

The use of bamboo, coconut and almond flour to obtain gluten-free and hypoglucidic cookies

Moldovan C.¹, Szasz-Toma M-L², Popa A-M², Toța C-E.³, Popa V-M¹, Raba D-N⁴, Borozan A-B³, Mișcă C-D¹, Bordean D-M², Poiana M-A¹, Dumbravă D-G.¹

¹Food Engineering Faculty, USV "King Mihai I" from Timișoara; ²"Henri Coandă" Technical College from Timișoara; ³Faculty of Engineering and Applied Technologies, USV "King Mihai I" from Timișoara
⁴Faculty of Management and Rural Tourism, USV "King Mihai I" from Timișoara

Abstract: The purpose of this work was to obtain and characterize hypoglycemic and gluten-free cookies intended for people with celiac disease, diabetics, and obese people. Thus, we obtained four types of cookies from wheat flour (control samples), bamboo flour, almond flour and coconut flour (experimental samples). The sensory characteristics of these products were very close to the usual ones, but due to the low carbohydrate content and the absence of gluten, these cookies can be consumed both by people with diabetes or celiac disease, as well as by people following a ketogenic diet. Acidity, ash and water content were lower in the experimental samples than in the control samples, giving the products better crispness and longer shelf life. The highest energy value was observed in cookies with almond flour. Bamboo, coconut or almond flours can be healthy alternatives to wheat flour for cookies intended for people with special nutritional needs.

Introduction

Starting from the nutritional needs of consumers affected by gluten intolerance, manufacturers in the bakery and pastry sectors have developed products substituting wheat flour with other types of gluten-free flours. Also, consumers are increasingly concerned about their own health and tend to adopt a healthier lifestyle, implicitly changing their diet as well. Thus, many people adopt the gluten-free diet, even if they do not have celiac disease, or the ketogenic diet (low carbs) even if they are not diabetic or overweight. Research in the field reveals that gluten seriously affects the health of some consumers (Humbert et al., 2006; Biesiekierski et al., 2011; Herfarth et al., 2014) and neurologically (Ford, 2009; Jackson et al., 2012). A particular interest among researchers has been shown in replacing wheat flour with rye flour, sorghum, coconut, almond, pea, soy, rice, corn, chickpea, quinoa, amaranth, vegetables (Man et al., 2014; Andersson, 2016; Javaria, et al., 2017; Păucean et al., 2017; Bolea, 2018; Stoin et al., 2018; Ghinea et al., 2019; Ramya and Anitha, 2020; Roshia et al., 2022; Hopkin et al., 2022) in obtaining bakery and pastry products. Bamboo flour can successfully replace wheat flour in pastry and confectionery products. It is gluten-free and has a low carbohydrate content (19% - four times less than rice flour which is often used instead of wheat flour), high protein and fat content (Wanjala et al., 2020). Nucifera, in the form of flour, are excellent alternative sources of wheat flour. These flours have a high fat and protein content, respectively a lower carbohydrate content (Hopkin et al., 2022). Due to its nutritional profile, coconut flour is gluten-free and also suitable for the ketogenic diet (Hopkin et al., 2022; nutritionvalue), being very rich in dietary fiber (twice as much as wheat bran, and 4 times more than oat ones) (Jiamariyatam et al., 2021). According to the study conducted by Arancon, (1999), cited by Ramya and Anitha, (2020), coconut flour has benefits for consumers, contributing to the control of cholesterol and blood sugar levels, as well as the prevention of colon cancer. Almond flour is also gluten-free, having a beneficial nutritional profile for consumers with celiac disease, but also with a pleasant taste (Stoin et al., 2018) and a substantial content of polyphenols (Takemoto et al., 2001, cited by Yildiz and Gocmen, 2020). The consumption of cookies is very high globally, which is why they are produced in an extremely varied range. This fact also determined the study of the behavior of different aglutenic flours on sensory, physico-chemical characteristics and nutritional aspects (Ramya and Anitha, 2020; Stoin et al., 2020; Hopkin et al., 2022; Moss et al., 2022).

Materials and methods

Four types of cookies were obtained from flour of: wheat, bamboo, almond and from coconut, all other ingredients remaining unchanged for the three recipes. Erythritol was used as a sweetener. The sensory analysis was performed by the hedonic method (1-7). The water content was determined by drying the sample in an oven at 103-105°C until constant mass. Ash content was determined by calcining the samples according to AOAC (1990). The acidity was evaluated by titrating the free acids from the aqueous extract of the sample with 0.1 N sodium hydroxide. The evaluation of the antioxidant activity was done by measuring the discoloration time of the sample extract in the presence of potassium permanganate. The approximate composition and energy value of the obtained cookies were determined by calculation, using the database: "NutritionValue".

Results and discussions

The results of the sensory and physico-chemical examinations are presented in the figures. The appearance, color, consistency and taste of almond flour cookies were the most appreciated (6.82, 6.88, 6.92 and 6.94 points, respectively). In the odor evaluation, coconut flour contributed substantially in the coconut cookies, scoring 6.88. The lower water content gave the products the property of being more crispy, in accordance with other data from the specialized literature (Yildiz and Gocmen, 2020). Acidity and ash content were more reduced in the samples obtained from coconut flour, respectively from almonds (Stoin et al., 2020). The highest energy value was observed for cookies with almond flour (451.97 kcal) and the lowest for classic cookies (342.32 kcal).



Conclusions:

The sensory analysis ranked the cookies made from wheat flour in the last place compared to those made from bamboo, almond or coconut flour;

The best acceptability was noted for cookies with almond flour;

The highest water content was determined in wheat flour cookies, their shelf life being thus lower than in the other cookies

The caloric value of cookies obtained from gluten-free flours was higher than that calculated for cookies made from wheat flour.

Cookies made from gluten-free flours have a lower carbohydrate content than those from wheat flour, being more suitable for people with diabetes or those on a keto diet.