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REVIEW

Food Iodine Content Table compiled from international databases

Tabela do Conteúdo de Iodo de Alimentos compilada de bancos de dados internacionais

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ABSTRACT

In Brazil, there are no data on the iodine content of foods, making it difficult for the population to assess their consumption of iodine. Such information is necessary for public policies aimed at establishing nutritional goals. The objective this article is to construct a table of the iodine content of foods. For the construction of the table, databases from 14 countries were used. The foods used were those listed in the 2008-2009 Household Budget Survey, except those containing added salt, and the doubts about whether or not the food was submitted to any kind of preparation. The compilation of international databases of iodine content resulted in 266 foods, which were grouped into 15 groups. Iodine was also quantified by food group and iodized salt. Data were presented as median, minimum, and maximum. A broad variation in the iodine content of foods was found

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between countries and inter- and intra-food groups. Those with the highest content were fish and seafood, and dairy products. Regarding salt iodization, these countries followed the recommendation of the World Health Organization, except for Spain, Norway and Turkey. The Food Iodine Content Table can be a useful tool for assessing iodine intake, being important in research on nutritional status, food guidance, and public health programs.

Keywords: Food composition. Food consumption. Mineral.

RESUMO

O objetivo deste trabalho é construir uma tabela de conteúdo de iodo de alimentos visto que tais informações são necessárias para que políticas públicas possam estabelecer metas nutricionais e no Brasil não existem dados do conteúdo de iodo dos alimentos, dificultando a avaliação do consumo pela população. Na construção da tabela utilizou-se bancos de dados de 14 países. Os alimentos utilizados foram aqueles listados na Pesquisa de Orçamentos Familiares de 2008-2009, exceto aqueles que continham sal de adição e os que suscitaram dúvidas em relação à existência de submissão ou não a algum preparo. A compilação dos bancos de dados internacionais do conteúdo de iodo resultou em 266 alimentos, os quais foram reunidos em 15 grupos. Foi realizada também a quantificação de iodo por grupo de alimentos e no sal iodado. Os dados foram apresentados como mediana, mínimo e máximo. Foi encontrada grande variação no conteúdo de iodo dos alimentos entre os países e inter e intra grupos de alimentos. Os que apresentaram maiores conteúdos foram o dos pescados e frutos do mar e dos laticínios. Em relação à iodação do sal, os países seguiram a recomendação da Organização Mundial da Saúde, exceto, Espanha, Noruega e Turquia. A tabela do conteúdo de iodo de alimentos poderá ser um instrumento útil para avaliação da ingestão de iodo, sendo importante em pesquisa do estado nutricional, orientação alimentar e programas de saúde pública.

Palavras-chave: *Composição de alimentos. Consumo alimentar. Mineral.*

INTRODUCTION

Iodine is essential in the synthesis of thyroid hormones, necessary for growth, development, and metabolism in the human body. Its inadequate intake can lead to thyroid dysfunction, causing a series of adverse health conditions, such as hypertrophy of the thyroid gland (goiter), cretinism in children (severe and irreversible mental retardation), deafness and congenital anomalies, cognitive changes (such as decreased learning capacity), and infant mortality [1-3]. Iodine deficiency is considered the main cause of preventable mental retardation [4-6]. On the other hand, it is observed that excessive iodine consumption can increase the risk of induced hyperthyroidism [7].

About 20% of the world population is at risk of iodine deficiency, being more prevalent in developing countries, although its mild or moderate form is found in industrialized countries [8]. Still, iodine deficiency is found in one third of the world population, in the groups of pregnant women, children, and healthy non-pregnant adults [9].

There was a reduction in the prevalence of iodine deficiency in the world, with the following chronological order: in 2003, fifty-four countries were considered iodine deficient, in 2011, they were reduced to thirty-two [10]. This reduction was due to the salt iodization programs and better monitoring of iodine deficiency [11]. In Brazil, due to the high consumption of added salt, and processed and ultra-processed foods, salt iodination was changed from 20 to 60 ppm to 15 to 45 ppm [2].

Differences in the iodine content of foods, together with different eating habits, are decisive factors in the iodine nutritional status in the population [12]. The distribution of iodine in the world is uneven, since the geographical characteristics interfere with its content in food [2,13]. Glaciation, flooding, and erosion remove iodine from the soil and thus it is mainly found in seas and oceans,

which justifies the higher content in foods of marine origin (algae, fish, and shellfish). Geochemical data demonstrate that iodine deficiency in food is related to the low concentration of iodine in the environment, especially in groundwater, which is the main source of water for the population [14].

In Brazil, there is no data on the iodine content of national foods, making it difficult to assess iodine consumption by the population. This information is necessary so that public policies can establish nutritional goals. In this sense, the construction of the Food Iodine Content Table (FICT) becomes an important pillar in the provision of subsidies for the assessment of iodine intake.

METHODS

The construction of the Food Iodine Content Table (FICT) is part of the *Projeto Multicêntrico de Deficiência de Iodo*: Brazil (EMDI, Multicentric Iodine Deficiency Project). The EMDI project aims to assess the magnitude of the deficiency and the factors associated with the iodine nutritional status in Brazilian pregnant women, nursing mothers, and infants.

For the construction of the Food Iodine Content Table (FICT), the review article entitled "Development of databases on iodine in foods in dietary supplements" was used [15]. It contains a list of all countries that had a database of iodine content in food. Of the 24 countries, only 14 made their databases available for consultation. Chart 1 shows the 14 countries consulted and their documents or databases.

Chart 1. Countries and documents or databases consulted for the construction of the Food Iodine Content Table.

Countries	Documents or Databases
Australia	Australian Food, Supplement and Nutrient Database 2011-13 [16]
Bahrain	Food Composition Tables for Kindgom of Bahraim [17]
Denmark	Frida Database [18]
Spain	*Base de Datos Española de Composión de Alimentos* [19]
France	Ciqual French food composition table [20]
Netherlands	*Nederlands Voedingsstoffenbestand* (NEVO) [21]
Italy	*Banca Dati di Composizione degli Alimenti per Studi Epidemiologici in Italia* [22]
Japan	Standards Tables of Food Composition in Japan [23]
Norway	Norwegian Food Composition Database [24]
New Zealand	New Zealand Food Composition Database [25]
United Kingdom	Composition of foods integrated dataset [26]
Sweden	The Swedish Food Composition Database [27]
Switzerland	The Swiss Food Composition Database [28]
Turkey	Turkish Food composition Database [29]

Source: Adapted from Ershow *et al*. [15].

The foods used to construct the FICT were those listed in the 2008-2009 *Pesquisa de Orçamentos Familiares* (POF, Household Budget Survey): Table of the Nutritional Composition of Foods Consumed in Brazil [30]. The option was made to search for foods that did not contain added salt since, in different countries, the levels of iodine added to salt vary. In addition, foods that raised doubts regarding the existence of preparation or not (*e.g.* cappuccino, instant coffee) were excluded. The diagram below illustrates the stages of construction of the FICT (Figure 1).

To build the FICT, international iodine content databases were compiled, resulting in 266 foods, which were grouped into 15 food groups as described in the POF: Cereals and legumes; Tuberous vegetables; Flours, starches, and pasta; Coconuts, chestnuts, and walnuts; Leafy vegetables, fruits, and others; Fruits; Sugars and pastries; Condiments; Meat and offal; Fish and seafood; Poultry and

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eggs; Dairy products; Non-alcoholic drinks and infusions; Oils and fats; and Miscellaneous [30]. The iodine contents in salt were compiled separately due to the divergence of iodine levels in different countries, as they adopt specific legislation for salt enrichment.

The data were described as median (minimum and maximum), expressed in µg of iodine per 100g of food in the FICT. For foods whose data were obtained from only one country, the figures were presented only in absolute terms.

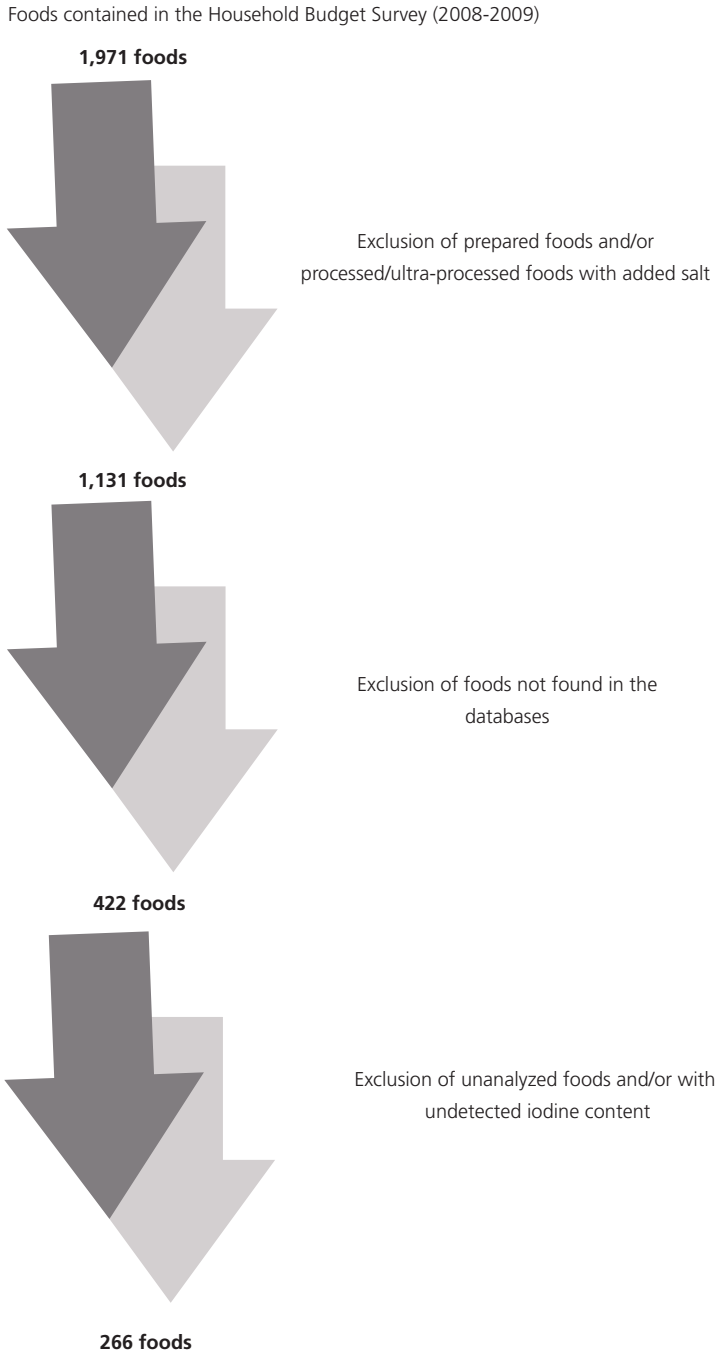

Figure 1. Flowchart of food selection.

RESULTS

The Table 1 shows the Food Iodine Content Table compiled from international databases and the specification of countries that provided data on iodine content. The number of foods and the median (minimum and maximum) iodine content per food group are shown in Table 2. The fish and seafood group had the highest iodine levels. In addition to this, the groups of dairy products and tuberous vegetables stood out in relation to the highest iodine contents among food groups. Regarding the iodine content in iodized salt, a large variation was found, up to 10 times more, in different countries (Table 3).

Table 1. Table of Food Iodine Content compiled from international databases.

1 of 5

Food	Country*	Median µg $100g^{-1}$	Min-Max µg $100g^{-1}$
Cereals and legumes			
Rice (polished, parboiled, *agulha, agulhinha*, *etc*.)	1,3,4,6,8,9,10,11,13	2.00	0.00-2.60
Brown rice	1,6,8,11	2.00	0.00-5.00
Corn (grain)	4,5,6,8,10,12,13	0.50	0.00-5.00
Peanut (grain) - in natura	1,4,6,7,8,9,10,11,12,13	2.10	0.50-20.00
Pea beans	1,3,4,8,11,13	1.30	0.15-2.00
Broad beans (grain)	4,8	1.00	0.00-2.00
Green beans	1,3,4,11,12,13	1.00	0.80-3.00
Linseed	1,12,13	5.00	0.00-10.00
Chickpeas	4,5,8,9,12,13	1.15	0.60-2.80
Lentil	1,3,4,5,9,10,12,13	0.70	0.40-5.70
Soybeans	3,4,5,8,11,12,13	2.00	0.00-24.00
Beans (black, *mulatinho*, purple, *rosinha*, *etc*.)	1,2,3,4,5,8,9,10,11,12,13	1.90	0.00-6.70
Organic green beans	13	25.00**	-
Light popcorn	5,13	1.25	0.00-2.50
Quinoa	1,9,10	0.50	0.20-0.60
Tuberous Vegetables			
Potato	1,3,4,6,9,11,12,13	1.20	0.20-2.60
Sweet potato	1,4,6,8,11,13	1.60	0.00-2.00
Yam	8,10,13	1.00	0.00-1.60
Cassava / manioc	1,9,13	1.80	1.60-2.00
Amerindian yam	13	1.60**	-
Radish	1,3,4,6,8,9,12,13	1.00	0.70-3.00
Beet	1,3,5,9,10,12	0.50	0.30-0.90
Carrot	1,2,3,4,6,9,12,13	1.80	0.40-9.50
Turnip	1,4	10.25	0.50-20.00
Saffron	9	11.00**	-
Organic potato	6	2.00**	-
Flours, Starches, and Pasta			
Oatmeal flour	4,6,8,9,10,13	0.50	0.00-20.00
Rolled oats	4,9,10,13	1.25	0.00-6.00
Corn flour	1,3,4,5,6,9	0.60	0.60-1.00
Maize starch	1,3,4,5,6,8,9,12,13	0.70	0.00-3.70
Rice starch	4	0.60**	-
Flaked corn breakfast cereal	3,4,5,6,9,10,12	0.90	0.00-5.00
Wheat germ	1,3,4,5,12,13	0.25	0.15-5.00
Wheat fiber	4,13	1.55	0-30.1.00
Cereal flakes	9,12,13	1.50	0.00-2.00
Spaghetti	3,4,5,9,11,13	1.95	0.60-12.00
Ground peanuts	1,8,13	2.10	1.00-3.20
Granola	4	5.00**	-
Muslix	3	0.91**	-
Cereal mix	4	8.50**	-
Instant noodles	4	6.90**	-
Soy protein	1	1.00**	-
Organic soy protein	1	1.00**	-

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Table 1. Table of Food Iodine Content compiled from international databases.

Food	Country*	Median µg $100g^{-1}$	Min-Max µg $100g^{-1}$
Coconuts, chestnuts, and walnuts			
Coconut (dry or green)	1,4,5,7,9,11,12,13	1.00	0.30-3.00
Portuguese chestnut	1,3,4,8	0.06	0.00-0.50
Pine nut	4,5,6,9,13	0.20	0.20-0.20
Almond	1,3,4,8,9,10,11,12,13	0.50	0.00-2.00
Hazelnut	1,4,5,9,10,11,12,13	3.55	0.00-17.00
Brazil nut	3,4,5,8,9,11,12	0.375	0.00-21.00
Cashew nut	4,6,7,9,10,11,12,13	6.25	0.00-11.00
Walnut	1,3,4,5,6,11,12,13	5.80	0.50-17.00
Horse chestnut	5	0.00**	-
Pistachio	1,7,10,12,13	6.00	0.50-12.00
Leafy Vegetables, Fruits and Others			
Lettuce	1,4,5,6,8,9,11,12,13	1.25	0.60-7.00
Chicory	1,3,4,6,8,9,12,13	0.70	0.40-2.40
Escarole	4	3.00**	-
Cabbage	1,4,5,8,9,10,11,12	0.75	0.00-2.60
Bell pepper	2,4,5,6,9,11,12	1.00	0.00-6.00
Okra	1,6	1.95	0.90-3.00
Tomato	1,2,3,4,5,6,9,10,11,12,13	2.00	0.10-8.80
Green beans	10,13	1.05	0.30-1.80
Fresh mushroom	1,3,4,5,6,8,10,12,13	1.00	0.00-3.00
Eggplant	1,4,9,10,11,13	0.35	0.00-1.20
Green peas	3,4,5,8,9,13	0.575	0.15-4.20
Onion	1,3,4,6,8,9,10,11,12,13	1.40	0.50-8.90
Garlic	1,3,4,6,8,9,10,11,12,13	2.00	0.00-4.70
Leek	1,3,4,6,9,10,12,13	1.05	0.27-8.60
Alfalfa sprout	1,8,9,12	1.05	0.00-2.00
Fruits			
Banana (dessert, gold, silver, cooking, *etc*.)	1,3,4,5,6,7,8,9,10,11,12,13	2.25	0.00-8.00
Orange (*Pêra*, Natal, Bahia, Valencia, Hamlin, *etc*.)	1,3,4,6,7,9,10,11,12,13	1.00	0.00-2.50
Lime	1,4,7,9,12,13	0.75	0.00-1.05
Lemon (common, Galician, etc.)	1,3,7,8,9,10,11,12,13	0.30	0.00-23.0
Tangerine (*Citrus reticulata*)	1,3,11,13	0.65	0.30-1.00
Tangerine (*Citrus deliciosa*)	1,3,10,13	0.40	0.20-1.00
Pineapple	1,3,4,5,8,9,10,12,13	1.00	0.00-4.30
Avocado	1,4,10,11,12,13	1.35	0.50-2.00
Khaki	4,7,9,13	1.00	0.10-1.60
Fig	1,4,8,10,12,13	1.15	0.00-1.50
Apple	1,3,6,9,10,11,12,13	0.77	0.00-4.00
Papaya	1,4,8,9,12,13	0.45	0.00-1.00
Mango	1,3,4,7,8,9,10,12,13	0.32	0.00-2.00
Passion fruit	1,5,9,10,12,13	0.95	0.10-1.30
Watermelon	1,2,3,5,8,10,12,13	0.27	0.00-10.00
Melon	1,3,4,5,7,8,9,10,12,13	0.40	0.10-7.00
Pear	4,6,7,8,9,10,12,13	1.00	0.00-2.50
Peach	1,3,4,7,8,9,10,12,13	1.80	0.00-3.00
Pinecone	4,8	0.75	0.00-1.50
Grape	1,2,3,4,6,7,8,9,10,12,13	1.00	0.00-2.50
Raisins	1,4,7,9,10,13	2.00	1.70-2.90
Guava	1,4,7,9,12	0.50	0.00-1.50
Plum	1,4,9,10,12,13	0.95	0.00-2.00
Cherry	1,3,4,7,9,10,13	1.00	0.10-2.20
Star fruit	9	0.10**	-
Strawberry	1,3,4,5,7,9,10,13	0.75	0.05-9.00
Tamarind	1	0.50**	-
Cocoa	4,6,7,9,12,13	2.90	2.00-3.10
Nectarine	1,3,4,9,11,12	1.75	0.30-3.00
Pomegranate	1,7,9,12	0.50	0.00-1.00
Acerola "cherry"	13	5.00**	-
Kiwi	1,3,4,5,8,9,10,12,13	0.60	0.00-1.40
Blackberry	1,3,5,9,13	0.40	0.40-0.50
Sugars and pastries			
Demerara	1,4,6,13	0.00	0.00-0.50

Table 1. Table of Food Iodine Content compiled from international databases.

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Food	Country*	Median µg 100g^{-1}	Min-Max µg 100g^{-1}
Brown sugar	1,4,6,8,12,13	0.00	0.00-15.00
Rapadura (solid form of sucrose)	1,6	0.25	0.00-0.50
Chocolate (bar)	4,1	16.05	11.00-21.10
Chocolate (powder of any brand)	6	0.00**	-
Ovaltine	6,13	5.95	2.50-9.40
Peanut butter	3,4,5,12	0.50	0.50-2.00
Marmalade	3,5,9,10	0.40	0.25-1.40
Honey	1,3,4,6,8,10,13	0.50	0.00-5.00
Gelatin of any flavor	1,3,6,9,12	2.50	0.20-6.00
Meringue	9,12	1.60	1.20-2.00
Pudding of any flavor	8,9,12,13	8.10	6.00-17.80
Easter egg	1	12.00**	-
Sugar	1,4,9,13	0.25	0.00-5.00
Light sugar	1	0.50**	-
Cereal bar	4	14.60**	-
Milk shake	3,4,6,9	11.90	7.20-16.70
Condiments			
Mint	1,4,13	4.00	3.00-6.60
Cilantro	1,9	3.65	0.70-6.60
Chili powder	8,9,13	5.00	0.05-5.00
Sesame	1,4,9,10,12,13	0.25	0.00-10.00
Meat, pork and offal			
Filet mignon	4,6,8,13	2.98	0.10-11.00
Striploin	1,5,8	1.00	0.90-1.20
Beef steak	8	1.00**	-
Rump steak	1,3,5,6,8	1.00	0.50-2.90
Sirloin cap	8	1.00**	-
Knuckle	8	1.00**	-
Loin (beef)	1,3,4,5,8	1.00	0.50-3.13
Eyeround	8	1.00**	-
Chuck	8	1.00**	-
Forerib	8	1.00**	-
Shoulder clod	8	1.00**	-
Shoulder with bone	8	1.00**	-
Beef muscle	8	1.00**	-
Brisket point end	4,8	4.00	1.00-7.00
Flank steak	4,8	4.00	1.00-7.00
Flank – round cap	4,8,9	1.80	1.00-7.00
Rib (Beef)	5,6,8,13	2.80	1.00-3.2.00
Beef heart	3,4,5,7,8,9	1.90	1.00-30.00
Beef kidney	5,6,7,8	10.50	4.20-15.00
Beef offal	8	6.00**	-
Beef liver	3,4,6,7,8,9,12,13	4.30	3.00-13.00
Hump steak	8	1.00**	-
Beef tongue	3,5,6,7,8,	2.30	1.00-5.00
Beef *mocotó*	9	1.40**	
Carré / pork chop	8	1.00**	
Pork shank	3,7,8	1.00	1.00-8.00
Pork rib	5,8,12	1.00	0.80-5.00
Pork loin	1,3,4,5,7,89,12,13	1.80	0.10-5.00
Bacon	12,13	2.50	0.00-5.00
Pork	4,6,8	1.00	1.00-3.00
Ground beef	4,8	4.00	1.00-7.00
Pork liver	3,4,8	3.10	1.00-10.00
Pork tongue	3,4	7.70	1.40-14.00
Kid meat	3,8	2.00	1.00-3.00
Goat meat	8	1.00**	-
Mutton	6,7,8	6.00	1.00-7.00
Pork rump	1,3,5,8	0.70	0.50-1.00
Pork backbone	8	1.00**	-
Beef	3,5,6,7,8,9,12	1.00	0.80-7.00
Fish and seafood			
Sea fish (whole, fillet, sliced, *etc*.)	4,13,14	45.00	40.40-80.51
Shrimp	4,5,6,8,9,10,12,13	24.50	5.00-210.00
Crab (*Arenaeus cribrarius*)	3,4,5,8,10	58.00	0.00-60.00
Crab (*Ucides cordatus*)	1,3,5,6,7,10	40.75	0.00-60.00

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Table 1. Table of Food Iodine Content compiled from international databases.

Food	Country*	Median µg $100g^{-1}$	Min-Max µg $100g^{-1}$
Shellfish	8,13,14	101.13	73.00-130.00
Oyster	1,3,4,5,6,7,8,9,10,12	66.50	20.00-160.00
Squid	1,4,5,7,8,13	20.00	8.00-64.00
Fish eggs (any species)	1	27.00**	-
Unspecified fish (whole, fillet, sliced, *etc*.)	1	35.50**	-
Poultry and eggs			
Whole chicken	1,3,4,5,6,7,8	4.10	0.40-8.00
Chicken breast	1,4,5,6,7,8,9,10	1.40	0.50-8.00
Chicken fillet	1,4,6,8,9	1.80	1.00-5.00
Chicken wings	1,4,6,8	5.00	1.00-6.90
Chicken gizzards	5,8	0.70	0.40-1.00
Chicken heart	1,4,8,9,12	1.20	0.00-7.00
Chicken liver	1,4,6,9,10,12	2.70	1.40-5.00
Turkey (unspecified parts)	4,7,12	2.20	2.00-5.00
Turkey wing	4,7	4.00	2.00-6.00
Quail	1	3.10**	-
Chicken wings and feet	6,7	6.50	5.00-8.00
Chicken eggs	1,2,3,4,5,6,7,8,9,12,13	32.00	2.00-57.60
Quail egg	1,4	50.80	44.00 -57.60
Duck breast	6,8	4.10	1.2-7.00
Duck meat	1,4,6,7,8	1.20	1.2-7.00
Dairy products			
Whole cow milk	1,3,4,5,6,8,9,13	14.85	9.00-24.80
Fresh cow milk	1,2,3,4,5,8,9,10	17.90	7.00-52.50
Goat milk	1,4,13	10.00	5.00-22.30
Powdered milk	1,2,3,4,5,6,7,10,12	30.00	7.00-150.00
Condensed milk	4,5,6,7,8,12,13	35.00	8.00-160.00
Table cream	8,12	9.20	8.00-10.40
Whipped cream	6,12	8.60	7.30-9.90
Yogurt of any flavor	3,4,5,6,7,8,9,11,12,13	11.70	5.50-48.00
Low-fat yogurt	1,3,4,5,6,7,8,11,12,13	14.45	5.30-48.00
Natural yogurt	1,3,5,6,7,8,9,11,12,13	13.50	8.00-63.00
Dairy beverages	4,5,11	24.30	11.00-25.00
Fermented milk	3,4,5,6,12	6.00	4.00-24.30
Curd	4,12	12.00	9.00-15.00
Flavored soy milk	1,3,4,6,11,12,13	1.00	0.00-90.35
Unspecified cheese	4,5,13	4.80	1.70-24.20
Flavored milk	1	6.00**	-
Aromatized milk	1	6.00**	-
Cream	1,4,10,12,13	8.00	1.00-12.00
Skimmed cow milk	4,5,6,9,12,13	14.15	3.10-16.00
Semi-skimmed cow milk	3,4,5,9,10,13	11.15	8.50-20.00
Pasteurized, unspecified milk type	3,5,9	11.70	7.00-14.80
Flavored milk	8,9,10	13.00	6.30-14.00
Aromatized milk	8,9	14.50	13.00-16.00
Non-Alcoholic Drinks and Infusions			
Traditional cola soda	2,4,5,7,13	0.00	0.00-4.10
Traditional Coca Cola	4,7	0.50	0.00-1.00
Traditional orange soda	5	0.40**	-
Traditional guarana soda	5	0.40**	-
Diet yogurt of any flavor	5	0.40**	-
Traditional grape soda	4,5	0.20	0.00-0.40
Coconut water	1,12	0.25	0.00-0.50
Yeast	13	4,00**	-
Barley powder	3,4,6,9,13	0.50	0.20-5.00
Traditional tonic water	1,13	0.30	0.00-0.60
Diet tea (black, chamomile, lemon balm, lemon grass, *etc*.)	2,3,6,13	0.70	0.22-2.80
Energy drink	1,9	0.25	0.00-0.50
Tea (black, chamomile, lemon balm, lemon grass, *etc*.)	5,6,9,13	0.31	0.00-1.00
Nescafé	1	0.60**	-
Yeast	1	16.60**	-
Beer (with alcohol)	1,3,4,5,7,8,9,12,13	1.00	0.00-8.00
Brandy / cachaça	1	0.50**	-
Vodka	1,4,12	0.00	0.00-0.50

Table 1. Table of Food Iodine Content compiled from international databases.

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Food	Country*	Median µg 100g^{-1}	Min-Max µg 100g^{-1}
Whiskey	1	0.50**	-
Champagne	3	35.00**	-
Champagne cider	1,5,6,13	1.10	0.50-10.00
Cognac	1,13	0.25	0.00-0.50
Wine	1,3,4,5,6,7,9,10,13,14	2.00	0.00-10.00
Beer (without alcohol)	1,7,9	0.75	0.50-1.00
Oil and fat			
Olive oil	3,4,5,8,12,13	0.00	0.00-0.00
Soy oil	1,3,5,8,9,12,13	0.00	0.00-0.80
Pork lard	1,3,5,7,8	1.80	0.00-7.00
Lard	1	0.50**	-
Palm oil	12	0.00**	-
Miscellaneous			
Pineapple juice	1,5,9,10	1.05	0.20-1.90
Orange juice	1,3,4,5,6,7,8,9,10,12,13	1.00	0.00-2.00
Mango juice	4,5	1.90	0.80-3.00
Peach juice	7,1	1.80	0.60-3.00
Peach juice syrup	13	2.60**	-
Banana smoothie	1	11.20**	-
Smoothie	1	11.30**	-
Gooseberry	4	1.00**	-
Lemon soda	7	1.00**	-
Coffee with milk	4,5,8,9,11,13	3.85	2.00-17.40
Espresso	1,5,9,10,12	1.10	0.10-3.00

Note:*The references to access the international iodine content tables can be seen in Chart 1; **The absolute values were presented because these foods were found in the database of only one country; 1: Australia; 2: Bahrain; 3: Denmark; 4: Spain; 5: France; 6: Netherlands; 7: Italy; 8: Japan; 9: Norway; 10: New Zealand; 11: United Kingdom; 12: Sweden; 13: Switzerland; 14: Turkey.

Table 2. Number of foods and median (minimum and maximum) iodine content of foods in the groups.

Food groups	Number of foods	*Median µg 100 g^{-1}	Min-max µg 100 g^{-1}
Cereals and Legumes	15	1.30	0.50-25.00
Tuberous Vegetables	11	1.80	0.50-10.25
Flours, Starches, and Pasta	17	1.00	0.50-8.50
Coconuts, Chestnuts, and Walnuts	10	0.55	0.10-6.25
Leafy Vegetables, Fruits and Others	33	1.05	0.15-5.00
Fruits	33	0.77	1.00-5.00
Sugars and Pastries	17	0.50	0.00-16.05
Salts and Condiments	4	3.82	0.25-5.00
Meat and offal	39	1.00	0.70-10.50
Fish and Seafood	9	40.75	20.00-101.13
Poultry and Eggs	15	3.1	0.70-50.80
Dairy products	23	11.70	1.00-17.90
Non-Alcoholic Drinks and Infusions	24	0.50	0.00-35.00
Oil and fat	5	0.00	0.00-1.80
Miscellaneous	11	1.80	1.00-11.30

Note: *The references to access the international iodine content tables can be seen in Chart 1.

DISCUSSION

A great variation was found in the iodine content of foods among countries, as shown in the Food Iodine Content Table (FICT) compiled from the international databases (Table 1). These findings can be justified by the interference of geographical characteristics in the iodine content, since it is proportional to its content in each country's soil and water [13]. This variability is also related to animal and plant production practices and the type of food processing [15]. It is worth mentioning that, in this study, prepared and processed/ultra-processed foods with added salt were not listed.

Table 3. Iodine content in iodized salt from different countries.

Countries	*Iodized salt µg $100g^{-1}$
Australia	4400.00
Bahrain	-
Denmark	1560.00
Spain	600.00
France	1860.00
Netherlands	-
Italy	-
Japan	**
Norway	500.00
New Zealand	4900.00
United Kingdom	-
Sweden	5000.00
Switzerland	2500.00
Turkey	950.81

Note: *The references to access the international iodine content tables can be seen in Chart 1. **Value not found.

The high iodine content found in the fish and seafood group may be related to the fact that iodine is naturally found in seas and oceans, accumulating in marine organisms [14,31]. Meanwhile, the expressive iodine content of the dairy group can be explained by the fact that iodine is used to fortify food for cows, or as an antiseptic for udders and containers [4]. If the animals are fed with plants that grew in soil with low in iodine, the content of this element may be poor as well [1]. This fact may justify the great variability in iodine content within this group. Another group where iodine contents also stood out was the tuberous vegetables group, probably because iodine is deposited in the terrestrial environment by rain, from the evaporation of marine water [31].

Regarding iodized salt, the large variation in iodine content is possibly related to differences in the amount of iodine added in the process of salt enrichment [15,32], since the WHO suggests that the average amount of iodine added to the salt should be based on the estimated consumption of salt by the population, with 14 to 65mg kg^{-1} of iodine in the salt (1400 to 6500µg 100 g^{-1}), for an estimated salt intake from 14g/day to 3g/day, respectively [8]. As observed in the databases, Spain, Norway, and Turkey did not comply with this recommendation. In Brazil, the reduction of the salt iodization levels from 2000-6000µg $100g^{-1}$ to 1500-4500µg $100g^{-1}$ occurred due to the large consumption of added salt and ultra-processed and processed foods [2].

The main limitation of the FICT, for its use in Brazil, is the fact that its data are compiled from other countries, not from food produced in Brazil. However, because it is intercontinental data, this discrepancy may have been minimized. Considering the scarcity of these data in Brazil and the importance of iodine analysis in dietary assessment, the FICT becomes an indispensable instrument for assessing iodine consumption.

CONCLUSION

Information on the iodine content in foods is essential for assessing their intake, being important in research of nutritional status, dietary guidance, and public health programs. Therefore, the FICT, compiled from international databases, becomes an essential tool for this purpose, since there are no data produced in Brazil on the iodine content in foods.

CONTRIBUTORS

RCRM MILAGRES, participated in the design, analysis, and interpretation of data, review and approval of the final version of the article. ECG SOUZA and MSL DUARTE participated in the conception, design, analysis, and interpretation of data, review and approval of the final version. MCG PELUZIO and SC FRANCESCHINI participated in the conception, design, analysis, and interpretation of data.

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