

Fig. 1 (a) Mean weights of boy low birthweight and (c) normal birthweight study infants. (b) Mean weights of girl low birthweight and (d) normal birthweight study infants.

and showed early faltering after that. LBW infants had WAZ scores below the NCHS standard at birth, but catch-up after birth. At 2 months of age, mean WAZ was twice that at birth (-1 SD compared to -2.16SD), became sustainable by 4 months, but fell rapidly from the sixth month, and declined to -2SD at 12 months. However, WAZ at 12 months was higher than at birth ($P=0.5$). In contrast, the variation in weight gain was slightly less marked in NBW infants than in LBW infants. It was 0.49SD at 4 months of age, and fell after that, and at 12 months of age mean WAZ was about 1SD lower than at birth (-0.98SD compared to -0.007SD; $P<0.001$). At 12 months of age, 50% of LBW infants were underweight. Overall, only about one-fourth of LBW infants never had a WAZ less than -2SD at any point during the first year of life. At some point between birth and 12 months of age, 95% of LBW infants had improved WAZ, 45% of LBW infants had

improved WAZ and 60% of underweight infants achieved catch-up growth.

LAZ is considered to be a good indicator of the nutritional status and health of infants and young children. During the

Table 4 Length gain of study infants

	LBW (n=20)	NBW (n=31)	P†
At 1 month (g)	3.8±1.7	4.6±1.6	0.11
At 12 month (g)	24.2±4.2	24.7±3.4	0.66
Relative to length birth at 1 month (%)	8.3±3.9	9.3±3.4	0.32
Relative to length birth at 12 months (%)	53.0±9.4	50.4±7.0	0.26

†Student's *t*-test.

LBW, low birthweight; NBW, normal birthweight.

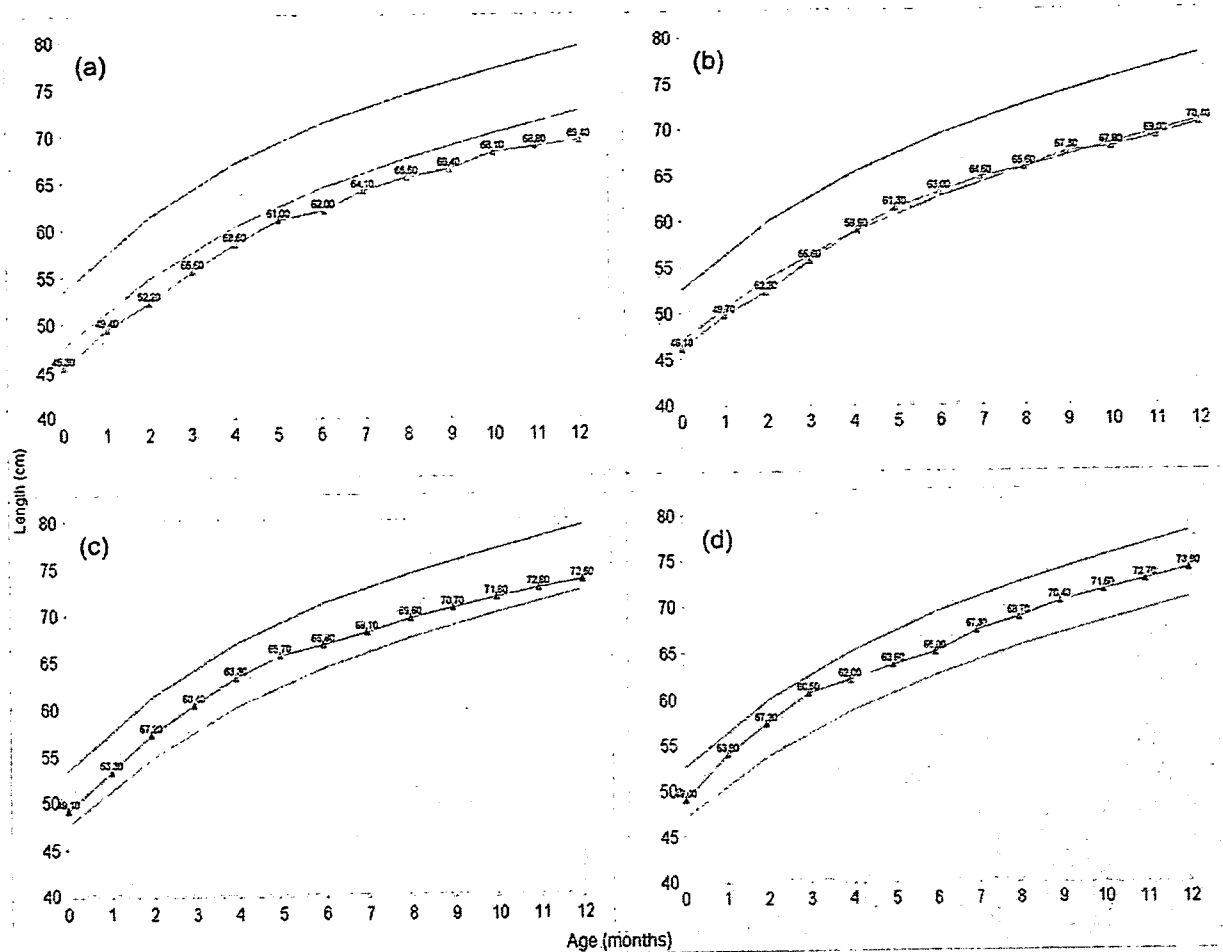


Fig. 2 (a) The growth curves of length-for-age of boy low birthweight and (c) normal birthweight infants compared to the National Center for Health Statistics standard. (b) The growth curves of length-for-age of girl low birthweight and (d) normal birthweight infants compared to the National Center for Health Statistics standard.

first year of age, LBW infants' LAZ improved: LBW infants' LAZ increased in the first month after birth and decreased in the second month and sharply increased again to 5 months of age. After that, LAZ decreased; at 12 months of age it was higher than at birth (-1.83 SD compared with -1.99 SD; $P=0.66$). NBW infants' LAZ increased after birth and decreased from 4 months of age. However, these increases were slower than in the LBW group, and LAZ at 12 months of age was lower than at birth ($P=0.36$). The trend distribution of LAZ scores during the first year are shown in Figure 4. Stunting indicates low growth and is the cumulative effect of low or inadequate intake of energy. At birth, stunting was observed in 40% of LBW infants. Among stunted LBW infants, catch-up growth sufficient to bring LAZ score above -2 SD was apparent in 62.5% at 12 months of age. Of LBW infants, 75% were stunted at least 1 month during the first year of life.

Discussion

Weight-for-age is commonly used as an indicator for malnutrition because weight is easier to measure than height. Weight-for-age reflects linear growth and weight accumulation achieved pre- and postnatal over the long term as well as weight accumulation in the short term. The results of this study demonstrate that in the first month and at 12 months of age, at term LBW infants gained weight and length more slowly than NBW infants. (These differences were insignificant.) However, a significantly higher weight growth rate was observed in LBW infants than in NBW infants by comparing the rates of weight gain at 12 months of age with respect to birthweight.

Low weight-for-age may reflect either normal variation in growth or a deficit in growth. The study sample showed that the WAZ and LAZ scores of LBW infants were below the

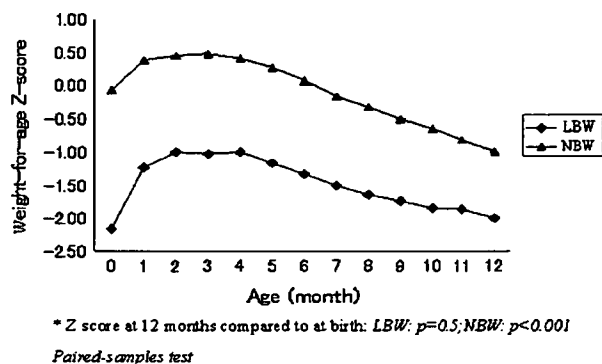


Fig. 3 The mean weight-for-age z-score during the first year for low birthweight and normal birthweight infant groups. LBW, low birthweight; NBW, normal birthweight.

NCHS median all year. The highest scores occurred after birth until 4 or 5 months of age, but fell after that and returned to the same level as at birth. These trends were the same in NBW infants but at a higher level. This finding contrasts with the findings of some studies in India, in which rapid growth of LBW infants was observed in the first 6 months of life.^{13,14} A study by Sridhar *et al.*¹⁵ showed good catch-up growth of LBW babies from 4 to 6 months of age. In several previous studies from developing countries, growth faltering was identified at 3 months of age compared with the NCHS references.^{16,17}

Our comparison of z-scores at 12 months of age and at birth revealed that z-scores (mean WAZ and LAZ) were increased during the first year in the LBW infants and decreased in the NBW infants. No significant differences were found in LAZ scores at birth and at 12 months of age in either group of study infants. At 12 months of age, NBW infants had very significantly decreased WAZ scores ($P<0.001$), but a slightly significant increase was found in the LBW infants. This finding is

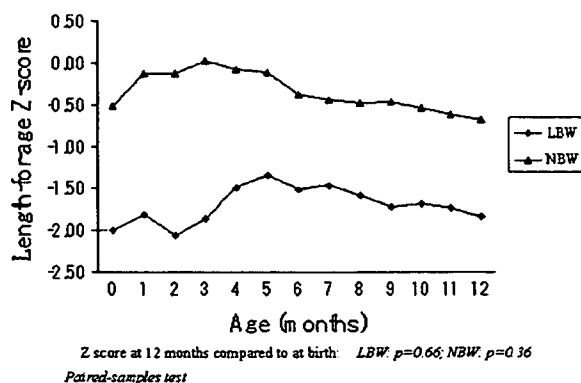


Fig. 4 The trend distribution of length-for-age z-score scores during the first year of life among study infants. LBW, low birthweight; NBW, normal birthweight.

consistent with a previous study by Brazil (1996) with full-term LBW infants, in which most LBW full-term infants improved their WAZ scores between birth and 12 months of age.¹⁸ Our length and weight growth curve finding in these LBW infants parallel to but remain below the growth curves considered normal for infants of the NCHS references. These findings were largely in line with results in a previous longitudinal study by Badson that LBW infants never attain the NCHS 50th percentile and drop below the 10th percentile from around 5 to 6 months.¹⁹ Another study by Wells *et al.* showed that growth of infants in the developing countries was poor compared to western standards and at 12 months of age mean weight was below the NCHS 50th percentile, even the 10th percentile.²⁰

For most infants in the developing world, the post-natal period that is most susceptible to poor linear growth begins from about 3 to 6 months and continues until about 24 to 36 months. After this time, it is thought that poor conditions have less of an effect on linear growth because growth velocity is much lower.²¹ In the study, both LBW and NBW infants showed poor growth in weight, length, and z-scores from about 5 to 6 months of age. The observed improvement in nutritional status in the first 4 months and reversal thereafter suggests that there was some potential for postnatal catch-up growth. This is perhaps because prior to this time, growth is likely to be affected only by nutritional factors.

In poor communities, exclusively breast-feeding is an important factor in infants' growth. A study by Lucas *et al.* showed that weight and length of small for gestational age infants during the first year were significantly greater in breast-fed infants than in infants fed a standard term infant formula.²² The long-term effect of breast-feeding on the nutritional status of children is also recognized in Vietnamese children with birthweight >2500 g.²³ In the present study, mean duration of exclusive breast-feeding was approximately 3 months after birth (Table 1). At 12 months of age all study infants were still breast-fed. The gradual introduction of supplementary food into the diet of study infants from around the fourth or fifth month postpartum could contribute to the explanation of poor growth after this age of the study infants. Some studies have shown that disease is only found to have a significant effect on growth in New Guinea population from the seventh month²⁴ or as soon as supplementary food is introduced.²⁵ Many previous studies have shown that inadequate energy intake is the most likely cause of infants' poor growth.²⁶ This supplementary food might provide insufficient energy density and micronutrient intake.^{27,28} The frequency, quantity, and type of supplementary feeding are strongly associated with stunting.²⁹ A study in Indonesia suggested that part of growth faltering, especially in the second half of the first year, was due to inadequate food intake.³⁰ The falling of growth beginning from about 4 to 6 months of age in the study highlights the need for increased attention to intervention and adequate supplemental feeding.

In conclusion, this study contributes to the understanding of the complex pattern growth of LBW at term infants in the first year of life. Differences with respect to NBW infants in weight and length gain by LBW at term infants in the first year of age were not statistically significant.

Weight and length growth by LBW at term infants is greater in the first 4 months of age and can still catch-up to normal at some point during the first year of life. At 1 year of age, the nutritional status (z-scores) of LBW infants tended to improve compared with their status at birth. However, these infants will not achieve the same weight or length curves at 12 months of age as the NCHS standard recommended for infants of the same gender and age.

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Feature Article

Situational analysis of maternal and child health services for foreign residents in Japan

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Abstract

Background: Since the 1980s, the number of foreign residents in Japan has continuously been on the rise. In order to improve the foreign resident support services infrastructure and effectiveness, a survey was conducted at a national level from February to August 2002. The survey was done via a mailed questionnaire to all municipalities in Japan.

Methods: For the purpose of the study, municipalities were divided into four groups based on level of urbanization and numbers of foreign residents in the area. The situation of the foreign maternal and child support programs were compared and the municipal administrations were evaluated. In addition, the attribution analysis and evaluation of the foreigner support program was conducted in each municipality group.

Results: The evaluation of the current service support program for foreigner was not judged positively in the majority (95%) of the municipalities. In the non-urbanized municipalities with a low composition of foreigners, the foreigner mother and child support program were not functional compared with other regions. Additionally, various factors were highlighted based on attribution analysis among each group. Although most of the municipalities recognized the importance of the foreign resident support program, the evaluations showed a wide gap between intention and reality.

Conclusion: It is recommended that the barriers as identified in the research results are rectified, and the current situation improved based on municipality characteristics, local demands and the needs of the population. The efficient use of limited fiscal and human resources is also advocated by strengthening of cooperation with other official bodies and also employing foreign residents to work in public offices for facilitating the foreign residents support programs.

Key words

foreign-residents in Japan, maternal and child health, multicultural Japan, municipal governments.

Since the 1980s the number of foreign residents in Japan has been increasing continuously. According to a survey conducted by the Ministry of Justice in 2003, the number of legally registered foreigners has reached 2 010 000.¹ Other reports suggest that, in order to maintain the working force in times of declining birthrate and a greying population, Japan will have to accept approximately 600 000 foreign immigrants each year for the next 50 years.²⁻⁴

In contrast, as earlier studies indicate, many foreign residents are put under cultural stress due to issues such as language,

racial discrimination, education, health care, and so forth, and these stresses keep them from conceiving, delivering, and raising children in Japan.⁵⁻¹³ In particular, the population statistics of foreign residents in Japan show that 74% are in the reproductive age group, which indicates that further resources should be directed towards maternal and child health care.¹

In terms of policies regarding maternal and child health care, and the welfare of foreign residents, the numbers of which are expected to increase with time, a comprehensive database and survey is required focusing on their diverse health needs.^{9,14}

The transfer of part of the maternal and child health services to municipal governments in 1997 enabled each local government to offer health services better suited to its local

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needs and demands. However, regional characteristics of each municipal government differ in attributes such as geographic and demographic conditions, which makes it difficult for the governments to respond to the diverse demands of local residents. Social support for foreign residents is not always sufficient because both the service providers and the recipients lack experience in this matter, not to mention the cost and staffing issues involved.

We conducted this research with the hypothesis that the attributes of support programs and their evaluation for foreign residents of each region differ based on the demographic characteristics of each municipal government.

The research was also intended to help each local governments build a better maternal and child health service system by: (i) describing the actual conditions of foreign resident support services in each local government after the transfer of maternal and child health services to municipalities; (ii) elucidating the differences in service needs, and the availability of maternal and child health services depending on the demographic characteristics of each local government; and (iii) presenting models suitable for each group (as defined later) by performing attribute analysis of foreign resident support programs and demographic characteristics for each local government.

Methods

Survey timeline and respondents

The survey was conducted between February and August of 2002 in the form of a mailed questionnaire that was sent to the 3295 maternal and child health departments of prefectures and municipal governments throughout Japan. A total of 1975 questionnaires were collected (59.8%) and, after discarding questionnaires with missing values, 1873 of them were used in the final analysis.

Contents of the questionnaire

The questionnaire focused on population and municipality characteristic, and the population size (inclusive of foreign registered persons). It also included the contents of consultation concerning foreigner residents, the components of foreigner resident support program, and the level of cooperation among official bodies to elucidate the service programs for the foreigner residents in municipalities.

It focused on the views and commitments of each municipality administration concerning the necessity of the foreigner resident support program and also its evaluation.

Statistical analysis

All statistical analyses were performed using SPSS version 11.0J for Windows (SPSS Japan, Tokyo, Japan). Based on the

result of the national census in 2000, a municipality with densely and semi-densely inhabited districts was defined as 'urban' type and all the others as 'non-urban' type.¹⁵ Also, a municipality in which the rate of formally registered foreigners is included in the top 25 percentile of the entire population was defined as a 'high' proportion group and all others as 'non-high' proportion group.

In order to perform analysis according to the population study characteristic of each municipality, each index of urban type, non-urban type, high-proportion group and non-high-proportion group was combined, and each municipality was classified into four groups: group UH (urban high-proportion group), group UN (urban non-high-proportion group), group NH (non-urban high-proportion group), and group NN (non-urban non-high-proportion group).

The contents of consultation with the foreign residents by the maternal child health section of each local authority and the existence of maternal child health service for the foreign residents in the municipality were compared using the χ^2 test between each municipality group for all variables. Moreover, more detailed relationships were clarified using multiplex comparison of Bonferroni correction.

For creating awareness about foreign resident support programs in each municipality, comparison was done between presence of each service and assistance with other public organizations using the χ^2 test, performed between local authority groups. Moreover, the difference in the level of responsibility that the administration feels was examined using the Kruskal–Wallis H -test between four municipality groups. For items that were found to be statistically significantly different, a more detailed analysis was performed using the Mann–Whitney U -test with Bonferroni correction.

Multiple logistic regression using stepwise variable increasing was performed to analyze attributes of the foreigner support organization evaluation in each of the four autonomy groups. The foreign resident program evaluation was divided into binomial categorical data and used as dependent variables. The independent variables were experience of the consultations for foreign residents, existence of a mother-and-child health service for foreign residents, the necessity for each mother-and-child health service as seen by the administrator, and cooperation with other public organizations.

Results

Contents of consultation about the foreign residents who sought services from maternal child health care in municipalities in Japan

It is an obligation for foreigners who stay in Japan for ≥ 90 days to register with local government. In addition, they are required to have national health insurance (in the case of stay

extending for ≥ 1 year), registration of newborn within 60 days, and foreign registration in their respective municipalities.^{16,17}

In this way municipalities also function as a window through which one can be introduced to other organizations. In contrast, however, it is also noted in this study that foreign residents do not necessarily have access to and understanding of the public organization structure that can provide support on various issues, maybe due to the language barrier.

In this study we have tried to explore each consultation that was brought to municipalities in the past 1 year.

The details of contents of consultation in each local authority group are shown in Table 1.

Significant difference ($P < 0.001$) was seen for almost all the items on χ^2 test. Those items were then additionally analyzed using multiplex comparison between each group.

In the results of χ^2 test with Bonferroni correction for each contents of consultation, significant difference was set at $P < 0.001$. Thus the differences between all municipality groups were elucidated.

Presence of maternal child health service for foreign residents in municipalities in Japan

After the change in policy and shifting of responsibility of the mother-and-child health services to the municipalities in 1997, each municipality has been trying to meet the local requirements of the residents according to the need and demand.

However, as far as the foreign resident support program is concerned, enforcement is difficult, and it is noted that maximum effect is not achievable due to problems in information dissemination and language barriers.¹⁸

During our nationwide survey, we found that maternal and child health services vary among municipalities, in order to meet the local needs and demands of the residents.

The characteristics of the maternal child health services for foreign residents are shown in Table 2.

The results show the following attributes to be important as far as health care for foreigners is concerned. It highlights that the statistically significant items are 'presence of personnel who can converse in a foreign language', 'presence of foreign language version maternity record book', 'presence of pamphlets and information magazines in various languages', and 'medical institution that has facility for foreign languages'.

It was noted that availability of foreign languages in various municipalities and hospitals was directly related to the number of native speakers of that particular language present in the area.

Deliberations among administration about foreign resident support program

In this investigation we found that almost 1006 municipalities (59.0%) tried to respond to problems of foreign residents related to maternal child health.

Table 1 Contents of consultation in each local authority group ($n = 1873$)

	Group UH $n = 251$		Group UN $n = 414$		Group NH $n = 217$		Group NN $n = 991$		<i>P</i>
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Medical service and medical institution that can provide services in foreign languages	175	69.7	144	34.8	85	39.2	191	11.4	***
Medical care and maternal child health service of Japan	230	91.6	275	66.4	145	66.8	404	40.8	***
Medical expenses	151	60.2	125	30.2	96	44.3	184	18.6	***
Subscription to health insurance	127	50.6	115	27.8	82	37.8	177	17.9	***
Problems in child's physical and mental health	208	82.9	220	53.1	133	61.3	332	33.5	***
Application for nursery	167	66.5	160	38.6	93	42.9	251	25.3	***
School entrance for children	137	54.6	137	33.1	83	38.2	200	20.2	***
Domestic problems	174	69.3	183	44.2	101	46.5	269	27.1	***
Problems of employment	141	56.2	132	31.9	88	40.6	210	21.2	***
Differences in culture and customs	171	68.1	177	42.8	104	47.9	249	25.1	***
Resident qualification	119	47.4	101	24.4	68	31.3	151	15.2	***
Others	249	99.2	414	100	216	99.5	991	100	

*** $P < 0.001$.

UH, urban municipality with high proportion of foreign residents; UN, urban municipality with low proportion of foreign residents; NH, non-urban municipality with high proportion of foreign residents; NN, non-urban municipality with low proportion of foreign residents.

Table 2 Presence of maternal and child health service in each local authority group ($n = 1873$)

	Group UH $n = 251$		Group UN $n = 414$		Group NH $n = 217$		Group NN $n = 991$		<i>P</i>
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Staff member who can converse in foreign languages	43	17.1	56	13.5	36	16.6	86	8.7	***
Mother and child health books (foreign language versions)	204	81.3	249	60.1	146	67.3	402	40.6	***
Information magazine in foreign language	91	36.3	73	17.6	58	26.7	112	11.3	***
IT-related services	6	2.4	4	1	0	0	4	0.4	
Medical institution in which foreign language facility is available	48	19.1	37	8.9	33	15.2	92	9.3	***
Support groups (e.g. childcare class)	9	3.6	21	5.1	10	4.6	53	5.3	

*** $P < 0.001$.

UH, urban municipality with high proportion of foreign residents; UN, urban municipality with low proportion of foreign residents; NH, non-urban municipality with high proportion of foreign residents; NN, non-urban municipality with low proportion of foreign residents.

In those municipalities in which the awareness of the current issue was not well perceived, they would have to bring in changes to help the foreigners understand and adopt the Japanese social insurance system because many of the foreigners may ultimately decide to reside permanently in Japan.

We also developed the hypothesis that the foreign resident mother and children services program is dependent on the population characteristics of the municipality.

The various factors necessary for the provision of foreign resident support services are shown in Table 3. On the whole we found that the majority of municipalities, that is, 1258 (67.2%), consider that distribution of 'foreign language version of maternal child health handbook' was very important, followed by 'necessity of medical institutions that provide foreign language services', which was considered necessary by 1190 municipalities (63.5%). Around 1164 municipalities (62.1%) considered that 'a multi-language pamphlet and information magazine was vital'. Also 948 municipalities (50.6%) highlighted the necessity of 'supporting groups, such

as childcare support and nutrition consultation', while 'availability of personnel who can respond in a foreign language' was considered important by 909 municipalities (48.5%).

Moreover, 717 municipalities (38.3%) thought that it was important that 'IT-related services be made available in multiple languages'.

Foreign resident support program evaluation by administrators in municipalities of Japan

The state of the foreign resident support program was difficult to evaluate based on a unified indicator, because the population characteristics and financial situation of each municipality was likely to differ.

Keeping these facts in mind, we tried to explore the situation in various steps. We involved and interviewed the administration officers who were in charge of the foreign resident programs, considering that they will have the most updated

Table 3 Awareness among administrators about a foreign resident support program ($n = 1873$)

	Group UH $n = 251$		Group UN $n = 414$		Group NH $n = 217$		Group NN $n = 991$		<i>P</i>
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Staff member who can converse in foreign languages	180	71.7	223	53.8	127	58.5	379	38.3	***
Mother and child health books (foreign language versions)	229	91.2	305	73.7	176	81.1	548	55.3	***
Information magazine in foreign languages	217	86.5	277	66.9	145	66.8	525	52.9	***
IT-related services	126	50.2	197	47.6	85	39.1	309	31.2	***
Medical institution in which foreign language facility is available	208	82.9	272	65.7	152	70	558	56.3	***
Support groups (e.g. childcare class)	157	62.5	229	55.3	110	50.7	452	45.6	***

*** $P < 0.001$.

UH, urban municipality with high proportion of foreign residents; UN, urban municipality with low proportion of foreign residents; NH, non-urban municipality with high proportion of foreign residents; NN, non-urban municipality with low proportion of foreign residents.

knowledge about problems and needs of the foreigners in their area.

The details of the problems faced and consultations sought by foreign residents are given in Table 1. There were many issues faced by foreigners and it was also acknowledged by the administration in various municipalities that there was certainly much scope for improvement.

Attribution analysis of the foreigner support organization in each municipality group

At present the demographic structure of Japan is undergoing rapid change.^{1,9} Given this, and the fact that there is regular influx and inclusion of foreigners in Japanese society, it is important not to make decisions (such as, for health care) based on unified national data because it will miss the minority foreigner groups. It is thus considered important that decisions, especially in health care, be based on the characteristics of each region, thus constructing a flexible service system that suits the local conditions.

The results of the multiple logistic regression analysis in each municipality group are shown in Tables 4–7. In group UH, the following factors for the foreign resident support program evaluation were considered important: ‘information about medical institution that can provide services in foreign language’ (odds ratio [OR], 5.31; 95% confidence interval [CI], 2.47–11.12), ‘cooperation with a hospital’ (OR, 8.05; 95%CI, 2.03–31.88), ‘cooperation with a health center’ (OR, 3.36; 95%CI, 1.86–13.14), and ‘use of information material, such as pamphlets, and magazines in foreign languages’ (OR, 5.12; 95%CI, 2.14–12.46).

In group NH, the important factors identified in the foreign resident support program evaluation were ‘existence of pamphlet, information magazine in foreign language’ (OR, 3.74; 95%CI, 1.78–7.83), ‘distribution of pamphlet, information magazines in foreign languages’ (OR, 3.14; 95%CI, 2.14–8.66), ‘cooperation with the prefecture concerned’ (OR, 13.70; 95%CI, 2.78–16.52), and ‘cooperation with a child consultation center’ (OR, 16.30; 95%CI, 3.01–29.76).

In group UN, the factors considered vital were ‘availability of professionals who can communicate in a foreign language’ (OR, 5.41; 95%CI, 2.10–13.98), ‘distribution of the maternity record book in foreign languages’ (OR, 1.85; 95%CI, 1.11–3.09), ‘presence of supporting groups, such as childcare support and nutrition consultation’ (OR, 7.96; 95%CI, 2.70–23.45), and ‘cooperation with a hospital’ (OR, 3.49, 95%CI, 1.33–9.18).

In group NN, the factors highlighted were ‘availability of professionals who can communicate in a foreign language’ (OR, 8.38; 95%CI, 3.22–21.8), ‘foreign-language version of mother and child health book’ (OR, 1.71; 95%CI, 1.18–2.49), ‘use of information material, such as pamphlets, and magazines in foreign languages’ (OR, 2.04; 95%CI, 1.29–3.21), and ‘presence of support groups, such as childcare support and nutrition consultation’ (OR, 2.64; 95%CI, 1.45–4.85).

Discussion

Concerning the experiences of the maternal and child health section in municipalities in Japan regarding issues highlighted in consultations, the hypothesis that there were differences in content of consultations sought by foreigners in different municipalities was supported in the study results and was also found to be statistically significant. Therefore, our hypothesis that population composition of each municipality (e.g. the proportion of foreigners and level of urbanization) does affect the kind of services sought from municipalities, was supported.

From the result, the necessity of properly disseminating the information specially related to maternal and child health services became evident. In addition it was also noted that there was gap in the knowledge of foreigners regarding the medical insurance system, even among those who can easily access the municipality offices.

Thus we conjecture that not only is there a need for better maternal and child services to foreigners, but also, due to lack of information, they were disadvantaged with regard to using the medical insurance services properly. We suggest developing a better system for proper information dissemination, for

Table 4 Multiple logistic regression analysis for the foreign resident support program evaluation in group UH

Variables	Categories	OR	95%CI	P
Information on medical institutions that can provide facility in foreign languages	Able to supply	5.31	2.14–12.46	***
Cooperation with a health center	With cooperation	3.36	1.86–13.14	*
Cooperation with a hospital	With cooperation	8.05	2.03–31.88	**
Information dissemination such as an information magazine, pamphlets etc. in multiple languages	Positive evaluation	5.12	2.14–12.46	***

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

CI, confidence interval; OR, odds ratio; UH, urban municipality with high proportion of foreign residents.

Table 5 Multiple logistic regression analysis for the foreign resident support program evaluation in group UN

Variables	Categories	OR	95%CI	P
Professionals who can converse in foreign languages	With arrangement: 1	5.41	2.10–13.98	***
Mother and child health book in multiple languages	With arrangement: 1	1.85	1.11–3.09	***
Cooperation with a hospital	With cooperation: 1	3.49	1.33–9.18	**
Support groups (e.g. childcare class)	Able to supply: 1	7.96	2.70–23.45	*

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

CI, confidence interval; OR, odds ratio; UN, urban municipality with low proportion of foreign residents.

Table 6 Multiple logistic regression analysis for the foreign resident support program evaluation in group NH

Variables	Categories	OR	95%CI	P
Cooperation with a child consultation center	With cooperation: 1	16.3	3.01–29.76	**
Presence of information magazines, a pamphlets etc. in multiple languages	With arrangement: 1	3.74	1.78–7.83	***
Information dissemination, such as information magazines, pamphlets, etc. in multiple languages	Positive evaluation: 1	3.12	2.14–8.66	*
Cooperation with the prefecture	With cooperation: 1	13.7	2.78–16.52	*

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

CI, confidence interval; NH, non-urban municipality with high proportion of foreign residents; OR, odds ratio.

Table 7 Multiple logistic regression analysis for the foreign resident support program evaluation in group NN

Variables	Categories	OR	95%CI	P
Mother and child health book in multiple languages	With arrangement: 1	1.71	1.18–2.49	***
Professionals who can converse in foreign languages	With arrangement: 1	8.38	3.22–21.8	*
Presence of information magazines, pamphlets etc. in multiple languages	With arrangement: 1	2.04	1.29–3.21	**
Support groups (e.g. childcare class)	Able to supply: 1	2.64	1.45–4.85	**

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

CI, confidence interval; NN, non-urban municipality with low proportion of foreign residents; OR, odds ratio.

example through the media and also by developing multi-language pamphlets.

After the provision of maternal and child health services was transferred to the respective municipalities in 1997, each municipality started adjusting services according to local demands and needs.

In some municipalities with a comparatively large number of foreign residents, the efforts to promote and support foreign resident health and welfare started early and some encouraging results were noticed. After the 'Hamamatsu declaration', in approximately 13 cities, visible efforts were made at the highest levels, to establish and promote better services for foreign residents.¹⁹

However, it was also reported that perhaps in some municipalities even minimum services for foreign residents might not exist due to issues of cost-effectiveness, lack of staff and the view that exceptional services to a few specific residents was not appropriate.^{9,11,18}

In the present study we explored the current state of enforcement of the foreign resident support programs in various municipalities across Japan, with the aim of disseminating and sharing this information among the various municipalities.

Significant differences were noted at the implementation level in all areas except in 'IT-related services' and 'presence of support groups, such as childcare consultation'. In all programs, which were also statistically significantly different, the implementation rates were high, from group UH, group NH, group UN, through to group NN.

In group NN, only half of the municipalities had done 'distribution of the maternal and children health handbook in foreign language'. There were reservations that foreign residents in this area might have difficulty in understanding the provided information about maternal and child health and the informed consent in hospital.

In this context we explored how the administration responsible for foreign resident support program responds, and the extent to which they were committed to implement the program. The main aim was to look at the foreign resident support program with regard to the future, with the perspective of not just understanding and recognizing the program differences in each municipality group, but also to recognize the implementation status of the program, based on local factors that might influence it.

In general, it became evident that the majority of administrators considered the provision of better services towards foreign residents in Japan, very important.

While comparing various groups, it was evident that group UH considered and rated the program a high priority. The result clearly showed that administration in most municipalities with a high proportion of foreign residents considered the program essential.

Another issue that was highlighted was the shortage of human resources and collaboration and cooperation with other organizations, such as 'support groups in consultation of the child care' and, 'information about the medical institution that can provide services in foreign language'. The necessity for networking among specialized agencies and non-government and non-profit organizations was also highly emphasized.

Regarding evaluation of the foreign resident support program by municipality administrations in Japan, only 4.1% of municipalities positively evaluated the present foreigner support program, and some improvements were considered necessary in most of the municipalities.

It was noted that there was a difference in importance assigned, and ideal ways to implement the foreign resident support program from an administration viewpoint, and its actual implementation status.

When comparing between municipality groups, the municipalities that did not negatively appraise the program were group UH (33.5%) and group NH (36%), where the foreign resident composition was high, compared to 26.8% in group UN and 31.9% in group NN.

It was noted that those municipalities that had high foreign resident composition, implemented the program and declared it a high priority, compared to those municipalities with low foreign resident composition, as shown in Table 3. It was considered that those municipalities in which the programs were actually implemented, also had wide-based support for the program.

Attribution analysis was conducted in which the dependent variable was foreign-resident-in-Japan in each municipality group. The factor that had the highest OR was 'cooperation and collaboration with other medical institution' in group UH. 'Information of the medical institution that provides services in foreign language' and 'cooperation with the public health center' were other significant factors. It became evident that cooperation and collaboration with other public organizations led to positive feedback of the foreign resident support

program, and this was more so where the foreign resident ratio was high.

Group UN had the highest OR for 'presence of childcare class'. Additionally, it became clear that 'presence of staff who can converse in foreign language', 'cooperation with other medical institution', and 'distribution of the maternal and child health handbook in foreign languages' were other significant factors, thus emphasizing the importance of the effective use of human resources and information in the municipalities.

In group NH, 'cooperation with other child guidance center' had the highest OR. Additionally, it became clear that 'cooperation with an administrative prefecture', 'presence of multi-language pamphlet', and 'distribution status of the pamphlet in foreign languages' were other significant factors.

In group NN, 'availability of staff who could converse in foreign language' had the highest OR. Additionally, it became clear that 'presence of childcare class', 'presence of pamphlet in foreign languages', and 'distribution of the maternal and children health handbook in foreign languages' were significant factors. It was evident that information sharing through media (pamphlets, papers etc.) in foreign languages and availability of people and consultation groups that provide services in foreign languages were considered very important. It was also noted in urban municipalities that foreign resident utilization of medical services was directly related to the ease with which the service could be utilized.

In non-urban regions, weight was given to 'presence of information magazines and pamphlets in foreign languages', and it seemed that the dissemination in the foreign language was considered important.

In the areas with a high proportion of foreigners, the utilization rate of information pamphlets was high. Thus it was noted that the dissemination of information by foreign language pamphlet was important.

In the municipal district towns and villages where foreigner resident proportion was low, 'presence of the supporting group' and the existence of services for mother and child and consultation of child care was considered a vital aspect.

Cooperation with a medical institution that can provide services in foreign languages, the presence of pamphlets in foreign languages and the presence of the supporting group were important factors from a foreign resident perspective, as was also highlighted in the focus group discussions. These factors are important for improvement of the support programs for foreign residents.

In conclusion, we found that the current systems of the foreigner support program are not working to full capacity and are far from reaching the objectives of providing quality and accessible services to foreign residents. We can also conclude that the main hindrance to foreigners living in Japan is the language barrier; consequently the majority are unaware of the range of services offered for maternal and child health. It is therefore important that municipalities provide information

through pamphlets and news magazine in various foreign languages, in order so that people not only understand the information but also are able to utilize these services. Although the majority of administration officers were concerned about foreign resident support services and emphasized their importance, the current infrastructure and service provision were contradictory to this. It is important to take the necessary measures to improve the current situation of service structure for foreign residents in Japan.

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Feature Article

Moderate–vigorous physical activity and body fatness in Chinese urban school children

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Abstract

Background: The exact relation between moderate–vigorous physical activity (MVPA) and body fatness in children has yet to be fully defined. This study examined the relationship between MVPA and body fatness in Chinese urban school children aged 9–11 years, in an 8 month longitudinal study.

Methods: Two hundred and ten children (aged 9–11 years; 97 boys and 113 girls) were recruited from two public primary schools in the Beijing urban area. The baseline and the 8 month follow-up percent body fat (fat%), fat mass (FM), body mass index (BMI), waist size, hip size and the waist : hip ratio were investigated as measures of body fatness. Habitual MVPA level (activity-related energy expenditure, AEE) was measured using a validated self-report questionnaire recall.

Results: Nine-year-old girls who were in the top quartile for MVPA had significantly lower fat% than other girls at the same age ($P < 0.05$); 10–11-years girls who were in the top quartile for MVPA had significantly less increase in all of the indices of body fatness ($P < 0.05$). There was no difference in fat% between the highly physically active (top quartile for MVPA) and less active 9–11 year boys in both cross-sectional and longitudinal statistical analyses.

Conclusions: Highly physically active girls had lower fat% and less increase in body fatness. In light of world trends showing increasing childhood obesity, this study supports the hypothesis that MVPA might be effective in fighting excess body fat gain in Chinese school-age girls.

Key words

body composition, body fatness, intensity, physical activity, school children.

The prevalence of childhood obesity is increasing rapidly worldwide and this poses a major public challenge.¹ Increasing sedentary behaviors and reduced physical activity (PA) in both adults and children have been considered as the essential risk factors in the increased rate of obesity.^{2–5} Although studies suggested that obese children are less active than their leaner peers and those with low levels of activity tend to gain more fat than peers, it has been difficult to demonstrate convincingly that PA plays a significant role in the development of excess body fat during childhood.^{6,7} The inconsistent findings are due, in part, to the different methodologies used to assess and define PA.⁸ Physical activity is a complicate behavior and different intensities of physical activity may have different health effects. Although definitive data are

lacking, moderate-intensity activity of approximately 45–60 min per day has been recommended for adults to prevent the transition to overweight or obesity.⁹ Studies conducted in children have also suggested a potential effect of moderate–vigorous physical activity (MVPA) in body fat fighting.^{10,11} The rapid increase in the prevalence of obesity in Chinese school children has been emphasized in several recent reports.^{12–14} The concurrent striking change in lifestyles means that children now have more sedentary lifestyles. The elucidation of the current level of MVPA and its effect on body fatness might contribute to the prevention and control of child obesity. To date, there has been little research in these fields in Asian children, who have different patterns of body composition compared to children of other ethnicities.¹⁵ The present study was designed to fill that gap: the aim therefore was to explore the relation between physical activity and body fatness in a group of primary school children, with emphasis on the effects of MVPA on changes in body fatness in school-age children.

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Methods

Study population

The children were recruited from two conveniently selected typical public primary schools in the central urban area of Beijing. Three classes were randomly selected from the fourth, fifth and sixth grade in each school. All of the children were invited to attend the study. The study protocol was explained to the parents and the children, and written informed consent was obtained from one parent or guardian. The children represented diverse socioeconomic environments. Children who had any illness at the time of anthropometric measures and who provided invalid questionnaire were excluded. Beijing University's Ethics Committee approved the study.

Study protocol

An 8 month follow-up study was carried out from October 2003 to June 2004. The baseline data on anthropometric and body composition in 220 sampled children were collected in October 2003. The repeated (terminal) measurement of anthropometric and body composition, and the data collection on MVPA were conducted in June 2004. A self-report questionnaire, Adolescent Physical Activity Recall Questionnaire (APARQ) was used to collect data on habitual MVPA during the follow-up period.¹⁶

Anthropometric and body composition measures

We used percent body fat (fat%), fat mass (FM), fat-free mass (FFM), body mass index (BMI), waist circumference (Waist), hip circumference (Hip) and the ratio of waist to hip size (WHR) as the indices of the children's body composition. All indices except FFM were used as the indices of body fatness. BMI was calculated as weight in kilograms divided by the square of height in meters ($BMI = \text{weight in kg} / [\text{height in meters}]^2$).

We used bioimpedance analysis to measure body weight, fat%, FM and FFM. They were measured by using portable digital scales with an internal calibrated four-terminal, single-frequency (800 μA at 50kHz) tetrapolar plethysmograph (TBF-026, Tanita, Tokyo, Japan). The measurements were made following recommended measuring conditions while the children were wearing light clothing and no shoes.¹⁷

Bodyweight was recorded to the nearest 0.1 kg. Standing height was measured in duplicate with a fixed vertical height measuring board (Research Institute of Sports Sciences, Beijing, China) and was recorded to the nearest 1.0 mm. Quality control was done by re-measuring every 10th child. Waist and hip size were measured in duplicate to the nearest 1.0 mm, using a flexible non-stretchable tape. Waist circumference was

measured at the umbilical level. Hip circumference was measured according to the largest horizontal circumference at the hip. WHR was calculated by dividing the waist size (cm) by the hip size (cm). Coefficients of variation for height, weight, waist, and hip measurements were obtained in two subjects aged 6 and 9 years who were measured 10 times; these coefficients were <1% for all of the indices.

Self-report measures of habitual moderate-vigorous physical activity

APARQ questionnaires were administered to the children at the end of the follow-up study during their physical education class. The APARQ is a validated questionnaire developed for use in Australian adolescents.¹⁶ This questionnaire seeks information on participation in MVPA during a typical school week in the past year. The information was sought on the frequencies per week and the duration per participation for a specific activity. The time spent on each activity (duration), multiplied by the frequency, was multiplied by the appropriate metabolic equivalent (MET), and the products were summed to obtain the final volume of physical activity (METs/week). Activities of duration <10 min and/or MET values <3.5 were excluded from calculations. Thus, the data referred only to MVPA. The MET values for the activities reported by the children were coded according to Appendix K (Estimated rates of energy expenditure) in the original questionnaire. Activities not available in the list were coded according to the review of Ainsworth *et al.*¹⁸ Before using the APARQ we conducted tests of reproducibility and validity in the present sample population.

In the present study, levels of PA were defined according to the energy expenditure in physical activity per kilogram body-weight per typical school day, or bodyweight-adjusted activity-related energy expenditure (Adj-AEE; kJ/kg per day) quartiles by sex; children belonging to the highest quartile were defined as highly physically active (high-PA), and others were defined as less physically active (low-PA).

Statistical analysis

The Kolmogorov-Smirnov test was used to assess normality of data distribution. A non-parametric test (Mann-Whitney *U*-test) was used to test for the gender differences in the parameters of physical activity (energy expenditure) and the differences in changes in the body composition indices between the high-PA and low-PA children. Two-way ANOVA was used to examine the sex and age differences in body composition. All computations, including descriptive statistics, were analyzed using SPSS for Windows (version 10.0; SPSS, Chicago, IL, USA), and the level of significance was set at $P < 0.05$.

Results

In total, 220 children completed baseline measurement and 217 children completed the second measurement. Three children did not complete the second measurement because they did not meet the measuring criteria (due to sickness or sports activity just before the second measurement). In addition, seven children gave invalid answers to the questionnaire (the reported AEE > 3 SD).

Ninety-seven boys and 113 girls finished the 8 month follow-up study and submitted valid questionnaires. The children were aged 9–11 years. The average age of both boys and girls studied was 10.1 ± 0.9 years. Using APARQ, AEE of MVPA was calculated. Tested using the Mann–Whitney test, the average energy expenditure on MVPA did not differ significantly between the two schools (529.2 kJ/day, $n=121$ vs 466.4 kJ/day, $n=89$, $P=0.36$). The average AEE was 664.9 ± 788.3 kJ/day in boys and 502.8 ± 661.1 kJ/day in girls ($P>0.05$). The Adj-AEE and the indices of body composition of the children studied are listed in Table 1 by sex.

Two-way ANOVA showed that boys and girls differed significantly in baseline fat% ($P<0.01$) and most of the other indices of body fatness ($P<0.05$). Post-hoc tests (Scheffe) in girls also showed that fat% in 9-year-old girls differed significantly to that in 10–11-year-old girls. Thus, the relation between MVPA

and body composition was explored in boys, 9-year-old girls and 10–11-year-old girls, separately.

We compared the baseline data and the changes in the indices of body composition across different PA levels (high-PA and low-PA) in each group. The median values and their intra-quartile confidence intervals of Adj-AEE in the highest quartile and in the low-PA quartiles in the three groups and the indices of body composition are given in Table 2. There were no differences in the indices of body composition at baseline measurement between the high-PA and low-PA groups in boys and 10–11 year-old girls ($P>0.05$), but high-PA 9-year-old girls had lower indices of body fatness than their low-PA counterparts ($P<0.05$).

Eight months later, the changes in the indices of body fatness did not differ significantly between physically active and less active boys and 9-year-old girls (Figs 1,2). But there were significantly lower increases in all of the indices of body fatness (fat%, FM, BMI, Waist, Hip, and WHR) in the highly physically active 10–11-year-old girls compared to their less physically active counterparts ($P<0.05$; Fig. 3).

Discussion

We report here consistent sex and age differences in the cross-sectional and longitudinal associations between MVPA and

Table 1 Adj-AEE and indices of body composition in children in an 8 month follow-up study

	n	Mean	SD	Percentiles (%)			
				5	25	75	95
Boys (9–11 years of age)							
Adj-AEE (kJ/kg per day)	97	16.3	19.7	0.0	4.2	22.6	50.7
Height (cm)	97	144.3	7.0	133.9	139.0	148.1	157.9
Weight (cm)	97	40.0	10.6	27.5	32.8	45.4	65.3
Fat% (%)	97	21.1	7.6	10.4	15.3	26.8	35.2
FM (kg)	97	9.0	5.4	3.5	5.1	11.4	21.0
FFM (kg)	97	30.9	6.4	22.8	26.7	33.9	45.0
BMI (kg/m ²)	97	19.0	3.7	14.5	16.0	21.2	26.4
Waist (cm)	97	67.4	10.6	54.4	59.2	73.7	90.8
Hip (cm)	97	77.4	8.2	66.4	71.8	82.9	95.4
WHR	97	0.9	0.1	0.8	0.8	0.9	1.0
Girls (9–11 years of age)							
Adj-AEE (kJ/kg per day)	113	13.4	16.7	0.0	1.7	18.8	55.3
Height (cm)	113	145.8	8.6	132.3	139.1	151.0	159.9
Weight (cm)	113	37.0	8.4	25.1	29.8	43.5	52.0
Fat% (%)	113	17.8	6.3	9.2	13.2	20.4	30.5
FM (kg)	113	7.0	4.0	2.5	4.1	8.9	14.2
FFM (kg)	113	30.0	5.1	22.7	25.6	34.2	38.3
BMI (kg/m ²)	113	17.3	2.7	13.7	15.2	18.9	22.1
Waist (cm)	113	62.1	7.3	52.1	56.4	66.3	75.2
Hip (cm)	113	75.8	7.2	65.4	70.0	81.1	89.0
WHR	113	0.8	0.0	0.7	0.8	0.9	0.9

Adj-AEE, bodyweight-adjusted activity-related energy expenditure; BMI, body mass index; fat%, percent body fat; FFM, fat-free mass; FM, fat mass; WHR, waist : hip ratio.

Table 2 Adj-AEE and baseline body composition indices

Groups		Adj-AEE (kJ/kg per day)	Fat%1 (%)	FM1 (kg)	FFM1 (kg)	BMI1 (kg/m ²)	Waist1 (cm)	Hip1 (cm)	WHR (cm/cm)
Boys (9–11 years of age)									
Low-PA	(n=74)								
Median		6.7	19.7	6.8	29.3	18.3	65.4	76.3	0.86
Percentiles (%)									
25		2.9	15.2	5.2	25.5	16.0	58.7	70.6	0.83
75		12.6	28.2	12.6	33.7	21.5	75.1	83.0	0.91
High-PA	(n=23)								
Median		38.9	17.7	6.4	31.1	17.7	64.6	74.5	0.86
Percentiles (%)									
25		33.9	15.2	4.7	27.7	16.4	61.1	72.6	0.84
75		47.7	23.1	10.1	35.7	19.4	71.0	81.4	0.91
Statistics									
U		0.0	704.5	760.0	668.5	775.5	849.5	847.5	805.0
P		0.00	0.21	0.44	0.12	0.52	0.99	0.98	0.70
9 year-old girls									
Low-PA	(n=26)								
Median		7.1	14.8	4.5	25.3	15.6	59.2	70.0	0.85
Percentiles (%)									
25		1.3	12.4	3.3	23.3	14.7	54.3	66.4	0.80
75		9.6	21.8	7.8	28.1	18.1	65.6	75.4	0.87
High-PA	(n=9)								
Median		37.7	9.8	2.5	24.1	13.9	52.4	66.4	0.80
Percentiles (%)									
25		25.5	9.1	2.2	22.4	13.4	51.3	65.2	0.78
75		54.4	15.0	4.5	25.6	16.0	57.6	69.6	0.83
Statistics									
U		0.0	50	54	79.5	58.5	48	64	71
P		0.00	0.01	0.02	0.16	0.03	0.01	0.05	0.09
10–11 year-old girls									
Low-PA	(n=59)								
Median		5.0	16.6	6.6	32.0	17.0	62.6	77.9	0.81
Percentiles (%)									
25		0.0	14.6	4.8	28.2	15.9	57.4	72.0	0.79
75		8.8	20.3	9.1	35.0	19.1	67.9	82.9	0.84
High-PA	(n=19)								
Median		25.5	19.6	7.8	33.3	18.0	64.8	80.7	0.82
Percentiles (%)									
25		22.2	16.4	6.1	29.5	16.8	60.5	73.6	0.79
75		50.7	25.8	12.2	35.3	21.2	69.2	85.1	0.86
Statistics									
U		0.0	428.0	444.5	509.0	415.5	445.0	470.0	496.0
P		0.00	0.12	0.18	0.55	0.09	0.18	0.29	0.45

Adj-AEE, bodyweight-adjusted activity-related energy expenditure calculated with the questionnaire; BMI1, baseline body mass index; fat%1, baseline percent body fat; FFM1, baseline fat-free mass; FM1, baseline fat mass; high-PA, highly physically active group; Hip1, baseline hip circumference; low-PA, less physically active group; waist1, baseline waist circumference; WHR1, baseline waist : hip ratio.

body fatness. Highly physically active 9-year-old girls had less body fatness than their less active counterparts at baseline, and highly physically active 10–11-year-old girls had significantly lower body fat gain during an 8 month period. The strength of the association was similar for all of the measures of body fatness in 10–11-year-old girls: the more active the girls, the lower the increase of the indices of fatness. The most active 10–11-year-old girls, those in the top quartile of physical activity, had statistically significantly lower increase of body fatness than girls in lower quartiles of PA. However, this favorable relation between MVPA and body fatness was significant only for girls but not for boys.

A sex difference in the relation of PA and body fatness was previously reported in young people of other ethnicities with

conflicting results.^{19–21} Ball *et al.* have reported the negative association of PA level (measured with doubly labeled water techniques, a method that measures the subject's carbon dioxide production over the interval) with fat% to be significant in 6–9-year-old boys and not girls.¹⁹ A significant negative association between activity, measured by movement counts, and fatness in girls and not boys has also been found previously.^{22,23} The significant sex differences in the relationship between physical activity and body fatness among different studies may due to the age of the subjects and the components of PA (i.e. sedentary behavior; time spent on different intensity PA; and the total amount of PA, counts in body movement and energy expenditure) measured. The details warrant further study. More age groups and a longer period of follow-up study

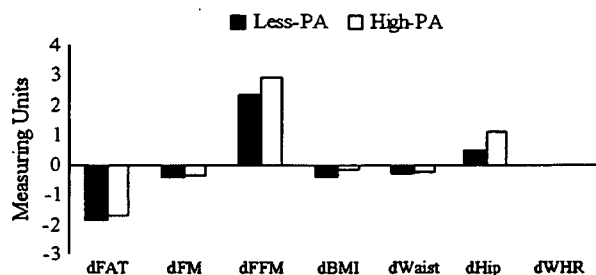


Fig.1 Changes in the indices of body composition in boys. dfat%, increase in percent body fat (%); dFM, increase in fat mass (kg); dFFM, increase in fat-free mass (kg); dBMI, increase in body mass index (kg/m³); dWaist, increase in waist circumference (cm); dHip, increase in hip circumference (cm); dWHR, increase in waist : hip ratio. There were no significant differences between the two groups (n=97, 23 in the high-PA group; P>0.05). PA, physical activity.

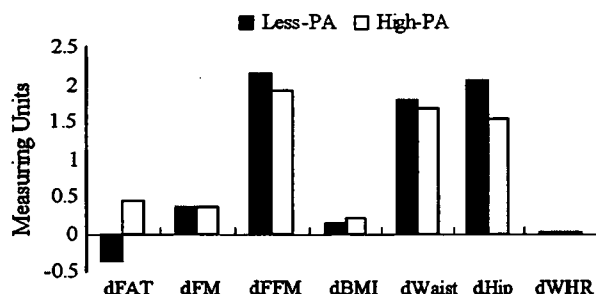


Fig.2 Changes in the indices of body composition in 9-year-old girls. dfat%, increase in percent body fat (%); dFM, increase in fat mass (kg); dFFM, increase in fat-free mass (kg); dBMI, increase in body mass index (kg/m²); dWaist, increase in waist circumference (cm); dHip, increase in hip circumference (cm); dWHR, increase in waist : hip ratio. There were no differences between the two groups (n=35, 10 in high-PA group; P>0.05). PA, physical activity.

may be helpful in detecting the long-term effects of MVPA on body composition in children.

The present findings show that MVPA measured by self-reported AEE at 25.5 kJ/kg per day was effective in lowering the body fat gains in 10–11-year-old Chinese girls. This contributed to the research on the thresholds of MVPA in fighting excess body fat gain in children of different ethnicities. Significant increasing amounts of moderate–vigorous intense and hard intense activity, measured as physical activity count or duration time, were associated with reduced percentage body fat in Western children.^{24,25} Indeed, these data are suggestive of a threshold of intensity of physical activity above which the activity interacts with body composition. The present study supported the potential effects of physical activity in the prevention of child obesity.

There are several limitations that should be considered when interpreting the findings from the present study. First,

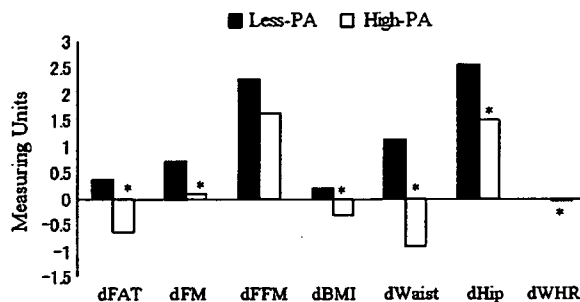


Fig.3 Changes in the indices of body composition in 10–11-year-old girls. dfat%, increase in percent body fat (%); dFM, increase in fat mass (kg); dFFM, increase in fat-free mass (kg); dBMI, increase in body mass index (kg/m²); dWaist, increase in waist circumference (cm); dHip, increase in hip circumference (cm); dWHR, increase in waist : hip ratio. Highly physically active children had less increase in body fatness than their less active counterparts (n=78, 19 in high-PA group; P<0.05). PA, physical activity.

even though we validated the questionnaire used in MVPA data collection, it is not possible to avoid the recall bias completely in MVPA data collection, which is an unavoidable component of self-report assessment of PA in children and adults. Furthermore, MET values used are from the data measured in adults; this may bias the quantities of the AEE of children. Second, we did not determine pubertal stage in the children, which, particularly if pubertal development differed between physical activity groups, could influence the observed relationships. In addition, because we are interested in the influence of the MVPA per se, we did not include the data on caloric intake. To elicit more information regarding other variables that may affect this relationship, physical activity must be measured accurately, and effect of diet on the activity–fatness relationship should be considered.

In summary, the present study used a relatively accurate method (bioimpedance analysis) to measure change in body fatness and a validated self-report questionnaire to measure the level of PA. The beneficial changes in body fatness caused by high level of MVPA are obvious. This provides new evidence for intensity and quantities for MVPA in fighting excess body fat gain in Chinese school children. Thus, successful strategies for the prevention of obesity need to include high levels of MVPA in order to curb childhood obesity.

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Feature Article

Risk factors for protein–energy malnutrition in children under 5 years: Study from Luangprabang province, Laos

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Abstract

Background: Laos is one of the poorest countries in which chronic malnutrition is highest. The aim of the present study was to determine the prevalence of and to identify risk factors associated with protein–energy malnutrition (PEM) in children under 5 years of age in Luangprabang province, Laos.

Methods: This cross-sectional study was undertaken from March to May 2004. Anthropometric measurements of 798 children were done and data were transformed into height-for-age, weight-for-age and weight-for-height ratios. Mothers were also interviewed with a semi-structured questionnaire. Anthropometric data were entered into Nutstat in Epi-Info 2000 and transferred to SPSS for analysis.

Results: There was a high prevalence of stunting, underweight and wasting, that is, 54.6%, 35%, and 6% respectively. It was also noted that children aged 12–23 months and Khmu ethnic children had a higher prevalence of stunting (65% and 66%) and underweight (45% and 40%), respectively. However, it was also found that boys were more prone to be stunted and underweight. Furthermore, restricted intake of meats, vegetables during illness, and low maternal education were main risk factors for child malnutrition in the study area.

Conclusion: Socioeconomic-demographic factors, low maternal education, poor nutrition knowledge for mother and feeding practices for sick children are affecting children's health regarding stunting and underweight. It is recommended that an improvement in societal infrastructure, better maternal education and nutrition are needed to address the child malnutrition issue.

Key words

child malnutrition, children under 5 years, Laos, nutrition status, risk factors.

Malnutrition is still prevalent worldwide, affecting all age groups and populations, especially the poor and vulnerable. In a developing country, malnutrition plays a major role in half of the 10.4 million annual child deaths; it also continues to be a cause and consequence of disease and disability in the children who survive.¹

Protein–energy malnutrition (PEM) affects every fourth child worldwide: 150 million are underweight while 182 million are stunted. Geographically, more than 70% of PEM is in Asia. The underlying causes of child malnutrition were insufficient access to food, inadequate maternal and child care practices, and poor access to health-care services; while immediate causes were inadequate dietary intake, severe and repeated infectious diseases.^{2–5}

Laos is one of the poorest countries in the western Pacific region, where the prevalence of communicable diseases is high, especially malaria, diarrheal diseases and respiratory infections, which exacerbate undernutrition and inhibit growth. It was also reported that the percentage of children under 5 years of age with a low height for age (stunting), low weight for age (underweight) and low weight for height (wasting) is high at 40.7%, 40%, and 15.4%, respectively.⁶ The specific objectives of the present study were to determine the prevalence of PEM and to identify risk factors for PEM in children under 5 years of age in Luangprabang province, Laos.

Methods

Study design and subjects

This cross-sectional study was undertaken in Luangprabang province, Laos from March to May 2004. Luangprabang is

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located in the center of the northern part of the country, with a population of 405 949.⁷ A total of 798 children under 5 years of age from 30 villages in three districts out of 11 were recruited using multi-stage random sampling. Children's weight were measured using a digital scale (Uniscale, Seca, UNICEF, USA) with an accuracy of 0.1 kg; length was measured using a Portable Rollametre by Raven, UNICEF; while height was measured using a Portable Stanley, UNICEF to the nearest 0.1 cm. Children were weighed bare-footed wearing minimal clothes. Each of the infants was weighed together with mothers first, and later mothers were then weighed separately. Their weights were recorded. For mothers, face-to-face interview was conducted using semi-structured questionnaire that focused on sociodemographic situation of household, maternal and child feeding practices and 24 h dietary recall for children, recorded for the previous day, at the time of the survey.

The ethics approval for research was obtained from the University of Tokyo and also the National Institute of Public Health, Ministry of Health, Laos. Informed consent was obtained from each parent.

Statistical analysis

Anthropometric data were entered using NutStat in Epi-Info 2000. Three indicators were used for assessment of nutrition status; they were height-for-age (HAZ), weight-for-age (WAZ) and weight-for-height (WHZ) z-scores (WHO, 1983).⁸⁻¹⁰ A cut-off of -2 SD was used to distinguish normal children from those stunted ($HAZ < -2SD$) or underweight ($WAZ < -2SD$) or wasted ($WHZ < -2SD$). The calculation of HAZ, WAZ, and WHZ was transferred to SPSS version 12.01 (SPSS, Chicago, IL, USA) for analysis; and the logistic regression model was mainly applied to analyze the association between categorical variables, in which $P < 0.05$ was taken as statistically significant.

Results

Sociodemographic characteristics

A total of 798 mother-child pairs were recruited. Children were classified into six groups: 0-5 months (13.0%), 6-11 months (9.0%), 12-23 months (26.1%), 24-35 months (19.2%), 36-47 months (17.9%) and 48-59 months (14.8%). Fifty-two percent were girls and 48.0% were boys. Almost half of the children belonged to the Lao ethnic group (50.3%), compared to those of Khmu and Hmong ethnicities, which were 43.2% and 6.5%, respectively. We found that 27.9% of mothers were illiterate, while 55.4% had completed primary school education (Table 1).

Table 1 Sociodemographic characteristics of respondents ($n = 798$)

	<i>n</i>	%
Age (months)		
0-5	104	13.0
6-11	72	9.0
12-23	208	26.1
24-35	153	19.2
36-47	143	17.9
48-59	118	14.8
Sex		
Boy	383	48.0
Girl	415	52.0
Ethnic minority		
Lao	401	50.3
Khmu	345	43.2
Hmong	52	6.5
Place of birth		
Health facility	107	13.4
Home	691	86.6
Maternal occupation		
House wife	23	2.9
Farmer	738	92.5
Officer	16	2.0
Trader	12	1.5
Other	9	1.1
Maternal education		
Up to high school	133	16.6
Up to primary school	442	55.4
Not attended school	223	27.9
No. family members		
1-3 people	195	24.4
≥4 people	603	75.6
Income per person/month (\$US)		
≥7.6	150	18.8
<7.6	648	81.2

1 \$US = 10 800 kip.

Prevalence of protein-energy malnutrition

The prevalence of stunting was found to be 54.8%; further, of these 26.3% and 28.5% had severe and moderate stunting, respectively. The prevalence of underweight and wasting were 35.0% and 6.0%, respectively. Severe underweight and severe wasting were 8.3% and 2.4%; and moderate underweight and moderate wasting were 26.7% and 3.6%, respectively (Fig. 1). The prevalence of malnutrition had an incremental trend. It increased in the 6-11 month age group and reached the highest level in the 12-23 months group, in which stunting, underweight and wasting were 65%, 45% and 10% respectively (Fig. 2). In addition, it was also found that the Khmu and Hmong ethnicities had a higher prevalence of stunting of 66% and 65%, and of underweight of 40% and 35%, respectively. It was also noted that the Hmong ethnicity had a comparatively high prevalence of wasting (8%), compared to the other ethnic groups (Fig. 3).