



**UNIVERSITI PUTRA MALAYSIA**

**FACTORS ASSOCIATED WITH DIETARY CALCIUM INTAKE AND  
BONE MINERAL DENSITY AMONG POSTMENOPAUSAL WOMEN  
IN TEHRAN, IRAN**

**ESRA TAJIK**

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By

**ESRA TAJIK**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra  
Malaysia, in Fulfilment of the Requirement for the Degree of Master of  
Science**

**December 2012**

*This thesis is dedicated to my most beloved father and  
mother.*

*To my father who taught me that the best kind of knowledge  
is to be learned for its own sake.*

*To my mother who this thesis would never be completed  
without her support that kept my spirit up.*

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

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**December 2011**

**Chairman: Associate Professor Zalilah Mohd Shariff, PhD**

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Osteoporosis is characterized by a decrease in the strength and density of bone with no clinical symptoms until fractures occur. Osteoporotic fracture is a major cause of morbidity and premature death in elderly. This is a descriptive cross-sectional study that aimed to determine factors associated with dietary calcium intake and bone mineral density among 299 postmenopausal women aged 50-65 years old in National Iranian Oil Company (NIOC) Central Hospital. This hospital is located in center of the city and accesbilty was easy for respondents to attend this research. Measurements included information on demographic and socio-economic factors and reproductive history using questionnaire, dietary intake using 24-houres dietary recall and semi-Food Frequency Questionnaire (SFFQ), physical activity using International Physical Activity Questionnaire (IPAQ - short form), anthropometry (Body Mass Index (BMI), weight and height) using using Seca digital scale and Seca body meter and bone mineral density (BMD) using Dual Energy X-Ray method (DEXA). The mean age of the women was  $56.34 \pm 4.46$  years old with 65.8% were

married. About a quarter of the respondents (26.6%) were in normal range of BMI but the majority were overweight (52.9%) and obese (20.4%). Most of the women (91.6%) were sufficiently active and 6.7% had low activity level. Only 1.7% of them had vigorous activity level. The mean calcium intake was  $965.33 \pm 396.42$  mg with  $664.70 \pm 2.19$  mg from food and  $302.31 \pm 3.39$  mg from dietary supplement. About 73% of the respondents had calcium intake less than the DRI (Dietary Reference Intake) and only one third of subjects (31.9%) consumed dietary calcium supplement. SFFQ showed that the major (66.8%) source of calcium intake was dairy products. The BMD of lumbar spine L<sub>2</sub>-L<sub>4</sub> was  $1.08 \pm 0.14$  g/cm<sup>2</sup>. About 2/3 of the respondents had normal BMD at spine while others were either osteopenic (32.1%) and osteoporotic (1.3%). The mean BMD (g/cm<sup>2</sup>) of left and right femoral neck and also total femoral neck (both sides) were  $0.96 \pm 0.07$ ,  $0.97 \pm 0.09$  and  $0.97 \pm 0.08$ , respectively. At femoral neck, 67.9% of the respondents had normal BMD while 30.8% and 1.3% were osteopenic and osteoporotic, respectively. Higher calcium intake was associated with higher intake of vitamin D and phosphorous, older age at menopause and higher years of education. In addition, postmenopausal women with lower protein intake and BMI were found to have higher intake of calcium ( $R^2 = 0.369$ ,  $p < 0.001$ ). Respondents with higher household income per capita (OR,0.997; CI,0.995-1.002) and higher intake of calcium (OR,0.993; CI,0.990-0.996) were significantly protective against osteopenia/osteoporosis of lumbar spine. Respondents with larger household size had 2.3 times the risk of osteopenia/osteoporosis (OR,2.269; CI,1.345-3.827) compared to subject with smaller household size. In addition, higher intake of calcium (OR,0.994; CI,0.992-0.997) was significantly protective against at risk osteopenia/osteoporosis of femoral

neck. As a conclusion, these findings indicated that most of the respondents had calcium intake less than DRI. About one third of the respondents had osteopenia and osteoporosis at lumbar spine and femoral neck. There is a need to develop appropriate educational programs to improve nutritional knowledge and to create awareness about the importance of exercise to get optimal bone health and doing annual densitometry to detect women at risk.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**FAKTOR-FAKTOR YANG BERKAITAN DENGAN PENGAMBILAN  
KALSIUM DIETARI DAN KETUMPATAN MINERAL TULANG DALAM  
KALANGAN WANITA POSTMENOPAUSAL DI TEHRAN, IRAN**

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Osteoporosis dikaitkan dengan pengurangan kekuatan dan ketumpatan tulang tanpa simptom-simptom klinikal sehingga berlaku kepatahan tulang. Kepatahan tulang disebabkan osteoporosis merupakan penyebab utama morbiditi dan kematian awal berlaku dalam kalangan warga tua. Kajian ini merupakan kajian keratan-rentas yang bertujuan untuk mengenal pasti faktor-faktor yang berkaitan dengan pengambilan kalsium dan ketumpatan mineral tulang dalam kalangan 299 wanita yang berumur 50-65 tahun di National Iranian Oil Company (NIOC) Central Hospital. Pengukuran yang di ambil adalah faktor demografi dan sosio-ekonomi serta sejarah reproduktif menggunakan borang soal-selidik, pengambilan diet menggunakan kaedah ingatan diet 24 jam dan kekerapan pengambilan makanan separa, aktiviti fizikal menggunakan International Physical Activity Questionnaire (IPAQ), ukuran antropometri (berat, tinggi, indeks jisim tubuh) menggunakan penimbang digital Seca dan Seca body meter dan ketumpatan mineral tulang menggunakan Dual

Energy X-Ray method (DEXA). Purata umur wanita yang dikaji ialah  $56.34 \pm 4.46$  tahun dan 65.8 % daripadanya sudah berkahwin. Hampir suku responden (26.6%) adalah dalam kalangan BMI julat normal, tetapi kebanyakannya terlampau berat (52.9%) dan obes (20.4%). Kebanyakan wanita (91.6%) telah cukup aktif, manakala 6.7% adalah pada tahap aktiviti yang rendah. Cuma 1.7% responden mempunyai tahap aktiviti yang amat cergas. Purata pengambilan kalsium ialah  $965.33 \pm 396.42$  mg, dengan pengambilan  $664.70 \pm 2.19$  mg kalsium daripada makanan dan  $302.31 \pm 3.39$  mg daripada suplemen diet. Hampir 73% responden mengambil kalsium kurang daripada nilai DRI dan 1/3 responden (31.9%) mengambil suplemen kalsium dalam diet mereka. SFFQ menunjukkan bahawa (66.8%) pengambilan kalsium responden adalah daripada produk tenusu. Min BMD ( $\text{g/cm}^2$ ) spina lumbar L<sub>2</sub>-L<sub>4</sub> ialah  $1.08 \pm 0.14$ . Hampir 2/3 responden adalah pada julat normal di bahagian spina dan 1/3 responden osteopenia (32.1%) dan osteoporosis. Purata BMD ( $\text{g/cm}^2$ ) di kiri dan di kanan leher femoral dan juga jumlah keseluruhan leher femoral (kedua-dua belah) ialah masing-masing  $0.96 \pm 0.07$ ,  $0.97 \pm 0.09$  dan  $0.97 \pm 0.08$ . Di bahagian leher femoral, 67.9% responden adalah pada julat normal dan selebihnya adalah pada julat osteopenia (30.8%) dan osteoporosis (1.3%). Pengambilan kalsium yang tinggi dikaitkan dengan pengambilan vitamin D dan fosforus yang tinggi, umur menopause yang lebih lewat dan bilangan tahun persekolahan yang lebih tinggi. Selain itu, wanita dalam usia postmenopausal dengan pengambilan protein yang rendah dan BMI yang kurang didapati mempunyai pengambilan kalsium yang tinggi ( $R^2 = 0.369$ ,  $p < 0.001$ ). Responden dengan pendapatan per kapita (OR, 0.997; CI, 0.995-1.002) dan pengambilan kalsium (OR, 0.993; CI, 0.990-0.996) yang lebih tinggi mempunyai risiko yang rendah mengalami osteopenia/osteoporosis di bahagian



lumbar spina. Responden dengan isi rumah yang lebih ramai mempunyai 2.3 kali risiko mengalami osteopenia/osteoporosis (OR,2.269; CI, 1.345-3.827) berbanding dengan responden daripada isi rumah yang lebih kecil. Pengambilan kalsium yang tinggi (OR,0.994; CI,0.992-0.997) juga merupakan faktor pelindung yang signifikan terhadap risiko mengalami osteopenia/osteoporosis di bahagian leher femoral. Sebagai kesimpulan, hasil kajian menunjukkan bahawa kebanyakan responden mempunyai pengambilan kalsium kurang daripada nilai yang disarankan. Satu pertiga responden mengalami osteopenia dan osteoporosis di bahagian spina dan leher femoral. Oleh yang demikian, program pendidikan yang sesuai perlu dibentuk untuk meningkatkan pengetahuan dan kesedaran tentang pentingnya senaman untuk kesihatan tulang yang optimum dan keperluan menjalani pemeriksaan densitometri tahunan untuk mengenal pasti risiko kerapuhan tulang dalam kalangan wanita.

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I certify that a Thesis Examination Committee has met on date on viva voce to conduct the final examination of Esra Tajik on her thesis entitled “Factors associated with dietary calcium intake and bone mineral density in postmenopausal women aged 50-65 years old in Tehran, Iran” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science (Community Nutrition).

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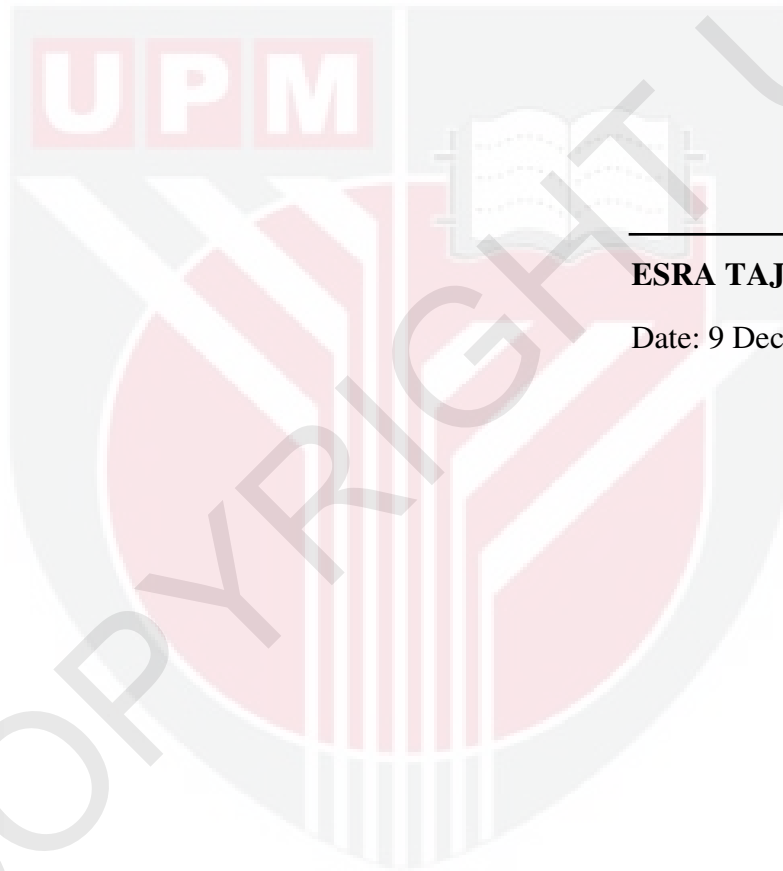
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## DECLARATION

I declare that the thesis is my original work except for 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 Universiti Putra Malaysia or at any other institutions.



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**ESRA TAJIK**

Date: 9 December 2011

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