Available online at www.sciencedirect.com
ScienceDirect
Food Control 18 (2007) 1161–1164
FOOD CONTROL
www.elsevier.com/locate/foodcont

Effect of quenching on cookability of some food legumes

E.N. Bede

Department of Food Science and Technology, Federal University of Technology, P.M.B. 1526, Owerri, Imo State, Nigeria

Received 1 September 2004; received in revised form 10 March 2005; accepted 14 March 2005

Abstract

The cooking time of three varieties of cowpea (*Vigna unguiculata*) were determined by sudden and rapid decrease in the temperature (quenching) of boiling cowpea seeds, by the addition of water at a lower temperature. The varieties of cowpea used were, 'Sokoto white', 'Potesco white' and 'Ife brown'. The results showed that quenching with water at a temperature of about 62 °C produced the maximum reduction in the cooking time for all the varieties. 'Sokoto white' which exhibited the longest cooking time among the cowpea varieties considered showed about 29% reduction in total cooking time while 'Ife brown' with the shortest cooking time showed a percentage reduction of about 13%. When the study was extended to another legume, pigeon pea (*Cajanus cajan*) which has a very long cooking time relative to most cowpea varieties, a 40% reduction in cooking time was observed. However, cooking the varieties with trona, 'Sokoto white' and 'Ife brown' showed 26% and 30% reduction in cooking time respectively, while the pigeon pea showed 25% reduction.

Keywords: Quenching; Cooking time; Legumes; Cowpea

1. Introduction

In many countries throughout the world, cowpea (*Vigna unguiculata*) are grown in a very large extent. This is due to the fact that cowpeas are important sources of vegetable protein, energy and other nutrients (Uzogara & Ofuya, 1992). Due to high cost and limited availability of animal proteins in the developing countries, attention has increased in the utilization of seed and legumes especially cowpeas as potential sources of low cost dietry proteins for food use (Sathe & Salunke, 1981; Wang, Lewis, Brennam, & Westby, 1997). Cowpeas in their varieties have now become an important grain legume in East and West African countries as well as other developing countries (Dovlo, Williams, & Zoaka, 1976; McWatters, 1983; Philips & McWatters, 1991; Prinyawiwatkul, Beuchat, Mcwatters, & Philips, 1996).

In Nigeria, cowpeas are grown extensively. Niger and Nigeria produce 49.3% of the annual world crop (Rachie, 1985). This legume crop form an important part of the diets of a good number of Nigerians (Oyenuga, 1968; Uriyo, 2001) as they are prepared and eaten as porridge, cake ('akara') and delicacy such as 'moinmoin' (Faboya & Aku, 1996).

Despite the fact that cowpeas have been found to be good sources of low cost vegetable protein, calcium, magnesium, zinc and B vitamins (Oke, 1967; Etakapan, Eka, & Ipon, 1983; Prinyawiwatkul et al., 1996) it has been underutilized (Prinyawiwatkul, McWatters, Beuchat, & Phillips, 1997). The underutilization in developed or industrialized countries such as the United States is mainly due to the presence of certain anti-nutritional factors and non-digestible components in cowpeas (Prinyawiwatkul et al., 1997) and partly due to storage induced textural defects that prolong cooking time and demand higher fuel inputs for food preparations (Aguilera & Stanley, 1985). However in developing countries such as Nigeria, underutilization or relatively low consumption of cowpeas and other edible legumes are partly due to tedious local processing methods which most times out weighs the size of an average family meal (such as in 'akara', 'moinmoin', and local salad prepared from 'akidi') and mainly due to the long cooking time of most cowpea and other legume varieties.

Locally, the cooking time of cowpea and other edible legumes are usually reduced by addition of trona ('Akawu') or potash as it hastens the softening process. A typical example is in the production of 'iru' from locust bean

0956-7135/$ - see front matter © 2005 Elsevier Ltd. All rights reserved.
doi:10.1016/j.foodcont.2005.03.005

(Iwuoha & Eke, 1996). This use of trona is not well accepted by some as it is locally observed to affect the taste of the cooked cowpea. Another known method of reducing the cooking time of food legumes is the presoaking of legume seeds (Sefa-Dedeh, Stanley, & Voisey, 1978; Silva, Bates, & Deng, 1981; Singh, Erskine, Robertson, Nakkoul, & Williams, 1988). Though this method reduces the cooking time of the food legumes, it lengthens the total time for the preparation of the legume meal. Research has emphasized expanding the utilization of cowpeas and other food legumes in the form of meal and flour (McWatters, 1990; Prinyawiwatkul et al., 1997). However, in Nigeria, consumption of cowpeas as family meals are more in the porridge form which depends on boiling the cowpea until softness is achieved. Moreover, purchase of raw cowpea seeds will be a lot cheaper than cowpea in the processed form as meal or flour. In such situation as this, a non chemical means of reducing the cooking time of cowpea will be of interest and will encourage more consumption of cowpea and other edible legumes.

It is a known physical fact that thermal shock could lead to unequal expansion or contraction in a material thereby resulting in cracking. Creating cracks in cowpea seeds will facilitate permeation of water into the seed and make heat transmission into the core of the seed easier. Here cowpea seeds were subjected to some different degrees of thermal shock by rapidly cooling them from boiling point by adding water at lower temperatures (a process known as quenching) during cooking. The effect of this process on the cooking time of some locally available varieties of cowpea was investigated in this work. In addition, the effect of this process on another legume pigeon pea (*Cajanus cajan*), with a very long cooking time was also investigated.

2. Materials and methods

2.1. Materials

Sound whole dried cowpea (*Vigna unguiculata*) varieties and pigeon pea (*Cajanus cajan*) were purchased at the local market at Owerri, Eastern part of Nigeria. Pigeon pea is designated as sample A and the cowpea varieties 'Sokoto white', 'Potesco white' and 'Ife brown' are designated as samples B, C, and D respectively. Trona was obtained in its local commercial form.

2.2. Method

2.2.1. Quenching method of cooking

Hundred grams of each sample was measured into an aluminum pot (with a tight fitting cover) and 300 ml of water at ambient temperatures of about 28 °C was added into the pot to completely cover the seeds. The pot had a diameter of 18 cm and a height of 10 cm. The cooking was done using a kerosene stove with a stable transparent light blue flame whose power is estimated to be about 0.32 kW. The stove was left in this state unadjusted throughout the experiment. A stop clock was switched on at the same time the pot was placed on the stove. This was used to determine the cooking time which is taken here as the time taken for the seeds to be cooked from the time it was placed on the stove to a point where they have softened and could be easily mashed under pressure between fingers. The quenching was effected at the time the 300 ml of water has almost dried up by addition of another 300 ml of water at 78 °C, 62 °C, 28 °C and 11 °C respectively to the boiling seeds to produce the different levels of thermal shock to the seeds. The temperature of the boiling seeds before and after quenching were noted. The temperature after quenching was taken immediately the seeds were quenched and stirred. As the boiling seed is still on the stove during quenching, the temperature measurements after quenching were done as quickly as possible to reduce the effect of temperature increase due to heating. In situations where a sample required more water after the introduction of the thermal shock (as in the case of pigeon pea, sample A), 300 ml of boiling water was added. This is to eliminate the effect due to double quenching. However, to determine the cooking time without the introduction of any thermal shock to the samples, 300 ml of boiling water was added to the boiling seeds after the initial 300 ml of water has almost dried up. To determine when seeds were cooked, a trained sensory panel of five people familiar with the traditional cooking method were used. The assessors determined softness of the cooked seeds by pressing single bean between fingers. About three bean seeds per panelist were used for the tests. Preliminary cooking of the seeds for each sample were carried out to determine times when softening of the bean seeds were expected. As a result of these preliminary cooking runs, the pots were opened two to three times after quenching to test for the softening of the seeds. The experiments were repeated three times and the average cooking time estimated.

2.2.2. Cooking with trona ('akawu')

Hundred grams of each sample placed in 300 ml of water at ambient temperatures of about 28 °C were again placed on the same local kerosene stove. On boiling, 500 mg of ground trona was added. To eliminate any form of quenching effect or thermal shock, boiling water was added to the boiling seeds as soon as the water in the boiling seeds goes below the surface level of the seeds. The total time of cooking for the samples under this condition were recorded. The same trained panelists were used to determine the cooked state of all samples during cooking with quenching method and during cooking with trona.

3. Results and discussions

The cooking times for the samples without chemical or quenching effects were obtained by using boiling water as additional water to the seeds when the initial water has almost dried up due to boiling. These cooking times obtained which are 75, 54, 50 and 40 min for samples A, B, C and D respectively are regarded as the normal cooking