

## Nutritional Quality of Commercial Fruit Baby Food

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**Abstract:** Commercial fruit baby food is a preserved fruit product usually made with fruit purees, sugar, water and variable additives (thickening agents, antioxidants, etc.). As the foodstuffs intended for particular nutritional uses, baby foods for infants and young children conforms to a set of strict guidelines e.g. maximum levels for pesticide residues, microbiological contamination, addition of additives, labelling, etc. However, being an important supplement to children diet and/or for their progressive adaptation to ordinary food, the nutritional quality of commercial fruit baby food is very important. Ten samples of commercial fruit baby food from the market were analysed for the fruit content, ascorbic acid and total polyphenols content and total antioxidant capacity determined by DPPH method. Hydroxymethylfurfural (HMF) and furfural content were followed as the time-temperature effort indicators. The method for the estimation of fruit content in products was based on the concentration of glucose, fructose, sorbitol, potassium, formol number, malic and citric acid, phosphorus, ash and refractive index and the results were compared with the Code of practice of AIJN and literature sources. The study indicates that there are big differences in composition and quality of commercial fruit baby food, whereas some samples contain fruits only, another products are diluted with significant amount of sugar, water and starchy fillers.

**Keywords:** fruit puree; quality; fruit content; authenticity, antioxidants

### INTRODUCTION

There is much evidence that the quality and composition of commercial fruit baby food may contribute to present and future health benefits of young children. Since infants between 6 month and 3 years of age are rather limited in their food choices, the commercial fruit baby foods serve as the important source of energy, basic nutrients, fiber, vitamins and minerals and establish their taste and eating patterns. Whereas food safety of baby food from the view of chemical pollution and microbiological contamination is a priority for both producers and state authorities, the composition and nutritive quality of products are often underestimated.

Nutritive value of baby food deeply depends on the composition, what raw materials are used

and what are the proportions of fruit or vegetable content. Apart as the supply of energy (from sugars and polysaccharides) the fruit baby food are perceived as the fiber, ascorbic acid, polyphenols and other antioxidants sources based on the fruit (vegetable) content and composition (BEHRENS & MADERE 1994; MONGEAU *et al.* 2001; WU *et al.* 2004). The other important factors affecting the nutritive value are conditions of processing and all parameters which could cause the reduction of nutrients in products, such as oxidation, non enzymatic browning, the effect of contaminants (metals, migrants from packaging, etc.). These reactions are usually affected by heating, therefore the heat damage during the blanching, boiling, pasteurisation or sterilisation, storage conditions during the retail, etc. are important for the nutritive value of baby food as well.

The aim of this work was to compare declared and real (measured) values of selected nutritive parameters to assess potential adulteration and/or differences between brands. The analyses were focused on the determination of authentic fruit content, identification of sugar and other additives addition, evaluation of the processing on the main quality indices, namely, contents of antioxidant and time–temperature effort indicators.

## MATERIALS AND METHODS

**Samples.** Ten fruit baby foods indented for younger infants were purchased in 2008 in Prague and represent five main trademarks sold in the region. The names, fruit flavor and quality declarations are given in Table 1 in the alphabetical order. One apple or pear single-fruit product and one colored multi-fruit product were chosen from each producer. All of the samples were on the beginning or the first third of their expiration dates.

**Methods.** Determination of chosen chemical markers were performed according to the IFU methods (by International Federation of Fruit Juice Producers), ash content by gravimetry (IFUMA 09), titrable acidity (IFUMA 03), formol number by titration (IFUMA 30), phosphorus by spectrophotometry (IFUMA 35), ascorbic acid by HPLC (IFUMA 17A), sucrose, glucose, fructose and sor-

bitol by HPLC (IFUMA 67). Content of potassium, citric acid and malic acid were determined by capillary isotachopheresis with conductivity detection (VOLDŘICH *et al.* 2002). HMF and furfural were determined by HPLC method. Total polyphenols determined by spectrophotometry and total antioxidant activity by DPPH assay were performed according to KONDRASHOV *et al.* (2009).

## RESULTS AND DISCUSSION

In recent times ready to eat fruit based baby products have become more and more popular, combining the advantages of the traditional home made fruit purees with the benefit of a convenient preparation and assurance of safe and nutritional composition. According to ingredients lists of ten analysed samples, in addition to a certain amount of fruit (usually the most expensive part of raw material), majority of these products consist also of sugars, organic acids and artificial thickening agents (Table 1).

### Composition of samples, real fruit content, evaluation of undeclared additives addition

Consumer acceptance of fruit baby foods is based on the content and composition of the fruit used

Table 1. Declared composition of 10 fruit baby foods

Producer	Fruit flavor	Composition per 100 g of product	Declared fruit content
Hallo	strawberries	fruit content 85 g (apple puree, strawberry puree 20%), water, sugar, modified starch E 1442, ascorbic acid	85
	apples	apple puree (85%), water, sugar, modified starch E 1442, ascorbic acid	85
Hamé	bilberries	bilberry puree (20%), apple puree, water, sugar, corn modified starch E 1442, citric acid, ascorbic acid	35
	apples	apple puree (60%), water, sugar, corn modified starch E 1442, citric acid, ascorbic acid	60
Hami	bilberries	apple puree (71%), bilberry puree (20%), apple concentrate, rice flour, ascorbic acid (min. 15 mg)	91
	apples	apple puree, ascorbic acid (min. 15 mg)	100
Hipp	pears	pear puree (50%), pear juice (46%), rice flour, rice starch, ascorbic acid	96
	plums	plums (50%), water, sugar, rice flour, rice starch, ascorbic acid	50
Sunárek	strawberries and peaches	apples (58%), strawberries (20%), peaches (16%), apple concentrate (6%)	100
	apples	apples	100

in their production. The most of the recent works that evaluate the quality of fruit purees or fruit baby products come out from the confirmation of declared and real composition and identification of undeclared sugar, other fruit types and organic acids addition (FUGEL *et al.* 2005). For the evaluation of fruit content the traditional approach based on the asses of range of components that appear in the fruit over a relatively narrow range such as ash, phosphorus, titrable acidity, formol number, potassium, malic acid and sorbitol was used. The several analytes had to be determined to obtain an accurate estimation of the fruit content, which allows some cross-checking between the various parameters to be made and detection of any distortion caused by the adding of sucrose, syrups, citric acid or other additives into the products. The mean values of AIJN Code of Practice (1999) and Food Composition and Nutrition Tables (SOUCI *et al.* 2000) were used for the calculation of fruit content after the withdrawn of outliers. Figure 1 presents the declared and estimated contents of fruit in our samples of baby fruit foods. The differences between the estimates and declared values varied slightly, usually within the relative error of calculation (15%) and only one (No. 8) of the analysed samples failed to contain the fruit content declared on the label. However, some of the samples were found to contain undeclared additives (sweeteners in samples 1 and 6, citric acid in samples 2, 3, 4 and 6 and ascorbic acid in samples 6 and 7).

### Antioxidants and antioxidant activity and time temperature effort indicators

The range of total antioxidant capacity by DPPH assay was large among different fruit flavors (Table 2). Of all the samples, berries and plums have the highest content which is in agreement with high antocyanin concentration. Also the single antioxidants composition of samples was rather variable. The concentration of total polyphenols varied from 414 to 1452 mg/kg. Content of ascorbic acid, which was in the majority artificially added and declared as antioxidant, was ranged from 186–550 mg/kg.

The formation of furfural and HMF via non-enzymatic browning reaction is often used as the indicator of time-temperature effort within the production and storage and their increase indicates degradation of essential nutrients, ascorbic acid decomposition and pigment destruction. The most of the samples fulfill the recommended maximum HMF concentration in fruit juices and purees 20 mg/kg according to the AIJN Code of Practice (1999) (Table 2).

The study indicates that there are big differences in composition and quality of commercial fruit baby food, whereas some samples contain only fruit, another products are diluted with significant amount of sugar, water and starchy fillers or enriched of declared or undeclared sweeteners and organic acids. That corresponds with the wide range of measured antioxidant activity of samples, which

Table 2. Antioxidants (polyphenols, ascorbic acid, total antioxidant activity) and time-temperature effort indicators (furfural and HMF) contents

Sample No.	Total polyphenols (mg of gallic acid/kg)	Ascorbic acid (mg/kg)	Total antioxidant capacity (mg gallic acid/kg)	Furfural (mg/kg)	HMF (mg/kg)
1	485	333	229	2.7	4.9
2	1028	327	163	2.3	18.6
3	780	354	387	3.3	17.0
4	1452	345	395	2.8	4.1
5	770	239	353	2.2	28.9
6	966	327	264	2.2	9.5
7	704	354	397	2.6	14.0
8	1068	555	475	2.1	14.9
9	1005	400	460	2.1	23.1
10	414	186	187	3.0	10.4

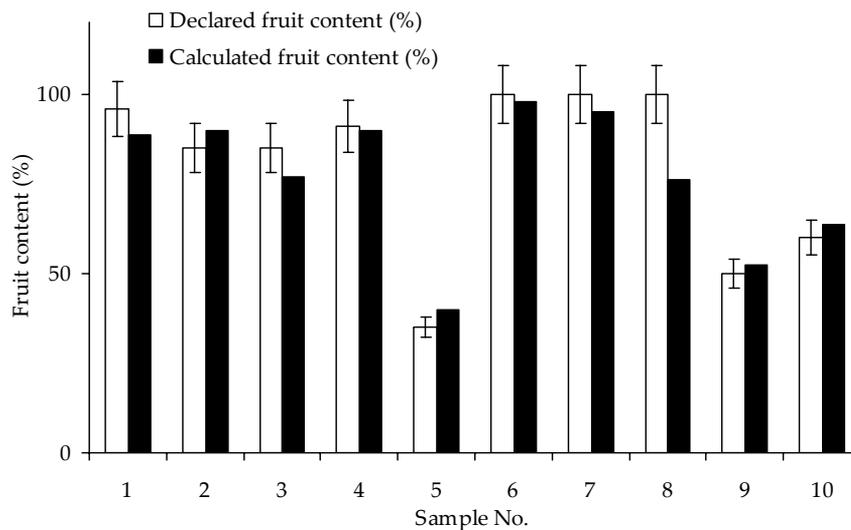


Figure 1. Comparison of declared and according to experimental data calculated fruit content

mostly depends, in the case of fruit based products, on ascorbic acid, polyphenolic compounds and carotenoids concentration. The nutritive value closely correlates with the fruit content in baby food, the highest antioxidation capacity as well as the content of antioxidants was found in the samples with higher fruit content.

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