SURVEY OF IODINE LEVELS IN BEVERAGES ENRICHED WITH SEAWEED

SUMMARY

In response to an increased number of reported human thyroid dysfunction cases resulting from high iodine intake, the National Food Incident Response Protocol was activated. An investigation into the cause of this increase suggested a link to consumption of Bonsoy soy beverage which contained high iodine levels resulting from the addition of seaweed (kombu, *Laminaria* spp) during the manufacturing process. FSANZ, in consultation with Australian States and Territories, has conducted a survey investigating iodine levels in other beverages with added seaweed. A total of 44 beverages were analysed and the results of this survey indicate that maximum iodine levels detected are below levels which would give rise to health concerns. Consumers can be reassured that iodine levels in the beverages analysed are well within the safety margin, and pose a negligible risk to Australian and New Zealand consumers.

BACKGROUND

On the 24 December 2009 Food Standards Australia New Zealand (FSANZ) issued advice for consumers not to consume Bonsoy soy beverage products. This advice was provided following a cluster of cases in NSW presenting with thyroid problems. All cases (nine adults aged from 29 to 47 years, and one child) reported having consumed Bonsoy soy beverage products. A voluntary food recall was coordinated by FSANZ immediately.

Initial testing of Bonsoy soy beverage showed unusually high levels of iodine. These levels were such that an adult consuming as little as 30 mL a day (one eighth of a cup) would have iodine intake exceeding the NHMRC's Upper Level of Intake (UL) for iodine. For adults, the UL is 1100 µg/day. As a result of this testing, a consumer level recall of all Bonsoy soy beverage products was initiated by the importer.

On 5 January 2010, the National Food Incident Response Protocol (the Protocol) was activated by FSANZ. The Protocol provides clear guidance to member agencies of the Food Regulation Standing Committee's Implementation Sub-Committee[1] (ISC) for responding to a range of national food incidents in a timely, appropriate, consistent and coordinated manner. It provides a link between the protocols of Australian Government and State and Territory agencies responsible for food safety and food issues.

In response to the Protocol activation, the Food Surveillance Network[2] convened and agreed to conduct an ISC National Coordinated Food survey to investigate iodine levels in other beverages enriched with seaweed. FSANZ coordinated the survey with States and Territories visiting food retail outlets to identify beverages enriched with seaweed that were available for sale. This information was forwarded to FSANZ for compilation and

[1] The Food Regulation Standing Committee's Implementation Sub-Committee (ISC) was established to develop guidelines on food regulations and standards implementation and enforcement activities. ISC comprises representatives from the Commonwealth, each State and Territory jurisdiction and New Zealand and includes representation from the Australian Quarantine and Inspection Service, FSANZ and a representative of Australian local government. ISC members are responsible for food safety and food issues and include the government agencies in each jurisdiction with statutory responsibility for food safety.

[2] FSANZ coordinates the Food Surveillance Network (FSN), which facilitates the planning and coordination of the food surveillance and monitoring activities undertaken by government health agencies in Australia and New Zealand. The FSN comprises representatives from most State and Territory jurisdictions and the Australian and New Zealand governments.

development of a sampling plan in consultation with the food regulatory agencies in the Australian States and Territories.

In recent years, FSANZ has monitored iodine levels in food available for sale in Australia and has estimated dietary intake for a various population groups. For example, iodine levels in foods were collected in 2004 as part of the 22nd Australian Total Diet Study (ATDS), which is available on the FSANZ website (http://www.foodstandards.gov.au/scienceandeducation/publications/22ndaustraliantotaldietstudy/).

OBJECTIVE

The objectives of this survey are:

- To determine the levels of iodine in soy and cereal based beverages enriched with seaweed or seaweed derived products (e.g. Aquamin, E407); and
- To assess whether there are any potential health and safety risks associated with iodine levels in soy and cereal based beverages enriched with seaweed or seaweed derived products.

METHODOLOGY

Sampling

Samples were collected from a variety of retail outlets in the ACT in March 2010. A total of 44 individual samples were purchased and composited prior to analysis. Each composite sample comprised of four primary samples (individual purchases). Composites were comprised of the exact same product with varying best before dates/batch codes, except for one 'soy milk' composite, the 'dairy milk' composite and the 'other' composite category. Samples were dispatched to the laboratory in an unopened state.

Analysis

FSANZ engaged the National Measurement Institute (NMI) to analyse the beverage samples using a NATA accredited method of alkaline digestion followed by Inductively Coupled Plasma-Mass Spectrometry (ICP/MS). This method was used in the FSANZ 22nd ATDS (FSANZ, 2008). The Limit of Detection (LOD) for this analysis was 0.005 mg/kg, with a Limit of Reporting (LOR) of 0.01 mg/kg.

RESULTS

A summary of the results from this survey are provided in Table 1. Of the 11 composite samples analysed, all samples had iodine levels detected above the LOR, except for one soy milk composite which was reported as <0.01 mg/kg.

Table 1: The range in iodine concentration (mg/kg) in beverages enriched with seaweed.

Beverage Type	*Description*	*Seaweed type listed on product ingredient list*	*Number of composites≠ analysed*	*Mean concentration (mg/kg)*	*Range (mg/kg)*
Soy milk	Includes varieties that are regular, lite, calcium enriched, organic and powdered soy (analysed as ready to consume)	Kombu, seaweed, Aquamin†, E407‡	6	0.04	<0.01 - 0.10
Rice milk	Includes varieties that are organic, calcium enriched	Seaweed, Aquamin	3	0.05	0.04 - 0.06
Dairy milk	Includes cow's milk, goat milk, vitamin enriched, low fat varieties	E407	1	0.16^	N/A
Other	Evaporated milk, regular, soy, lite, coconut varieties included	E407	1	0.41^	N/A

† Aquamin is a seaweed-derived source of mineral; ‡ E407 (carrageenan) is a polysaccharide derived from red seaweed; ≠ Each composite comprised of 4 primary samples (individual purchases); ^ Only one composite sample was analysed.

These results are consistent with previous FSANZ analyses of soy and dairy milk beverages, which have shown iodine concentrations of 0.1 mg/kg in regular fat soy beverage and concentrations ranging from 0.15 to 0.45 mg/kg in regular fat cow's milk (FSANZ, 2008).

HEALTH SIGNIFICANCE OF SURVEY RESULTS

The assessment undertaken by FSANZ to determine any public health and safety risks is based on establishing a maximum iodine concentration that could safely be present in beverages without risk of exceeding the UL established for iodine. To determine an appropriate UL of intake, 2-3 year old children were used in these calculations, as this is the age group previously identified by FSANZ to be at greatest risk of exceeding the UL for iodine for their age group (200 µg/day).

The age-specific ULs for iodine are not absolute thresholds for toxicity; they represent intake limits which provide a comfortable margin of safety. Previously, FSANZ noted there is evidence to indicate that healthy individuals including children can exceed their respective UL by 2-3 times without apparent adverse effects[3]. For a child aged 2-3 years, this means intakes of 400 - 600 µg of iodine per day.

FSANZ estimates that for a 2-3 year old child who consumes soy beverages rather than dairy milk, background intakes of iodine are approximately 76 µg/day (mean), taking into account iodine from the addition of iodised salt to bread, and that typically about half of iodine intake in this age group comes from dairy foods. The iodine intake from a soy or cereal based beverage to reach 400 µg (2xUL) of iodine per day can then be calculated as follows:

(UL × 2) – Background intake = 400 µg/day – 76 µg/day = ***324 µg/day***

Allowing for a threefold exceedance of the UL, the maximum intake would be **524 µg/day,** and the UL would be achieved with an additional iodine intake of **124 µg/day**.

In the 2007 National Children's Nutrition and Physical Activity Survey (Commonwealth of Australia 2008 a, b), the 90th percentile of soya milk consumption reported for 2-3 year olds, averaged over two days, was 661 g/day, approximately equivalent to three glasses of milk. Using the iodine intake from a soy or cereal based beverage to reach 600 µg of iodine per day (3xUL), and the estimated soy and cereal beverage consumption, the maximum iodine concentration that could be acceptable in a cereal beverage can be calculated as:

Intake from beverage to reach 600 µg ÷ 90th percentile of soya milk consumption × 1000 = 524 µg/day ÷ 661 g/day × 1000 = 793 µg/kg = ***0.79 mg/kg***

Table 2 shows the amount of beverages that would need to be consumed each day before a 2-3 year old child would achieve one or two times the UL for their age group. For soy and rice based beverages, more than 1 or 2 L (respectively) would need to be consumed every day before the UL would be exceeded and more than 3 or 5 L respectively before twice the UL is reached. It is highly improbable that 2-3 year old children would consume such large amounts of these products on a daily basis. Typical high (90th percentile) consumption of these beverages would lead to an iodine intake in the order of 150 µg/day, which is below the UL for this age group.

The highest concentration of iodine measured was 0.44 mg/L in evaporated milks ('other' in Table 2). A 2-3 year old child would have to consume about 280 mL of evaporated milk each day to reach the UL, whereas high consumers (90th percentile) in the 2007 National Children's Nutrition and Physical Activity Survey consumed less than 60 g/day.

[3] Although it is generally undesirable to exceed the UL, there is evidence to indicate that young children are able to exceed their respective estimated ULs by 2-3 fold without apparent adverse consequences. This, and the reversible nature of the endpoint (sub-clinical hypothyroidism), means such intakes are unlikely to represent a health and safety risk to young children, though a reduced margin of safety exists (FSANZ, 2007). FSANZ continues to monitor the available information on the safety of dietary iodine, including safety for neonates whose exposure to iodine is via their mother's milk.

Based on this estimate, FSANZ concludes that the concentrations of iodine found in the samples tested in this survey are unlikely to result in iodine intakes above the UL and therefore are unlikely to result in clinical effects.

Table 2: Amount of beverages that would need to be consumed daily by 2-3 year olds to result in a total iodine intake of one or two times the UL*

Beverage Type	Maximum Concentration (mg/L) ‡	Amount of beverage to exceed 1xUL	Amount of beverage to exceed 2xUL
Soy beverage	0.10	1.2 L	3.2 L
Rice beverage	0.06	2.1 L	5.4 L
Dairy milk	0.17	0.73 L	1.9 L
Other	0.44	0.28 L	0.7 L

* Assumes a background iodine intake from other dietary sources of 76 µg/day. UL = 200 µg/day
‡ Maximum concentration values in mg/kg have been converted to mg/L based on the specific gravity of each composite sample as determined by the laboratory. The average specific gravity of each beverage type was used to convert the maximum concentration in mg/kg (Table1) to mg/L. The specific gravity of the various beverage types ranged from 1.027-1.076.

RISK MANAGEMENT

The risk management approach to the initial food incident involving Bonsoy soy milk was managed through the Protocol, where a consistent risk management approach was agreed amongst the relevant regulatory agencies. The same risk management approach was applied to the findings of this survey.

The maximum iodine concentrations detected in this survey were all below levels which would give rise to concern, and are highly unlikely to result in clinical effects. Based on this, it was decided that no additional risk management was necessary and that products surveyed were considered safe and suitable for consumption. FSANZ is currently considering whether there is any need for future amendments to the Food Standards Code, in light of this food incident.

State and Territory Health departments continue to monitor cases of thyroid dysfunction closely. The Australian Quarantine Inspection Service (AQIS) continues to monitor Bonsoy milk imported into Australia. Once five consecutive importations of the product have been found to be safe, then AQIS will withdraw the Holding Order on Bonsoy. At this stage, no further action will be taken in relation to other cereal based beverages enriched with seaweed.

RISK COMMUNICATION

For further information relating to this incident and iodine generally, please refer to the FSANZ website (www.foodstandards.gov.au) and the relevant factsheet (http://www.foodstandards.gov.au/scienceandeducation/factsheets/factsheets2010/bonsoysoymilkrecallb4693.cfm).

CONCLUSION

The findings from the survey of iodine levels in beverages enriched with seaweed indicates that no additional risk management is required in relation to currently marketed products. This provides significant reassurance to the Australian and New Zealand population who consume these products.

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