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EFFECT OF SOAKING, TEMPERATURES AND STEAMING TIME ON PHYSICAL AND COOKING QUALITY OF ANBER AND JASMINE IRAQI RICE

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Absract

Two varieties of local rice (Anber and Jasmine) that grown in middle Iraq were used. The study aims to improve milling properties of damage rice. Samples of paddy rice were soaked in water at three tm (50, 60 and 70 °C) for 3h in laboratory conditions. Then Samples were autoclaved with steam at 121°C for 15 and 20 min and dried. Effectiveness of soaking temperature and steaming time in cooking quality and physical of parboiled process of rice led to significantly increased in milling yield. The results of this study also indicated that parboiling rice process significantly ($P \leq 0.05$) increased in head rice ratio and grain homogeneity ratio. Chalkiness score for all parboiled rice treatment were (1). The parboiling rice process significantly increased in cooking time based on increase of soaking tm (50 -70) C^{o} and the steaming time (15-20) min. Water absorption significantly decreased based on soaking temperature and steaming time increased. also significantly increase in cooking time. Sensory evaluation showed that color of milled rice better than parboiled but the parboiled process was improved grain separation, grain shape and less sticky product properties. Anber rice was better than jasmine for all treatment. In our study, the panelists were appeared that soaking at 70 C^{o} to 3 h and steaming to 20 min for both Anber and Jasmine rice were provided the most desirable quality in head rice yield and Sensory evaluation.

Key words : Parboiling process, Cooking Quality, Anber, Jasmine, Iraq.

Introduction

the Parboiling process is a hydrothermal happened in post-harvest of paddy rice (*Oryza* sp.*)*, which used in quality maintenance, nutritional products value enhancement, decreased breaking rate depending on milling and imparting divers properties of eating and cooking from rice that not parboiled (Ali and Ojha 1976; Sakurai *et al.,* 2006; Ibukun 2008; Hardi 2011).

Elbert *et al.,* (2000) improved that the gelatinization of the starch of the rice resulting from Parboiling process, It is include the steaming, soaking, and rough rice drying. The major causes of this process used higher yields of milling, and nutritional value also more resistance to harmful factors such as insects and molds.

The classical method of parboiling which includes soaking process which carried out at room temperature and slowly causes bacterial and fungal contamination while hot soaking (CFTRI method) needs to accurate monitoring and particular attention since a tm and moisture decline that gradient develops and perhaps cause surfaces removing before hydration the core of the kernel achievement. The Long and medium types of grains are commonly used as parboiled rice in parboiled rice consuming populations (Kunze and Hall 1965; Kunze and Choudhury 1972).

Many studies indicated that the consciousness and importance of parboiling among consumers and factories compared to raw brown rice (Luh and Mickus 1980).

The aim of present study is to estimation effect of difference in the soaking temperature and steaming in physicals and cooking features of two varieties parboiled rice (Anber and Jasmine)

Materials and Methods

Samples of two varieties (Anber and Jasmine) of rough medium grain rice were collected from Al-Mishkhab Rice Research Station at Najaf Governorate during 2017 season.

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Parboiling Process

Soaking Condition : Parboiling process was carried out according to (Fan *et al.,* 1999) Paddy, which pre-cleaned and washed, samples (1 kg) of each types were taken in aluminum container and soaked in a bath with a controlled temperatures at (50°C, 60°C and 70°C) in 1.5 liters of water for 2h. Water was heated to the optimum temperature and then the rough rice was added into the bath.

Steaming Condition : the samples were removed from the bath After soaking, exclude of excess water, and the container of sample was transferred to the autoclave for steam at 121°C for 10 and 20 min (Kunze and Choudhury 1972).

Drying condition : The steamed rice samples were transferred to trays for dried it at room temperature (30±1°C) and relative humidity (60±5%) resulting in the final moisture 13±1% (w.b.). the dried samples stored in specific airtight polyethylene bags for moisture equilibration and hardness stabilization (Kimura 1991). The analysis of Physical and cooking carried out after two weeks. The tested treatment combinations were shown in Table 1.

Milling yield : It evaluated for each tested variety about two weeks after drying by detected rice weight before husking (m1) and after husking (m^2). (%) Milling yield = (m^2/m1) ×100**.**

Head rice ratio: The head rice was manually separated from a 20 g of milled sample. The Grains with a length was greater than three-quarters of complete grains were considered as head rice, the remaining were considered as broken grains. Head rice ratio = (Weight of head rice (g)/20) ×100.

Grain homogeneity ratio

This test was implemented in to triplicate by taken about 10 g of each sample of milled parboiled was separate manually, its sorted under a magnifying glass (m1) from the other grains (m^2) and weighed.. Grain homogeneity ratio = (m1/m0) ×100.

Table 1 : The Treatment combinations for parboiling Anber rice.

Treatment	Soaking		Steaming	
Anber	Tm C°	Time h	Tm C°	Time(min)
Untreated rice	-	-	-	-
Anber (A1)	50	3	121	10
Anber (A2)	50	3	121	20
Anber (A3)	60	3	121	10
Anber (A4)	60	3	121	20
Anber (A5)	70	3	121	10
Anber (A6)	70	3	121	20

Table 2 : Treatment combinations for parboiling Jasmine rice.

Treatment	Soaking Process		Steaming Process	
Jasmine	Tm C°	Time h	Tm C°	Time(min)
Untreated rice	-	-	-	-
Jasmine (J1)	50	3	121	10
Jasmine (J2)	50	3	121	20
Jasmine (J3)	60	3	121	10
Jasmine (J4)	60	3	121	20
Jasmine (J5)	70	3	121	10
Jasmine (J6)	70	3	121	20

Chalkiness: Chalkiness test was conducted by randomly selected two-hundred whole grains based on the standard evaluation systems of the International Rice Research Institute (IRRI 1996), A score of 1 (less than 10% chalkiness), 5 (10-20% chalkiness) or 9 (over 20% chalkiness) were considered for each sample.

Cooking Properties

Cooking Time

The cooking time was performed according to (Juliano1982).

Water Absorption

Water absorption of samples was implemented according to (Sabularse 1991).

Cooking Test: Cooking test was implemented according to the (Martinz *et al.*1989).

Sensory Evaluation: Sensory evaluation was detection by 12 trained panelists for the food science college where 300 g of parboiled rice for each variety were subjected to evaluation and a scale of 1-5 was used.

Statistical data analysis: Complete randomized design (CRD) and completed statistical program were used for data analysis (SAS (2001). The duncan multivariate test was used to measure the significance of the differences between the averages at the probability level of $P \leq 0.05$.

Results And Discussion

Effect of parboiled rice at different conditions on physical properties:

Table 3 shows the effect of different soaking temperatures and time steaming on the milling yield, head rice ratio and chalkiness scores compared to un-parboiled rice.

There was significant increase in Milling rice yield in Anber brown rice from 60.55% to 86.90% and in Jasmine

brown rice from 58.00% to 77.90% both that soaking and steaming temperature at (80°C, 3h, 121°C, 20 min).This results may be caused by stronger compositions of starch rice resulted from of gelatinization process (Soponronnarit *et al.*, 2005).

This result agreement with the Sareepuang *et al.*, (2008) who explained that Parboiling process give higher rice yield compared to un-parboiled rice. Also, head milling rice yield was significantly increased from 51% in brown rice to 59, 83 and 84% in PR 40, PR 50 and PR60. Wimberly (1983) suggested that head rice yield value in brown rice was different from 54% to 71% for all three rice types, indicate increasing in the yield of head rice after parboiling process is happened that resulted from tensile strength causes increment in kernel by gelatinization of the starch granules, Head rice ratio significantly increased for all of the varieties but the highest values were obtained with Anber variety (A6). On the other hand, there is no significant difference on chalkiness score for raw rice as compared to parboiled rice. For grain homogeneity after 3h of soaking at tm of 70°C and steaming at 121C° for 20 min from Anber and jasmine rice showed significant increase ($P \leq 0.05$) more than other parboiled rice treatment.

Effect of parboiled brown rice at different conditions on cooking quality for Anber and jasmine rice

Water absorption properties of parboiled brown rice at different soaking temperature and steaming time are shown in table 4.

Soaking is normally carried out to make faster and uniform absorption of water (Wimberly 1983). Water absorption during cooking of Anber and jasmine rice was decreased depend on increasing of soaking temperature and steaming time. Water absorption in Anber brown rice was decreased from 3.90 g/g to 2.00g/g in soaking temperature at (80°C, 3h) and steaming temperature at (121°C, 20 min), while for jasmine brown rice, water absorption was decreased from 3.00 g/g to 1.6 g/g at the similar condition for Anber brown rice. The lowering in water absorption of parboiled brown rice may be contributed to starch granules modified that resulting from heating and parboiling process. thus, stronger structure was obtained and difficult for water penetration into kernel (Parnsakhorn and Noomhorn 2008).

Cooking time

Table 4 shows that the time of cooking was significantly decreased gradually with increasing of soaking temperature and time steaming rice. The highest cooking time were obtained with Jasmine rice verity (J6) while the lowest cooking time was obtained with Anber rice variety (A1). Lower cooking time obtained with untreated samples (raw rice) compare to the treated rice (parboiled rice). This maybe because hydration rate was low during cooking for parboiled rice compared to raw rice (Bhattacharya and Subba Rao 1966; Indudhara Swamy *et al.* 1 971).

Table 3 : Different parboiling methods effect in physical properties of Anber and Jasmine rice varieties.

Treatment Anber and jasmine	Means ± Std Error			
	Milling yield (%)	Head rice ratio (%)	Grain homogeneity (%)	Chalkiness (score)
Untreated rice	60.50 ± 1.15h	65.45 ± 0.57i	77 ± 1.73de	1
A1	74.60 ± 2.30efg	78.90 ± 1.15ef	82 ± 1.15cde	1
A2	75.10 ± 2.88de	79.20 ± 0.57def	84 ± 2.30bcd	1
A3	79.60 ± 0.57bcde	84.11 ± 2.30cde	86 ± 2.30abcd	1
A4	80.20 ±1.73bcd	86.30 ± 1.15abc	87 ± 1.73abc	1
A5	85.50 ± 2.88a	90.40 ± 5.77ab	89 ± 0.57ad	1
A6	86.90 ± 2.30a	92.32 ± 1.73a	91 ± 1.15a	1
Untreated rice	58.00 ± 1.15h	58.47 ± 1.15j	76 ± 2.30e	1
J1	70.10± 5.03g	70.30 ± 1.15hi	80 ± 5.77de	1
J2	70.50 ± 0.57fg	72.55 ± 1.15gh	81 ± 0.57cde	1
J3	76.20 ± 1.15de	77.70 ± 1.73fg	84 ± 1.15bcd	1
J4	77.90 ± 1.73cde	79.22 ± 0.57def	85 ± 2.88bcd	1
J5	82.40 ± 1.15abc	85.35 ± 2.88bcd	87 ± 1.73abc	1
J6	83.50 ± 1.73ab	87.78 ± 1.73abc	89 ± 0.57ab	1
Pr≤0.05	0.0001	0.0001	0.0001	1

Same letter show non- significantly different.

(Sowbhagya and Ali 1991) it has been reported that the presoaking process reduced the cooking time by 50% for raw and 25 to 400% for parboiled rice compared to unsoaked rice, and that parboiled rice required longer cooking time than raw rice.

Sensory Evaluation

Evaluation usually reflects the consumer's desire for food. These tests were done by twelve panelists for the food science college. The cooked parboiled rice showed negative effect on color (Discoloration). This may be because of change the color to dark that led to losses market value and consumer acceptability in different countries (Bhattacharya 1985). The panelists detect no significant difference on aroma

Table 4 : Effect of different Soaking Temperature and steaming time on cooking quality from Anber and jasmine rice variety.

Treatment Anber and jasmine	Means ± Std Error	
	Water absorption (g rice /g water)	Cooking time (min)
Untreated rice	3.90 ± 0.57a	14.00 ± 1.15f
A1	2.8 ± 0.15a	17.00 ± 1.73efg
A2	2.60 ± 0.15a	18.40 ± 1.15def
A3	2.5 ± 0.32a	20.30 ± 0.57cde
A4	2.20 ± 0.61a	21.50 ± 0.57bcd
A5	2.10 ± 0.15a	23.10 ± 1.73abc
A6	2.00 ± 0.57a	24.20 ± 2.03ab
Untreated rice	3.00 ±0.89a	15.30 ± 0.57fg
J1	2.6 ± 0.57a	18.00 ±1.15def
J2	2.2 ± 0.45a	19.50 ± 0.57cde
J3	2.00 ± 0.57a	21.30 ± 0.57bcd
J4	1.9 ± 0.57a	22.40 ± 1.15bc
J5	1.7 ± 0.36a	24.00 ± 1.73ab
J6	1.6 ± 0.23a	26.15 ± 1.15a
P≤0.05	N.S	0.0001

Means with the same letter are not significantly different.

between parboiled rice and milled rice for Anber and Jasmine varieties.

The cooked parboiled rice showed positive effect on other sensory qualities such as grain separation, grain shape compared to the milled rice and the panelists were observed that the properties of Anber better than jasmine rice for all treatment.

The cooked parboiled rice samples were showed effect on texture lower values of hardness and gumminess than cooked milled rice. Samples were cooked parboiled firmer and less sticky than non -parboiled cooked rice (Kar *et al.* 1998).

The evaluation of sensory for properties, aroma, color, grain shape, texture, grain separation and taste for Anber parboiled rice was better than for raw rice and jasmine parboiled rice as shown in table 5 where there is significantly higher overall acceptability score were given to Anber parboiled rice samples.

Conclusion

1. The parboiled rice gave better milling yield and cooking quality thane untreated rice.
2. The parboiled rice processing increased head rice ratio and grain homogeneity.
3. The parboiled rice processing improved some sensory evaluation.
4. The parboiled rice processing decreased water

Table 5 : Quality evaluation of anber and jasmine rice varieties after cooking.

Treatmeant Anber and jasmine	Means ± Std Error							
	Aroma	Color Grain	Grain separation	Grain shape	Texture	Stickiness	Taste	Overall acceptability
Untreated rice	3.5 ± 0.23 a	4.9 ± 0.52 a	3.00 ± 0.78 a	3.20 ± 0.48 a	3.40 ± 0.96 a	3.10 ± 0.75 a	3.00 ± 0.58 a	3.4 ±0.95a
A1	4.10 ± 0.22 a	4.2 ± 0.56 a	4.00 ± 0.95 a	3.80 ± 0.56 a	3.70 ± 0.41 a	3.80 ± 0.87 a	3.40 ± 0.35 a	3.8 ±0.78a
A2	4.10 ± 0.25 a	4.2 ± 0.25 a	4.10 ± 0.58 a	3.80 ± 0.85 a	3.70 ± 0.62 a	3.90 ± 0.58 a	3.50 ± 0.56 a	3.9 ±0.95 a
A3	4.40 ± 0.15 a	3.8 ± 0.45 a	4.40 ± 0.15 a	4.00 ± 0.78 a	4.00 ± 0.05 a	4.20 ± 0.95 a	3.9 ± 0.63 a	4.1 ±0.87a
A4	4.50 ± 0.58 a	3.7 ± 0.32 a	4.40 ± 0.42 a	4.20 ± 0.25 a	4.10 ± 0.61 a	4.30 ± 0.78 a	3.9 ± 0.45 a	4.2 ±0.85a
A5	4.80 ± 0.57 a	3.10 ± 0.59 a	4.7 ± 0.89 a	4.40 ± 0.43 a	4.60 ± 0.15 a	4.70 ± 0.95 a	4.7 ± 0.47 a	4.4 ±0.78a
A6	4.90 ± 0.32 a	3.00 ± 0.54 a	4.8 ±0.52 a	4.50 ± 0.94 a	4.70 ± 0.48 a	4.80 ± 0.87 a	4.8 ± 0.62 a	4.5 ±0.45a
Untreated rice	3.00 ± 0.21 a	4.7 ± 0.56 a	3.00 ± 0.82 a	3.10 ± 0.89 a	3.20 ± 0.45 a	3.00 ± 0.65 a	2.8 ± 0.52 a	3.2 ±0.58a
J1	3.6 ± 0.57 a	4.2 ± 0.78 a	3.7 ±0.57 a	3.6 ± 0.78 a	3.50 ± 0.15 a	3.80 ± 0.23 a	3.20 ± 0.15 a	3.6 ±0.85a
J2	3.7 ± 0.56 a	4.1 ± 0.59 a	3.8 ±0.96 a	3.7 ± 0.78 a	3.50 ± 0.65 a	3.80 ± 0.81 a	3.30 ± 0.35 a	3.7 ±0.56a
J3	4.00 ± 0.25 a	3.7 ± 0.58 a	4.10 ± 0.78 a	3.9 ± 0.45 a	3.70 ± 0.45 a	4.10 ± 0.87 a	3.80 ± 0.15 a	3.9 ±0.05a
J4	4.10 ± 0.22 a	3.7 ± 0.56 a	4.10 ± 0.56 a	3.9 ± 0.67 a	3.80 ± 0.15 a	4.20 ± 0.45 a	3.9 ± 0.85 a	3.95 ±0.9a
J5	4.30 ± 0.25 a	3.2 ± 0.05 a	4.5 ±0.78a	4.10 ± 0.28 a	4.00 ± 0.75 a	4.40 ± 0.35 a	4.20 ± 0.35 a	4.10 ±0.36a
J6	4.50 ± 0.15 a	2.9 ± 0.11 a	4.6 ±0.85a	4.2 ± 0.57 a	4.20 ± 0.47 a	4.50 ± 0.25 a	4.40 ± 0.35 a	4.2 ±0.56a
P≤0.05	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Means with the same letter are not significantly different.

absorption but it increased cooking time.

5. The optimum conditions of parboiling for Anber and Jasmine rice varieties were the soaking at 70 °C for 3h and steaming for 20 min where it provided the most desirable quality in head rice yield and sensory evaluation.

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