

Review Article

Evaluate the effect of oat-beta glucan in controlling blood glucose levels among type 2 diabetic individuals

Ahmad Abdulrazzag Ali Albalawi¹, Fatmah Abdulrazzaq Ali Albalawi^{2*}

¹Department of Clinical Nutrition, Faculty of Applied Medical Sciences University of Tabuk, Saudi Arabia

²Faculty of Applied Medical Sciences, University of Tabuk, Saudi Arabia

Received: 09 March 2016

Revised: 10 March 2016

Accepted: 07 April 2016

*Correspondence:

Dr. Fatmah Abdulrazzaq Albalawi,
E-mail: fa-albalawi@ut.edu.sa

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Diabetes mellitus (DM) is a metabolic disorder characterized by inappropriate hyperglycemia due to deficiency in producing insulin or inefficient action of this hormone. Patients with DM are frequently afflicted with ischemic vascular disease, wound healing defect, vascular alterations, myocardial infarction, nephropathies, retinopathies and neuropathies. The uses of hypoglycemic agents or insulin are the common conventional treatments of diabetes. However, the frequent use of such expensive medications increased the financial burden upon patients. Low glycaemic food consumption is a very fruitful alternative in controlling diabetes. Foods that are rich in fiber are on the top of the glycaemic index and the potential component is beta glucan. The evidence of consuming oat beta-glucan to enhance glycaemia and insulin levels is not well established. So, the objective of this overview review is to evaluate the effect of oat-beta glucan in controlling blood glucose levels among type 2 diabetic individuals.

Keywords: Oat beta-glucan and type 2 diabetes, Beta glucan and diabetes, Oat beta glucan and blood glucose

INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder characterized by inappropriate hyperglycemia due to deficiency in producing insulin or inefficient action of this hormone. Patients with DM are frequently afflicted with ischemic vascular disease, wound healing defect, vascular alterations, myocardial infarction, nephropathies, retinopathies and neuropathies.¹The prevalence has been increasing steadily all over the world and estimated that 5% of all deaths worldwide are resulted from diabetes complications. The uses of hypoglycemic agents or insulin are the common conventional treatments of diabetes.² According to Andrade et al 2015; the frequent use of such expensive medications increased the financial burden upon patients. As a result, various studies have been done investigating non-pharmacological form of

treatments such as physical activity and functional food to reduce the side effect of diabetes.³ Low glycaemic food consumption is a very fruitful alternative in controlling diabetes.⁴ Foods that are rich in fiber are on the top of the glycaemic index and the potential component is beta glucan. Beta glucans comprise a group of non-starch polysaccharides naturally occurring in the cell walls of grains like oats, rye, barley, mushroom and yeast.⁵ Recent studies have reported that beta-glucans could reduce hyperglycemia, hyperlipidemia, and hypertension.⁵⁻⁷ Studies have suggested that food products containing beta-glucans could reduce hyperglycemia.^{3,4} Reyna et al 2003, suggested that the fiber build a barrier to prevent nutrients including glucose from being absorbed in the small intestine and consequently reducing insulinemia, glycaemia and cholesterol levels.⁸ Studies that have been examining the

impacts of beta glucans in people who are more likely to develop metabolic syndrome are frequent, however, the evidence of consuming oat beta-glucan to enhance glycaemia and insulin levels are not well established.⁹ So, the objective of this overview review is to evaluate the effect of oat-beta glucan in controlling blood glucose levels among type 2 diabetic individuals.

Study design

Strategy of the research : In December 2015 I directed an electronic search on the EBSCO host database, PubMed and ScienceDirect using the keywords oat beta-glucan and type 2 diabetes, beta glucan and diabetes, oat beta glucan and blood glucose.

Study selection

All studies that were selected had met the following criteria:

1. Only studies that investigated the effect of oat-beta glucan on type 2 diabetics were included.
2. Studies that were on humans only.
3. Randomized Controlled Trials.
4. Have control group.
5. The least dose was 3g of oat beta glucan.

However, there were no restrictions whether the doses were taken in the form of diet or in its pure form.

From searching PubMed database, there were 151 articles investigated the effect of beta-glucan and only 3 studies had met the criteria of this review (Figure 1). The rest of the articles in the PubMed database (148) were excluded because they were mixed between animal studies, vivo or vitro and topics that were not within the focus of this review. The search in EBSCO host yielded 502 articles, but none of them had met the criteria. In ScienceDirect database, there were 635 research investigated the effect of beta glucan and other types of fibers on diabetes and other metabolic and cardiovascular diseases, however, none of these investigations were on the effect of oat beta glucan on human type 2 diabetics. So, the total studies that were included in this review were 3 articles. The average age in all studies was 55 years old. The number of volunteers was varied from 21 to 53. The minimal dose was 3.5 g/per person/per day while the highest dose was 10g. All the doses were in a form of diet and none of them were in its pure shape (eg. capsules or tablets). The most recent RCT study that was investigating the effect of oat-beta glucan on the level of blood glucose among diabetics was done in 2010. The highest dose was 10g while the lowest was 3.5g. The longest period of time for examining the effect of oat beta glucan was for 2 months while the shortest period was for 3 days. The most assessed parameters were glycaemia, insulin level in blood, triglycerides, plasma glucose, HDL-Cholesterol, LDL-Cholesterol, total cholesterol, HbA1c, BMI and palatability (Table 1).

RESULTS

Table 1: Summary of the selected studies.

Author	Year	Control group	Number of participants	Average age of participants	Period of experiment	Dose of beta-glucan
Cugnet-Anceau et al	2010	Yes	53 CG:24 EC:29	62 years old	Pre-experiment: 3 weeks to the two groups for adaptation of consuming soups without oat beta-glucan. The period of experiment period: 8 weeks of consuming soup with OBG (experiment group). 8 weeks consuming soup without OBG (Control Group).	3.5 g in form of soup per day
AL Jenkins et al	2002	Yes	16 males CG:8 EG:8	50 years old	4 weeks	7.3g in form of breakfast cereal, 50g of cereals containing 6.2g of oat beta glucan and 3.7 g in 50 g of oat bread.
Reyna et al.	2003	Yes	16 men	50 years old	4 weeks	4,6 or 8g in form of breakfast cereals

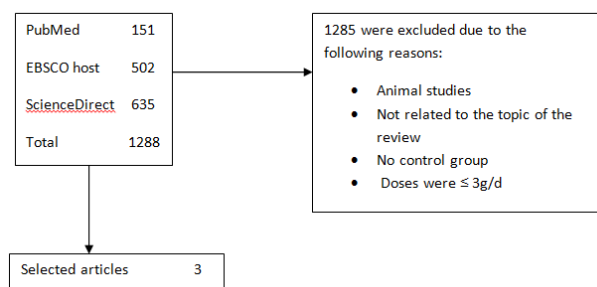


Figure 1: Flowchart of the process of searching by using the keywords oat beta-glc and type 2 diabetes, beta glucan and diabetes, oat beta glucan and blood glucose.

DISCUSSION

This overview review is to show the effect of oat beta glucan with a dose of 3 g or more a day on blood glucose in type 2 diabetics. We included three studies that met its criteria. A similar review was done by Andrade et al in 2015 that included these three studies. However, their systematic review included studies with and without control groups. This may weaken the studies if it only concentrate on the treatment group without randomization or comparisons.¹⁰ The absence of randomization or comparison pattern with a control group may increase the chances of bias and that may alter the effect of the treatment.¹⁰ Based on the hierarchy of evidence, the most valuable and significant types of research is the ones that use RCTs style as a method.¹⁰ The results of such studies give more accurate assumptions than others.¹⁰ The reason of including articles with a 3 g of oat beta glucan and more is because this dose showed a significant reduction in the level of blood glucose than those of less than 3g.²

Period of the experiments

From literature, red blood cells need from 8 to 12 weeks to be renewal and at that time HbA1c can be measured properly for indicating diabetes.¹¹ Based on that, experiments that are longer in time with 4 weeks or more were included in this overview review. Among the three studies that were selected, only one showed a reduction in HbA1c. However, the study also showed that the subjects were performed aerobic exercise on a daily bases during the experiment. According to Umpierre 2011, combined physical activity with aerobic exercise reduces HbA1c in type 2 diabetics.¹² Which means it could be a distort factor that may change the results when examining the effect of oat beta glucan. Regand et al 2011 compared the effect of 0.6 and 6.2 g of oat beta glucan in regards to its viscosity, molecular weight and solubility.¹³ The study noted that 6.2g of oat beta glucan gives higher viscosity when consumed and consequently decrease glucose responses. It also concluded that the higher molecular weight of beta glucan the lower of the peak of blood glucose responses. According to Beck et al 2009, food

processing could affect the polymerization of beta glucan which means it depends on the food vehicle.¹⁴ For example, 5 g of beta glucan in pasta showed no improvement in regard to glucose responses while only 2 g of beta glucan in a hot cereal showed a significant reduction in blood glucose.¹⁵ Moreover, Beck et al in 2009 noted that oat beta glucan with a dose more than 3 g could constantly maintain insulin responses which help indirectly enhance glycaemic action among patients.

CONCLUSION

Based on the results of these three studies and based on the systematic review, oat beta glucan has positive and potential effects in reducing blood glucose among type 2 diabetics. Moreover, there are efficient effects of oat beta glucan in reducing cardio-metabolic risk factors such as cholesterol. However, there is a need for more investigation for long-term effect of oat beta glucan and to be more specific, extracted capsules of oat beta glucan should be among these investigations.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Kolluru GK, Bir SC, Kevil CG. Endothelial dysfunction and diabetes: effects on angiogenesis, vascular remodeling, and wound healing. *Int J Vasc Med.* 2012;2012:918267.
2. Andrade EF, Lobato RV, de Araújo TV, Gilberto M, Zangerônimo RVdS, Pereira LJ. Effect of beta-glucans in the control of blood glucose levels of diabetic patients: a systematic review. *Nutr Hosp.* 2015;31(1):170-7.
3. Cugnet-Anceau C, Nazare JA, Björklund M, Le Coquil E, Sassolas A, Sothier M et al. A controlled study of consumption of β -glucan-enriched soups for 2 months by type 2 diabetic free-living subjects. *British journal of nutrition.* 2010;103(03):422-8.
4. Jenkins A, Jenkins D, Zdravkovic U, Würsch P, Vuksan V. Depression of the glycemic index by high levels of beta-glucan fiber in two functional foods tested in type 2 diabetes. *Eur J Clin Nutr.* 2002;56(7):622-8.
5. Gajdošová A, Petrušáková Z, Havrlentová M, Červená V, Hozová B, Šturdík E et al. The content of water-soluble and water-insoluble β -D-glucans in selected oats and barley varieties. *Carbohydrate polymers.* 2007;70(1):46-52.
6. Chen J, Raymond K. Beta-glucans in the treatment of diabetes and associated cardiovascular risks. *Vasc Health Risk Manag.* 2008;4(6):1265-72.
7. Lattimer JM, Haub MD. Effects of dietary fiber and its components on metabolic health. *Nutrients.* 2010;2(12):1266-89.

8. Reyna NY, Cano C, Bermúdez VJ, Medina MT, Souki AJ, Ambard M et al. Sweeteners and beta-glucans improve metabolic and anthropometrics variables in well controlled type 2 diabetic patients. *Am J Ther.* 2003;10(6):438-43.
9. Health Benefits of Barley. The Whole Grains Council. [Wholegrainscouncil.org](http://wholegrainscouncil.org). 2016 [cited 30 April 2016]. Available from: <http://wholegrainscouncil.org/whole-grains-101/health-benefits-of-barley>.
10. Petrisor B, Bhandari M. The hierarchy of evidence: levels and grades of recommendation. *Indian J Orthop.* 2007;41(1):11-5.
11. Barnard M, Mulnier H, Noble L, Potts H, Reid A. Co-creating Health phase 2 joint local evaluation (Type 2 diabetes). 2013.
12. Umpierre D, Ribeiro PA, Kramer CK, Leitão CB, Zucatti AT, Azevedo MJ et al. Physical activity advice only or structured exercise training and association with HbA1c levels in type 2 diabetes: a systematic review and meta-analysis. *Jama.* 2011;305(17):1790-9.
13. Regand A, Chowdhury Z, Tosh SM, Wolever TM, Wood P. The molecular weight, solubility and viscosity of oat beta-glucan affect human glycemic response by modifying starch digestibility. *Food Chem.* 2011;129(2):297-304.
14. Beck EJ, Tapsell LC, Batterham MJ, Tosh SM, Huang X-F. Increases in peptide YY levels following oat β -glucan ingestion are dose-dependent in overweight adults. *Nutr Res.* 2009;29(10):705-9.
15. Holm J, Björck I. Bioavailability of starch in various wheat-based bread products: evaluation of metabolic responses in healthy subjects and rate and extent of in vitro starch digestion. *The American journal of clinical nutrition.* 1992;55(2):420-9.

Cite this article as: Albalawi AAA, Albalawi FAA. Evaluate the effect of oat-beta glucan in controlling blood glucose levels among type 2 diabetic individuals. *Int J Res Med Sci* 2016;4:1309-12.