



**UNIVERSITI PUTRA MALAYSIA**

**PLASMA ZINC CONCENTRATION IN CORD BLOOD AND ASSOCIATED  
FACTORS OF INFANT BIRTH WEIGHT AMONG MOTHERS WHO  
DELIVERED IN FATEMIEH HOSPITAL, HAMADAN, IRAN**

**MOJGAN NAZARI**

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FACTORS OF INFANT BIRTH WEIGHT AMONG MOTHERS WHO  
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**By**

**MOJGAN NAZARI**

**Thesis Submitted to the School of Graduate Studies, University Putra Malaysia,  
in Fulfilment of the Requirements for the Degree of Doctor of Philosophy**

**February 2012**

*This dissertation is dedicated to*

*My dear parents*

*Mr Firoux Naxari and Mrs Shahin Ahmadian*

*My lovely sisters Mitra and Maryam*

*All my teachers who taught me during my life*

*And specially is dedicated to homeland soldiers sacrificed their lives for their  
country*

Abstract of thesis presented to the Senate of University Putra Malaysia in fulfillment of the requirement for the degree of Doctor of Philosophy

**Plasma Zinc Concentration In Cord Blood And Associated Factors Of Infant Birth Weight Among Mothers Who Delivered In Fatemieh Hospital, Hamadan Iran**

By

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**February 2012**

**Chairman: Associate Professor Sharifah Zainiyah Bt. Syed Yahya, PhD**

**Faculty: Medicine and Health Sciences**

Micronutrient deficiency is one of the most prevalent nutritional problems all over the world, especially in the developing countries. Nowadays, more than 2 billion persons are deprived of getting the minimum micronutrients intake needed for health. Zinc is an essential trace element that has an important role in normal growth and development. Zinc deficiency during pregnancy may have an adverse effect on pregnancy outcome, especially low birth weight (LBW) and some malformation such as cleft palate and anencephaly. The World Health Organization reported that 20 million infants were born with LBW in 2008. LBW increases the risk of infant mortality. The goal of the millennium development goals (MDG) until 2015 is to reduce child mortality.

The objective of this study was to determine the analysis of plasma zinc concentration in cord blood and associated factors of infant birth weight among mothers who delivered in Fatemieh Hospital, Hamadan, Iran using the case-control study design. The cases were healthy infants  $\leq 2500$  g and the controls were healthy infants  $>2500$  to 4000 g at time of birth. A total of 268 (134 cases, 134 controls) infants and their mothers were selected at the time of birth at the Fatemieh teaching hospital which admits high risk mothers and has a neonatal intensive care unit (NICU) ward in Hamadan, Iran. The data collection of this study started from 6th December 2009 and ended on 18th October 2010.

Cord blood zinc was collected at the time of delivery from venous cord blood. Plasma zinc concentration was determined by Atomic Absorption Spectrophotometry (AAS) method. Data was analyzed using SPSS version 16. Total of 268 mothers-infant pair participated in the study about zinc level in the cord blood among these mothers, 3.7% had severe zinc deficiency, 7.8% had mild to moderate zinc deficiency and 88.5 % had normal plasma zinc concentration. The independent sample t-test showed that there was no significant difference between plasma cord blood zinc among LBW and normal birth weight infants (  $t = -0.083$ ,  $P\text{-value} = 0.934$ ) at the  $P$  level of 0.05. The mean birth weight among low birth weight infants (LBW) was  $2267.5 \pm 324$  g and in normal infants was  $3311 \pm 323$  g. The mean gestational age in LBW and normal infants were  $35.85 \pm 3$  and  $39 \pm 1.4$  weeks, respectively. There was a significant association between the plasma cord blood zinc

concentration in LBW and normal weight infants ( $X^2$  (df: 2) = 6.934,  $P=0.031$ ). Hierarchical multiple logistic regressions showed that plasma cord blood zinc, maternal pre-pregnancy BMI, maternal weight gain during pregnancy, maternal age, previous LBW, and parity significantly predicted infant birth weight. Overall, there was no statistically significant relationship between plasma cord blood zinc concentration and infant birth weight. Infants with severe zinc deficiency ( $\leq 60 \mu\text{g}/\text{dl}$ ) were more than 12 times at higher risk of LBW compared to infants with normal plasma cord blood zinc levels (OR = 12.234, 95% CI 1.22, 133.39,  $P=0.040$ ).

In conclusion, there was a significant association between severe zinc deficiencies in plasma cord blood and infant birth weight. There was also significant association between maternal pre-pregnancy BMI, maternal weight gain during pregnancy, maternal age, previous history of LBW, and parity with infant birth weight.

**Keywords:** infant, LBW, zinc deficiency, pregnancy, cord blood, Hamadan, Iran

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah doctor of philosophy

**KEPEKATAN ZINK PLASMA DIDALAM TALI PUSAT DAN FAKTOR  
BERKAITAN BERAT LAHIR BAYI DALAM KALANGAN IBU YANG  
BERSALIN DI HOSPITAL FATEMIEH, HAMADAN, IRAN**

Oleh

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**Pengerusi: Profesor Madya Sharifah Zainiyah Bt. Syed Yahya, PhD**

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Kekurangan mikronutrien adalah salah satu daripada masalah pemakanan yang paling lazim di seluruh dunia, terutamanya di negara-negara membangun. Kini, lebih daripada 2 bilion orang yang tidak mendapat pengambilan minimum mikronutrien yang diperlukan untuk kesihatan. Zink merupakan elemen surih penting yang mempunyai peranan penting dalam pertumbuhan dan perkembangan badan yang normal. Kekurangan zink semasa mengandung mungkin mempunyai kesan yang buruk terhadap hasil kehamilan iaitu kelahiran bayi yang berat badan rendah (Low Birth Weight) dan beberapa kecacatan seperti langit rekah dan “anencephaly”. Pertubuhan Kesihatan Sedunia (WHO) melaporkan bahawa 20 juta bayi yang dilahirkan dengan berat badan rendah (LBW) pada tahun 2008, meningkatkan risiko kematian bayi. Sehubungan dengan itu Matlamat Pembangunan Milenium

(Millenium Developmental Goal) sehingga tahun 2015 adalah untuk mengurangkan kadar kematian bayi.

Objektif kajian ini adalah untuk menentukan hubungan antara berat badan lahir bayi dan kepekatan zink di dalam darah plasma tali pusat menggunakan reka bentuk kajian kes kawalan. Menggunakan reka bentuk kajian kes kawalan. Kes-kes yang masih bayi sihat  $\leq 2500$  g dan kawalan bayi yang sihat  $> 2500-4000$ . Sejumlah 268 (134 kes dan 134 kawalan) bayi dan ibu-ibu mereka telah dipilih pada masa kelahiran di Hospital Pengajaran Fatemieh yang mengaku ibu-ibu yang berisiko tinggi dan mempunyai sebuah unit penjagaan intensif neonatal (NICU) yang terletak di Hamadan, Iran. Pengumpulan data kajian ini bermula dari 6hb. Disember 2009 dan berakhir pada 18hb. Oktober 2010. Kepekatan zink di dalam darah tali pusat dikumpul pada semasa process kelahiran. Kepekatan zink di dalam plasma telah ditentukan oleh kaedah spektrofotometri Penyerapan Atom (Atomic Absorption Spectrophotometry). Data dianalisis menggunakan SPSS versi 16. Jumlah 268 pasangan ibu-bayi yang mengambil bahagian dalam kajian mengenai tahap zink di dalam darah tali pusat di kalangan ibu-ibu ini, 3.7% mempunyai zink yang teruk sementara ke, 7.8% mempunyai tahap biasa hingga kekurangan zink sederhana dan 88,5% mempunyai kepekatan zink plasma biasa. Ujian-t sampel bebas menunjukkan bahawa tiada perbezaan yang signifikan di antara plasma darah tali pusat zink di kalangan bayi rendah berat lahir (LBW) dan berat lahir bayi normal ( $t = -0,083$ ,  $P\text{-value} = 0,934$ ) pada peringkat  $P < 0,05$ . Min berat lahir di kalangan bayi berat lahir rendah (LBW)  $2267,5 \pm 324$  g dan pada bayi normal adalah  $3311 \pm 323$  g. Min umur



kehamilan di kalangan bayi LBW dan bayi normal adalah  $35,85 \pm 3$  dan  $39 \pm 1,4$  minggu masing-masing. Terdapat hubungan signifikan di antara kepekatan zink di dalam darah plasma tali pusat di kalangan bayi LBW dan bayi berat badan normal ( $X^2$  (df: 2) = 6,934,  $P = 0.031$ ). Hierarki terurus logistic (logistic regression test) berganda menunjukkan bahawa plasma darah zink, pertambahan berat badan ibu semasa kehamilan, usia ibu, pernah melahirkan bayi LBW sebelum ini, dan pariti dapat meramalkan berat kelahiran bayi dengan ketara. Secara keseluruhan, tidak ada hubungan statistik yang signifikan di antara kepekatan zink plasma darah di dalam tali pusat dan berat badan bayi. Bayi yang mempunyai kekurangan zink yang teruk ( $\leq 60 \mu\text{g} / \text{dl}$ ) mempunyai lebih dari 12 kali ganda risiko untuk dilahirkan LBW berbanding dengan bayi dengan tahap plasma darah zink yang normal. (OR = 12,234, 95% CI 1,22, 133,39,  $P = 0,040$ ).

Sebagai kesimpulan, kajian menunjukkan bahawa terdapat hubungan signifikan di antara kekurangan zink yang teruk dalam plasma darah tali pusat dan berat badan bayi semasa kelahiran. Selain itu, terdapat hubungan signifikan di antara berat badan ibu semasa kehamilan, usia ibu, pernah melahirkan bayi LBW, dan pariti dengan berat badan lahir bayi .

**Kata kunci:** bayi, LBW, kekurangan zink, kehamilan, Hamadan, Iran

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## **APPROVAL**

I certify that a Thesis Examination Committee has met on 24 February 2012 to conduct the final examination of **MOJGAN NAZARI** on her PhD thesis entitled “**Plasma zinc concentration in cord blood and associated factors of infant birth weight among mothers who delivered in Fatemieh hospital, Hamadan, Iran**” in accordance with Universiti Putra Malaysia [P.U.(A) 106] 15 March 1980. The Committee recommends that the student be awarded the PhD.

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## **DECLARATION**

I declare that the thesis is my original work except for the quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at University Putra Malaysia or at any other institution.

**MOJGAN NAZARI**

Date: 24 February 2012

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