
Snack Bars as a Functional Snack Option for Individuals with Diabetes: A Review

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Abstract

Snack bars can be a great example of functional foods, which are foods that provide health benefits beyond basic nutrition. By adding other functional ingredients such as nuts, seeds, fruits, and spices, snack bars can offer even more health benefits. For example, nuts and seeds are rich in healthy fats and can help lower cholesterol levels, while fruits and berries are high in antioxidants and can help boost the immune system. Spices like cinnamon and ginger have anti-inflammatory properties and can help improve digestion.

Moreover, snack bars can be a convenient and portable way to get the nutrition and energy needed throughout the day. They can be a great option for busy individuals who need a quick and easy snack on the go or for athletes who need sustained energy during exercise.

The demand of functional food increasing day by day as the threat of non-communicable diseases increasing such as diabetes, CVD and obesity. From the ancient time the use of medicinal food such as seeds of chia, millets and multigrain has been seen to get different health benefits. Currently seeds are widely used for numerous health benefits. Seeds are well known for their high content of PUFA mainly omega-3 and omega-6 fatty acids and fiber. These seeds are also rich source of polyphenols which further helps in protecting the body from free radicals. Furthermore, seeds are rich source of the fiber which helps in reducing cholesterol level, regulate bowel movement and reduce inflammation in the body. Demand for practical and convenient food increasing day by day due to busy lifestyle. Food items that are convenient and can improve health are needed in today's time. The seeds incorporated snack bar can be a convenient and practical food product with complete nutritional components. There are some ingredients which can be used as the raw material to prepare an anti-diabetic snack bar. On the basis of existing research, seed and modified cassava flour (MOCAF) can reduce blood sugar levels and that can reduce the risk of diabetes too.

Key Words: Chia seed, antidiabetic, snack bar, MOCAF, Health, Nutritious food.

Introduction

At present, People are more conscious about their health and awareness regarding nutrition and

health increasing among people. Eating nutritious and healthy food is necessary for the good health.¹ People are now being conscious about their health in

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order that eating behaviour are not only for enjoying delicious food but can also affect their whole some level of health and fitness.² Due to busy lifestyle people getting lesser time for preparing food so mostly they are switching on the fast food because those are practical, quick, eaten t anytime and easy to get. Snack bar can be a food product which is practical easy to get, need no preparation and provide health benefits too.³ Increasing fitness consciousness, activity levels and consciousness about the benefits of frequent and smaller meals leading into the high use of snacks.⁴

The protein rich bars initially produced to address the nutritional deficiencies to military and physical exercise practitioners. The main purpose of the research and development team of food industry is to develop new products and market them to consumers but due to high demand of nutritious healthy products protein bars are good option to provide the fiber, protein healthy fat vitamin and minerals.⁵

Functional food use is the trend of today's time as consciousness increased for the healthy eating and non-communicable diseases like diabetes mellitus, and hyperlipidemia. In the diabetes mellitus people not able to control blood sugar levels in normal limits and leads to hyperglycemia in a longer run.⁶ Blood sugar levels can be controlled if we eat food items with low glycemic index and long starch digestibility. Glycemic index and blood glucose level are related with each other so if we eat food which have high glycemic index it will raise the blood sugar level faster, at variance with if we eat food with low glycemic index, the blood sugar level will rise slowly.⁷ If the fiber content of the food is good it will have a low glycemic index but not always. Nutritious snacks should not only rich in energy, but they should also provide dietary fiber, antioxidants, protein, vitamins, and minerals that are crucial for maintaining good health⁸. Chia seeds due to its potential health benefits consider as the functional food or super food. seeds and their food products are promising food items which can help in maintaing a good health.^{9,10,11} The hypoglycaemic effect of Nuts and seeds is well known which can reduce the blood glucose levels and reduce the risk of diabetes. On the other hand, apart from chia seeds many other products that also have

potential to reduce blood sugar levels is mocaf. Mocaf is known as the cassava flour made by fermentation of cassava cell modification. It is generally used as a replacement of wheat flour. Mocaf is similar to wheat flour but it's coarse in texture than wheat flour.¹²

Chia Seed (*Salvia hispanica* L)

Chia seeds are oval in shape, have a glossy surface, and has many colors such as dark brown, grey, white, and black. Chia seeds has a width of 1.2 - 1.5 mm, length about 2 - 2.5 mm, and thickness of 0.8 - 1 mm.¹¹ Chia seeds has protein about (15-25%), fat (30-33%), carbohydrates (26-41%), fiber (18-30%), and minerals (4-5%). Chia seeds also rich in omega 3 fatty acids especially (linolenic acid) by 17.83%.¹³ To Make chia seed flour first of all weight 250g of chia seeds and roast them for about 6 minutes and keep stirring. Grind the roasted chia seeds until you get a smooth texture and then sieved with a 60-mesh flour sieve.¹⁴

Cassava (*Manihot esculenta*)

Modified Cassava Flour (MOCAF) is a product from cassava (*Manihot esculenta*) in which cassava cells modified with the lactic acid bacteria via fermentation process. Mocaf flour is generally and vigorously used in various food products.¹⁵ Modified cassava flour has many advantages over basic cassava flour as it has higher viscosity, better rehydration power, and a covered cassava flavour. 100 grams of mocaf flour contains 1.2% protein, 0.4% fat, and 3.4% fiber.¹⁶ Mocaf is gluten free in nature and has the ability to be processed to produce resistant starch 3 (rs3). Resistant starch capability needed for diabetics people it means this can be used as food processing for diabetics.¹² To make the mocaf from cassava starts from selecting cassava it should be 10 months old, after it peel the cassava and wash with clean water. Then cut the cassava in thin strips with help of slicer. Then cassava chips go through the fermentation process by the addition of water and a starter in 1000:1. There are Two different grinding methods. In the dry milling, fermented cassava chips dried by the sun (sun drying) to produce chips Mocaf, and then blended using a blender for one minute and eventually sieved with a 100-mesh sieve. In the wet milling process, the fermented cassava chips are blended with by adding 6: 1 water using blender for one minute until a nice slurry formed. The slurry is

dried with sun drying method and milled again with the help of a blender for one minute. Sieved with a 100-mesh sieve to get a cassava flour.¹⁵

Snack Bar Production

The snack bar production starts from the weighing the ingredients according to the formulation. Both the flours mocaf and chia flour mixed with the other ingredients and then mixed for 20 minutes. After every ingredient being incorporated a dough is formed and transfer the in to the baking sheet sized 26.5x10x3.5 cm. After it the snack bar dough baked at 120 degrees Celsius for 40 minutes, and then it again baked at 140-degree Celsius for 5 minutes. prepared snack bar left for to stand for half an hour.¹⁶ The high concentration of mocaf flour was used for lighter colour of the snack bar. The texture of resulting snack bar was is not too hard and the protein content of 5.6%. it was low due to roasting via high temperatures.¹⁷ When high temperature for a longer period of time has been used the high protein damage take place in these food products. In spite the fact that the resultant snack bar has low water content which mean its shelf life is high. Based on other research by Singh et al. (2020), snacks produced with the addition of chia flour have fiber content in the resultant product. 100 g of chia seeds contains 50 g of dietary fiber. High fiber content provides better water holding capacity and high emulsifying activity. Hence when more concentration of chia seeds uses the moisture content will reduce which ultimately increase the shelf life of the product.¹⁸

Other Antidiabetic Snack Bars Flour

The available snacks for diabetic people mellitus need further mindfulness. Many researchers have been conducted studies on the formulation of snack bars by using different nutrient rich ingredients. A study conducted by Jahanzeb *et al* (2016) in which he formulated bars using cereal and utilizing guava pulp at 10% and 15% concentration. The results showed a high protein, and lower fat content in the cereal bars.¹⁹ In a different study conducted by Mridula *et al* (2013) developed an energy bar by using different concentration of flaxseed (0–20%) in addition to cereals and pulses with different levels of sweeteners (45, 50, and 55%).²⁰ As the level of flaxseed increase, the total calories obtained from the energy bar significantly increase.

The snacks should have high fiber content and low glycemic index to be appropriate for diabetic people. Insulin sensitivity can be improved by eating high fiber and low glycemic index food. By doing so the complication due to diabetes mellitus can be reduced. Generally, whole grains, nuts, seeds and tubers have low glycemic index and high infiber. Snack bar also made with sorghum flour as main ingredient. But in final product the resistant starch content reduced. Sorghum flour has ability to reduce systolic blood pressure. Hypertension and diabetes can co-exist.²¹ A nutrimat bar also made from soybean and red bean flour, which can say to be a best formulation of soybean flour 25%: 75% red bean flour due to delicious taste, savoury aroma, brown color, and soft texture with high nutritional value.²² Snack bars made with functional foods such as nuts, seeds, and whole grains can help regulate blood sugar levels due to their high fiber content and antioxidant properties. This can be particularly beneficial for many metabolic syndrome diabetes, CVD and many more.^{23,24}

Methodology

A literature research has been conducted to recognize the recent articles on the snack bar production by using functional ingredients such as chia seeds, flax seeds, nuts and multigrain flours. Different sets of terms have been used for the literature research such as snack bars, antidiabetic bars, blood sugar control snack, chia seeds and snack bars, multigrain bars, cassava flour and bars. To confirm the applicability for review all the abstracts has been reviewed carefully. Additional articles were also extracted from the reference of the articles.

Conclusion

The use of snack bars made from functional ingredients such as nuts, seeds and cassava flour can be a healthy and convenient option for individuals with diabetes. These bars are typically high in fiber and protein, which can help regulate blood sugar levels and keep individuals feeling full and satisfied for longer periods of time. Additionally, nuts and seeds are rich in healthy fats, vitamins, and minerals, which can support overall health and well-being.

Overall, incorporating snack bars made from seeds and nuts into a balanced and varied diet can

be a helpful strategy for individuals with diabetes who are looking for a convenient and healthy snack option. Top of FormFrom the current literature it has been shown that seeds, nuts and cassava have the ability to help in managing the lifestyle disorders such as diabetes, obesity and CVD. It can reduce the risk of diabetes mellitus. As people have lesser time and want something easy to eat different snacks has been made from seeds with the incorporation of different flours as the main ingredient. Overall, snack bars can be an excellent choice for functional foods, offering a combination of nutrients and health benefits in a convenient and tasty form. To develop nutritious food product which provide potential health benefits thorough analysis of different parameters should be in future studies.

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