

A SIMPLE PROCESS FOR PREPARING QUICK COOKING LEGUMES

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طريقة بسيطة لاعداد بقوليات سريعة الطهى

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ملخص البحث

تم هذا البحث على البقول الجافة الشائعة الاستعمال فى مصر وهى الحمص - البسلة - اللوبيا - والفاصوليا البيضاء وذلك بغرض الوصول الى طريقة سريعة وسهلة لطهى هذه البقول وأوضحته الدراسة أن نقع البقول فى محلول بيكربونات الصوديوم بتركيز ٤ ٪ على درجة حرارة الغرفة (٢٣ - ٢٦ م) لمدة تتراوح بين ٨ الى ١٠ ساعات تبعاً لنوع البقول ثم الطبخ المبدئ تحت ضغط فى حالة كل من البسلة والحمص أو البخار مع اللوبيا والفاصوليا البيضاء متبوعاً بالتجفيف على درجة حرارة ٦٠ م الى أن يصل المحتوى الرطوبى فى الناتج الى ٨ - ١٠ ٪ يؤدى الى انتاج بقوليات سريعة الطهى والاعداد كذلك فان عملية اعادة الترطيب للبقوليات المعاملة يحتاج فقط الى ٢٠ - ٣٠ دقيقة فى الماء المغلى حيث تستعيد البقول حوالى ٨٠ ٪ من وزنها وأيضا انخفض زمن الطهى اللازم لها بما يعادل ٦٥ - ٨٠ ٪ وكذلك تحسن اللون والقوام ولكن قلت هذه المعاملة نسبيا من طعم ورائحة هذه البقوليات .

ABSTRACT

A modified method has been suggested to prepare quick cooking beans from the dry commercial one. It involves soaking of beans in 0.4% NaHCO₃ at room temp. (22-26°C) for 8 to 10 hrs according to the bean type, followed by pre-cooking using pressure cooker in case of peas, and

chick-pea, and with steam in white and kidney beans, then drying in a cabinet at 60°C to reduce the moisture content to 8-10%. These products regain 80% of its weight through 20-30 min. rehydration in boiling water and thus reducing the cooking time by about 65 to 80%. The quick cooked beans had good colour and texture and less in taste and odour compared with those of the untreated ones.

INTRODUCTION

However, dry legumes are the primary source of dietary protein in different parts of the world particularly in the developing countries. It suffers from poor cooking quality, takes longer time for cooking and needs more energy. Therefore, many research trials were conducted to establish a quick cooking method for dry legumes. Bongirasar and Sreenivasan (1976) developed a dehydrated baked bean that could be reconstituted within 90 minutes in cold water. Feldberg et al. (1956) suggested a quick cooking method for peas. Their process depends upon soaking in water for at least 8 hr, followed by cooking at 118°C, then freezing to minimize bursting before drying at 77°C or 88°C in a cabinet dryer. Also, this method is satisfactory for lima bean, blanched pea and red kidney beans (Rockland et al., 1967). Unfortunately, freezing increases the cost of processing and makes it uneconomical specially in the third world countries. According to Perry et al. (1976) and Silva et al. (1981) Soaking of soy bean and black beans in a solution containing 2.5% NaCl, 1% Na₂PO₄, and 0.75% NaHCO₃ reduced cooking time by 50%. Also, the same observation was reported by Moharram et al. (1986) for lintel seed. Generally, the factors probably involved for poor cooking quality of dry legumes are, the low permeability of water due to the husk, free pectin, thickness of the outer seed coat, and their content of lignin and alpha cellulose.

Taking into account the previous trials, efforts have been made in this study to develop an improved technique for producing a relatively quick cooking method adopted to peas, chick-pea, kidney and white beans, the most common dry legumes used in the Egyptian diets. The process includes soaking or hydration of dry legumes, pre-cooking followed by dehydration in air dryers.

MATERIALS AND METHODS

Materials:

Local dry peas, chick-pea, white, and kidney beans were obtained from the local market. The moisture content of these beans was in the range of 10 to 12%.

A laboratory grade sodium bicarbonate was used in preparing the alkaline solution for soaking.

Meanwhile, polyethylene bags of 700 gauge were used for keeping the treated and dry beans.

Methods:

A- Technological treatments: Dry beans from each variety were cleaned to remove the foreign matters, and then subjected to the following treatments: hydration by steeping, pre-cooking, and dehydration. The optimum conditions for each treatment were established after using the following trials:-

- 1) Hydration: Samples were separately soaked in tap water and in different concentrations of sodium bicarbonate (from 0.1 to 2%) for different times (1 to 16 hours), at ratios of bean/solution ranged from 1:1 to 1:5 (w/v). All samples were performed at room temperature ($25 \pm 2^\circ\text{C}$). The % increase in weight (water, or

solution uptake and cooking time of each variety was determined at intervals of one hour.

- 2) Pre-cooking: The hydrated beans were removed from the solutions, washed with tap water and drained. Pre-cooking was conducted either in boiling water at 100°C in a stainless steel vessel, or steamed in a vessel, or in house pressure cooker at 15 lb/sq. inch for different times (0.5 to 45 minutes).
- 3) Dehydration: Each pre-cooked sample was dried with a tray load of 4 kg/sq m.) at 60°C in a cabinet dryer to reduce the moisture content to 8-10%. The dried beans were packed immediately in polyethylene bags and kept tightly at ambient temperature for further evaluation.
- 4) Rehydration ratio: This was determined by dividing the hydrated weight after soaking (in boiling water for 5 to 30 min.) over the original weight of dry bean.
- 5) Cooking time determination: This was measured according to Illuse et al. (1977) as the time required to soften 50% of the dry beans (control) and rehydrated samples.

B- Sensoric evaluation: The test panel was performed by 10 panelists which were asked to indicate the over all acceptability of both cooked commercial and quick cooked beans using rank method (Kramer and Twigg, 1970) at 5% significance.

C- Moisture content of ground beans (30-40 mesh) was determined according to the method of A.O.A.C. (1975).

RESULTS AND DISCUSSION

1- Soaking: The effect of soaking on solution uptake as shown in Fig. (1) was indicated that solution uptake was increased rapidly

through the first 4 hrs of soaking either in H_2O and/or in 0.25% $NaHCO_3$ solution at room temperature. Generally, the levels of solution uptake was more increased in dry beans soaked in $NaHCO_3$ solution compared with those soaked in tap water. The optimum soaking time for dry peas, white beans, kidney beans, and chickpea was 12 and 10, 12 and 8, 8 and 7, 9 and 8 hrs. in water and in $NaHCO_3$ solution respectively. The variations in soaking time among tested samples may be attributed to the differences in size, macro, and micro structure as well as the thickness of their seed coats.

The cooking time of dry beans was reduced with increasing soaking time (Fig. 2). This reduction was more pronounced in case of beans soaked in $NaHCO_3$ solution compared with those soaked in water (Fig. 2 A,B).

The previous results make sure the importance of application of soaking in $NaHCO_3$ solution to prepare quick cooking beans. The effect of this medium may be due to the ability of $NaHCO_3$ in softening the hulls, solubilizing the protein and starch, content of beans and maintaining the pH of the dried beans. These changes helped in increasing the penetration of the soaking medium and also in leaching the highly pigmented substances from the hulls which improved from both texture and colour.

Results given in Fig. (3) indicate the effect of $NaHCO_3$ concentration in soaking medium on cooking time of soaked beans. Generally cooking time decreased gradually with increasing the concentration of $NaHCO_3$ in soaking medium. On the other side, feeling of the soapy taste was started to appear when the concentration was 0.5%. Therefore, 0.4% $NaHCO_3$ solution was selected as the optimum concentration for soaking of all studied beans.

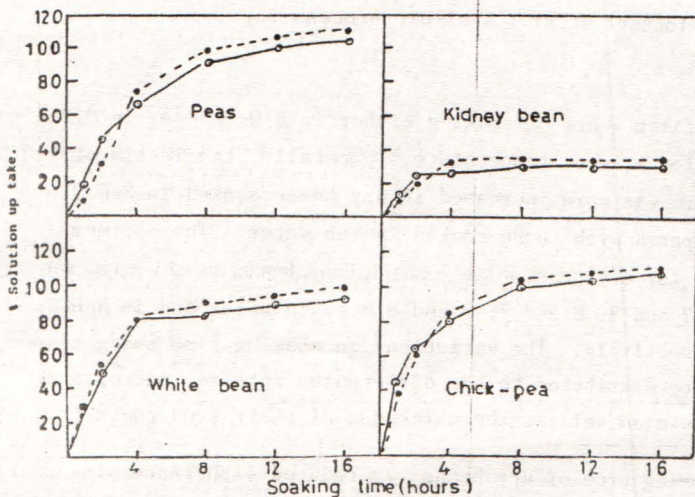
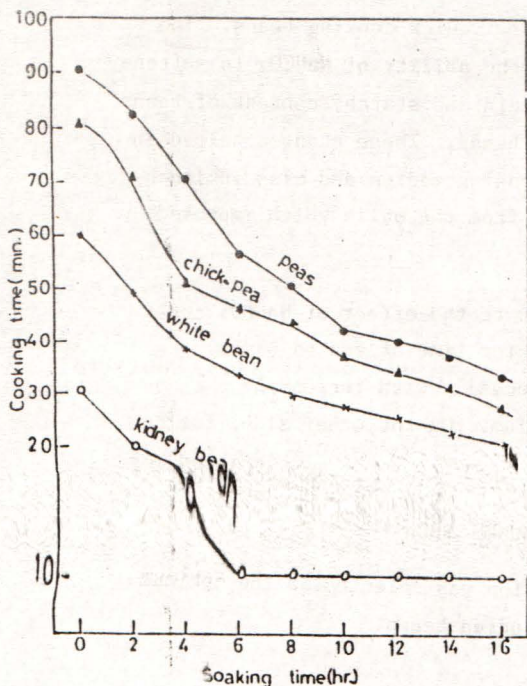


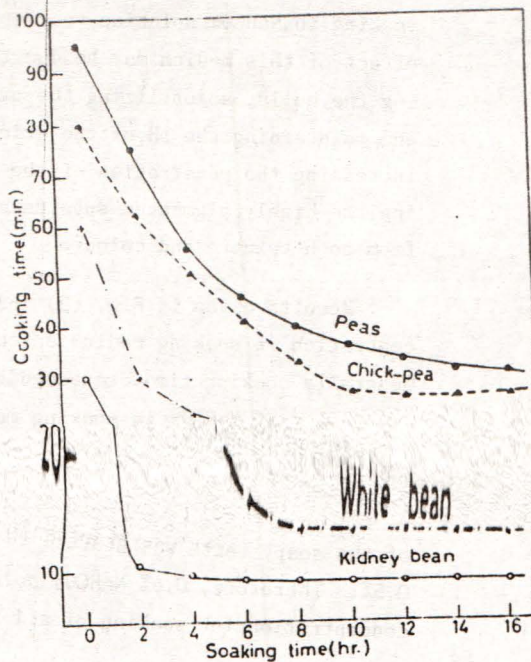
Fig. (1): Effect of soaking on solution uptake of some dry beans.

Soaking medium:-

○ — H₂O, ● — NaHCO₃.



A



B

Fig. (2): Effect of soaking on cooking time (min.) of some dry beans.

Soaking medium :

A : H₂O soaked beans.

B : NaHCO₃ soaked beans.

As illustrated in Table (1) the ratios of dried beans to soaking medium affected the cooking time of soaked beans. Optimum ratio was 1:3 for both dried peas and white beans, and 1:4 in case of kidney beans and chick-pea.

2- Pre-cooking: The optimum conditions for pre-cooking step were determined using various methods. It was observed from the results in Table (2) that using pressure cooker reduced the cooking time to a considerable means for all varieties which either soaked in H₂O or in NaHCO₃ solution compared with the other two methods. Cooking time was reduced to a considerable period in case of soaked peas and chick-pea and to a slight period with the others. Hence, it was selected as optimum method for the first two beans. To avoid the bursting and texture damage beside the sufficient time from view point of the industrial process, the steam cooking was preferred for pre-cooking of white beans and kidney beans.

3- Dehydration and Rehydration ratios: Fig. (4) represents the dehydration curves of soaked precooked dry beans. The optimum dehydration time required to lower the moisture content of beans to 8-10% was about 7 hrs in beans were soaked in NaHCO₃ solution and 8 hrs in those soaked in water. The rehydration curves of dehydrated beans are illustrated in Fig. 5). The data referred that beans soaked in NaHCO₃ solution regain more water in all cases of different times compared to beans soaked in water. After 30 min. of rehydration the NaHCO₃ soaked beans regained about 80% of their weight.

4- Final Cooking time: Table (3) show the cooking time of soaked precooked, dehydrated and rehydrated beans (quick cooked beans). The cooking time of dry treated beans was reduced by 66 to 80% due to the previous treatment. This reduction was more pronounced in beans soaked in NaHCO₃ solution.

Table (1): Effect of soaking medium/bean ratio on the cooking time of some dry legumes[Ⓜ].

Bean/solution ratio (w/v)	Cooking time (min.) of							
	Peas		White bean		Kidney bean		Chick pea	
	A	B	A	B	A	B	A	B
1:1	60	54	27	18	11	8	49	30
1:2	58	39	25	15	10	7	45	27
1:3	39	35	23	13	10	7	40	26
1:4	39	35	23	13	7	6	40	25
1:5	39	35	23	13	7	5	40	24

Table (2): Effect of pre-cooking treatment on the cooking time of some dry legumes.

Cooking method	Cooking time (min.) of							
	Peas		White bean		Kidney bean		Chick pea	
	A	B	A	B	A	B	A	B
Boiling in water	39	35	30	20	10	7	40	35
Steam cooking	35	30	23	13	6	5	35	25
Pressure cooking	15	10	4	2	>1	>1	22	5

Table (3): Cooking time (min.) of commercial and quick cooking dry beans.

Dry beans	Moisture content (%)		Cooking time (min.)			
	Commercial dry beans	Quick cooking dry beans	Commercial dry beans		Quick cooking dry beans	
			A	B	A	B
White beans [Ⓜ]	9.0	8.9	9.2	60	16	12
Kidney beans [Ⓜ]	8.0	9.8	9.5	30	7	5
Chick pea ^{ⓂⓂ}	8.5	9.6	8.9	80	25	20
Peas ^{ⓂⓂ}	8.5	9.5	9.4	90	32	29

A = H₂O soaked beans (12, 12, 8, 9 hrs for peas, kidney beans, chick peas and peas respectively.

B = NaHCO₃ = Soaked beans'0.4%' (10, 8, 7, 8 hrs. for peas, kidney beans, chick peas and peas respectively.

Ⓜ Steam cooking.

ⓂⓂ Pressure cooking.

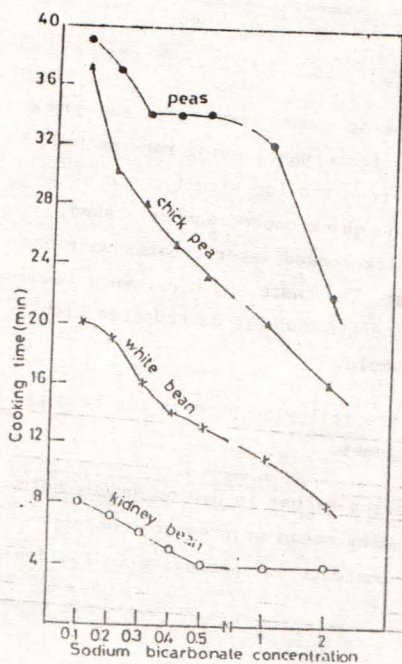


Fig. (3): Effect of NaHCO_3 concentration in soaking medium on cooking time of some dry beans.

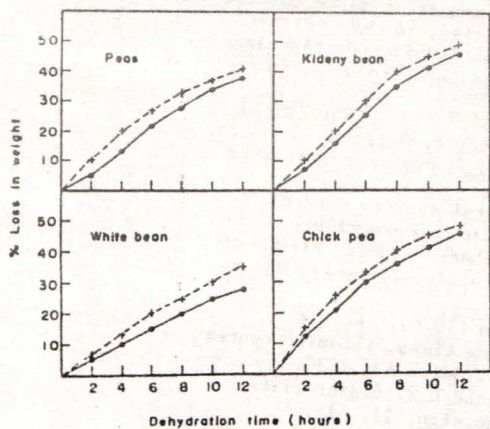


Fig. (4): Dehydration curves of some soaked, precooked beans.

Soaking medium:

●—● H_2O , ○---○ NaHCO_3 .

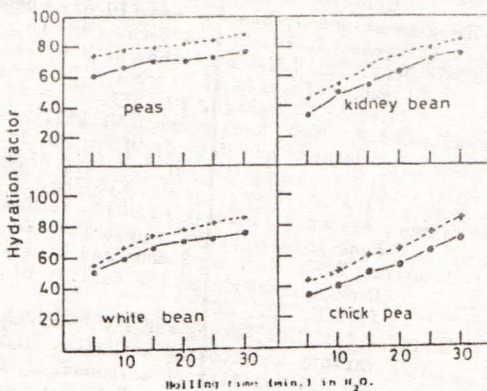


Fig. (5): Rehydration curves of some soaked, precooked and dehydrated beans.

Soaking medium:

●—● H_2O , ○---○ NaHCO_3 .

5- Organoleptic properties: Samples of cooked commercial and quick cooked dry beans were subjected for taste panel using rank method. The data showed that at rank total required for significance at 5% level, the colour and texture of the quick cooked NaHCO_3 soaked beans were the best followed by quick cooked water treated samples and lastly cooked commercial beans. The taste and odour were found to be more better in the last two cooked samples as compared with the quick cooked NaHCO_3 treated sample.

Based in the above results, the following process can be suggested to produce quick cooked legumes.

Dry cleaning by sieving, soaking either in H_2O or NaHCO_3 solution at room temp., pre-cooking using steam or pressure cooker, drying at 60°C to 8-10% moisture content, and packaging in low density polyethylene bags.

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