

Original Article

Food and nutrient intakes among nomads living in three different areas of Inner Mongolia, China

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The subjects, from Mongolian-style gel tribes, aged 6-79 years, living in three different areas of Inner Mongolia, were asked about their daily food consumption in August 2001 using the 24-hr dietary recall method. There were no significant differences in food intakes between males and females of the same age group in the same area, with a few exceptions, although considerable variation was found among individuals and areas for the amount of foods consumed. Some subjects consumed greater amounts of wheat, vegetables, fruits, and vegetable oils, which suggested they had changed their eating patterns. All subjects drank large quantities of tea, to which was added milk (sheep/goat), cream, butter, parched millet and/or sawa. This traditional tea supplied vitamins and minerals such as vitamin A, iron and calcium.

Key Words: nomads, gels, food consumption, tea, milk (sheep/goat), nutrient intake, traditional food habits, children, adults, elderly, Inner Mongolia, China

Introduction

Inner Mongolia, China is located at the southern part of the Mongolia plateau and is the third largest among the administrative regions of China. Mongolians are Tibetan Buddhism followers and live as nomads at over 1000m above sea level. The Mongolian population of China is 5 810 000, with 73% residing in this region.¹ Recently, many Chinese people have moved into this region to work in agriculture and the proportion of Chinese and Mongolians is 79% and 15%, respectively, in this region.¹ The Ewenki tribe, one of the minority nomad tribes living in north Siberia, lives also in Mongolian-style gels.¹ They believe in the religion, Shamanism.

The lifestyle of the nomads, including eating patterns, has been influenced by Chinese migration. Nomads have settled down, changing their place of domicile from the plateau to the farm. Some have moved into the city. Mongolian lifestyles seem to be changing gradually. The traditional milk products of the nomads have been the subject of many reports,²⁻⁶ but there is little information on the food intake and nutritional status of these nomads. Traditional Mongolian diets have a high proportion of animal foods relative to plant foods, consisting primarily of meat (especially mutton), internal organs and blood of mutton, meat products and milk & milk products (sheep/goat). In this study, we surveyed the dietary intake of nomads living in Mongolian gels in three different areas

of Inner Mongolia during summer and examined the relationship between food and nutrient intakes.

Subjects and methods

The subjects, aged 6-79 years, were members of Mongolian-style gel tribes living in three different areas of Inner Mongolia, China. This study on daily food consumption was conducted on 98 Mongolians in Sonid Youqi (Saihan Tel; Gereltjod and Butmuj villages) and 90 Mongolians in Sonid Zuoqi (Mandalt; Bayintal village and its neighbourhood), in Xilingol Meng (district). A further 106 were studied in Ewenki in Hailar, Hulun Buir Meng (district; Haji, Yatege, Enhe, Huitun and Mengennuore villages). We visited almost all of the gels in a village. The subjects' age group information is summarized in Table 1. The dietary survey was carried out in August 2001 using the 24-hr dietary recall method. We visited each gel and interviewed the subjects about what they had consumed the previous day. Total gels visited were 31 in Sonid Youqi, 29 in Sonid Zuoqi and

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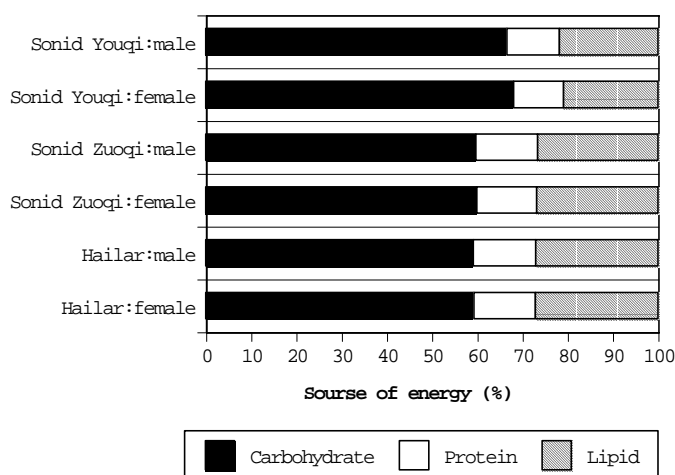
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Table 1. Age group of subjects examined

Age group (years)	Sonid Youqi			Sonid Zuoqi			Hailar		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
6-14	10	6	4	16	9	7	31	17	14
15-19	13	8	5	6	2	4	16	6	10
20-29	25	11	14	21	11	10	13	6	7
30-39	19	11	8	21	11	10	26	12	14
40-49	19	9	10	12	4	8	12	6	6
50-79	12	7	5	14	7	7	8	4	4
All	98	52	46	90	44	46	106	51	55

**Figure 1.** Contribution of macronutrients to total energy intake

35 in Hailar, respectively. These gels were located 2-3 km to 20-30 km distance from each other. These covered most of the two villages in each area. The data were analyzed and nutrient intakes were calculated from Japanese food tables. Foods listed in the table were substituted with similar items such as local vegetables (wild leek and green peppers). Each subject gave informed consent before participation. All results are expressed as mean \pm SD. Statistical analysis was performed using Stat View (SAS Institute Inc., NC, USA). Student's unpaired t test was used to assess the statistical significance of difference. Pearson's correlation coefficients were used to examine the relationship between variables.

Results

Description of the local region

Sonid Youqi (northern part of Ulanqab Meng) and Sonid Zuoqi (north-western part of Xilingol Meng), Xilingol district had little rain in summer 2001. In the Xilingol district, the absence of rain led to a lack of food for domestic animals (sheep and goats). People said that they would have to give up raising animals if there was no rain until autumn. There was no grass on the plateau, which became like a desert. Moreover, the Chinese have begun cultivating the plateau, changing it into agricultural land. At present, the plateau accounts for at most about one fourth of all the land³ and alarmingly the remaining land is becoming barren like a desert due to the promotion of agriculture and nomad settlements. The rainless summer exacerbated the situation. Some families had built houses beside gels and seemed to have settled there.

Some of the subjects cultivated vegetables and had sunk wells near gels. Thus their living styles certainly had changed. In Hailar, the Hulun Buir district, there was comparatively more grass and the people were able to pasture their animals. In the evening, milk collectors visited the gel to gather milk. Residents also mowed the grass for the animals for the coming winter.

Food consumption and nutrient intake

The average food consumption of the subjects aged 6-79 years is shown in Tables 2, 3 and 4. The mean number of food items was about 10. There was no significant difference between males and females of the same age group in the same area, with a few exceptions. However, considerable variation was found between individuals and areas for the amount and kinds of food consumed. All of the subjects in the three areas consumed more wheat than rice (Table 2). People in the Xilingol district consumed steamed buns, fried cakes and noodles made from wheat and cornflour, while the subjects in Hailar consumed a baked Russian bread, called leva. People in the Xilingol district consumed more of the other cereals than those in Hailar. There were age groups in the three areas in which potatoes and sugar/sweets were never consumed. The subjects in Sonid Zuoqi consumed more potatoes than rice. People in Sonid Youqi consumed fats/oils more than those in the other areas (Table 3). Among the three areas, the amount of fats/oils consumed was highest in Sonid Youqi, while the amount of fats consumed in Hailar was less than that in the other areas. The amount of oils consumed was almost the same for all areas. The major oils were soybean oil and sesame oil in the Xilingol district, and soybean oil in Hailar. The average amounts of coloured vegetables consumed in Sonid Youqi, Sonid Zuoqi and Hailar were about 17, 31 and less than 1g, respectively. All of the subjects mostly consumed other vegetables. The amounts of vegetables and fruits differed between age groups, but these foods were consumed more than other foods. The amount of meat intake varied with the area, age group and gender. The males of the 15-19 year group in Sonid Zuoqi consumed the least amount of meat (24 ± 8 g/day); other groups varied from 38 ± 35 g (40-49 age group females in Sonid Youqi) to 126 ± 95 g (males of 50-73 age group in Hailar). Egg consumption was very low in all three areas. Milk and milk product consumption (Table 4) was very low among the people in Sonid Youqi, but high for those in Sonid Zuoqi and Hailar.

Table 2. Average consumption of rice, wheat, other cereals, potatoes and sugar & sweets

Age group (years)	Rice (g)		Wheat (g)		Other cereals (g)		Potatoes (g)		Sugar & sweets (g)	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Sonid Youqi										
6-14	28±68	42±84	218±116	260±83	55±42	101±41	17±28	0	17±38	0
15-19	26±74	82±112	240±85	244±109	94±49	70±46	0	13±29	11±15	27±48
20-29	104±111	85±121	183±92	175±98	69±39	59±44	22±31	33±37	21±26	23±32
30-39	52±89	71±98	286±109	241±89	79±51	88±48	32±47	22±42	20±42	8±21
40-49	93±145	99±137	193±101	199±101	69±59	63±50	6±17	12±25	13±20	12±18
50-74	74±70	30±67	183±82	246±80	67±35	82±52	9±23	0	22±30	4±9
All	66±100	75±109	219±101	214±96	73±46	72±46	16±30	18±32	17±29	14±27
Sonid Zuoqi										
6-14	27±45	3±8	146±67	127±62	62±47	59±28	39±59	27±46	0	3±8
15-19	18±25	69±61	148±32	123±5	112±53	88±36	105±148	110±127	23±32	0
20-29	38±49	26±45	150±47	171±115	86±20	103±62	21±69	60±100	22±39	19±36
30-39	21±34	38±50	169±93	155±84	122±54*	81±23	47±83	13±41	8±27	10±28
40-49	100±68*	19±42	125±102	170±69	70±52	91±45	85±110	85±99	0	8±23
50-79	7±19	30±41	210±93	144±76	93±27	79±32	0	0	6±17	22±42
All	31±47	28±44	161±77	152±80	91±45	84±41	38±74	44±80	10±26	12±28
Hailar										
6-14	16±22**	39±20	181±49	162±63	11±26	7±19	10±20	18±32	8±32	19±47
15-19	23±27	28±31	248±98	230±88	18±45	2±7	0	21±35	22±53	13±41
20-29	63±81	38±76	284±108	272±57	4±11	7±12	37±57	16±42	0	0
30-39	52±44	46±42	200±81	204±78	13±46	21±47	43±53	39±54	3±12	16±51
40-49	37±33	28±32	213±34	236±92	18±45	6±16	11±27	11±27	22±53	53±85
50-73	53±61	54±62	223±87	168±83	36±52	36±52	25±50	49±56	48±95	48±95
All	36±44	39±41	213±78	207±81	14±36	12±30	21±39	25±42	12±40	21±53
t test: between areas	A- B, M, $P<0.05$ A- B, F, $P<0.01$ A-C, F, $P<0.05$		A- B, M&F, $P<0.01$ B- C, M, $P<0.01$ B-C, F, $P<0.001$		A- C, B-C, M&F, $P<0.001$		A-B, F, $P<0.05$			

* $P<0.05$, ** $P<0.01$ (vs. female, same area and same age group). A=Sonid Youqi, B=Sonid Zuoqi, C=Hailar, M=Male, F=Female

Table 3. Average consumption of fats and oils, vegetables, fruits, meats and egg

Age group (years)	Fats (g)		Oils (g)		Vegetables (g)		Fruits (g)		Meats (g)		Egg (g)	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Sonid Youqi												
6-14	13.5±12.8	13.8±13.8	1.3±3.3	5.0±10.0	88±97	103±31	242±427	540±492	64±28	75±23	9±15	9±18
15-19	14.0±10.0	5.4±3.3	5.3±9.9	6.0±8.9	130±102	67±94	556±317	340±471	70±34	49±38	0	0
20-29	11.6±9.7	8.9±9.6	11.0±12.5	12.7±20.1	184±152	130±114	290±395	343±363	60±55	56±33	6±13	12±18
30-39	9.8±9.5	12.8±10.7	6.4±8.2	3.5±6.8	78±71	104±76	418±473	399±493	73±26	76±20	13±24	4±12
40-49	13.3±13.0	8.8±8.8	3.2±6.5	7.3±9.9	142±98	143±151	356±424	477±421	52±32	38±25	2±7	6±12
50-74	12.0±10.5	12.8±10.6	9.3±10.0	8.2±7.8	192±176	88±94	317±400	184±374	66±53	59±22	5±13	10±22
All	12.2±10.4	10.0±9.5	6.4±9.3	8.0±13.2	136±122	115±107	367±403	381±411	64±39	57±30	6±15	7±15
Sonid Zuoqi												
6-14	7.1±7.6	4.0±4.7	2.8±4.4	2.9±3.8	108±72	66±79	21±45	106±183	136±69*	50±31	0	0
15-19	12.5±17.7	9.5±9.4	4.0±5.7	10.5±12.2	60±57	90±58	725±177	388±470	24±8	53±19	0	13±25
20-29	3.4±5.6	9.4±11.0	8.8±9.3	3.4±5.8	129±50	74±79	427±411	237±322	71±38	61±45	5±15	0
30-39	8.5±9.0	7.9±8.2	2.9±5.7	2.3±4.9	99±91	110±81	72±180	86±252	101±65	99±64	0	0
40-49	8.5±7.3	11.9±10.3	7.0±14.0	6.8±10.3	131±22	77±51	238±475	181±342	95±57	100±74	10±20	0
50-79	4.4±6.1	2.5±3.1	0.7±1.9	5.3±5.6	74±61	124±68	254±393	282±379	103±94	74±42	0	0
All	6.5±7.7	7.6±8.6	4.4±7.4	4.6±7.1	106±68	90±71	224±350	194±314	97±66	76±54	2±10	1±7
Hailar												
6-14	2.0±4.1	0.3±0.9	5.7±6.0	6.2±6.0	86±82	69±74	246±320	224±324	85±62	68±56	0	4±15
15-19	1.1±2.0	0.6±1.3	6.3±7.1	5.3±6.8	41±56	59±83	629±384	273±368	62±47	45±36	18±45	12±32
20-29	1.7±2.6	4.9±9.1	8.8±5.0	6.7±5.3	152±66	178±82	269±387	335±342	51±28	61±49	33±46	28±36
30-39	2.1±7.2	0	8.1±8.9	9.5±8.3	145±106	102±92	230±331	274±371	107±55	98±69	0	0
40-49	0.5±1.2	0.3±0.6	8.1±11.1	2.3±3.1	52±56	12±20	447±493	430±421	73±47	74±94	0	17±41
50-73	1.3±2.5	1.3±2.5	5.3±6.4	7.5±5.4	43±53	78±63	409±476	409±476	126±95	100±101	0	0
All	1.6±4.3	0.9±3.5	6.9±7.3	6.6±6.6	95±87	84±88	326±378	296±357	85±59	73±64	6±23	9±25
t test: between areas	A-B, M, $P<0.01$ A-C, B-C, M&F, $P<0.001$						A-B, F, $P<0.05$		A-B, M, $P<0.01$, F, $P<0.05$, A-C, M, $P<0.05$		A-B, F, $P<0.05$ B-C, F, $P<0.05$	

* $P<0.05$ (vs. female, same area and same age group). A=Sonid Youqi, B=Sonid Zuoqi, C=Hailar, M=Male, F=Female

Table 4. Average consumption of milk and milk products and beverages

Age group (years)	Milk and milk products (g) [#]		Tea (g)		Alcoholic beverages (g)	
	Male	Female	Male	Female	Male	Female
Sonid Youqi						
6-14	113±197	100±200	1300±245	1188±511	0	0
15-19	280±234	176±243	1663±409	1510±442	44±125	0
20-29	281±225	289±225	1527±413	1529±405	23±75	0
30-39	165±229	160±222	1564±505	1375±495	0	0
40-49	249±238	269±233	1628±472	1660±472	14±43	0
50-74	240±226	96±215	1629±454	1800±424	45±104	0
All	226±224	212±226	1561±427	1528±455	20±71	0
Sonid Zuoqi						
6-14	375±79*	228±125	1089±348	900±458	0	0
15-19	248±329	408±54	1500±424	1350±300	0	0
20-29	311±193	346±182	1418±303	1470±298	0	0
30-39	463±88	400±104	1736±673	1240±350	132±310*	0
40-49	428±64	366±149	1500±346	1650±424	83±99	0
50-79	386±176	299±201	1714±540	1457±680	9±25	0
All	382±151	341±153	1489±511	1352±470	42±163	0
Hailar						
6-14	275±78	324±123	824±270	857±285	0	0
15-19	385±96	343±99	1200±379	1020±290	0	0
20-29	373±86	377±80	1100±245	1114±227	0	0
30-39	397±40	409±46	1150±173	1200±235	11±38	0
40-49	418±33	413±22	1300±245	1200±0	0	0
50-73	363±111	313±131	1050±300	900±346	83±165	0
All	352±89	365±95	1051±306	1047±282	9±49	0
t test: between areas	A- B, A-C, M, $P<0.001$ A- B, F, $P<0.01$ A-C, F, $P<0.001$		A-C, B-C, M&F, $P<0.001$			

* $P<0.05$ (vs. female, same area and same age group). A = Sonid Youqi, B = Sonid Zuoqi, C = Hailar, M=Male, F=Female. [#] sheep and goats milk

Table 5. Average intake of energy, protein, fats and carbohydrates

Age group (years)	Energy (kcal)		Protein (g)		Fats (g)		Carbohydrate (g)	
	Male	Female	Male	Female	Male	Female	Male	Female
Sonid Youqi								
6-14	1380±416	1863±384	40.0±11.5	50.3±9.5	36.7±13.6	46.1±15.0	216.4±73.9	302.5±45.4
15-9	2013±705	1758±448	56.7±19.7	45.9±11.6	51.8±18.0	34.4±12.2	330.1±114.2	313.7±91.9
20-29	2126±399	1995±342	62.1±24.6	53.6±9.8	50.3±12.9	48.4±17.2	346.5±68.8	328.5±48.3
30-39	2048±451	1885±490	59.9±16.7	55.3±19.4	47.4±19.0	42.8±11.3	337.9±72.1	312.7±98.7
40-49	2020±532	2008±534	52.1±13.4	52.7±16.4	44.7±13.5	41.4±14.9	343.0±101.6	347.1±102.2
50-74	1979±388	1779±107	61.0±22.0	49.9±6.4	47.8±9.8	44.9±9.5	316.6±59.0	283.3±39.9
All	1968±516	1916±409	56.4±19.3	52.2±13.0	47.0±15.0	43.8±14.3	322.5±88.8	321.0±75.4
Sonid Zuoqi								
6-14	1499±314	1063±205	58.7±15.2	35.6±12.1	53.1±16.4	30.0±9.9	187.7±16.8	158.7±30.4
15-19	1878±299	1892±315	46.0±16.5	56.6±3.6	41.1±23.8	54.9±4.0	331.3±22.6	287.3±84.1
20-29	1770±298	1819±294	54.0±10.2	55.7±11.3	47.1±16.0	47.4±13.6	278.0±73.6	286.5±51.4
30-39	1848±328	1639±353	63.7±11.2	57.1±14.7	54.6±13.9	50.4±16.0	259.4±64.2	230.9±54.1
40-49	2055±481	1852±241	61.7±10.3	61.6±14.4	55.8±14.2	60.8±18.3	312.7±92.7	256.3±72.6
50-79	1782±229	1583±320	62.9±21.9	52.3±11.3	49.5±22.4	43.2±14.9	262.7±51.5	242.0±78.9
All	1767±330	1619±380	59.1±14.1*	52.9±13.8	51.1±16.3	47.5±16.4	258.0±70.2	238.7±72.2
Hailar								
6-14	1452±458	1384±455	52.9±16.0	46.9±15.6	47.7±15.6	44.1±17.4	220.2±96.0	197.9±83.2
15-19	1881±333	1639±377	59.2±8.5	45.8±10.5	45.8±10.5	44.2±12.0	307.9±65.3	252.8±93.2
20-29	1885±344	1864±327	62.9±6.8	61.5±9.4	54.0±9.3	53.6±13.0	283.2±82.5	288.1±69.6
30-39	1798±420	1823±600	64.7±14.8	64.0±20.4	59.8±13.0	59.6±19.0	245.5±92.3	254.5±104.6
40-49	1825±366	1910±654	62.2±8.3	63.6±20.8	52.6±13.3	52.1±22.7	272.5±95.7	294.5±115.0
50-73	2218±609	1923±806	72.2±21.1	63.0±25.2	60.2±23.9	55.9±26.4	326.4±90.6	290.5±128.7
All	1739±467	1700±539	60.2±14.5	57.5±17.4	52.6±14.8	51.0±18.2	258.4±92.9	251.0±98.3
t test between areas	A- B, A-C, M, $P<0.05$ A- B, F, $P<0.001$, A-C, F, $P<0.05$				A-C, F, $P<0.05$		A-B, A-C, M&F, $P<0.001$	

* $P<0.05$ (vs. female, same area and same age group). A=Sonid Youqi, B=Sonid Zuoqi, C=Hailar, M=Male, F=Female

Table 6. Average intake of saturated (SFA), monoenoic (MFA) and polyenoic (PUFA) fatty acids and cholesterol

Age group (years)	SFA (g)		MFA(g)		PUFA(g)		Cholesterol (mg)	
	Male	Female	Male	Female	Male	Female	Male	Female
Sonid Youqi								
6-14	14.31±6.19	15.87±8.61	12.24±5.56	14.71±6.09	3.69±2.43	6.31±5.62	119±48	118±70
15-19	19.74±7.68	12.01±6.63	15.45±4.64*	9.48±4.19	6.70±6.45	6.40±5.28	122±73	68±54
20-29	17.91±6.39	18.22±6.97	14.49±4.41	14.08±4.92	10.12±6.71	8.99±6.66	134±83	141±78
30-39	15.57±6.33	15.65±6.29	13.49±5.02	12.23±4.01	7.49±4.57	5.40±4.08	145±104	115±57
40-49	17.53±6.64	14.96±6.52	13.61±5.08	11.28±3.80	5.49±3.92	7.58±5.87	118±87	115±85
50-74	17.46±4.89	14.67±4.86	14.56±3.82	13.36±3.47	9.18±5.77	8.77±4.02	139±86	110±98
All	17.16±6.34	15.80±6.59	14.02±4.62	12.63±4.49	7.37±5.47	7.52±5.50	131±81	117±75
Sonid Zuoqi								
6-14	22.39±7.43**	12.30±4.89	15.53±6.15*	8.31±3.31	4.64±1.94	3.58±1.39	159±62**	74±38
15-19	15.81±13.45	20.26±2.49	11.19±9.38	15.42±2.03	5.26±2.88	9.19±6.83	68±54	152±106
20-29	16.93±6.30	19.17±6.25	12.58±6.09	13.37±5.22	7.92±5.44	5.75±3.76	120±76	103±36
30-39	22.77±5.47	21.32±6.25	15.17±5.84	14.48±6.27	5.17±2.48	4.38±2.52	143±50	135±51
40-49	22.67±5.38	24.43±10.15	16.64±6.03	17.81±7.42	6.36±6.03	7.19±5.36	175±86	143±76
50-79	21.04±11.22	16.66±7.12	13.07±7.24	11.40±5.31	4.41±1.56	6.06±4.08	141±97	106±45
All	20.60±7.55	19.14±7.47	14.21±6.16	13.46±6.00	5.74±3.74	5.67±4.10	140±71	117±59
Hailar								
6-14	18.60±5.78	16.91±6.39	13.61±5.07	13.00±6.04	7.81±4.07	7.88±4.77	200±50	115±64
15-19	17.68±3.53	17.20±4.61	12.13±2.28	12.57±3.76	8.09±4.50	7.45±4.64	177±166	157±118
20-29	18.76±3.93	20.09±7.44	14.94±2.08	14.68±3.18	12.47±6.57	10.82±6.27	303±214	221±136
30-39	23.19±5.57	22.53±7.26	17.49±5.24	16.88±6.58	10.36±6.30	11.04±5.71	143±53	134±60
40-49	20.67±2.91	21.96±9.18	14.09±3.39	14.53±6.87	8.64±6.88	6.02±2.83	138±35	212±141
50-73	22.70±11.58	20.25±12.66	16.75±7.32	15.43±7.80	9.22±2.21	9.69±1.58	147±90	220±185
All	20.16±5.81	19.59±7.40	14.81±4.80	14.47±5.76	9.20±5.28	8.91±5.04	158±112	159±108
t test between areas	A-B, M&F, $P<0.05$, A-C, M, $P<0.05$, F, $P<0.01$				B-C, M&F, $P<0.001$		A-C, A-B, F, $P<0.05$	

* $P<0.05$, ** $P<0.01$ (vs. female, same area and same age group). A=Sonid Youqi, B=Sonid Zuoqi, C=Hailar, M=Male, F=Female.

Table 7. Average intake of calcium, iron and dietary fibre

Age group (years)	Calcium (mg)		Iron (mg)		Total dietary fibre (g)		Insoluble dietary fibre (g)	
	Male	Female	Male	Female	Male	Female	Male	Female
Sonid Youqi								
6-14	265±236	248±208	4.9±1.3	6.6±1.0	9.5±3.1*	13.7±0.7	6.9±2.5*	10.3±0.1
15-19	473±272	344±284	7.2±1.9	5.2±1.0	14.8±3.5	11.8±2.9	10.9±2.9	8.6±2.4
20-29	504±228	500±288	8.3±4.6	6.8±1.8	14.3±4.3	14.4±5.1	10.5±3.4	10.4±3.9
30-39	346±254	318±249	7.4±1.9	6.7±2.3	14.3±2.8	13.2±3.5	10.3±2.2	9.8±3.5
40-49	435±282	454±250	6.3±1.4	6.5±1.8	13.8±3.9	13.5±5.2	10.2±3.4	9.8±4.1
50-74	482±223	274±270	8.9±4.9	6.8±0.9	14.2±4.6	13.1±2.0	10.5±3.6	9.5±1.5
All	423±252	395±268	7.3±3.2	6.5±1.7	13.7±3.9	13.5±4.0	10.0±3.1	9.8±3.1
Sonid Zuoqi								
6-14	552±111	352±176	7.0±2.2	4.3±1.0	10.0±2.2	9.8±5.1	7.3±1.8	6.8±3.4
15-19	399±361	607±66	6.6±1.3	7.4±1.3	14.1±2.5	12.5±3.2	10.1±2.2	9.0±2.2
20-29	513±211	538±193	6.9±1.2	6.9±1.7	12.8±2.7	15.6±9.0	9.4±2.0	11.0±5.8
30-39	603±221	585±126	7.5±2.1	6.6±2.3	15.3±8.5	11.0±2.8	11.2±5.3	8.3±1.8
40-49	604±69	599±196	7.8±1.5	7.2±1.0	11.6±3.2	11.7±2.5	8.6±2.3	8.5±1.8
50-79	625±266	532±276	7.0±1.4	6.2±1.4	11.7±1.6	11.8±3.6	8.7±1.1	8.7±2.8
All	565±201	532±192	7.1±1.7*	6.4±1.8	12.6±4.9	12.2±5.3	9.3±3.3	8.8±3.5
Hailar								
6-14	505±151	522±183	5.2±2.3	4.0±1.8	9.1±3.3	8.0±2.8	6.9±2.6	6.1±2.1
15-19	617±146	533±171	6.2±1.7	5.1±1.0	11.5±3.0	9.3±3.9	8.6±2.3	7.0±2.9
20-29	630±130	637±126	6.3±1.3	6.0±1.3	12.2±3.3	13.1±2.3	9.4±2.4	9.9±1.8
30-39	653±140	687±162	5.8±2.3	5.6±2.8	11.9±5.2	11.2±4.2	9.2±4.3	8.6±3.5
40-49	626±120	682±204	6.0±1.4	5.7±2.2	9.7±3.7	8.6±3.0	7.5±2.8	6.3±2.0
50-73	635±261	582±301	7.8±1.2	7.3±1.9	12.7±3.6	11.6±4.7	9.9±3.1	9.1±3.9
All	592±158	602±188	5.9±2.0	5.3±2.1	10.8±4.0	10.0±3.8	8.2±3.2	7.6±3.0
t test between areas	A-B, M&F, $P<0.01$ A-C, M&F, $P<0.001$		A-C, B-C, M&F, $P<0.01$		A-C, M&F, $P<0.001$ B-C, M&F, $P<0.05$		A-C, M, $P<0.01$ A-C, F, $P<0.001$	

* $P<0.05$ (vs. female, same area and same age group). A=Sonid Youqi, B=Sonid Zuoqi, C=Hailar, M=Male, F=Female.

Table 8. Average intake of vitamins

Age group (years)	Vitamin A (μg)		Vitamin E (mg)		Vitamin B1 (mg)		Vitamin B2 (mg)		Niacin (mg)		Vitamin C (mg)	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Sonid Youqi												
6-14	382±476	787±540	2.8±0.7	4.7±2.2	0.63±0.21	0.87±0.18	0.92±0.37	0.96±0.39	8.5±2.2	10.7±1.5	47±35	88±37
15-19	1040±756	525±552	6.4±5.9	4.1±2.1	0.94±0.38	0.78±0.24	1.39±0.49	1.05±0.40	12.0±4.4	10.0±2.3	96±40	56±68
20-29	759±770	859±864	7.6±4.5	7.2±5.7	1.02±0.25	1.03±0.23	1.39±0.39	1.37±0.43	14.6±6.5	12.1±3.1	96±58	92±65
30-39	653±595	603±590	5.3±1.7	4.3±1.9	1.01±0.29	0.86±0.31	1.22±0.38	1.09±0.46	12.4±3.9	12.1±4.1	72±72	75±59
40-49	655±632	976±784	4.5±1.7	6.4±5.1	0.95±0.27	0.94±0.28	1.26±0.46	1.32±0.43	11.2±3.0	11.6±3.8	80±44	93±57
50-74	893±851	406±516	8.0±5.3	5.7±1.9	1.04±0.25	0.93±0.27	1.46±0.40	1.11±0.41	15.3±6.8	10.8±1.9	95±52	55±67
All	736±685	748±707	5.9±4.0	5.8±4.2	0.95±0.29	0.93±0.26	1.29±0.43	1.21±0.43	12.5±5.0	11.5±3.2	82±54	81±59
Sonid Zuoqi												
6-14	444±502	467±535	4.9±3.2	3.8±4.0	0.67±0.11	0.50±0.11	1.38±0.30*	0.88±0.39	11.2±3.0*	7.7±3.2	57±42	48±28
15-19	1217±23	809±743	4.4±0.7	5.2±1.4	0.93±0.21	0.97±0.27	1.19±0.66	1.44±0.23	10.2±3.7	11.2±2.5	117±34	125±76
20-29	970±676	595±458	6.1±1.8	4.4±1.8	0.83±0.20	0.87±0.17	1.34±0.26	1.35±0.31	10.6±2.3	11.9±5.3	95±54	64±53
30-39	556±501	603±621	5.0±2.9	5.1±3.3	0.78±0.21	0.75±0.22	1.70±0.24*	1.40±0.25	14.3±6.8	10.5±3.1	57±41	48±39
40-49	664±694	495±452	4.4±1.0	4.4±1.2	0.99±0.25	0.82±0.19	1.58±0.27	1.49±0.33	12.4±1.7	11.8±2.7	88±88	76±57
50-79	749±652	840±614	5.0±1.7	5.6±2.0	0.79±0.18	0.71±0.18	1.57±0.53	1.32±0.32	11.4±3.4	10.0±3.3	51±48	63±44
All	707±596	615±542	5.2±2.3	4.7±2.5	0.80±0.20	0.75±0.22	1.49±0.36*	1.31±0.35	11.9±4.2	10.5±3.7	71±52	65±51
Hailar												
6-14	450±507	457±498	4.7±2.2	4.6±2.5	0.63±0.25	0.56±0.22	1.07±0.29	1.09±0.28	9.1±3.6	8.3±3.6	58±48	54±39
15-19	1022±635	513±578	5.6±1.9	4.6±2.2	0.79±0.15	0.65±0.25	1.44±0.33	1.25±0.34	9.4±2.5	8.9±2.0	82±49	53±46
20-29	651±639	680±586	6.9±2.9	6.2±2.7	0.99±0.33	1.01±0.25	1.50±0.36	1.44±0.31	9.8±1.7	9.8±2.1	62±45	80±46
30-39	470±480	575±535	6.2±3.1	6.8±3.4	0.76±0.27	0.76±0.29	1.42±0.14	1.44±0.26	12.2±3.8	11.5±4.4	73±54	74±49
40-49	825±712	797±657	5.3±2.5	4.5±1.9	0.70±0.16	0.70±0.28	1.48±0.21	1.52±0.24	10.6±2.2	9.8±3.2	74±54	61±46
50-73	722±668	749±641	5.2±1.3	5.4±0.8	0.93±0.22	0.87±0.29	1.35±0.47	1.34±0.48	11.8±3.3	10.2±4.3	74±67	78±62
All	611±576	584±546	5.5±2.5	5.4±2.7	0.75±0.27	0.72±0.29	1.32±0.32	1.32±0.33	10.3±3.3	9.7±3.5	68±50	65±45
t test between areas					A-B, M, $P<0.01$, A-C, M, $P<0.01$, A-B, A-C, F, $P<0.001$		A-B, B-C, M, $P<0.05$		A-C, M&F, $P<0.05$ B-C, M, $P<0.05$			

* $P<0.05$ (vs. female, same area and same age group). A=Sonid Youqi, B=Sonid Zuoqi, C=Hailar, M=Male, F=Female.

Table 9. Correlation among types of food consumed (all three areas combined)

	Rice	Wheat	Other cereals	Potatoes	Fats/Oils	Vegetables	Fruits	Meats	Milk & milk products	Egg	Tea
Rice	1.000										
Wheat	-0.398***	1.000									
Other cereals	-0.080	-0.108	1.000								
Potatoes	0.120*	-0.253***	0.119*	1.000							
Fats & oils	0.206***	0.001	0.333***	0.170**	1.000						
Vegetables	0.290***	-0.186**	0.079	-0.157**	0.399***	1.000					
Fruits	0.011	-0.015	0.090	-0.025	-0.101	0.036	1.000				
Meats	-0.096	0.121*	0.050	-0.031	-0.090	-0.057	-0.109	1.000			
Milk & milk products	-0.075	-0.055	-0.076	0.187**	-0.131*	-0.066	-0.045	0.141*	1.000		
Egg	0.069	0.272***	-0.168**	-0.078	-0.069	-0.058	0.162**	-0.201***	-0.038	1.000	
Tea	0.190***	-0.098	0.521***	-0.012	0.293***	0.199***	0.093	-0.048	0.021	-0.058	1.000

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.**Table 10.** Correlation among food consumption and nutrient intake (all three areas combined)

	Rice	Wheat	Other cereals	Potatoes	Fats & oils	Vegetables	Fruits	Meats	Milk & milk products	Egg
Energy	0.364***	0.199***	0.298***	0.078	0.363***	0.191***	0.343***	0.318***	0.174**	0.077
Carbohydrate	0.443***	0.133*	0.293***	0.018	0.294***	0.212***	0.519***	0.011	-0.045	0.132*
Protein	0.034	0.278***	0.122*	0.070	0.043	-0.021	0.063	0.678***	0.426***	-
Fat	-0.026	0.152**	0.101	0.142*	0.356***	0.090	-0.113	0.610***	0.449***	-0.063
Ca	-0.061	0.002	-0.104	0.101	-0.137*	0.022	0.046	0.302***	0.887***	-0.041
Fe	0.048	0.117*	0.441***	0.083	0.275***	0.115*	0.220***	0.488***	0.010	-0.033
Vitamin A	0.083	-0.107	0.158**	-0.061	-0.073	0.209***	0.854***	-0.048	0.190***	0.106
Vitamin E	0.190**	-0.049	0.036	-0.149	0.287***	0.439***	0.209***	-0.006	0.170**	0.054
Vitamin B1	0.209***	0.184**	0.166**	0.090	0.288***	0.230***	0.459***	0.065	0.087	0.115*
Vitamin B2	0.055	0.006	0.161**	0.128*	0.008	0.097	0.190***	0.352***	0.782***	0.079
Niacin	0.291***	-0.064	0.385***	0.226***	0.243***	0.157**	0.082	0.402***	0.109	-0.119*
Vitamin C	0.188**	-0.174**	0.151**	0.249***	0.188**	0.414***	0.759***	0.013	0.109	0.048
Dietary fibre	0.087	0.005	0.578***	0.147*	0.327***	0.373***	0.327***	-0.002	-0.026	-0.038
SFA	-0.118*	0.114	0.072	0.152**	0.147*	-0.011	-0.148*	0.641***	0.609***	-0.121*
MFA	-0.027	0.156**	0.071	0.161**	0.393***	0.074	-0.211***	0.589***	0.284***	-0.054
PUFA	0.190***	0.053	-0.145*	0.024	0.430***	0.265***	0.021	-0.035	0.050	0.087
Cholesterol	-0.004	0.275***	-0.191***	0.022	-0.102	-0.104	0.044	0.327***	0.293***	0.669***

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

People in Hailar consumed less tea than those in the other areas. None of the females in the three areas consumed alcoholic beverages, while many males over 30 years of age consumed moderate amounts. The major alcoholic beverage was beer.

The nutrient composition of the diets is shown in Tables 5, 6, 7 and 8. Energy, protein and fat intakes varied: energy 1063 ± 205 kcal (females of the 6-14 age group in Sonid Zuoqi) to 2213 ± 609 kcal (males of the 50-73 age group in Hailar); protein $35.6 \pm 12.1 \sim 72.2 \pm 21.1$ g; fat $30.0 \pm 9.9 \sim 60.2 \pm 23.9$ g (Table 5). The amounts of saturated (SFA), monounsaturated (MFA) and polyunsaturated (PUFA) fatty acids varied among individuals - some of this variation was attributed to the varied amounts of meat (mostly whole mutton). The contributions of carbohydrate, protein and fat to total energy intake are shown in Figure 1. There were no gender differences in the same area, but the proportion of energy intake from carbohydrate in Sonid Youqi was higher, and those from protein and fat lower than in other areas. The average intake of calcium for men and women in Sonid Youqi was significantly lower than the other two areas (Table 7). Iron intake was low, especially in the growing generation and particularly lower for the subjects in Hailar than in the other areas. Total dietary fibre intake, mostly the insoluble form, was highest in Sonid Youqi (14g/day) and about 10-11g in Hailar.

All of the subjects consumed cereals, vegetables, meats, milk and milk products and fruits (Tables 2, 3 and 4). The major fruit consumed was watermelon - this was probably influenced by the time of year the survey was carried out (summer). The subjects drank mainly milk tea ("dan-cha") which was boiled and mixed with milk. Milk tea for the entire day was made in the morning and kept in thermos bottles. The average intake of vitamin A (retinol + β carotene) was more than $600\mu\text{g}$ per day, except in a few age groups. Vitamin E intake varied among areas, age groups and genders. Intake of these vitamins did not differ between subjects, except for males aged 6-14 years in Sonid Youqi. The average intake of the vitamin B group was highest in Sonid Youqi because of the amount of cereals consumed. The average intakes of vitamin C in Sonid Youqi, Sonid Zuoqi and Hailar were 81 ± 59 , 65 ± 51 and 65 ± 45 mg, respectively.

Relationship between food consumption and nutrient intake

Table 9 shows the correlation among major food items. Rice correlated positively with potatoes, fats/oils, and vegetables and negatively with wheat. Wheat correlated positively with egg and meats and negatively with potatoes and vegetables. These findings indicated the major food item to be wheat or rice with potatoes. Vegetables are eaten with fats/oils. Other cereals showed a correlation with vegetables and fats/oils. Meats correlated positively with milk and milk products and negatively with egg.

Table 10 shows the relationship between the food and nutrient intake of the subjects. Energy correlated with cereals, fats/oils, vegetables, fruits, meats and milk and milk products. Calcium correlated positively with meats and milk and milk products, with the latter especially

contributing to calcium intake. Iron correlated positively with other cereals, fats/oils, fruits and meats. Vitamin A correlated strongly with vegetables and fruits. Vitamin E correlated with plant-origin food, while SFA and MFA correlated with fats/oils, meats and milk and milk products. Vitamin B1 correlated with plant-origin food, vitamin B2 with fruits, meats and milk and milk products, and niacin with plant-origin food and meats.

Discussion

The basic diet of the Mongolian nomad is known to be meat (mutton) in winter and milk and milk products in summer with a lack of vegetables. The average meat, milk and milk product and fruit consumption of those aged 30 plus in this study was higher and that of vegetables was lower than 35-64 year old Chinese in the study by Wang et al.,⁷ (meat: 25 ± 21 g, milk & milk products: 0.32 ± 2.41 g, fruit: 18 ± 59 g and vegetables: 317 ± 246 g). The subjects in this study generally consumed greater amounts of wheat, vegetables, fruits and vegetable oils. These findings suggest that eating patterns have been changing to include more plant food. They also drank large amounts of tea to which was added milk, cream, butter, parched millet and/or sawa millet (milk tea, suutei tsai). This traditional tea supplied vitamins and minerals such as vitamin A, iron and calcium. Compared to Nepalese living in a southern agricultural region,⁸ the subjects in this study consumed less rice and coloured vegetables and more wheat, potatoes, meats and milk/milk products. The amounts of food consumed differed significantly from one area to another (rice, wheat, other cereals, fats, milk/milk products and tea) and these differences were also reflected in their nutrient intakes. This suggested that food availability greatly influenced their eating habits. They did not drink fermented horse milk mentioned elsewhere.^{2-4,6} Some food items such as mushroom, seaweeds and fish were not consumed because they were not available in the vicinity of the village.

The average energy intake for the 15-19 year old age group in this study was similar or greater than ethnic Korean high school students living in dormitories in Yanbian Korean Self-governing Province, Jilin (mean intake of 1700 kcal for both sexes). In contrast, protein and fat intakes were lower in the study subjects compared with Korean students (56.3g, 57.7g respectively for both sexes).⁹ On the other hand, those in the over 50 year age group in this study showed greater nutrient intakes than an elderly group (mean age 73 years) in a welfare institution⁹ (energy: 1751 and 1083kcal; protein: 47.5 and 30.6g; fat: 44.8 and 22.5g for males and females, respectively).

According to FAO reports, Chinese adults have an average energy intake of 3029kcal per day (men and women); intakes of protein and fat are 85.5g and 84.0g per day, respectively.¹⁰ The average energy intake for the head of a household among Mongolian nomads in Mongolia was around 2200 kcal.¹¹ In this study, the average intakes of energy and nutrients, except for vitamin A and calcium (for females), were generally lower than intakes of the Chinese population reported in 1992¹² (energy 2328 kcal, protein 68g, fat 58.3g, carbohydrate 378.4g, calcium 405 mg, iron 23.4 mg and vitamin A 476 μg)

and reported by FAO.¹⁰

The contribution of macronutrients to total energy intake in Sonid Youqi was similar to the wider Chinese population (carbohydrate 65.5%; protein 11.2%; fat 22.7%). The average calcium intake of the subjects in Hailar was about 600mg, equivalent to the recommended calcium intake for the Japanese (600~800 mg for both sexes).¹³ Vitamin A intake seemed to be sufficient for people over 15 years with a few exceptions, partly due to the consumption of watermelon and milk/milk products. Watermelon consumption added fluid in summer and was a good source of β -carotene (830 μ g/100g of edible portion in Japanese food tables). However, it was insufficient for the 6-14 year old age group in which many important nutrients for growth are essential. Therefore, a nutritional support system for the young generation is needed. Although nomads are thought to consume much meat and animal-origin fat, the average meat intake in this study corresponded to only one of three meals per day. The reason for such a low meat intake may be due to the season studied (in summer). To evaluate seasonal intake, the study also needs to be conducted in winter or another dietary survey method could be used, such as the food frequency questionnaire assessing intake over the last 12 months.

Recently, the income of the people has increased with economic development, and extended economic exchange has gradually led to uniform living styles and the reduction of traditional eating habits. The number of food items consumed was about 10 in this study. However, the number is increasing due to the acceptance of Chinese food. The introduction of more plant-based Chinese foods to the traditional animal-based Mongolian diet has probably helped improve their food and nutrient intakes and subsequent risk of certain chronic diseases.

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