IJMPR 2023, 7(3), 16-21

International Journal of Modern Pharmaceutical Research

www.ijmpronline.com

ISSN: 2319-5878

IJMPR

Research Article

SJIF Impact Factor: 5.273

COMPARITIVE STUDY ON DETERMINING THE EFFICACY OF PUMPKIN AND SUNFLOWER SEEDS IN REDUCING THE HYPERGLYCEMIC LEVELS IN INDIVIDUALS WITH TYPE 2 DIABETES MELLITUS

Soundharya Subramanian[1], Lally Hanna Luke*[2] and Deepa C. Philip[3]

[1]Post Graduate Student, Department of Clinical Nutrition, MMM College of HealthSciences, Tamil Nadu Dr. MGR University, Chennai, India.

[2]Associate Professor of Clinical Nutrition, Department of Clinical Nutrition, MMM Collegeof Health Sciences, Tamil Nadu Dr. MGR University, Chennai, India.

[3]Principal, MMM College of Health Sciences.

Received on: 04/01/2023

Revised on: 24/01/2023

Accepted on: 14/02/2023

***Corresponding Author**

Lally Hanna Luke

Associate Professor of Clinical Nutrition, Department of Clinical Nutrition, MMM Collegeof Health Sciences, Tamil Nadu Dr. MGR University, Chennai, India.

lallyluke3@gmail.com

ABSTRACT

Purpose: The current study aims in comparing the efficacy of pumpkin and sunflower seeds in reducing hyperglycaemic level in Type 2 Diabetes Mellitus and finding the best suitable one out of two. **Methodology:** An experimental study involving cases and controls with type 2 diabetes mellitus. The cases were divided into two groups. Group 1 (n=12) was supplemented with pumpkin seeds and Group 2 (n=12) with sunflower seeds and were compared with controls (n=12). The fasting and post prandial blood glucose levels of pre and post supplementation was collected from the samples using GlucoRite glucometer. **Results:** There was a huge decrease in fasting and post prandial blood glucose levels in samples supplemented with sunflower seeds than pumpkin seeds. Fasting and post prandial blood glucose values showed a significance difference in group 2 (p value=0.01). Comparison of post supplementation values of fasting and post prandial blood glucose levels with controls was significant with group 2 (p Value= 0.03). **Conclusion:** Cases depicted reduced blood glucose levels than controls. Sunflower seeds have greater antidiabetic activity than pumpkin seeds. Thus, diabetic individuals can include these seed varieties in their daily diet to maintain a healthy blood glucose profile.

KEYWORDS: Pumpkin seeds, Sunflower seeds, Diabetes Mellitus, Phyto-bioactive compounds, Nutrients, Anti-oxidants, Insulin resistance.

INTRODUCTION

Type 2 diabetes mellitus, is a chronic metabolic disorder characterized by high blood glucose levels that result from insulin resistance and impaired pancreatic beta-cell function.[1] The aetiology of T2DM is a complex multi-factorial process.[2] The primary contributors are genetics (40% chance if one parent is diabetic and 70% chance if both are diabetic) and lifestyle factors (physical inactivity, sedentarism, smoking, consumption of alcohol).[3,4] Obesity has been closely associated with diabetes and contributes to approximately 55% of cases of T2DM.[5,6] This close relationship led to the connotation 'diabesity', highlighting the fact that the majority of individuals with diabetes are overweight or obese.[7] Various natural products and its bioactive compounds in plants are used as therapeutic alternatives for treatment of type 2 diabetes and its complications without causing toxicity and adverse effects.[8,9,10]

In recent years, seeds and nuts have received growing attention due to its high nutraceutical and natural therapeutic value of their bioactive components. The pumpkin seeds are rich in bioactive composites like flavonoids, squalene, saponins, phytosterols, triterponoids, and polyphenolic components and macromolecules like Trigonelline (TRG), Nicotinic acid (NA) and D-Chiro-inositol (DCI) that induces hypoglycaemic effect by stimulating insulin release from pancreatic β-cells and protecting β-cells from pro inflammatory markers.[11,18] DCI is considered as an insulin-sensitizer.[8] Pumpkin seeds are rich in functional components like tocopherols, carotenoids, pro-vitamins, pigments, phytosterols, phenolic compounds and their derivatives, unsaturated fatty acids and proteins too.[12] The chemical constituents of sunflower seeds contained flavonoids (heliannone, quercetin), phenolic acids (caffeic acid, chlorogenic acid, gallic acid and ferulic acid) and fatty acids (lauric, palmitic, oleic, linoleic, stearic, linolenic). These compounds effectively control postprandial hyperglycaemia through α-glycosidase inhibitors which suppress intestinal brush border enzymes and thereby reduce carbohydrate digestion and absorption from the gut.[13] The heliangolide sesquiterpene lactone is a bioactive secondary metabolite derivative in sunflower seeds. It reduces the fasting blood glucose by reducing glucose absorption, increased glucose uptake by the liver & skeletal muscle and stimulated insulin release & beta-cell regeneration.[14] Therefore; this paper focuses on comparing and understanding the hypoglycaemic effect of pumpkin and sunflower seeds and identifying the potential seed variety as an effective and sustainable alternative for reducing hyperglycaemic level in patients with type 2 Diabetes Mellitus.

MATERIALS AND METHODS

Experimental study design was conducted in which the cases were supplemented with pumpkin and sunflower seeds. A sample of 36 participants (24 Cases and 12 Controls) (age range: 30-60 years) were selected through random sampling method and all of them had diabetes duration for a period of 6 months to 25years. Informed consent was obtained from all the participants. The inclusion criteria were male and female subjects diagnosed with type 2 diabetes mellitus and HbA1c level of ≥6.1%. Pregnant women, lactating mothers and geriatric population were excluded. The primary data needed for the study was collected through a questionnaire method directly from the participants. The questionnaire contains 35 questions which enquire about their anthropometry measurements (height and weight), age, family history, medications, physical activity and dietary pattern through food frequency table and 24 hours dietary recall.

The cases were armed into two groups: **GROUP 1:** 12 Participants was supplemented with pumpkin seeds. **GROUP 2:** 12 Participants was supplemented with sunflower seeds.

SUPPLEMENTATION OF PUMPKIN AND SUNFLOWER SEEDS: PROCEDURE

Both pumpkin and sunflower seeds were roasted separately in medium flame for 3-4 minutes till the seeds popped up. The seeds were cooled down and then packed in small zip lock covers separately with each cover carrying 5 grams of seeds measured using ESSAE Teraoka 30kg weighing scale. 30 packets (of these small ones) of both pumpkin and sunflower seeds were packed separately into a large zip lock cover as an individual kit. Twelve participants were provided with the pumpkin seed kit and twelve participants with sunflower seed kit for duration of one month. All participants received instructions on the protocol of consuming the seeds during the first visit and were also given an option of hourly reminders (via call or text message) to avoid missing a sample. The protocol instructed the participants to consume one small seed pack (with 5grams of seeds) every day along with their breakfast.

RESULTS

Males and females were equally distributed between the cases and controls groups. The meanage of group 1 was 54.1 ± 3.43, group 2 was 50.7 ± 6.66 and Controls was 49.8 ± 4.78. The post supplementation values of fasting (p value=0.01) and post prandial (p value= <0.01) blood glucose levels showed a significance difference in group 2. On comparison of group 2 with controls the fasting and post prandial blood glucose levels were significant (P value=0.03). Independent sample t test was conducted for comparison between case and control groups. The level of significance was taken as p value ≤0.05%. Paired t test was conducted between case and control to identify statistical difference.

Table 1: Demographic and Anthropometric details of individuals in two groups andControls.

Variables	Group 1 (n=12)	Group 2 (n=12)	Controls (n=12)	P value
Age	54.1 ± 3.43	50.7 ± 6.66	49.8 ± 4.78	0.10[a]
Gender (M:F)	6:6	5:7	4:8	0.71[b]
BMI	26.75 ± 5.25	30.51 ± 9.49	30.13 ± 6.40	0.39[a]

Abbreviations: BMI- Body Mass Index. a One way ANOVA, b Chi square test.

Table 2: Medical and Diet History of all individuals in two groups and Controls.

QUESTIONS	GROUP 1 (n)%	GROUP 2 (n)%	CONTROLS (n)%
Family history			
Yes	(8) 66.7%	(10) 83.3%	(10) 83.3%
No	(4) 33.3%	(2) 16.7%	(2) 16.7%
Physical Activity			
Yes	(7) 58.3%	(5) 41.7%	(4) 33.3%
No	(5) 41.7%	(7) 58.3%	(8) 66.7%
Sugar Intake			
Yes	(6) 50%	(7) 58.3%	(7) 58.3%
No	(6) 50%	(5) 41.7%	(5) 41.7%
Artificial Sweeteners Intake			
Yes	(2) 16.7%	(2) 16.7%	(3) 25%
No	(10) 83.3%	(10) 83.3%	(9) 75%

Diet Pattern			
Vegetarian	(7) 58.3%	(8) 66.7%	(6) 50%
Non- Vegetarian	(4) 33.3%	(4) 33.3%	(6) 50%
Ova- Vegetarian	(1) 8.3%	-	-

Mean values were represented in percentage.

Table 3: 24 hour's dietary recall of individuals in two groups and Controls.

Variables	Group 1	Group 2	Controls		RDA
	Mean	Mean	Mean	Male	Female
Energy	1896Kcals	1750kcals	1925kcals	2110kcals	1660kcals
Protein	65g	62.3g	50.3g	54g	45.7g
Carbohydrate	250g	215g	300.4g	130g	130g
Fat	22.9g	25g	30.2g	25g	20g
Fiber	26.7g	34.8g	30g	24g	24g

Abbreviations: RDA- Recommended Dietary Allowances.

Table 4: Comparison of Fasting Blood glucose level of individuals in Group 1, 2 andControls.

Groups	Pre-supplementation (mg/dl)	Post supplementation (mg/dl)	P value
Group 1	208.42 ± 77.32	188.33 ± 55.90	0.20
Group 2	197.33 ± 70.11	140.92 ± 28.33	**0.01***
Controls	146.75 ± 25.24	172.33 ± 40.79	**0.02***

*p <0.05% denotes statistical significance.

Table 5: Comparison of Post Prandial Blood glucose level of individuals in Group 1, 2 and Controls.

Groups	Pre-supplementation (mg/dl)	Post-supplementation (mg/dl)	P value
Group 1	300.42 ± 123.93	288 ± 120.48	0.64
Group 2	284.08 ± 84.98	189 ± 41.81	**<0.001***
Controls	224.08 ± 37.35	248.92 ± 79.86	0.22

*p <0.05% denotes statistical significance.

Table 6: Comparison of blood glucose level between Group 1 and Controls postsupplementation.

Variables	Group 1	Controls	P value
Fasting	188.33 ± 55.90	172.33 ± 40.79	0.43
Post prandial	288 ± 120.48	248.92 ± 79.86	0.35

Parameters summarized as mean ± SD.

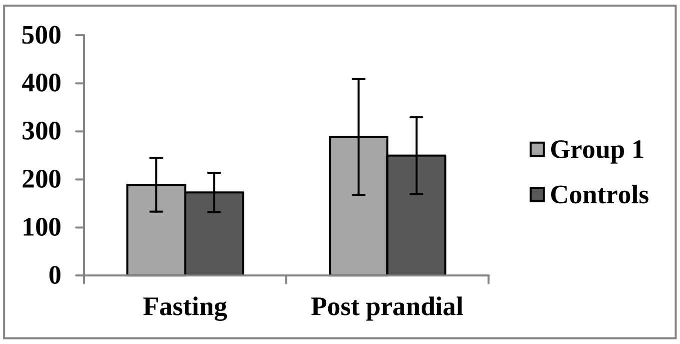

Fig 1: Bar graph depicting comparison of blood glucose level within Group 1 andControls Post supplementation.

Table 7: Comparison of blood glucose level between Group 2 and Controls postsupplementation.

Variables	Group 2	Controls	P value
Fasting	140.92 ± 28.33	172.33 ± 40.79	**0.03***
Post prandial	189 ± 41.81	248.92 ± 79.86	**0.03***

*p <0.05% denotes statistical significance.

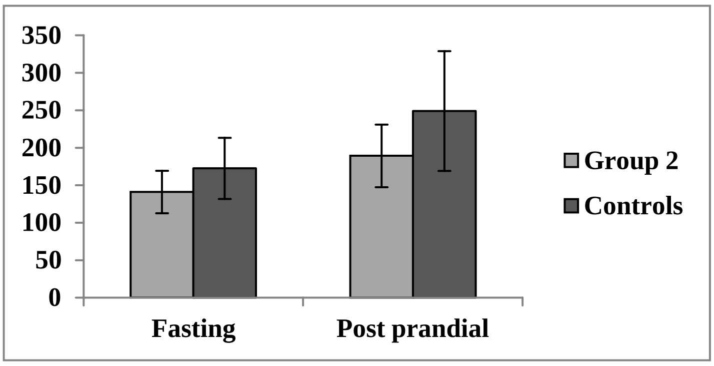

Fig 2: Bar graph depicting comparison of blood glucose level within Group 2 andControls post supplementation.

DISCUSSION

Controlling blood sugar levels is very much important for patients suffering from DM and forthose who are at a high risk of developing it. Even modest fasting and postprandial hyperglycemia may lead to β-cell dysfunction, leading to T2DM manifestation.[15] Insulin resistance (IR) and pancreatic beta-cell dysfunction are the core defects in the development of T2DM.[16] Throughout history, different remedies and drugs have been used to treat T2DM. Natural phyto-bioactive compounds are currently more in demand for the treatment of diabetes owing to the rich availability, efficacy and fewer side effects.[17] Therefore, our paper aimed at understanding the naturally occurring bioactive compounds in seeds of pumpkin and sunflower and their mechanism in regulating the blood glucose levels in body.

In a randomized placebo-controlled clinical trial by Flávia G. Cândido et al., reported that consumption of 65 g of pumpkin seed markedly reduced postprandial hyperglycemia.[18] In a Randomized Crossover Study by Michio Shimabukuro et al., stated that there was a reduction of around 35% of total postprandial hyperglycemic response, when pumpkin seeds were added to carbohydrate-rich meals.[19] Maryam Jafari et al, and F. Guillon et al., indicated that pumpkin seeds are rich in pectin, a type of dietary fiber, which regulates blood glycemic levels and reduce the need for insulin when fiber-rich foods are consumed by diabetic patients.[20] Gu and Li et al., suggested that inositol, zinc, chromium, cobalt and protein from germinated pumpkin seed, could chronically reduce hyperglycemia in diabetic individuals.[21] A study by Ashok Sharma et al., and Alyae, M.S. Gabal noted that pumpkin seed extracts produced significant anti-diabetic effect in controlling the blood glucose level by increasing either the pancreatic secretion of insulin from β-cells of islets of langerhans or its release from bound insulin or increased peripheral utilization of glucose in streptozotocin induced diabetic rats.[22,23] Studies on male albino rat models by A.M. Abdul Azeem et al., suggested that the γ-irradiated pumpkin seeds afforded substantial treatment of hyperglycemic disorders by improving the endocrine disturbance.[24] Mohamed Makni et al. reported that supplementing diet with flax and pumpkin seed mixture partly preserved pancreatic function, increased hepatic glycogen content and improved peripheral glucose in alloxan induced diabetic rats. This indicates that the preservation of hepatic glycogen was maintained and the gluconeogenesis rate was depressed.[25] Contradicting to these above statements the current study reported that there was not much reduction in post prandial bloodglucose levels in diabetic individuals when supplemented with pumpkin seeds. Our results indicates that clinically pumpkin seeds had ability to lower both fasting and post prandial blood glucose levels to some extent but, statistically it was not significant. The natural compounds present in sunflower seeds like heliannone, quercetin, phenolic acids (caffeic acid, chlorogenic acid, gallic acid and ferulic acid) had higher efficiancy in reducing blood glucose levels compaired to pumpkin seeds.

Cheenam.B et al., stated that the participants taking sunflower seeds showed a positive and a faster decrease in their fasting blood glucose level than controls.[26] A study by Saini et al., reported that the ethanolic extract of sunflower seeds and its fractions were given to albino rats at dose level 250 mg/kg and 500 mg/kg. The phytochemical assesment showed that ethanolic extract of sunflower seeds contain tannins, steroid, terpenoids, saponins, flavonoids, and alkaloid; caused a reduction in diabetes and its complications. This concluded that the ethanolic extract of sunflower seeds have potential antidiabetic activity.[27] Supporting to these statements our statistical results indicates that sunflower seeds help in reduction of both fasting and post prandial blood glucose levels in diabetic individuals. On comparison with controls, sunflower seeds showed significant reduction in hyperglycaemic status. These results postulated that sunflower seeds have better anti-diabetic activity than pumpkin seeds and proved as a best suitable seed variety to control hyperglycaemia. Along with diabetic medications sunflower seeds showed better management. A regular inclusion of sunflower seeds in diet helps in effective and better control of fasting and post prandial blood glucose levels whereas; daily consumption of pumpkin seeds will help in gradual management of blood glucose levels. Future studies can be done to examine the hypoglycaemic effect of pumpkin seed and sunflower seed by conducting for a longer period of time.

CONCLUSION

USDA national nutrition database reports states that both pumpkin and sunflower seeds plays a significant role in providing the essential macro and micronutrients for the wellness of body. On the basis of above described results, it is concluded that sunflower seeds have greater antidiabetic activity than pumpkin seeds. Daily inclusion of sunflower seeds in diet along with a physically active lifestyle helps in managing hyperglycaemic levels in individuals with type 2 diabetes mellitus.

ACKNOWLEGMENT

I sincerely acknowledge Vishwa Shree Group Clinic and Pharmacy for the support throughout the process. My sincere and heartfelt thanks to all research participants for their time and never ceasing patience.

CONFLICT OF INTEREST

No conflict of interest was declared by the authors.

FINANCIAL DISCLOSURE

The authors declared that this study has received no financial support.

REFERENCES

1. Watanabe, R. M., Ghosh, S., Langefeld, C. D., Valle, T. T., Hauser, E. R., Magnuson, V. L & Boehnke, M. (2000). The Finland–United States investigation of non–insulin-dependent diabetes mellitus genetics (FUSION) study. II. An autosomal genome scan for diabetes- related quantitative-trait loci. *The American Journal of Human Genetics*, *67*(5): 1186-1200.
2. Artasensi, A., Pedretti, A., Vistoli, G., & Fumagalli, L. (2020). Type 2 diabetes mellitus: a review of multi-target drugs. *Molecules*, 1987; *25*(8).
3. Ali, O. (2013). Genetics of type 2 diabetes. *World journal of diabetes*, *4*(4): 114.
4. Javeed, N., & Matveyenko, A. V. (2018). Circadian etiology of type 2 diabetes mellitus. *Physiology*, *33*(2): 138-150.
5. Al-Goblan, A. S., Al-Alfi, M. A., & Khan, M. Z. (2014). Mechanism linking diabetes mellitus and obesity. *Diabetes, metabolic syndrome and obesity: targets and therapy*, *7:* 587.
6. Choudhury, H., Pandey, M., Hua, C. K., Mun, C. S., Jing, J. K., Kong, L., & Kesharwani, P. (2018). An update on natural compounds in the remedy of diabetes mellitus: A systematic review. *Journal of traditional and complementary medicine, 8*(3): n 361-376.
7. Leitner, D. R., Frühbeck, G., Yumuk, V., Schindler, K., Micic, D., Woodward, E., & Toplak, H. (2017). Obesity and type 2 diabetes: two diseases with a need for combined treatment strategies-EASO can lead the way. *Obesity facts*, *10*(5): 483-492.
8. Ríos, J. L., Francini, F., & Schinella, G. R. (2015). Natural products for the treatment of type 2 diabetes mellitus. *Planta medica*, *81*(12/13): 975-994.
9. Yadav, M., Jain, S., Tomar, R., Prasad, G. B. K. S., & Yadav, H. (2010). Medicinal and biological potential of pumpkin: an updated review. *Nutrition research reviews*, *23*(2): 184- 190.
10. Gothai, S., Ganesan, P., Park, S. Y., Fakurazi, S., Choi, D. K., & Arulselvan, P. (2016). Natural phyto-bioactive compounds for the treatment of type 2 diabetes: inflammation as a target. *Nutrients, 8*(8): 461.
11. Dotto, J. M., & Chacha, J. S. (2020). The potential of pumpkin seeds as a functional food ingredient: A review. *Scientific African*, *10*: e00575.
12. Adams, G. G., Imran, S., Wang, S., Mohammad, A., Kok, M. S., Gray, D. A., & Harding, S. E. (2014). The hypoglycemic effect of pumpkin seeds, Trigonelline (TRG), Nicotinic acid (NA), and D-Chiro-inositol (DCI) in controlling glycemic levels in diabetes mellitus. *Critical reviews in food science and nutrition*, *54*(10): 1322-1329.
13. Guo, S., Ge, Y., & Na Jom, K. (2017). A review of phytochemistry, metabolite changes, and medicinal uses of the common sunflower seed and sprouts (Helianthus annuusL.). *Chemistry Central Journal*, *11*(1): 1-10.
14. Onoja, S. O., Nnadi, C. O., Udem, S. C., & Anaga, A. O. (2020). Potential antidiabetic and antioxidant activities of a heliangolide sesquiterpene lactone isolated from Helianthus annuus L. leaves. *Acta Pharmaceutica*, *70*(2): 215-226.
15. Galicia-Garcia, U., Benito-Vicente, A., Jebari, S., Larrea-Sebal, A., Siddiqi, H., Uribe, K. B., & Martín, C. (2020). Pathophysiology of type 2 diabetes mellitus. *International journal of molecular sciences*, *21*(17): 6275.
16. Palacios, O. M., Kramer, M., & Maki, K. C. (2019). Diet and prevention of type 2 diabetes mellitus: beyond weight loss and exercise. *Expert review of endocrinology & metabolism*, *14*(1): 1-12.
17. Ríos, J. L., Francini, F., & Schinella, G. R. (2015). Natural products for the treatment of type 2 diabetes mellitus. *Planta medica*, *81*(12/13): 975-994.
18. Cândido, F. G., de Oliveira, F. C., Lima, M. F. C., Pinto, C. A., da Silva, L. L., Martino, H. S., ... & Rita de Cássia, G. A. (2018). Addition of pooled pumpkin seed to mixed meals reduced postprandial glycemia: A randomized placebo-controlled clinical trial. *Nutrition research*, *56*: 90-97.
19. Shimabukuro, M., Higa, N., Chinen, I., Yamakawa, K., & Takasu, N. (2006). Effects of a single administration of acarbose on postprandial glucose excursion and endothelial dysfunction in type 2 diabetic patients: a randomized crossover study. *The Journal of Clinical Endocrinology & Metabolism*, *91*(3): 837-842.
20. Jafari, M., Goli, S. A. H., & Rahimmalek, M. (2012). The chemical composition of the seeds of Iranian pumpkin cultivars and physicochemical

characteristics of the oil extract. *European Journal of Lipid Science and Technology*, *114*(2): 161-167.

21. Gu, M., & Li, D. (2008). Pumpkin hypoglycaemic active ingredients progress in pharmacological research. *Journal of Medical Research*, *37*(5): 15-16.
22. Sharma, A., Sharma, A. K., Chand, T., Khardiya, M., & Yadav, K. C. (2013). Antidiabetic and antihyperlipidemic activity of Cucurbita maxima Duchense (pumpkin) seeds on streptozotocin induced diabetic rats. *J Pharmacogn Phytochem*, *1*(6): 108-16.
23. Alyae, M. S. Ameliorative activity of pumpkin (Cucurbita Maxima) fruit and seeds powders on diabetic, oxidative and pancreatic status in rats.
24. Azeem, A. A., Mounir, A. M., & El-Shahat, A. N. (2021). Studying the Anti-Diabetic Effect of Gamma-Irradiated Pumpkin Seeds.
25. Makni, M., Fetoui, H., Gargouri, N. K., Garoui, E. M., & Zeghal, N. (2011). Antidiabetic effect of flax and pumpkin seed mixture powder: effect on hyperlipidemia and antioxidant status in alloxan diabetic rats. *Journal of Diabetes and its Complications*, *25*(5): 339-345.
26. Cheenam, B., & Leena, P. (2016). Effects of sunflower seeds on fasting blood glucosein diabetes mellitus type 2 patients. *Journal of Chemical and Pharmaceutical Research*, *8*(4): 1211-1217.
27. Saini, S., & Sharma, S. (2013). Antidiabetic effect of Helianthus annuus L., seeds ethanolic extract in streptozotocinnicotinamide induced type 2 diabetes mellitus. *Int J Pharm Pharm Sci*, *5*(2): 382-387.