

Quality assessment of traditional breads in Gonabad bakeries, Iran

Ali Alami¹, Samaneh Banoorkar², Tahereh Rostamiyan²,
Seyedeh Nastaran Asadzadeh³, Morteza Mohammadzadeh
Moghaddam⁴

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1. Assistant Professor of Public Health Department, School of Health; Social Determinants of health Research Center, Gonabad University of Medical Sciences, Gonabad, Iran

2. BS of Environmental, Student Research Committee, Gonabad University of Medical Sciences, Gonabad, Iran

3. **Correspondence to:** MSc in Environmental Health, University of Medical Sciences Bojnurd, Bojnurd, Iran
Tel/Fax: +98 51 57223028

Email: asadzade_69@yahoo.com

4. MSc of Food Industrial, Social Development & Health Promotion Research Center, Gonabad University of Medical Sciences, Gonabad, Iran

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Abstract

Bread, as a main food of most people around the world, provides major part of energy, protein, and essential vitamins. So, health and quality of consumable bread would be very important. The aim of this study was to assess quality of taftoon bread which was produced in taftoon bakeries in Gonabad, Iran. We applied a cross-sectional descriptive study on 140 taftoon breads which were selected by two-stage cluster sampling and assessed their bacterial and fungal contaminations, value of PH, and percentage of salt. The data were gathered using a checklist and were analyzed. Our findings showed no bacterial contamination in the sample, while there was 9.3% fungal contamination in the baked breads which was the standard range. Mean (standard deviation) of PH and percentage of salt was 5.92 (0.214) and 1.30 (0.547), respectively. The value of PH in 77.1 % of the breads was into standard interval and percentage of salt in only 7.1% of the breads was more than standard measure. According to our results, 28.6% of the taftoon breads in Gonabad bakeries were unqualified. Our results indicated current situation in production of taftoon bread in Gonabad and would be used by inspectors who supervised the bakeries.

Keywords: Bacterial, Contamination, Sodium Chloride

Introduction

Bread, as the most important wheat product, is the staple food of people in many countries of the world, especially developing countries, and provides a large proportion of daily required energy, protein, minerals, and vitamins [1-3]. According to research conducted at national level in Iran, per capita consumption of bread is about 160 kilograms, which is much higher than the world average [4]. In Iran, bread provides on average for 46.2% of total energy of an urban dweller and 59.3% of total energy consumption of a rural person [5]. According to a survey by FAO, Near-Eastern and Middle-Eastern people receive about 70% of their required daily energy from bread and other wheat products [6]. In

Iranian traditional medicine, bread is also considered among good foods. For instance, in the book "Mofaralghlob", it is cited that the best bread is wheat bread, prepared from good wheat, and wholemeal bran flour, since bread containing bran is more easily digested than bread without bran [7]. Many factors have been proposed as indicators of bread quality, including: sensory indicators (such as: shape, volume, taste, skin color, and texture of bread), nutritional indicators (such as: vitamins, iron and calcium), and health indicators (including: microbial contamination and disallowed additives, like baking soda). Furthermore, allowable pH for Sangak bread is 4.6-5.6, and for other

traditional breads 5-6, and allowable sodium chloride salt, is maximum 2% dry weight [8]. Generally, several microbes can contaminate bread. Coliform is a variety of bacterial contaminant that can contaminate foods, including bread. Coliforms are rod-shaped, aerobic and anaerobic, gram-negative, non-spore bacteria that ferment lactose by producing gas at 35°C in 48 hours. This group includes enterobacter, klebsiella, sterobacter, and E-coli. E-coli is a bacterium that produces gas through fermentation of lactose at 44 °C, and produces indole from tryptophan [9].

Yeasts are single-celled microorganisms that primarily proliferate through budding, and are used in all bread baking techniques to create volume, improve taste, improve gluten quality, and increase digestibility. Bakery yeast is of *saccharomyces cervicae* genus that is active at pH less than 6 [10]. Molds are microscopic fungus that produce spore-quality mycelium, and are able to grow in conditions specified in standard 1169 [11]. In general, some microbial pathogens are likely to enter the body through food [12]. Some studies have demonstrated likelihood of presence of bacterial and mold contamination [13]. Given such likelihood in bread, it seems this vital nutrient can also cause spread of microbial contamination across the community [14]. Furthermore, some bakeries illegally use baking soda or sodium bicarbonate (NaHCO_3) to make the dough rise up and leavened. This chemical decomposes and produces carbon dioxide when heated, and in significant amounts, increases bread flatness and waste, reduces scent of the bread, and causes alkalinity and yellow color due to sodium carbonate, which is not desirable in the bread produced [15]. Meanwhile, since yeast or sour-dough is not used in preparation of bread, or the dough is not given sufficient time to rise, existing phytic acid in wheat flour persists into the bread produced, and can bind with calcium in other food stuff to create insoluble calcium phytate, followed by impaired calcium absorption from nutrients [16]. Moreover, consumption of baking soda causes impairment in absorption of micronutrients through

increased gastric pH; it can even cause indigestion, gastritis, and peptic ulcer through delayed gastric emptying [17, 18]. Despite the ban on use of baking soda by the Ministry of Health since 2001, some reports indicate persistent use of this material in bakeries [19], even up to 41% in some cases [20].

Meanwhile, the role of salt in bread is much more important than other additives. Salt improves taste, and through relatively neutralizing fermentation acids, prevents souring of bread. However, if too much salt is used, besides the salty taste, it prevents fermentation, which in turn is also undesirable [8]. Moreover, using too much salt in bread, in addition to increasing bread waste [10], can be harmful for health [21-23]. Salt greatly affects rising of the dough and solubility of gluten. A little salt increases stability and strength of gluten, and the dough better tolerates kneading and mixing. Whereas, with high concentration of salt, dough weakens. In other words, addition of a little salt to the dough positively affects gluten; conversely, too much salt negatively affects it [2].

In the mean time, use of traditional breads is increasing. Traditional Iranian breads are thin and flat, and are prepared from mixing flour with water. These breads date back to several thousands of years ago, to Achaemenids time. The weaker wheat in central Iran has caused creation of a bread called "Tafton", whereas, better quality wheat from the West and North-Western regions of Iran has led to production of the very thin "Lavash" bread with quality flour and highly elastic dough [6]. One of the most common traditional breads is Tafton bread, used in huge amounts by people in the East of the country, including in Gonabad. So far, in spite of increasing use of traditional breads, including Tafton, no accurate quality assessment of traditional Tafton breads produced in Gonabad bakeries has been carried out. Thus, this study was conducted with the aim to determine status of microbial contamination, pH value, and percentage of salt in traditional breads in Gonabad city.

Method

This descriptive cross-sectional study was conducted on 140 Tafton bread samples made by bakeries in Gonabad in 2012 using two-stage cluster sampling method proportional to volume. There were 8 Tafton bakeries in Gonabad, and each was considered as a cluster. Then, required sample size was determined in proportion to volume of bread produced in each bakery. Tafton bread samples were taken in sterile conditions, such that, using sterile latex gloves, researcher took samples from all parts of bread by the oven and near an alcohol burner. Bread samples were placed in sterile brown bottles and transferred to the unit laboratory. Next, 1 gram bread was taken from every part in sterile conditions, and diluted in saline 0.9%. Then, 0.1 cc of serum was taken to Mac Conkey's agar and Sabouraud dextrose agar culture media, and cultured linearly in agar medium. To detect coliforms, Mac Conkey culture medium was incubated at 37 °C for 24 hours, and to detect mold and yeast, Sabouraud dextrose agar was incubated at 20 °C for 72 hours. Ten milliliters of the above serum was added to the Lauryl sulfate broth culture medium for detection of E-coli and incubated at 37 °C for 24 hours. pH value was measured to detect presence of baking soda in bread dough. To that end, 10 grams of dried bread was crushed in a mortar, and 90 cc of boiled distilled water was added. Then, PpH

was measured using a calibrated pH meter.

To measure percentage of salt, the prepared suspension from previous stage was passed through normal filter paper, and 10 cc of the filtered solution was poured into Erlenmeyer flask, then 1 cc potassium chromate 5% was added, and titrated with 0.1 normal silver nitrate. Data were recorded in a check-list, and entered into SPSS-18 software and described using mean and standard deviation indices, frequency distribution tables and linear graphs.

To assess rigor of test results, 10% of samples were sent to another laboratory to perform required tests again. Consistency of results in relation to microbial contamination was 100%, and in relation to pH value and percentage of salt were acceptable.

This study was approved by the Student Research Committee of Gonabad University of Medical Sciences and Healthcare Services. Prior to sampling, bakery managers were informed of the research project, and sampling was carried out after obtaining their verbal consents.

Results

In this study, results of tests on 140 Tafton bread samples were analyzed. Table 1 presents status of sampling in each bakery according to daily production rates.

Table 1 Number of tested samples from Tafton Bakeries in Gonabad city-2012

Bakery	Absolute frequency (%)	Accumulative frequency (%)
No 1	10(7.1)	10(7.1)
No 2	30(21.5)	40(28.6)
No 3	20(14.3)	60(42.9)
No 4	10(7.1)	70(50.0)
No 5	10(7.1)	80(57.1)
No 6	10(7.1)	90(64.2)
No 7	30(21.5)	120(85.7)
No 8	20(14.3)	140(100)

Microbial test results of all samples revealed that they were all within the standard range, and none showed bacterial contamination, while 9.3% of bread samples had mold, which

was still within the standard range. Mean (standard deviation) of pH of test samples was 5.92 (0.214), and mean (standard deviation) of salt percentage was 1.3 (0.547).

State of pH and salt percentage of bread samples can be seen in Figures 1 and 2, respectively.

Table 2 presents status of pH and salt percentage in tested samples.

Table 2 PH and salt percentage in Tafton bread samples produced by Gonabad bakeries-2012

Variable	Desirability status	Quantity	Percentage
pH value	Desirable (5 to 6)	108	77.1%
	Undesirable (≤ 6)	32	22.9%
Percentage salt	Desirable ($\leq 2\%$)	130	92.9%
	Undesirable ($> 2\%$)	10	7.1%

Table 3 presents overall status of Gonabad Tafton bread quality. It can be seen that 28.6%

of breads tested did not have the desired quality.

Table 3 Quality of traditional Tafton breads produced in Gonabad city in 2012

Quality	Quantity	Percentage
Desirable	100	71.4%
Undesirable	40	28.6%
Total	140	100%

*Fungus contamination, PH value and salt percentage within standard range

*At least one fungus contamination indicators, PH and salt outside standard range

Discussion

The present study was conducted to assess the quality of Tafton bread produced in Gonabad city. While providing awareness about the present quality of breads produced, results of this study can also be used for future planning. In this study, no bacterial contamination was found in traditional Tafton bread produced in Gonabad city. However, mold development was observed in 9.3% of bread samples tested, which was within the standard range. 22.9% of samples had pH outside the standard range, and only 7.1% contained salt outside the standard range. Generally, 28.6% of bread samples tested did not have the desired quality. In the present study, no bacterial contamination was found, while other studies have shown a variety of bacterial contaminations in various breads produced [24-26]. The main difference between the present and other studies may be due to the fact that in the present study, bacterial contamination assessment was carried out on samples immediately after production and by the oven, while in other studies, sampling was conducted at the point of consumption, where the bread may have already been contaminated during packaging and transportation. In this study type of bread tested was also different from breads in other studies, which may be a reason for the difference in results.

In the present study, mold was reported in 9.3% of bread tested, but microorganism count in none exceeded the allowable standard limit. Although in the present study, the amount of fungus contamination was less than other similar studies, in terms of presence of fungus contamination, it concurred with them [26,27]. It should be noted that if after production conditions of packaging, distribution and storage are not well-observed, mold contamination can increase, thereby increasing amount of microorganisms, which will result in moldy breads. In this study, mean pH of tested breads was 5.9, but 22.9% of breads did not have pH within the standard limit, and pH of 75% of breads exceeded 6. High pH value of bread may be due to various causes, including: quality of water, unleavened dough, and use of baking soda. Generally, national mean baking soda use in bread production has been reported 9.1% [19], and many similar studies have cited widespread use of baking soda in bread production in Iran [14, 28, and 29]. On the other hand, reduced pH value can be due to such reasons as: excessive use of yeasts, and prolonged fermentation period. In present study, mean salt percentage was reported 1.3, which is similar to results of studies by Malekotian&Loloe [14] and

Hassanzadeh et al. [30]. Rezaee-Mofrad et al. reported percentage of salt in traditional bread samples in Mehrdasht-Najafabad 64% [29]. In the present study, only 7.1% of Tafton breads contained salt more than standard limit, which could be considered a sign of relative quality of Tafton breads produced in Gonabad.

Generally, according to the status of microbial contamination, pH value and percentage of salt, over 28% of Tafton breads produced in Gonabad did not enjoy the desired quality. However, according to similar studies, it seems that, if a study was conducted at distribution and supply levels, the rate of low quality bread would rise beyond values obtained because usually contaminations are removed through baking, and microbial contaminations may occur after baking. For instance, Ariaian et al. concluded that 80% of Barbari and 65% of Lavash breads produced in Tehran were inconsumable in terms of pH and percentage of salt [31]. Another important issue is bread waste, which relates to modifying bread production and consumption patterns. In fact, bread waste is associated with many factors, and a great proportion of these factors is associated with bread production process, storage, and consumption. Among important factors, type of flour, baking equipments, dough processing, lack of practical staff training, bakeries working hours, storage, and consumption by consumers can be cited [32]. Improper storage conditions of wheat in farms or silos in terms of temperature, moisture, frost, and heat can cause enzymatic and undesirable changes in structure of protein, starch, fat and micronutrients of wheat, thereby reducing quality of wheat, flour, and the bread. Other factors involved in lowering bread quality include genetic characteristics of wheat, milling process, use of baking soda, not using yeast or sourdough, excessive use of salt to compensate for poor flour quality, improper dough making conditions, lack of attention to proper shaping of the bread, not allowing for final fermentation, and inappropriate size [5]. Furthermore, shortage of skilled workers and insufficient fermentation time can also affect bread waste in baking process [32]. It

should be noted that, if bran flour is used in production of bread, and if fermentation is allowed to occur naturally with sourdough, people's protein and energy requirements can be provided for by enhancing quality of bread [5]. Although it seems a great proportion of bread waste is practically produced during consumption (close to 30%) [32], staling of bread that is induced by physical and chemical changes in skin and core of the bread, along with microbial contamination, are considered among the main causes of reduced bread shelf-life. Staling creates a tough and brittle texture and loss of freshly baked taste in bread. Sourdough delays staling associated with volume, which is a positive factor in softness of bread. Sourdough changes starch hydrolysis rate by regulating activity of flour alpha-amylase, which is effective in reducing starch crystallization and staling of bread [33]. Meanwhile, reduced pH and increased acidity in bread due to sourdough are the main reasons for useful changes in bread [34].

Given the method used in the present study, one of the limitations can be due to not recognizing potential causes of poor quality in a relatively high percentage of Tafton breads produced in Gonabad city bakeries. Thus, researchers recommend more extensive analytical studies with larger sample size to determine causes of current status. Study results can be used by those involved in monitoring preparation and distribution of bread, which is sacred and precious nutrient.

Conclusion

In general, more than 28% of Tafton bread samples tested did not have the desired quality. It seems noteworthy that if Gonabad Tafton bread is properly made, it can become one of the best breads. Therefore, according to study results, it is recommended that by using quality flour and resolving technical deficiencies in preparation and distribution processes, and by providing necessary training to the Bakers' Guild, and also educating the public to observe proper storage conditions, quality of Gonabad Tafton bread can be enhanced.

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Contributions

Study design: A A, SB, TR, N A

Data collection and analysis: AA, SB, TR, NA,MMM

Manuscript preparation: AA, SB, TR, NA,MMM

Conflict of Interest

"The authors declare that they have no competing interests."

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