QUALITY CONTROL OF COMMERCIALIZED SPICES IN THE ARGENTINE REPUBLIC

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Abstract

140 samples belonging to 12 botanical species used as condiment in the Argentine Republic were analyzed from the pharmacobotanical and hygienic points of view to establish their quality and safety. Most of them showed a great quality grade: they were botanically genuine and mesophilic bacteria, molds, yeasts, coliforms and pathogens proved to be in accordance with the limits for raw vegetable products.

1. Introduction

This paper is the result of a survey performed by several Departments of the Faculty for Pharmacy and Biochemistry of the University of Buenos Aires with a grant by contract of CAEMPA (Argentine Chamber of Spicers).

The work team is integrated by the Departments of Hygiene and Sanity, Pharmacobotany and Toxicology and Legal Chemistry.

Spices of common use in our country were obtained directly in markets, groceries or bought from ambulant sellers to establish quality criteria because of the non-availability of legislation about these products.

Spices studied were: Capsicum (*Capsicum annuum* L. -Solanaceae-), Garlic (*Allium sativum* L. -Alliaceae-), Anise (*Pimpinella anisum* L. -Apiaceae-), Cinnamon (*Cinnamomum zeylanicum* Blume -Lauraceae-), Onion (*Allium cepa* L. -Alliaceae), Cumin (*Cuminum ciminum* L. -Apiaceae-), Tarragon (*Artemisia dracunculus* L. -Asteraceae-), Laurel (*Laurus nobilis* L. -Lauraceae-), Nutmeg (*Myristica fragrans* Houtt. -Myristicaceae), Wild marjoran (*Origanun vulgare* L. -Lamiaceae-), Parsley (*Petroselinum crispum* (Mill) Nyon -Apiaceae-), Spanish paprika (*Capsicum annuum* L. -Solanaceae-), Black and white pepper (*Piper nigrum* L.-Piperaceae-).

2. Materials and methods

2.1. Materials

140 samples from different origins (some of them commercially packed or to be sold by weight), with an average of 11 samples for each one were analyzed.

Since most species have different presentations, they were compared during the study.

The products were: capsicum: ground; garlic: scales, powdered and ground; anise: grains; cinnamon: powdered; onion: scales and powdered; cumin: powdered; tarragon: entire leaves; laurel: entire leaves; nutmeg: powdered; wild marjoram: ground; parsley: powdered and ground; Spanish paprika: powdered; white pepper: in grains and powdered and black pepper: in grains and powdered.

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2.2. Methods

2.2.1. Micrographic study (WHO, 1991):

- direct observation of powdered samples,
- characterization of starch,
- disintegration with 5% NaOH for entire and more or less ground leaf samples.

2.2.2. Hygienic-sanitary analysis (FDA-AOAC,1992; Infyb, 1980; USP XXIII, 1995; IRAM, 1996):

- count of viable mesophilic aerobic bacteria, myceliar molds, yeasts, total and fecal coliforms and sulfite-reducing anaerobic bacteria;
- determination of *Escherichia coli*, *Clostridium perfringens* and *Staphylococcus aureus* in 0,1 g plant material;
- determination of *Salmonella* sp. in 25 g plant material.

In all cases, standard microbiologic methods were employed. Counts of viable mesophilic bacteria, yeasts and myceliar molds were performed on plates, while counts of total and fecal coliforms and sulfite-reducing anaerobic bacteria were developed by the statistics method of the "most probable number".

3. Results

3.1. Micrographic study: Results are presented in Tables 1 and 2.

3.2. Hygienic analysis: Results are presented in Tables 3-5.

4. Conclusions

4.1. From the pharmacobotanic point of view (Eschrich, 1988; Youngken, 1951):

- All products showed a great quality degree.
- Most of the non-genuine samples corresponded to spices to be sold by weight (not commercially packed).
- Different starch grains were the most frequent foreign elements.

4.2. From the microbiological point of view:

- 66% of the samples were within acceptable limits for raw vegetable products of the European Economic Community and World Health Organization. Only 13% exceeded these limits (European Pharmacopoeia, 1997; WHO, 1991).
- The determinations for coliforms were acceptable, taking into account the corresponding limits for other raw aliments. *Escherichia coli* could not be detected in most samples.
- Neither *Staphylococcus* nor *Salmonella* were detected.
  In some samples, however, *Clostridium perfringens* was isolated, although the total number of sulfite-reducer anaerobic bacteria was in lower concentration than 100 CFU/g. This could be caused during product elaboration (Müller, 1981; ICMSF, 1980).

- Myceliar molds and yeast levels were lower than those which appear in the literature (IRAM, 1996).

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Table 1 - Genuinity of analyzed spices

Spices	Commercially packed products			Products to be sold by weight		
	Number	Genuine	Non-Genuine	Number	Genuine	Non-Genuine
Capsicum	6	4	2	5	2	3
Garlic	1	1	0	9	8	1
Anise	2	2	0	4	1	3
Cinnamon	4	4	0	3	3	0
Onion	1	1	0	7	6	1
Cumin-fruit	6	6	0	4	1	3
Tarragon	2	2	0	4	3	1
Laurel	3	3	0	0	0	0
Nutmeg	4	3	1	5	4	1
Wild marjoran	9	4	5	4	2	2
Parsley	7	4	3	5	3	2
Spanish paprika	12	11	1	5	3	2
White pepper	9	9	0	5	3	2
Black pepper	5	5	0	6	4	2

Table 2 - Non-genuine samples

Spices	Adulteration and /or Contamination
Capsicum	· Molds
	· Starch from Leguminosae
Garlic	· Cells with thick lignified walls
Anise	· Mixture with *Coriandrum sativum*-fruits -Apiaceae-
Onion	· Starch
Cumin-fruits	· Substitution with *Carum carvi*-fruits L. -Apiaceae-
	· Foreign epidermis-cells
	· Starch
Tarragon	· Molds
Nutmeg	· Foreign starch
Wild marjoran	· Molds
	· Abundant stems (>3%)
	· Sand
Parsley	· Hairy plant material
	· Sand
Spanish paprika	· Starch from Poaceae
	· Starch from Leguminosae
	· Foreign starch
White pepper	· Starch from Leguminosae
	· Starch from Poaceae
Black pepper	· Starch and tissue fragments from Poaceae
	· Foreign starch

Table 3 - Counts of total bacteria, molds and yeasts

Spices	n	Viable mesophilic aerobic (average) (CFU/g)	Molds (CFU/g)	Yeasts (CFU/g)
Capsicum	11	$1,3.10^7$	nd-$1,2.10^5$	nd-$8,2.10^3$
Garlic	12	$1,9.10^4$	nd-$1,6.10^3$	nd-$1,8.10^3$
Anise	7	$6,6.10^5$	2.10^2-$1,1.10^3$	nd-$1,8.10^3$
Cinnamon	7	$3,4.10^6$	nd-$1,2.10^5$	nd
Onion	8	$1,3.10^6$	$1,8.10^2$-$5,3.10^4$	nd
Cumin-fruit	10	$4,4.10^6$	nd-$1,4.10^4$	nd-6.10^4
Tarragon	6	$1,5.10^6$	nd-$5,8.10^4$	nd-10^3
Laurel	3	$2,9.10^3$	4.10^3-$1,7.10^4$	nd
Nutmeg	9	$4,7.10^5$	nd-$4,9.10^4$	nd
Wild marjoran	13	$5,9.10^5$	nd-$2,2.10^4$	nd-$3,1.10^4$
Parsley	12	$3,9.10^7$	nd-$4,1.10^3$	nd-6.10^4
Spanish paprika	18	$1,7.10^8$	nd-$2,8.10^4$	nd-5.10^4
White pepper	14	$7,8.10^5$	nd-10^4	nd-2.10^3
Black pepper	11	$4,9.10^7$	nd-$2,7.10^3$	nd-$1,9.10^3$

Table 4 - Total coliforms distribution (mpn/g) in the different spices

Spices	n	< 10	10 - 100	100 - 1000	> 1000
Capsicum	11	4	5	2	--
Garlic	12	12	--	--	--
Anise	7	2	2	2	1
Cinnamon	7	5	1	1	--
Onion	8	5	3	--	--
Cumin-fruit	10	3	2	3	2
Tarragon	6	1	2	2	1
Laurel	3	2	1	--	--
Wild marjoran	13	9	--	--	4
Nutmeg	9	8	1	--	--
Parsley	12	3	4	2	3
Spanish paprika	18	7	3	4	3
White pepper	14	10	1	2	1
Black pepper	11	2	3	3	3

Table 5 - Isolation of pathogen bacteria

Spices	N	Escherichia coli/ 0.1g	Staph. aureus/ 0.1g	Salmonella sp/ 25g	C. perfringens/ 0.1g
Capsicum	11	--	--	--	9.1
Garlic	12	--	--	--	--
Anise	7	--	--	--	--
Cinnamon	7	--	--	--	--
Onion	8	--	--	--	--
Cumin-fruit	10	10	--	--	--
Tarragon	6	--	--	--	33.3
Laurel	3	--	--	--	--
Wild marjoran	13	--	--	--	7.7
Nutmeg	9	--	--	--	--
Parsley	12	--	--	--	--
Spanish paprika	18	--	--	--	27.7
White pepper	14	--	--	--	14.3
Black pepper	11	--	--	--	18,2