"I certify that the above statement made by the candidate is true and that this thesis is suitable for submission to the university for the purpose of evaluation"

.....
Dr. S.P. Deraniyagala

14.12.2000
.....
Date

"The work described in this thesis was carried out by me under the supervision of Dr. S.P. Deraniyagala and a report on this has not been submitted to any university for another degree"

W.V.S.M. Perera

14/12/2000
Date

LEVELS OF IODINE IN SRI LANKAN FOOD VARIETIES

by

Wathure Vidanalage Shirani Manel Perera

Thesis submitted to the University of Sri Jayawardenepura for the award of the degree of Master of Philosophy in Chemistry on 14.12.2000

Dedicated
to
my loving parents

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ABSTRACT

Iodine is needed for the synthesis of thyroid hormones which are necessary for mental and physical health of both humans and animals. It cannot be synthesized in the human body and therefore should be provided in the daily diet. Daily requirement is around 150 μg for an adult. The non availability of this amount regularly can lead to iodine deficiency disorders (IDD) of which the best known manifestation is endemic goiter. One approach for elimination and prevention of iodine deficient disorders in Sri Lanka would be from iodine rich dietary sources without recourse to measures such as iodization of salt. The inclusion of iodine content of Sri Lankan foods in food composition tables can make the public aware of the iodine levels in foods consumed in their daily diet. Thus the objective of this study was to determine the levels of iodine in Sri Lankan food varieties. This involved the use of Sandell and Kolthoff reaction which is a the redox reaction between Ce(IV) and As(III) catalyzed by trace amounts of iodide ions in acidic medium. Kinetics are monitored over longer reaction times and a different calibration plot to those previously published was employed in the determination of iodide concentration. The method is relatively sample and sensitive and the minimum working concentration was found to be 4 ng cm^{-3} in the working iodide solution. The

accuracy was found to be satisfactory for all the standard solution analyzed both at high and low levels of iodide. The Sri Lankan food variety analyzed for iodide in this study included prawns, crabs, fish, cereals, pulses, spices, fruits, vegetables, tap/ground water and coconut/king coconut water.

The iodide content of four marine prawn species,namely, *Penaeus indicus* (Indian white prawn), *Penaeus monodon* (Giant tiger prawn),*Penaeus semisulcatus* (Green tiger prawn), and *Metapenaus ensis* (Greasyback prawn) collected from Negombo on three different days was determined. The iodide content was highest in *Penaeus indicus* (121 ± 6 μg/110g). For all species under study, iodide was found to be largely concentrated in the exo-skeleton rather than in the edible flesh. Boiling of prawns leads to significant loss of iodide with relative loss being greater when boiled without the exo-skeleton. Moreover, boiling prawns with the exo-skeleton intact leads to an increase the iodide content in the edible flesh. The mean iodide levels of raw prawn species (both with and without exo-skeleton) collected on three different days are not significant ($p > 0.5$).

The iodine content of three crab species namely *Neptunus pelagicus*, *Neptunus sanguinolentus* and *Scylla serrata* collected on different days from Negombo was determined. Marine crab flesh (*Neptunus pelagicus*, 62.3 ± 2.8 μg/100g; *Neptunus Sanguinolentus*, 95.8 ± 4.9 μg/100g) is a rich source of iodine, compared to lagoon crab (*Scylla Serrata*, 29.4 ± 1.9 μg/100g). The most of the iodine in crabs are concentrated in the gills. Iodine in raw crab flesh was lost on boiling (35 – 55%) and the relative percentage iodine loss from marine crabs (33.5 ± 3.7) significantly lower than lagoon

crabs (49.9 ± 4.7). The relative percentage loss of iodine from crabs was in the same range as prawns.

The iodine content of twenty seven species of marine/fresh water fish collected from different areas of Sri Lanka on different days has also been determined. The iodine content in marine fish was found to be significantly higher (three to five times) than fresh water fish except in the case *Histophorous gladius* which had a very low iodine level. Large marine pelagics had a significantly lower level of iodine than small pelagics. All species under study lost iodine on boiling. A comparison of the means ($p = 0.05$) of the relative percentage loss of iodine in marine/fresh water fish during boiling indicates that the loss in large marine pelagics and fresh water fish is significantly higher than small marine pelagics and marine fish respectively.

The iodide content of five types of pulses namely *Phaseolus aureus* (Mung bean/Green gram), *Cicer arietinum* (Chick-peas/Kadala), *Lens esculentas* (Mysoor dhal), *Cajanus cajan* (Bengal gram/Kadala parippu), & *Vigna sinensis* (black pea/cowpea) and three types of cereals namely *Oryza sativa* (rice: sudu kekulu (polished), rathu kekulu (raw), samba (parboiled), *Triticum vulgarae* (wheat flour) & *Eleusine coracana* (millet/kurakkan) purchased from two areas in Sri Lanka was determined using the Sandell and Kolthoff reaction.

Of all species analyzed, *Phaseolus aureus* falls into the iodine rich category and can provide the daily recommended quantity of iodine with one single meal. Boiling of these foodstuffs leads to loss of iodine with the relative loss being greater for cereals than for pulses.

CHAPTER 1

INTRODUCTION

1.1 Importance of iodine

For optimal human health at least ten elements namely iron, zinc, copper, selenium, manganese, fluorine, iodine, molybdenum, cobalt and chromium are essential in minute quantities. They are hence called essential trace elements or more suitable to be called micronutrient elements. These elements constitute 0.005% of the body weight. These play vital roles in regulating the body metabolisms and maintenance of life. The elements, however, can become toxic at sufficiently high intakes and margin between benificial and toxic levels may be small.

Of the ten micronutrient elements, iodine plays a major role in the human body. It cannot be synthesized in the human body and therefore should be provided in the daily diet. A healthy adult contains 15 – 20 mg of iodine of which 70-80% is in the thyroid gland. Daily requirements of iodine according to age is given in table I.

Table I Recommended level of iodine intake

Age	Intake (μg/day)
0 - 12 months	50
1 - 6 years	90
7 - 12 years	120
12 - adulthood	150
Pregnant mothers	200
Lactation	200