http://www.cjmb.org

Open Access Original Article

Crescent Journal of Medical and Biological Sciences
Vol. 3, No. 4, October 2016, 136–138
eISSN 2148-9696

# The Effect of Commercial Sweetener "Cipla" on the Serum Lipid Profiles in Diabetes-Induced Rats

**Jafar Rahmani Kahnamoei[1*], Hamid Asadi Ghaleh[2]**

## Abstract

**Objective:** Deriving from sugar or sucrose, sucralose sweetener has no calories and is 600 times sweeter than sugar. Cipla as a commercial sweetener has different compounds, including lactose, L-leucine, cross, carmellose sodium, also creates a low calorie. In the present study the effect of Cipla on serum lipid profiles of diabetic and healthy rats was evaluated.

**Materials and Methods:** This study was conducted on 24 male Wistar rats weighing 230 ± 30 g that randomly divided into 4 equal groups: healthy control group, diabetic control group, healthy treatment group and the diabetic treatment group. Sucralose dosage in the present study was determined as daily 15 mg/kg for one month in healthy treatment group. The diabetic treatment group received that amount of sucralose by gavage. In order to induce diabetes in rats at 65 mg/kg dosage of streptozotocin was injected intraperitoneally and the rate of serum glucose was measured with a glucometer after 24 hours; so, the cases higher than 250 mg/dL were considered as diabetic rats. At the end of this process, blood samples were collected from tail vein of all rats. Following serum separation the serum lipid profiles (cholesterol, triglyceride, low-density lipoprotein [LDL], high-density lipoprotein [HDL]) were evaluated and analyzed using SPSS software (version 18).

**Results:** In this study, although the lack of meaningful change in HDL and meaningful decrease of triglyceride and cholesterol was proved

**Conclusion:** It seems that the administration of the sweetener by diabetic and cardiovascular patients must be done with caution due to increasing and meaningful effect of Cipla on serum LDL.

**Keywords:** Cipla, Sucralose, Lipid profiles, Rat

## Introduction

Sweeteners are classified into four groups: natural, artificial, purified, and sugar alcohols; among which the artificial one does not produce high energy even some of them such as sucralose are excreted from body without entering metabolic processes. The sweetening effect of sucralose is 600 times more than sugar and is available in different commercial brands. Sucralose decomposes to 4-CG and 1, 6 DCF due to hydrolysis.

These products are stable against more hydrolysis, because sucrose chlorination and conversion to sucralose makes changes in molecule conformation and makes it stable against glycoside enzymes of the digestive tract which cause normally the decomposition of carbohydrates (1).

According to the conducted studies, the pure sucralose is lack of meaningful effects on serum biochemical factors such as glucose and lipid profiles, but since the sweetener, beside 6.5 mg sucralose, has lactose, cellulose, and magnesium stearate as well as it provides a low calorie, Cipla was used in the present study. On the other hand, the main consumers of the sweeteners are diabetics and fat people; therefore, in the present study the effect of Cipla on serum lipid profiles (cholesterol, triglyceride, low-density lipoprotein [LDL], high-density lipoprotein [HDL]) in diabetic and healthy rats was evaluated. Sucralose maximum daily allowance is 15 mg/kg (2).

In the study conducted by Saada et al (3), it was demonstrated that the administration of sucralose in healthy rats caused a 14% decrease in serum glucose, a 20 % increase in total cholesterol, 25% increase in HDL, a 32% increase in LDL, and 17% decrease in triglyceride levels.

In a study by Grotz and Munro, it was found that sucralose in a 7.5 mg/kg/day dosage for one month had no meaningful effect on HbA1c and serum glucose in human (5).

## Materials and Methods

This study was conducted on 24 male Wistar rats weighing 230 ± 30 g that randomly divided into 4 equal groups: healthy control group, diabetic control group, healthy treatment group and the diabetic treatment group. The healthy and diabetic control groups received basic dietary. Considering the conducted studies by Shastry et al (2), as well as the Food and Drug Administration (FDA) standards, sucralose dosage in the present study was determined as daily 15 mg/kg for one month in healthy treatment group. The diabetic treatment group received

**Received** 18 October 2015, **Accepted** 12 August 2016, **Available online** 29 August 2016

[1]Department of Clinical Science, Tabriz Branch, Islamic Azad University, Tabriz, Iran. [2]Department of Veterinary Medicine, Tabriz Branch, Islamic Azad University, Tabriz, Iran.
***Corresponding author:** Jafar Rahmani Kahnamoei, Email: Jrahmani28@gmail.com

that amount of sucralose by gavage. In order to induce diabetes in rats at 65 mg/kg dosage of streptozotocin was injected intraperitoneally and the rate of serum glucose was measured with a glucometer after 24 hours; so, the cases higher than 250 mg/dL were considered as diabetic rats. Equal conditions of light, temperature, and food were provided for all rats during the experiment. At the end of this process, blood samples were collected from tail vein of all rats. Following the serum separation, serum lipid profiles (cholesterol, triglyceride, LDL, HDL) were evaluated using Pars Azmoon kits and the obtained data were analyzed using SPSS software (version 18).

## Results

### The Mean Level of Serum Cholesterol

The mean level of cholesterol was measured in different groups and the results were compared using analysis of variance (ANOVA) test in probability level of 95% and *P* value of 0.05 which has been presented in Table 1 .

Based on the obtained results, a meaningful difference was observed among understudied groups in the mean of cholesterol ($P < 0.05$). The highest and lowest rates were in the diabetic control and Cipla treatment groups, respectively.

### The Mean Level of Serum Triglyceride

The mean level of triglyceride was measured in different groups and the results were compared using ANOVA test in probability level of 95% and *P* value of 0.05 which has been presented in Table 2.

Based on the obtained results, a meaningful difference was observed among understudied groups about the mean of triglyceride ($P < 0.05$). The highest and lowest rates were in the healthy control and Cipla treatment groups, respectively.

### The Mean Level of Serum HDL

The mean level of HDL was measured in different groups and the results were compared using ANOVA test in probability level of 95% and *P* value of 0.05 which has been presented in Table 3.

Based on the obtained results, no meaningful difference was observed among understudied groups about the mean of HDL serum activity ($P > 0.05$). The highest and lowest rates were in the diabetic control and diabetic treatment groups, respectively.

### The Mean Level of Serum LDL

The mean level of LDL serum activity was measured in different groups and the results were compared using ANOVA test in probability level of 95% and P value of 0.05 which has been presented in Table 4.

Based on the obtained results, a meaningful difference was observed among understudied groups about the mean serum LDL level ($P < 0.05$). The highest and lowest rates were in the diabetic treatment and Cipla treatment groups, respectively.

## Discussion

In a study conducted by Shastry et al (2) in which oral administration of 15 mg/kg sucralose (ADI accepted dosage) was conducted on rats in three-time phases (0-3 weeks= 1×ADI, 3-7 weeks= 2×ADI, and 7-13 weeks= 4×ADI), the meaningful increase was proved in serum lipid profiles on phases 2 and 3 whereas in phase one no tangible change was observed in the treatment group compared with the control group which is completely in contrast with the results of the present study (2 ).

In the study conducted by Saada et al, a meaningful cholesterol increase was reported in sucralose group compared with the control group that is not compatible with the results of this study (3).

In the present study a meaningful increase of LDL and decrease of triglyceride was observed in sweetener and sweetener- diabetic compared with the control group which is consistent with the results of the study conducted by Saada et al (3).

In the present study the lack of meaningful change in HDL was proved which is not consistent with the results of the

**Table 1.** Comparison of the Serum Cholesterol Level (mg/dL) in Understudied Groups*

| Group | Mean ± SE | SD |
|---|---|---|
| Sweetener-diabetic treatment | 82.57 ± 4.57 [ab] | 12.10 |
| Sweetener treatment | 67.14 ± 4.43 [a] | 11.73 |
| Diabetic control | 92.00 ± 6.22 [b] | 13.91 |
| Healthy control | 75.50 ± 6.50 [ab] | 9.19 |

* $P = 0.02$.
Different letters represent a meaningful statistical difference.

**Table 2.** Comparison of triglyceride Level (mg/dL) in Understudied Groups*

| Group | Mean ± SE | SD |
|---|---|---|
| Sweetener-diabetic treatment | 66.71 ± 4.95 [a] | 13.11 |
| Sweetener treatment | 57.86 ± 4.22 [a] | 11.18 |
| Diabetic control | 68.40 ± 3.45 [a] | 7.73 |
| Healthy control | 92.50 ± 11.50 [b] | 16.26 |

* $P = 0.01$.
Different letters represent a meaningful statistical difference.

**Table 3.** Comparison of the HDl Level (mg/dL) in Understudied Groups*

| Group | Mean ± SE | SD |
|---|---|---|
| Sweetener-diabetic treatment | 36.07 ± 2.18 | 5.76 |
| Sweetener treatment | 36.85 ± 2.75 | 7.27 |
| Diabetic control | 44.06 ± 4.39 | 9.82 |
| Healthy control | 39.05 ± 1.95 | 2.75 |

* $P = 0.29$.

**Table 4.** Comparison of the LDL Level (mg/dL) in Understudied Groups*

| Group | Mean ± SE | SD |
|---|---|---|
| Sweetener-diabetic treatment | 37.92 ± 5.42 [b] | 14.35 |
| Sweetener treatment | 18.71 ± 2.92 [a] | 7.74 |
| Diabetic control | 34.26 ± 3.77 [ab] | 8.43 |
| Healthy control | 17.95 ± 6.85 [a] | 9.68 |

* $P = 0.01$.
Different letters represent a meaningful statistical difference.

study conducted by Saada et al that a 25% decrease has been reported in HDL (3).

In the study conducted by Mathe the increased cholesterol following administration of sucralose has been reported that the increased intestinal absorption and/or increased cholesterol synthesis has been mentioned as a reason that is not consistent with the results of the present study (6).

In this study, the rate of serum triglyceride in sucralose treatment group has decreased compared with the control group that contrasts with the results of the study conducted by Semenkovich et al (7) that elevated triglycerides were reported after consumption of sucralose in conflict.

In the study conducted by Ferré, the decreased level of triglyceride has been proved following administration of sucralose, which is consistent with the results of the present study. The reason of this decrease may be due to the effect of sucralose on PPAR-α which causes lipoprotein expression lipoprotein lipase and increased triglyceride reserve (8).

In the study conducted by Fruchart et al (9), the increased HDL following administration of sucralose has been reported that is in contrast with the findings of the present study.

Already Kawamura et al proved that hyperglycemia by accelerating lipid peroxidation of LDL through path-dependent superoxide generates free radicals (10).

Increase serum cholesterol is associated with increased intestinal absorption. The decline may be related to the effect of the PPAR-α sucralose that will lead to expression of lipoprotein lipase.

Although in the present study the meaningful decrease in triglyceride and cholesterol as well as the lack of meaningful change in HDL was proved, it seems that Cipla by diabetics and the cardiovascular patients must be consumed with caution due to its increasing and meaningful effect on serum LDL.

## Ethical Issues

All protocol of the study approved by ethic committee of Islamic Azad University, Tabriz Branch, Tabriz, Iran.

## Conflict of Interests

None.

## Financial Support

None.

## Acknowledgments

None.

## References

1. Campos MB. Sucralose. Food Ingredients. 2000;17;18-21.
2. Shastry, CS, Yatheesh CK, Aswathanarayana BJ. Comparative evaluation of diabetogenic and mutagenic potential of artificial sweeteners aspartame, acesulfame-k and sucralose. NUJHS. 2012;2(3):80-84.
3. Saada HN, Mekky NH, Eldawy HA, Abdelaal AF. Biological effect of sucralose in diabetic rats. Food Nutr Sci. 2013;4:82-89. doi: 10.4236/fns.2013.47A010
4. Rodero AB, Rodero LD, Reinaldo A. Toxicity of sucralose in humans: a review. Int J Morphol. 2009;27(1):239-244. doi:10.4067/S0717-95022009000100040.
5. Grotz VL, Munro IC. An overview of the safety of sucralose. Regul Toxicol Pharmacol. 2009;55:1-5.
6. Mathe D. Dyslipidemia and diabetes animal models. Diabetes Metab. 1995;21(2):106.
7. Semenkovich CF1, Wims M, Noe L, Etienne J, Chan L. Insulin regulation of lipoprotein lipase activity in 3T3-L1 adipocytes is mediated at posttranscriptional and posttranslational levels. J Biol Chem. 1989;264(15):9030-8.
8. Ferré P. The biology of peroxisome proliferator-activated receptors: relationship with lipid metabolism and insulin sensitivity. Diabetes. 2004;53(1):43-50.
9. Fruchart JC, Staels B, Duriez P. PPARs, metabolic disease and atherosclerosis. Pharm Res. 2001;44(5): 345-52.
10. Kawamura M, Heinecke JW, Chait A. Pathophysiological concentrations of glucose promote oxidative modification of low density lipoprotein by a superoxide-dependent pathway. J Clin Invest. 1994;94(2):771-8.