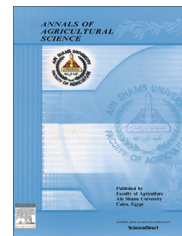




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Sensory evaluation and nutritional value of balady flat bread supplemented with banana peels as a natural source of dietary fiber

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Abstract The aim of this study was to evaluate the effect of two different concentrations of banana peels BP (5% and 10%) as a partial replacement for wheat flour on physicochemical and sensory properties of Egyptian balady flat bread. The peel powder (0.50 mm size) from banana was prepared from their dried peel. The bread was prepared by replacing 5% and 10% of wheat flour with a banana peel. The bread prepared was designated as B1 and B2 respectively. They were tested for moisture, ash, protein, fat, crude fiber as per the standard methods. The physicochemical and sensory parameters of these two test bread were compared with a control bread 100% wheat flour designated as B0. Results showed that BP flour was owing 11.20% crude fiber which is higher than the wheat flour 1.21%. Also, BP flour has high potassium, calcium, sodium, iron and manganese compared with wheat flour. The protein and fiber content of B2 and B1 bread were higher (12.52% and 11.79% protein and 2.18% and 1.97% fiber) as compared to the control bread (10.79 protein and 1.42% fiber). B1 and B2 had the highest K, Na, Ca, Fe, Mg and Zn content compared with control bread. The water holding capacity (WHC) and oil holding capacity (OHC) of bread with BP flour were higher as compared to the bread control. The bread prepared by replacing 5% and 10% of BP (B2) is found to be sensorially acceptable. Our results showed that the nutritionally and sensory acceptable bread can be prepared by replacing at most 10% of flour.

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Introduction

The amount of waste from fruit peels is expected to increase with the development and progression of industrial manufacturing processes that use bananas as either green or ripe. For example accurate banana peels possibly introduce new prod-

ucts for various industrial and household uses (Gunaseelan, 2004; Bori et al., 2007; Emaga et al., 2007).

Fruits and vegetable flour is rich in fiber, protein and minerals and has a high water holding capacity (WHC) and oil holding capacity (OHC). Thus, it can be used in a new low-calorie and cost products (Ferreira et al., 2013).

Banana is called *Musa* spp., (Leslie, 1976) and is among the leading fruit crops in the economic value in the world. It is ranked the fifth in the world trade (Guyène et al., 2008).

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There is a lack of information about the content of nutritional value waste fruit but there are many sources of waste fruit in Egypt (Hanan and Abdelrahman, 2013).

Banana peels have various health benefits to excellent nutritional status, and it treats the intestinal lesion, diarrhea, dysentery, ulcerative colitis, nephritis, gout, cardiac disease, hypertension, and diabetes. (Emaga et al., 2007, 2008; Wachirasiri et al., 2008; Imam and Akter, 2011).

Banana peels are rich in phenolic compounds as they are a good source of antioxidants, which protect against heart disease and cancer (Someya et al., 2002).

Banana peel wastes from industrial processes represent about 40% of fresh bananas (Anhwange et al., 2008). These wastes pose an environmental problem for their generation of large quantities of organic waste. Researchers have shown that noodles flour from banana peels lowers glycemic index and reduces the duration of digestion due to the high content of resistant starch (Li et al., 2006; Ramli et al., 2009).

There was a general trend recently toward increasing the nutritional value of bakery products like bakery products strengthening fiber, as the bakery products are consumed widely in the international food markets (Kotsianis et al., 2002).

Bread is a staple diet that is consumed daily, and its quality and sensory attributes are highly considered by consumers (Motrena et al., 2011).

Flat bread is as old as civilization. It is eaten with almost every meal in the Middle East. Flat bread is often served freshly baked and produced in both the bakeries and home. The consumption of flat bread is increasing all over the world: both from traditional production and commercial mechanical bread production of Middle East bread. Flat bread is simple bread made from a flattened dough of flour, salt, water, yeast and other optional components. Additional (optional) components may be used for processing aids which are essential, particularly in the bread-making process, to improve the quality and enrich the bread to get more nutritional value (Al-Dmoor, 2012).

The objective of this study was to evaluate the effect of two different concentrations of banana peels as a natural source of dietary fiber (5 and 10%) as a partial replacement for wheat flour on physicochemical and sensory properties of Egyptian balady flat bread

Materials and methods

Materials

Commercial wheat flour (72% extraction rate) and fresh compressed yeast, crystal white sugar, salt, corn oil and unripe banana were obtained from local markets, Assiut, Egypt.

Preparation of raw materials

Banana peels powder

The banana fruit was washed with the tap water and peels were separated from the pulp and cut into small pieces. Peels were dipped in 0.5% (w/v) citric acid solution for 20 min to avoid a browning reaction, then drained and dried at the room temperature for 6 days. Dried peels were ground into powder in the mixer, and sieved with a mesh of size 0.50 mm to obtain banana peel flour. All dried powders were stored in clean brown bottles at room temperature for further analysis.

Preparation of banana peels bread

Balady flat bread. Balady bread was prepared according to the method described by Hegazy et al. (2009). Flat bread contained two different concentrations of banana peels flour (5% and 10%) as a partial replacement for wheat flour (72% extraction rate). Formulas consisted of 90, 95, 100 g of flour, 2% compressed yeast dissolved in warm water (40 °C), 3.5 g corn oil, 2 g salt and 50–72 ml water as mentioned in Table 1. Flour and other ingredients were mixed and then the dough is left at room temperature for 40 min. to complete fermentation. The dough was cut into loaves, which were baked at 250 °C for 3 min in an electric oven. Then they were air cooled, and packed in polyethylene bags until use for the required analysis and measurements (the flat bread pictures at different blends are shown in Fig. 1).

Analysis

Chemical analysis

Moisture was determined according to the methods of AOAC (2000), protein was determined by Micro-Kjeldahl according to the methods of (AOAC, 2000), crude fiber was determined with an enzymatic–gravimetric procedure according to AOAC Method 991.43 (AOAC, 2000), fat was determined by Soxhlet Extractor according to AOAC (1995), and ash was determined according to the method of AOAC (1942). Total carbohydrate was calculated by difference. These analyzes were determined in Central Laboratory for Chemical Analysis, Faculty of Agriculture, Assiut University.

Determination of minerals

Potassium and sodium were determined by flame photometer according to Jackson (1973). The elements (calcium, iron, manganese, zinc, and phosphor) were determined using the ICP (Inductively Coupled Plasma Emission Spectrometer) (ICAP6200) according to Isaac and Johnson (1985). These analyzes were determined in Central Laboratory for Chemical Analysis, Faculty of Agriculture, Assiut University.

Water holding capacity (WHC) and oil holding capacity (OHC) of banana Peels Bread

1 g of the sample and 25 ml of distilled water were taken in tubes of 30 ml capacity and allowed standing at room temperature at ambient temperature for 15 min. The tubes were centrifuged for 20 min at 4000g, and then the supernatant was allowed to drain. The residue remains after draining of

Table 1 Formulas of flat bread with different concentrations of banana peels (g/100 g).

Samples	Formula 1(B0)	Formula 2(B1)	Formula 3(B3)
Wheat flour	100	95	90
Banana peels	---	5	10
Corn oil	3.5	3.5	3.5
Sugar	6	6	6
Salt	2	2	2
Water	50 ml	66 ml	72 ml
Yeast	3	3	3

Formula 1: Wheat flour 100% (B0) control, Formula 2: Banana peels 5% (B1), Formula 3: Banana peels 10% (B2).

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