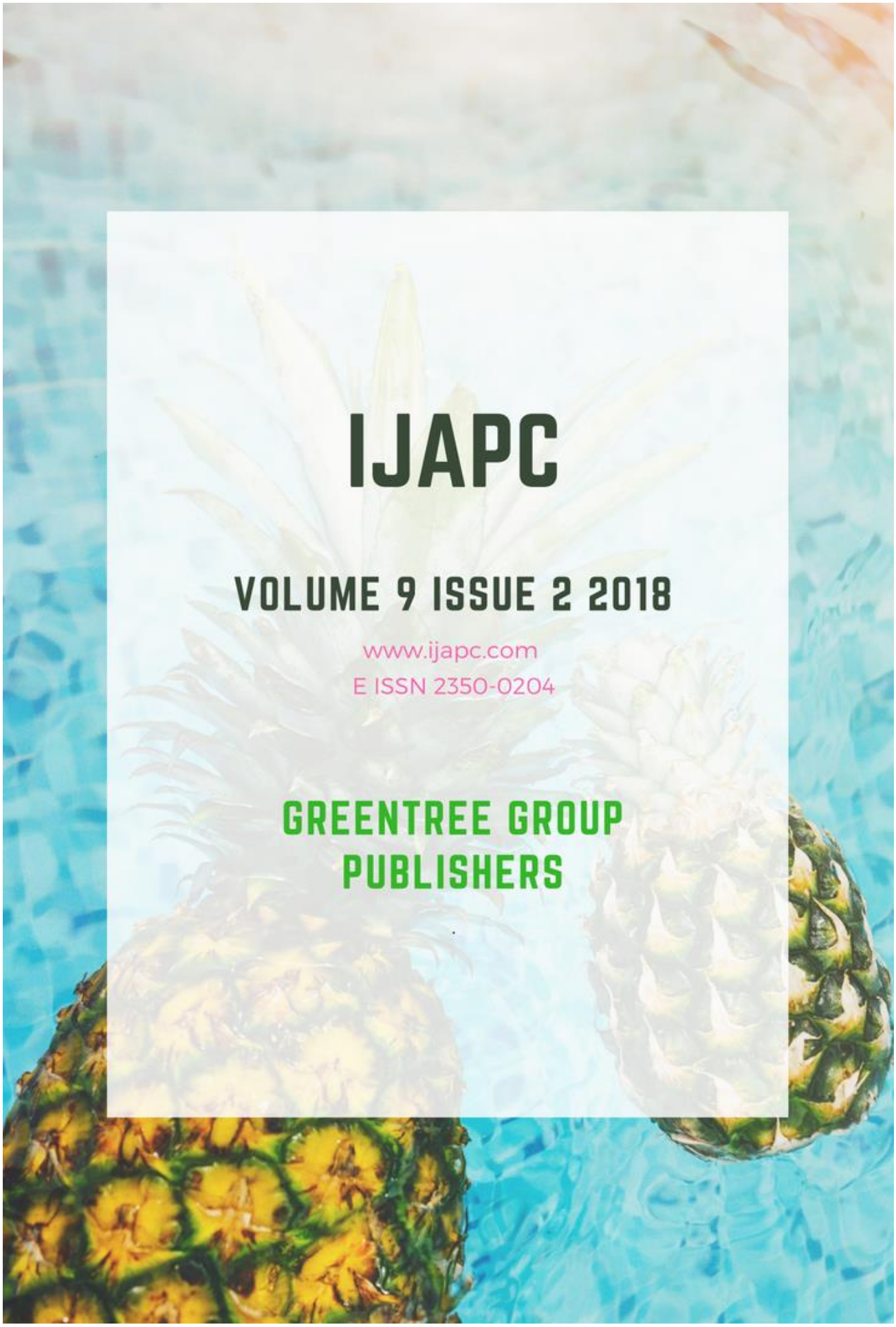

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Yava (Barley) in Prevention and Management of Diabetes Mellitus

Sadhana Misar (Wajpeyi)*

*Dept. of Kayachikitsa,Mahatma Gandhi Ayurved College, Hospital & Research Centre, DMIMS (Deemed to be University), Sawangi, Wardha, MS, India

ABSTRACT

Diabetes mellitus is a group of metabolic disorders in which increased blood sugar level is caused due to inadequate insulin secretion, diminished tissue response to insulin, or both. It is predicted to rise of global incidence from 366 million people to about 552 million in the next two decades. It is a leading cause of death, disability and carries a large socioeconomic burden globally.

The etiological factors and symptoms of Diabetes mellitus can be compared with *Madhumeha*, a type of *Prameha* in *Ayurveda*. *Acharya Charak* described it under *Santarpanajanya vyadhi*. Diet plays an important role in etiopathogenesis of *Prameha*. Hence *Pathyakara ahar* has major role in preventing the type II Diabetes.

Among all *Pathya*, *Yava*/ Barley (*Hordeum vulgare* L.) is the best *Ruksha santarpan dravya* described in *Prameha Chikitsa* by *Acharya Charak*. Many research studies conducted on it concluded that *Yava* should be used as food & medicinal preparation in any form for management of the lifestyle disorders (*Santarpanjanya vyadhi*) mainly Diabetes, Hypercholestrolemia and Obesity. The present paper aims at putting forward the importance of *Yava* in the prevention and dietary management of *Prameha*.

KEYWORDS

Barley, Diabete Mellitus, *Pathya*, *Prameha*, *Yava*

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INTRODUCTION

Diabetes mellitus is a group of metabolic disorders in which increased blood sugar level resulting from defects in Insulin secretion, Insulin action or both. Chronic increased in blood sugar level eventually results in long-term organ damage, particularly to the kidneys, the heart, the eyes and blood vessels[1].Diabetes mellitus is the most common endocrine disorder affecting more than 285 million people worldwide, and if not controlled, then it will exceed 333 million by 2025[2,3].

The etiological factors and symptoms of Diabetes mellitus can be compared with *Madhumeha*, a type of *Prameha* in *Ayurveda*. The vitiation of *Vata* may be caused due to its aggravation, *avarana* (obstruction) by *Kapha* and *Pitta* to its path or by *Dhatukshaya (*depletion of*dhatus)*. According to *Acharya Vagbhata*, there are two categories of *Madhumeha* viz. *DhatukshayajanyaMadhumeha* and *AvaranajanyaMadhumeha*. The etiological factors directly aggravating the *Vata* causes *ApatarpanajanyaMadhumeha* while the factors which aggravate *Kapha* and *Pitta dosha* causes *Santarpanajanya Madhumeha* which is compared to Type II Diabetes mellitus. In *samprapti* of *Prameha*, *Kaphavardhakahetusevana* causes aggravation of Kapha which vitiates *Medadhatu*[4].

Diet plays a significant role in etiopathogenesis of *Prameha*, hence *Pathyakarahar* has key role in preventing the type II Diabetes. In *CharakSamhita*, the importance of *ahar* is described in *Swasthachatushka*, *Annapanachatushka* and at various other places in different context. In *CharakSamhita*, *ahar* is classified in 12 *vargas* in *Annapanavidhi Adhyaya* of *Sutrasthana*, *Yava* (barley) has been included in *shukadhanyavarga* of these classification[5].

In *Ayurveda*, role of *Pathya ahar* is ~~is~~ broadly described in management of *Madhumeha* along with medications. *Acharya Charak* stated that habitual intake of parched or roasted Barley *(Yava)* flour, *Mudga* and *Amalaka* prevents the appearance of *Prameha*[6].

Acharya Charak, mentioned *Yava* as a specific diet in *Prameha*. It is considered as the best *ruksha santarpana dravya*. In *Samhitas* various preparations of *Yava* are described like *Yavaud (Yavanna*), *Vatya (Yavamanda*), *Yava Saktu* (flour of *Yava), Apoopa* (*chapati*, *poori*, *Dhana*, fried *Yava*). *Yava* (Barley) has *kashaya rasa*, *ruksha guna* and *lekhana* property[7].These properties of *Yava* helps in reducing the excess *kleda* from the body and reduce excess appetite. *Lekhana* property causes

kaphashaman and *medodhatu vilayana* which helps to correct *Medoduhsti* and clarifies obstructed channels of circulation thus leads in breaking *samprapti* of *Prameha*. *Pureeshavardhaka* property of *Yava* causes *doshanulomana* and reduces the *dhatushaithilaya* in *Prameha.* Barley is rich in beta glucans, a specific type of soluble fiber which causes slow absorption of glucose and helps in maintaining glycemic control. It has low glycemic index that helps in maintaining normal blood glucose level in the patients. The aim of this review is to emphasize on importance of *pathya ahar* in the form of various preparations of Barley and its role in prevention and management of type II Diabetes by collecting information from different literary review and research studies.

MATERIALS & METHODS

Information of the *Yava* (Barley) was collected manually from the *Samhitas* and from various research studies conducted on it by using key words.

OBSERVATIONS

Following animal and human research studies conducted on *Yava* proved their efficacy in prevention and management of Diabetes mellitus.

- In one of the animal research studies, two dietary formulations were prepared according to the dietary preparations mentioned in *Ayurvedic* classics. Barley, brown rice and Bengal gram were used in first formulation whereas these food grains in the form of parched grains were used in second formulation. Postprandial glycemic effect of both the formulations was evaluated in rats and it was then compared with a nutritional formulation prepared by mixing commonly used modern nutritional food grains (wheat, polished white rice and pigeon pea). The assessment of Methanolic extract of these formulations was carried out for antioxidant activities by applying several in vitro test methods. It was detected that time dependent rise in the postprandial blood glucose levels of rats up to two hours and overall postprandial glycemic loads induced by *Ayurvedic* dietary formulations were significantly less than the formulation of modern dietary food grains and starch. They stated that *Ayurvedic* dietary formulations were superior to extract of modern dietary mixture; in their reducing powers, free radicals scavenging activities and antioxidant activity[8].
- In another animal research study, they demonstrated that diabetic rats treated with Barley could repair hepatic damage and

restoring β-cells of pancreas from deformation due to some of its components (amino acids and chromium). This was proved by the biochemical and immunoassay results and microscopic study, where they stated that components like chromium and amino acids may be responsible for hypoglycemic and hypolipidemic action of Barley [9].

- A research conducted to study the long-term effects of dietary fiber intake on glucose tolerance and lipid metabolism in rats, in which total 30 male type 2 diabetic model GK rats were divided randomly into 3 groups. One group was fed with a Barley (high-dietary fiber) diet, second group was fed with rice (low-dietary fiber) diet and third was fed with corn starch (very-low-dietary fiber) diet. All rats were fed for 9 months. They found that group fed with barley diet significantly improved the area under the plasma glucose concentration time curves, reduction in the fasting plasma glucose and HbA1C levels, and lowered plasma total cholesterol ,triglycerides and free fatty acid levels. This study proved that long-term intake of barley has favourable effects on glucose tolerance and lipid levels and suggested to take high fiber diet for improvement in Type 2 Diabetes mellitus and hyperlipidemia[10].

- An animal study conducted, in which normal and streptozotocin (STZ)-induced diabetic rats were given normal saline (1 ml), Barley hydroalcoholic extract (BHE) (0.1, 0.25, 0.5 g/kg), protein enriched fraction (PEF) (0.1, 0.2, 0.4 g/kg) and glibenclamide (1 and 3 mg/kg), separately for 11 days and then investigated. Their results suggested that hydroalcoholic extract of Barley seeds, has a role in controlling type II diabetes when consumed for a long duration and according to them its high soluble fibre might be responsible for these effects. They stated that there is a need of more detailed studies for demonstration of mechanism of action and for identification of its active components[11].

- In comparative clinical study of total sixty patients, they made two groups, of which one consisting thirty patients with newly diagnosed Diabetes mellitus who were not taking any medication and other include 30 patients with concomitant anti-diabetic (Allopathic) medication, whose blood glucose level is not under control. They were given *Apoopa* (*chapati*) prepared with *Saktu* of *dhana* (flour of *Bharjita Yava*), in their regular *ahar* (breakfast, lunch, dinner) for 2 months. They found highly significant and significant improvement in subjective and

objective parameters in both groups. They concluded that *Yava* is one of the important *pathya ahar* in *Prameha*. They stated that *kashaya rasa* and *rukshaguna* of *Yava* causes reduction in excess *kleda* from the body and it is a good supplier of protein, fibers and micronutrients in diet of NIDDM patients[12].

- A pilot study was conducted in normal individuals to evaluate the effect of different cereals on blood sugar level. In this study first fasting blood sample of seven normal subjects was taken, then they were given 200 gm *chapati* made from Wheat, Barley, Bajara, Maize, Gram and Rice with *Patola* curry separately. This study showed that, the maximum increase in blood sugar level was recorded in rice, followed by wheat & minimum increase of blood sugar level in individuals consuming *chapati* made from Barley, when compared to glucose it surpasses all cereals. From this study they concluded that Barley is the best diet for patients of *Prameha*. In this clinical trial, they selected 30 diabetic patients and divided them into 3 groups according to the predominance of *doshas i.e Vataj, Pittaja* and *kaphaja.* They found more significant results in patients having *kapha prakriti.* From these observations they concluded that the *ahar Chikitsa* (Dietary management) is highly effective in early onset of disease and in case of *kaphadosha* predominant NDDM patients[13].
- A clinical study carried out on total 64 patients of *Madhumeha* and they were directed to follow dietary interventions (mainly *Amalaki, Yava, Mudga*) and lifestyle modifications strictly as per advised by them for 3 months. They found significant improvement in biochemical parameters like Plasma glucose level, Lipid profile, HBA1C and Urine after following the dietary interventions and lifestyle modifications. From this they concluded that Dietary interventions and lifestyle modifications are two important modalities to control newly diagnosed Diabetes mellitus and for patients who were on antidiabetic therapy having no sugar control. They stated that *Yava* causes *santarpana* without vitiating *doshas*. *Yava* have properties like reducing urine, mitigating fat, *pitta* and *kapha* and bestowing stability[14]
- In another clinical study, metabolic responses to Barley in healthy individuals were investigated. For that *chapatis* prepared from barley flour were given to provide 40% of the total daily cereal intake. After 4 weeks, they observed that the incremental area under the 3-hour glucose curve decreased from 107.9 mg/dL to 91.5 mg/dL. Form this they concluded

that these results might be due to the water soluble β-glucan portion of dietary fibers in Barley and are promising in prevention as well as management of Diabetes mellitus and cardiovascular disorders[15].

- In other research,they studied the mechanism of action of β-glucan fibers in postprandial glucose metabolism in the healthy males. They found the low glycemic response after consuming a meal containing β-glucan and they concluded that it is related to delay and/or decreased absorption of glucose which may be due to increased viscosity in the intestine. Barley is a rich source of β-glucan which helps in lowering the blood glucose levels[16].
- A clinical study conducted on role of *Yava* (Barley) based diet and yogic practices in management of *Madhumeha* (Diabetes mellitus), they selected total 60 patients of Type II DM based on the fulfilment of diagnostic criteria and randomly divided into 3 groups (20 patients in each group). First Control group was given Ongoing *Ayurvedic* treatment (*Nisha-amalaki* and *Shilajatu*), second group was treated with Ongoing *Ayurvedic* treatment and *Yava* based diet whereas third group was given Ongoing *Ayurvedic* treatment, *Yava* based diet and Yogic practices. On intra-group comparison they found that all the three groups were showed significant results in most of the subjective and objective parameters. Among three groups, third group was effective due to synergistic effect of both Yoga and *Yava* based diet[17].
- A study conducted for long duration which was published in the August 2007 edition of the Diabetes Research and Clinical Practice journal stated a 30 percent reduction in glycated haemoglobin level HbA1C (average blood glucose level) in patients of type 2 diabetes who consumed a wholesome diet which include pearl Barley supplying 18 grams of soluble fibers per day[18].
- In randomized controlled trials, viscous soluble fibres have proved for acute and long-term metabolic improvements in type 2 diabetes, such as fall in Hb A1C, fasting and postprandial blood sugar levels, insulinemia and cardiovascular risk factors. Moreover they may be helpful in controlling body weight through promoting early satiety[19].
- A study conducted from Lund University in Sweden showed that Barley can be used for improvement of health by reducing blood sugar levels and the risk for diabetes. They stated that, this type of results may be achieved due to special type of soluble dietary fibers present in Barley,

which can help to reduce appetite and risk of cardiovascular disease[20].

These all research studies indicate importance of *Yava* in the prevention and management of Diabetes mellitus.

DISCUSSION:

According to *Ayurveda, Madhura, Guru, Abhishyandi, kaphavardhaka ahar* along with sedentary lifestyle are the main causative factors of *Prameha* (Type 2 Diabetes mellitus)[21]. Lifestyle intervention along with medications has been mentioned in the classics for prevention and management of Diabetes mellitus.

Most of the above studies indicate importance of *pathya ahar* in prevention and management of Diabetes mellitus. According to these studies *Yava* helps in breaking *samprapti* of *Prameha* due to its *kashaya rasa, ruksha, guru guna* and *lekhana* property. It is a good supplier of proteins, fibers and micronutrients. The soluble fiber β-glucan and micronutrients in Barley is effective in lowering blood glucose, cholesterol and triglycerides level and affect glycemic responses. Various researches proved that nutrition therapy can significantly lower glycated hemoglobin by approximately one per cent in type 1 diabetes and by one to two per cent in type 2 Diabetes mellitus within three to six months[22,23].

Most of the research studies stated that ß-glucanhas antihyperglycemic effect and Barley is one of the richest sources of ß-glucan (3.5 to 5.9 per cent of dry matter), which slows gastric emptying, delays glucose absorption and improves postprandial glycemic response. A meta-analysis of six prospective cohort studies from the United States and Finland showed that increased consumption of whole grain by two servings per day was associated with reduction in 21 per cent risk of type II diabetes[24,25].

The above studies have suggested that increasing consumption of plant foods like Barley decreases the risk of obesity, diabetes, heart disease and overall mortality. Barley contains antioxidant like tocopherols, tocotrienols, vitamin E, lunasin a cancer preventive peptide, soluble fiber, beta glucan etc. Barley has high nutritive value with low calories having high fibers and protein content. Alkaline property of Barley reduces acidity in the body. It is an easily digestible food and it regulates blood sugar and controls cholesterol level thus helps in preventing coronary heart diseases.

Barley is classified under having low Glycemic Index which decreases the need for anti-hyperglycemic medications. The most recent systematic review of 12 trials found that low-GI diets reduced HbA1C

by 0.4 per cent compared to control diets[26]. In newly diagnosed cases of diabetes, adequate glycemic control can be attained by dietary and lifestyle management alone in approximately 50%, only 20-30% will require anti diabetic medications and 20-30% will need insulin. Consumption of plant-based foods of all kinds have reduces risk of many lifestyle related disorders.

It also affects the physiological response to carbohydrate ingestion by blunting the increase in postprandial plasma glucose and insulin. High Soluble fibers in Barley may attenuate the postprandial glycemic response due to their fermentation in the large intestine. Fermentation produces the short-chain fatty acids butyrate, acetate and propionate, which may decrease endogenous glucose production or increase extra hepatic insulin action. All these properties of Barley help in prevention and reducing the symptoms of Diabetes mellitus. It can be a good *Pathya ahar* for prevention and management of *Prameha* as *Ayurveda* emphasizes on *Nidanparivajan* the first line of treatment.

CONCLUSION

From above review it can be concluded that *Pathyakara ahar (*wholesome diet) is the unique concept of *Ayurveda*. *Acharya Charak* mentioned *Yava* (Barley) as one of the important *pathyaahar* in *Prameha. Yava* possesses properties which can help in breaking *Samprapti* of *Prameha*.

Barley is rich source of protein, soluble fibers and micronutrients. The soluble fiber β-glucan in Barley is effective in reducing rate of gastric emptying, reduces appetite and carbohydrate absorption. Low glycemic index of Barley decreases need of antihyperglycemic medications and helps in reducing dose of these medications.

Both in experimental animals and clinical research studies, Barley and its various products have been described to have preventive as well as therapeutic antidiabetic properties. All properties of *Yava* are helpful in lowering and maintaining blood glucose level. Hence *Yava* can be used in prevention as well as management of Diabetes mellitus. It is recommended that more research studies can be conducted to prove the mechanism of action and efficacy of Barley in diabetes and other metabolic disorders.

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