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RESEARCH ARTICLE

Relationship of chemical properties of different peanut varieties to peanut butter storage stability

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Abstract

This study examined the effect of peanut quality on the storage stability of peanut butter. The quality of 17 varieties of peanuts was analyzed, and each was used to prepare peanut butter. For different storage temperatures and durations, stability of the peanut butter was measured according to three indicators: peroxide value, acid value, and centrifugal rate. The correlation between peanut components and peanut butter storage stability was also investigated. The results indicated significant differences in fatty acid composition between different varieties of peanut. Peanut butter prepared with high oleic peanuts (Kainong 17-15) had a significantly longer shelf life than that of other varieties. The significant correlation between the stability of peanut butter and peanut quality suggests that oleic acid and linoleic acid were the main influencing factors on stability. This study finds that the high oleic peanuts (HOP) is the most suitable variety for making peanut butter, which can allow farmers and processors to choose the specific variety for better product and shelf life.

Keywords: peanut varieties, quality, peanut butter prepared, storage stability

1. Introduction

Peanut (*Arachis hypogaea* L.) is an important crop in many parts of the world. China is the world's largest peanut producer, which has more than 8 000 varieties (Wang *et al.* 2017). In 2017, China produced about 17.40 million tons of peanuts (USDA 2017). A large proportion of peanut production is used for domestic foods, because peanuts contain high levels of oil and protein for producing peanut oil and peanut butter. The dry seed typically contains 40–50% oil by weight, with oil content from conventional peanuts (NP) approximately 41–67% oleic acid (18:1), whereas that of high oleic peanuts (HOP) can be up to 80% oleic acid (Dean *et al*. 2011). Wilkin *et al*. (2014) reported that the high monounsaturated and low polyunsaturated fatty acid content can increase the storage time of these cultivars when compared with that of other varieties.

Peanut butter is one of the popular peanut products, which is used for direct consumption or as an ingredient in the preparation of other foods. The unique flavor and nutritional value make peanut butter one of the most favorite American snacks, where peanut butter yield accounts for 40% of the total peanut output. However, preservation

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and storage stability of these products are an ongoing concern in the peanut industry (Bolton and Sanders 2002). Isleib *et al*. (2006) and Pattee *et al*. (2002) found that lipid oxidation is the primary cause of decreased shelf life and the development of off-flavors and aromas in roasted peanuts. Moreover, the factors affecting the lipid oxidation include vitamin E, packaging, hypoxic environment, storage temperature, and time. Previous studies demonstrated that the HOP varieties exhibited the highest oxidative stability compared with conventional peanut, because it contains a higher amount of oleic acid (Jonnala *et al*. 2006; Craft *et al*. 2010). Manufacturers have selected HOP cultivars to prepare peanut butter owing to their low degree of lipid oxidation during storage, which significantly improves the preservation of sensory and chemical quality parameters (Riveros *et al*. 2010). This effect was first detected in fried-salted peanuts (Valeria *et al*. 2006). A study on peanut butter prepared using seven peanut cultivars commonly grown in the major producing states of India showed that peanut variety Somnath is best suited for producing peanut butter (Dhamsaniya *et al*. 2012). Other studies have reported differences in the physical and chemical properties of peanuts and of peanut butter from the ÇOM and NC-7 cultivars, although little is known of the decreases in antioxidant activity during preliminary storage (Özcan *et al*. 2003). There is a demonstrated significant correlation between the storage stability of peanut butter and peanut varieties. However, the storage stability of peanut butter prepared with different peanut varieties, particularly those produced with conventional and high oleic acid peanut varieties in China has not been studied. In particular, no study has examined the most suitable Chinese peanut varieties for the best quality and storage of peanut butter.

The objective of this study was to compare the oxidative stability among different varieties of peanut butter. A total of 17 peanut samples, which included 16 conventional and 1 high oleic peanut cultivars were selected for study. First, the quality characteristics of 17 peanut varieties were analyzed; second, across different temperatures and storage durations, the increases in peroxide value (PV), acid value (AV), and centrifugal rate (CR, %) were measured; third, the effects of different peanut varieties on peanut butter quality, as well as the relationship to the storage stability of peanut butter were analyzed.

2. Materials and methods

2.1. Materials

For sample preparation, 17 varieties of peanuts commonly grown in major peanut producing provinces of China were selected. The pods of these selected peanut varieties were provided from the Chinese Academy of Agricultural Sciences. Samples were collected from 6 provinces and autonomous regions in China in 2013: Shandong, Liaoning, Henan, Hebei, Xinjiang, and Guangxi (Table 1). The pods were decorticated manually to obtain medium grade size sound kernels.

2.2. Proximate determination

The physical properties and chemical composition of different varieties of peanut kernels were analyzed according to the AOAC Official Method with minor modifications (Wilkin *et al*. 2014). The fat content was determined by using Soxhlet extraction. Approximately 1 g of peanuts was ground, placed in a thimble, and refluxed for 2 h using petroleum ether (60–90°C) as the solvent. After 2 h, the solvent was recovered and the residue was weighed. The protein content was determined by the Kjeldahl method using 5.46 as the conversion factor.

The total sugar content was determined using the vitriolic acid-phenol method (Duboils *et al*. 1956). Briefly, about 15 mg of ground peanut was placed in an anaerobic jar with 15 mL of deionized water, and was then hydrolyzed using vitriol at the room temperature for 3 h and heated in a vacuum oven at 105°C for 4 h. Finally, sugar content was determined using a UV-3010 spectrophotometer (Hitachi, Tokyo, Japan).

Table 1 Peanut varieties included in a study of peanut butter quality and shelf-stability

Code	Name	Source	Code	Name	Source
1	Huayu 22	Shandong	10	Jihuatian 1	Hebei
2	Weihua 8	Shandong	11	Huayu 22	Xinjiang
3	Shangyan 9658	Henan	12	Guihua 17	Guangxi
4	Fenghua 1	Shandong	13	Fuhua 18	Liaoning
5	Luhua 17	Shandong	14	Baisha 1016	Liaoning
6	13-2	Henan	15	Fuhua 12	Liaoning
7	13-3	Henan	16	Kainong 17-15	Shandong
8	Guihua 22	Guangxi	17	Yuhua 9414	Henan
9	Guihuahong 95	Guangxi			