

Standardizing Peanut Roasting Process Of Peanut Butter Production

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Abstract

The current practice of roasting peanut kernels is based mainly on color development at the endpoint. But, the flavor is more important than the color as far as peanut butter is concerned. The roasting is basically aimed to develop nutty flavor in peanut butter thus need to be standardized and it can be based on more objectively defined parameters such as moisture content and water activity of the roasted peanut to produce butter of good quality. The minimum values obtained for the moisture content and water activity were 1.37 % and 0.54, respectively. A panel of nine experts evaluated the sensory characteristics of the peanut butter samples. The data were analysed statistically using Duncan's New Multiple Range Test. Based on instrumental measurements and sensory evaluation; it was found that the roasting of peanut kernels at 130°C for 60 min was effective and its butter showed superior quality from the point of view of overall acceptability.

Keywords: peanut; peanut butter; roasting; water activity; sensory characteristics.

1. Introduction

Peanut (*Arachis hypogaea* L.) can be consumed directly as an item of food. It is eaten in a variety of forms, or crushed to provide vegetable oil for human consumption and protein rich meal for livestock. Sometimes, it is converted into value added products like roasted, salted or fried nuts. Some of the indigenous sweets are also made using powder of peanut kernels. The non-indigenous products such as peanut butter, peanut curd, peanut milk, etc. which are common in the developed countries, give more return as compared to the indigenous value added products [1,2].

Roasting is an important process involved in the production of peanut butter. The current practice of roasting peanut kernels is based mainly on color development. But, the flavor is more important than the

color as far as peanut butter is concerned. The generation of roasted peanut flavor is complex [3, 4]. Therefore, the traditional roasting process need to be standardized and it can be based on more objectively defined parameters such as the measurement of moisture content and water activity as well as determination of sensory characteristics of the peanut butter.

2. Materials and methods

The important process parameters involved in roasting peanut kernels were the temperature and time duration of roasting. In this laboratory study, peanut cultivar GG20 popularly grown amongst farmers in Gujarat state (India) were selected for the study due to its high oleic acid trait for getting the higher stability of the final product [5, 6]. The sound mature kernels of GG20 cultivar were obtained from the Main Oilseeds Research Station of Junagadh Agricultural University, Junagadh. The kernel lot of 100g for each sample was spread over a petri dish of 177 cm² area, roasted at varying temperature and time duration using laboratory digital hot air electrical oven (sensitivity 1°C).

Initially, roasting was carried out at 90°C temperatures for 15, 30, 45 and 60 min time duration. Then, it was carried out for 110, 130, 150, 170 and 190°C temperatures with the same time duration. In all, 24 samples of peanut kernels were roasted with the proposed combination of temperature and time. Then six samples, out of 24 samples, were selected for further experimentation based on ease of skin removal and brownness of the skin. For the selected roasting temperature, the time duration of roasting was further varied to obtain the appropriate temperature-time combination to obtain optimized roasting of peanut kernels. Finally, six samples of roasted peanut kernels were selected amongst all the roasted samples for the preparation of peanut butter. The butter was prepared using the process described by Tressler and Woodroof [7]. Salt was added at the rate of 2 per cent in each butter samples. The experiments were repeated thrice following completely randomized design.

2.1. Determination of moisture content and water activity

The moisture content of peanut butter samples was determined by drying (10 g) butter at 110°C for 10 h using the digital hot air electrical oven at the Department of Processing and Food Engineering, College of Agricultural Engineering and Technology, Junagadh Agricultural University, Junagadh. The water activity of the butter samples was obtained using the water activity meter at the Food Testing Laboratory of Junagadh Agricultural University, Junagadh.

2.2. Evaluation of sensory characteristics

The sensory attributes, particularly the taste, odor, color and overall acceptability, were evaluated using sensory technique described by Ranganna [8]. A panel of nine experts was constituted for the evaluation. The panellists were asked first to observe the color of the sample presented followed by the odor by sniffing before tasting the samples. Each quality attribute was evaluated on 10-point basis (1 for the lower and 10 for the highest) and the panellists were requested to assign the points to each sample accordingly. The puffed rice and fresh water were served to the panellists before initiating the test as well as between tasting of the samples. The sensory data were analysed statistically. The Randomised Block Design was used to compare the significance of various combinations of roasting temperature and time duration during the investigation. The butter samples, which were significantly different from each other, were detected using 'Duncan's New Multiple Range Test' [8].

3. Results and discussion

The roasting of peanut kernels at 90 and 110°C temperatures for all the combinations of time duration was found under-roasted. There was no remarkable change in the color and flavor of the skin. Moreover, the skin of kernels could not be removed easily for this range of temperature-time combinations. Hence, all the samples of this range were discarded for further experimentations. Also, roasting at 190°C for all the combinations of time interval were found over-roasted which indicated no need of further experimentation for this value of temperature. From the remaining temperature-time combinations, the kernels roasted at 130°C temperature for 15 and 30 min as well as the kernels roasted at 150°C for 15 min were observed under-roasted while the kernels roasted at 150°C for 60 min and the kernels roasted at 170°C for 45 and 60 min were found over-roasted. Therefore, six samples were selected, by discarding the under and over-roasted samples having the temperature and time duration as

given in Table 1. The peanut butter was prepared using the process described by Tressler and Woodroof [7] from the roasted peanuts. Two per cent salt was added to all the samples as seasoning agent. All the experiments were repeated thrice.

Table 1. Moisture content and water activity of the peanut butter samples

Initial mean moisture content of raw peanut was 4.82 % (d.b.)

Sample Number	Roasting parameters		Moisture Content *, d.b. (%)	Water activity *
	Temp. (°C)	Time (min)		
01	130	60	1.98 ^{ab}	0.68 ^{ab}
02	130	70	1.37 ^a	0.54 ^a
03	150	45	2.74 ^b	0.79 ^b
04	150	55	1.52 ^{ab}	0.56 ^a
05	170	20	2.81 ^{bc}	0.85 ^{bc}
06	170	30	1.65 ^{ab}	0.61 ^{ab}
S.Em ±			1.36	0.23
C.V.,%			14.37	11.59

* Mean values of the samples having same superscript letter are not significantly different (P<0.05)

3.1. Moisture content and water activity

The mean moisture content of raw peanut kernels was obtained as 4.82 per cent. The minimum moisture content (1.37 %) was obtained in the peanut butter sample prepared using peanut kernels roasted at 130°C for 70 min while the maximum mean moisture content was found in the sample prepared of peanut kernels roasted at 170 °C for 20 min time duration as given in Table 1. This indicated that the peanut kernels should be roasted at lower temperature and higher time duration for obtaining the minimum moisture content in the selected ranges of temperature and time duration.

The values obtained for water activity was ranged between 0.54 and 0.85 for the peanut butter samples (Table 1). Here also, the minimum water activity was recorded for the peanut butter samples prepared from peanut kernels roasted at 130°C for 70 min time duration. This indicated the data of water activity are in accordance with the moisture content of the butter samples. The lower value of water activity indicated the higher microbiological safety of food during storage [4, 9]. Hence, it would be advisable to roast the peanut kernels at 130°C for 70 min time duration for getting the peanut butter of higher stability during the storage with minimum microbial deterioration.

3.2. Sensory quality

The randomly coded peanut butter samples were presented to the panellists for the sensory evaluation. The panellists evaluated the samples and assigned the score to each sensory attribute. The mean sensory score assigned to different attributes is given in Table 2. The sensory score data were analysed statistically. The effect of roasting parameters on taste, odor, color and overall acceptability of peanut butter are discussed in following sub-sections.

Table 2: Mean sensory score attributed to peanut butter samples

Sample code	Roasting parameters		Mean score*			
	Temp. (°C)	Time (min)	Taste	Odor	Color	Overall acceptability
R11	170	20	5.7 ^{ab}	4.8 ^a	5.2 ^b	5.8 ^a
R12	130	70	5.3 ^{ab}	4.6 ^b	4.7 ^b	5.1 ^b
R13	150	45	6.3 ^a	5.2 ^a	5.9 ^b	6.7 ^a
R14	130	60	6.6 ^a	6.1 ^a	7.4 ^a	7.0 ^a
R15	150	55	4.0 ^{bc}	3.1 ^c	3.3 ^c	3.7 ^c
R16	170	30	2.7 ^c	2.1 ^c	1.3 ^d	2.6 ^d
S.Em ±			0.47	0.42	0.38	0.40
C.V.,%			13.43	15.00	13.27	12.37

3.2.1. Effect on Taste. The effect of roasting process was quite pronounced as observed during the evaluation of taste attribute of peanut butter samples. The analysis of variance for taste response indicated that the results were highly significant even at 1 per cent probability level. While comparing the mean score of samples, according to the Duncan's New Multiple Range Test (DNMRT), the highest mean score (6.6) was assigned to the butter prepared using the peanut kernels roasted at 130°C temperature for 60 min. The results indicated that the peanut butter prepared by roasting the peanut kernels at 130°C for 60 min was superior in taste followed by the butter prepared from peanut kernels roasted at 150, 170 and 130°C for 45, 20 and 70 min, respectively. The taste of butter prepared by roasting the kernels at 150°C for 55 min and also at 170°C for 30 min was poor.

3.2.2. Effect on odor. The effect of roasting the peanut kernels on odor of peanut butter was also found highly significant ($P < 0.01$), which revealed that the variation in roasting temperature and time severely affected the odor of peanut butter. DNMRT results indicated that the sample prepared from the peanut kernels roasted at 130°C temperature for 60 min exhibited the better smell, i.e., pleasant odor followed by the samples

prepared from the peanut kernels roasted at 150 and 170°C temperature for 45 and 20 min, respectively. The butter of peanut kernels roasted at 130 °C temperature for 70 min expressed the moderate odor while the inferior odor was noticed in case of the butter prepared by roasting the peanut kernels at 150 °C temperature for 55 min and at 170°C temperature for 30 min. This revealed that the optimum pleasant odor could be obtained in the butter prepared by roasting the peanut kernels at 130°C temperature for 60 min time duration.

3.2.3. Effect on color. The analysis of variance for color response on roasting indicated the prominent effect of varying the roasting time and temperature on color of the peanut butter. The results were found highly significant ($P < 0.01$). It was observed that the color of peanut butter prepared from the kernels roasted at 130°C temperature for 60 min time duration was superior followed by the kernels roasted at 150, 170 and 130°C temperature for 45, 20 and 70 min time duration, respectively. The sample prepared by roasting the peanut kernels at 170 and 150°C temperature for 30 and 55 min time duration exhibited the inferior color of the butter, respectively. This implied that the peanut kernels should be roasted at 130°C temperature for 60 min to obtain the butter of good color.

3.2.4. Effect on overall acceptability. The profound effect of varying the roasting temperature and time duration was noticed (Table 2). The test results were highly significant even at 1 per cent probability level. The highest mean score (7.0) was given to the peanut butter prepared by roasting the kernels at 130°C for 60 min while the least score (2.6) was noted in case of butter prepared by roasting the kernels at 170°C for 30 min. DNMRT revealed that the peanut butter prepared by roasting the kernels at 130°C for 60 min was quite superior even from the point of view of overall acceptability. This was followed by the sample prepared from the peanut kernels roasted at 150 and 170°C temperatures for 45 and 20 min, respectively.

The descriptive sensory evaluation indicated that the roasted peanut kernels having light color gave an optimal score of preferred flavour, which could give higher score of overall acceptability of the butter (Fig. 1). These findings are in accordance with the results reported by Smyth [10].

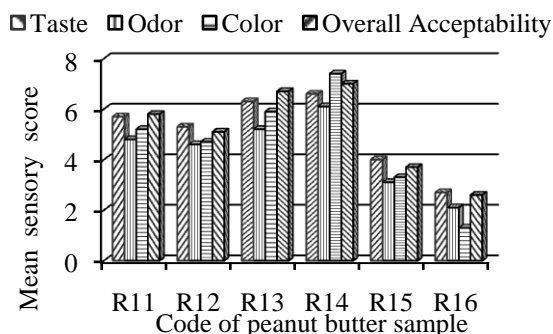


Figure 1. Descriptive sensory evaluation of peanut butter samples prepared with varying roasting temperature and time duration

Hence, the measurements of moisture content and water activity of peanut butter samples implied to roast the peanut kernels at 130 °C temperature for 70 min time duration for obtaining the peanut butter having higher microbiological safety. Also, this was found statistically at *par* with the roasting at 130°C temperature for 60 min time duration. In the sensory evaluation, the roasting of peanut kernels at 130°C temperature for 60 min time duration reported peanut butter of superior overall acceptability. Hence, from the combined evaluation of instrumental and sensory technique, it could be recommended that the peanut kernels should be roasted at 130°C temperature for 60 min time duration using hot air electric oven for obtaining peanut butter of superior quality.

Conclusions

It could be concluded that the color and flavor of peanut butter depended on the extent to which brown roasting had been allowed to proceed. The color of the roasted product was highly influenced by the duration of roasting. It was also noted that the roast flavor plays a key role for optimising the roasting parameters. Descriptive sensory analyses showed that the roasted peanut kernels having light color gave an optimal score of preferred flavour, which could give higher score of overall acceptability of the butter. From the combined evaluation of moisture content, water activity and sensory characteristics, it could be recommended that the roasting of peanut kernels at 130°C temperature for 60 min time duration will yield peanut butter of superior quality.

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