

# 開發利用感應耦合電漿質譜儀檢測母乳碘之新方法

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## 摘要

哺乳婦女與其接受母乳哺育之嬰兒為碘營養缺乏之易感受族群，嬰幼兒時期缺碘，對生長發育和甲狀腺功能有不良影響，準確評估此族群之碘營養狀態至關重要。現今以哺乳婦女之群體尿碘中位數  $> 100 \mu\text{g/L}$  來代表碘營養充足之標準，因為沒有考慮到母乳碘排出之情況，可能有誤判的情形，然而臺灣尚未發展出檢測母乳之技術。過去利用 Sandell-Kolthoff 比色法檢測尿液碘濃度的方式，難以準確檢測母乳此等複雜的基質，為了能運用感應耦合電漿質譜儀進行鑑驗，我們首先嘗試運用感應耦合電漿質譜儀進行尿液碘濃度測定，目前已經獲得認證為檢測優良單位。此次，我們將憑藉以感應耦合電漿質譜法檢測尿碘濃度的經驗，進一步開發檢測母乳碘之技術。現行前處理母乳的方式，有利用四甲基氫氧化銨萃取者，亦有利用鹼稀釋或者酸消化的方法，配合臺北榮總實驗室之環境與設備，我們將優先考慮使用氨水稀釋的方法，進行母乳碘檢測，並以 NIST1549 奶粉標準品進行校正，進行準確度測試。此技術有助於釐清缺碘性疾病和甲狀腺功能異常的成因，對於獲得本土重要的碘營養與飲食模式之資料大有裨益。

關鍵字：碘、母乳、感應耦合電漿質譜儀

## Abstract

Breastfeeding women and their breast-fed infants are vulnerable to iodine deficiency because iodine deficiency in the neonates may result in consequences such as mental retardation, poor intellectual performances, and thyroid dysfunction. A maternal median urinary iodine concentration (UIC) above  $100 \mu\text{g/L}$  defines adequate iodine status in lactating women. However, the current standard does not account for the secretion of iodine into breastmilk and could not truly reflect the amount of iodine delivered to the infants. Measuring breastmilk median iodine concentration (BMIC) is of crucial importance but the method to measure MBIC has not been developed in Taiwan. Traditionally, UIC was measured spectrophotometrically through Sandell-Kolthoff (S-K) reaction but this method was not suitable for measuring iodine content in complex matrixes including the breastmilk. Inductively coupled plasma mass spectrometry (ICP-MS) serves as the gold standard and the method to measure UIC by ICP-MS has been developed by our group. The results have been certified by the Ensuring the Quality of Iodine Procedures (EQUIP) program for excellence performance in 2019. The aim of the study is to develop an ICP-MS method to measure BMIC Taipei Veterans General Hospital (TVGH). The ICP-MS analysis for BMIC could be performed following either tetramethylammonium hydroxide extraction, acid digestion, or alkaline dilution. Using ammonia to dilute the breast-milk before ICP-MS analysis may fit the current ICP-MS protocol in TVGH and the ICP-MS setting shall be modified based on serial testing and corrections using NIST 1549 non-fat milk powder as standard reference. The result of the current study may aid in the etiological diagnosis of iodine research and influence the content of our national nutritional guidelines.

Keywords : iodine, breast milk, inductively coupled plasma mass spectrometry