a b c d e

Gembloux Agro-Bio Tech
Université de Liège

Kashin-Beck Disease Fund

CFSA

IRIHA

Dietary mineral intakes of young Tibetan children living in areas endemic for Kashin-Beck disease: preliminary results of a cross-sectional survey

M. Dermience[a], F. Mathieu[b], X. Li[c], S. Vandevijvere, W. Claus[b], V. De Maertelaer[b], G. Dufourny[d], L. Bin[e], D. Yangzom[b], G. Lognay[a]

36th SICOT Orthopaedic World Congress (Guangzhou, P.R. China, 2015)

Background

- Kashin-Beck disease (KBD) is an endemic and chronic osteochondropathy whose etiology remains unclear [1]

- Environmental factors are assumed to be involved, among which the selenium and iodine deficiency [2,3]

Background

- Tibetan populations share 4 macro-ecosystems [4]:
  - Urban zones
  - Suburban zones
  - Pastoral zones
  - Agricultural zones
- KBD only encountered in Agricultural zones

➢ Diet is a major difference between these zones

Aim of the study

- Assessment of minerals intakes of preschool children living in endemic areas for Kashin-Beck disease
- Compare the calculated intakes with Chinese [5] and US [6,7] nutritional recommendations
- Investigated nutrients:

  Energy, Water, Na, K, Ca, P, Mg, Fe, Cu, Zn, Se, Mn

Preliminary studies

- Effects of thirty elements on bone metabolism [8]

- The relevance of food composition data for nutrition survey in rural Tibet: pilot study in the context of Kashin-Beck Disease [9]

- Minerals and trace elements in traditional foods of rural areas of Lhasa Prefecture, Tibet Autonomous Region (P.R. China) [10]

Experimental design

- Cross-sectional survey
- 250 Children (aged 3 to 5) of Lhasa Prefecture (3 Counties) interviewed twice (2 seasons)
- Interactive multiple-pass 24-hour food recall
- Specific Food Composition Table
- Intakes computed with Nubel Foodplanner PRO

Results

Table 1. Distribution of children according to their age and county

County	n total	age	n male	n female
Lhünzub (L)	70	3	10	11
		4	16	11
		5	7	15
Maizhokunggar (M)	27	3	4	3
		4	6	8
		5	4	2
Nyêmo (N)	153	3	24	27
		4	33	20
		5	23	26
Total	250		127	123

Results

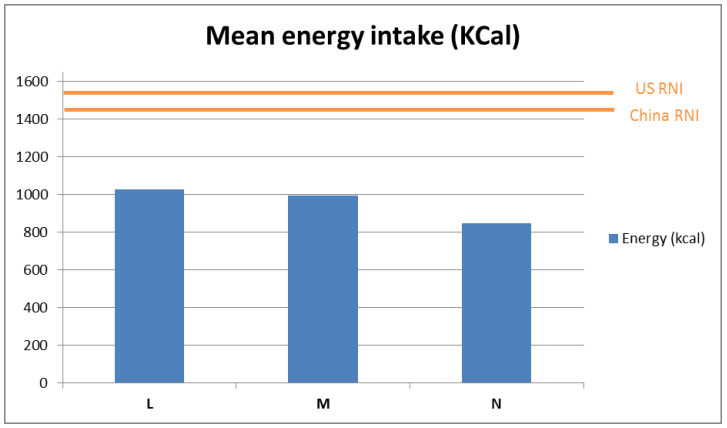
Table 2. Energy and water mean intakes by county and comparison with the Chinese and US recommendations

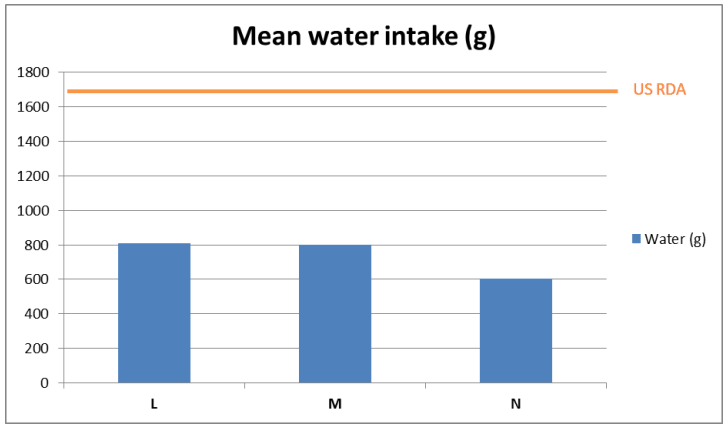
Nutrient	County	Mean	StDev	(%)[#]	China RNI/AI for 4 y/o	US RDA/AI for 4-8 y/o	China ULs for 4 y/o	US ULs for 4-8 y/o
Energy (kcal)	L	1026[a]	428	71				
	M	995[a,b]	535	69	1300-1600	1485-1642	-	-
	N	848[b]	455	58				
Water (g)	L	811[a]	386	48				
	M	798[a]	334	47	-	1700	-	-
	N	606[b]	354	36				

RNI: recommended nutrient intake; AI: adequate intake; RDA: recommended dietary allowance; ULs: upper limits

[#] Percent of China RNI/AI/ or US AI/RDA if Chinese value is missing

[a,b] Values with the same letter present no significant differences, values with different letters present significant differences (P<0.05)





Results

Table 3. Major elements mean intakes by county and comparison with the Chinese and US recommendations

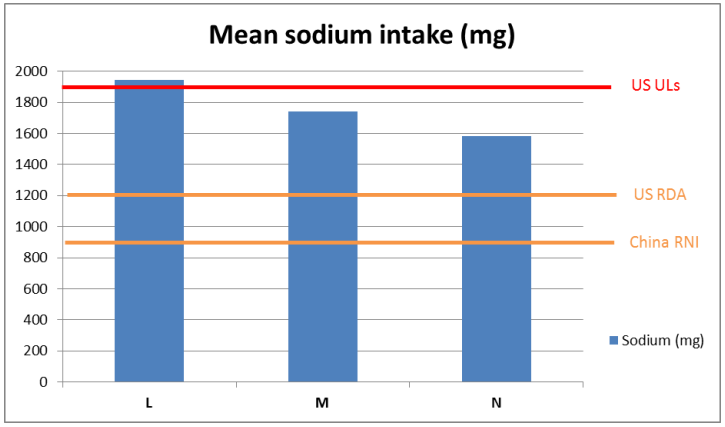
Nutrient	Region	Mean	StDev	(%)[#]	China RNI/AI for 4 y/o	US RDA/AI for 4-8 y/o	China ULs for 4 y/o	US ULs for 4-8 y/o
Sodium (mg)	L	1945[a]	1152	216				
	M	1739[a,b]	944	193	900	1200	-	1900
	N	1580[b]	1327	176				
Potassium (mg)	L	998[a]	571	67				
	M	981[a,b]	511	65	1500	3800	-	-
	N	821[b]	533	55				
Calcium (mg)	L	361[a]	314	45				
	M	394[a,b]	252	49	800	1000	2000	2500
	N	251[b]	374	31				
Phosphorus (mg)	L	575[a]	306	115				
	M	588[a]	272	118	500	500	3000	3000
	N	487[b]	387	97				
Magnesium (mg)	L	157[a]	71	105				
	M	143[a]	72	95	150	130	300	110
	N	116[b]	57	77				

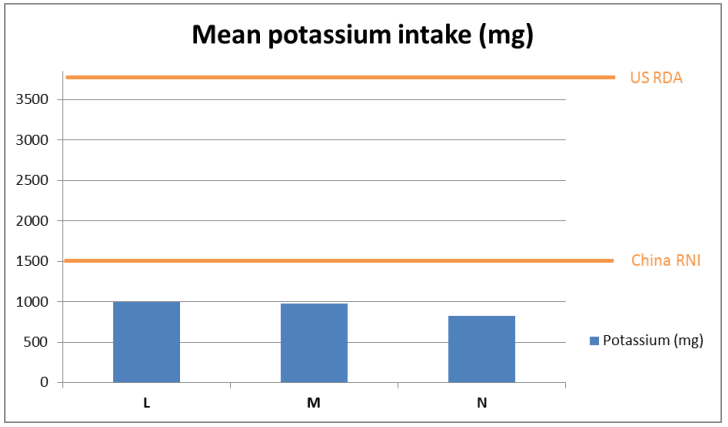
RNI: recommended nutrient intake; AI: adequate intake; RDA: recommended dietary allowance; ULs: upper limits

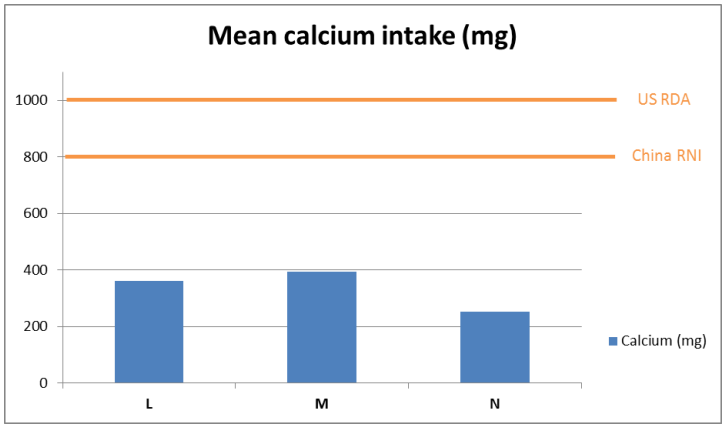
[#] Percent of China RNI/AI/ or US AI/RDA if Chinese value is missing

[a,b] Values with the same letter present no significant differences, values with different letters present significant differences ($P<0.05$)

Results


Mean sodium intake (mg)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
L
M
N
US ULs
US RDA
China RNI
Sodium (mg)


Mean potassium intake (mg)
3500
3000
2500
2000
1500
1000
500
0
L
M
N
US RDA
China RNI
Potassium (mg)


Mean calcium intake (mg)
1000
800
600
400
200
0
L
M
N
US RDA
China RNI
Calcium (mg)

Results

Table 4. Minor elements mean intakes by county and comparison with the Chinese and US recommendations

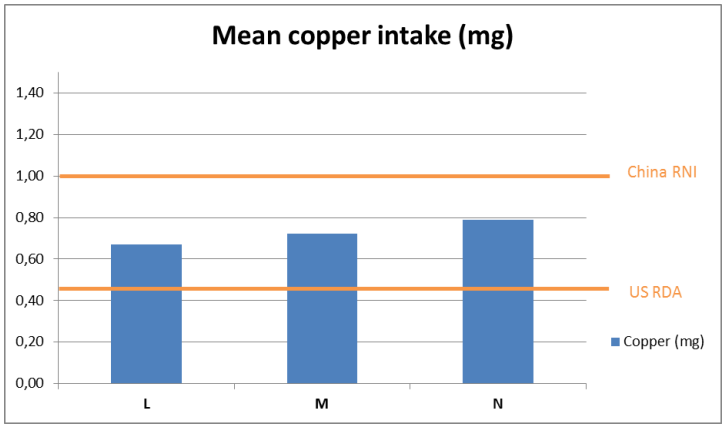
Nutrient	Region	Mean	StDev	(%)[#]	China RNI/AI for 4 y/o	US RDA/AI for 4-8 y/o	China ULs for 4 y/o	US ULs for 4-8 y/o
Iron (mg)	L	14,7[a]	10,1	122				
	M	12,0[a,b]	6,0	100	12	10	30	40
	N	11,2[b]	10,4	93				
Copper (mg)	L	0,67[a]	0,28	67				
	M	0,72[a]	0,37	72	1	0,44	2	3
	N	0,79[a]	1,10	79				
Zinc (mg)	L	4,9[a]	2,2	41				
	M	5,2[a]	4,2	44	12	5	23	12
	N	3,6[b]	2,2	30				
Selenium (µg)	L	13[a]	8	50				
	M	14[a]	12	55	25	30	180	150
	N	9[b]	9	36				
Manganese (mg)	L	2,5[a]	1,1	165				
	M	2,3[a]	1,0	153	-	1,5	-	3
	N	1,7[b]	0,7	112				

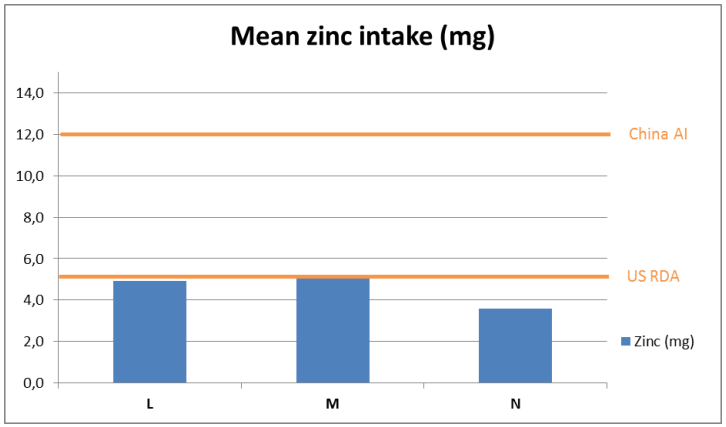
RNI: recommended nutrient intake; AI: adequate intake; RDA: recommended dietary allowance; ULs: upper limits

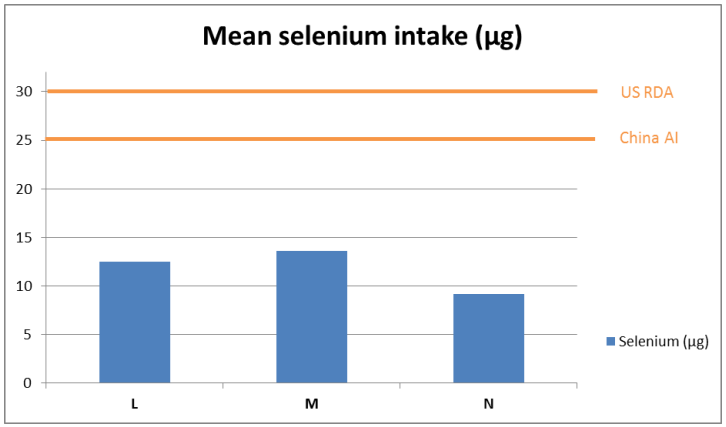
[#] Percent of RNI/AI/RDA

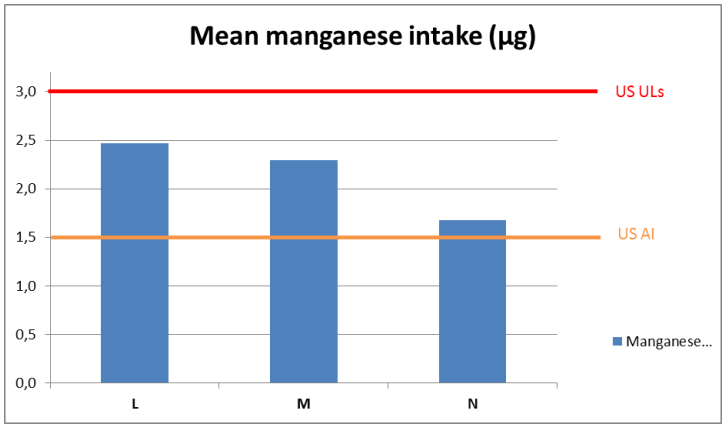
[a,b] Values with the same letter present no significant differences, values with different letters present significant differences ($P<0.05$)

Results


Mean copper intake (mg)
1,40
1,20
1,00
0,80
0,60
0,40
0,20
0,00
China RNI
US RDA
Copper (mg)
L
M
N


Mean zinc intake (mg)
14,0
12,0
10,0
8,0
6,0
4,0
2,0
0,0
China AI
US RDA
Zinc (mg)
L
M
N


Mean selenium intake (µg)
30
25
20
15
10
5
0
US RDA
China AI
Selenium (µg)
L
M
N


Mean manganese intake (µg)
3,0
2,5
2,0
1,5
1,0
0,5
0,0
US ULs
US AI
Manganese...
L
M
N

Conclusions

Low intakes in:

- Energy (58-71% of China AI)
- Water (36-48% of US RDA)
- Potassium (55-67% of China AI)
- Calcium (31-49% of China AI)
- Copper (67-79% of China AI)
- Zinc (30-44% of China RNI)
- Selenium (36-55% of China RNI)

High intakes in:

- Sodium (176-216% of China AI)
- Manganese (112-165% of US AI)

Thank you for your attention !

References

1. Mathieu, F., and Hinsenkamp, M., 2008. Kashin-Beck disease. *In:* Malaisse, F., and Mathieu, F. eds. *Big Bone Disease. A multidisciplinary approach of Kashin-Beck disease in Tibet Autonomous Region (P.R. China)*. Gembloux: Les presses agronomiques de gembloux, a.s.b.l., 11-18.
2. Li, S.*, et al.*, 2009. Soil selenium concentration and Kashin-Beck disease prevalence in Tibet, China. *Frontiers of Environmental Science & Engineering in China,* 3 (1), 62-68.
3. Chasseur, C.*, et al.*, 2008. The mineral defiiency hypothesis. *In:* Malaisse, F., and Mathieu, F. eds. *Big Bone Disease. A multidisciplinary approach of Kashin-Beck disease in Tibet Autonomous Region (P.R. China)*. Gembloux: Les presses agronomiques de gembloux, a.s.b.l., 101-103.
4. Malaisse, F.*, et al.*, 2008. Framework. *In:* Malaisse, F., and Mathieu, F. eds. *Big Bone Disease. A multidisciplinary approach of Kashin-Beck disease in Tibet Autonomous Region (P.R. China)*. Gembloux: Les presses agronomiques de gembloux, a.s.b.l., 19-36.
5. National Institute of Nutrition and Food Safety China CDC. 2009. *China Food Composition.* 2nd ed. Beijing: Peking University Medical Press.
6. Intakes, S. C. S. E. D. R.*, et al.*, 2005. *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids (Macronutrients).* National Academies Press.
7. NAS. IOM. Food and Nutrition Board. Dietary Reference Intakes: Elements. Available from: http://www.nal.usda.gov/fnic/DRI/DRI_Tables/DRI_Elements.pdf [Accessed: 31/07/2015].
8. Dermience, M., Lognay, G., Mathieu, F., Goyens, P., 2015. Effects of thirty elements on bone metabolism. J. Trace Elem. Med. Biol. 32, 86–106. doi:10.1016/j.jtemb.2015.06.005
9. Dermience, M.*, et al.*, 2013. The relevance of food composition data for nutrition surveys in rural Tibet: pilot study in the context of Kashin-Beck Disease. *Biotechnologie, Agronomie, Société et Environnement,* 17 (1), 32-42.
10. Dermience, M.*, et al.*, 2014. Minerals and trace elements in traditional foods of rural areas of Lhasa Prefecture, Tibet Autonomous Region (P.R. China). *Journal of Food Composition and Analysis,* 35 (2), 67-74.