



The Impact of Barley-based diet on Diabetes: A Case-Report

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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Case Study

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ABSTRACT

Background: Diabetes is becoming more prevalent in India. The increase in prevalence in most populations has probably been driven by modifiable risk factors, including lack of exercise and an increasing prevalence of overweight/obesity and unhealthy diets and habits. Yava(Barley)is one among the food articles and its preparation is extensively suggested in Prameha(Diabetes) and other lifestyle disorders. Diet intervention is the primary and effective way to control sugar levels. Diet therapy without much alteration of one's habits will be acceptable to individuals. A barley-based diet is formulated and evaluated for its effectiveness in the case of diabetics.

Aim: To study the effectiveness of a Yava-based diet on fasting and postprandial blood sugars, fasting and postprandial urine sugars and lipid profile.

Study Design: Modified crossover study

Place and Duration of the Study: Department of Swasthavritta, Sri Dharmasthala Manjunatheshwara College of Ayurveda and Hospital, Hassan, between December 2022 and February 2023.

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Methodology: A single case study was designed and a barley-based diet was planned as a flatbread, suggested for a month as a dietetic intervention along with the routine dietary habit. The diabetic subject was screened in the outpatient department. Laboratory investigations were carried out at one-month intervals three times. Subject studied for observation period and intervention period with the follow-ups.

Results: There were decreases in blood sugar and urine sugar levels and in lipid profile. Symptoms like polyphagia, heaviness in the body are also reduced.

Conclusion: Ayurveda literature opines Prameha is a disease of vitiated Kapha and fat tissue. Yava has the properties of pacifying Kapha and fat. The diet plan acts as a potential antidiabetic food. Yava can be an alternative to other grains and more beneficial for diabetes.

Keywords: Yava; barley; prameha; diabetes; life style disorders; ayurveda; diet; case report.

1. INTRODUCTION

Dietary habits and sedentary lifestyle are the major factors for rapidly rising incidence of DM among developing countries. The role of diet in the etiology of T2DM was proposed by Indians as mentioned earlier, who observed that the disease was almost confined to rich people who consumed oil, flour, and sugar in excessive amounts. The poorly controlled DM can lead to damage to various organs, especially the eyes, kidney, nerves, and cardiovascular system [1]. Diabetics practice various dietary trials to control sugar levels and prevent complications. Yava (barley) is one among food article suggested in Prameha(Diabetes) in Ayurvedic literatures. Preparations of Yava are food of choice and elaborately discussed [2]. It also helps in reducing fat [3]. Prameha is one among diseases caused due to over nutrition [4]. Wrong dietary habits vitiate Kapha (one of three humors of the body) and Medas (fat tissue) and increases Kledata (moistness) in the body [5]. Yava-based diet increases dryness, reduces Kapha [6]. Yava is also considered as a daily consumable food article [7]. This case hints us regarding benefits of Yava-based diet in Diabetes Type II. The functions of barley are mainly attributed to its higher contents of dietary fiber (such as β -glucan) and tocopherols. Barley is characterized by its high grain β -glucan content, almost 10-fold higher than wheat on average. Indeed, it is well documented that diets rich in β -glucan can improve immunity of human bodies, providing protection against hypertension, stroke, cardiovascular disease, and type 2 diabetes. Barley grains are rich in a variety of health beneficial functional compounds, such as β -glucan, tocopherols, and resistant starch. Barley β -glucan can reduce serum cholesterol and blood glucose levels and improve intestinal function. Tocopherols have the effect of lowering serum cholesterol, and resistant starch can lower blood sugar and promote intestinal function [8]. Among

whole grains, there appears to be the potential for more utilization of barley in functional foods as part of a low GI diet and an additional strategy for preventing diabetes and obesity. This is due to barley's classification as not just a low glycemic index food but its high fiber content relative to other whole grains and its unique phytochemical configuration with implications for oxidative stress and inflammation control; both risk factors leads to diabetes [9].

2. PRESENTATION OF CASE

2.1 Time Line

The female subject of age 59 years screened for Diabetes. A single case with modified crossover study was designed. The case was enrolled as an outpatient at Sri Dharmasthala Manjunatheshwara Ayurveda Medical College and Hospital, Hassan, Karnataka, India. She was a known diabetic since 4 years and was on antidiabetic medicine. The other examination were within normal limits. She was prescribed Yava-based diet replacing her two major meals per day for a month along with her routine diet practices. Her antidiabetic medicine was continued. The follow up of the patient done on every tenth day. Blood and urine samples were tested for fasting blood sugar, postprandial blood sugar, fasting urine sugar, postprandial urine sugar and Lipid profile once in a month for three times.i.e. on 03.12.2023, 05.01.2023, 08.02.2023. First month was observation period with no intervention continuing her antidiabetic medicine alone as before. The blood and urine analysis were performed and common do and don'ts in Diabetes were suggested. The diet intervention started on the second month after laboratory investigation, and her antidiabetic drug was continued along with the Yava-based diet twice a day. The blood and urine were analyzed at the end of second month.

2.2 Diet Intervention

The case was asked to consume Yava-based diet as Rotika/Roti/Chapati/flat bread in the dose of two Rotis twice a day for a month. The flour of the same was packed and distributed every 10 days on follow ups. The kitchen spices were added like cumin, pepper, turmeric, gooseberry as it is a common method of preparing Roti locally. The subject was monitored well. None of the other food practices of the subject was altered.



Fig. 1. Yava-based Rotika

2.3 Adverse Drug Event

Subject complained of constipation for two days initially which was relieved later with no treatment.

3. RESULTS AND DISCUSSION

Yava-based diet was introduced to the subject and studied on blood and urine sugar levels. Lipid profile is also observed as several prospective studies present both impaired insulin release and insulin resistance as the major factors for the development of type 2 diabetes [10]. Yava-based diet showed a marked reduction in fasting blood sugars, postprandial blood sugar, fasting and Postprandial urine sugar. There was a decrease in total cholesterol, triglycerides, low density lipoprotein and very low density lipoprotein. Food recipes of Yava have been prescribed in the texts of Ayurveda. Rotika formulation prepared out of Yava reduces Kapha

in the body [11]. In Prameha, increased Kapha, Meda and Kleda in the body is due to habituated intake of unhealthy diet such as excess of Madhura (sweet), Amla (sour), Lavana (salt), Snigdha(oily), Picchila(sticky), Abhishyandi (obstructive) Ahara (food). Fatigue, tendency to sit, sleep, to be comfortable, increase intake of food and increase frequency of micturition are a few of its symptoms. Yava is the food article primarily said in the context of Prameha and Santarpanajanyavyadhi (lifestyle disorders). Yava and added spices has the qualities of reducing Kapha and fat and imparts dryness in the body. It has Madhura and Kashaya rasa(sweet and astringent taste) [12]. Yava - based diet can be easily consumed every day. It brings early satiety as it is heavy and reduces frequency of hunger. It takes away Kleda from the body due to its dry quality. When the Kapha and Meda start reducing, the individual feels lightness in the body and enthusiasm.

3.1 Diagnostic Entry

Dietary factors are of paramount importance in the management and prevention of type 2 diabetes [13]. Food produced from barley is a good source for many nutrients such as protein, fiber, minerals, and B-vitamins. The fiber content of barley is high and rich in β -glucan that is mainly soluble. Fiber-rich cereals such as barley are beneficial for balancing the human diet. Low-digestible carbohydrates, especially β -glucan and resistant starch have a positive impact on lowering post-prandial blood glucose levels. Further, β -glucan has been reported to reduce blood cholesterol levels. Barley contains a group of natural antioxidants called flavonoids. Barley confers many health benefits such as modulating degenerative diseases, cardiovascular diseases, and lowering blood cholesterols. Barley products are thought to be good for diabetics, obese and overweight people, and for those who have a high blood cholesterol level. The nutritive composition is shown in the Table 2 [14].

Table 1. Interval of laboratory investigation with findings

Laboratory investigations	03.12.2023	05.01.2023	08.02.2023
FBS	130.0	120.6	96.7
PPBS	201.0	167.9	113.5
FUS	ABSENT	TRACE	ABSENT
PPUS	1.0%	0.5%	ABSENT
Total Cholesterol	209.0	188.0	141.0
H.D.L. Cholesterol	40.3	45.0	38.2
L.D.L. Cholesterol	125.1	107.0	68.2
Triglycerides	213.0	180.0	173.3
V.L.D.L. Cholesterol	42.6	36.0	34.5

FBS=Fasting blood sugar, PPBS=Postprandial blood sugar.FUS=Fasting urine sugar. PPUS=Postprandial urine sugar, H.D.L.=High-density lipoprotein, L.D.L.=Low-density lipoprotein, VLDL=Very low-density lipoprotein

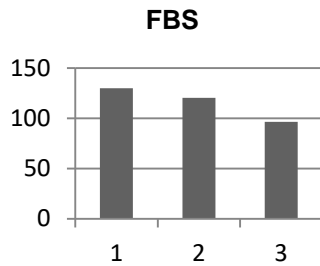


Fig. 2

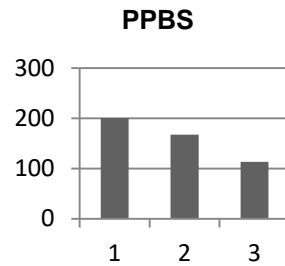


Fig. 3

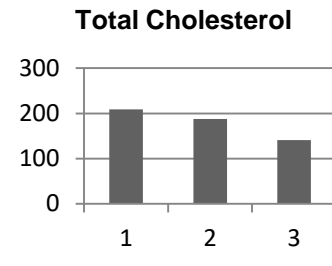


Fig. 4

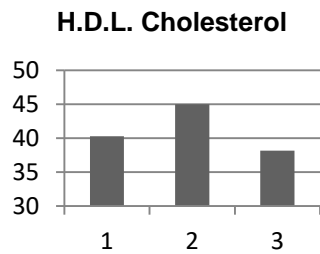


Fig. 5

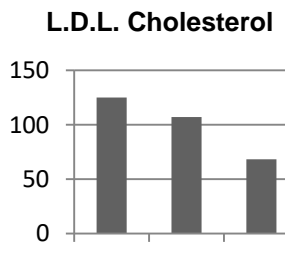


Fig. 6

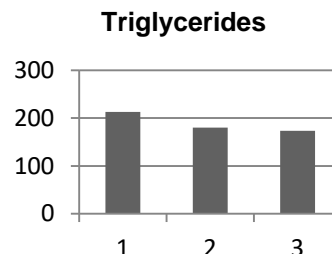


Fig. 7

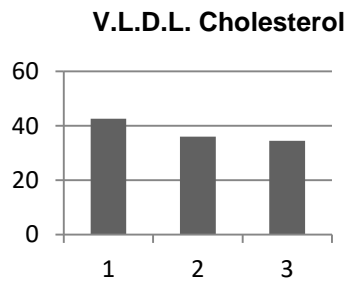


Fig. 8

Figs. 2-8. Graphs shows the effect of Yava based diet on biochemical parameters at one month intervals i.e., at 0th day(1st laboratory investigations), after one month observation(2nd laboratory investigations) and after diet intervention(3rd laboratory investigations)

Table 2. Chemical composition of barley

Component	% of dry matter
Carbohydrates	78-83
Starch	63-65
Sucrose	1-2
Other sugars	1
Water-soluble polysaccharides	1-1.5
Alkali-soluble polysaccharides	8-10
Cellulose	4-5
B-glucan	1-4
Lipids	2-3
Protein	10-12
Albumins and globulins	3.5
Prolamins (hordeins)	3-4
Glutelins (hordenins)	3-4
Nucleic acids	0.2-0.3
Minerals	2
Other	5-6

Source: Gashaw Abebaw et.al. [14]

3.2 Patient Perspective

The subject was satisfactory in taking the Yava-based diet. The prescribed dose was said to be sufficient and felt full, polyphagia was reduced. There was a presence of lightness in the body from the third day. Initially, she complained of constipation for two days, which was relieved later. A few symptoms like fatigue and sleepiness are reduced and comfortable on following the diet.

4. CONCLUSION

Yava, which was used widely before in day-to-day food habits. Diet and lifestyle are modifiable risk factors. When corrected, the disease can be reversed or brought under control. Diabetes is

one of metabolic or lifestyle disorders. The knowledge of causative factors and pathology is essential to share with the health seekers so that they can follow the prescribed intervention, such as diet therapy in this case. The diet intervention which is near to the food practice of the individual becomes more acceptable and followed longer. There is a need for such dietary solutions that has an effective role in preventing diabetic morbidity. When one suffers from lifelong diseases like diabetes, more challenging and confusing for the patients is restriction and regulating the food pattern. The correction of diet is of the utmost importance to controlling sugar levels. A lot of diabetic foods, though available, seem to be expensive and taking them in the long run is difficult. And it needs to replace the normal diet pattern. Whereas, the Yava-based diet is very much safer, near to one's food practice. The diabetic doesn't feel that he is on some special foods for his disease. Diet therapy should also have psychological acceptance. Yava is a food grain considered as a daily consumable. It is good for Kaphaja vyadhi (diseases due to increased kapha) and Medoja vyadhi (diseases due to increased fat). Yava can be consumed in the form of regular chapati/roti/flat bread. The practice of such a diet not only reduces blood and urine sugar levels, but also has a relieving effect on subjective symptoms. The nutritional benefits of barley is that it prevents risk factors of Diabetes and its complications.

CONSENT

All authors declare that written informed consent was obtained from the patient (or other approved parties) for publication of this case report and accompanying images.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

NOTE

The study highlights the efficacy of "Ayurved" which is an ancient tradition, used in some parts of India. This ancient concept should be carefully evaluated in the light of modern medical science and can be utilized partially if found suitable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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