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Stunting reflects deficiencies in the socio-economic environment in diverse ethnic populations in Lao PDR

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ABSTRACT

Background: From 1990 to 2019, stunting declined considerably from over 253 million children globally to 144 million, but it remained most prevalent in South Asia and even increased in Sub-Saharan Africa. From countries of continental Southeast Asia, Lao PDR still stands out with a relatively high proportion of stunted children aged 60 months and below.

Objectives: This study aimed to assess the differences in stunting among diverse ethnicities in Lao PDR by using deficiencies in the length for age deficiencies in preschool children as a proxy indicator for their well-being.

Methods: A cross-sectional descriptive study design was used utilizing secondary data from a previous survey conducted in the Bolikhamxai Province, Lao PDR. Basic anthropometric measurements and information about the mothers' socio-economic status were applied. Categories of the variables were taken from the original study. Differences in variables between ethnic groups were assessed through the chi-square- or Fisher exact test.

Results: Separating the three ethnicities of Lao PDR showed that the rate of stunted children from Lao Sung, 43.9%, and Lao Teng, 39.3%, exceeded the proportion of stunting for Lao Lum, measuring 23%. Living in rural areas, mothers' lower educational background, economic status, and occupational activities contributed to higher stunting rates in the Lao Sung and Lao Teng groups.

Conclusion: Health authorities in areas with low resources can detect and monitor deficiencies in the welfare of children in disadvantaged ethnicities by simple, conventional means for planning further action in problem-solving.

Keywords: Education, Ethnicity, Lao PDR, Occupation, Stunting

1. Introduction

Pregnant women, those giving birth, breastfeeding mothers, newborns, and preschool children are the most vulnerable groups in society, heavily dependent on a functioning healthcare system. To address deficiencies in maternal and child health, the entire system must be examined to uncover underlying disparities. Worldwide, maternal mortality and child mortality rates have declined significantly and food security has been achieved in many low- and middle-income countries [1]. Severe forms of undernutrition, such as marasmus and kwashiorkor, have ceased to be a significant public health issues in many countries. However, insufficient weight and height development among children under five remains a persistent concern [2]. Wasting characterized by low weight for a given height, indicates an immediate nutritional problem. While some young wasted children may recover but still become stunted displaying low height or length relative to their age, wasting may not be the primary cause of stunting in developing countries [3]. Stunting is now widely considered the best overall indicator of children's well-being. [4]. From 1990 to 2019, the global stunting rate declined considerably from over 253 million children to 144 million, though it remains most prevalent in South Asia and has even increased in Sub-Saharan Africa. Among Southeast Asia countries, Lao PDR stands out with a relatively high proportion of stunted children under the age of five [5]. A recent study in a mountainous area near the Vietnam border reported that although the wasting rate was only 4.5 %, the stunting rate was nearly 40% [6].

Stunting in Lao PDR surpasses neighbouring countries such as Thailand (13.4%) and Vietnam (23.8%) [7]. Severe issues with food availability can be ruled out as indicated by the low rate of wasting across all groups. However, ethnicity plays a significant role in the persistence of stunting. Lao PDR' populations comprise a diverse range of ethnic groups unlike neighbouring Vietnam, Cambodia, and Thailand where one or a few ethnic groups dominate. In Lao PDR, the population is roughly divided into three main groups : 65% Lao Lum (lowland settlers), 27% Lao Teng (mountainside settlers), and 13% Lao Sung (highland settlers) [8]. This study aimed to assess the differences in stunting among diverse ethnicities in Lao PDR by using deficiencies in the length for age in preschool children as a proxy indicator for their well-being.

2. Methods

2.1 Study Area

The province in the middle of Lao PDR borders Thailand to the west and Vietnam to the east. Mountains and forests cover this area with a low population density. The province's population, particularly the Viengthong district, is highly populated with different ethnicities. The survey, conducted in the Viengthong district, is one of 7 districts of the province, and the district has a border with Vietnam to the east. The inhabitants of the district mainly belong to various sub-ethnicities of the Lao Teng and Lao Sung groups.

2.2 Study Design

This study is a cross-sectional descriptive design using secondary data from a previous survey conducted in the Bolikhamxai Province, Lao PDR [6].

2.3 Sample size and sampling

According to a census conducted in 2018, there are about 4048 children under five years old. While the original survey assessed the overall proportion of stunting in children under five, a conventional sample size calculation was based on the overall stunting prevalence reported by the Lao Statistic Bureau (2018), which was assumed to be 31%. According to the estimate, 310 mothers with children under five years were selected.

2.4 Data Collection

With a multi-stage random sampling, 3 out of 7 sub-districts were selected, and 2 locations were sampled from each sub-district. Within these 6 locations, study participants were chosen by systematic random sampling. Only mothers with healthy children aged under 60 months were included to answer the questionnaire. Routine weight and height measurements according to age were taken, and stunting was calculated as – 2.00 SD and below based on the WHO standard integrated into the Anthro V3.2.2 software [9]. Mothers identified themselves as belonging to the ethnicity Lao Lum, Lao Sung, or Lao Teng. The locations were classified as urban or rural according to the official classification of the provincial administration. A rural area is difficult to access and dominated by crop cultivation and livestock raising, collectively referred to here as farming, while an urban location resembles small marketplace.

2.5 Data Analysis

A questionnaire developed using standard social science method was used to collect data on education, occupation and income along with the sex and age of the children, the

age of their mothers and the mothers' height. The variable categories were derived from the original study. Differences between ethnic groups were analysed using the chi-square test or Fisher's exact test. The chi-square distribution is used to estimate confidence intervals for a population variance. However, Fisher's exact test is applied when the sample size is too small to meet the requirements of the chi-square test.

2.6 Ethical Clearance

The investigation was approved as PROJECT LAO/027 by Lao-Luxembourg Health Sector Support Programmer II (LL. HSSP-II).

3. Results

The largest group, with 135 children, belonged to the Lao Lum ethnicity. In comparison, 114 children were born from mothers of the Lao Sung- and the smallest group, with 30 children, originated from the Lao Teng ethnicity. The proportion of boys and girls were almost equal for the three groups. However, the distribution of children throughout the age categories differed between the groups. The ratio of young children of the Lao Sung ethnicity significantly exceeded those of the other two groups (Table 1).

Table 1: Sex and age categories of preschool children of ethnic groups

Characteristics	Lao Lum	Lao Sung	Lao Teng	Total	P-value
	n (%)	n (%)	n (%)	n (%)	
Children	135 (43.5)	114 (36.8)	61 (19.7)	310 (100)	
Sex					0.485*
Boys	67 (49.6)	65 (57.0)	31 (50.8)	163 (52.6)	
Girls	68 (50.4)	49 (43.0)	30 (49.2)	147 (47.4)	
Age (month)					0.024**
0 – 5	11 (8.1)	21 (18.4)	3 (4.9)	35 (11.3)	
6 – 11	17 (12.6)	18 (15.8)	8 (13.1)	43 (13.9)	
12 – 23	37 (27.4)	37 (32.5)	21(34.4)	95 (30.6)	
24 - 60	70 (51.9)	38 (33.3)	29 (47.6)	137 (44.2)	

*chi-square test, **Fisher exact test

Table 2 showed the mothers' age and height as well as socio-economic variables were separated from each of the three ethnic groups. The proportion of mothers aged 20 years or younger was significantly higher in the Lao Sung and Lao Teng groups compared to the Lao Lum group. Only six mothers of the Lao Lum ethnicity were below 20 years old, whereas twenty-three women from the Lao Sung and twenty-two from the Lao Teng group were aged 20 years or younger.

The height of the mothers from all three ethnic groups generally did not exceed 160 cm with only 13 women from the Lao Lum

group and one from the Lao Teng group surpassing this height. Most Lao Lum women were between 150 and 159 cm while the majority of Lao Sung and Lao Teng women measured below 150 cm. Around 70% of Lao Lum mothers lived in urban areas with the remaining 30% in rural areas. In contrast, most Lao Sung and Lao Teng mothers also resided in rural areas with Lao Teng mothers predominantly living there.

Educationally, the Lao Lum group showed a clear advantage with only 5 mothers lacking formal schooling and 40% completing high school or higher education. Lao Sung mothers had approximately 30% with no schooling and 20% completed high school or beyond. In contrast, Lao Teng mothers mostly had compulsory (50%) or secondary schooling (35%) with only a few lacking schoolings and few achieving high school education.

Occupation-wise, Lao Sung and Lao Teng mothers were primarily engaged in farming or shopkeeping with nearly 65% of Lao Teng mothers involved in shopkeeping. The Lao Lum group had a more diverse range of occupations with 30% as farmers, 28% as shopkeepers, 26% as housewives and nearly 20% as government officers. Income satisfaction was notably lower among Lao Teng mothers with over 50% dissatisfied with their income. Around 40% of Lao Sung mothers reported sufficient income while Lao Teng mothers had a similar proportion but only a few claimed to have savings. Lao Lum mothers were in a more favourable economic position with about 40% indicating sufficient income and over 35% with savings. The Lao Sung group was better off than the Lao Teng group with more than 20% having savings.

Table 2: Mothers' age and height and socio-economic background

Characteristics	Lao Lum	Lao Sung	Lao Teng	Total	P-value
	n (%)	n (%)	n (%)	n (%)	
Age (years)					<0.001*
≤20	6 (4.4)	23 (20.2)	22 (36.1)	51 (16.5)	
≥ 21	129 (95.6)	91 (79.8)	39 (63.9)	259 (83.5)	
Height (cm)					0.001*
≤ 149	23 (17.1)	61 (53.5)	32 (52.5)	116 (37.4)	
150 - 159	99 (73.3)	53 (46.5)	28 (45.9)	180 (58.1)	
≥ 160	13 (9.6)	0 (0)	1 (1.6)	14 (4.5)	
Residence					<0.001*
Rural	43 (31.8)	93 (81.6)	55 (90.2)	191 (61.6)	
	92 (68.2)	21 (18.4)	6 (9.8)	119 (38.4)	
Education					<0.001*
No schooling	5 (3.7)	34 (29.8)	4 (6.6)	43 (13.9)	
Compulsory	34 (25.2)	35 (30.7)	30 (49.2)	99 (31.9)	

Characteristics	Lao Lum	Lao Sung	Lao Teng	Total	P-value
	n (%)	n (%)	n (%)	n (%)	
Secondary	41 (30.4)	24 (21.1)	21 (34.4)	86 (27.7)	
High school	55 (40.7)	21 (18.4)	6 (9.8)	82 (26.5)	
Occupation					<0.001**
Farmer	39 (28.9)	36 (31.6)	16 (26.2)	91 (29.4)	
Housewife	35 (25.9)	12 (10.5)	3 (4.9)	50 (16.1)	
Gov. officer	23 (17.0)	6 (5.3)	3 (4.9)	32 (10.3)	
Shopkeeper	38 (28.2)	60 (52.6)	39 (63.9)	137 (44.2)	
Income					<0.001**
Not sufficient	33 (24.4)	45 (39.5)	32 (52.5)	110 (35.5)	
Enough	53(39.3)	43 (37.7)	24 (39.3)	120 (38.7)	
Savings	49(36.3)	26 (22.8)	5 (8.2)	80 (25.8)	

*chi-square test, ** Fisher exact test

As shown in Table 3, the overall prevalence of stunting for both sexes was 34% with the Lao Teng group having the highest rate at 40% followed by the Lao Sung group at 44%. The Lao Lum group had the lowest stunting rate at 23%. In the first year of life, stunting was relatively low affecting only 4 children from the Lao Lum group, 7 from the Lao Sung group and 3 from the Lao Teng group. However, stunting increased in the second year with 13 stunted children in the Lao Lum group, 19 in the Lao Sung group and 5 in the Lao Teng group. For children aged 24 to 60 months, stunting affected 20% of Lao Lum children but the rates rose significantly in the Lao Sung (63%) and Lao Teng (55%) groups. Stunting was generally higher among boys, with more than 45% of boys in the Lao Sung and Lao Teng groups being stunted compared to nearly 30% in the Lao Lum group. In contrast, the proportion of stunted girls was lower with 40% of girls in the Lao Sung group, over 30% in the Lao Teng group and below 20% in the Lao Lum group. These findings highlighted significant ethnic disparities in stunting rates among preschool children.

Table 3: Stunting of preschool children from different ethnic groups

	Lao Lum		Lao Sung		Lao Teng		Total		P-value
	Normal n (%)	Stunting n (%)	Normal n (%)	Stunting n (%)	Normal n (%)	Stunting n (%)	Normal n (%)	Stunting n (%)	
Total	104 (77.0)	31 (23.0)	64 (56.1)	50 (43.9)	37 (60.7)	24 (39.3)	205 (66.1)	105 (33.9)	0.001*
Boys	48 (71.6)	19 (28.4)	34 (52.3)	31 (47.7)	17 (54.8)	14 (45.2)	99 (60.7)	64 (39.3)	0.057*
Girls	56 (82.4)	12 (17.6)	30 (61.2)	19 (38.8)	20 (66.7)	10 (33.3)	106 (72.1)	41 (27.9)	0.032*
Age (month)									
0 – 5	10 (90.9)	1 (9.1)	21 (100.0)	0 (0.0)	3 (100.0)	0 (0.0)	34 (97.1)	1 (2.9)	0.400**

	Lao Lum		Lao Sung		Lao Teng		Total		P-value
	Normal n (%)	Stunting n (%)	Normal n (%)	Stunting n (%)	Normal n (%)	Stunting n (%)	Normal n (%)	Stunting n (%)	
6 - 11	14 (82.3)	3 (17.7)	11 (61.1)	7 (38.9)	5 (62.5)	3 (37.5)	30 (69.8)	13 (30.2)	0.316**
12 –23	24 (64.9)	13 (35.1)	18 (48.7)	19 (51.3)	6 (76.2)	5 (23.8)	58 (61.1)	37 (38.9)	0.109**
24 -60	56 (80.0)	14 (20.0)	14 (36.8)	24 (63.2)	13 (44.8)	16 (55.2)	83 (60.6)	54 (39.4)	<0.001*

*Chi-square test, ** Fisher exact test

4. Discussion

Significant differences in stunting rates were observed across ethnic groups with the Lao Lum group having the lowest rate followed by an increase in the Lao Teng group and the highest rate found in the Lao Sung group. These differences across various variables provide a basis for hypothesizing factors that may contribute to stunting. Further studies are needed to verify these hypotheses which could ultimately lead to actionable steps to address the underlying issues.

Since the term stunting was introduced by *Waterlow et al. (1977)* [10], the question of what stunting stands for is still controversial. *Waterlow et al.* interpreted stunting as a process of adaptation to a more extended period of marginal nutritional intake, probably in connection with infection [11]. Stunting usually doesn't result from a preceding acute state of protein-energy undernutrition, such as wasting [11]. The observation supports the view that a dominant endogenous proteinase inhibitor, i.e., alpha-2 macroglobulin, was elevated in children prone to stunting, as verified by a laboratory animal study [12, 13]. That gave rise to the hypothesis that a metabolic mechanism exists to find an optimal relationship between catabolism and synthesis resulting in stunting [13].

Numerous variables, directly and indirectly, influence preschool children's metabolism within the most rapid developmental process of their lives. Following a similar conceptual framework, two more recent review papers portrayed the facets of the complex environment behind the child stunting. One article published in the first half of the preceding decade emphasized the importance of complementary feeding and infection as key drivers of stunting. In contrast, the second most recent article discussed the factors contributing to the global decline in stunting [5, 14]. Several factors both direct and indirect, are linked to stunting, as mentioned in the two publications. Analysing the differences in variables between the three

ethnic groups may help explain why Lao Lum children fare better than those from the other two groups.

Ethnicity plays a significant role in stunting rates. Among the over 5 million inhabitants of Lao PDR, the primary ethnic differentiation used here is between the Lao Lum, Lao Teng and Lao Sung groups. The Lao Lum group consists mostly of ethnic Lao (52.2%) with the Thai as another major subgroup primarily living in the lowlands. The Lao Teng family includes various subgroups mostly residing on mountain slopes and speaking languages from the Mon-Khmer and Austroasiatic groups. In contrast, the Lao Sung group lives in the highlands and is divided into two main subgroups such as the Hmong and Lou Mien/Lao who speak Sino-Tibetan and Tibetan-Burmese languages.

Language differences among these groups likely correspond to distinct cultural habits and beliefs. Compared to the Lao Lum group, the Lao Sung and Lao Teng groups which predominantly live in rural areas tend to have earlier pregnancies with the Lao Sung mothers possibly having shorter birth intervals. Lao Lum mothers generally have higher educational levels and engage in more diverse occupations.

Around 30% of Lao Sung mothers did not attend school which suggests they mostly reside in remote areas. However, there seems to be a trend of Lao Sung families moving from the mountains to the lowlands in search of better living conditions which could explain why nearly 20% of Lao Sung mothers have a high school education, a level of education almost absent among Lao Teng mothers. It is likely that the Lao Sung mothers with a high school education are those living in urban areas.

Economic-wise, the Lao Teng mothers are the most disadvantaged ones, claiming that their income were insufficient and that it is impossible to accumulate some savings. To work for a living, many Lao Sung and Lao Teng mothers are shopkeepers. Shopkeeping is a much less strenuous occupation but still can be very time-consuming, especially as a significant source of income. It would be interesting to study whether shopkeeping limits their time caring for their children and indirectly contributes to stunting. Hard work for mothers for low payments in India was singled out as the most influential factor for stunting [15]. It was found that economic improvement such as irrigation projects that enabled mothers to grow and sell vegetables year-round, contributed to reduced

participation in a nutritional intervention program in Thailand. Due to spillover effects at the provincial level, a so-called control village, which was not part of the intervention group, performed much better than several of the intervention communities [16].

The breastfeeding results from all three ethnic groups emerged as a positive aspect of this study, as mother and child health services seem to work but still need improvement. Genetic influences on parental height cannot be ruled out [17, 18]. There might be sex-dependent epigenetic effects on birthweight, which also affects stunting [5, 19], but this could not be explored.

5. Conclusion

The province used to investigate stunting mirrors the situation in broad areas of Lao PDR. Stunting to various degrees is still found in the three main ethnicities. This is a challenge for health authorities, who use their simple anthropometric measurements and statistics to identify reasons for stunting and possible improvement methods. Here, educational and occupational differences show that the Lao Sung is more diverse than the other groups with the highest proportion of stunting. In contrast to Lao Teng mothers of Lao Lum, almost 30% have no schooling. On the other side, a higher proportion of them attended high school. Lao Sung and Lao Theng try to improve their household income by shopkeeping. The possibility that the mother's engagement in enhancing the family income is one of the main factors for stunting. Discussions in the community might sensitize the mothers who wish to give more attention to their children and improve their well-being. The example presented here for Lao PDR might also be true for similar situations in areas with various ethnicities.

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