8th International Symposium on Nutritional Aspects of Osteoporosis
Lausanne/Switzerland, 17–19 May 2012

Final Program & Abstracts

www.congrex.ch/isnao2012
Nestlé, founded in 1867 by Henri Nestlé, is the world's leading Nutrition, Health and Wellness Company. With headquarters in Vevey, Switzerland, Nestlé employs about 328,000 people across the globe, with factories and operations in almost every country around the world.

With unrivaled Research & Development capabilities, Nestlé has a rich heritage in food and nutrition science. Consumer health and wellness was the driving force for Henri Nestlé when he revolutionized infant feeding with Nestlé's first product, Farine Lactée. This tradition continues today, through Nestlé's extensive network of 32 Research, Development and Technology Centres, comprised of over 5,200 people worldwide.

Nestlé Research focuses on developing nutritional solutions to promote health benefits for consumers, such as growth and development and healthy ageing. Nutrition and bone health is an important aspect of this research. Optimizing bone mass during childhood and attenuating bone loss are two important ways of reducing the risk of osteoporosis later in life.

This research is translated into nutritional products for consumers of all ages and stages of life. Nestlé's dairy products range from fortified milks for growing children, to milks for healthy adults, including low in fat, with added fibre, or with phytosterols to help lower cholesterol.

For older adults, RESOURCE® Senior Activ is a nutritional supplement from Nestlé Health Sciences designed to rebuild strength after a fall or fracture.

Learn more about Nestlé at www.nestle.com.
Welcome

Most causes for osteoporosis, like genetics, age, menopause and intercurrent diseases with their treatments, are not modifiable. The investigation of the influence of nutrition on bone health is therefore a fascinating field. It concerns a modifiable factor of the development of bone and the prevention of osteoporosis.

It is the privilege of this symposium to gather every three years scientists from all over the world working in this field. The 8th edition of this symposium is again organized by Bess Dawson-Hughes, Connie Weaver and myself. We are determined to match the previous symposia in quality and standard.

As the only regular meeting in the bone field to be exclusively devoted to nutrition in a broader sense, it allows to review the new scientific data, discuss new concepts and update the knowledge on several nutrients.

We welcome you to Lausanne and wish you a successful meeting.

In the name of the chairpersons

Peter Burckhardt
Calcimagon®-D³ Forte: Tried-and-tested and now even smaller!

• Smaller tablet is easier to take
• One-a-day dose for improved compliance by up to 40%¹
• The only chewable tablet with 800 IE vitamin D and 1000 mg calcium²

Calcimagon®-D³ Forte encourages compliance, thus contributing to successful therapy!¹,³

# Table of Contents

Scientific program overview ........................................ 4–5  
Sponsors ................................................................. 6–9  
Scientific program ..................................................... 10–17  
Posters ................................................................. 18–22  
Awards / Accreditation ............................................... 23  
Instructions for authors ............................................. 24  
General information .................................................. 25  
Registration ............................................................ 26–27  
Social events ............................................................ 28  
Abstracts of oral and poster presentations (blue part) ... 29–81  
List of speakers and authors (blue part) ......................... 82–83  
City map of Lausanne .................................................. 84
Scientific program overview

Wednesday, 16 May 2012
Room Delta

08:00
08:30
09:00
09:30
10:00
10:30
11:00
11:30
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30

09:00 – 09:15 Opening

09:15 – 10:30
Session 1

10:30 – 11:00 Coffee break & posters

11:00 – 12:30
Session 2

12:30 – 14:00
Lunch
(free admission for symposium delegates)

14:00 – 15:30
Session 3
Protein and acid base

15:30 – 16:00 Coffee break & posters

16:00 – 16:45
Session 3
Protein and acid base (continued)

16:45 – 18:15
Session 4
Flavonoids and bone

17:00 – 18:30
Registration

Thursday, 17 May 2012
Room Richemont

09:00 – 09:15 Opening

09:15 – 10:30
Session 1

10:30 – 11:00 Coffee break & posters

11:00 – 12:30
Session 2

12:30 – 14:00
Lunch
(free admission for symposium delegates)

14:00 – 15:30
Session 3
Protein and acid base

15:30 – 16:00 Coffee break & posters

16:00 – 16:45
Session 3
Protein and acid base (continued)

16:45 – 18:15
Session 4
Flavonoids and bone
Friday, 18 May 2012
Room Richemont

09:00–10:00
Session 5
Various nutrients  p. 13

10:00–10:30  Coffee break & posters

10:30–12:15
Session 6
Vitamin D, bone and muscle  p. 14

12:15–14:00
Lunch
(free admission for symposium delegates)

14:00–15:30
Session 7
Vitamin D  p. 15

15:30–16:00  Coffee break & posters

16:00–17:00
Session 7
Vitamin D (continued)  p. 15

17:00–18:00
Session 8
Debate on the optimal 25OHD level for bone and muscle  p. 15

18:45
Bus departure Hotel Lausanne Palace

19:00
Bus departure Hotel Château d'Ouchy

20:00
Aperitif followed by Candlelight dinner at the Castle of Chillon  p. 28

Saturday, 19 May 2012
Room Richemont

09:00–10:15
Session 9
Calcium  p. 16

10:15–10:30  Coffee break & posters

10:30–11:15  Session 9
Calcium (continued)  p. 17

11:15–12:15
Session 10
Debate on safety (and amounts) of calcium supplements  p. 17

End of the symposium
The organizers cordially thank the following companies for their generous contribution:

**Endorsement**

This symposium is endorsed by the
**International Osteoporosis Foundation**
9 rue Juste-Olivier
1260 Nyon/Switzerland
Phone: +41 22 994 01 00
Fax: +41 22 994 01 01
E-mail: info@iofbonehealth.org
Website: www.iofbonehealth.org

**Gold sponsors**

**ALPRO Comm. VA - Headquarters**
Kortrijksesteenweg 1093 C
9051 Gent/Belgium
Phone: +32 9 260 22 11
Fax: +32 9 260 21 65
E-mail: nutrition@alpro.com
Website: www.alprosoya.com

**Dairy Australia**
Level 5, IBM Centre, 60 City Road
Southbank, Victoria 3006 / Australia
Phone: +61 3 9694 3777
Fax: +61 3 9694 3733
E-mail: hpnutrition@dairyaustralia.com.au
Website: www.dairyaustralia.com.au

**HEXAL AG / Sandoz International GmbH**
Industriestraße 25
83607 Holzkirchen / Germany
Phone: + 49 8024 908 0
Fax: + 49 8024 908 1290
E-mail: service@hexal.com
info.sandoz@sandoz.com
Website: www.hexal.com
www.sandoz.com
Nestlé S.A.
1800 Vevey / Switzerland
Phone: +41 21 924 2111
Fax: +41 21 921 18 85
E-mail: mediarelations@nestle.com
Website: www.nestle.com

Silver sponsors

AMGEN Switzerland AG
Zährerweg 6
P.O. Box 1459
6301 Zug / Switzerland
Phone: +41 41 369 01 00
Fax: +41 41 360 02 00
Website: www.amgen.ch

Nycomed Pharma AG
Wallisellenstrasse 55
Postfach 350
8600 Dübendorf / Switzerland
Phone: +41 800 887 997
Fax: +41 44 782 69 99
E-mail: infoswiss@nycomed.com
Website: www.nycomed.com

Bronze sponsors

DSM Nutritional Products AG
Wurmisweg 576
4303 Kaiseraugst / Switzerland
Phone: +41 61 815 88 88
Fax: +41 61 815 88 80
E-mail: info.DNP@dsm.com
Website: www.dsmnutritionalproducts.com

Fonterra Co-Operative Group Limited
9, Princes Street
Auckland / New Zealand
Phone: +64 9 374 900
Fax: +64 9 374 900
Website: www.fonterra.com
Sponsors

FrieslandCampina Domo EMEA – Head office
Stationsplein 4, 3818 LE Amersfoort
P.O. Box 1551, 3800 BN Amersfoort
The Netherlands
Phone: +31 33 713 3333
E-mail: info.domo@frieslandcampina.com
Website: www.vivinalgos.com

Lallemand Inc.
1620 rue Prefontaine
Montreal, Quebec H1W 2N8 / Canada
Phone: +1 514 522 21 33
Website: www.lallemand.com

Omya International AG
Baslerstrasse 42
4665 Oftringen / Switzerland
Phone: +41 62 789 2929
Fax: +41 62 789 2596
Website: www.omya.com

Pharmavite LLC
8510 Balboa Blvd. Suite 100
Northridge, California 91325 / United States
Phone: +1 818 221 62 00
Fax: +1 818 221 66 18
Website: www.pharmavite.com

Servier International
1 rue Carle Hébert
92415 Courbevoie Cedex / France
Sponsors

Eli Lilly (Suisse) SA
CP 580
Ch. des Coquelicots 16
1214 Vernier, GE / Switzerland
Phone: +41 22 306 04 01
Fax: +41 22 306 04 72
E-mail: lilly_ch@lilly.com

GlaxoSmithKline
Consumer Healthcare
1500 Littleton Road
Parsippany, New Jersey 07054 / United States
Website: www.gsk.com

Rottapharm | Madaus
Madaus GmbH
Colonia Allee 15
51067 Köln / Germany
Phone: +49 221 899 80
Fax: +49 221 899 87 01
Website: www.rottapharm-madaus.com

Schweizer Milchproduzenten SMP
Weststrasse 10
Postfach
3000 Bern 6 / Switzerland
Phone: +41 31 359 51 11
Fax: +41 31 359 58 51
E-mail: smp@swissmilk.ch
Website: www.swissmilk.ch

The Coca-Cola Company
P.O. Box 1734
Atlanta, Georgia 30301 / United States
Phone: +1 800 438 26531
Websites: www.thecoca-colacompany.com
www.beverageinstitute.org
09:00 – 09:15 **Opening**  
Room Richemont  
P. Burckhardt (Lausanne, CH)

09:15 – 10:30 **Session 1**  
Room Richemont  
Chairs: S. Shapses (New Brunswick, US)  
S. Lanham-New (Guildford, UK)

09:15 Inflammation, nutrition, and bone and muscle: clinical correlations  
R. Daly (Melbourne, AU)

09:45 Interactions of dietary patterns, systemic inflammation, and bone mineral density  

10:00 Weight and weight loss, bone and muscle: exercise induced weight loss and nutrition  
R. Fielding (Boston, US)

10:30 – 11:00 **Coffee break and poster exhibition**

11:00 – 12:30 **Session 2**  
Room Richemont  
Chairs: G. El-Hajj Fuleihan (Beirut, LB)  
R. Fielding (Boston, US)

11:00 Do the hormonal changes in obesity regulate trabecular, cortical and geometric properties of bone?  
S. Shapses (New Brunswick, US)

11:30 Emerging nutritional and lifestyle risk factors for bone health in young women: a mixed longitudinal twin study  
J. Christie, C. Nowson, S. Garland, J. Wark (Melbourne, Burwood, AU)

*Abstracts number*
11:45 Dietary fat composition is associated with indexes of skeletal muscle mass in women
A.A. Welch, A. MacGregor, T. Spector, A. Cassidy
(Norwich, London, UK)

12:00 The relationship between body fat (central versus peripheral) and bone mass
I. Reid (Auckland, NZ)

12:30–14:00 Lunch
Salon J.P. Delamuraz

12:30–14:00 Poster exhibition
Poster Area

14:00–15:30 Session 3
Protein and acid base
Room Richemont

14:00 Musculo-skeletal effects of acid-base balance: current knowledge and future directions
S. Lanham-New (Guildford, UK)

14:30 When is lowPRAL beneficial for bone?
T. Remer (Dortmund, DE)

15:00 Potassium citrate and bone: an RTC
D.E. Sellmeyer (Baltimore, US)

15:30–16:00 Coffee break and poster exhibition

*Abstracts number
16:00 – 16:45 **Session 3**

**Protein and acid base (continued)**

Chairs: B. Dawson-Hughes (Boston, US)  
H. Macdonald (Aberdeen, UK)

16:00 **The effects of protein supplementation on bone mass in Chinese postmenopausal women**  
Q. Zhang, F. Wu, X. Hu, C. Wang, Y. Liu, R. Prince, K. Zhu (Beijing, CN; Perth, AU)

16:15 **Protein-calcium interaction**  
P. Burckhardt (Lausanne, CH)

16:45 – 18:15 **Session 4**

**Flavonoids and bone**

Chairs: C. Weaver (West Lafayette, US)  
J. Nieves (West Nyack, US)

16:45 **Prebiotics, probiotics and PUFAs for bone health**  
M. Kruger (Palmerston North, NZ)

17:15 **Comparison of natural products for bone balance**  
C. Weaver (West Lafayette, US)

17:45 **Hesperidin and bone health**  
M.N. Horcajada (Lausanne, CH)

*Abstracts number*
09:00 – 10:00 Session 5
Various nutrients
Chairs: P. Burckhardt (Lausanne, CH)
M. Hannan (Boston, US)

09:00 Carotenoid intake and risk of hip fracture in the Singapore Chinese Health Study
W.-P. Koh, Z. Dai, A Jin, J.-M. Yuan
(Singapore, SG; Pittsburgh, US) 16*

09:15 Dietary B-Vitamin intake and risk of hip fracture in The Singapore Chinese Health Study
Z. Dai, W.-P. Koh, A. Jin, J. Yuan
(Singapore, SG; Pittsburgh, US) 17*

09:30 Dietary anthocyanidin intakes are associated with increased bone mineral density and decreased markers of bone resorption in a population of Scottish women
C.J. Macdonald, L. Aucott, W.D. Fraser, D.M. Reid, H.M. Macdonald (Aberdeen, Liverpool, UK) 18*

09:45 Low-dose MK-7 supplementation reduced age-related bone loss in healthy post-menopausal women
E. Theuwissen, M. Knapen, E. Smit, C. Vermeer (Maastricht, NL) 19*

10:00 – 10:30 Coffee break and poster exhibition

*Abstracts number
10:30 – 12:15 **Session 6**  
**Vitamin D, bone and muscle**  
Chairs: B. Dawson-Hughes (Boston, US)  
I. Reid (Auckland, NZ)

10:30  
**Relative effects of Vitamin D3 and calcifediol**  
H. Bischoff-Ferrari (Zurich, CH)

11:00  
**Physical performance, muscle strength, falls and Vitamin D**  
P. Lips (Amsterdam, NL)

11:30  
**Vitamin D status in relation to veiling, obesity, and milk intake in Saudi Women**  
K. Hussein, H. AlKadi, S. Lanham-New, M. Ardawi (Jeddah, SA; Guildford, UK)

11:45  
**Serum 25(OH)D and calcium intake predict changes in hip BMD and structure in young active men**  
J. Nieves, M. Zion, J. Ruffing, R. Lindsay, S. Tendy, P. Garrett, F. Cosman (West Nyack, West Haverstraw, New York, West Point, US)

12:00  
**Comparison of Vitamin D2 versus Vitamin D3 supplementation in raising serum 25(OH)D status: a systematic review and meta-analysis**  

12:15 – 14:00 **Lunch**  
Salon J.P. Delamuraz

12:15 – 14:00 **Poster exhibition**  
Poster Area

*Abstracts number*
14:00 – 17:00 **Session 7**  
**Vitamin D**  
Chairs: H. Bischoff-Ferrari (Zurich, CH)  
P. Lips (Amsterdam, NL)

14:00  
**Graded oral dosing of Vitamin D₃ in early adolescence:** serum Vitamin D and bone biomarker responses; findings from the GAPI Vitamin D intervention trial  
*R. Lewis (Athens, US)*

14:30  
**Determinants of the 25OH-Vitamin D response to Vitamin D supplements**  
*D. Dawson-Hughes (Boston, US)*

15:00  
**Vitamin D from food, does it matter?**  
*T. Green (Vancouver, CA)*

15:30 – 16:00 **Coffee break and poster exhibition**

16:00  
**The regulation of calcium absorption: insights into the physiology of Vitamin D**  
*R.P. Heaney (Omaha, US)*

16:30  
**25 OH-Vitamin D levels – global perspective – any evidence that optimal levels vary globally**  
*G. El-Hajj Fuleihan (Beirut, LB)*

17:00 – 18:00 **Session 8**  
**Debate on the optimal 25OHD level for bone and muscle**  
Moderator: R.P. Heaney (Omaha, US)  
H. Bischoff-Ferrari (Zurich, CH)  
P. Lips (Amsterdam, NL)  
Discussion

20:00 **Dinner at Castle of Chillon**  
For details please see p. 28
09:00 – 10:15 **Session 9**  
**Calcium**  
Chairs: C. Weaver (West Lafayette, US)  
P. Burckhardt (Lausanne, CH)

09:00  
**Sexual dimorphism in bone and body composition in rural Gambian pre-pubertal children habituated to a low calcium intake**  
L. Jarjou, K. Ward, G. Goldberg, Y. Sawo, A. Prentice  
(Keneba, GM; Cambridge, UK)  

09:15  
**Dairy foods, but not cream, are associated with higher bone mineral density: the Framingham Offspring Study**  
S. Sahni, K. Tucker, D. Kiel, L. Quach, V. Casey, M. Hannan  
(Boston, US)

09:30  
**Galactooligosaccharides: effects on calcium absorption and gut microflora in young premenarcheal girls**  
(West Lafayette, US; Amersfoort, NL)

09:45  
**The relationship of weight-bearing physical activity and dietary calcium intake with bone mass accrual in the bone mineral density in childhood study cohort**  
J. Lappe, P. Watson, V. Gilsanz, H. Kalkwarf, S. Oberfield, J. Shepherd, B. Zemel, K. Winer  
(Omaha, Los Angeles, Cincinnati, New York City, San Francisco, Philadelphia, Bethesda, US)

*Abstracts number*
A dairy-based protein, calcium and Vitamin D supplement reduces falls and femoral neck bone loss in aged care residents: a cluster randomised trial

10:15 – 10:30 Coffee break and poster exhibition

10:30 – 11:15 Session 9
Calcium (continued)
Chair: J. Lappe (Omaha, US)

Effects of Vitamin D and calcium supplementation on heart rate and blood pressure in community dwelling older individuals – a prospective, randomized, double-blind study
M. Pfeifer, H.W. Minne, A. Fahrleitner-Pammer, H. Dobnig (Bad Pyrmont, DE; Graz, AT)

Calcium metabolism in Mexican American adolescents
C. Palacios (San Juan, PR)

11:15 – 12:15 Session 10
Debate on safety (and amounts) of calcium supplements
Moderator: B. Dawson-Hughes (Boston, US)
I. Reid (Auckland, NZ)
C. Weaver (West Lafayette, US)
Discussion

12:15 End of the symposium

*Abstracts number
The posters may be viewed during the coffee and lunch breaks.

**Influence of selected nutrients on Vitamin D metabolites concentrations in children with low bone mass**  
*J. Karalus, D. Chlebna-Sokol (Lodz, PL)*

**The assessment of the Vitamin D supply in the population of Polish children at the age of 9–12 years – multicentre research – preliminary report**  

**Relationship between body composition with bone mineral density in postmenopausal women by using dual energy X-ray absorptiometry (DEXA) technique**  
*S. Rahimi Petrodi, S. Zieai, A. Emami Ardekani (Tehran, IR)*

**Vitamin D status in young HIV infected Israeli women of various ethnic origins: incidence of Vitamin D deficiency and possible impact on bone density**  
*E. Segal, E. Shahar, Z. Shen-Orr, G. Hassoun, E. Kedem, S. Pollack, S. Ish-Shalom (Haifa, IL)*

**Effect of cigarette smoking on bone mineral density among Saudi men: implications for Vitamin D deficiency**  
*S. Alhashemi, S. Khoja, S. Lanham-New, M. Ardawi (Jeddah, SA; Guildford, UK)*

**Malnutrition with selected administrative demographic factors can identify risk for osteoporotic hip fracture in community dwelling older adults**  
*M. Albaba, S. Cha (Rochester, US)*

**Vitamin D status in postmenopausal Saudi women with Type 2 Diabetes Mellitus**  
*S. Saddekk, S. Khoja, S. Lanham-New, M. Ardawi (Jeddah, SA)*
Is high dose Vitamin D harmful? K.M. Sanders, G.C. Nicholson, P.R. Ebeling (Melbourne, Toowoomba, AU)

The association of sarco-osteopenia with 25(OH) Vitamin D level in a population based cohort in Estonia M. Kull, R. Kallikorm, M. Lember (Tartu, EE)

Implication of a free fatty acid receptor in bone remodeling C. Philippe, F. Wauquier, V. Coxam, M. Spilmont, Y. Wittrant (Theix, FR)

Borage and fish oils supplementation effects on bone health in a murine model of senile osteoporosis: a 10 months pre-clinical study F. Wauquier, C. Philippe, M. Spilmont, C. Tagliaferri, V. Coxam, Y. Wittrant (Theix, FR)


Pre-diabetes and cardiometabolic indicators across Vitamin D status in healthy men S. Tepper, D. Shahar, D. Geva, S. Ish-Shalom (Beer-Sheva, Haifa, IL)

Relationship between calcaneal bone stiffness and body composition in young European children I. Sioen, T. Mouratidou, D. Herrmann, J.-M. Kaufman, D. Molnar, L.A. Moreno, S. Marild, G. Barba, A. Siani, M. Tornaritis, T. Veidebaum, S. De Henauw, W. Ahrens (Ghent, BE; Zaragoza, ES; Bremen, DE; Pécs, HU; Gothenburg, SE; Avellino, IT; Strovolos, CY; Tallinn, EE)
The influence of nutrition and Vitamin D status on calcaneal ultrasound parameters in Belgian children
I. Sioen, T. Mouratidou, G. Barba, S. Marild, D. Herrmann, W. Ahrens, S. De Henauw (Ghent, BE; Zaragoza, ES; Avellino, IT; Gothenburg, SE; Bremen, DE)

Influence of habitual dietary intake and age on risk of poor bone health in pre-menopausal women
L. Wilson, K. Hart, S. Lanham-New, L. Tripkovic (Guildford, UK)

Validation of a food frequency questionnaire for the assessment of calcium intake in schoolchildren aged 9-10 years
B. Pampaloni, E. Bartolini, P. Piscitelli, G.L. DiTanna, L. Giolli, M.L. Brandi (Florence, Rome, IT)

Associations between dietary carotenoid intakes and bone health in a Scottish population
C.J. Macdonald, L. Aucott, W.D. Fraser, D.M. Reid, H.M. Macdonald (Aberdeen, Liverpool, UK)

Ethnic differences in the circadian rhythm of calcium metabolism in older British and Gambian adults
J. Redmond, A. Prentice, I. Schoenmakers (Cambridge, UK)

Is Vitamin D deficiency indicated in the aetiology of rickets in Bangladesh?

Hypovitaminosis-D is prevalent in alimentary school-children in Kuwait
K.O. Alyahya, S.A. Lanham-New (Kuwait City, KW; Guildford, UK)

Relationship between Vitamin D and physical performance in community dwelling elderly women
M. Tamulaitiene, V. Alekna, V. Strazdiene, A. Mastaviciute (Vilnius, LT)
Blueberry in calcium and Vitamin D enriched fermented milk is able to modulate bone metabolism in postmenopausal women
C. Puel, M. Spilmont, Y. Wittrant, C. Tagliaferri, V. Coxam (Theix, FR)

Vitamin D levels in osteopenic patients in west Bohemia
V. Vyskocil, J. Svobodova (Pilzen, CZ)

Differences in Vitamin D status in Caucasian and Asian women following UVB exposure
O. Hakim, K. Hart, P. McCabe, J. Berry, L. Rhodes, N. Spyrou, A. Alfuraih, S. Lanham-New (Guildford, Manchester, UK; Riyadh, SA)

Bone pain, 25(OH)D concentration, volumetric bone mineral density (VBMD) at radius and tibia sites in premenopausal south Asian and Caucasian women
O. Hakim, A. Darling, S. Lanham-New, J. Berry, K. Hart (Guildford, Manchester, UK)

Carbohydrates intake is a major determinant of quantitative bone ultrasound in Spanish premenopausal woman

Disbalanced calcium or protein intake as risk factors of osteoporosis in Spanish women

Vitamin D status is positively correlated with radial/tibial bone area/density in postmenopausal Caucasian women, and with radial trabecular vBMD in postmenopausal South Asian women
A.L. Darling, O.A. Hakim, J.L. Berry, S.A. Lanham-New, K.H. Hart (Guildford, Manchester, UK)
The concentration of 25-hydroxyvitamin D (25(OH)D) for optimal femoral neck bone mineral content varies between Caucasians and South Asians - a true effect or artefact of different 25(OH)D concentrations by ethnic group?
A.L. Darling, K.H. Hart, J.L. Berry, S.A. Lanham-New (Guildford, Manchester, UK)

Does calcium supplementation affect cancer risk?
S.M. Bristow, M.J. Bolland, A. Grey, G.D. Gamble, I.R. Reid (Auckland, NZ)

Calcium and Vitamin D daily intake level and frequency of Vitamin D deficiency amount Ukrainian population
V. Povoroznyuk, N. Grygorieva, N. Balatska, F. Klimovytsky, O. Synenky (Kiev, UA)

Can one or two high doses of oral Vitamin D3 correct insufficiency in a non-supplemented rheumatologic population?
D. Stoll, J. Dudler, O. Lamy, D. Hans, M.-A. Krieg, B. Aubry-Rozie (Lausanne, Fribourg, CH)

The effect of long-term supplementation with different dietary omega-6/omega-3 ratios on minerals content and Ex vivo PGE2 release in bone of growing rabbits
D.M. Al-Nouri, A.S. Al-Khalifa (Riyadh, SA)
Awards for best oral presentation and best poster presentation

The organizers cordially thank DSM Nutritional Products for sponsoring the award for the best oral presentation and the best poster presentation.

The selection will be made by the chairpersons.

The awards will be presented during the Candle Light Dinner on Friday, 18 May 2012. Each prize is worth €1000.

DSM Nutritional Products AG
Wurmisweg 576
4303 Kaiseraugst / Switzerland
Phone: +41 61 815 88 88
Fax: +41 61 815 88 80
E-mail: info.DNP@dsm.com
Website: www.dsmnutritionalproducts.com

Accreditation

The 8th International Symposium on Nutritional Aspects of Osteoporosis is accredited by the following societies:

- Swiss Society for Endocrinology and Diabetology 15.5 credits
- Swiss Society for Rheumatology 15 credits
**Instructions for authors**

**Oral presentations**
The session room will be equipped with a PC and a data projector for PowerPoint presentations. PowerPoint presentations must be handed in at the **Speakers’ Service Center (SSC)** on a USB-stick.

It is essential for the smooth running of the symposium that all speakers hand in their presentations **at least one hour before the beginning of their sessions (not lectures)**. Speakers will have the opportunity to review their presentations on a PC available at the SSC. The SSC is located in Room Richemont.

**Posters**
All posters are on display in the poster area for the duration of the symposium.

Participants are invited to visit the poster exhibition during the coffee and lunch breaks. Authors are kindly asked to be present during the coffee and lunch breaks.

<table>
<thead>
<tr>
<th>Mounting Time</th>
<th>Presentation Time</th>
<th>Removal Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thursday, 17 May 2012 08:00 – 09:00</td>
<td>From Thursday, 17 May 2012 09:00 Until Saturday, 19 May 2012 12:00</td>
<td>Saturday, 19 May 2012 12:00 – 13:00</td>
</tr>
</tbody>
</table>

Please note that the mounting and removing of the posters is the responsibility of the authors. Posters that have not been removed by the author by 13:00 on Saturday, 19 May 2012 are removed and destroyed by the congress staff.

**Poster measurements**
Height: 180 cm / 70”
Width: 120 cm / 48”

**Publication**
Invited speakers and authors of oral presentations are kindly asked to provide a manuscript of their presentation which will be published by Springer after the symposium. All accepted abstracts are published on the symposium website [www.congresx.ch/isnao2012](http://www.congresx.ch/isnao2012), and also in this program.
General information

Location
Hotel Lausanne Palace
Grand-Chêne 7 – 9
1002 Lausanne / Switzerland

The Hotel Lausanne Palace is located in the city center.
For further information please visit
www.lausanne-palace.com

Date
Thursday, 17 May – Saturday, 19 May 2012

Official language
English (no simultaneous translation)

Local chairperson
Peter Burckhardt
Madeleine Rueger, Secretary
Clinique Bois-Cerf
Avenue d’Ouchy 31
1006 Lausanne / Switzerland
Tel. +41 21 619 68 44
Fax +41 21 619 68 46
E-mail: madeleine.rueger@bluewin.ch

Administrative and scientific secretariat
ISNAO 2012
C/o Congrex Switzerland Ltd.
Peter Merian-Strasse 80
4002 Basel / Switzerland
Tel. +41 61 686 77 77
Fax +41 61 686 77 88
E-mail: isnao@congrex.com

Address during the congress
ISNAO 2012
C/o Hotel Lausanne Palace
Grand-Chêne 7 – 9
1002 Lausanne / Switzerland
Tel. +41 21 331 31 31
Fax +41 21 331 32 22

Website
www.congrex.ch/isnao2012
Registration fees

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Physicians</td>
<td>€ 460</td>
</tr>
<tr>
<td>Physicians in training and students *</td>
<td>€ 300</td>
</tr>
<tr>
<td>Dinner at Castle Chillon for active participants (Friday, 18 May 2012)</td>
<td>€ 80</td>
</tr>
<tr>
<td>Dinner for accompanying persons (Friday, 18 May 2012)</td>
<td>€ 100</td>
</tr>
</tbody>
</table>

* proof of status required

The registration fee for conference participants includes:

- Access to the scientific sessions
- Final program including the abstracts
- Seated 3-course lunches on Thursday and Friday
- Two coffee breaks on Thursday and Friday, one coffee break on Saturday

Pre-registration

Pre-registered participants can pick up their symposium documents at the congress secretariat during the official opening hours.

Onsite-registration

For onsite-registration, payments need to be done either by credit card or cash. Onsite registrants cannot be guaranteed to receive all symposium documents.
Registration

Cancellation

In case of cancellation, the fees minus handling charges (25%) will be refunded, provided the cancellation is made in writing up to 10 April 2012. After this date no refund can be made for cancellations. For any name changes a fee of € 30 will be charged.

Disclaimer

The participant acknowledges that he / she has no right to lodge damage claims against the organizers should the holding of the congress be hindered or prevented by unexpected political or economic events or generally by force majeure, or should the non-appearance of speakers or other reasons necessitate program changes. With registration, the participant accepts this proviso.

Registration desk and congress secretariat

All the symposium documents will be handed out to registered participants during the following opening hours:

- Wednesday, 16 May 2012  17:00 – 18:30
- Thursday, 17 May 2012  08:00 – 18:30
- Friday, 18 May 2012  08:30 – 18:00
- Saturday, 19 May 2012  08:30 – 12:30

Contact information

ISNAO 2012
c/o Congrex Switzerland Ltd.
Peter Merian-Strasse 80
4002 Basel / Switzerland
Tel. +41 61 686 77 77
Fax +41 61 686 77 88
E-mail: isnao@congrex.com
www.congrex.ch/isnao2012
Social events

Friday, 18 May 2012

Dinner at Castle of Chillon

A candlelight dinner will take place at the medieval Castle of Chillon on Friday, 18 May 2012.

A bus transfer is organized from the Hotel Lausanne Palace and the Hotel Château d’Ouchy to the Castle of Chillon.

**Bus departure:** 18:45, main entrance Hotel Lausanne Palace 19:00, main entrance Hotel Château d’Ouchy

**Admission fee**

Active participants € 80
Accompanying persons € 100

Places are limited. We advise you to register early for the candlelight dinner. For onsite registrations, places are subject to availability.

Lunches and coffee breaks

On Thursday, 17 May and on Friday, 18 May 2012 seated 3-course lunches are provided. There is no lunch offered on Saturday.

The lunches take place in the Salon J.P. Delamuraz.

On Thursday, 17 May and on Friday, 18 May 2012 two coffee breaks are offered for the congress delegates; on Saturday, 19 May 2012 one coffee break will be provided in the morning.

The coffee breaks take place in the poster exhibition area.

For conference participants the coffee breaks and lunches are included in the registration fee.
Interactions of dietary patterns, systemic inflammation, and bone mineral density


Examination of dietary patterns and bone health outcomes may provide insight into nutritional aspects of osteoporosis. Inflammation, associated with a number of chronic conditions and diseases has been linked to bone remodelling (Arron & Choi, 2000) and a chronic inflammatory state could contribute to bone loss (Clowes et al, 2005). We aimed to examine associations between dietary patterns and systemic inflammation as assessed by serum concentrations of high sensitivity C-reactive protein (hsCRP), and determine whether past dietary patterns can predict current bone mineral density (BMD) in Scottish postmenopausal women.

Data collected from the Aberdeen Prospective Osteoporosis Screening Study cohort was used for this investigation. During 1997–2000, participant (mean age (SD) = 55 (2) years) diet was assessed (n=3238) by validated food frequency questionnaire, from which dietary patterns were generated by principal components analysis. In a follow up visit after 11.3 (1.3) (mean (SD)) years, participant (mean age (SD) = 66 (2) years) BMD was measured (n=2208) at the femoral neck (FN) and lumbar spine (LS) (L2-L4) by dual energy x-ray absorptiometry (GE Lunar). Concentrations of hsCRP from stored serum collected during 1997–2000 study visits were measured (n=2452) using standardised automated procedures. Linear regression was used to test the relationship between diet, hsCRP and BMD.

Five dietary patterns (accounting for 26% of the variance in the diet) were identified. A ‘healthy’ dietary pattern with positive factor loadings for fruit, vegetables and oily fish positively predicted BMD (FN $r=0.048, P=0.022$; LS $r=0.049, P=0.018$). A ‘high fat’ pattern with positive factor loadings for fats/oils and bread was a negative predictor of BMD (FN $r=0.072, P=0.001$; LS $r=-0.073, P=0.001$). The ‘healthy’ pattern was negatively associated with serum hsCRP ($r=0.112, P<0.001$), and a third dietary pattern with positive factor loadings for non-oily fish and fats/oils was positively associated with serum hsCRP ($r=0.111, P<0.001$). Relationships remained significant after adjustment for confounders (weight, and national deprivation category, smoking status and physical activity level at baseline). Serum hsCRP concentration did not predict BMD in our regression model.

A ‘healthy’ dietary pattern may be related to suppression of inflammation and attenuation of bone loss. Dietary patterns with a high intake of fats and oils may have negative effects on these health outcomes.
Emerging nutritional and lifestyle risk factors for bone health in young women: a mixed longitudinal twin study

J. Christie, C. Nowson, S. Garland, J. Wark (Melbourne, Burwood, AU)

Late adolescence and early adulthood are times of major behavioural transition in young women as they become more independent and make choices about lifestyle that will affect their long term health. We prospectively evaluated nutrition and lifestyle factors in 566 15 – 30-year-old female twins participating in a mixed longitudinal study of the impacts of diet and lifestyle related to bone health. Twins completed 790 study visits including questionnaires and measures of anthropometry, body composition and bone mineral density. Non-parametric tests (chi-square, Mann-Whitney U and Kruskal-Wallis; SPSS) were used to examine age-related differences in selected variables. Median dietary calcium intake (short food frequency questionnaire) was relatively low [852 (535,1245)] mg/day (median, IQR) and did not vary significantly with age. The number of young women who reported ever consuming alcohol (12+ standard drinks ever) increased from 50% under 18 yrs to 93-99% for the 18+ age groups. Of those who consumed alcohol in the year prior to their visit, monthly intake doubled from under 18 yrs (5.7, 3.9, 19.0; median, IQR) to 18+ yrs (12.0, 4.7, 26.0; P < 0.001) with the highest consumers being 21–23 and 27–29 yrs. At age 15–17 yrs, 14% reported ever smoking and by age 27–29, 51% had smoked (P = 0.002). Under the age of 20 yrs, median cigarette consumption in smokers was 6 (4,10) per day, increasing to 10 (2,15) above age 20 (P < 0.001). Participation in sporting activity decreased progressively with age (P < 0.001): 47.5% of 15–17 yr-olds undertook 4 or more h/week of sport, compared with 23.5% at age 27–29 yrs. Conversely, sedentary behaviour increased with age: 25.0% of 15–17 yr-olds reported 1 or less h/week of exercise compared with 50.0% at age 27–29 yrs. Changes in walking activity were complex, suggesting an increase with age. BMI increased progressively with age (P = 0.01), the youngest group (15–17 yr) having the lowest (21.3, 19.5, 23.6; median, IQR) and the oldest (27–29 yr) having the highest (23.1, 21.5, 25.9).

These findings demonstrate highly-significant changes in behaviour in young women as they transition into independent adult living. Many of these changes are predicted to impact adversely on bone and other health outcomes in later life. There is a pressing need to improve understanding of the determinants of these changes and to develop effective interventions to improve long term bone health and other outcomes in young women.
Dietary fat composition is associated with indexes of skeletal muscle mass in women

A.A. Welch, A. MacGregor, T. Spector, A. Cassidy (Norwich, London, UK)

Objectives: Conservation of skeletal muscle is important for preventing falls and fractures but age-related loss of muscle mass occurs even in healthy individuals. The fat composition of the diet could influence muscle mass firstly, through its integral association with muscle metabolism and influence on membrane metabolism, and secondly, indirectly through its effects on inflammation, with saturated and trans fatty acids suggested to be pro-inflammatory and polyunsaturated fatty acids (PUFA) anti-inflammatory (1,2).

Methods: We investigated the relationship between dietary fat composition and indexes of muscle mass in a cohort of 2689 healthy female twins aged 18-79 years. St. Thomas’s Hospital Research Ethics committee provided ethical approval. Body composition was measured using dual-energy X-ray absorptiometry (Hologic QDR, Ltd, Crawley, West Sussex, UK) and total fat free mass (FFM) and the fat free mass index (FFMI as kg/height²) calculated. FFM and FFMI were calculated according to quintile of fatty acid intake in the diet (measured using an FFQ) and adjusted for age, physical activity, smoking habit, total body fat, total fat and energy intake and under-reporting, using robust regression with the cluster option in Stata version 10 (StataCorp, College Station, TX, USA).

Results: Intakes of saturated fat ranged from 13.2g/d (Q1) to 42.1g/d (Q5), of trans fatty acids from 1.1 g/d (Q1) to 4.3 g/d (Q5) and of PUFA from 7.8g/d (Q1) to 22.3 g/d (Q5). FFM was significantly lower by 0.3 kg (P=0.004) between Q1 and Q5 of trans fatty acids and FFMI was 0.53 kg/m² lower (P<0.005). For saturated fat intake FFM and FFMI were lower in Q5 than Q1 by 0.9 kg (P=0.004) and 0.41 kg/m² (P=0.003), respectively. Although FFM and FFMI were higher in Q5 than Q1 of PUFA these differences were not significant.

Conclusion: These results suggest an association between indexes of fat free mass and fat composition of the diet which deserves further investigation.

The effects of protein supplementation on bone mass in Chinese postmenopausal women

Q. Zhang, F. Wu, X. Hu, C. Wang, Y. Liu, R. Prince, K. Zhu (Beijing, CN; Perth, AU)

Background: Sufficient calcium intake is essential for the maintenance of bone health in older people. However, the effect of protein on bone mass of older women is controversial. To the best of our knowledge, there has been no clinical trial evaluating the effect of protein supplementation on bone mass in older Chinese women.

Objective: To evaluate the effect of one-year protein and calcium supplementation on bone mass in older Chinese women compared to calcium supplementation alone.

Design: A one-year randomized controlled trial was conducted in 283 Chinese postmenopausal women aged 68.1 ± 0.5 years (range 60-86 years). Study participants were randomized to receive either protein powder containing 30g soy bean protein and 1000 mg calcium as calcium carbonate (Pro+Ca group, n=142) or only 1000 mg calcium per day (Ca group, n=141). Measurements performed include dietary intakes by one-year food frequency questionnaire, physical activity by International Physical Activity Questionnaire (IPAQ) – Short Form, and areal bone mineral density (aBMD) at hip, lumbar spine (L2-L4) and total body by DXA at baseline and one year.

Results: There were no significant differences between the two groups in baseline characteristics. With supplementation, both groups had significantly higher calcium intake compared to the baseline (1647±53mg/d vs 879±30mg/d, P=0.01), and the average dietary protein intake was significantly higher in the Pro+Ca group compared to the Ca group (107.8 ± 4.6 g/d vs 75.7 ± 3.1 g/d, P<0.001).

After one-year supplementation, aBMD at total-body, femoral neck, trochanter and total hip increased slightly but significantly in both groups after adjusting for baseline age, BMI, calcium intake, physical activity level and serum 25(OH)D level (time effect, all P<0.05). There were no significant time effects of intervention on lumbar spine aBMD. The Pro+Ca group had significantly greater increase in total body aBMD (9.5 mg/cm²) compared to the Ca group (0.4 mg/cm²) after one-year of supplementation before and after adjustment for covariates (time×group interaction, all P<0.05). There were no significant effects of protein supplementation on aBMD measured at other sites.

Conclusion: Higher intake of dietary protein might have a positive effect on total body bone mass in Chinese postmenopausal women when calcium intake is sufficient.
Carotenoid intake and risk of hip fracture in the Singapore Chinese Health Study

W.-P. Koh, Z. Dai, A Jin, J.-M. Yuan (Singapore, SG; Pittsburgh, US)

Objective: There is experimental evidence that free radicals, which are markers of oxidative stress, may increase bone resorption by promoting osteoclastic differentiation. Common carotenoids found in fruits and vegetables have antioxidant functions that may reduce oxidative stress, and have been postulated to protect against osteoporosis. Although recent Western studies have suggested that carotenoids may reduce the risk of osteoporotic fracture, such findings are inconsistent. We examined the association between dietary intakes of common carotenoids and hip fracture risk in an Asian population.

Method: The Singapore Chinese Health Study is a population-based cohort study in Singapore that enrolled 63,257 Chinese men and women of ages 45 to 74 years between 1993 and 1998. Dietary intakes were obtained via in-person interviews using a validated food frequency questionnaire. Incidence of hip fracture within this cohort was obtained via linkage with nationwide hospital discharge database up to 31 December 2010. Cox proportional hazards model was used to determine carotenoid intake and hip fracture risk after adjusting for other risk factors.

Results: After a mean follow-up of 13.8 years, there were 1,630 incident cases of hip fracture within this cohort. Compared to men in the lowest quartile, men in the highest quartile intake of beta-carotene had 29% reduction in hip fracture risk [hazard ratio (HR) 0.71, 95% confidence interval (CI) 0.53-0.96]; p for trend was 0.007. Similarly, among women, those in the highest quartile intake had 13% reduction in hip fracture risk compared to those in lowest quartile (HR 0.87, 95% CI 0.73-1.03); p for trend was 0.036. In contrast, lycopene intake was associated with reduction in hip fracture risk among women but not among men. The relative risk for women with the highest quartile intake of lycopene compared to those in the lowest quartile was 0.81 (95% CI 0.67-0.97); p for trend was 0.005. Intakes of alpha-carotene, beta-cryptoxanthin and lutein did not show any significant association with hip fracture risk in either gender.

Conclusion: Our findings suggest that dietary intake of beta-carotene may have possible protective effect against hip fracture in elderly men and women. Furthermore, dietary intake of lycopene may also reduce hip fracture risk in women though not in men. A balanced diet including adequate servings of bright-colored fruits and vegetables may be beneficial to bone health among aging populations.
Various nutrients

17

Dietary B-Vitamin intake and risk of hip fracture in The Singapore Chinese Health Study

Z. Dai, W.-P. Koh, A. Jin, J. Yuan (Singapore, SG; Pittsburgh, US)

Background: Homocysteine has been implicated in pathogenesis of osteoporotic fractures. Studies among Caucasians have suggested that B vitamins (vitamins B2, B6, B12 and folate) involved in homocysteine metabolism may therefore influence hip fracture risk. Incidence of osteoporotic hip fracture is rising in Asia but there is paucity among Asian populations on dietary factors.

Objective: To assess dietary intakes of B vitamins and hip fracture risk among elderly Chinese population in the Singapore Chinese Health Study.

Methods: A population-based, prospective cohort study was conducted between 1993 and 1998 with enrollment of 63,257 men and women (mean±SD age: 56.5±8 yr). Baseline dietary intakes of vitamins B2, B6, B12 and folate were obtained via in-person interviews using a validated food frequency questionnaire. After a mean follow-up period of 13.8 years, 1,630 hip fracture incident cases were identified within this cohort via linkage with the nationwide hospital discharge database up to December 31, 2010. HRs were estimated using Cox proportional hazards model, adjusting for other risk factors and potential confounders of hip fracture.

Results: We observed a statistical significant inverse relationship between vitamin B6 intake and hip fracture risk among women but not among men. Compared to women in the lowest quartile (<0.61 mg/1000 kcal/day), women in the highest quartile intake (≥0.78 mg/1000 kcal/day) had a relative risk of 0.76 (95% confidence interval = 0.62-0.92). There was a strong inverse dose-response relationship between increasing vitamin B6 intake and hip fracture risk (p for trend=0.003). The other B vitamins were not associated with hip fracture risk in either gender.

Conclusion: Our study suggests that low intake of vitamin B6 may increase risk of osteoporotic hip fracture among women but not among men. Vitamin B6 is a cofactor in the transulfuration pathway that converts homocysteine to cystathionine and then to cysteine, thus deficiency in this vitamin may result in accumulation of homocysteine with subsequent dire affects on bone health. Ensuring adequate vitamin B6 intake may prevent osteoporotic fracture among the elderly women.
Dietary anthocyanidin intakes are associated with increased bone mineral density and decreased markers of bone resorption in a population of Scottish women

C.J. Macdonald, L. Aucott, W.D. Fraser, D.M. Reid, H.M. Macdonald (Aberdeen, Liverpool, UK)

Fruit and vegetable consumption may improve bone health. Anthocyanidins are bioactive compounds found mostly in berries but little is known about their role in bone. Blueberry consumption has been shown to prevent bone loss in a rat model of postmenopausal osteoporosis. To our knowledge, associations between dietary anthocyanidins and bone health have not been studied in humans.

The aim of this study was to determine if dietary total anthocyanidins or individual anthocyanidins (cyanidin (Cy), delphinidin (Dp), malvidin (Mv), pelargonidin (Pg), peonidin (Pn) and petunidin (Pt)) are associated with markers of bone health in a population from the Aberdeen Prospective Osteoporosis Screening Study (APOSS).

A total of 3239 women (mean age 54.8 (2.2) y (SD)) completed a food frequency questionnaire (FFQ) between 1997 and 1999 which was analysed for dietary anthocyanidin intake using data derived from U.S. Department of Agriculture (USDA). Bone mineral density (BMD) was measured at the femoral neck (FN) and lumbar spine (LS) by dual-energy X-ray absorptiometry (DXA). Urinary bone resorption markers free pyridinoline (PYD) and deoxypyridinoline (DPD) were measured by high-performance liquid chromatography (HPLC). Bone formation marker amino-terminal procollagen propeptides of type 1 collagen (P1NP) was measured in serum by ELISA. Since anthcyanidin intakes were skewed, ANCOVA was used to determine whether quartiles of energy adjusted anthocyanidin intakes were associated with markers of bone formation and resorption and BMD and annual change in BMD since baseline in 1990–1994.

The total anthocyanidin intake was 22 (20) ug/d (mean (SD)). The greatest contributor to the diet was Cy (32%) followed by Mv (27%), Dp (18%), Pt (9%), Pg (8%) and Pn (6%). Associations were observed between total anthocyanidins and PYD (p<0.001) and DPD (p=0.039). Dp and mv intakes were associated with annual percent change in FN BMD (dp p=0.025 and mv p=0.014) and PYD (dp p=0.04 and mv p=0.021). Pg was associated with FN BMD (p=0.03) and DPD (p=0.001). Pn intake was associated with annual percent change in FN BMD (p=0.045), PYD (p=0.001) and DPD (p=0.036). Pt intake was associated with PYD (p=0.002) and DPD (p=0.05). These results were seen after adjusting for confounders.

In conclusion, dietary anthocyanidins are associated with BMD, change in BMD and markers of bone resorption in a population of middle aged women. Further work is required to investigate the cellular mechanism of action.
Low-dose MK-7 supplementation reduced age-related bone loss in healthy postmenopausal women

E. Theuwissen, M. Knapen, E. Smit, C. Vermeer (Maastricht, NL)

Objective: Previous studies have shown that supplementation with high dose (10–50 x RDA) vitamin K1 and the short-chain menaquinone-4 (a form of vitamin K2) may help decrease bone loss in healthy postmenopausal women. The long-chain menaquinone-7 (MK-7) has a longer half-life and was shown to have a higher efficacy in catalyzing osteocalcin (OC) carboxylation than vitamin K1 and MK-4. The question remains whether MK-7 administration at a nutritional dose (around the RDA for vitamin K, i.e. 2.3 nmol/kg body weight/day) also leads to measurable improvements in bone health.

Methods: In this 3-year study, 244 healthy post-menopausal women aged between 55 and 65 years randomly received either placebo or MK-7 capsules (natural MK-7 as MenaQ7, 275 nmol/day). Bone mineral density (BMD) and bone mineral content (BMC) of lumbar spine, total hip, and femoral neck were determined by DXA at baseline and after 1, 2, and 3 years of treatment. Bone strength indices (bending, compression, impact) were calculated from BMD, hip-axis length, and femoral neck width.

Results: It was found that low-dose supplemental MK-7 intake significantly reduced age-related decline of BMC and BMD at the lumbar spine and femoral neck, but not of the total hip. Calculated bone strength indices were favorably affected by MK-7 supplementation. Moreover, both the BMD of the lumbar spine and the impact strength remained unchanged during the entire treatment period in the MK-7 group, and declined as expected for age-associated bone loss in the placebo group.

Conclusion: We conclude that postmenopausal women can benefit from taking MK-7 supplements to prevent bone loss and optimize bone quality. Whether these results can be extrapolated to other population groups, such as children and elderly men needs further investigation.
Introduction and Aims: Vitamin D deficiency is a global health problem. Limited skin exposure to sunlight, obesity and low dietary calcium intake may all impact vitamin D status and bone health. The aims of this study were to: determine vitamin D status and its association with the extent of veiling and different measures of obesity, and to examine the impact of milk intake on vitamin D status and bone metabolism markers in a sample of randomly selected pre- and postmenopausal healthy Saudi women.

Methods: A total of 449 women were recruited 226 premenopausal [20-39 years]; and 223 postmenopausal women [>51 years]. Fasting blood samples were collected for assessment of 25(OH)D status and carboxyterminal telopeptide of type I collagen (CTX). Weight, height, waist circumference (WC), hip circumference (HC) and total body fat (TBF) by dual energy X-ray absorptiometry were measured. Waist-to-hip ratio (WHR) and body mass index (BMI) were calculated. Milk intake was determined using a validated food frequency questionnaire.

Results & Discussion: A total of 85.5% of women had vitamin D deficiency with a serum level < 50 nmol/L. Women who were completely covered (both face and hands or face only), (n=261) were found to have a significantly lower 25(OH)D status than women who covered their heads but not their faces and hands (n=188) (25(OH)D 26.5 [SD 19.6] nmol/L vs. 32.0 [SD 24.4] nmol/L) respectively (p<0.011). A significant negative correlation between BMI (r= -0.203, P<0.01), TBF (r= -0.340, P< 0.01) and WC (r=0.140, P<0.05) was found in the postmenopausal women. A positive correlation was found between milk intake and 25(OH)D status, which remain significant after controlling for BMI and age (r= 0.193, P<0.001). A trend for milk intake to be negatively associated with CTX excretion was also observed (r= -0.083, P≤0.07) after adjustment for age and BMI.

Conclusion: Vitamin D deficiency is rather highly prevalent among healthy Saudi women. Further investigations are currently underway to explore concomitant effects of these factors on bone density in this population.
Peak bone mass (PBM) is mostly determined by genetics but lifestyle and diet during youth may modify the final PBM. Little is known about PBM acquisition in college-aged, physically active men. We examined changes in spine and hip bone mineral density (BMD) in a cohort of 146 males entering the US Military Academy (average age=18.8±1.1; n=126 Caucasian, n=7 Asian, n=13 African American), randomly sampled from the full study population (755 males; 70% of male admissions). We prospectively evaluated the relative importance of total dietary calcium intake and serum vitamin D on bone density and structural changes over 4 years. Calcium intake was determined by a brief food frequency questionnaire. Within 3 days of arrival to the academy (July), a serum sample was taken, and 25(OH)D level was measured by Diasorin RIA; Intact (1-84)PTH was measured using the Elecsys (Abbott). BMD at the lumbar spine and total hip were measured at baseline and annually for 4 years, by DXA (Lunar DPX-IQ). Hip structural analysis (HSA) was done using the methodology of Yoshikawa (JBMR 1994). Slopes of change in spine and hip BMD and HSA parameters were determined for each male. Average calcium intake was 1803 mg/day (range 387 to 6258). There was no significant use of calcium or vitamin D supplements. Men with calcium intake <800 mg lost 1% of total hip BMD per year, whereas those with calcium intakes >800 mg a day gained 0.23% BMD per year (p<0.007), after controlling for race and serum 25(OH)D (P<0.05). There was no relationship with change in spine BMD and calcium intake. Males with serum 25(OH)D<20 ng/ml had significantly higher PTH levels (41± 5 pg/ml) versus those with serum 25OHD≥20 ng/ml (33±1.4 pg/ml) [p<0.04]. In those with 25OHD<20 ng/ml, 21% [n=4 of 19] had PTH values > 65 pg/ml. In men with 25(OH)D≥ 20ng/ml, only 4% [n=5 of 124] had PTH levels above the normal range. Males with serum 25(OH)D level≥20 ng/ml had a significantly greater increase in hip BMD (0.2% gain in hip BMD/year) as compared to a 0.3% hip BMD loss per year in the 25(OH)D<20 ng/ml group. There was also a relationship between serum vitamin D and hip cross-sectional area. Both relationships with 25(OH)D persisted after controlling for race and BMI (p<0.03). However, there was no relationship between serum 25(OH)D and change in spine BMD. Conclusion. In highly physically active college-aged men, dietary calcium intake and vitamin D status modify peak bone mass acquisition.
Comparison of Vitamin D2 versus Vitamin D3 supplementation in raising serum 25(OH)D status: a systematic review and meta-analysis

(Guildford, Chipping Campden, London, Manchester, UK; Toronto, CA)

Maintaining a healthy vitamin D status is a problem within the UK, with 47% of the population thought to be insufficient and 15% deficient during the winter and spring months1. With the implications of a low vitamin D status known to include poor bone and muscle function2, compromised immune function and risk of diabetes3, establishing effective strategies to improve the vitamin D status of the population is vital. Yet in order to achieve this target, the current controversy as to whether vitamin D2 and D3 are equally effective in raising serum 25(OH)D levels needs urgent attention. The current study aimed to address this issue through the completion of a first-ever systematic review and meta-analysis specifically assessing randomised controlled trials (RCTs) that have directly compared the effects of vitamin D2 vs. vitamin D3 on serum 25(OH)D levels in humans. An electronic database search of the ISI Web of Knowledge (January 1966 to July 2011) was completed. All relevant studies involving adults directly comparing vitamin D2 to vitamin D3 were retrieved. Clinical trial registries were searched for any unpublished trials. Ten studies were relevant to the meta-analysis and 7 studies were included in the final analysis (3 studies did not provide sufficient data).

Armas 2004 JCEM; Biancuzzo 2010 AJCN; Binkley 2011 JCEM; Glendenning 2009 Bone; Heaney 2011 JCEM; Holick 2008 JCEM; Leventis 2009 Scand J Rheumatol; Romagnoli 2008 JCEM; Tjellessen 1986 Bone and Mineral; Trang 1998 AJCN. A random effects model determined that, overall, vitamin D3 was significantly more effective at raising serum 25(OH)D levels compared to vitamin D2 (p=0.001). Frequency of dosage was examined, with a significant favouring found towards vitamin D3 in raising serum 25(OH)D levels when given as a bolus dose (single or infrequent bolus, p=0.0002). The effect was lost for daily supplementation, with vitamin D3 and D2 appearing equally favourable (p=0.11). Overall vitamin D3 appears to be more effective in raising serum 25(OH)D levels compared to D2. However, the small numbers of studies suitable for analysis means that any conclusions must be somewhat cautiously drawn. Large-scale studies are required to strengthen the evidence base and to further our understanding of the metabolism of vitamin D2 and D3, essential steps in order to fully inform public health strategies.

Introduction: Gender differences in bone during childhood and adolescence are well described in countries with moderate to high calcium intakes; there are few data from countries where children have delayed puberty and low habitual calcium intakes. The aim of this study was to determine whether gender differences in bone and body composition exist in pre-pubertal Gambian children accustomed to low calcium intake.

Methods: Children were recruited between the ages of 7.8 to 12.0 y. Bone mineral content (BMC) and bone area (BA) were measured at whole body, lumbar spine and hip using dual-energy X-ray absorptiometry (DXA, GE-Lunar Prodigy). Whole body data were analysed as whole body-less head (WBLH). Weight and height were measured using standard procedures. Sex effects were tested using univariate regression (M/F = 0/1) and multiple regression. BMC was adjusted for BA, weight, height (size-adjusted BMC, SA-BMC), and body composition for age and height, with continuous variables transformed to natural logs. Sex effects are presented as %differences ± SE.

Results: 447 children (216M, 231F) were recruited. Mean±SD age M=9.3±0.1y, F=9.2±0.1y; height M=127±6cm, F=128±7cm; weight M=23.8±0.2kg, F=24.0±0.3kg; lean mass M=20.5±0.2kg, F=19.2±0.2kg; fat mass M=2.2±0.06kg, F=3.6±1.1kg.

BMC was greater (P≤0.05) in M than F at total hip (9.3±2.1%) and femoral neck (16.1±2.1%) but not significantly so at WBLH (3.0±2.1%) or spine (1.2±1.8%). BA was significantly greater in males at femoral neck (6.4±1.7%) and spine (2.5±1.1%) but not WBLH (-2.3±1.4%) or total hip (1.4±1.5%).

SA-BMC was greater in M than F at the total hip (10.8 ±1%) and femoral neck, (10.2±1.0%) and lower at WBLH (-0.9±0.4%) and spine (-3.4±1.0%).

M had greater size adjusted total lean mass (7.7±0.7%) than F, conversely fat mass was lower (-45.8±3.3%).

Conclusions: Gender differences exist in this population of children. The differences appear to be site-specific, with M having greater SA-BMC at the total hip and femoral neck but lower at WBLH and lumbar spine. M also have greater BA at the femoral neck and spine, indicating wider bones. Differences between the bone sites may be due to asynchrony in the timing of skeletal maturation between M and F. Whether such differences persist and whether there are environmental influences require further investigation.
Objective: Health effects of dairy foods may be due to more than a single nutrient. We evaluated the association of milk, yogurt, cheese, cream and total dairy intakes (with/without cream due to high fat content) with bone mineral density (BMD) at hip (femoral neck-FN, trochanter-TR) and lumbar spine (LS) in the Framingham Offspring Study.

Methods: 2,733 men and women completed food frequency questionnaires (FFQ) in 1992-95 or 1995-98 and BMD assessments in 1996–2001 using dual-energy X-ray absorptiometry. We used linear regression to estimate mean BMD by quartile/categories of dairy intake (servings/week) adjusting for age, sex, total energy intake, weight, height, menopause and estrogen use (in women), calcium and vitamin D supplement uses. Final models simultaneously included all dairy items.

Results: Mean age was 55y (SD: 9.6, range: 26-86) at FFQ exam. Total dairy (excluding cream and ice cream) was positively associated with hip and spine BMD (P range: <0.0001-0.0005) while total dairy (including cream and ice cream) was associated only with FN and TR (P=0.02 each) but not LS-BMD (P=0.12). Milk intake was associated with hip and spine BMD (P range: 0.03-0.007). However, cream intake tended to be negatively associated with FN (P=0.07) but not with other BMD sites (P range: 0.11-0.16). Subjects with high yogurt intake (>4 servings/week) had higher TR-BMD compared to those with no intake (P=0.006). No significant associations were seen for yogurt and other BMD sites as well as for cheese intake (P range: 0.11-0.44). When milk, yogurt, cheese and cream were considered simultaneously, milk and high yogurt intake remained positively associated with FN-BMD (P range: 0.02-0.05) while cream remained negatively associated with hip and spine BMD (P range: 0.02-0.05). The positive associations for cheese did not reach significance.

Conclusion: Total dairy intake, specifically milk and yogurt intake, were significantly positively associated with BMD at hip and spine in men and women, while cream adversely influenced BMD, perhaps due to its high fat content and low calcium and vitamin D content. This suggests that not all dairy products are equally beneficial for the skeleton.
Calcium

33

Galactooligosaccharides: effects on calcium absorption and gut microflora in young premenarcheal girls


Adolescence presents an opportunity to influence peak bone mass with prebiotic agents like galactooligosaccharides (GOS) that increase calcium absorption in the large intestine in animal models and adults. The objectives of this study were 1) to investigate the dose response of GOS supplementation on calcium absorption during growth and 2) to assess total colonic microbiota and bifidobacteria to better understand the mechanism of action. Using a randomized, double-blind, crossover design, thirty-one 10–13 year old girls consumed smoothie drinks enriched with 0, 2.5 or 5 g GOS twice a day for 3 weeks. The 3-week periods were separated by 2-week washout periods. Fractional calcium absorption was determined, using dual stable isotope methods, as the ratio of oral and intravenous tracers in urine over 48 hours. DNA was extracted from fecal samples to quantify total microbiota and bifidobacteria using qPCR. Preliminary results show that GOS increased fractional calcium absorption. Bifidobacteria as a proportion of total bacteria was also significantly greater after consumption of GOS. Results suggest that GOS consumption increases fractional calcium absorption in young girls through possible mechanisms in the large intestine. Supported by a grant from FrieslandCampina Domo.
The relationship of weight-bearing physical activity and dietary calcium intake with bone mass accrual in the bone mineral density in childhood study cohort


Background: Although it is widely accepted that dietary calcium intake (CaI) and weight-bearing physical activity (WBA) increase bone mass accretion during growth, few prospective studies have followed children from early childhood to sexual maturity.

Aims: To describe the relationship between CaI and WBA and bone mineral content (BMC) accretion in a large, multi-racial cohort of children followed prospectively from early childhood until sexual maturity.

Methods: Five U.S. centers recruited 2014 healthy children (ages 5 to 19 yr) and measured them annually for up to 7 years. Subjects with at least 2 annual visits are included in this analysis (943 males, 973 females). Total body (TB), total hip, and spine BMC were assessed by dual energy x-ray absorptiometry. Height (ht) was measured with a stadiometer and Tanner’s stage was assessed by physician exam. Annual increases in BMC and ht were calculated as the difference from the 1st to the last measurement divided by the yrs on study for each subject. Hrs/wk of WBA were assessed annually by self-report using the modified Slemenda questionnaire and averaged for each subject. CaI (mg/d) was assessed annually by a food frequency questionnaire and averaged for each subject.

Analyses: Multiple regression was used to model annual increases in BMC controlled for annualized overall ht growth, Tanner stages, and the baseline value of each BMC measure. The effect of adding WBA and CaI to this basic model was evaluated using a t-test (type III SS).

Results: Mean WBA: girls 12±6 hrs/wk, boys 14±7 hrs/wk. Mean CaI: girls 749 mg/d and boys 945 mg/d. WBA had a significant positive association with increases in BMC at all sites in both sexes and also in the racial subgroups (p<0.05). Among all males and the racial subgroups, CaI had no significant association with BMC increases. Among all females, CaI had a positive association with increases in TBBMC, when ht growth was excluded from the model (p<0.05). In nonblack females, CaI had a significant effect whether or not ht change was included.

Conclusion: In this large, racially diverse cohort, WBA contributes to bone mass accrual in both boys and girls. CaI, however, increases accrual significantly in girls only in total body BMC. The effect is stronger in non-black than in black girls. These findings support the importance of public health efforts to increase physical activity in children and adolescents while assuring adequate calcium intake.
A dairy-based protein, calcium and Vitamin D supplement reduces falls and femoral neck bone loss in aged care residents: a cluster randomised trial


Background: Falls and fracture rates are high in ambulatory aged care residents, and malnutrition may contribute to falls and fracture risk. We aimed to test if a dairy-based protein (9g/d), calcium (600mg/d) and vitamin D (960IU/d) supplement formulated to increase intakes to recommended levels would reduce falls and fracture risk in ambulatory low-level aged care residents.

Methods: Cluster-randomised, single-blind intervention involving 813 residents (mean age 86.1 ± 5.9 years, 76% female) from 16 low-level aged care facilities in Melbourne, Australia. 12 months of observation in all facilities was undertaken followed by 8 months of food-based supplementation (intervention) or usual intake (controls). Number of fallers, and non-vertebral fractures, serum 25(OH)D, PTH, osteocalcin, bone mineral density (BMD), bone structure and volumetric BMD at the distal radius and tibia using high-resolution pQCT, balance (Lord’s balance test) and functionality (timed up and go, walking velocity) were tested. Repeated measures ANOVA and logistic regression models were used to compare cases and controls.

Results: Among the whole sample, supplementation reduced the number of fallers by 42% (OR = 0.58, 95% CI: 0.44 – 0.78, p < 0.001), Among the 58 participants with follow up data, supplementation slowed bone loss at the proximal femur, maintained serum 25(OH)D and reduced PTH by 16% ± 8%, p < 0.03.

Conclusion: Fortifying foods with protein, calcium and vitamin D reduced falls in ambulatory aged care residents and is a widely accessible, and inexpensive approach to reduce falls and slow the progression of bone fragility in the elderly.
Effects of Vitamin D and calcium supplementation on heart rate and blood pressure in community dwelling older individuals – a prospective, randomized, double-blind study

M. Pfeifer, H.W. Minne, A. Fahrleitner-Pammer, H. Dobnig (Bad Pyrmont, DE; Graz, AT)

At present there are only few studies available investigating effects of vitamin D and calcium supplementation on parameters of heart function. This prospective study was undertaken to test the influence of latitude, seasonal variations, possible threshold effects and duration of vitamin D efficacy after cessation of therapy. 242 healthy male and female subjects over 70 years of age and a 25-OH-D3 serum level below 75 nmol/l were recruited in Bad Pyrmont and Graz and were randomly assigned to two treatment groups: one receiving 1000 mg Calcium/day (Ca) and the other 1000 mg Calcium and 800 I.U. Vitamin D (Ca+D) over 12 months. Systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) were determined under standardized conditions every four months. Statistical evaluation was carried out using the statistics software of IDV, Gauting (Test + Estimation, Version 5.2, “CRO” Dr. Heinz, Vienna, Austria). Baseline parameters did not differ between groups.

We performed an intention-to-treat analysis and found the following results:
In the (Ca+D) group 25(OH)D increased significantly (p<0.01) from 57 ± 20 nmol/l at baseline (BL) to 84 ± 18 nmol/l at month 12 (M12), whereas in the (Ca) group there was no change (54 ± 19 versus 55 ± 18 nmol/l).
In the (Ca+D) group SBP decreased significantly (p<0.01) from 134 ±17 mmHg at BL to 124 ± 14 mmHg at M12, whereas in the (Ca) group there was no change (137 ± 17 versus 133 ± 16 mmHg).
In the (Ca+D) group DBP decreased significantly (p<0.01) from 76 ± 7 mmHg at BL to 72 ± 7 mmHg at M12, whereas in the (Ca) group there was no change (79 ± 8 versus 78 ± 9 mmHg).
In the (Ca+D) group HR decreased significantly (p<0.01) from 74 ± 4 beats/min. at BL to 70 ± 4 beats/min. at M12, whereas in the (Ca) group there was no change (74 ± 4 versus 75 ± 4 beats/min.)
Despite a relatively high inclusion criterion for vitamin D (75 nmol/l) and independent of latitude, we observed a significant reduction of blood pressure and heart rate after supplementation with vitamin D and calcium. This effect of nutritional supplements may be comparable to the efficiency of hypertensive drugs.
Influence of selected nutrients on Vitamin D metabolites concentrations in children with low bone mass

J. Karalus, D. Chlebna-Sokol (Lodz, PL)

The aim of the study was to investigate correlation between vitamin D metabolites concentrations in serum and selected dietary components in children with primary low bone mass.

Patients and methods: 76 children aged 6-18,5 (35 F/41 M) with primary low bone mass were included. Concentration of 30ng/ml was adopted as the lower limit of normal 25OHD level. The diagnosis of low bone mass (LBM) was determined based on comprehensive examination, including the assessment of clinical, radiological, biochemical and particularly densitometric indices. In all children mean daily intake of selected nutrients were evaluated on the basis of three-day record of 24-hour diet. On the basis of evaluation of the nutrients supply in diet mean intake of selected compounds were calculated. In whole group the concentration of 25-hydroxycholecalciferol, 1,25-dihydroxycholecalciferol and parathormone were determined.

Results: On the basis of diet evaluation in LBM children significant deficiency of vitamin D intake was observed in 61/76 children (80%). Diet covered on average 56% of daily requirement. The calcium deficiency was seen in 51/76 (67%) patients. Simultaneously the excessive intake of phosphorus (185% of daily requirement) was showed. The influence of intake of sodium and proteins on calcium absorption in intestines and renal excretion was described and in analyzed group the proteins intake exceeded 2 times and sodium 6 times daily requirements. In 35 children concentration of 25OHD was lower than 30 ng/ml. Regarding this data children were divided into 4 groups on the basis of vitamin D intake and the comparison between I and IV quartile revealed a significant difference (t= 2,04; p= 0,021). between liver metabolite of vitamin D concentrations. Mean concentrations of 25OHD in I quartile was 18,5ng/ml and in IV quartile was 37,9 ng/ml It showed that children with daily intake lower than 33 % of daily requirements (I quartile) had statistically lower 25OHD concentration than children whose intake was higher than 73% of daily requirement ( IV quartile).

Conclusion:
1. Low concentrations of 25OHD in serum were significantly correlated with low vitamin D intake, what indicate that diet is the important source of vitamin D.
2. Low vitamin D and calcium intake and excessive sodium and phosphorus consume determine adverse configuration of essential factors to optimal bone mineralization in developmental period, particularly in children with bone mineral disturbances.
The assessment of the Vitamin D supply in the population of Polish children at the age of 9–12 years – multicentre research- preliminary report


Introduction: The vitamin D pleiotropic effect has been broadly discussed. The systemic deficiency of vitamin D connected with the lower sunlight exposure and the decreased diet supply during the rapid growth may hamper the correct peak bone mass acquisition. More and more often the vitamin D deficiency in children is observed. The aim of the study was to determine the vitamin D supply in schoolchildren in Poland.

Patients and methods: The study comprised 6 research centers from Poland: Lodz, Bialystok, Katowice, Szczecin, Lublin, Poznan. The healthy schoolchildren at the age of 9-11,99 were examined. In every child the liver metabolite of vitamin D was detected twice: after the winter and summer. The serum was analysed with the immunochemiluminescence method with the DEQAS international control system. The sufficient 25 OHD serum concentration was recognized at range of 20-100 ng/ml, the insufficiency at the range of 10-20 ng/ml and deficiency below 10 ng/ml.

Results: The 715 of children were examined. The greatest vitamin D shortages were observed in Szczecin and Bialystok – in 95% and in 90% children (insufficiency in 64% and 67% and deficiency in 31% and 23%). In Katowice and Lublin the lower vitamin D concentration was detected in 89% and 88% of children (insufficiency in 73% and 68% and deficiency in 16% and 20%). The lower shortages were revealed in children from Lodz and Poznan - in 77% and 74% (insufficiency in 57% and 59% and deficiency in 20% and 15%). The results of the 25OHD improved considerably after the summer. The greatest shortages were obtained in Poznan and Szczecin – in 52,9% and 42,1% (insufficiency in 52,2% and 42,1% and deficiency in 0,7% and 0%). In Lodz the decreased concentration was observed in 41,5% of children and it was the insufficiency only. The lowest shortages were revealed in Lublin, Bialystok and Katowice- in 28%, 26,3% and 26,3% of children and it were the insufficiency also.

Conclusions:
1. The lower concentration of vitamin D in as many children indicates on adverse diet and climatic conditions which may influence on bones.
2. The results of this study confirm the neccesity of the prophylaxis of vitamin D deficiency in schoolchildren in Poland.
3. The considerable improvement of the 25OHD serum concentration in the majority of children after the summer may provide favourable influence of the sunlight.
Relationship between body composition with bone mineral density in postmenopausal women by using dual energy X-ray absorptiometry (DEXA) technique

S. Rahimi Petrodi, S. Zieai, A. Emami Ardekani (Tehran, IR)

Objective: Despite known positive association between body mass and bone mineral density (BMD), relative contribution of fat and lean tissue to BMD remains under debate. We aimed investigating the effect of selected anthropometric parameters, including total fat mass (TFM) and total lean mass (TLM) on BMD in postmenopausal women.

Methods: This cross-sectional study involved 46 healthy postmenopausal women of Iranian, aged between 51 and 69 years, who were randomly sampled of various districts in Tehran. Femoral neck (FN), L1-L4 BMD and total body soft tissue composition were measured by dual X-ray absorptiometry (DEXA). Furthermore, their body mass index (BMI) and waist circumference (WC) were calculated. Analysis of correlation was used to explore possible impacts of fat and lean mass on BMD.

Results: We showed both FN and L1-L4 BMD was positively correlated with TFM (r=0.41; p≤0.004 and r=0.42; p≤0.003 respectively) and TLM (r=0.39; p≤0.006 and r=0.31; p≤0.03 respectively). In addition, BMI was positively correlated with FN BMD (r=0.35; p≤0.01) and L1-L4 BMD (r=0.34; p≤0.01) but Relationship of FN and L1-L4 BMD with WC (r=0.23; p≤0.11 and r=0.27; p≤0.06 respectively) was not significant.

Conclusions: These data suggest that both lean mass and fat mass are important determinants of BMD. In contrast to the effect favorable BMI on bone mineral density in postmenopausal elderly women, WC was not correlated with BMD.

Keywords: Body composition; Bone mineral density; Total fat mass; Total Lean mass; postmenopausal women
P42

Vitamin D status in young HIV infected Israeli women of various ethnic origins: incidence of Vitamin D deficiency and possible impact on bone density

(Haifa, IL)

Background: Decreased bone mineral density (BMD) was reported in HIV infected patients. Mechanisms leading to this decrease are poorly understood.
Aim: To assess factors influencing BMD in young HIV infected Israeli women of Ethiopian (ET) and Caucasian (CA) origin.
Methods: Young HIV infected women aged 34.5±8.5 followed up at the Institute of Allergy, Clinical Immunology & AIDS filled a questionnaire about sun exposure, daily calcium intake and dress habits. Data about HIV status and treatment regimens were collected from the patients' charts. Serum hydroxyvitamin D [25(OH)D] levels, bone turnover markers: total procollagen type1 amino-terminal peptide (P1NP) and collagen beta cross-laps (CTX), BMD at lumbar spine (LS), femoral neck (FN) and total hip (TH) were evaluated.
Results: There were 75 patients: 28 (65%) of ET and 2 (6.25%) of CA had 25(OH)D serum levels<10 ng/ml (vitamin D deficiency), p=0.001. 21 (67.7%) ET and 16 (39%) CA avoided sun exposure, p= 0.019. Daily calcium intake was 514 mg and 164 mg, respectively, p= 0.001. Z scores<-1 found at LS in 26 (89.7%), at FN in 20(69%), at TH in 17 (58.6%) of vitamin D deficient patients compared to 20 (48.8%), 17 (41.5%), 9 (22%), in patients with 25(OH)D >10 ng/ml, p<0.01, <0.03, <0.001, respectively.
Significantly more ET than CA women covered their face (32.3% and 9.5%, p =0.003) and hands (58.1% and 30.9%, p= 0.03). There was no difference in CTX, P1NP levels.
Conclusion: Significantly lower BMD in dark skinned patients might be at least partially explained by poorer vitamin D status.
Effect of cigarette smoking on bone mineral density among Saudi men: implications for Vitamin D deficiency

S. Alhashemi, S. Khoja, S. Lanham-New, M. Ardawi (Jeddah, SA; Guildford, UK)

Osteoporosis is a skeletal disorder characterized by low bone mineral density (BMD) and loss of bone tissue that can lead to weak and fragile bones. Cigarette smoking was first identified as a risk factor for osteoporosis more than 20 years ago. The aims of the present study were to investigate the influence of cigarette smoking on BMD and to investigate vitamin D deficiency among Saudi men. A total of 96 men aged 32–50 years were divided into 4 groups according to smoking status: non-smoker (n=26), light smoker (<10 cigarettes/day; n=18), moderate smoker (11-20 cigarettes/day; n=26) and heavy smoker (>20 cigarettes/day; n=26). Participants visited the Center of Excellence for Osteoporosis Research (CEOR) at King Abdul Aziz University and completed a questionnaire about medical history, lifestyle and smoking habits. Written informed consent was obtained from all participating men. Vitamin D status was assessed in fasting blood samples by chemiluminescent immunoassay. Serum levels of intact parathyroid hormone (iPTH) and the bone turnover markers (serum C-terminal telopeptide (s-CTx) and osteocalcin (s-OC) were also determined. Bone density was measured using DEXA. Femoral neck BMD was significantly lower in the heavy smoker group compared to the non-smoker group (P<0.05). BMD correlated negatively with smoking duration (years) (P<0.05). Nearly 69% of our study population had low (<25nmol/l) serum 25-hydroxy vitamin D (25-OH-D) levels. In the heavy smoker group, 80% had vitamin D deficiency (<25 nmol/L) compared with 46% in the non-smoker group. There was a significant negative correlation between serum 25-OH-D and number of cigarettes smoked daily and iPTH level in the smoking groups and a significant negative correlation between s-CTx and serum 25-OH-D in the heavy smoker group. There was a significant positive correlation between both s-OC (bone formation marker) and s-CTx (bone resorption marker) with iPTH in the heavy smoker group. In conclusion, smoking was associated with reduced BMD in the heavy smoker group and the smoking duration (years) had a stronger effect on BMD than the number of cigarettes smoked daily. Low 25-OH-D and higher iPTH were significant risk factors for low BMD in the men in this study.
Malnutrition with selected administrative demographic factors can identify risk for osteoporotic hip fracture in community dwelling older adults

M. Albaba, S. Cha (Rochester, US)

Objectives: Recently at the Department of Medicine at Mayo Clinic in Rochester Minnesota, we created and validated a hip fracture risk stratification tool that used administrative data base to predict risk for hip fracture. This tool included several clinical risk factors (Malnutrition, liver cirrhosis, peripheral vascular disease, Parkinson’s disease and hyperparathyroidism) and demographic factors and was found to predict risk for hip fracture with an area under receiver-operating curve (AUC) of 0.82. Our goal is to test a nomogram that includes Malnutrition as the only clinical risk factor in addition to demographic factors as a hip fracture risk stratification tool.

Methods: A retrospective cohort study: All community-dwelling patients >60 years in a primary care panel in Olmsted County, MN on 01/01/2005 were enrolled (N=12,650). Subjects were randomly divided into a development cohort (N=8,387) and a validation cohort (N=4,263).

Using the development cohort’s electronic medical records (EMR), we used multivariate regression to evaluate a model that included diagnosis of malnutrition, age, race, gender, prior hip fracture, prior hospitalization, and prior nursing home stay. The outcome was incident osteoporotic hip fracture in the subsequent four years. Risk factors were assigned a score based on their regression coefficient and a total risk score was created. We used EMR of the validation cohort to evaluate the total risk score and create a receiver-operating curve.

Results: 288 (3.43%) subjects in the development cohort sustained a new hip fracture. The final model included age >75 (odd ratio (OR) 11.2, 95%CI 4.9, 25.4), age 70-74 (OR 7.9, 95%CI 3.4, 18.7), age 65-70 (OR 3.9, 95%CI 1.6, 9.5), prior hip fracture (OR 5.4, 95%CI 3.9, 7.5), malnutrition (OR 2.9, 95%CI 1.7, 4.9), white race (OR 2.6, 95%CI 1.2, 5.6), prior nursing home stay (OR 1.9, 95%CI 1.4, 2.5), prior hospitalization (OR 1.5, 95%CI 1.1, 1.8), and female gender (OR 1.4, 95%CI 1.1, 1.8). Area under receiver-operating curve (AUC) was 0.81, SE 0.017.

Conclusion: Malnutrition with selected administrative demographic factors can provide a simple tool for osteoporotic hip fracture risk stratification in a heterogeneous cohort of community dwelling adults.
Vitamin D status in postmenopausal Saudi women with Type 2 Diabetes Mellitus

S. Saddekk, S. Khoja, S. Lanham-New, M. Ardawi (Jeddah, SA)

Vitamin D is involved in glucose homeostasis and in the mechanisms underlying insulin release. Vitamin D deficiency increases the risk of many diseases, including type 2 diabetes and osteoporosis. Serum 25-hydroxy vitamin D (25-OH-D) is an important determinant of bone health. We assessed vitamin D status in postmenopausal diabetic and non-diabetic Saudi women and determined the incidence of low bone mineral density (BMD) in relation to bone mass index (BMI) and bone turnover markers (BTMs). Postmenopausal Saudi women (n 98) aged 50–80 years living in Jeddah, Saudi Arabia were divided into diabetic (n=53) and non-diabetic (n=45) groups. Serum levels of intact parathyroid hormone (iPTH), 25-OH-D, glucose, insulin and BTMs were measured. BMD was measured by dual-energy X-ray absorptiometry (DEXA) at the lumbar spine, total hip and femur neck. We observed that 86.0% of the diabetic group and 81% of the non-diabetic group were vitamin D-deficient [25-OH-D<50.0 nmol/L (20 ng/ml)]. The prevalence of osteoporosis was 9.6% in the diabetic group and 4.5% in the non-diabetic group at the lumbar spine and 13% in the diabetic group and 0% in the non-diabetic group at the femur neck. The women were further divided into four subgroups according to their diabetes diagnosis and BMI: subgroup 1, 35 diabetic obese; subgroup 2, 18 diabetic overweight; subgroup 3, 25 non-diabetics obese; and subgroup 4, 20 non-diabetes overweight. Serum 25-OH-D level was inversely related to BMI and PTH in all four subgroups. BMI was significantly negatively correlated with BMD at three sites in subgroup 1. Diabetes mellitus markers [insulin, glucose and homeostatic model assessment-insulin resistance (HOMA-IR) were negatively correlated with 25-OH-D in the subgroup 2 compared to the subgroup 4. The 25-OH-D level was significantly positively associated with BMD at the lumbar spine in subgroup 3. Markers of bone turnover (osteocalcin (OC) and C-terminal telopeptide (CTX) were significantly negatively correlated with 25-OH-D in both the diabetic and non-diabetic overweight subgroups. In conclusion, low vitamin D levels contribute to osteoporosis and diabetes complications in postmenopausal Saudi women, and the effects of vitamin D on cortical bone were different from the effects on cancellous bone. The BMD results suggested that osteoporosis was more common among these diabetic women and certainly warrants further investigation.
Is high dose Vitamin D harmful?

K.M. Sanders, G.C. Nicholson, P.R. Ebeling (Melbourne, Toowoomba, AU)

With the potential to minimize the risk of many chronic diseases and the apparent biochemical safety of ingesting doses of oral vitamin D several-fold higher than the current recommended intakes, recent research has focussed on supplementing individuals with intermittent, high-dose vitamin D. However, two recent RCTs both using annual high-dose vitamin D reported an increase, rather than a decrease, in the primary outcome of fractures. We have summarised results from studies that have used intermittent, high doses of vitamin D, with particular attention to those finding evidence of adverse effects. Results from observational, population-based studies with evidence of a U-shaped curve are also presented as these findings also suggest an increased risk of adverse outcomes in those with the highest serum 25D levels.

Of the 18 studies using high doses of vitamin D and reporting biochemical data, nine reported cases of hypercalcemia (of n=1481 with biochemistry). The dose of vitamin D ranged from 600,000IU as a single (annual) dose; 300,000IU per three months to 10,000IU per day.

Three observational studies have shown evidence of a U-shaped curve where those in the highest percentiles of vitamin D status had an inverse relationship to disease risk compared to those in the lowest percentile of the study population. A further five case-cohort studies report increased disease risk in those in the highest quartile of vitamin D status where serum samples were collected prior to diagnosis.

Of the eight RCTs using intermittent high-dose vitamin D, only Heikinheimo et al. and Trivedi et al., report a significant reduction in fractures. However, the Australian and the Wessex RCTs both show a significant increase in fracture risk in older females. The Australian study also showed increased falls risk. Equivocal results are reported for four RCTs with outcomes of fracture, bone turnover markers and depression.

Thus, emerging evidence from both observational studies and RCTs suggests caution about recommending high serum 25-hydroxyvitamin D concentrations for the entire population. There is an urgent need for dose-ranging studies with physical function outcomes. In addition, the safety of loading doses of vitamin D should be demonstrated before these regimens become recommended as routine clinical practice.
The association of sarco-osteopenia with 25(OH) Vitamin D level in a population based cohort in Estonia

M. Kull, R. Kallikorm, M. Lember (Tartu, EE)

Background: Combining osteopenia and sarcopenia has been suggested to identify a frailer, higher-fracture-risk population. Recently a working definition of sarco-osteopenia was proposed based on a population sample, which incorporated muscle quantitative (muscle mass) and qualitative (strength) parameters. The impact of sarco-osteopenia on vitamin D level has not been evaluated.

Objective: To assess the impact of sarco-osteopenia on the level of 25(OH) vitamin D in a population based sample of Estonia.

Methods: Sarco-osteopenia (SOP) was defined in a population-based healthy young sample using both muscle functional and quantitative parameters (1). Patients were considered sarco-osteopenic if they had low bone mass combined with either low muscle mass or low muscle strength (grip strength 2SD below mean of healthy population). Bone mineral density was measured using a Lunar DPX-IQ bone densitometer and the WHO T-score criteria was used to define low bone mass (T-score <-1SD). Low muscle mass was defined as an appendicular skeletal muscle mass divided by body weight (squared) that was less than 2 SD below the sex-specific mean for young adults. Serum 25-hydroxyvitamin D (25(OH)D) and PTH levels were measured twice (in winter and in summer).

Results: Subjects with sarco-osteopenia had significantly lower 25(OH)D levels in winter than did subjects with normal bone and/or muscle mass (36.2 vs 44.0 nmol/L, p=0.04). Subjects with only osteopenia or sarcopenia did not exhibit a lower vitamin D level (25(OH)D level 45.5 nmol/L) when compared with healthy individuals (25(OH)D level 42.9 nmol/L; p>0.05).

The difference in PTH level was not statistically significant between SOP and normal individuals (4.5 vs 3.9, p=0.37). 25(OH) vitamin D correlated negatively with total body fat mass (r=-0.2, p=0.003) and PTH (but not 25(OH)D level) correlated negatively with appendicular lean mass (r=-0.17, p=0.01).

Conclusions: Vitamin D levels were significantly lower in subjects with sarco-osteopenia than in those with only sarcopenia or osteopenia. We confirm that using the combined sarco-osteopenia definition identifies a frailer sub-population in whom vitamin D levels are lower, which is a known risk factor for falls and fractures. This cross-sectional study however does not infer a causal relationship between SOP and low 25(OH)D levels, but rather suggests that further studies are needed.
Implication of a free fatty acid receptor in bone remodeling

C. Philippe, F. Wauquier, V. Coxam, M. Spilmont, Y. Wittrant (Theix, FR)

In a context of increasing life expectancy, the prevalence of age-related diseases such as osteoporosis is becoming a major social and economical issue. While nutritional strategies appears to be an excellent alternative to conventional treatments, the study of nutrients' biological activities remains marginal for some tissues and certain types of molecules. This is particularly the case for bone and lipids, most notably fatty acids. Current literature, although growing in size, contains mainly descriptive studies that do not fully explain the mechanisms involved. Recently, the membrane receptor GPR40 (G Protein Coupled Receptor 40) has been highlighted for its interaction with long chain free fatty acids. Because, we demonstrated for the first time its expression in bone cells at the mRNA and protein level, we hypothesized that this receptor may play a role in mediating the effects of fatty acids on bone remodeling parameters. In this study, the analysis by μComputed Tomography of the femurs of mice invalidated for GPR40 reveals a marked osteoporotic phenotype that supports a protective role of this receptor for bone health. In vitro, the effects of a specific agonist of GPR40, the GW9508 were analyzed. At high doses, this compound inhibits the proliferation of osteoclast precursors (Raw 264.7), whereas it has no effect on the viability of MC3T3-E1 osteoblast lineage. In addition, at lower doses, this compound blocks the osteoclastic differentiation of Raw 264.7 induced by RANKL, by inhibiting the activation of ERK and NF-κB. GW9508 also stimulates the early stages of differentiation of osteoblastic MC3T3-E1, induce a rise in activity ALP (Alkaline phosphatase) and an increased expression of osteocalcin transcript. Moreover, the study of a line RAW264.7 invalidated by RNA interference (shRNA) supports the working hypothesis, while the effect of GW9508 on induced-bone loss by ovariectomy in wild-type mice is being analyzed. In conclusion, these studies reveal for the first time a protective role of GPR40 in the bone tissues leading to a new insight in the bone and lipid relationships.
Borage and fish oils supplementation effects on bone health in a murine model of senile osteoporosis: a 10 months pre-clinical study

F. Wauquier, C. Philippe, M. Spilmont, C. Tagliaferri, V. Coxam, Y. Wittrant (Theix, FR)

Fats are prevalent in western diets; they have known deleterious effects on muscle insulin resistance and may contribute to bone loss. However, relationships between fatty acids and locomotor system dysfunctions in elderly population remain controversial. The aim of this study was to analyze the impact of fatty acid quality on the age related evolution of the locomotor system and to understand which aging mechanisms are involved. In order to analyze age related complications, the SAMP8 mouse strain was chosen as a progeria model as compared to the SAMR1 control strain. Then, two months old mice were divided in different groups and subjected to the following diets: (1) standard “growth” diet – (2) “sunflower” diet (high omega6/omega3 ratio) – (3) “borage” diet (high gamma-linolenic acid) – (4) “fish” diet (high in long chain omega3). Mice were fed ad libitum through the whole protocol. At 12 months old, mice were sacrificed and tissues were harvested for bone studies, fat and muscle mass measures, inflammation parameters and bone cells markers expression. We demonstrated for the first time that borage and fish diets restored inflammation and bone parameters using an original model of senile osteoporosis that mimics clinical features of aging in humans. Therefore, our study strongly encourages nutritional approaches as relevant and promising strategies for preventing aged-related locomotor dysfunctions.
Does alkaline loading prevent salt-induced protein wasting?

J. Buehlmeier, P. Frings-Meuthen, T. Remer, C. Maser-Gluth, P. Stehle, G. Biolo, M. Heer (Cologne, Dortmund, Heidelberg, Bonn, DE; Trieste, IT)

Objectives: The most important determinants of fall and fracture risk include muscle mass and function. Thus, factors that influence muscle/protein metabolism likewise affect bone. A diet rich in sodium chloride (NaCl) induces protein wasting, most likely from skeletal muscle, via changes in acid base balance. In contrast, alkaline loading protects whole body protein content. Acid base balance and protein turnover were studied in subjects whose high NaCl diet was supplemented by alkaline salts.

Methods: Eight healthy male subjects participated in a randomized cross-over trial. Each of 2 study parts consisted of 5 days adaptation followed by 10 days of intervention and 1.5 day of recovery. Subjects received a high NaCl diet (7.3 mmol/kg body mass/d) which was supplemented in one study part by 90 mmol potassium bicarbonate (KHCO3)/d. Rates of phenylalanine hydroxylation were measured by 3-h primed-constant infusion of L-[ring-D5]phenylalanine and L-[ring-3.5-D2]tyrosine in the postabsorptive state as a marker of whole body net protein catabolism. Daily nitrogen balance was calculated as difference between nitrogen intake and urinary excretion. Markers of bone resorption (C- and N-terminal telopeptide of Type I collagen (CTX, NTX)), net acid excretion and free cortisol were analysed in 24h urine. Blood gases were analysed in arterialized blood.

Results: During high NaCl intake postprandial buffer capacity increased and net acid excretion decreased when KHCO3 was supplemented ([HCO3-]: p≤0.002, NAE: p≤0.012). No changes were observed for urinary excretion of CTX and nitrogen balance (CTX: p≤0.176, N-balance: p≤0.550). However, free cortisol excretion, urinary calcium and NTX were reduced when the high NaCl diet was supplemented with KHCO3 (UFF: p≤0.013; Calcium: p≤0.047; NTX: p≤0.044). Net protein catabolism, quantified as phenylalanine hydroxylation, showed a tendency to decline when KHCO3 was ingested during high NaCl intake (p≤0.052).

Conclusion: We conclude that KHCO3 ingestion during high NaCl intake rapidly shifts acid base balance to a more alkaline state and has a modest anti-catabolic impact, revealed by small reductions in free cortisol and calcium excretion, bone resorption markers and a trend of protein preservation. These results should be followed by long-term observations of muscle metabolism and function in populations with a high habitual NaCl intake.
Objective: The relationship between vitamin D status and risk of hip fracture has not been established. Our aim was to study this relationship in a population-based case-cohort study of elderly men and women in Norway.

Methods: N=21,774 men and women aged 65-79 years attended baseline examinations in four population-based health studies in Norway during 1994-2001. Subsequent hip fractures were retrieved from patient administrative systems and verified by X-ray or medical records, with maximum follow-up 10.7 years. All hip fracture cases and randomly sampled gender-specific subcohorts of men (4.5% yielding n=444) and women (9.0% yielding n=1058) were selected for analysis of 25-hydroxyvitamin D (25(OH)D) in serum samples from baseline stored at -80°C. 25(OH)D2 and 25(OH)D3 was determined by HPLC-APCI-MS. We performed Cox proportional hazards regression of hip fracture vs. quartiles of total 25(OH)D, with left-truncation for age at baseline and right-censoring for age at exit, inverse probability weighting and robust variance, adjusted for study site. Additional analyses were adjusted for season of blood sample, body mass index, daily cigarette smoking, and self-rated health.

Results: During a median follow-up of 8.2 years, 1232 individuals (340 men (3.4%) and 892 women (7.5%)) sustained a hip fracture. The subcohorts included 1502 individuals of whom 93 were also cases. Intact frozen serum was available and successfully analysed in n=2526 (95.6%). In men, there was a trend of increasing risk of hip fracture with decreasing 25(OH)D, statistically significant for Q1 (<43.3 nmol/l) vs. Q4 (≥69.2 nmol/l): HR 1.68 (95% CI 1.05-2.68) in the main analysis, and HR 1.65 (95% CI 1.01-2.67) in the fully adjusted analysis. In women, there was no significant relation between 25(OH)D and hip fracture. However, there was a tendency of increased HR in decreasing quartiles of 25(OH)D in adjusted analysis, with HR 1.19 (95% CI 0.90-1.59) in Q1 (<41.5 nmol/l) vs. Q4 (≥67.0 nmol/l).

Conclusion: According to these preliminary analyses, lower vitamin D status was significantly associated with increased HR of hip fracture in men, but not women.
Pre-diabetes and cardiometabolic indicators across Vitamin D status in healthy men

S. Tepper, D. Shahar, D. Geva, S. Ish-Shalom (Beer-Sheva, Haifa, IL)

Metabolic dysregulation and osteoporosis are etiologically related. Metabolic dysregulation was proven to be related to poorer physical performance in relatively healthy older men. This may lead to increased propensity to fall and fractures.

Objectives: To explore the associations between vitamin D status and pre-diabetes and cardiometabolic indicators among healthy men.

Methods: Healthy men were recruited from periodical check-up clinic. Blood pressure, BMI and waist circumference were measured. Serum concentrations of 25(OH)D, PTH, calcium, albumin, fasting plasma Insulin (FPI), fasting plasma glucose (FPG), lipid profile and high sensitive C-Reactive Protein (hs-CRP) were assessed in fasting blood sample.

Results: 358 men, aged 48.8 ±10.2 were enrolled. The mean serum 25(OH)D level was 22.1± 7.9 ng/l; 40.5% of participants had serum 25(OH)D ≤20 ng/ml, 44.7% were 20 – 30 and 14.8% were >30ng/ml. Across 25(OH)D status from lower to higher level, BMI values were 27.43±3.97, 26.94±3.79, and 25.74±3.11 respectively (p=0.005). Waist circumference 98.48±10.97, 95.10±11.37, 92.47±8.93 respectively (p<0.0001), HOMA-IR 2.76±1.58, 2.69±1.83, 2.13±1.15 (p<0.0001), HOMA-beta 123.7±92.3, 125.05±105.41, 102.55±59.10 (p=0.019), TG 130.5±57.82, 114.28±55.64, 101.67±45.67 (p=0.003), hs-CRP 2.40±2.47, 2.11±2.27, 2.27±2.65 (p=0.027), and systolic blood pressure 125.48±15.51, 121.5±15.29, 116.02±13.59 (P=0.003). The association between FPG and LDL across 25(OH)D levels did not reach the significance level (P=0.079 and p=0.101 respectively). In a multivariate regression analyses that include BMI as the most influential factor on outcomes, 25(OH)D levels was significantly associated with blood pressure, hs-CRP, Homa-IR, Insulin and TG. The full model explained 10–20% of the variance in the cardiometabolic outcomes. The independent contribution to the percent variance explained (R2) by the model of vitamin D was 3% for systolic blood pressure, 4% for diastolic blood pressure and 3% for hs-CRP. For the prediabetes indices, the contribution of vitamin D was 1% for Homa-IR and FPI and 2% for TG.

Conclusion: We have demonstrated a significant and independent association between vitamin D status and diabetes indicators including FPI, HOMA-IR, blood pressure and CRP in healthy men. Future studies are required to address temporal relationships and to test the impact of vitamin D supplementation in a clinical trial.
Relationship between calcaneal bone stiffness and body composition in young European children

I. Sioen, T. Mouratidou, D. Herrmann, J.-M. Kaufman, D. Molnar, L.A. Moreno, S. Marild, G. Barba, A. Siani, M. Tornaritis, T. Veidebaum, S. De Henauw, W. Ahrens (Ghent, BE; Zaragoza, ES; Bremen, DE; Pécs, HU; Gothenburg, SE; Avellino, IT; Strovolos, CY; Tallinn, EE)

Objectives: The aim of this study was to investigate the relation between body composition and calcaneal bone stiffness in a large sample of European healthy young children.

Methods: Between September 2007 and May 2008, body composition measurements (weight, height, waist and hip circumference, skinfold thickness of triceps and subscapular) and calcaneal quantitative ultrasound measurements to determine bone stiffness index (SI) were performed in 7552 European children (spread over eight different countries) aged 6.1 ± 1.8 years; (min to max: 2.1 to 9.9 years), with 50.7% boys. This was part of the baseline survey of the IDEFICS multicenter study, an Integrated Project within the 6th Framework Programme of the European Commission (Identification and prevention of Dietary- and lifestyle-induced health EFfects In Children and infants; www.idefics.eu). Analyses were stratified by sex and by age group (pre-school children: 2 up to 6 years old – primary school children: 6 up to 9.9 years old). The statistical analyses were controlled for the effect of the cluster design used in the multicenter study.

Results: In the overall study population, the average calcaneal SI was equal to 80.2 ± 14.0, ranging from 42.4 to 153.0. The weight, the waist circumference, the sum of triceps and subscapular skinfold thickness and the z-score of BMI were used as markers of adiposity. It was found that pre-school children with a higher adiposity have a lower calcaneal SI. The opposite was seen in primary school children: those with a higher adiposity have a higher calcaneal SI. Some possible explanation for the inverse relation found between body weight and calcaneal SI in primary versus pre-school children found in this large-scale European study are (1) that the influence of hormones on bone mass is different in pre-school children compared to primary school and (2) that the bone mass needs time to adapt to the greater body weight so that there is a time lag between the skeletal compensations and the increase in body weight.

Conclusion: These data show that adiposity significantly influences calcaneal bone stiffness in young children and that the relation between fat mass and stiffness index differs between pre-school children and primary school children.

Acknowledgment: Funded by the EC, FP 6, Contract No. 016181 (FOOD). I. Sioen is financially supported by the Research Foundation – Flanders
The influence of nutrition and Vitamin D status on calcaneal ultrasound parameters in Belgian children

I. Sioen, T. Mouratidou, G. Barba, S. Marild, D. Herrmann, W. Ahrens, S. De Henauw (Ghent, BE; Zaragoza, ES; Avellino, IT; Gothenburg, SE; Bremen, DE)

Objectives: The aim of the study was to investigate how nutrition and vitamin D status influence calcaneal quantitative ultrasound (QUS) parameters in young children.

Methods: Anthropometric measurements, blood sampling and calcaneal QUS measurements were performed in 319 Belgian children (4-11 years old; 51.1% boys) from February 2010 to June 2010. A children’s eating habits questionnaire was completed by the parents, registering the consumption frequency of different food groups (e.g. fruit & vegetables, milk and other dairy products, fish). 25-Hydroxyvitamin D was measured in the serum using radioimmunoassay. The calcaneal QUS measurement resulted in three different parameters: broadband attenuation (BUA), speed of sound (SOS) and a calculated parameter, i.e. stiffness index (SI = (0.67 x BUA) + (0.28 x SOS – 420)). The data were collected in the framework of the second survey of the IDEFICS multicenter study, an Integrated Project within the EU 6th Framework Programme (Identification and prevention of Dietary- and lifestyle-induced health EFfects In Children and infantS; www.idefics.eu). The correlations between QUS parameters and nutrition as well as vitamin D status were tested with linear regression models, to allow inclusion of additional covariates simultaneously (i.e. age, height and weight). The analyses were stratified for sex. Statistical results with p<0.05 were considered as significantly different.

Results: The mean ± SD for QUS parameters were 93.5 ± 23.9 for BUA, 1618.1 ± 50.1 for SOS and 93.4 ± 16.3 for SI. Only the BUA values were significantly different between boys and girls. The linear regression analyses indicated that there is no relation between the vitamin D status and the different QUS parameters in these young children. Concerning the nutritional habits, a positive relation was found between the consumption frequency of milk and other dairy products (times per week) and the SI; the unstandardised regression coefficient was 0.259 in boys (p=0.023) and 0.334 in girls, however not significant (p=0.080).

Conclusion: These data show that the consumption frequency of milk and other dairy products positively influences the stiffness index of the calcaneus, particularly in boys. In contrast, no relation was found between the vitamin D status and the calcaneal QUS parameters in children.

Acknowledgment: Funded by the EC, FP 6, Contract No. 016181 (FOOD). I. Sioen is financially supported by the Research Foundation – Flanders.
The effect of habitual diet and age on bone health has been extensively researched in post-menopausal women, but little data is available for pre-menopausal women. At present it is unclear as to whether young and middle-aged women are at a tangible risk of poor bone health and if so, what factors may be influencing this perceived risk prior to the menopause. The current study aimed to assess habitual dietary intake and volumetric bone mineral density (vBMD) in healthy weight, pre-menopausal women.

In total 41 healthy, pre-menopausal women of normal weight (BMI 20 – 25kg/m²), aged 20 – 49 years were recruited as part of an RCT trial, with cross sectional analysis performed for this specific sub-study. The women were divided into two groups – aged 20 – 34 years (n=20) and aged 35 – 49 years (n=21). Nutrient intake was assessed with a 4 day estimated food diary and vBMD was measured via peripheral Quantitative Computed Tomography (pQCT). Anthropometrics, including body mass index (BMI) and blood pressure were also recorded.

For the cohort analysed as a whole (n 41, aged 33.7±10.7yrs, BMI 21.5±2.2 kg/m²) no significant correlations were found between habitual dietary intake and vBMD, nor was there a significant relationship between age and vBMD.

The younger age category (n 20, 24.0±3.50yrs, BMI 20.7±1.90 kg/m²) showed few associations between diet and bone health, except for a significant positive association between Stress Strain Index (SSI) and vitamin D intake (P<0.009); this is despite relatively low mean intake values for vitamin D within the group (2.49±2.46µg/day).

The older age group (43.8±4.03yrs BMI 22.3±2.24 kg/m²) showed a strong significant association between age and both total density (P<0.024), and the T Score for total density (P<0.023). Vitamin D intake was not associated with any vBMD parameters, however significant associations were found between SSI and absolute daily intakes for energy (P<0.009), fat (P<0.03), carbohydrate (P<0.004), dietary fibre (P<0.01), potassium (P<0.009), calcium (P<0.04) and magnesium (P<0.02).

When comparing between the age groups, a significant difference was found for both total density (P<0.05) and the T Score for total density (P<0.05).

This study demonstrates that despite the relatively young age of the cohort, risk to poor bone health increases steadily with age. The influence of dietary intake on bone density in the older premenopausal women showed some interesting associations and further research is warranted.
Validation of a food frequency questionnaire for the assessment of calcium intake in schoolchildren aged 9-10 years

B. Pampaloni, E. Bartolini, P. Piscitelli, G.L. DiTanna, L. Giolli, M.L. Brandi (Florence, Rome, IT)

Bone mass increases steadily until age 20–30 years, and during the first two decades of life when peak bone mass (PBM) is acquired. Nutrition plays a critical role in the achievement of the optimal genetically programmed PBM, with eduction the risk of osteoporosis later in life.

Nutrient intakes can be estimated through the use of various tools, which differ depending on study objectives, design and resources. Typically, food frequency questionnaires (FFQ) are used in epidemiologic studies to assess dietary intakes, often in relation to the development of a future disease.

Objective: To validate a twenty-one-item, semi-quantitative, Food Frequency Questionnaire to assess important nutrient intakes for bone health, as calcium and vitamin D, in 9–10 years old Italian schoolchildren.

Methods: The relative validation was accomplished through comparison of the 7-Day Food Record (7DR) with a FFQ ad hoc developed. FFQ and a 7-day food records were filled from a group of 75 Italian schoolchildren (36 female and 39 male). Data on intakes of energy, fat, protein, carbohydrate, Ca, P, K, Mg and vitamin D were available to assess the agreement of the two methods. Particular attention was reserved to nutrients relevant for bone health. The agreement between two methods was evaluated by statistical analysis (Spearman correlation Test and Bland Altman analysis).

Results: Results shows that not significant differences between methods were observed for the mean evaluated nutrients. Good correlations between the two methods (FFQ and 7DR) were observed for all nutrients. Mean dietary calcium intakes were 725.6 (95% CI: 683.2-768.1) mg/day from 7DR, and 892.4 (95% CI: 844.6-940.2) mg/day from FFQ. The correlation for calcium intake was 0.64 (p<0.0001) and the difference among the two methods was within the Bland Altman limits of agreement.

Conclusion: These results indicates that the FFQ for schoolchildren aged 9–10 years presented here is highly acceptable and is an accurate method that can be used in large-scale or epidemiological studies for evaluation of nutrient intakes important to prevent osteoporosis in a similar population.
Associations between dietary carotenoid intakes and bone health in a Scottish population

C.J. Macdonald, L. Aucott, W.D. Fraser, D.M. Reid, H.M. Macdonald (Aberdeen, Liverpool, UK)

Fruit and vegetable consumption may be beneficial for bone health. There is increasing evidence to suggest that bioactive compounds in fruit and vegetables, such as carotenoids may play a role. Previous investigations in an elderly population showed protective associations between total and individual carotenoid intakes and 4 year change in bone mineral density (BMD) although contradictory results have been shown in some intervention studies.

The aim of this observational study was to determine if dietary intake of total carotenoids or individual carotenoids (alpha-carotene, beta-carotene, beta-cryptoxanthin, lycopene, and lutein and zeaxanthin) are associated with markers of bone health in a population of Scottish women from the Aberdeen Prospective Osteoporosis Screening Study (APOSS) cohort.

A total of 3239 women aged 54.8 (2.2)y (mean (SD)) completed a food frequency questionnaire (FFQ) between 1997 and 1999 which was analysed for dietary carotenoid intake using data derived from U.S. Department of Agriculture (USDA). BMD was measured at the femoral neck (FN) and lumbar spine (LS) by dual-energy X-ray absorptiometry (DXA). Bone resorption markers free pyridinoline (PYD) and deoxypyridinoline (DPD) were measured by high-performance liquid chromatography (HPLC) in second early morning fasted urine samples. Bone formation marker amino-terminal procollagen propeptides of type 1 collagen (P1NP) was measured in serum by ELISA. Linear regression was used to determine whether energy adjusted carotenoid intakes were associated with markers of bone formation and resorption and BMD and annual change in BMD since baseline visit in 1990–1994.

The total dietary carotenoid intake was 7.3mg (3.8) mg/day (mean (SD)). The greatest contributor to the diet was beta-carotene (44%) followed by lycopene (23%), lutein and zeaxanthin (17%), alpha-carotene (14%) and beta-cryptoxanthin (2%). Linear regression showed that energy adjusted lycopene intake was positively associated with BMD at the FN (r=0.066, p=0.001) and inversely associated with bone resorption markers PYD and DPD (PYD r=-0.077, p<0.001, DPD r=-0.091, p<0.001). These results were observed after adjusting for confounding factors.

In conclusion, these data suggest that lycopene may contribute positively to bone health in middle aged women. However, further work is required to address the disparities between these and contradicting data from lycopene intervention studies.
Ethnic differences in the circadian rhythm of calcium metabolism in older British and Gambian adults

J. Redmond, A. Prentice, I. Schoenmakers (Cambridge, UK)

Objectives and Methods: The circadian rhythm (CR) of calcium (Ca) metabolism is important for skeletal integrity and ethnic differences between Americans of Caucasian and African origin exist. We investigated ethnic differences in the CR of healthy older Caucasian British (B) and Black Gambian (G) men and women (n=30/country; 60-75y) for 24h in their habitual environment. Dietary Ca intake (dCa) (content & timing) was assessed with a 4-day food diary and B and G food composition tables. Blood and urine samples were collected every 4h. Plasma total Ca (tCa), blood ionised Ca (iCa) (pH7.4), PTH, urinary (u) Ca and creatinine (Cr) were analysed [1]. Between/within country differences were examined by Student’s paired/unpaired t-tests as appropriate. We investigated the CR with cosinor analysis with a linear prediction model. Data are expressed as 24h mean (SD); the CR as % variation.

Results: British: Total dCa was 1121(325)mg/d. 24h mean values were: iCa: 1.10(0.05)mmol/L, tCa: 2.34(0.08)mmol/L, PTH: 53.5(21.1)pg/ml, uCa/Cr: 0.36(0.17)(mmol/mmol). There was a significant CR for uCa/Cr (variation: 76%), PTH (46%) (P<0.01), non-significant for iCa (8%) or tCa (9%). dCa had a peak between 9-11AM, which coincided with that of tCa. PTH had a CR with a peak at 5PM and at 3AM, which mirrored the CR in dCa and tCa. The CR of uCa/Cr was opposite to tCa with a peak at 7PM and at 3AM.

Gambian: Total dCa was 287(125)mg/d. 24h mean values were: iCa: 1.13(0.06)mmol/L, tCa: 2.21(0.09)mmol/L, PTH: 76.9(31.7)pg/ml, uCa/Cr: 0.19(0.21)(mmol/mmol). The CR was significant for uCa/Cr (134%), PTH (49%) (P<0.01), non-significant for iCa (6%) or tCa (9%). dCa intake had a peak at 7-9AM, a larger 2nd peak at 1-3PM. The CR of PTH did not follow the CR of dCa and tCa. PTH peaked at 7-9AM and 7PM, and uCa/Cr peaked at 5AM.

Country Differences: B subjects had higher total dCa (P<0.01) and the largest peak of dCa earlier in the day than G subjects. In both countries, the CR of dCa and tCa coincided. 24h mean PTH was lower in B vs G subjects (P<0.01). Both countries had a CR of PTH with 2 peaks, but differed in timing. 24h mean uCa/Cr was higher in B vs G subjects (P<0.01), both countries had an afternoon nadir but the time of the peak of uCa/Cr was different. Conclusion: B and G had a CR of Ca metabolism, but the pattern suggests there were differences in their timing. This may reflect ethnic differences in the renal/skeletal response to fluctuations in PTH, iCa and P.

Is Vitamin D deficiency indicated in the aetiology of rickets in Bangladesh?

(Cambridge, UK; Dhaka, Chakaria, Cox’s Bazar, BD)

Objective: A case-control study in Chakaria, Bangladesh, where there is a rickets epidemic, to investigate the aetiology and determine if vitamin D deficiency is a possible factor.

Methods: Newly diagnosed cases (confirmed active rickets with Thacher Score ≥1.5), with no other known disease, sex-matched siblings and community controls (matched for age, sex and village of cases) were studied. Plasma [25OHD] was measured in overnight fasted blood samples by Diasorin Liaison Chemiluminescence Assay with quality assurance through the DEQAS scheme.

Results: 64 cases were studied (40M, 24F). Median (range) age was 2.9 (1.0-10.0), 3.1 (1.2-10.6) and 6.7 (1.1-10.4) y in cases, village controls and sibling controls. The difference between cases and village controls was not significant, whereas sibling controls were older (p<0.0001). Mean±SD wt for the cases and village controls was 10.4±1.2 and 11.9±1.3 kg (p=0.001). Mean±SD ht for the cases and village controls was 83.0±1.1 and 92.0±1.1 cm (p<0.0001). Differences remained after controlling for age and sex (p=0.002 and p<0.0001, respectively for wt and ht). Mean±SD [25OHD] was 34.6±18.4, 48.1 ±17.5 and 47.0 ±15.0 nmol/L for cases, sibling controls and village controls. Cases had lower [25OHD] than village controls (mean±SE difference 12.3±3.0 nmol/L, p<0.0001) and sibling controls (13.5±4.3 nmol/L, p=0.008). There was no significant difference in [25OHD] between the control groups. [25OHD] was independent of age but girls had lower values than boys (mean±SE difference 7.3±3.1 nmol/L, p=0.02). After controlling for sex, [25OHD] was still significantly lower in cases than controls (p<0.0001). 22 cases, 1 sibling control and 4 village controls had [25OHD] <25nmol/L indicative of an increased risk of clinical vitamin D deficiency, but only 2 cases had [25OHD] <12.5 nmol/L suggestive of primary vitamin D deficiency rickets.

Conclusion and Discussion: The finding that most of the cases had [25OHD] above the range generally associated with an increased risk of clinical vitamin D deficiency and well above the range associated with vitamin D deficiency rickets is similar to results found in The Gambia and Nigeria. Primary vitamin D deficiency is therefore not indicated, but the marked difference between rickets-affected and control children suggests that the cases had an increased requirement for vitamin D. A more in-depth study is therefore needed to determine the primary aetiological factors of rickets in Bangladesh.
The majority of studies established in the Middle East have confirmed the extremely low serum levels of vitamin D across different regions, but mostly among the Gulf Cooperation Council (GCC) populations. The intolerable high temperatures, traditional clothing, and the availability of private transportation to most of the population have discouraged regular exposure to sunlight. Inadequate vitamin D levels lead to elevated parathyroid hormone (PTH) and accordingly inadequate mineralization of the bone. Since almost 90% of adult bone mass is accumulated by late childhood, sufficient vitamin D levels are necessary during childhood to obtain a maximum peak bone mass and a lower risk for developing osteoporosis in later life. In addition, individuals with vitamin D deficiency have been shown to possess a higher risk for heart disease, diabetes and cancers.

We have previously assessed serum vitamin D levels in Kuwaiti female adolescents (10–18 yrs) and found that vitamin D deficiency was prevalent. However, younger children have not been assessed to our knowledge. Thus, we aim to assess serum vitamin D levels in children.

A total of 207 healthy school children (6-11 yrs, mean 8.47 ± 1.38 yrs, males 96, females 111) were recruited by sending invitation letters to 24 schools located in different areas of the country. Those who were interested in participation and were eligible were recalled for assessment. Assessment involved anthropometric measurements, skin colour, habitual food intake, sun exposure frequency, and serum analysis to measure 25-hydroxyvitamin D (25(OH)D) and parathyroid hormone (PTH). These were measured in a single batch at a single lab (The doctors lab, TDL, London, UK).

Mean ± SD of serum 25(OH)D for the total was 32 ± 14.12 nmol/L, whereas that of PTH was 5.1 ± 2.1 pmol/L. Fifty percent were vitamin D deficient (25(OH)D <30 nmol/L) and 40% were insufficient (25(OH)D 30-49.9 nmol/L). Boys had a significantly higher mean 25(OH)D (36.9 ± 14 nmol/L) than girls (28 ± 12.7 nmol/L). Serum 25(OH)D and PTH were negatively correlated (r²=-0.383, p<0.001). Among 13% who had PTH levels above the normal range (7.2 pmol/L), 81.5% were deficient in 25(OH)D levels.

Hypovitaminosis-D is very common in school-children in Kuwait, more in girls then in boys. Although awareness on vitamin D role and its deficiency has been significantly raised among the general population, more attention is needed towards children.
Relationship between Vitamin D and physical performance in community dwelling elderly women

M. Tamulaitiene, V. Alekna, V. Strazdiene, A. Mastaviciute (Vilnius, LT)

Introduction: Vitamin D deficiency is common in the elderly population and is associated with poor physical performance. Vitamin D may have attribute to muscle strength through a highly specific nuclear receptor in muscle tissue.

Aim: To investigate the association between vitamin D level and physical performance in older women.

Materials/Methods: This was a pilot cross-sectional study on community dwelling women aged 65 years and more who visited National Osteoporosis Center in Vilnius, Lithuania. Exclusion criteria were current taking vitamin D supplements, conditions known to affect bone and muscle tissue metabolism. Serum vitamin D was measured by automated immunoassay (Cobas E411, Roche Diagnostic). For this study population, the percentile values cut points were used to define vitamin D levels. Physical performance was assessed by the short physical performance battery (SPPB). The SPPB consists of standing balance tasks, five repeated chair stand test and the 4-m walk test. Each of the three performance components were measured in seconds and a score ranging from 0 to 4 was assigned. The sum of three scores composed the total SPPB score ranging from 0 to 12. Handgrip strength as a surrogate measurement of muscle strength was used. All participants performed three maximum attempts for dominant handgrip strength measurements with handle dynamometer and the mean value of these trials was recorded in kilogram (kg). Statistical analysis was carried out using SPSS version 18.0 for Windows. Spearman correlation coefficient was used to evaluate the relationship between variables. Significance level was defined as 0.05.

Results: A total of 144 women with a mean age 72.8 ± 7.8 years were investigated. Age was statistically significantly negatively associated with the vitamin D level (r = -0.4; p < 0.001). Each of three short physical performance battery components was analyzed separately. The standing balance time showed an association with vitamin D level (r = 0.3; p = 0.001). No statistically significant correlation was found between vitamin D level and time to complete five repeated chair stand test, the 4-m walk test and total SPPB score. We have found positive correlation between vitamin D and handgrip strength (r = 0.3, p = 0.002).

Conclusions: The serum vitamin D was statistically significantly positively associated with standing balance time and handgrip strength in older women.
Blueberry in calcium and Vitamin D enriched fermented milk is able to modulate bone metabolism in postmenopausal women

C. Puel, M. Spilmont, Y. Wittrant, C. Tagliaferri, V. Coxam (Theix, FR)

Research in the field of nutrition allows considering the establishment of a real prevention of osteoporosis. The value of fruit and vegetables is discussed. Red fruits are particularly interesting for their high anthocyan content, endowed with anti-oxidant and anti-inflammatory properties.

The present clinical, controlled, randomized, double-blind placebo, prospective study, conducted over 3 months, aims to evaluate the possible osteoprotective effects of anthocyan on bone metabolism, in postmenopausal women (less than 6 years).

In that purpose, fermented based blueberry extract milk, providing respectively 25% and 20% RDA of calcium and vitamin D, rich in anthocyan, has been given to volunteers. Fifty six women aged 50 to 65 years, without HRT, were included in the study after a medical examination and a blood test. Throughout the study period, they kept their eating habits, limiting however the red fruits. They were randomized into 2 groups of 28 subjects receiving either 0 or 120 mg of anthocyan per day. The intake of anthocyan was conducted in the form of fermented milk containing 0 or 60 mg of active molecule / 100ml, with 2 bottles of 100 ml per day.

Consumption of a milk enriched in polyphenols significantly improved the serum bPAL activity, (an osteoblastic marker), without significant modification of CTX, a marker for bone resorption. This favorable orientation of bone metabolism could be explained by the contribution of anthocyan from bilberry extract, the only noticeable difference between the 2 test foods. This finding is independent of the initial calcium and vitamin D consumption.

In conclusion, consumption of fermented milk containing blueberry, enriched with calcium and vitamin D for 3 months, has corrected the vitamin status of postmenopausal women for less than 5 years. In addition, it resulted in a favorable orientation of bone metabolism, as indicated by the rise of a biomarker of osteoblastic activity. This benefit is most likely related to the presence of blueberries (rich in polyphenols and phenolic acids).
Authors observed a group of 2900 patients in age between 18 – 91, who were examined by dual Hologic and Lunar X-Ray absorbciometry in period from February 2011 to February 2012. All patients had at any of the measured points, ie. L1-4 spine, left or right hip or femoral neck bone mineral density lower than -2.0 SD. These patients were automatically with every other laboratories and biochemical markers of bone turnover gain value for the 25(OH)D vitamin in order to assess the degree of supplementation with calcium and vitamin D levels or need for normalization of vitamin D when considering antiresorptive treatment (in patients older than 55 years).

Levels of the vitamin D were judged according to the criteria of sufficiency, deficiency and insufficiency of vitamin D and patients were divided into groups by age 18 – 25 (15 patients), 26 – 55 (307 patients), 56 – 80 (1469 patients), 81 and more (112 patients). Subnormal levels of vitamin D (25(OH)D<50 nmol/l) showed 80% of patients in the group 18 – 25 years, 71% of a group of 26-55 years, 64.7% in the group 56 – 80 years and only 59.5% in the group older than 80 years.

Conversely, adequate blood levels of vitamin D deficiency (25(OH)D<25 nmol/l) could be found in 13% of patients in the group 18 – 25 years, in 37% of a group of 26 – 55 years, 27% in the group 56 – 80 years and 30.8% of patients older than 80 years.

The next section, the authors focused on the percentage of deficiency and insufficiency of vitamin D in the examined population with regard to the season of the year, eventually calcium and vitamin D supplementation with OTC medicines or food supplements.

For authors insuficince of vitamin D was surprising occurrence in a young population, conversely they expected a higher percentage incidence in the elderly population and also predicted a higher incidence in winter months.
Differences in Vitamin D status in Caucasian and Asian women following UVB exposure

O. Hakim, K. Hart, P. McCabe, J. Berry, L. Rhodes, N. Spyrou, A. Alfuraih, S. Lanham-New (Guildford, Manchester, UK; Riyadh, SA)

It is known that skin pigmentation reduces the photosynthesis of 25(OH)D. However, the ethnic differences in 25(OH)D production remains to be fully elucidated. This study aimed to investigate the differences in vitamin D production between Asian and Caucasian postmenopausal women, in response to a defined, controlled UVB exposure. Seventeen women; 9 Caucasian, 8 South Asian women participated in the study, acting as their own controls. Three blood samples were taken for measurement of 25(OH)D during the run in period (9 days, no sunbed exposure) after which all subjects underwent an identical UV exposure protocol irrespective of skin colour (9 days, 3 sun bed sessions, 6, 8 and 8 minutes respectively with approximately 82% body surface exposed). Skin tone was measured four times during the study along with an assessment of skin type and skin reaction.

Both groups showed a gradual increase in 25(OH)D with final levels significantly higher than baseline (p<0.01). 25(OH)D concentration mean rose from a baseline of 43.58(19.65) to 57.80(17.11) nmol/l among Caucasian and from 27.03(23.92) to 44.73(17.74) nmol/l among Asian women. The baseline level of vitamin D was classified as deficient among the Asian women and insufficient among the Caucasian women. The percentage increase in vitamin D3 among Caucasians was 39.86% (21.02) and 207.78% (286.02) in Asian subjects respectively. This greater response to UV exposure reflects the lower baseline levels of the Asian subjects. Mixed linear model analysis identified a significant effect of duration of UV exposure on the production of 25(OH)D. However, the model shows no significant effect of ethnicity and skin tone on the production of 25(OH)D.

These novel findings indicate that people of Asian ethnicity have the full capability to produce similar amount of vitamin D compared to Caucasian group; initial vitamin D concentration influences the amount of UVB needed to reach equal serum concentrations.
Bone pain, 25(OH)D concentration, volumetric bone mineral density (VBMD) at radius and tibia sites in premenopausal south Asian and Caucasian women

O. Hakim, A. Darling, S. Lanham-New, J. Berry, K. Hart (Guildford, Manchester, UK)

Little data are available on the extent of bone pain in South Asian populations, particularly in women of child-bearing age. Findings from an earlier study in older women suggested wide spread bone pain among the Asian population¹ whilst Macfarlane et al., (2005) reported that low vitamin D levels were more common among those with widespread pain².

As part of the D-FINES (Vitamin D, Food Intake, Nutrition and Exposure to Sunlight in Southern England) study, we aimed to determine if there was an association between bone pain, serum 25(OH)D, and volumetric bone mineral density (vBMD) at radial and tibial sites. Forty healthy pre-menopausal women (21 Caucasian (C) and 19 South Asian (SA)), aged between 18 and 55 yrs took part in the study. Fasted blood samples were collected for vitamin D, bone pain was assessed via a questionnaire and sit-to-walk test and subjects were scanned by peripheral Quantitative Computed Tomography (pQCT) at the radius and tibia (non-dominant) using a Stratec XCT 2000 pQCT machine.

SA had significantly higher BMI (p<0.05) than C women, with a mean BMI of 24.5 [SD3.9]kg/m² and 27.9[5.5]kg/m² respectively. 25(OH)D concentration was significantly lower among SA women than C women (p<0.001) (mean 25(OH)D 31.53[16.32] and 80.91[20.08]nmol/l respectively). Bone pain and back pain scores were significantly higher in SA subjects than Caucasian (p<0.05). There was no significant difference in sit-to-walk test results between ethnic groups. Bone pain correlated positively with total bone area at the 66% radius site and with bone mass at the 14% tibia site(p<0.05) in the Asian group after adjustment for weight and height. A trend towards a negative correlation between back pain and vitamin D status (p=0.10) was observed, but no associations were identified between bone pain and vitamin D in either specific ethnic group.

The current study confirms that bone pain and back pain are prevalent amongst premenopausal Asian women. Any association between bone pain and vitamin D concentrations may have been masked by the consistently low vitamin D levels within the Asian sub-group and so further investigations in a larger sample is warranted.

Carbohydrates intake is a major determinant of quantitative bone ultrasound in Spanish premenopausal woman


Background: Few data are available on the effect of carbohydrates intake on bone health.

Objective: The objective of this study was to identify dietary patterns and to evaluate the association between carbohydrates and other major nutrients intake and quantitative bone ultrasound in a cohort of premenopausal Spanish women.

Methods: We analyzed a sample of 443 healthy premenopausal women aged 35.55 ± 9.71 years and with a BMI of 23.57 ± 3.01. Assessment was performed by a questionnaire on general health and diet, and amplitude-dependent speed of sound (Ad-SoS) measured by ultrasound on phalanges II-V in the nondominant hand was performed.

Results: Based on dietary variables, the intake of carbohydrates in our cohort was 267.38 ± 85.92 g/d and energy intake was 2152.69 ± 492.16 Kcal/day. We found a significant and positive correlation between Ad-SoS (m/s) and carbohydrates intake (g/d) (r=0.152; p=0.0013). In the multiple regression analysis adjusted by anthropometric and biological factors carbohydrates were a major positive determinant of Ad-SoS (B=0.090; F=12.424) while proteins were a negative determinant of bone mass (B=-5.196; F=56.927) both p<0.001. When the women were clustered by BMI proteins remained as a negative determinant of Ad-SoS (B=-0.628; F=14.849; p<0.001) in the normal group (n=317), while carbohydrates remained as a positive determinant of bone mass in the overweight group (n=107) (B=0.112; F=7.226; p=0.0052). None of the nutrients studied were determinants of bone mass in the obese group (n=19).

Conclusions: Our results support the hypothesis that carbohydrates intake increases bone mass, measured as Ad-SoS, in healthy premenopausal Spanish women. Bone mass may be then sensitive to diet and dietary interventions in such population.
P67
Disbalanced calcium or protein intake as risk factors of osteoporosis in Spanish women


Background: Osteoporosis is a severe health problem that affects menopausal women. Fracture, its only clinical complication, causes high morbidity and mortality and high economic costs. It is necessary to identify risk factors in order to prevent fragility fractures in people at risk in our community. It is widely known the influence of calcium and protein intake on bone health.

Objective: To clarify the role of calcium intake and protein intake as risk factors of osteoporosis in Spanish women.

Methods: We have studied a large cohort of 2231 women of Extremadura (Spain). Bone mass measurements were assessed using dual energy X-ray absorptiometry in lumbar spine and hip. Bone mineral density results for the femur neck and lumbar spine were classified into 3 groups according to WHO criteria as normal (T score > -1.0 SD), osteopenia (T score -1.0 to -2.5 SD), and osteoporosis (T score < -2.5 SD). Calcium and protein intake as quantified using a dietetic scale based on 7 days of diet records.

Results: Prevalence of osteoporosis in our sample was 9.547%, osteopenia 32.542% and no affected 58.001%. Results also indicate that the protein intake in our area exceed RDA (> 1gr/Kg/day). The odds ratio (OR) for protein intake was 1.74 (1.11-2.70; IC 95%). The OR for calcium intake over dietary recommendations (>1200 mg/day) was 1.63 (1.22-2.18; IC 95%) and below RDA was 1.58 (1.07-2.32).

Conclusion: We do confirm that in our area, protein intake and calcium intake (either higher or lower than the RDA) are risk factors for osteoporosis in Spanish women.
Vitamin D status is positively correlated with radial/tibial bone area/density in postmenopausal Caucasian women, and with radial trabecular vBMD in postmenopausal South Asian women

A.L. Darling, O.A. Hakim, J.L. Berry, S.A. Lanham-New, K.H. Hart (Guildford, Manchester, UK)

Calcitriol (1, 25 di-hydroxyvitamin D) is essential for adequate mineralisation of bone tissue via its endocrine effects on calcium and phosphate metabolism, and through autocrine/paracrine effects on bone cell metabolism. Previous research has found an association between vitamin D status (25-hydroxyvitamin D, 25(OH)D) and volumetric Bone Mineral Density (vBMD) in Caucasians. However, there has been little research assessing this relationship in South Asians.

In summer 2010, 17 postmenopausal South Asian and 48 postmenopausal Caucasian women (aged 58 to 75 years) had pQCT scans (Stratec X2000L) undertaken of the tibia (4% and 38% sites) and radius (4 and 66% sites) to measure bone geometry. Fasting blood samples were obtained for assessment of serum 25(OH)D and anthropometry was measured. Pearson’s correlations were undertaken for vitamin D and bone parameters, adjusting for body mass index (BMI).

At the 4% radius site, in Caucasians, there was a positive correlation between vitamin D status and bone mass (r=0.404 p=0.008), total area (r=0.327 p=0.035), and trabecular area (r=0.327 p=0.034). There was also a positive correlation at the 66% site with fracture load (r=0.373 p=0.015). For Asians, at the 4% site there was no significant correlation between vitamin D status and any bone parameters (p>0.05) except for trabecular density (r=0.547 p=0.036), and no significant associations for the 66% site.

At the tibia, in Asians there was no significant correlation between vitamin D status and any bone parameter, at either site (p>0.05). Interestingly, at the 38% site in Caucasians, there were significant correlations between vitamin D status and bone mass (r=0.304 p=0.050) and a trend for a relationship with cortical area (r=0.299 p=0.055). Lastly, there were significant correlations at the 4% site in Caucasians for vitamin D and total area (r=0.336 p=0.029) and cortical subarea (r=0.336 p=0.029).

Overall, vitamin D appears in Caucasians to be positively correlated with radial size, strength and bone mass and in Asians with radial trabecular density. Vitamin D was not correlated with tibial bone parameters in the Asians, but was associated with some tibial mass and area parameters in Caucasians. It is not clear why these ethnic and site specific differences in the relationship between vitamin D status and bone geometry should be apparent. Further analysis is underway to assess the dietary and lifestyle factors that may influence these relationships.
The concentration of 25-hydroxyvitamin D (25(OH)D) for optimal femoral neck bone mineral content varies between Caucasians and South Asians- a true effect or artefact of different 25(OH)D concentrations by ethnic group?

A.L. Darling, K.H. Hart, J.L. Berry, S.A. Lanham-New (Guildford, Manchester, UK)

It is unknown whether the optimal concentration of 25(OH)D varies between ethnic groups living at the same latitude. This analysis aimed to assess the optimal concentration of 25(OH)D for Femoral Neck Bone Mineral Density (FNBMD) and Bone Mineral Content (FNBMC) in UK dwelling (51oN) South Asian and Caucasian women. The data used was originally collected as part of the D-FINES (Vitamin D, Food Intake, Nutrition and Exposure to Sunlight in Southern England) study. In this analysis, 260 women (South Asian (n=29 postmenopausal) and Caucasian (n=231 pre and postmenopausal)) in autumn 2006 had DEXA (Dual x ray absorptiometry; Hologic) scan results and a fasted blood sample for measurement of serum 25(OH)D.

A quadratic model was fitted to the data to assess the 25(OH)D associated with optimal FNBMD and FNBMC. Although no models were statistically significant, there were some interesting trends found for FNBMC. For the postmenopausal Caucasians, whose 25(OH)D ranged from 25-125nmol/l, the quadratic model showed a maximum for FNBMC at 60-65nmol/l (r²=0.001 p=0.931 n=130). For the premenopausal Caucasians, with 25(OH)D ranging from 34nmol/l to 165nmol/l the maximum was 100nmol/l (r²=0.03 p=0.22 n=101). In postmenopausal Asians, whose 25(OH)D ranged from 11.4 to 57.2nmol/l, the quadratic model showed a maximum for FNBMC at 35 nmol/l (r²=0.03 p=0.70 n=29).

The above models would suggest that there may be an ethnic difference in 25(OH)D, with Caucasians having a higher requirement for 25(OH)D to maximise FNBMC. However, when all the groups were restricted to only those women who had 25(OH)D between 20nmol/l and 50nmol/l, to make the groups comparable, the maxima of the Caucasian groups were only 40-45 nmol/l (post: r²=0.01 p=0.89; pre: r²=0.03 p=0.75). This was now much more similar to the Asian maximum (30nmol/l) (r²=0.02 p=0.82).

These results suggest that it may not be ethnicity driving the differences in optimal 25(OH)D seen above, but the simple fact that Caucasians and Asians have a very large difference in 25(OH)D. Indeed, computer models will choose different maxima accordingly. Although only trends, this finding of varying optimal concentrations for bone outcomes by differer 25(OH)D range has not been previously reported and potentially has important implications for comparing estimates of ‘optimal’ 25(OH)D between and within populations. The repetition of this work with larger samples for higher statistical power would now be required.
Does calcium supplementation affect cancer risk?

S.M. Bristow, M.J. Bolland, A. Grey, G.D. Gamble, I.R. Reid (Auckland, NZ)

Background: Some evidence suggests calcium and vitamin D supplements affect cancer risk, but it is uncertain whether effects are due to calcium, vitamin D or the combination.

Objective: To investigate the effect of calcium supplements without coadministered vitamin D on cancer risk.

Design: Medline, Embase and the Cochrane Central Register of Controlled Trials, reference lists of meta-analyses of calcium supplements, and two clinical trial registries were searched. Data was analysed using random-effects meta-analyses.

Results: Sixteen trials were eligible for inclusion, ten provided trial-level data (10,496 participants, mean duration 3.9 years) and six had no data available. Allocation to calcium did not alter the risk of total cancer (pooled relative risk 0.95, 95% confidence interval 0.76 to 1.18, P = 0.63), colorectal cancer (1.38, 0.89 to 2.15, P = 0.15), breast cancer (1.01, 0.64 to 1.59, P = 0.97) or cancer-related mortality (0.96, 0.74 to 1.24, P = 0.75), but reduced the risk of prostate cancer (0.54, 0.30 to 0.96, P = 0.03), although there were few events.

Conclusions: Calcium supplements without coadministered vitamin D did not alter total cancer risk over 4 years, although the meta-analysis lacked power to detect very small effects, or those with a longer latency.
Introduction: Prolonged and severe vitamin D deficiency leads to rickets and osteomalacia. Secondary hyperparathyroidism as a result of vitamin D deficiency is a significant contributing factor for osteoporosis. Because of signs and symptoms of vitamin D deficiency are nonspecific, it often goes unrecognized and untreated.

Aim: To determined the calcium and vitamin D daily intake level and frequency of vitamin D-deficiency and insufficiency in people of different age, not previously treated with vitamin D, who living in different regions of Ukraine (west, centre, east).

Methods: There were examined 450 patients from different regions of Ukraine (mean age 57.0±13.7 yrs.). 25 (OH) vitamin D and PTH level evaluated by Elecsys 2010. BMD was examined by ultrasound densitometry (HOLOGIC, Sahara). Ca and vitamin D-intakes level was determined by three days food frequency questionnaire.

Results: The study showed that 85.4% examined people had deficiency of vitamin D, 13.9% – insufficiency and 0.7% normal level of 25 (OH) vitamin D. The mean level of 25 (OH) vitamin D was (42.66±16.68) nmol/l in people of western region, (27.08±14.96) nmol/l in central and (29.64±14.58) nmol/l in eastern region of Ukraine. The difference between the groups wasn’t significant. 9.9% people had higher level of PHT. Only 2.1% observed had normal calcium intake level, most people (72.3%) took 500 mg and less of calcium per day. 85.7% patients had deficiency of vitamin D in diet. It important to show the weak negative correlation between PHT and 25 (OH) vitamin D (r=-0.11, p=0.049); positive significant correlation between 25 (OH) vitamin D and Ca-intakes (r=0.13, p=0.012) in examined patient. It wasn’t determined any significant correlation between 25 (OH) vitamin D level and BMD (r=-0.06, p=0.27) and Stiffness (r=0.17, p=0.71).

85.4% examined people had deficiency of vitamin D, 13.9% – insufficiency and 0.7% normal level of 25 (OH) vitamin D. There is no significant difference in mean level of 25 (OH) vitamin D in patients from researched regions. 9.9% people had higher than maximum target level of PHT. It was determined significant correlation between 25 (OH) vitamin D and PTH; also 25 (OH) vitamin D and daily Ca-intakes. No correlations between 25 (OH) vitamin D level and ultrasound densitometry data.
Can one or two high doses of oral Vitamin D3 correct insufficiency in a non-supplemented rheumatologic population?

(Lausanne, Fribourg, CH)

Introduction: Adherence with daily oral supplements of vitamin D3 is suboptimal. We evaluated the effectiveness of supplementation with a single high dose of oral vitamin D3 (300’000 UI) to correct hypovitaminosis D in a rheumatologic population.

Methods: Over one month, 292 patients had level of 25-OH vitamin D determined. Results were classified as: deficiency <10ng/ml, insufficiency ≥ 10ng/ml to < 30ng/ml and normal ≥ 30ng/ml. Patients with deficient or normal levels were excluded, as well as patients already supplemented with vitamin D3. 141 selected patients with vitamin D insufficiency (18.5ng/ml (10.2-29.1)) received a prescription for 300’000 IU of oral vitamin D3 and were asked to return after 3 (M3) and 6 months (M6). Patients still insufficient at M3 received a second prescription for 300’000 IU of oral vitamin D3.

Results: 124 patients had a blood test at M3. 2 (2%) had deficiency, 50 (40%) normal results (36.7ng/ml (30.5-56.5)). 72 (58%) were insufficient (23.6ng/ml (13.8-29.8)) and received a second prescription for 300’000 IU of oral vitamin D3. Of the 50/124 patients who had normal results at M3 and did not receive a second prescription, 36 (72%) had a test at M6. 17 (47%) had normal results (34.8ng/ml (30.3-42.8)), 19 (53%) were insufficient (25.6ng/ml (15.2-29.9)). Of the 72/124 patients who receive a second prescription, 54 (75%) had a test at M6. 28 (52%) had insufficiency (23.2ng/ml (12.8-28.7)) and 26 (48%) had normal results (33.8ng/ml (30.0-43.7)).

There was a significant negative relation correlation (coefficient r=-0.3, p=0.0007): the lowest the baseline value the highest the change after 3 months. There was no more correlation between the differences and values at M6 vs M3 (r=-0.11, p=0.43).

Conclusion: We have shown that one or two oral bolus of 300’000 IU of vitamin D3 can correct hypovitaminosis D in 50% of patients and that the patients who benefited more from supplementation were those with the lowest baseline levels.
The effect of long-term supplementation with different dietary omega-6/omega-3 ratios on minerals content and Ex vivo PGE2 release in bone of growing rabbits

D.M. Al-Nouri, A.S. Al-Khalifa (Riyadh, SA)

The long-term effects of different dietary oil sources with varying omega-6/omega-3 (w-6/w-3) polyunsaturated fatty acids (PUFAs) ratios on the bone marrow fatty acid profile, ex vivo prostaglandin E2 (PGE2) release, and minerals content in bone were evaluated in rabbits. Weanling male and female New Zealand white rabbits were randomly assigned to five groups and offered ad libitum diets containing 70 g/kg of added oil for 100 days as follow: soy bean oil (SBO control), sesame oil (SO), fish oil (FO), DHA algae oil (DHA), and DHA and ARA algae oils (DHA/ARA). The dietary lipid treatments were formulated to provide the following ratio of w-6/w-3 fatty acids: 8.7 (SBO), 21.8 (SO), 0.4 (FO), 0.6 (DHA), and 0.7 (DHA/ARA). The bone marrow fatty acid profile of rabbits was significantly influenced by and reflected the dietary lipid treatments. Rabbits fed the FO diet had the highest w-3 PUFA concentration, and those fed on SBO diet were highest in w-6 PUFA. Ex vivo PGE2 level declined progressively as the w-6/w-3 dietary ratio declined. There was a significant main effect of dietary treatment on femur calcium Ca, phosphorous P, magnesium Mg, and zinc Zn contents in both genders. These results demonstrate that dietary w-6/w-3 ratio modulates bone PGE2 production in growing rabbits, hence may reduce bone resorption and improve bone mass during growth. In addition, the significant elevation in minerals content and the maintenance of optimal Ca/P ratio in bone of DHA/ARA and DHA fed groups demonstrates that marine algae oils may be promising dietary sources for promoting bone mineralization during the growing stage.
<table>
<thead>
<tr>
<th>Name</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahmed, L.A.</td>
<td>P51</td>
</tr>
<tr>
<td>Ahmed, S.</td>
<td>P59</td>
</tr>
<tr>
<td>Ahrens, W.</td>
<td>P53, P54</td>
</tr>
<tr>
<td>Albaba, M.</td>
<td>P44</td>
</tr>
<tr>
<td>Alekna, V.</td>
<td>P61</td>
</tr>
<tr>
<td>Alfuraih, A.</td>
<td>P64</td>
</tr>
<tr>
<td>Alhashemi, S.</td>
<td>P43</td>
</tr>
<tr>
<td>AlKadi, H.</td>
<td>22</td>
</tr>
<tr>
<td>Al-Khalifa, A.S.</td>
<td>P73</td>
</tr>
<tr>
<td>Al-Nouri, D.M.</td>
<td>P73</td>
</tr>
<tr>
<td>Alonso, J.</td>
<td>P67</td>
</tr>
<tr>
<td>Alyahya, K.O.</td>
<td>P60</td>
</tr>
<tr>
<td>Ardawi, M.</td>
<td>22, P43, P45</td>
</tr>
<tr>
<td>Aubry-Rozie, B.</td>
<td>P72</td>
</tr>
<tr>
<td>Auchott, L.</td>
<td>2, 18, P57</td>
</tr>
<tr>
<td>Balatska, N.</td>
<td>P71</td>
</tr>
<tr>
<td>Barba, G.</td>
<td>P53, P54</td>
</tr>
<tr>
<td>Bartolini, E.</td>
<td>P56</td>
</tr>
<tr>
<td>Berry, J.</td>
<td>24, P64, P65, P68, P69</td>
</tr>
<tr>
<td>Biolo, G.</td>
<td>P50</td>
</tr>
<tr>
<td>Bischoff-Ferrari, H.</td>
<td>20, 30</td>
</tr>
<tr>
<td>Blomhoff, R.</td>
<td>P51</td>
</tr>
<tr>
<td>Bolland, M.J.</td>
<td>P70</td>
</tr>
<tr>
<td>Brandi, M.L.</td>
<td>P56</td>
</tr>
<tr>
<td>Bristow, S.M.</td>
<td>P70</td>
</tr>
<tr>
<td>Bucca, G.</td>
<td>24</td>
</tr>
<tr>
<td>Buehlmeier, J.</td>
<td>P50</td>
</tr>
<tr>
<td>Burckhardt, P.</td>
<td>12</td>
</tr>
<tr>
<td>Calderon-Garcia, J.F.</td>
<td>P67</td>
</tr>
<tr>
<td>Canal-Macias, M.L.</td>
<td>P67</td>
</tr>
<tr>
<td>Casey, V.</td>
<td>32</td>
</tr>
<tr>
<td>Cassidy, A.</td>
<td>6</td>
</tr>
<tr>
<td>Cha, S.</td>
<td>P44</td>
</tr>
<tr>
<td>Chlebna-Sokol, D.</td>
<td>P39, P40</td>
</tr>
<tr>
<td>Chope, G.</td>
<td>24</td>
</tr>
<tr>
<td>Christie, J.</td>
<td>5</td>
</tr>
<tr>
<td>Clavijo, A.</td>
<td>33</td>
</tr>
<tr>
<td>Cosman, F.</td>
<td>23</td>
</tr>
<tr>
<td>Costa-Fernandez, M.C.</td>
<td>P66</td>
</tr>
<tr>
<td>Coxam, V.</td>
<td>P48, P49, P62</td>
</tr>
<tr>
<td>De Henauw, S.</td>
<td>P53, P54</td>
</tr>
<tr>
<td>DiTanna, G.L.</td>
<td>P56</td>
</tr>
<tr>
<td>Dobnig, H.</td>
<td>36</td>
</tr>
<tr>
<td>Dobrzanska, A.</td>
<td>P40</td>
</tr>
<tr>
<td>Dudler, J.</td>
<td>P72</td>
</tr>
<tr>
<td>Duthie, G.G.</td>
<td>2</td>
</tr>
<tr>
<td>Ebeling, P.R.</td>
<td>P46</td>
</tr>
<tr>
<td>El-Hajj Fuleihan, G.</td>
<td>29</td>
</tr>
<tr>
<td>Emami Ardekani, A.</td>
<td>P41</td>
</tr>
<tr>
<td>Fahrleitner-Pammer, A.</td>
<td>36</td>
</tr>
<tr>
<td>Fielding, R.</td>
<td>3</td>
</tr>
<tr>
<td>Forsmo, S.</td>
<td>P51</td>
</tr>
<tr>
<td>Fraser, W.D.</td>
<td>18, P57</td>
</tr>
<tr>
<td>Frings-Meuthen, P.</td>
<td>P50</td>
</tr>
<tr>
<td>Gamble, G.D.</td>
<td>P70</td>
</tr>
<tr>
<td>Garland, S.</td>
<td>5</td>
</tr>
<tr>
<td>Garrett, P.</td>
<td>23</td>
</tr>
<tr>
<td>Geva, D.</td>
<td>P52</td>
</tr>
<tr>
<td>Ghassam Zadeh, A.</td>
<td>35</td>
</tr>
<tr>
<td>Gilsanz, V.</td>
<td>34</td>
</tr>
<tr>
<td>Giolli, L.</td>
<td>P56</td>
</tr>
<tr>
<td>Gjedsal, C.G.</td>
<td>P51</td>
</tr>
<tr>
<td>Goldberg, G.</td>
<td>31, P59</td>
</tr>
<tr>
<td>Golec, J.</td>
<td>P40</td>
</tr>
<tr>
<td>Green, T.</td>
<td>27</td>
</tr>
<tr>
<td>Grey, A.</td>
<td>P70</td>
</tr>
<tr>
<td>Grimmes, G.</td>
<td>P51</td>
</tr>
<tr>
<td>Grygorieva, N.</td>
<td>P71</td>
</tr>
<tr>
<td>Hakim, O.</td>
<td>P64, P65, P68</td>
</tr>
<tr>
<td>Halaba, Z.P.</td>
<td>P40</td>
</tr>
<tr>
<td>Hannan, M.</td>
<td>32</td>
</tr>
<tr>
<td>Hans, D.</td>
<td>P72</td>
</tr>
<tr>
<td>Haque, S.</td>
<td>P59</td>
</tr>
<tr>
<td>Hardcastle, A.C.</td>
<td>2</td>
</tr>
<tr>
<td>Hart, K.</td>
<td>24, P55, P64, P65, P68, P69</td>
</tr>
<tr>
<td>Hassoun, G.</td>
<td>P42</td>
</tr>
<tr>
<td>Heaney, R.P.</td>
<td>28</td>
</tr>
<tr>
<td>Heer, M.</td>
<td>P50</td>
</tr>
<tr>
<td>Herrmann, D.</td>
<td>P53, P54</td>
</tr>
<tr>
<td>Holvik, K.</td>
<td>P51</td>
</tr>
<tr>
<td>Horcajada, M.N.</td>
<td>15</td>
</tr>
<tr>
<td>Hu, X.</td>
<td>11</td>
</tr>
<tr>
<td>Hussein, K.</td>
<td>22</td>
</tr>
<tr>
<td>Hypponen, E.</td>
<td>24</td>
</tr>
<tr>
<td>Ish-Shalom, S.</td>
<td>P42, P52</td>
</tr>
<tr>
<td>Iuliano-Burns, S.</td>
<td>35</td>
</tr>
<tr>
<td>Jarjou, L.</td>
<td>31</td>
</tr>
<tr>
<td>Jin, A</td>
<td>16, 17</td>
</tr>
<tr>
<td>Kalkwarf, H.</td>
<td>34</td>
</tr>
<tr>
<td>Kallikorm, R.</td>
<td>P47</td>
</tr>
<tr>
<td>Karalus, J.</td>
<td>P39, P40</td>
</tr>
<tr>
<td>Karczmarewicz, E.</td>
<td>P40</td>
</tr>
<tr>
<td>Kaufman, J.-M.</td>
<td>P53</td>
</tr>
<tr>
<td>Kedem, E.</td>
<td>P42</td>
</tr>
<tr>
<td>Khoja, S.</td>
<td>P43, P45</td>
</tr>
<tr>
<td>Kiel, D.</td>
<td>32</td>
</tr>
<tr>
<td>King, K.</td>
<td>35</td>
</tr>
<tr>
<td>Klimovytksy, F.</td>
<td>P71</td>
</tr>
<tr>
<td>Knapen, M.</td>
<td>19</td>
</tr>
<tr>
<td>Koh, W.-P.</td>
<td>16, 17</td>
</tr>
<tr>
<td>Konstantynowicz, J.</td>
<td>P40</td>
</tr>
<tr>
<td>Krieg, M.-A.</td>
<td>P72</td>
</tr>
<tr>
<td>Kruger, M.</td>
<td>13</td>
</tr>
<tr>
<td>Krupa, B.</td>
<td>P40</td>
</tr>
<tr>
<td>Kulik-Rechberger, B.</td>
<td>P40</td>
</tr>
<tr>
<td>Kull, M.</td>
<td>P47</td>
</tr>
<tr>
<td>Lambert, H.</td>
<td>24</td>
</tr>
<tr>
<td>Lamy, O.</td>
<td>P72</td>
</tr>
<tr>
<td>Lanham-New, S.</td>
<td>8, 22, 24, P43, P45, P55, P60, P64, P65, P68, P69</td>
</tr>
<tr>
<td>Lappe, J.</td>
<td>34</td>
</tr>
<tr>
<td>Lavado-Garcia, J.</td>
<td>P66, P67</td>
</tr>
</tbody>
</table>
## List of speakers and authors

<table>
<thead>
<tr>
<th>Name</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lember, M.</td>
<td>P47</td>
</tr>
<tr>
<td>Lewis, R.</td>
<td>25</td>
</tr>
<tr>
<td>Lindsay, R.</td>
<td>23</td>
</tr>
<tr>
<td>Lips, P.</td>
<td>21, 30</td>
</tr>
<tr>
<td>Liu, Y.</td>
<td>11</td>
</tr>
<tr>
<td>Macdonald, C.J.</td>
<td>18, P57</td>
</tr>
<tr>
<td>Macdonald, H.M.</td>
<td>2, 18, P57</td>
</tr>
<tr>
<td>MacGregor, A.</td>
<td>6</td>
</tr>
<tr>
<td>Marild, S.</td>
<td>P53, P54</td>
</tr>
<tr>
<td>Martin, B.</td>
<td>33</td>
</tr>
<tr>
<td>Maser-Gluth, C.</td>
<td>P50</td>
</tr>
<tr>
<td>Mastaviciute, A.</td>
<td>P61</td>
</tr>
<tr>
<td>McCabe, G.</td>
<td>33</td>
</tr>
<tr>
<td>McCabe, L.</td>
<td>33</td>
</tr>
<tr>
<td>McCabe, P.</td>
<td>P64</td>
</tr>
<tr>
<td>Meyer, H.E.</td>
<td>P51</td>
</tr>
<tr>
<td>Minne, H.W.</td>
<td>36</td>
</tr>
<tr>
<td>Molnar, D.</td>
<td>P53</td>
</tr>
<tr>
<td>Moran, J.M.</td>
<td>P66, P67</td>
</tr>
<tr>
<td>Moreno, L.A.</td>
<td>P53</td>
</tr>
<tr>
<td>Mouratidou, T.</td>
<td>P53, P54</td>
</tr>
<tr>
<td>Nakatsu, C.</td>
<td>33</td>
</tr>
<tr>
<td>Nicholson, G.C.</td>
<td>P46</td>
</tr>
<tr>
<td>Niedziela, M.</td>
<td>P40</td>
</tr>
<tr>
<td>Nieves, J.</td>
<td>23</td>
</tr>
<tr>
<td>Nowson, C.</td>
<td>5</td>
</tr>
<tr>
<td>Oberfield, S.</td>
<td>34</td>
</tr>
<tr>
<td>Palacios, C.</td>
<td>37</td>
</tr>
<tr>
<td>Pampaloni, B.</td>
<td>P56</td>
</tr>
<tr>
<td>Pedrera-Zamorano, J.D.</td>
<td>P67</td>
</tr>
<tr>
<td>Penson, S.</td>
<td>24</td>
</tr>
<tr>
<td>Pfeifer, M.</td>
<td>36</td>
</tr>
<tr>
<td>Philippe, C.</td>
<td>P48, P49</td>
</tr>
<tr>
<td>Piscitelli, P.</td>
<td>P56</td>
</tr>
<tr>
<td>Pollack, S.</td>
<td>P42</td>
</tr>
<tr>
<td>Povoroznyuk, V.</td>
<td>P71</td>
</tr>
<tr>
<td>Prentice, A.</td>
<td>31, P58,</td>
</tr>
<tr>
<td></td>
<td>P59</td>
</tr>
<tr>
<td>Prince, R.</td>
<td>11</td>
</tr>
<tr>
<td>Puel, C.</td>
<td>P62</td>
</tr>
<tr>
<td>Quach, L.</td>
<td>32</td>
</tr>
<tr>
<td>Rahimi Petrodi, S.</td>
<td>P41</td>
</tr>
<tr>
<td>Raqib, R.</td>
<td>P59</td>
</tr>
<tr>
<td>Redmond, J.</td>
<td>P58</td>
</tr>
<tr>
<td>Reid, D.M.</td>
<td>2, 18, P57</td>
</tr>
<tr>
<td>Reid, I.</td>
<td>7, 38, P70</td>
</tr>
<tr>
<td>Remer, T.</td>
<td>9, P50</td>
</tr>
<tr>
<td>Rey-Sanchez, P.</td>
<td>P66</td>
</tr>
<tr>
<td>Rhodes, L.</td>
<td>P64</td>
</tr>
<tr>
<td>Rodriguez-Dominguez, T.</td>
<td>P66</td>
</tr>
<tr>
<td>Roncero-Martín, R.</td>
<td>P66</td>
</tr>
<tr>
<td>Rothnie, I.</td>
<td>2</td>
</tr>
<tr>
<td>Roy, S.K.</td>
<td>P59</td>
</tr>
<tr>
<td>Ruffing, J.</td>
<td>23</td>
</tr>
<tr>
<td>Saddekk, S.</td>
<td>P45</td>
</tr>
<tr>
<td>Sahni, S.</td>
<td>32</td>
</tr>
<tr>
<td>Samuelsen, S.O.</td>
<td>P51</td>
</tr>
<tr>
<td>Sanders, K.M.</td>
<td>P46</td>
</tr>
<tr>
<td>Sawo, Y.</td>
<td>31</td>
</tr>
<tr>
<td>Schoenmakers, I.</td>
<td>P58</td>
</tr>
<tr>
<td>Schoterman, M.</td>
<td>33</td>
</tr>
<tr>
<td>Seeman, E.</td>
<td>35</td>
</tr>
<tr>
<td>Segal, E.</td>
<td>P42</td>
</tr>
<tr>
<td>Sellmeyer, D.E.</td>
<td>10</td>
</tr>
<tr>
<td>Shahar, D.</td>
<td>P52</td>
</tr>
<tr>
<td>Shahar, E.</td>
<td>P42</td>
</tr>
<tr>
<td>Shapes, S.</td>
<td>4</td>
</tr>
<tr>
<td>Shen-Orr, Z.</td>
<td>P42</td>
</tr>
<tr>
<td>Shepherd, J.</td>
<td>34</td>
</tr>
<tr>
<td>Siani, A.</td>
<td>P53</td>
</tr>
<tr>
<td>Simpson, W.G.</td>
<td>2</td>
</tr>
<tr>
<td>Sioen, I.</td>
<td>P53, P54</td>
</tr>
<tr>
<td>Smit, E.</td>
<td>19</td>
</tr>
<tr>
<td>Smith, C.P</td>
<td>24</td>
</tr>
<tr>
<td>Spector, T.</td>
<td>6</td>
</tr>
<tr>
<td>Spilmont, M.</td>
<td>P48, P49, P62</td>
</tr>
<tr>
<td>Spyrou, N.</td>
<td>P64</td>
</tr>
<tr>
<td>Stehle, P.</td>
<td>P50</td>
</tr>
<tr>
<td>Stoll, D.</td>
<td>P72</td>
</tr>
<tr>
<td>Strazdiene, V.</td>
<td>P61</td>
</tr>
<tr>
<td>Svobodova, J.</td>
<td>P63</td>
</tr>
<tr>
<td>Synenyk, O.</td>
<td>P71</td>
</tr>
<tr>
<td>Tagliaferri, C.</td>
<td>P49, P62</td>
</tr>
<tr>
<td>Tamulaitiene, M.</td>
<td>P61</td>
</tr>
<tr>
<td>Tell, G.S.</td>
<td>P51</td>
</tr>
<tr>
<td>Tendy, S.</td>
<td>23</td>
</tr>
<tr>
<td>Tepper, S.</td>
<td>P52</td>
</tr>
<tr>
<td>Theuwissen, E.</td>
<td>19</td>
</tr>
<tr>
<td>Thies, F.</td>
<td>2</td>
</tr>
<tr>
<td>Tornaritis, M.</td>
<td>P53</td>
</tr>
<tr>
<td>Tripkovic, L.</td>
<td>24, P55</td>
</tr>
<tr>
<td>Tucker, K.</td>
<td>32</td>
</tr>
<tr>
<td>van den Heuvel, E.</td>
<td>33</td>
</tr>
<tr>
<td>Veidebaum, T.</td>
<td>P53</td>
</tr>
<tr>
<td>Vermeer, C.</td>
<td>19</td>
</tr>
<tr>
<td>Vieth, R.</td>
<td>24</td>
</tr>
<tr>
<td>Vyskocil, V.</td>
<td>P63</td>
</tr>
<tr>
<td>Wang, C.</td>
<td>11</td>
</tr>
<tr>
<td>Wang, Q.</td>
<td>35</td>
</tr>
<tr>
<td>Wang, X.-F.</td>
<td>35</td>
</tr>
<tr>
<td>Ward, K.</td>
<td>31</td>
</tr>
<tr>
<td>Wark, J.</td>
<td>5</td>
</tr>
<tr>
<td>Watson, P.</td>
<td>34</td>
</tr>
<tr>
<td>Waquier, F.</td>
<td>P48, P49</td>
</tr>
<tr>
<td>Weaver, C.</td>
<td>14, 33, 38</td>
</tr>
<tr>
<td>Welch, A.A</td>
<td>6</td>
</tr>
<tr>
<td>Whisner, C.</td>
<td>33</td>
</tr>
<tr>
<td>Wilson, L.</td>
<td>P55</td>
</tr>
<tr>
<td>Winer, K.</td>
<td>34</td>
</tr>
<tr>
<td>Wittrant, Y.</td>
<td>P48, P49, P62</td>
</tr>
<tr>
<td>Wood, A.D.</td>
<td>2</td>
</tr>
<tr>
<td>Wood, J.L.</td>
<td>35</td>
</tr>
<tr>
<td>Wu, F.</td>
<td>11</td>
</tr>
<tr>
<td>Yuan, J.</td>
<td>16, 17</td>
</tr>
<tr>
<td>Zemel, B.</td>
<td>34</td>
</tr>
<tr>
<td>Zhang, Q.</td>
<td>11</td>
</tr>
<tr>
<td>Zhu, K.</td>
<td>11</td>
</tr>
<tr>
<td>Zieai, S.</td>
<td>P41</td>
</tr>
<tr>
<td>Zion, M.</td>
<td>23</td>
</tr>
</tbody>
</table>
City Map of Lausanne

1 Hotel Lausanne Palace
2 Hotel Château d’Ouchy
3 Hotel Elite
4 Hotel Mirabeau

© Ville de Lausanne, Service du cadastre
What is it about plant power that keeps bones healthy?

All Alpro® products are made with delicious plant goodness and are a great source of vitamins B2, B12, D and calcium. Alpro soy products are a good source of plant protein too to maintain healthy bones. So eat well and feel uplifted. With Alpro products, you've every reason to indulge.

stay curious enjoy plant power
Sandoz is a household name with a history of global leadership in developing and producing complex, high-quality products. As part of the Novartis Group, we believe that superior quality is key to our long-term success. We make high-quality medicines that are equivalent to the originator - with the exception of our affordable price. Our state-of-the-art technologies, decades of experience, and rigorous across-the-board quality standards all contribute to an offer we are justly proud of: quality at a price that everyone can afford.

www.sandoz.com

Sandoz – a healthy decision