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COPPER, LEAD, TIN AND ZINC CONTENTS IN CANNED AND BOTTLED FRUIT AND FRUIT PRODUCTS

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Copper, lead, tin and zinc contents of canned and bottled foods were determined. Maximum levels of Cu, Pb, Sn and Zn in fruit and fruit products were 3.62, 9.67, 56.25 and 50.15 ppm respectively. These levels were comparitively less in products packed in glass jars than those in tin containers.

Key words: Trace element, Heavy metals, Fruit products.

INTRODUCTION

The determination of trace elements in canned food has assumed importance in recent years [1-3]. Depending on the conditions, canned food may provide a significant addition of copper, lead, tin and zinc to the diet as a result of corrosion of the container by its elements [4-7]. The exact determination of traces of metals is necessary in quality control of canned food and for food safety.

In Pakistan, there is a growing tendency to use canning as a method of preservation and packing. Although most of these canned items are exported, yet a small percentage is consumed in the country as well. The primary objective of this study is to assess copper, lead, tin and zinc contents of canned and bottled foods.

MATERIAL AND METHODS

Materials. Freshly packed fruit products in the form of jams (apple, mango, plum, mixed fruits), jelly (apple), marmalade, fruit halves (pear and peach) and fruit salad were purchased from the local market. The content of each can was macerated prior to subsampling. These were kept at ambient temperature which ranged from 18 to 30^{o}

Methods. Food samples (50 g) were wet – digested [8] and analyzed by atomic absorption spectrophotometry (Hitachi 170/10 flame stomic absorption spectrophotometer) for copper, lead and zinc contents. Ammonium pyrrolidine dithio-carbamate (APDC) was used as a chelating agent, and the complex was extracted with methyl *iso*butyl ketone (MIBK) for the final determination.

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The colorimetric method of Krik and Pocklington [9] was adopted for the determination of tin.

pH of the macerated product was recorded with a pH meter (Model EIL 7045/46).

RESULTS AND DISCUSSION

The concentration of copper in canned and bottled fruit products is summarized in Table 1. Copper content was maximum (3.62 ppm) in mixed fruit samples and minimum (1.07 ppm) in pear halves. The jam packed in tin containers and that packed in glass jars showed small variation in copper content. The copper level in all fruit products was below the maximum permissible limit, i.e., 50 ppm for canned fruit and vegetables [10].

Table 1. Characteristics of canned and bottled fruit products

Fruit products	Canned products: No. of samples	Can type*	pH	Bottled products: No. of samples	pH
Apple jam	3	L	3.5	4	3.6
Apple jelly	3	L	3.8	4	3.7
Mango jam	3	L	3.4	4	3.5
Plum jam	3	L	3.5	4	3.4
Mixed fruit jam	3	L	4.0	4	4.1
Marmalade	3	L	3.5	4	3.3.
Pear halves	3	L	3.2	–	–
Peach halves	3	L	3.4	–	–
Fruit salad	3	L	3.3	–	–

*Can type: L. lacquered.

Table 2. Copper, lead, tin and zinc contents of fruit products*

Fruit products	Copper (ppm)		Pb (ppm)		Sn (ppm)		Zn (ppm)	
	Can container	Glass jar	Can container	Glass jar	Can container	Glass jar	Can container	Glass jar
Apple jam	2.37(±0.53)	2.17(±0.23)	7.50(±1.29)	3.25(±0.60)	46.70(±2.21)	4.5(±0.90)	18.25(±2.75)	1.20(±0.20)
Apple jelly	2.85(±0.67)	2.07(±0.10)	9.67(±0.69)	4.50(±1.18)	52.75(±4.76)	3.9(±0.78)	17.50(±3.41)	0.70(±0.15)
Mango jam	1.57(±0.75)	1.20(±0.21)	9.25(±2.21)	4.15(±0.97)	56.25(±2.21)	1.8(±0.16)	14.25(±0.47)	0.85(±0.20)
Plum jam	1.62(±0.53)	1.47(±0.25)	9.25(±2.20)	4.75(±1.47)	48.87(±2.21)	1.5(±0.30)	16.05(±2.36)	0.30(±0.10)
Mixed fruit jam	3.62(±1.83)	3.40(±0.33)	8.50(±1.29)	3.50(±1.20)	45.60(±2.16)	3.3(±0.50)	20.57(±1.37)	1.80(±0.35)
Marmalade	2.60(±0.81)	2.30(±0.15)	9.50(±2.00)	4.25(±1.52)	27.75(±3.80)	2.9(±0.30)	31.00(±2.71)	0.65(±0.22)
Pear halves	1.07(±0.17)	–	8.70(±1.50)	–	48.50(±1.82)	–	32.11(±0.62)	–
Peach halves	1.25(±0.36)	–	7.70(±0.31)	–	31.92(±1.55)	–	38.72(±0.98)	–
Fruit salad	1.17(±0.30)	–	7.50(±1.29)	–	61.87(±1.75)	–	50.15(±0.62)	–

*Each value represents the average of triplicate determinations in the contents of separate cans.

The lead contents of various fruit products packed in tin cans ranged between 7.50 to 9.67 ppm (Table 2). Higher level of lead was observed in the case of apple jelly (9.67 ppm) and marmalade (9.50 ppm) as compared to pear halves (8.70 ppm), peach halves (7.70 ppm) and fruit salad (7.50 ppm). Levels of lead in fruit products packed in glass jars were lower than those in tin cans. The concentrations of lead in all these products were higher than the maximum permissible limit (3.0 ppm) of lead [11]. The lead levels reported here are in agreement with those reported in the literature [12]. Lead may enter the products during processing and due to the addition of various chemicals, but cans appear to be the main source of contamination in canned fruits. High lead contents of canned fruits, though undesirable, yet they do not pose any real threat to be general public health because of the relatively small proportions of such foods being injected by a common man in Pakistan.

There is a great variation in the tin contents of various fruit products as reported in the Table 2. Fruit salad packed in tin cans contained the highest amount of tin (61.87 ppm), while marmalade contained the lowest tin contents (27.75 ppm). Products preserved in glass jars had much lower tin (1.50-4.50 ppm) content than canned samples. The presence of tin in the canned food was well within the recommended FAO/WHO tolerance limits (250.0 ppm) [15]. These results are in agreement with those reported by Peattie *et al.* [14] who reported the presence of tin in canned fruits from 10.0-100.0 ppm. The low tin content in bottled fruits shows that nearly all the tin in the canned food comes from the canned food and contamination from the environment is minimum.

Zinc content of the canned fruits varies widely, ranging from 14.25 ppm in mango jam to 50.15 ppm in fruit salad. From these results, it can be seen that canned fruits were higher in zinc levels than those packed in bottles (0.30-1.80 ppm), but were within acceptable limits of 50 ppm Zn. Similar results have been reported [15] for bottled and canned fruits.

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