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RESEARCH ARTICLE

IMPACT OF WHOLE WHEAT DIET ON GLYCEMIC CONTROL IN NON-INSULIN DEPENDENT DIABETICS

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ABSTRACT

Diabetes mellitus is a complicated metabolic disorder that has gravely troubled the human health and quality of life. There are currently 371 million people living with diabetes and another 280 million are at high risk of developing the disease. The objective is to examine the impact of whole wheat diet on glycemic control of type 2 diabetics. A total number of 30 diabetics were selected by using purposive sampling method from Coimbatore medical college hospital. The experimental group (15) was directed to follow whole wheat diet and control group (15) was advised to follow their regular diabetic diet, for a period of three months. The fasting blood sample was drawn for estimation of blood glucose before and after the experimental study. The results shows that the decrease in the blood glucose levels of the experimental group at fasting, postprandial and HbA1c state were significant at five per cent level (p<0.05).

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INTRODUCTION

Diabetes mellitus is a complicated metabolic disorder that has gravely troubled the human health and quality of life. Across the world it is one of the most widespread non-communicable diseases (NCDs). Certainly, the most challenging health problem in the twenty first century is diabetes and it is one such condition which is being treated from centuries. It generally distresses the people who are from developed and developing countries (Vasim *et al,* 2012). Next to China, India leads the world with largest number of diabetic subjects, earning the dubious distinction of being phrased, *"the diabetes capital of the world"* (International Diabetes Federation, 2012 and Mohan *et al,* 2007). At the same time as the population is growing old, the incidence of Type 2 diabetes is multiplying and our people are becoming more racially diverse. Today, the ageing phenomenon plays an important role in the progression of diabetes both at genetic and epidemiological level. Diabetes is a global public health hazard which has rapidly increased in Asian population in recent decades (Juliana *et al,* 2009).

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The prevalence is increasing around the world at a rate that appears so dramatic as to have been characterized as an epidemic. Maiti *et al,* (2004) has estimated that twenty five per cent of the world's population is affected by this disease. According to the World Diabetes Atlas (2013) there are currently 371 million people living with diabetes and another 280 million are at high risk of developing the diabetes. Half a billion people are projected to be living with diabetes by 2030. Anjana *et al,* (2011) had reported that the prevalence of diabetes in India was 31.7 million in 2000, 40.9 million in 2007, 50.8 million in 2010 and 62.4 million in 2011.

New figures for diabetes prevalence in India indicate that the epidemic is progressing rapidly across the country reaching a sum of 62.4 million people with diabetes as well as 77.2 million people with pre-diabetes. The Hindu dated 20th May (2011) reported that 2.8 lakh people had diabetes in Coimbatore district, Tamilnadu and 3.2 lakh people had pre-diabetes. According to Sairam, (2013) the prevalence of hypertension and diabetes were 36.45 and 28.2 per cent respectively. Sharma *et al,* (2012) state that Type 2 diabetes is strongly associated with cardiovascular events and high incidence of macrovascular and microvascular complications such as coronary artery disease, strokes, peripheral arterial

disease, diabetic retinopathy, neuropathy and nephropathy which are major causes of illness and an enormous economic burden. This disease causes some direct and indirect effects on the human vascular tree. Diabetes is the leading cause of end stage renal failure in many populations in both developed and developing countries. The age-adjusted mortality, mostly due to coronary heart disease (CHD) is two to four times higher in diabetic population and people with diabetes have a two-fold increased risk of stroke. In developed countries diabetes is one of the leading causes of visual impairment and blindness (Yach *et al,* 2003). The origin of most Indian diets is polished rice and refined wheat with high glycemic index and glycemic load. In south India, rice is the staple food and highly polished white rice has been linked to Type 2 diabetes (Joshi *et al,* 2012). As Simin (2003) states fiber-rich whole wheat foods may indeed have many overlapping physiologic effects, including flattering gastro-intestinal function, enhanced lipid and glycemic profiles and reduced oxidative stress. Whole wheat consumption confers protection which is a vital device of insulin sensitivity.

Laurie (2010) and Martin *et al,* (2008) support the recommendation that most carbohydrate intake and a high dietary fiber intake should come from whole grains rather than refined grains to help prevent Type 2 diabetes. Thus, the goal of diabetes management must be to improve glycemic control and to provide adequate protein and micronutrients to help reduce muscle wasting, co-morbidity and the risk of mortality. With this background, the present study was conceived to incorporate whole wheat products in the diet of Type 2 diabetics and to observe the changes in glycemic control. These recipes were incorporated in the diet of selected type 2 diabetics and their efficacy was studied. The specific objectives of the present research on "Impact of Whole Wheat Diet on Glycemic Control in Non-insulin Dependent Diabetics" is to examine the impact of whole wheat meal plan on glycemic control in the selected Type 2 diabetics.

METHODOLOGY

Selection of area

The study was conducted in Coimbatore city. Coimbatore medical college hospital was selected for identification of diabetic subjects.

Selection of subjects

A total number of 30 type 2 diabetics were selected for conduct of the study. The purposive sampling method was based for selecting non-insulin dependent diabetics who met the inclusion criteria of above 35 and below 60 years of age and those who were willing to consume whole wheat preparations during the experimental period, not on insulin therapy and without any other complications were enrolled for the feeding trial. The subjects were grouped in such a way that the mean blood glucose levels were almost the same.

Evaluation of the impact of whole wheat meal plan

The impact of this meal plan on glycemic control of selected diabetics was evaluated. For this purpose the sample of 30 diabetics both male and female were selected and divided into the test and control groups, with fifteen patients in each group. One group was designated as the experimental group and was directed to follow whole wheat meal plan developed by the investigator. The second group was termed as control group and was advised to follow their regular diabetic diet, for a period of three months. The subjects were instructed to take whole wheat meal for whole day (breakfast, lunch and dinner) and were educated about whole wheat recipe preparation such as whole broken wheat uppuma, pongal, bisibelabath, vegetable biriyani, puttu, egg white stuffed chappathi, greens chappathi, adai, vegetable idlli and whole broken wheat cooked meal.

Biochemical estimation

As per WHO (1999) recommendations, the selected subjects were asked to have overnight fast for 8 to 10 hours. The fasting blood sample was drawn for estimation of fasting blood glucose and glycosylated haemoglobin (HbA1c) of the selected sample before and after the experimental study. The postprandial blood glucose was estimated $1^1/2$ hours after the breakfast. Fasting plasma glucose and postprandial plasma glucose were estimated by the GOD-POD method. High Performance Liquid Chromatography (HPLC) method was adopted in estimation of glycosylated haemoglobin (HbA1c) (Center for Disease Control and Prevention (CDC), 2007-2008).

Statistical analysis

Finally the collected data were statistically analysed by using paired one-tailed students't' test and the results were interpreted.

RESULTS

Efficacy of Whole Wheat Meal in Glycemic Control

Blood glucose levels

Table I exhibits the mean fasting and postprandial blood glucose levels of the subjects before and after substitution of whole wheat recipes for the normal diet for a period of three months. Graph 1 also depicts the blood glucose levels before and after substitution of whole wheat meal. The fasting mean blood glucose values of the experimental group was 131to 108 whereas in control group 126 to 148 (mmHg). In the case of postprandial blood glucose the mean values of the experimental group was 193 to 153 whereas in control group 198 to 226. The decrease in the blood glucose levels of the experimental group both at fasting and postprandial state were significant at five per cent level (p<0.05).

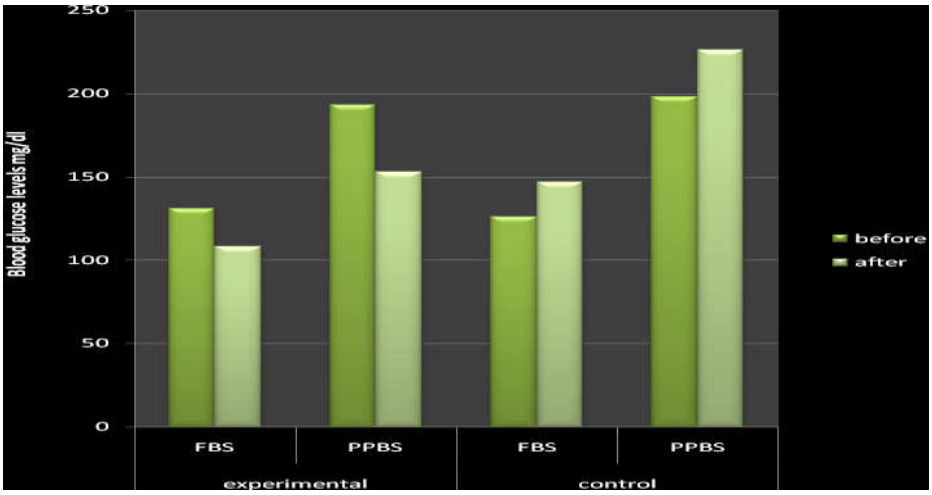
Glycosylated haemoglobin (HbA1c)

Table II and Graph 2 indicate the mean glycosylated haemoglobin levels of the selected sample before and after consuming whole wheat diet for a period of three months. The mean glycosylated haemoglobin levels of the experimental group had decreased from 8.0 per cent to 7.8 per cent after substitution of whole wheat meal plan for 90 days. The reduction in glycosylated haemoglobin was statistically significant at five per cent level. At the same time the difference in glycosylated haemoglobin level of the control group had shown and an increase of 7.7 to 8.0 per cent which was not statistically significant.

Table 1. Mean blood glucose levels of subjects before and after substitution of whole wheat meal

S.No	Blood Glucose		Experimental (n=15)		Control (n=15)	
			Mean± S.D	't' value	Mean± S.D	't' value
1.	Fasting Blood Glucose	Before	131±10.7	11.5*	126±13.4	3.82ns
		After	108±6.02		148±30.2	
2.	Postprandial Blood Glucose	Before	193±21.5	19.0*	198±32.2	3.57ns
		After	153±17.6		226±50.6	

*Significant at five per cent level ns-Not significant

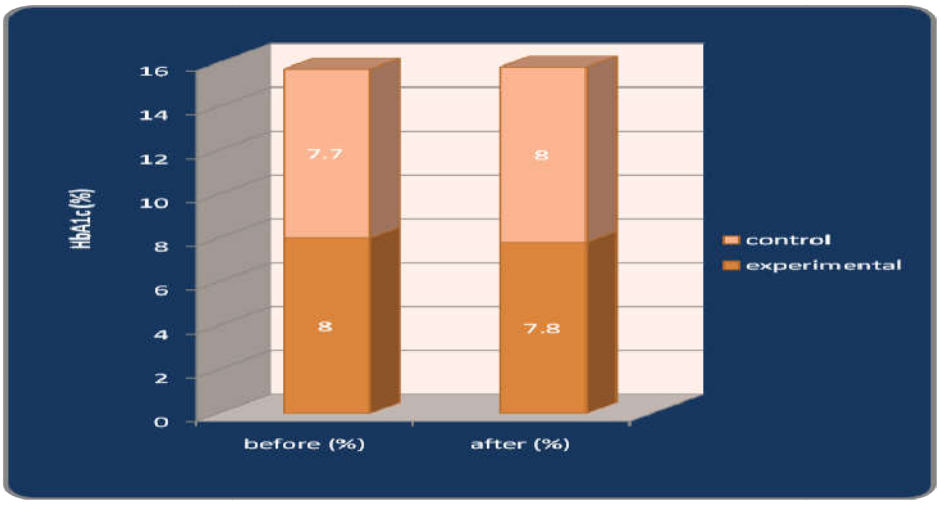


Graph 1. Mean blood glucose levels of subjects Before and after whole wheat diet

Table 2. Mean glycosylated haemoglobin levels of the selected subjects

Groups	Glycosylated Haemoglobin (%)		
	Before	After	't' value
	Mean± S.D	Mean± S.D	
Experimental (n=15)	8.0±0.43	7.8±0.50	5.85*
Control (n=15)	7.7±0.66	8.0±0.51	3.18ns

*Significant at five per cent level ns-Not significant



Graph 2. Mean glycosylated haemoglobin levels

DISCUSSION

The fasting mean blood glucose values of the subjects before and after substitution of whole wheat meal showed reduction in blood glucose by 23 mgs. In the case of postprandial blood glucose also a reduction of 40 mgs was registered after 3 months of consumption of whole wheat recipes.

The decrease in the blood glucose levels both at fasting and postprandial state were significant at five per cent level (p<0.05). But in the case of control group an increase was noticed both for fasting and postprandial blood glucose levels. But the increase was not statistically significant. The mean glycosylated haemoglobin levels of the experimental group had decreased 0.2 per cent.

The reduction in glycosylated haemoglobin was statistically significant at five per cent level. At the same time the difference in glycosylated haemoglobin level of the control group had shown and an increase of 0.3 per cent after substitution of whole wheat meal plan for 90 days which was not statistically significant. Both experimental and control groups received similar treatments. But the experimental group was directed to consume whole wheat meal during the experimental period of three months. So it is evident that whole broken wheat meal plan had the effect of reducing fasting and post prandial blood glucose levels. These results indicate the beneficial effect of whole broken wheat recipes in maintaining blood glucose levels.

Conclusion

The results of the present study have brought out the beneficial effects of whole wheat diet in improving the glycemic control. This study recapitulates the "whole wheat" as a hypocaloric and high fibre diet which is more supportive in treatment of type 2 diabetes mellitus. Whole wheat is not consumed by the population regularly. If the whole wheat meal is consumed in our daily diet, uncontrolled diabetes and high cholesterol could be overcome to certain extent. The incidence of diabetes will also decrease. The whole wheat recipes developed in the research were found to be efficient in maintaining blood glucose levels in diabetics. Thus the whole wheat meal has been proved to have effective medicinal virtues and is a better treatment strategy for diabetics.

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