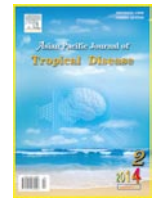




Contents lists available at ScienceDirect

Asian Pacific Journal of Tropical Disease

journal homepage: www.elsevier.com/locate/apjtd

Document heading

doi: 10.1016/S2222-1808(14)60738-6

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Fungal contamination of produced wheat flour in West Azerbaijan, northwest of Iran

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ARTICLE INFO

Article history:

Received 24 Feb 2014

Received in revised form 30 Apr 2014

Accepted 2 Jun 2014

Available online 29 Aug 2014

Keywords:

Wheat

Flour

Mold

Fungal contamination

West Azerbaijan

Iran

ABSTRACT

Objective: To investigate fungal contamination of produced wheat flours in West Azarbaijan Province, located in the North West of Iran as wheat flour is one of the most important food and nutrient in the Iranians diet.

Methods: This descriptive study was performed during March 2011 to April 2013 in flour mills of West Azerbaijan province. A total of 17 samples of produced wheat flour in Azerbaijan Province of Iran were tested for mold contamination based on Iran National Standard Method No. 2393.

Results: Presence of molds in all collected 151 samples from flour factories of Azerbaijan Province were at the limit based on Iranian national standard.

Conclusions: The obtained results showed that the process of flour production was hygienic quietly. Bread is staple ingredient of Iranian diet, and strict control on its processing of wheat flour, maintenance and distribution results nonpolluting or reduction of fungal contamination.

1. Introduction

In recent years, the use of proteins with plant sources is recommended more than previously in diet. Consumption of these proteins is cheaper than animal source. Reduction in saturated fats intake can prevent chronic diseases, particularly cardiovascular disease, diabetes, renal failure, hyperlipidemia, cancer and osteoporosis[1].

Wheat is a strategic and important crop in human life. As

one of the most consuming agriculture crops, it can play an important role in endangering human health if contaminate with pollutants.

Wheat flour is commonly used for baking bread that almost is used in all meals of Iranian food culture. Prepared foods of cereals such as breads are inexpensive with high nutritional value in diet[2].

The use of bread made from whole wheat flour or high extracted rate flour is recommended due to higher levels of fiber, minerals and vitamins[3]. Advancement of world health culture, Food science and technology and food hygiene caused declining of microbial and chemical food infection or toxicosis with exception of fungal contamination of foods. The aim of this study was investigation of fungal contamination of wheat flours

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Foundation Project: Supported by Food and Drug Deputy of Urmia University of Medical Sciences (Grant No. 23454/004/4).

produced in West Azarbaijan province of Iran.

2. Methods and materials

2.1. Sampling

A descriptive study was done since March 2011 to April 2013 in flour mills in West Azerbaijan province of Iran. Randomly, 151 samples of produced wheat flour from 17 plants were collected and sent to laboratory. Microbial total count and molds were counted, according to Iran national standard No. 2393 for assessment flours microbial count[4].

2.2. Methods

At first 5 g of flour samples were mixed in 45 mL Ringer solution (0.1) and serial dilution prepared (10^{-1} to 10^{-5}).

2.3. Total count

A total of 1 mL of desired dilution (10^{-1} to 10^{-5}) pour plated in sterile plate count agar culture mediums and incubated at 30 °C for 24–48 h.

2.4. Mold count

A total of 1 mL of the desired dilution (10^{-1} or 10^{-2}) distributed on the plate count agar medium and incubated at 25 °C for 5–3 d.

3. Results

All samples were clean with no microbial and fungal contamination. Obtained results were showed in Table 1.

Table 1

Number, permissible levels mold (Standard No. 2393), test results and acceptable or unacceptable for samples.

Number	Permissible levels mold (Standard No. 2393)	Test results	Acceptable or unacceptable
1	5×10^3	$< 10^2$	acceptable
2	5×10^3	$< 10^2$	acceptable
3	5×10^3	$< 10^2$	acceptable
4	5×10^3	$< 10^2$	acceptable
5	5×10^3	$< 10^2$	acceptable
6	5×10^3	$< 10^2$	acceptable
7	5×10^3	$< 10^2$	acceptable
8	5×10^3	$< 10^2$	acceptable
9	5×10^3	$< 10^2$	acceptable

10	5×10^3	$< 10^2$	acceptable
11	5×10^3	$< 10^2$	acceptable
12	5×10^3	$< 10^2$	acceptable
13	5×10^3	$< 10^2$	acceptable
14	5×10^3	$< 10^2$	acceptable
15	5×10^3	$< 10^2$	acceptable
16	5×10^3	$< 10^2$	acceptable
17	5×10^3	$< 10^2$	acceptable
18	5×10^3	$< 10^2$	acceptable
19	5×10^3	$< 10^2$	acceptable
20	5×10^3	$< 10^2$	acceptable
21	5×10^3	$< 10^2$	acceptable
22	5×10^3	$< 10^2$	acceptable
23	5×10^3	$< 10^2$	acceptable
24	5×10^3	$< 10^2$	acceptable
25	5×10^3	$< 10^2$	acceptable
26	5×10^3	$< 10^2$	acceptable
27	5×10^3	2×10^3	acceptable
28	5×10^3	$< 10^2$	acceptable
29	5×10^3	$< 10^2$	acceptable
30	5×10^3	$< 10^2$	acceptable
31	5×10^3	$< 10^2$	acceptable
32	5×10^3	$< 10^2$	acceptable
33	5×10^3	$< 10^2$	acceptable
34	5×10^3	$< 10^2$	acceptable
35	5×10^3	$< 10^2$	acceptable
36	5×10^3	5×10^2	acceptable
37	5×10^3	$< 10^2$	acceptable
38	5×10^3	$< 10^2$	acceptable
39	5×10^3	$< 10^2$	acceptable
40	5×10^3	$< 10^2$	acceptable
41	5×10^3	$< 10^2$	acceptable
42	5×10^3	$< 10^2$	acceptable
43	5×10^3	$< 10^2$	acceptable
44	5×10^3	$< 10^2$	acceptable
45	5×10^3	1×10^3	acceptable
46	5×10^3	$< 10^2$	acceptable
47	5×10^3	$< 10^2$	acceptable
48	5×10^3	$< 10^2$	acceptable
49	5×10^3	$< 10^2$	acceptable
50	5×10^3	$< 10^2$	acceptable
51	5×10^3	3×10^3	acceptable
52	5×10^3	2×10^3	acceptable
53	5×10^3	10^3	acceptable
54	5×10^3	10^3	acceptable
55	5×10^3	$10^3 >$	acceptable
56	5×10^3	$10^3 >$	acceptable
57	5×10^3	$< 10^2$	acceptable
58	5×10^3	$< 10^2$	acceptable
59	5×10^3	$< 10^2$	acceptable
60	5×10^3	$< 10^2$	acceptable
61	5×10^3	$< 10^2$	acceptable
62	5×10^3	$< 10^2$	acceptable
63	5×10^3	$< 10^2$	acceptable
64	5×10^3	$< 10^2$	acceptable
65	5×10^3	$< 10^2$	acceptable
66	5×10^3	$< 10^2$	acceptable
67	5×10^3	$< 10^2$	acceptable
68	5×10^3	$< 10^2$	acceptable
69	5×10^3	2×10^3	acceptable
70	5×10^3	2×10^2	acceptable
71	5×10^3	$< 10^2$	acceptable
72	5×10^3	$< 10^2$	acceptable
73	5×10^3	$< 10^2$	acceptable
74	5×10^3	$< 10^2$	acceptable
75	5×10^3	$< 10^2$	acceptable
76	5×10^3	$< 10^2$	acceptable
77	5×10^3	$< 10^2$	acceptable
78	5×10^3	$< 10^2$	acceptable
79	5×10^3	1×10^2	acceptable
80	5×10^3	2×10^2	acceptable
81	5×10^3	1.5×10^2	acceptable

82	5×10^3	2×10^3	acceptable
83	5×10^3	$< 10^2$	acceptable
84	5×10^3	1×10^3	acceptable
85	5×10^3	1×10^2	acceptable
86	5×10^3	$< 10^2$	acceptable
87	5×10^3	$< 10^2$	acceptable
88	5×10^3	1×10^2	acceptable
89	5×10^3	$< 10^2$	acceptable
90	5×10^3	$< 10^2$	acceptable
91	5×10^3	$< 10^2$	acceptable
92	5×10^3	$< 10^2$	acceptable
93	5×10^3	$< 10^2$	acceptable
94	5×10^3	$< 10^2$	acceptable
95	5×10^3	$< 10^2$	acceptable
96	5×10^3	$< 10^2$	acceptable
97	5×10^3	$< 10^2$	acceptable
98	5×10^3	$< 10^2$	acceptable
99	5×10^3	$< 10^2$	acceptable
100	5×10^3	$< 10^2$	acceptable
101	5×10^3	$< 10^2$	acceptable
102	5×10^3	$< 10^2$	acceptable
103	5×10^3	$< 10^2$	acceptable
104	5×10^3	$< 10^2$	acceptable
105	5×10^3	$< 10^2$	acceptable
106	5×10^3	$< 10^2$	acceptable
107	5×10^3	1.4×10^3	acceptable
108	5×10^3	2×10^2	acceptable
109	5×10^3	$< 10^2$	acceptable
110	5×10^3	1×10^2	acceptable
111	5×10^3	$< 10^2$	acceptable
112	5×10^3	7.5×10^2	acceptable
113	5×10^3	2.13×10^3	acceptable
114	5×10^3	1.1×10^2	acceptable
115	5×10^3	$< 10^2$	acceptable
116	5×10^3	$< 10^2$	acceptable
117	5×10^3	$< 10^2$	acceptable
118	5×10^3	$< 10^2$	acceptable
119	5×10^3	$< 10^2$	acceptable
120	5×10^3	3×10^2	acceptable
121	5×10^3	1×10^2	acceptable
122	5×10^3	1×10^2	acceptable
123	5×10^3	2×10^2	acceptable
124	5×10^3	1×10^2	acceptable
125	5×10^3	6×10^2	acceptable
126	5×10^3	4×10^2	acceptable
127	5×10^3	1×10^2	acceptable
128	5×10^3	1×10^3	acceptable
129	5×10^3	1.1×10^2	acceptable
130	5×10^3	$< 10^2$	acceptable
131	5×10^3	$< 10^2$	acceptable
132	5×10^3	$< 10^2$	acceptable
133	5×10^3	$< 10^2$	acceptable
134	5×10^3	$< 10^2$	acceptable
135	5×10^3	$< 10^2$	acceptable
136	5×10^3	$< 10^2$	acceptable
137	5×10^3	$< 10^2$	acceptable
138	5×10^3	$< 10^2$	acceptable
139	5×10^3	$< 10^2$	acceptable
140	5×10^3	$< 10^2$	acceptable
141	5×10^3	$< 10^2$	acceptable
142	5×10^3	$< 10^2$	acceptable
143	5×10^3	$< 10^2$	acceptable
144	5×10^3	$< 10^2$	acceptable
145	5×10^3	$< 10^2$	acceptable
146	5×10^3	$< 10^2$	acceptable
147	5×10^3	$< 10^2$	acceptable
148	5×10^3	$< 10^2$	acceptable
149	5×10^3	$< 10^2$	acceptable
150	5×10^3	$< 10^2$	acceptable
151	5×10^3	$< 10^2$	acceptable

In this study, 151 samples were negative for fungal and were in normal range. All samples taken were acceptable.

4. Discussion

The results showed that 100 samples did not have any pollution and were consumable. It showed sanity of the process of flour production in West Azarbaijan Province. Consumption of bread products without any contamination in livestock and poultry reduced the risk of mycotoxins in foods[5].

Unfavorable conditions such as storage in high temperature of flour in bakery, factory or warehouse location or whereabouts and microbial or fungal contamination of grains and flour during the manufacturing process can be effective on mycotoxin production[6].

Fungal contamination of wheat with *Aspergillus* species was seen in Egypt[6].

Okhovvat *et al.* have done a study on imported wheat varieties to Iran and reported fungal contamination[7].

A study was done by Li *et al.* in India to assess gastrointestinal illness that associated with consumption of bread made of damaged wheat and their obtained results showed contamination of breads by *Aspergillus* and *Fuzarium general*[8]. The flour products maintenance, personnel hygiene, transporting hygiene, raw materials maintenance, packaging and equipment hygiene affects on reducing corruption and microbial contamination. In all items storing should be done at temperatures below 20 °C. it's recommended that flour with best quality and low heat-resistant spores, used for white bread[9–12].

Investigation on flour samples in Tabriz bakeries showed contamination of 31.5% of 89 samples with fungi above the limit of 10^4 colonies per each gram of the flour[13].

Quality control mean is development, design, manufacture and deliver high quality products and services, which use economic and consumer satisfaction is a permanent. Many people are interested to buying breads which is healthy[14–16]. Food intake possibility of transmission of pathogens (bacteria, viruses and parasites) provides the human body[17].

To prevent microbial contamination of food, educate people, and supervision of the hygiene principles in preparing, transport, storage and supply of food is

essential[18].

Previous studies were reported flour contamination but no contamination was seen in this study. The results of this study showed that production of flour in west Azerbaijan is quite hygienic. Consideration and following of health departments and authorities at all stages of production, storage and distribution of wheat flour is necessary to reduce and eliminate the fungal contamination.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgements

The authors thank the Food And Drug Deputy of Urmia University of medical sciences for funding in this study (Grant No. 23454/004/4).

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