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CASE REPORT

Nigella sativa tea mitigates type-2 diabetes and edema: a case report

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Abstract
Diabetes is a major deadly disease. In 2019 alone, it caused an estimated 1.5 million deaths world-wide. Cases of diabetes are rising rapidly in low- and middle-income countries. Natural remedies that can lower the glucose level would be very useful, particularly to people living in low- and middle-income countries. A 2-year case study was carried out, therefore, to determine if *Nigella sativa* tea can lower the glucose level in a 72-year-old man with type-2 diabetes, stage 3–4 chronic kidney disease, and congestive heart failure. Changes in body weight, lipids, estimated glomerular filtration rate (eGFR), and urinary albumin-to-creatinine ratio (UACR) were also studied. *N. sativa* tea was prepared with *N. sativa*, barley, and wheat seeds. The 72-year-old drank approximately 50 ml of *N. sativa* tea daily, in the morning. Results showed that after drinking *N. sativa* tea daily, hypoglycemia started to occur and occurred more frequently as time went by and that the glycated hemoglobin, HbA1c, was decreasing. Subsequently, the dosages of insulin glargine and insulin aspart were reduced by 33% and 50%, respectively. Results also showed that weight loss led to the 72-year-old cutting back his intake of the diuretic furosemide by at least 50%. His triglycerides level was also lower and there were no changes in his total cholesterol, high-density lipoprotein cholesterol, and low-density lipoprotein cholesterol levels. His eGFR was stable but his UACR was worsening. *N. sativa* tea is easy to prepare, costs very little, and could be a natural remedy for mitigating diabetes and edema. Many more studies on *N. sativa* are warranted.

Keywords Nigella sativa · Diabetes · Edema · Chronic kidney disease

Introduction

Diabetes can lead to blindness, kidney failure, heart attack, stroke, and require lower limb amputation. In 2019 alone, diabetes caused an estimate of 1.5 million deaths world-wide. Cases of diabetes are rising more rapidly in low- and middle-income countries compared with higher income countries (WHO 2021). People in low- and middle-income countries, who have no access to or cannot afford allopathic medicines, may find natural remedies very useful because of their accessibility and low cost. Those in high-income countries, on the other hand, may also appreciate alternative medicines for glycemic control.

Nigella sativa L. (Fig. 1) is widely grown in Eastern Europe, the Middle East, Western Asia, and North Africa (Aisa et al. 2019). Its seeds have been used in home remedies and as spices. *N. sativa* is regarded as a promising natural remedy for wide range of illness (Yimer et al. 2019). In a recent review article, Aisa et al. (2019) proposed that *N. Sativa* could be used as a complementary medicine for metabolic diseases, especially in the treatment of diabetes (Aisa et al. 2019). To-date, results from human clinical trials are inconsistent. Consuming *N. sativa* oil for 40 days reduced the fasting glucose level from 190.8 mg/dL to 168.3 mg/dL (Bilal et al. 2009). Similarly, taking *N. sativa* seeds, in the form of powder and oil, for 3 or up to 12 months lowered the fast glucose and glycated hemoglobin (HbA1c) levels (Bamosa et al. 2010; Hosseini et al. 2013; Kaatabi et al. 2015; Heshmati et al. 2015). In contrast, consuming *N. sativa* oil for 3 months led to an increase in HbA1c from 8.4 to 9.4% in patients with chronic kidney disease stage 3 and 4 (Ansari et al. 2017). HbA1C is a standard biomarker to measure the average glucose levels over a period of three months. This inconsistency calls for additional studies to ascertain the effectiveness of *N. sativa* in glycemic control.

Therefore, a study was conducted to investigate the effect of *N. sativa* tea on the HbA1c level in a 72-year-old man

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Fig. 1 *Nigella sativa* plant

with chronic kidney disease stage 3 and 4. The 72-year-old's triglycerides level, cholesterol level, estimated glomerular filtration rate (eGFR), urinary albumin-to-creatinine ratio (UACR), and body weight were also monitored as they could also be changes in response to the *N. sativa* tea treatment. In comparison with the above-mentioned studies, this study used *N. sativa* seeds in the form of tea instead of oil or powder as treatment, over a period of treatment that lasted two years.

Methods

The subject of this study was a 72-year-old man with a history of type-2 diabetes, stage 3–4 chronic kidney disease, and congestive heart failure. He was overweight with a body mass index of 28.2. He had been taking two insulins, glargine and aspart, by injection to control his glucose level, and the diuretic furosemide to control his edema.

N. sativa tea was prepared by using commercial *N. sativa* seeds from India, local wheat seeds (variety: (Nass et al. 2006)) and local barley seeds (variety: AAC Starbuck (Choo et al. 2015)) (Fig. 2), combining the three grain seeds (100 g each) in 5 cups (1 cup=180 ml) of water which was then brought to a boil in a small pot in which it continued to cook for 10 min. The aqueous decoction (or tea) was collected after it had cooled down. The *N. sativa* tea was then stored in a refrigerator and was ready for use in the next seven days. The details of this preparation have been circulated in social media for many years, but to my knowledge, nothing has been reported in the scientific literature on its effectiveness on glycemic control.

From September 26, 2019, the 72-year-old began drinking approximately 50 ml of *N. sativa* tea each morning on an empty stomach. Before each subsequent meal, he checked his glucose level using a Contour Next Blood Glucose Monitoring System (Ascensia Diabetes Care, Switzerland) and injected whatever units of insulin aspart as recommended. Each day, he also took insulin glargine at bedtime and furosemide in the morning.

During the course of the study, an endocrinologist, a nephrologist, and a cardiologist monitored his health conditions. They issued laboratory requisitions, prescribed medications, and advised appropriate dosages. The endocrinologist advised that his HbA1c level be targeted at 7–8%. Biochemical analysis for HbA1c, triglycerides, cholesterols, eGFR, and UACR was carried out at an accredited laboratory and paid for by the Ontario Health Insurance Plan (OHIP). Transthoracic echocardiograms were performed as needed to monitor his heart conditions at a cardiovascular centre and were also paid for by OHIP. He logged his body weight using a glass electronic scale (BIOS living) once daily in the evening. Lower eGFR and higher UACR are risk factors for end-stage renal disease, thus correlation analysis was performed to determine if the two factors are correlated.

Results

During the first month, September 2019, there was no hypoglycemia (Table 1). After drinking the *N. sativa* tea on September 26, 2019, hypoglycemia started to occur, which it

Fig. 2 Three types of seeds

did increasingly as testing continued. By April 2020, hypoglycemia accounted for 18% of the readings. Such a high frequency of hypoglycemia needed to be corrected because it could result in confusion, seizure, brain damage, and even death (Cryer et al. 2003). Following the advice of the endocrinologist, the 72-year-old reduced his dosage of insulins to minimize the occurrence of hypoglycemia (Table 2). He further reduced his dosage of insulins up to May, 12 2021. From June 2021 onward, no hypoglycemia was detected. The frequency of hypoglycemia was also reflected in mean glycemia, Hb1Ac. The HbA1c lowered from a baseline of 7.0 to 5.9% on April 30, 2020, and remained low (5.8%) on October 30, 2020 (Table 3). Then it began to increase, reaching 7.1% after the dosage of insulins was further reduced. The 72-year-old experienced foot numbness and found that he had to rest after walking for approximately 20 min. After taking the *N. sativa* tea, he reported his foot numbness had disappeared on December 15, 2019 and did not return. He was now able to walk for an hour without any rest.

The 72-year-old experienced weight loss after taking the *N. sativa* tea (Table 3). Consequently, from February 1, 2020, he reduced his daily intake of furosemide from 8 mg to 4 mg. He then stopped taking furosemide every other day, starting from September 8, 2020. A subsequent echocardiogram on March 19, 2021, indicated severe pulmonary arterial hypertension. The cardiologist advised him to increase his intake of furosemide from zero to 2 mg every other day from May 26, 2021 onwards. His latest echocardiogram (September 24, 2021) indicated that the pulmonary artery pressures had diminished. The 72-year-old's final body weight at the conclusion of the study was 86 kg, which was 2 kg lighter than the baseline, despite the reduction of furosemide intake. Approximately 5 months after his first treatment, the 72-year-old stopped his daily practice of wearing compression stockings as water retention in his legs was no longer severe.

The *N. sativa* tea lowered the 72-year-old's triglycerides level by 61% (from 3.9 mmol/L to 1.5 mmol/L). At the same time, it did not lead to significant changes in total cholesterol, high-density lipoprotein (HDL) cholesterol, and low-density lipoprotein (LDL) cholesterol levels. eGFR levels seemed to be relatively stable, but UACR levels suggested a worsening albuminuria (Table 4). The correlation coefficient between eGFR and UACR was

Table 1 Effect of Nigella sativa tea on occurrence of hypoglycemia (i.e., random glucose < 4.0 mml/L)

Month	Frequency	Month	Frequency
September, 2019	0/90	October, 2020	6/93
October, 2019	1/93	November, 2020	2/91
November, 2019	1/92	December, 2020	1/93
December, 2019	0/94	January, 2021	1/94
January, 2020	4/89	February, 2021	1/87
February, 2020	7/88	March, 2021	0/94
March, 2020	7/93	April, 2021	0/90
April, 2020	16/90	May, 2021	2/93
May, 2020	9/90	June, 2021	0/93
June, 2020	6/91	July, 2021	0/92
July, 2020	5/91	August, 2021	0/93
August, 2020	3/90	September, 2021	0/88
September, 2020	5/90		

Table 2 Changes in medication dosage after drinking *N. sativa* tea daily

Date	*Nigella sativa* tea (ml)	Glargine	Aspart	Furosemide
March 11, 2019	0 o.d	38 units b.t.	10 units t.i.d., a.c.	80 mg o.d.
September 24, 2019	50 o.d.	38 units b.t.	10 units t.i.d., a.c.	80 mg o.d.
February 1, 2020	50 o.d.	38 units b.t.	10 units t.i.d., a.c.	40 mg o.d.
April 29, 2020	50 o.d.	32 units b.t.	10 units t.i.d., a.c.	40 mg o.d.
May 23, 2020	50 o.d.	32 units b.t.	6 units t.i.d., a.c.	40 mg o.d.
June 18, 2020	50 o.d.	32 units b.t.	6 units t.i.d., a.c.	40 mg o.d.
August 24, 2020	50 o.d.	32 units b.t.	6 units t.i.d., a.c.	40 mg o.d.
September 8, 2020	50 o.d.	32 units b.t.	6 units t.i.d., a.c.	40 mg q.o.d
November 10, 2020	50 o.d.	30 units b.t.	6 units t.i.d., a.c.	40 mg q.o.d
February 10, 2021	50 o.d.	28 units b.t.	6 units t.i.d., a.c.	40 mg q.o.d
May 12, 2021	50 o.d.	25 units b.t.	5 units t.i.d., a.c.	40 mg q.o.d
May 26, 2021	50 o.d.	25 units b.t.	5 units t.i.d., a.c.	40/20* mg o.d.

o.d., once a day; b.t., bedtime; t.i.d., 3 times a day; a.c., before meals; q.o.d., every other day; *alternate daily intake of 40 and 20 mg.

Table 3 Changes in body weight, HbA1c, and lipids after drinking *N. sativa* tea daily

Date	Body weight (kg)	HbA1c (%)	Triglycerides (mmol/L)	Total cholesterol (mmol/L)	HDL Cholesterol (mmol/L)	LDL Cholesterol (mmol/L)
March 11,2019	88	7.0	3.94	4.07	1.11	1.15
March 25,2019	89	7.0				
October 9, 2019	87	7.0	2.94	3.28	1.05	0.88
March 13, 2020	85	6.3				
April 30, 2020	87	5.9	1.20	3.37	1.48	1.34
July 31, 2020	85	5.9	1.44	3.16	1.32	1.18
October 28, 2020	87	5.8	1.21	2.66	1.37	0.73
November 17, 2020	86	6.1				
January 28, 2021	87	6.3	1.37	3.01	1.34	1.04
March 29, 2021	88	6.2				
April 30, 2021	89	6.4				
September 15, 2021	86	7.1	1.52	3.14	1.32	1.12

Table 4 Changes in estimated glomerular filtration rate (eGFR) and urinary albumin-to-creatinine ratio (UACR) after drinking *N. sativa* tea daily

Date	eGFR (mL/min/1.73 m*2)	Urine ACR (mg/mmol creat)
March 11,2019	26	3.3
March 25,2019	35	5.0
October 9, 2019	30	2.1
March 13, 2020	34	9.7
April 30, 2020	35	7.6
June 15, 2020	32	5.8
June 30, 2020	36	7.4
July 31, 2020	33	10.5
August 10, 2020	35	12.0
October 28, 2020	38	23.1
January 28, 2021	34	32.3
March 29, 2021	35	28.4
April 30, 2021	36	29.3
September 15, 2021	35	24.5

0.52, which was not significantly different from zero at the 0.05 level.

Discussion

This 2-year case study showed that drinking the preparation of *N. sativa* tea daily increased the occurrence of hypoglycemia and lowered the HbA1c level. As a result, injection of insulin glargine was reduced from 38 units to 25 units and injection of insulin aspart was reduced from 10 units to 5 units, while maintaining almost the same HbA1c level as that at the baseline (7%). Previously, several authors (Bamosa et al. 2010; Hosseini et al. 2013; Kaatabi et al. 2015; Heshmati et al. 2015) also reported that *N. sativa* seeds, in the form of powder or oil, reduced HbA1c. Unlike the study by Ansari et al. (2017), this case study showed that *N. sativa* tea can be used to reduce the glucose level in a 72-year-old with type-2 diabetes and stage 3–4 chronic kidney disease.

This study also showed that drinking *N. sativa* tea daily lowered body weight and thus reduced dosage of furosemide by 4 mg or more. In this case study, further reduction of furosemide dosage was not possible without the supplementation of medication such as empagliflozin (Neeland et al. 2016) because of the 72-year-old's pulmonary arterial hypertension. This is the first report to demonstrate that *N. sativa* mitigates edema which was related to congestive heart failure. Decrease in body mass index due to *N. sativa* seeds was noted by Hosseini et al. (2013) and Heshmati et al. (2015).

Another benefit of *N. sativa* tea was the desirable change from high triglycerides (3.9 mmol/L) to normal triglycerides level (1.5 mmol/L). High triglycerides increase the risk of stroke, heart attack and heart disease. Tasawar et al. (2011) and Heshmati et al. (2015) also found that *N. sativa* seeds reduced the triglycerides level. The total cholesterol and HDL cholesterol levels were normal at the baseline. Throughout the course of this study, *N. sativa* tea brought little change in total cholesterol, HDL cholesterol, and LDL cholesterol levels. Changes in total cholesterol, HDL cholesterol, and LDL cholesterol levels were reported by others (Heshmati et al. 2015; Tasawar et al. 2011). eGFR levels indicate a stage 3 chronic kidney

disease (i.e., eGFR is between 30 and 59) and these were relatively stable, but UACR increased over the two years. High UACR, may be alleviated by supplementation of empagliflozin (Cherney et al. 2017).

Nigella sativa oils contain many phytochemicals, including thymoquinone, linoleic acid, oleic acid, palmitic acid, stearic acid, etc., with thymoquinone being a major phytochemical component of the seeds' volatile oil (14.5%) (Heshmati et al. 2015; AbuKhader 2012). Pure thymoquinone has shown a lowering of the blood glucose level in rats. It has been postulated that the hypoglycemic effect of *N. sativa* seeds is the result of thymoquinone restoring the activity of enzymes involved in glucose metabolism and/or having a protective effect on *β*-cells of the pancreas against the damaging effect of oxidative stress and nitric oxide (AbuKhader 2012).

Coincidentally, metformin is derived from galegine, a natural product from the plant *Galega officinalis*, used in herbal medicine in medieval Europe. It is usually the first-line medication for the treatment of type 2 diabetes. Despite its clinical use for 60 years, its molecular mechanisms of action remain not very clear (Rena et al. 2017).

AAC Starbuck barley seeds contain an average amount of ß-glucan and reasonable levels of total antioxidant phenols and antioxidant capacity (Choo et al. 2015). It has been shown that *β*-glucan improves glycemic control in type-2 diabetes (Pick et al.1998). Wheat seeds probably act as a thickening agent for the *N. sativa* tea.

In conclusion, this 2-year case study showed that drinking *N. sativa* tea daily lowered the blood glucose level and reduced body weight in a 72-year-old with type-2 diabetes, stage 3 chronic kidney disease, and congestive heart failure, and thereby reduced the dosages of insulin injection and diuretic intake. The cost of the ingredients is low, $4 per 200 gm *N. sativa* seeds, $0.8 per 200 gm wheat kernels, and $0.8 per 200 gm barley grains (all in Canadian currency). The modest cost and ease of preparation make *N. sativa* tea very attractive for glycemic and edematous control for people in low- and middle-income countries. *N. sativa* tea will also be useful as an alternative in high-income countries.

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Data availability All data generated or analysed during this study are included in this published article.

Declarations

Competing interest The author declares no competing interest.

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