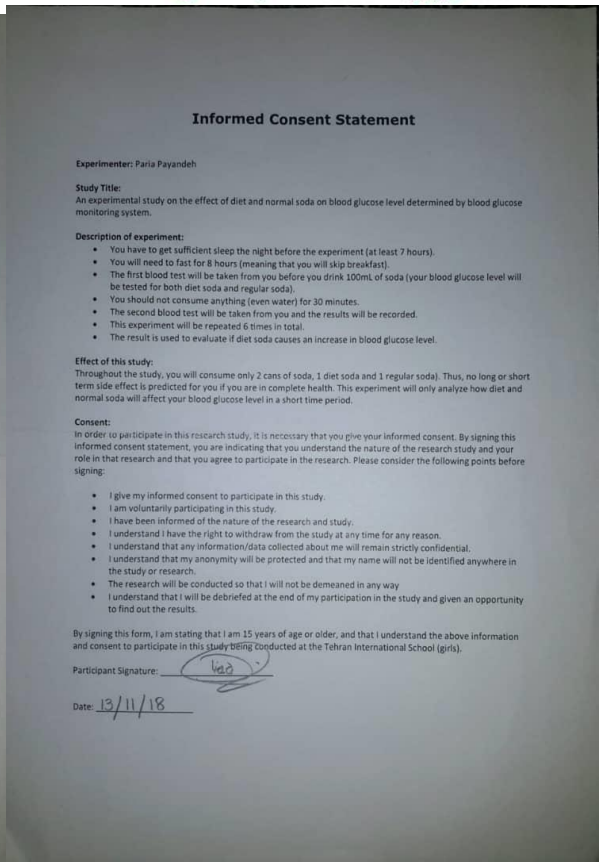

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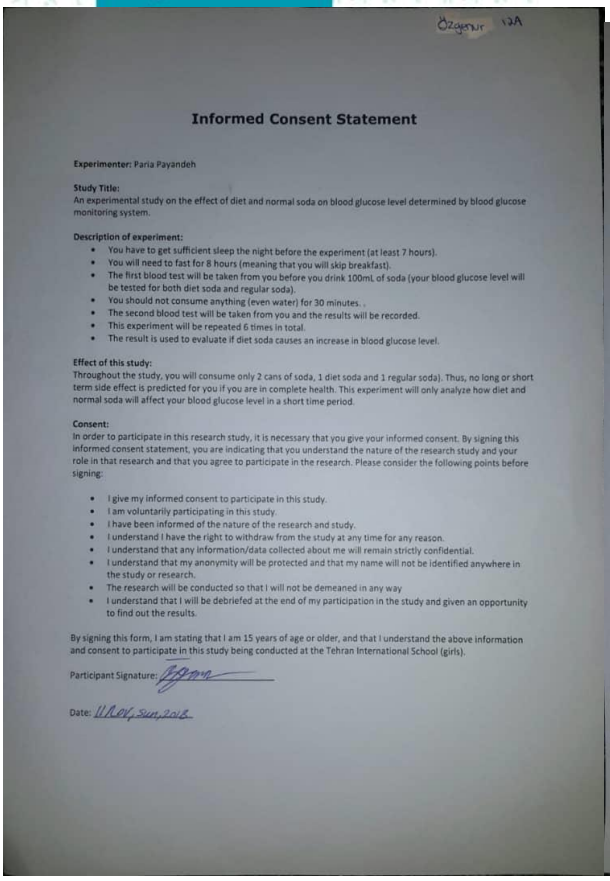
- I understand that my anonymity will be protected and that my name will not be identified anywhere in the study or research.
- The research will be conducted so that I will not be demeaned in any way
- I understand that I will be debriefed at the end of my participation in the study and given an opportunity to find out the results.

By signing this form, I am stating that I am 15 years of age or older, and that I understand the above information and consent to participate in this study being conducted at the Tehran International School (girls).

Participant Signature: _____

Date: 13/11/18



Özgenur 12A

Informed Consent Statement

Experimenter: Paria Payandeh

Study Title:
An experimental study on the effect of diet and normal soda on blood glucose level determined by blood glucose monitoring system.

Description of experiment:

- You have to get sufficient sleep the night before the experiment (at least 7 hours).
- You will need to fast for 8 hours (meaning that you will skip breakfast).
- The first blood test will be taken from you before you drink 100mL of soda (your blood glucose level will be tested for both diet soda and regular soda).
- You should not consume anything (even water) for 30 minutes. .
- The second blood test will be taken from you and the results will be recorded.
- This experiment will be repeated 6 times in total.
- The result is used to evaluate if diet soda causes an increase in blood glucose level.

Effect of this study:
Throughout the study, you will consume only 2 cans of soda, 1 diet soda and 1 regular soda). Thus, no long or short term side effect is predicted for you if you are in complete health. This experiment will only analyze how diet and normal soda will affect your blood glucose level in a short time period.

Consent:
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- I am voluntarily participating in this study.
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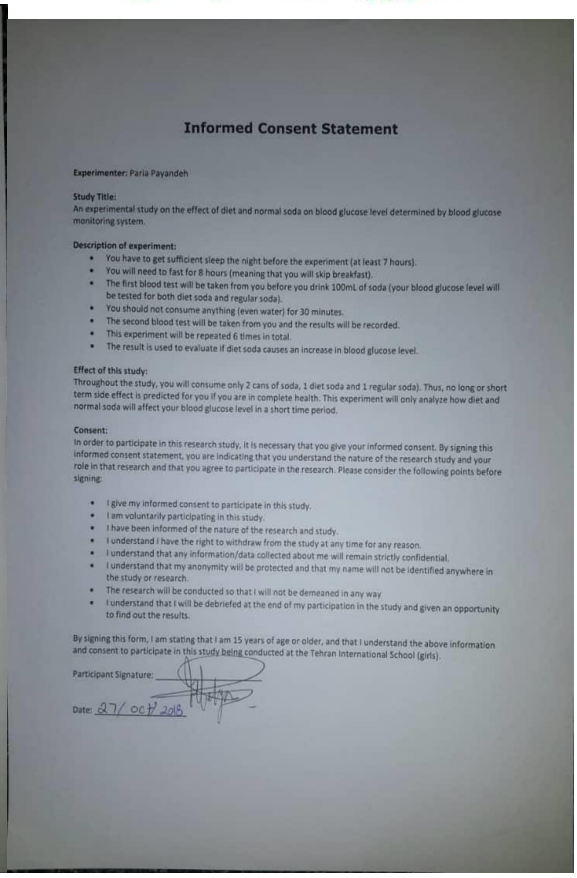
Participant Signature:

Date: 11 Nov, Sun, 2018



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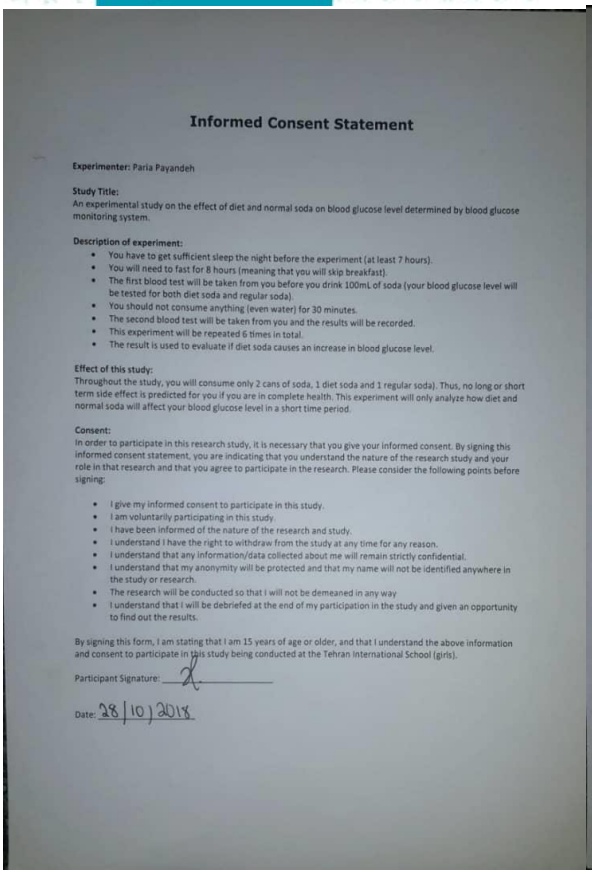
Participant Signature:

Date: 27/ Oct/ 2018



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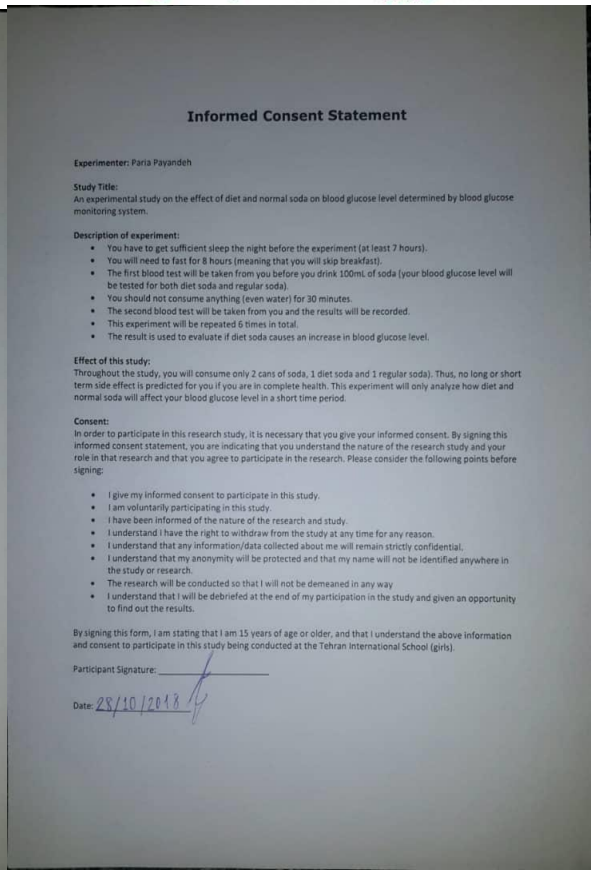
Participant Signature: _____

Date: 28/10/2018



Informed Consent Statement

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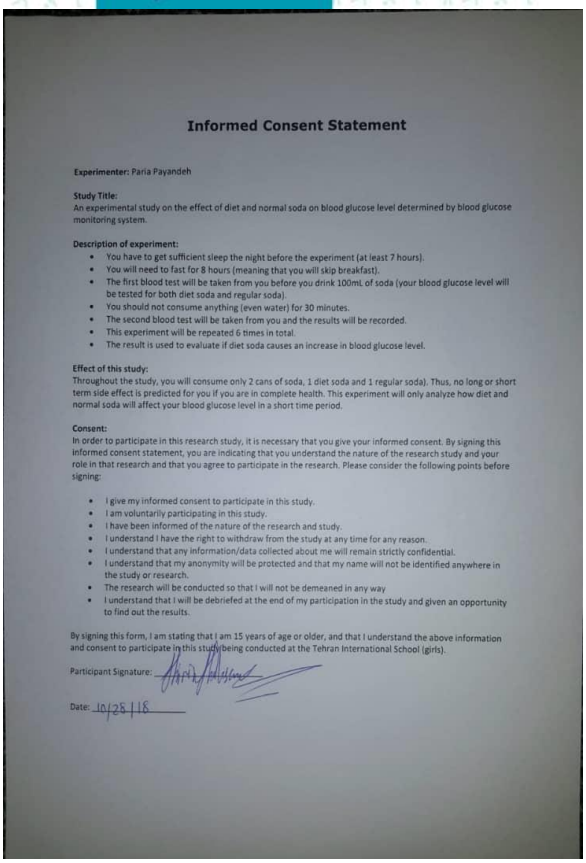
Participant Signature: _____

Date: 28/10/2018



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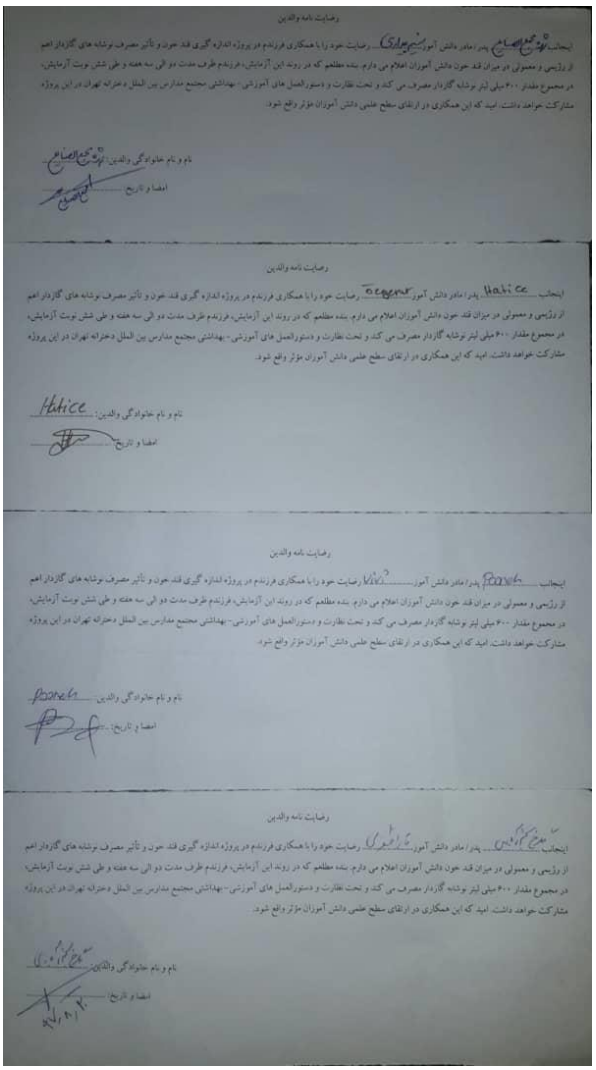
Participant Signature:

Date: 10/25/18

Informed consent statement signed by parents/guardians of participants under age of 18:



رضایت نامه والدین

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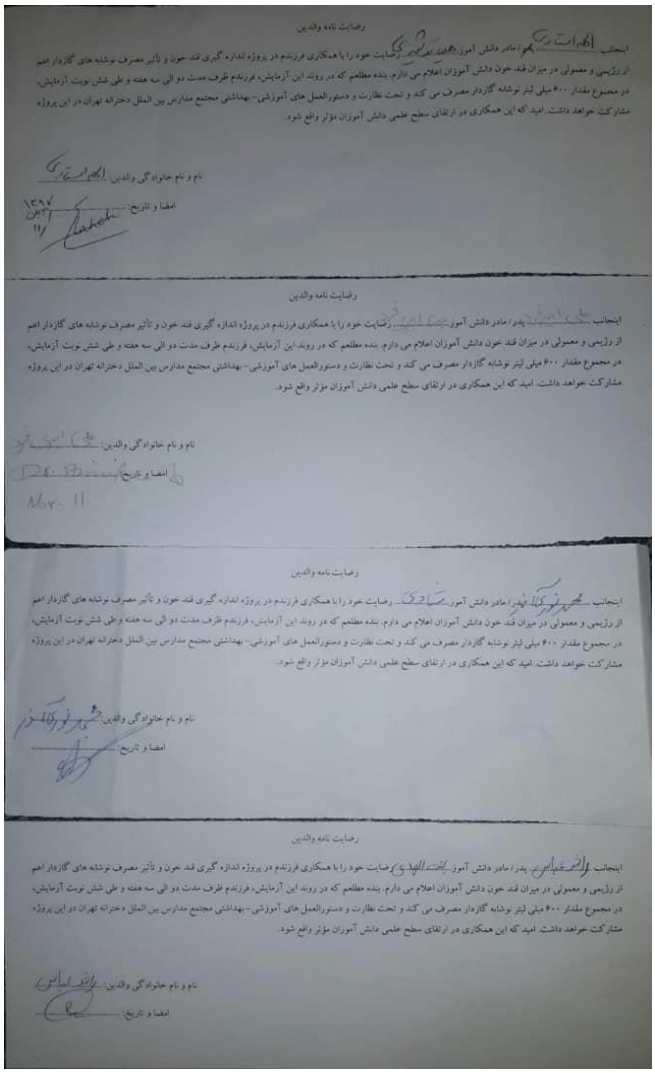

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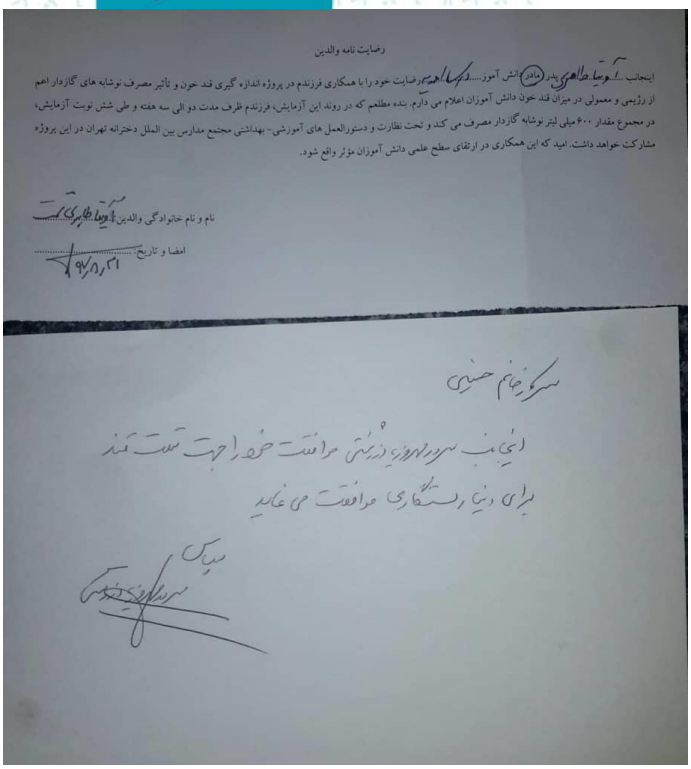


رضایت نامه والدین

اینجانب ..آیسا طاهری.. پدر (مادر) دانش آموز .....دریا ادم.. رضایت خود را با همکاری فرزندم در پروژه اندازه گیری قند خون و تاثیر مصرف نوشابه های گازدار اعم از رژیمی و معمولی در میزان قند خون دانش آموزان اعلام می دارم. بنده مطلعم که در روند این آزمایش، فرزندم ظرف مدت دو الی سه هفته و طی شش نوبت آزمایش، در مجموع مقدار ۶۰۰ میلی لیتر نوشابه گازدار مصرف می کند و تحت نظارت و دستورالعمل های آموزشی- بهداشتی مجتمع مدارس بین الملل دخترانه تهران در این پروژه مشارکت خواهد داشت. امید که این همکاری در ارتقای سطح علمی دانش آموزان مؤثر واقع شود.

نام و نام خانوادگی والدین: آیسا طاهری

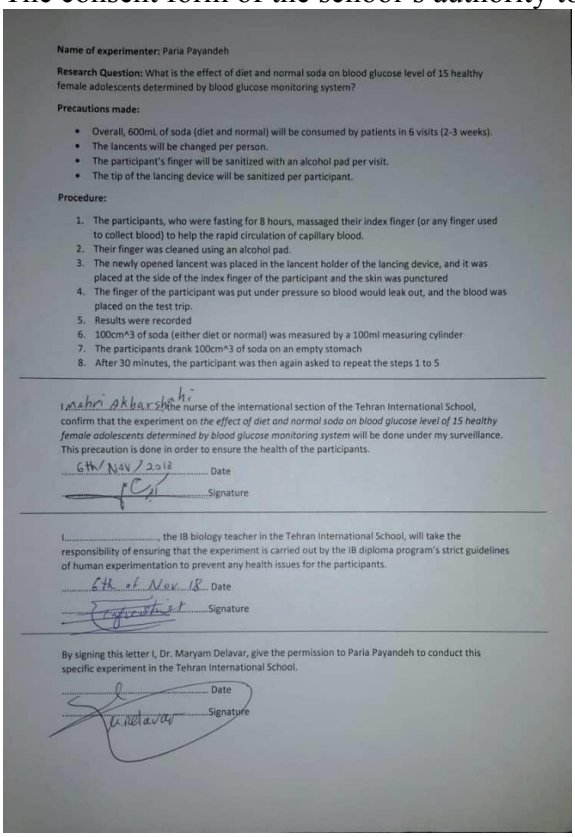
امضا و تاریخ: ۹۷/۸/۲۱

سرکار خانم حسنی

اینجانب بدینوسیله رضایت خود را جهت شرکت فرزند برای دختر دانشکاری موافقت می نماید

This parental consent statement summarizes the aim of the experiment: “I, ……, mother/father of ……. give the consent that allows my child to participate in the effect of natural and diet soda on blood glucose level of participant’s experiment. I am aware that my daughter will drink a total of 600mL of soda throughout the 6 session (2-3 weeks) experimentation under the influence of the standards of hygiene of the Tehran International School. With the hopes that this experiment will aid the advancement of students.
Name and last name of parent: ….
Signature and date: ….”

The consent form of the school's authority to allow me to perform the experiment in school:



Name of experimenter: Paria Payandeh

Research Question: What is the effect of diet and normal soda on blood glucose level of 15 healthy female adolescents determined by blood glucose monitoring system?

Precautions made:

- Overall, 600mL of soda (diet and normal) will be consumed by patients in 6 visits (2-3 weeks).
- The lancents will be changed per person.
- The participant's finger will be sanitized with an alcohol pad per visit.
- The tip of the lancing device will be sanitized per participant.

Procedure:

1. The participants, who were fasting for 8 hours, massaged their index finger (or any finger used to collect blood) to help the rapid circulation of capillary blood.
2. Their finger was cleaned using an alcohol pad.
3. The newly opened lancent was placed in the lancent holder of the lancing device, and it was placed at the side of the index finger of the participant and the skin was punctured
4. The finger of the participant was put under pressure so blood would leak out, and the blood was placed on the test trip.
5. Results were recorded
6. 100cm^3 of soda (either diet or normal) was measured by a 100ml measuring cylinder
7. The participants drank 100cm^3 of soda on an empty stomach
8. After 30 minutes, the participant was then again asked to repeat the steps 1 to 5

I Mahri Akbarshahi the nurse of the international section of the Tehran International School, confirm that the experiment on *the effect of diet and normal soda on blood glucose level of 15 healthy female adolescents determined by blood glucose monitoring system* will be done under my surveillance. This precaution is done in order to ensure the health of the participants.

6th/Nov/2018 ..... Date

..... Signature

I ..... the IB biology teacher in the Tehran International School, will take the responsibility of ensuring that the experiment is carried out by the IB diploma program's strict guidelines of human experimentation to prevent any health issues for the participants.

6th of Nov. 18 ..... Date

..... Signature

By signing this letter I, Dr. Maryam Delavar, give the permission to Paria Payandeh to conduct this specific experiment in the Tehran International School.

..... Date

..... Signature