



Contents lists available at ScienceDirect

Journal of Traditional and Complementary Medicine

journal homepage: <http://www.elsevier.com/locate/jtcme>

Immediate effect of bitter gourd, ash gourd, Knol-khol juices on blood sugar levels of patients with type 2 diabetes mellitus: A pilot study

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ARTICLE INFO

Article history:

Received 6 September 2016

Received in revised form

25 November 2016

Accepted 18 January 2017

Available online 15 February 2017

Keywords:

Type 2 diabetes mellitus

Ash gourd juice

Knol-khol juice

Bitter gourd juice

Juice therapy

ABSTRACT

Aim: The aim of this study was to investigate the immediate effect of bitter gourd, Knol-khol, and ash gourd juices on blood glucose level among Type II diabetes mellitus patients.

Methods: In 2015, pilot study was conducted randomly enrolling 30 patients with type 2 diabetes mellitus into three groups in SRK college, India. The first group received bitter gourd juice at FBS range between 120 to 300 mg per dl. The second, third group received Knol-khol, ash gourd juice respectively in the same range of fasting blood sugar level. Blood sugar level was evaluated ½ hour interval till 2 h after received respective juices. Data were collected for statistical analysis.

Results: The mean blood glucose concentration in bitter gourd group was not statistically significant between time points, ($P = .176$). However, 90 min after the intake of bitter gourd juice shows statistical significant reduction of blood glucose level when compare with fasting level, ($p = .049$). After Knol khol juice the mean blood glucose level differed statistically significant between time points, shown in ($p = .029$). But no statistical changes seen in ash gourd group. As a result bitter gourd juice is immediately reducing the blood glucose level, while Knol khol juice reduces the blood sugar level gradually for longer period of 120 min.

Conclusion: This study shows the significance of hypoglycemic effects of bitter gourd and Knol khol juices among the type 2 Diabetic patients. Hence Bitter gourd juice, Knol khol juices may be beneficial in Diabetes patients to reduce the blood glucose level.

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1. Introduction

Type II Diabetes Mellitus is a complex, chronic metabolic disease that is expected to increase in prevalence in the coming decades. The prevalence of Type II Diabetes Mellitus (T2DM) is predicted to rise from 171 million in 2000 to 366 million in 2030 worldwide.¹ India has the second largest number (>61 million) of individuals with Type II Diabetes Mellitus in the world and this is expected to

increase nearly double by 2030.² The effect of diabetes has increased because of worsening obesity, global population aging, and decrease in physical activity.^{1,3} Complications are still common and it leads to cause retinopathy (loss of vision), nephropathy (end stage of renal disease), neuropathy (degeneration of nerves).^{4,5} In additional 50% people died in cardiovascular complications such as hypertension, stroke are the leading cause of morbidity, mortality and expenditures in Type II Diabetes Mellitus.^{6,7}

Diabetic management can be divided into two main groups: pharmacological and non-pharmacological ones. One of the most significant limitations associated with pharmacological diabetic management is that almost every drug that is used for diabetes cause some undesirable effects such as lower blood sugar, upset stomach, constipation, skin rash or itching, weight gain, tiredness or dizziness, risk of liver disease, etc.⁸

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Peer review under responsibility of The Center for Food and Biomolecules, National Taiwan University.

The general goals of the treatment of diabetes are to avoid acute decompensation, prevent or delay the appearance of late disease complications, decrease mortality, and maintain a good quality of life,⁹ and the non-pharmacological (Complementary and alternative medicine) methods satisfy all of these.

Complementary and alternative medicine (CAM) may include physical activity, dietary recommendation and herbal plant extracts, which reduce the blood sugar level in type 2 diabetes mellitus and it is considered as first line clinical approach for type 2 diabetes mellitus.¹⁰ In a survey around 48% of patients with diabetes reported using Complementary and alternative medicine in United States of America.¹¹ Several Complementary and alternative medicine modalities like naturopathy, acupuncture, therapeutic massage, reflexology, dietetics etc. are found to be effective in the management of type II Diabetes Mellitus.

Over the years, the mankind had used to drink bitter gourd, Knol-khol juices, etc. Bitter gourd (*L. Momordica charantia*) contains a lectin that has hypoglycemic effect which develops after eating bitter guard by acting on peripheral tissues and suppressing appetite, it's similar to insulin's effects in the brain.^{12,13}

Knol-khol (*L. Brassica oleracea*) rich in the antioxidant vitamins C, E and carotene and are good sources of dietary fibre. They also contain sulphoraphanes and other isothiocyanates, which are believed to stimulate the production of protective enzymes in the body.¹⁴ Knol khol extract proved that it has hypoglycemic effect and antioxidant activity in diabetic rats.¹⁵

Ash gourd (*Benincasa hispida* (Thunb).cogn) contains plenty of moisture, protein, carbohydrates and fibre, apart from calcium, phosphorous, iron, riboflavin, thiamine, niacin and vitamin c. Being low in calories, it is ideal for diabetic patients and those seeking weight control.^{16,17}

The lack of sufficient research on the effectiveness of bitter gourd, Knol-khol and ash gourd juices in type 2 diabetes patients, has hindered the implementation of juice therapy in clinical practice, there is need for more research in alternative management in type 2 diabetes. We aimed to study the immediate effect of bitter gourd, Knol-khol, and ash gourd juices on type 2 diabetes, as a practical strategy for controlling blood sugar without use of drugs.

2. Materials and methods

This study was a clinical trial with three study groups on Type II Diabetes Mellitus who attended the general ward in SRK nature cure hospital, Tamilnadu, india in 2015. The study protocol was approved by the Research and Ethics committee of SRK Medical College of Naturopathy & Yogic sciences, Kulasekharam, Tamilnadu. The purpose of the study was explained to all participants by researchers and all recruited subjects had given informed (signed) consent.

30 subjects (FBS range between 120 to 300 mg per dl) with type 2 diabetes of both sexes aged 29–65 years were included. Patients who have more than 300 mg per dl (FBS) with systematic complication were not included.

For convenience and comparison, the random allocation software for clinical trial was used to assign the subject into three groups namely bitter gourd, Knol-khol and ash gourd juice. Sampling days was selected randomly for each group (see Fig. 1).

For the 1st group of patients received 250 ml bitter gourd juice, 2nd group of patients had 250 ml Knol-khol juice and 3rd group of patients had 250 ml ash gourd juice. Bitter gourd juice should be prepared in 30:70 ratios, because of its bitter taste. 30% (75 ml) of

bitter gourd grinded concentrate and 70% (175 ml) of water to make 250 ml of juice. Fresh ash gourd juice concentrate 220 ml is mixed with 30 ml of water, made into 250 ml of juice. Fresh Knol khol juice concentrate 200 ml is mixed with 50 ml of water, made into 250 ml of juice.

Juices are prepared in the morning 7.30AM in the diet section; it will be given to the patients by 7.45AM. Around 7.30AM fasting blood sugar level checked with Hematological analyzer (mindray Bc-3000 plus). Every 30 min after the juice blood sugar levels are checked. Patients are not allowed to take any nature cure, yoga treatments and medications till 2 h.

This test is usually done in early mornings. A suitable vein is identified, and a tourniquet applied to distend vein for puncture. The skin over the vein is antiseptically cleaned. Peripheral cannula inserted through the vein, sterile needle and syringe are used to draw about 2 ml of blood for each half an hour till 2 h from the vein, the needle withdrawn, and the cannula is removed after 2 h and the puncture site compressed for a few minutes, then covered with a clean dressing. The blood sample was used for analysis. Data was recorded on the information sheet provided. To find out any statistical differences between the blood glucose levels at different time points of each juices group we used Repeated measure ANOVA in SPSS 16.0. Also to find which juice have high beneficial in reducing the blood glucose level we used one way ANOVA.

3. Results

Comparison of average blood glucose level among Bitter Gourd Juice, Knol khol Juice and Ash Gourd Juice in different time periods are plotted in Fig. 2.

A repeated measures ANOVA with a Greenhouse-Geisser correction determined that mean blood glucose concentration in bitter gourd group was not statistically significant between time points, ($P = .176$, $F = 1.917$). However, 90 min after the intake of bitter gourd juice shows statistical significant reduction of blood glucose level when compare with fasting level, ($p = .049$, Std Error = 3.216).

After Knol khol juice the mean blood glucose level differed statistically significant between time points, shown in Fig. 3, ($p = .029$, $F = 4.739$). Also it shows statistical significant between the blood glucose level of 30 min and after 90 min, ($p = .012$, Std Error = 1.555) and 120 min, ($p = .031$, Std Error = 2.268). Even though blood sugar level was reduced after the intake of ash gourd juice group the mean blood glucose concentration was not statistically significant between time points, ($p = .245$, $F = 1.544$). Tabulated in Table 1.

There was a statistical significant difference between groups at 30 min after intake of juices as determined by one-way ANOVA ($p = .030$, $F = 4.016$). A Tukey post-hoc test revealed that the bloodglucose level after bitter gourd juice was statistically significant with blood glucose of ash gourdjuice, ($p = .036$, Std Error = 20.031). 60 min after intake of juices there was a statistical significance between the groups, ($p = .037$, $F = 3.750$) but Tukey post-hoc test failed to show the pair wise difference. There was a statistical significance between the groups after 90 min of intake of juices in blood sugar level ($p = .031$, $F = 3.965$). Tukey post-hoc test revealed that there was a statistical significant reduction in blood glucose concentration of bitter gourd juice group after 90 min of intake, against blood glucose concentration of ash gourd juice group ($p = .049$, Std Error = 19.202). After 120 min of intake of juices there was no statistical significance between the groups, ($p = .082$).

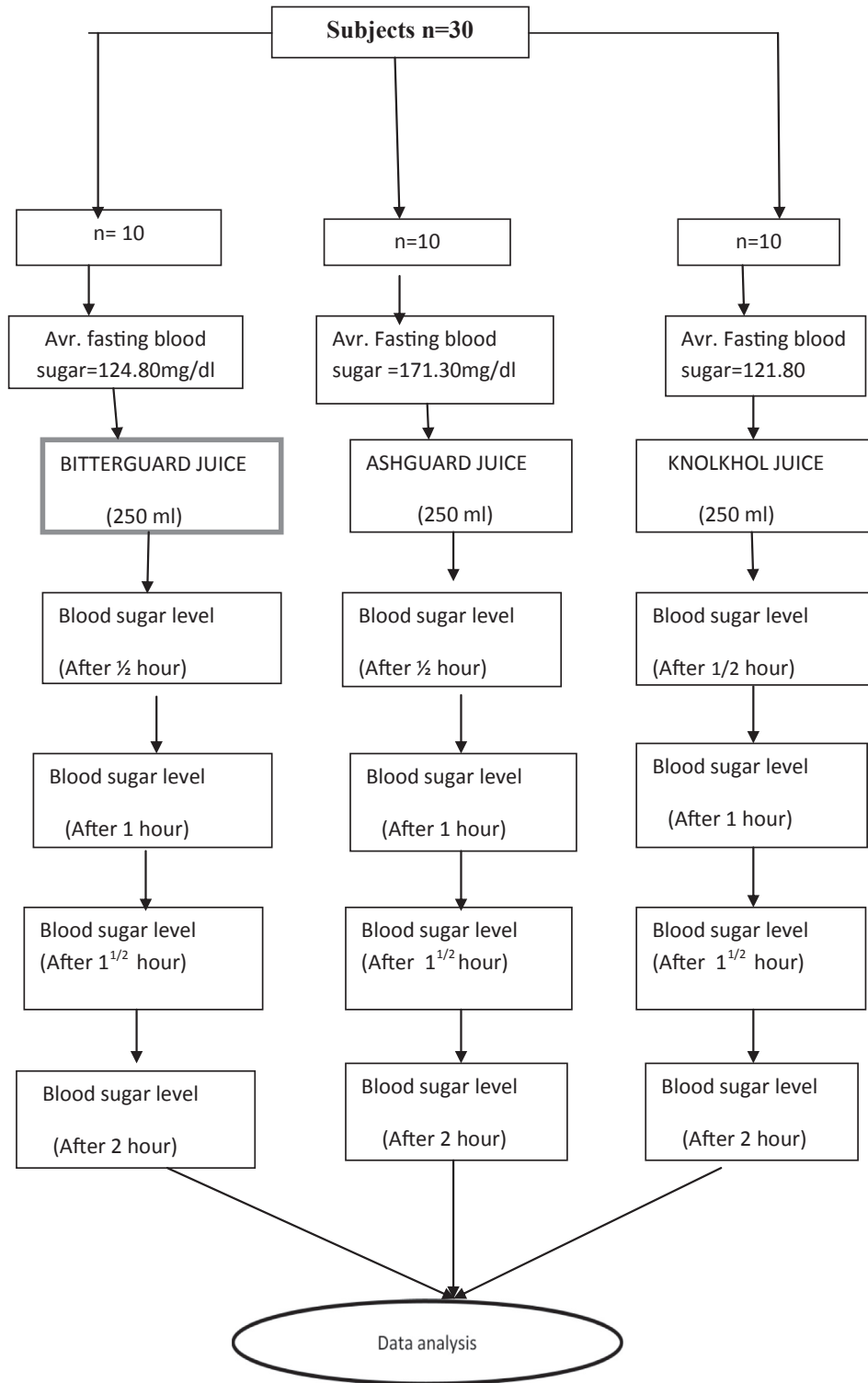


Fig. 1. Trial profile.

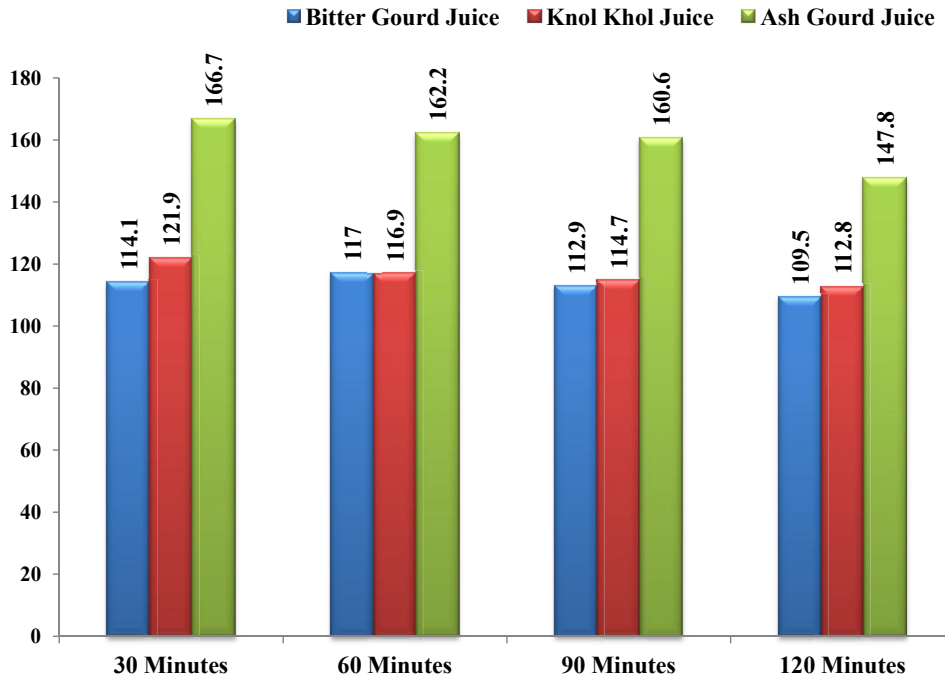


Fig. 2. Comparison of bitter gourd, Knol khol and ash gourd juice levels in different time periods.

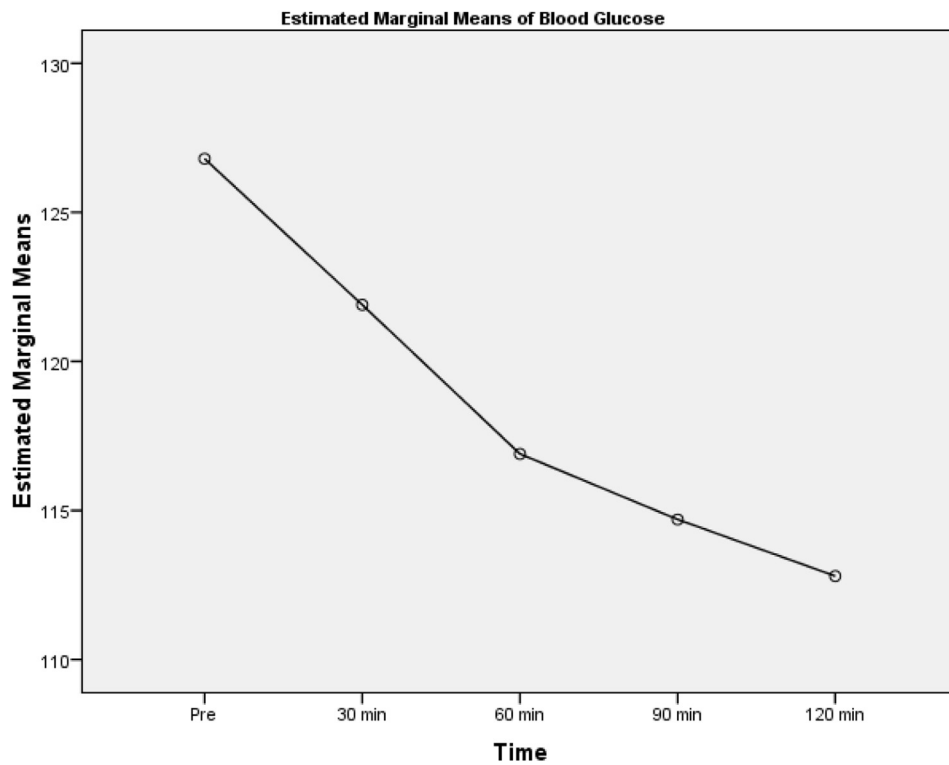


Fig. 3. Mean Blood Glucose Level of Knol khol Juice group.

Table 1
Represents mean and standard deviation of bitter gourd, Knol-khol and ash gourd juices levels on different time periods.

Blood glucose level	Bitter gourd (<i>L.Momordica charantia</i>)		Knol-khol (<i>L. Brassica oleracea</i>)		Ash gourd (<i>Benincasa hispida</i> (Thunb).cogn)	
	Mean	Standard deviation (S.D)	Mean	Standard deviation (S.D)	Mean	Standard deviation (S.D)
Fasting (mg/dl)	124.80	56.772	126.80	24.702	171.30	62.594
30 min (mg/dl)	114.10	53.224	121.90	16.543	166.70	53.967
60 min (mg/dl)	117.00	47.462	116.90	19.416	162.20	53.339
90 min (mg/dl)	112.90	53.036	114.70	17.78	160.60	49.004
120 min (mg/dl)	109.50	49.507	112.80	15.28	147.80	47.142

Bitter gourd juice and Knol khol juices may be beneficial in Diabetes patients to reduce the blood glucose level and this should be supported by further large randomized control trials.

4. Conclusion

Our study clearly exhibited the hypoglycemic effect of bitter gourd, Knol-khol, juices in patient with type 2 diabetes mellitus. Hence the naturopathic diet management especially juices plays an important role in type 2 diabetes mellitus. Further studies are needed to determine the exact mechanism of action, bioactivity-guided fractionation, and enzymatic study of constituents of the plant extract with other pharmacological drugs for betterment of treating type 2 diabetes mellitus.

5. Discussion

Type 2 diabetes is a chronic condition due to lack of insulin secretion or body fail to respond insulin as a result of increased blood sugar level in the body.¹⁸ The development of type 2 diabetes mellitus is caused by life style factors such as diet, increasing age, and lack of sleep and genetic too.^{19,20}

Almost all anti diabetic drugs cause mild to severe side effects.⁸ The naturopathic treatment approach frequently includes important dietary and lifestyle recommendations included in current medical treatment guidelines for diabetes, hypertension, and hyperlipidaemia, although improvements can be made on the precision of recommendations.¹⁰

The objective of the present study was to determine the immediate effect of bitter gourd, Knol-khol, and ash gourd juices on type 2 diabetic management. Our results indicate that the blood sugar level was significantly lower immediately in bitter gourd than Knol-khol juice compared with ash gourd juice group.

According to Lolitkar and Rao²¹ the blood sugar once lowered after 30 days treatment did not increase even after 15 days of discontinuation of the treatment which expressed that bitter gourd was helpful in reducing blood sugar patients who have type 2 diabetes mellitus. Chongkol Tiangda et al²² suggested that had no significant effect on the blood glucose level in normal rabbits but there is no direct evidence of reduced blood sugar level in normal healthy individual though it has hypoglycemic action in diabetic mellitus patient. Our results also showed significant reduction of blood sugar level immediately and after 120 min of consuming bitter gourd juice but lasting effect was not noticed.

Andallu B¹⁴ noticed that Knol khol juice significantly improved the glycemic control and also significantly brought down lipid peroxidation in erythrocytes (33 percent), plasma (21 percent) and urine (16 percent) due to presence of polyphenols, tannins and ascorbic acid in it. Hence it has the property of anti diabetic effect and anti oxidant activity. In the present study Knol-khol juice group showed significantly lowers the blood sugar level after 120 min of Knol-khol juice therapy but it has no immediate (30 min) effect on patient with type 2 diabetes mellitus.

The phyto chemical presence in ash gourd which includes carbohydrates, tannins, phenols, glycosides, alkaloids, and flavonoids.²³

Flavonoids stimulate lipogenesis and glucose transport in the adipocytes. Hence it lowers the blood sugar level.²⁴ Mohana Rupa L²⁵ found marked decrease in blood glucose levels at 200 mg/kg in alloxan diabetic rabbit when compared with that of the control whereas the peak action for aqueous extract of *Benincasa* (ash gourd) was seen at 6th hour of its administration due to potentiating the insulin effect of plasma by stimulating insulin release from the remnant pancreatic β -cells. Our results suggested that there is no significant reduction in blood sugar level after consuming of ash gourd juice.

Our study indicates that, bitter gourd juice immediately lowers the blood sugar level in 30 min, and significantly lowers at 120 min but Knol-khol juices significantly lowers the blood sugar level in 90 min and 120 min but lasting effect was not noticed. However, a low glycemic index diet that reduces postprandial hyperglycemia is recommended by the American diabetes association (ADA) to control glycemia in patients with diabetes.^{26,27} Hence the benefits of bitter gourd, Knol-khol juices that has been shown to improve diabetes mellitus.

6. Limitation

- Sample size is relatively small; hence it requires bigger sample size to generalize the study outcome to larger population.
- Randomized control trial would strengthen the findings.

7. Direction for future research

A. Long term follow up studies to find out the long term effect of bitter gourd, Knol khol and Ash gourd juices in the management of type II Diabetes mellitus.

B. Further studies are required to fix the dosages of each juice in the management of type II diabetes mellitus.

Conflict of interest

The author declared that, they have no conflict of interest.

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