

# The Quality of the Manufactured Bread and Hygienic Conditions of Bakeries

*\*M Malakootian<sup>1</sup>, SH Dowlatshahi<sup>1</sup>, M Malakootian<sup>2</sup>*

<sup>1</sup>*Dept. of Environmental Health, School of Public Health, Kerman University of Medical Sciences, Iran*

<sup>2</sup>*Dept. of Genetics, School of Basic Sciences, Tarbiat Modaress University, Tehran, Iran*

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## ABSTRACT

In Iran and the countries of the Eastern Mediterranean Region, bread has always been considered as the staple food of choice. Because of having high quantities of minerals and vitamins in bread, the hygienic condition of its production is of prime importance. This cross-sectional study was conducted in 302 bakeries in Kerman city, Kerman Province, Iran, from April 2004 to March 2005. Variables such as burning and pasting rate, pH, soda addition, salt rate in various types of bread as well as hygienic conditions of bakeries were analyzed. The results showed that because of bread wastage owing to the addition of soda as well as the pasting and burning rate (17.46% and 10.84%, respectively), more than 30% of the manufactured bread were out of direct cycle of consumption. Half of the bakeries added soda as a leavening agent to breads. The amount of salt used per production of each loaf of local bread: Sangak, indirect heat, machinery Taftoon and oven Taftoon bakeries was 48.72%, 33.33%, 31.13% and 8.97%, respectively, which was more than the approved standards. Moreover, only 24.2% of Kerman's bakeries enjoyed suitable hygienic conditions. Aforementioned hinders must be considered as important signals to take immediate hygienic measures.

**Keywords:** *Bread quality, Hygienic condition, Bakeries, Iran*

## INTRODUCTION

Bread is highly respected among the followers of different religions. Bread is also respected by Egyptian Pharaoh, ancient Persians and Greeks, and in some cases as a particular goddess. In Russian language, the word hospitality is a concatenation of the words for bread and salt (Payan, 1995; Scanlon and Zghal, 2001). The average bread consumption per capita in Iran is about 300 g per day- about five times as high as that of Europe (Sabeghi, 2004). Bread is a man's common food and the staple food of

choice in developing countries including Iran. Therefore the significant source of energy and protein of Iranians is of wheat origin (Payan, 1995; Qazi et al., 2003; Sabeghi, 2004). Despite of three thousand year record of grain cultivation, flour production and bread making in Iran, the quality of bread is at the lowest level of the world standard (Sabeghi, 2004). Good flour can never be obtained from unsuitable wheat, e.g. Euryjaster, rusted, young, putrid and pestiferous wheat. Preservation of the produced wheat from spoiling agents and its storage in the suitable and closed places away from direct sunlight exposure, rain, heat, and the required hygienic controls throughout transportation and delivery

\*Corresponding Author: E-mail: mmalakoot@yahoo.com, Tel: 0913-140-1536

to the milling plants, play a determinant role in the production of good flour (Payan, 1995; Sabeghi, 2004). Demand for bread in big cities is growing owing to the population growth and urbanization. Bread making process in traditional bakeries has been confronted with many insufficiencies including unskilled worker employment, not observing the rules of hygiene and quality, slowness in the work, low productivity and eventually investor's discontent and being uneconomical, no steps have been taken to prompt the quality. Hygienic aspects of the issue have been overshadowed by the people's need. Rotten bread by mold or chemical reasons would itself be collected by a faulty system and is fed to livestock and poultry. This practice would result not only to milk and meat contamination but also to the spread of zoonoses as well (Payan, 1995; Takbiri, 2005).

Direct oven flame and incomplete combustion of fuel would result in dangerous residues on bread. Air pollution as a result of the activities of a large number of small bakery units in various parts of the city, possible microbial contamination due to unhygienic delivery and the supply unwrapped bread are only the part of the problems. Mentioned problems have reached to the point that can only be solved by approaching to the establishment of modern bakery units (Payan, 1995).

Good bread can be made from dough to which the adequate amount of yeast is added. The dough is then allowed to ferment and kept at desirable temperature for an appropriate period of time. Unfortunately, in most bakeries for accelerating the bread making process, recovering defects due to under-fermented dough as well as undesirable flour quality, there is no choice but to use chemicals such as soda, blankit (sodium hydrosulfite), extra salt for the reduction of gluten fluidity and increasing of dough elasticity, from Euryjaster wheat. This practice, in turn, impairs health and is a cause of stomach trouble, malnutrition, increased blood pressure, allergies, etc (Faridi et al., 1983;

Nawab Khon et al., 1983; Rezakhah, 2001; Eivaz Zadeh, 2005; Takbiri, 2005).

The object of this study was to investigate the quality of bread in the bakeries of Kerman.

## **MATERIALS AND METHODS**

Three hundred and two bakery units are officially operating in Kerman including 166 machine-made Taftoon, 78 oven-made Taftoon, 13 fancy-made, 39 Sangak-made and 6 indirect-heat type units. Samples were collected from all 302-bakery units in two steps (three loaves from first batch and three loaves from final batch) from April 2004 to March 2005. None of the bakers had knowledge of the research intention during sampling frequency. According to the sampling guidelines and tests of traditional bread, collected samples from first batch were used to determine pH. Other variables were determined using a homogeneous mixture of samples of first and final batch. The measurement of pH and salt was done in accordance to the standard method of Institute of Standard and Industrial Research of Iran (ISIRI, 1999). Pasting rate of bread was determined by weighing the doughy part of bread and bread as a whole. Burning rate of bread was measured in terms of square centimeter, and was also compared to the total bread surface. A Printed checklist (the same as official checklist used by the Office of Environmental Health was used to evaluate the hygienic condition of the bakeries. The checklist was then completed and each was weighted so that it scored 100 if observed all the rules of hygiene. Then, bakeries gaining 1/3, 2/3 and 3/3 of total score were graded as weak, medium and good, respectively. Statistical analyses were conducted using SPSS software.

## **RESULTS**

Information concerning the pasting and burning rate of various kinds of bread manufactured in selected bakeries is presented in Table 1.

**Table 1:** Average of pasting and burning rate of different kinds of bread manufactured in Kerman's bakeries

Type of bread and bakery	Number of bakeries	Burning rate (%)			Standard deviation	Pasting rate (%)			Standard deviation
		Min	Max	Mean		Min	Max	Mean	
Taftoon (Machine)	166	0.40	49	12.10	7.60	2.87	42.73	18.50	9.29
Taftoon (Oven)	78	4.97	27.50	11.75	5.31	2.76	36.40	17.90	10.10
Fancy	13	0	0	0	0	4.5	25.70	14.80	6.99
Sangak	39	2.10	23	10.09	5.10	5.38	42.80	18.64	7.35
Indirect heat	6	1.44	22.70	9.44	7.70	10	30.30	17.47	7.80
Total	302	-	-	10.84	-	-	-	17.46	-

Results from pH measurement of different types of bread at first batch and final batch and its comparison with the approved standard are listed in Table 2.

Results from the amount of salt in bread are presented in Table 3.

**Table 2:** Average ph of different types of manufactured bread at first batch and final batch of Kerman's bakeries and its comparison with approved standards

Type of bread and bakery	Min.	Max.	Mean		Standard deviation		Above the standard limit (cases)		Soda added		Standard (pH)
			First batch	Final batch	First batch	Final batch	number	percent	number	percent	
Taftoon (machine)	4.61	6.61	6.10	5.6	0.34	0.39	57	34.34	93.00	56.02	5-6
Taftoon (Oven)	4.80	7.8	6.20	5.6	0.48	0.42	24	30.77	39	50	5-6
Fancy	5.22	6.3	5.80	5.6	0.35	0.27	3	23.08	3	23.08	5-6
Sangak	5.75	6.31	6.02	5.57	0.26	0.31	26	66.60	14	35.90	4.6-5.6
Indirect heating	5.57	6.26	6.10	5.8	0.17	0.03	3	50.00	2	33.33	5-6
Total	-	-	-	-	-	-	113	37.79	151	50	-

$$\bar{X} = 6.04 ; \quad \mu_0 = 5.42 ; \quad S = 0.32 ; \quad n = 302 ; \quad t = 31$$

$$\alpha = 0.05 ; \quad t_{0.975} = 2.20$$

$$\alpha = 0.01 ; \quad t_{0.995} = 3.10$$

**Table 3:** Frequency distribution of various bakeries in terms of the amount of salt in the manufactured bread (gram in one hundred grams) and its comparison with standard limit

Type of Bread and Bakery	Amount of salt (gram in one hundred grams)			Standard deviation	Above the standard limit (cases)		Standard (gram in one hundred)
	Min.	Max.	Mean		Number (Bakery)	percent	
Taftoon (machine)	0.58	3.28	1.87	0.29	55	33.13	2
Taftoon (Oven)	1.17	2.92	1.70	0.19	7	8.97	2
Fancy	0.12	1.75	0.96	0.3	0	0	2
Sangak	0.58	2.81	1.55	0.21	19	48.72	2
Indirect heat	1.05	2.22	1.92	0.3	2	33.33	2
Total	-	-	-	-	83	27.48	-

$\alpha = 0.05$  ;  $t_{0.975} = 2.20$

$\bar{X} = 1.6$  ;  $\mu_0 = 2$  ;  $S = 0.26$  ;  $n = 302$  ;  $t = 26.66$

$\alpha = 0.01$  ;  $t_{0.995} = 3.10$

The hygienic condition of bakeries is indicated in Table 4.

**Table 4:** Hygienic condition of Kerman's bakeries in terms of bread type

Hygienic condition \ Type of Bakeries	Weak		Medium		Good		Overall	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Taftoon (machine)	36	21.7	97	58.4	33	19.9	166	55
Taftoon (Oven)	19	24.4	41	52.6	18	23	78	25.8
Fancy	2	15.4	6	46.1	5	38.5	13	4.3
Sangak	6	15.4	21	53.8	12	30.8	39	12.9
Indirect heat	0	0	1	17	5	83	6	2
Total	63	20.9	166	54.9	73	24.2	302	100

Chi - sq = 16.54 ; Df = 8 ; P = 0.035

## DISCUSSION

Increased bread wastage is resulted from various factors such as high pasting and burning rate. This study revealed that the average pasting and burning rate was 17.46 and 10.84, respectively. It is estimated that 30% of the

manufactured bread in Iran is wasted (Takbiri, 2005). Bread wastage rate in Kerman is higher than that of nation if staling rate is added to the wastage rate. Wasted bread is easily molded resulting in aflatoxin formation. Since such wasted bread is fed to livestock in the course of an unsafe consumption cycle, transmission of

infection to human being is feasible (Payan, 1995; Takbiri, 2005). Microorganisms present in yeast and bread dough grow best in a relatively weak acidic condition (pH= 4.5-5.5). In such condition, 70% of the flour phytic acid breakdown occurs during fermentation period owing to the presence of phytase enzymes. During this period the yeast cells multiply and the yeast contributes substantially, together with the fermentation products (alcohol, ketones, carbon dioxide and aromatic organic matter) to the flavour of bread. In this condition, absorption of minerals, vitamins, antioxidants and micronutrients (iron, calcium, zinc, phosphorous, etc) is become possible (Ranhotra et al., 1981; Faridi et al., 1983; Qazi et al., 2003). Results of the conducted study and its comparison with Iran's standard (pH standard for machinery Taftoon, oven Taftoon, fancy and indirect heat is 5-6, and for Sangak is 4.6-5.6) showed that pH of the manufactured bread of first batch in 34.34% of machinery Taftoon, 30.77% of oven Taftoon, 23.08% of fancy, 66.6% of Sangak and 50% of indirect heat was above the standard limit (ISIRI, 1999). The result of *t*-test showed significant difference ( $P < 0.05$ ). Detailed analysis of the results is indicative of the addition of soda, a banned leavening agent, in about half of the bakeries. Relationship between alkaline dough owing to the addition of soda and decreased phytic acid hydrolysis during fermentation has been proved (Faridi et al., 1983; Rezakhah, 2001; Qazi et al., 2003; Takbiri, 2005). Inadequate absorption of iron, calcium, zinc, and so on, incidence of the complications due to the deficiency of these micronutrients in human as well as digestive disorders are among the most important consequences of the addition of soda to bread (Cameron, 1995; Fox and Qazi et al., 2003; Kathleen and Escott, 2004; Takbiri, 2005). Thus, the necessary measures for prevention of the addition of soda have been successful in only half of the bakeries (52.3%). The addition of soda is in contrast to the programs of the Iranian Ministry of Health and WHO concerning flour fortifi-

cation with iron and folic acid. Therefore drastic control of bakeries for soda use is recommended (Rastmanesh, 2002; WHO, 2002).

Since the recommended daily requirement for salt in normal condition is satisfied by one's diet, adding salt to bread is not justifiable. Bakers use salt to reduce the fluidity of dough and to increase its elasticity because low-grade flour and warm weather make the dough looser and cause it to drop from wall of the oven (Clements, 1973). Data analyses of the salt content of bread showed that besides of the fancy bread which was within the range of the approved standard of Iran (2 grams in one hundred grams), amount of salt in each loaf of the manufactured bread in 48.72% of Sangak, 33.33% of indirect heat, 33.13% of machine Taftoon and 8.97% of oven Taftoon Bakeries exceeded the standard. The comparison of the average values of salts in manufactured bread with the standard values was also significant when *T*-test was performed ( $P < 0.05$ ). High salt content reduce the activity of dough yeast and its long-term consumption also accompanying with high blood pressure and is detrimental for people with kidney and heart trouble (Takbiri, 2005).

Although only 20.9% of Kerman's bakeries had weak hygienic conditions, remarkable consequences from unhygienic condition of same number of bakeries and placing more than half of them (54.9%) in medium hygienic level is an alarming sign hygienically. Chi-Square test indicated that hygienic condition of bakeries had significant difference ( $P = 0.035$ ).

Similar studies have been conducted in other cities of Iran such as Tehran, Yazd, Rafsanjan, Shahrekord in past years which had been effective in the understanding of the present situation and difficulties (Faridi et al., 1983; Kargar et al. 2000; Malakootian and Loaloei, 2000; Mostaghi Moghadam et al., 2004). In Yazd and Rafsanjan studies, for example, 13.5% and 10.36% of manufactured bread was reported as stale and hygienic condition of bakeries was 9% and 16%, respectively which was accept-

able (Kargar et al. 2000, Malakootian et al, 2000). The hygienic condition of Kerman bakeries is better than these two cities.

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