

North Koreans' Current Living Conditions Based on UNICEF Survey Results: With a Focus on the Status of Infant Nutrition

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This English translation is a summarized and edited version of the research paper "*Livelihoods in North Korea and Cooperation Plan*" by Jea Hwan Hong, Suk-Jin Kim, and Eun Mee Jeong (Seoul: Korea Institute for National Unification, December 2018)

1. Introduction	7
2. Introduction of Data and Terms	13
3. Infant Nutritional Status in North Korea:	
Trends and Characteristics	19
A. Long-term Trends of Infant Nutritional Index in North Korea	21
B. International Comparison of North Korea's Infant Nutritional Index	22
4. Improvement of North Korean Infant Nutrition:	
Factors and Implications	29
A. Factors Impacting the Infant Nutritional Status	31
B. Economic Factors	33
C. Social Factors	41
D. Geographical and Climatic Factors	48
E. Conclusion: Overall Evaluation	50
5. Regional Comparison Regarding North Korea's Infant	
Nutritional Conditions	53

North Koreans' Current Living Conditions
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1. Introduction

This research analyzes North Koreans' current living conditions based on the findings of international survey conducted within North Korea regarding its infant nutritional status.¹⁾ The research especially focuses on the state of infant nutrition among many other survey items for the following reasons.

First, an index on infant nutrition is one of the major indexes indicating people's current living standard in each country. Although the level of infant development is known to show no difference depending on race,²⁾ in reality there exists a significant gap in the level of average infant development by a country. Such a fact is indicative of the significantly different environment allowing infants to grow depending on a country. Therefore, the state of infant nutrition can provide an insight to some extent into the level of social and economic development of a specific country.

Second, improving the level of infant nutrition is one of the most pressing and important tasks impacting people's lives. A lack of nutrition in infants is not only one of the major causes behind the infant mortality but also negatively affects the standard of living in the long-term in the form of a physical and psychological damage and reduced productivity. In the underdeveloped world, this may not be a problem only occurred at the individual level but could serve as a factor to perpetuate a vicious cycle of underdevelopment

1) For more on the current status of international survey on North Koreans' living conditions, please refer to "Current Status of International Survey on Living Conditions of North Korea and Underdeveloped Countries" by Suk-Jin Kim and "Livelihoods in North Korea and Cooperation Plan" by Jea Hwan Hong, Suk-Jin Kim, and Eun Mee Jeong (Seoul: Korea Institute for National Unification, recent publication).

2) Onis, M., & Branca, F., "Childhood stunting: a global perspective," *Maternal & Child Nutrition*, vol. 12 (2017), p. 16; Prendergast, A. J., & Jean H. H., "The stunting syndrome in developing countries," *Paediatrics and International Child Health*, vol. 34, no. 4 (2014), p. 252.

t. 3)

Third, an analysis of infant nutritional status can contribute to data utility. There are relatively abundant data on the status of North Korea's infant nutrition since the international community, aside from UNICEF's Democratic People's Republic of Korea (DPR Korea) Multiple Indicator Cluster Survey (MICS), has often conducted a nutrition survey (or assessment) on North Korea's nutritional status. A survey on the state of infant nutrition has mostly been the subject covered by international survey on people's livelihood, which makes it easy for international comparison.

Fourth, the findings of the survey on infant nutritional status have a relatively higher credibility compared to other survey subjects. Sometimes a survey on people's living conditions requires people surveyed to write down answers, which hints a possibility that the survey respondents might falsely answer the question. By contrast, a survey on infant nutritional status requires an examiner to measure the height and weight of infants surveyed, which makes the distortion of information unlikely.

In this paper, second chapter introduces the data utilized in the research and the criteria for assessing the infant nutritional status. Third chapter compares and reviews the long-term patterns of North Korea's infant nutritional state since the late 1990s by tapping into various survey data, including international community's assessment of nutrition in North Korea, MICS data, and survey data on other underdeveloped countries. Fourth chapter lays out factors that have caused a change of North Korean infant nutrition and its implications. Fifth chapter delves into implications of infant

3) Aguayo, Víctor M., and Purnima Menon, "Stop stunting: improving child feeding, women's nutrition and household sanitation in South Asia," p. 4.

nutrition on inequality in North Korea by making a regional comparison.

North Koreans' Current Living Conditions
Based on UNICEF Survey Results:
With a Focus on the Status of Infant Nutrition

2. Introduction of Data and Terms

The international community has engaged in a wide variety of survey projects either as part of an activity of collecting data within North Korea or in light of figuring out the demands for humanitarian assistance and the achievements thereof. A survey on infant nutrition was carried out eight times in the process of conducting MICS and Nutrition Survey from 1997 to 2017. A 1997 survey was confined only to infants in nurseries and kindergartens residing in five regions out of nine North Korean provinces, which makes it difficult to utilize its findings as a reference. So this research only uses the findings of surveys conducted after 1998. In addition, this chapter presents an international comparison of infant nutritional status. The author taps into the data on infant nutrition required of that international comparison from database jointly operated by the United Nations Children’s Emergency Fund (UNICEF), World Health Organization (WHO), and the World Bank.⁴⁾

In fact, various indexes are being utilized in assessing the nutritional conditions of infants. The most widely-used index is the one calculated on the basis of age (or moon’s age), height, and weight. The most representative indexes include the ratio of chronic malnutrition, acute malnutrition, and underweight,⁵⁾ all of which are also utilized in this research.

Chronic infant malnutrition is defined as the status, at which infant’s height for the moon’s age under the age of five (0 to 59 months-old) is less than over two standard deviations (SD) from the WHO Child Growth Standards median. In other words, it is

4) UNICEF/WHO/World Bank Joint Child Malnutrition Estimates Expanded Database: Stunting, January 2018, New York. <<https://data.unicef.org/topic/nutrition/malnutrition>>

5) UNICEF, “Levels and Trends in Child Malnutrition,” UNICEF, 2017.

the status of extreme stunted growth for the moon's age. Chronic infant malnutrition occurs when an infant goes undernourished for a long period of time or suffers from a chronic lack of nutrition due to illness, a condition most frequently found in South Asia and Sub-Saharan Africa.⁶⁾

Acute malnutrition is defined as a state where the height for weight of a child under the age of five is over two standard deviations less than WHO Child Growth Standards median. Such a condition occurs when one fails to properly gain weight or the weight dramatically reduces in the short-term due to food shortage crisis, natural disaster, and man-made calamity. Low weight refers to a state, in which infant's weight for the moon's age under the age of five is over two standard deviations less than the median of WHO Child Growth Standards. As specified in Table 1 below, WHO has criteria classified into four stages of the nutritional state for evaluation of infant nutrition.

<Table 1> WHO Criteria for Evaluating Infant Nutritional Status

	Low	Medium	High	Very high
underweight	< 10%	10-19%	20-29%	≥ 30%
chronic malnutrition	< 20%	20-29%	30-39%	≥ 40%
	Acceptable	Poor	Serious	Critical
acute malnutrition	< 5%	5-9%	10-14%	≥ 15%

Data: WHO, *Nutrition Landscape Information System Country Profile Indicators Interpretation Guide*, 2010, p. 2.

An analysis conducted in this paper mostly focuses on chronic malnutrition rate. Such a rate is measured on the basis of age and height because height, compared to weight, is not hugely impacted

6) UNICEF, "Levels and Trends in Child Malnutrition," UNICEF, 2018, p. 1.

by a short-term change of the environment. Moreover, height is a cumulative indicator of how the living environment has affected the health of infants. The chronic malnutrition rate is the most comprehensive index on the quality of life for infants in each country⁷⁾ and is widely favored as the most reliable index indicating the long-term nutritional status.⁸⁾

7) UNICEF, “Levels and Trends in Child Malnutrition,” UNICEF, 2018, p. 1.

8) Bredenkamp, Caryn, Leander R. Buisman, and Ellen Van de Poel, “Persistent inequalities in child undernutrition: evidence from 80 countries, from 1990 to today,” *International Journal of Epidemiology*, vol. 43, no. 4 (2014), p. 1330.

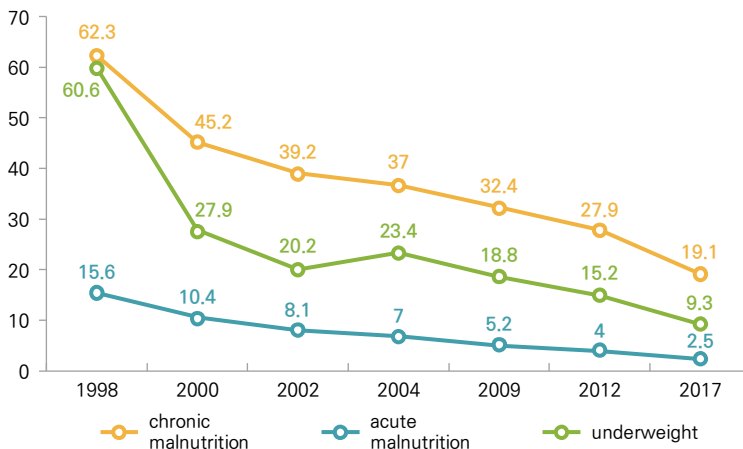
North Koreans' Current Living Conditions
Based on UNICEF Survey Results:
With a Focus on the Status of Infant Nutrition

3. Infant Nutritional Status in North Korea: Trends and Characteristics

A. Long-term Trends of Infant Nutritional Index in North Korea

This chapter looks into the long-term trends of infant nutritional index in North Korea by utilizing the findings of the international survey on North Korean people's living conditions. Figure 1 shows the trends of major indexes on North Korean infant nutritional status from 1998 to 2017 with all three indexes indicating that North Korea's infant nutrition has significantly improved over the last 20 years.

<Figure 1> Trends of Major Indexes on North Korea's Infant Nutritional Status (Unit: %)



Data: See the text for reference.

The chronic malnutrition rate was at 62.3% in 1998, and sharply dropped to 45.2% two years later in 2000. The downward trends had continued thereafter reaching at as low as 19.1% in 2017. The chronic malnutrition rate in North Korea was in the range of “high” in the 2000s compared to WHO criteria for evaluating infant nutritional status but went down entering the range of “low” in 2017, followed by the “middle” range in 2012.

The same patterns were observed in the rate of acute malnutrition and underweight. The underweight rate had dramatically decreased from 60.6% in 1998 to 9.3% in 2017. In the same period, the acute malnutrition rate had also plummeted from 15.6% to 2.5%. The former went down to the lowest level of “acceptable” since a 2012 survey and the latter entered the level of “low” in a 2017 survey on the basis of WHO criteria for evaluating infant nutritional status.

B. International Comparison of North Korea’s Infant Nutritional Index

What should be noted is that North Korea’s infant nutritional status has improved at an unprecedented pace over the past 20 years compared to other countries. Such a trend is all the more noticeable when comparing a change of chronic infant malnutrition rate of North Korea in 2000 to that of countries in the similar level of economic development.

Figure 2 and 3 demonstrate the rate of chronic infant malnutrition of 80 countries by size (including North Korea) in the 2000s and 2010s, those that were categorized as low-income or low- and middle-income countries by the World Bank in 2000. The rate of chronic infant malnutrition around 2000 as shown in Figure 2 suggests that North Korea had the second highest rate of chronic infant malnutrition after Brundi among a total of 80 countries according to a 1998 survey. Figure 2 also shows that the North was the 22nd highest in chronic infant malnutrition according to a 2000 survey (marked in red in Figure 2).

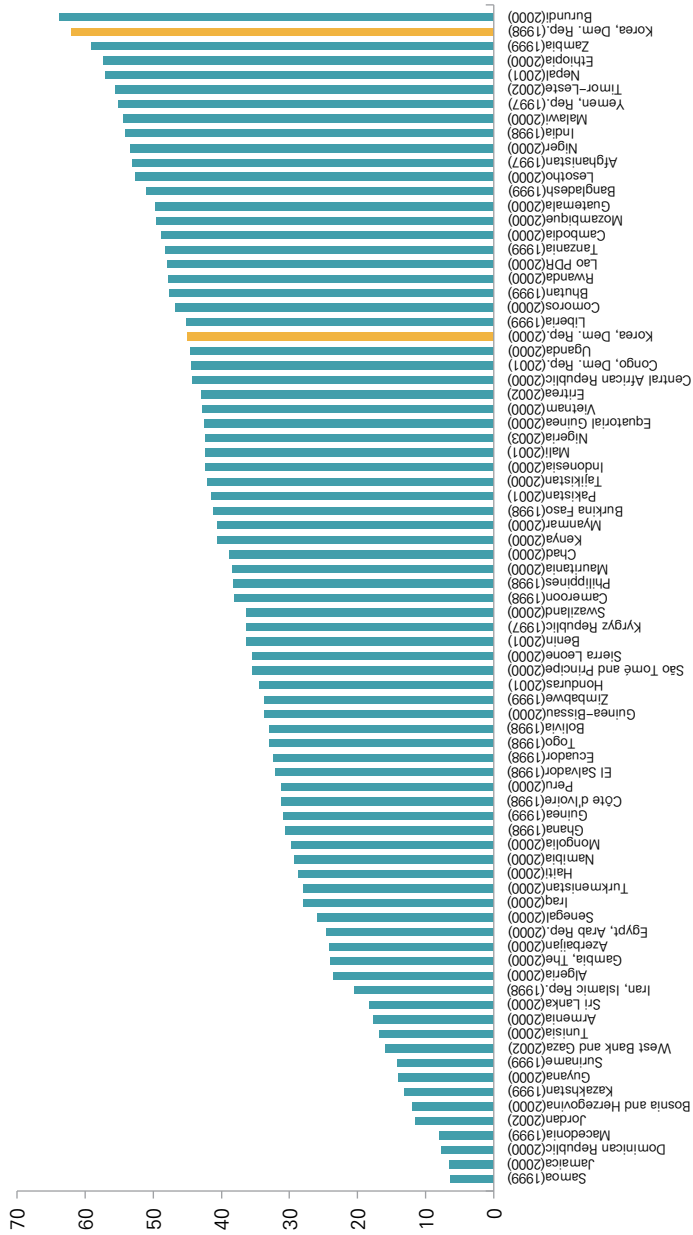
However, the situation in the 2010s in Figure 3 illustrates that

North Korea's standing has significantly changed. The North had the 38th highest rate of chronic infant malnutrition among 80 countries according to a 2012 survey finding, which marks an increasingly reduced rate compared to 2000. A 2017 survey result indicates that Pyongyang had the 55th highest rate. In other words, North Korea belonged to the highest-ranking groups in terms of infant malnutrition around 2000 but joined the low-ranking groups into the 2010s.

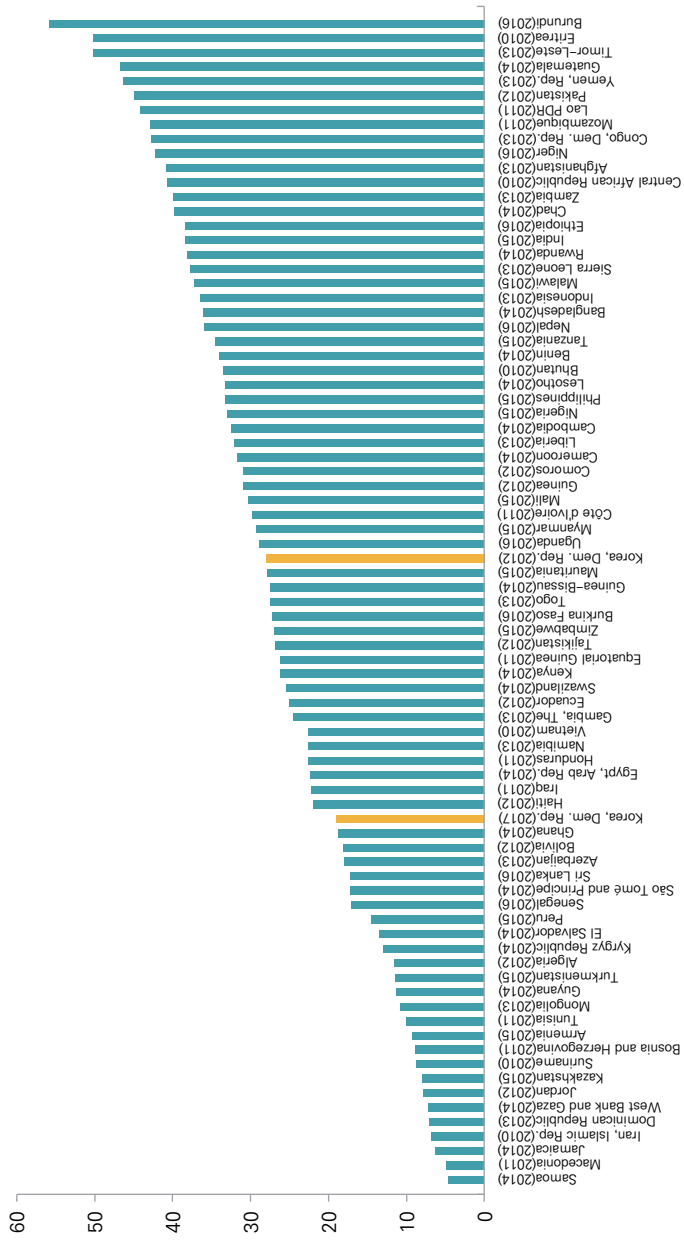
Figure 4 shows more clearly that North Korean infant nutritional status has remarkably improved at an unprecedented level compared to other countries. In Figure 4, the x-axis (the horizontal axis) represents the chronic malnutrition rate per country around 2000 and the y-axis (the vertical axis), after the 2010s. Chronic malnutrition rate went down in the 2010s compared to the 2000s in most low-income or low- and middle-income countries. An improvement of infant nutritional condition is not an exceptional phenomenon in North Korea. It is rather attributable to multi-dimensional efforts of the international community for the economic development of underdeveloped countries and the enhancement of infant nutrition of low-income countries, including North Korea.

Second, the chronic malnutrition rate seems low in general mostly in low- and middle-income countries compared to low-income countries, which signals correlations between the income level and the infant nutritional state. Third, it is also notable that a high level of correlations of chronic malnutrition exists in each country between 2000 and the 2010s. The correlation coefficient is quite high at 0.81 in 79 countries, except for an outlier North Korea, revealing that no significant deviation in a change of malnutrition rate exists in each country between those two survey periods.

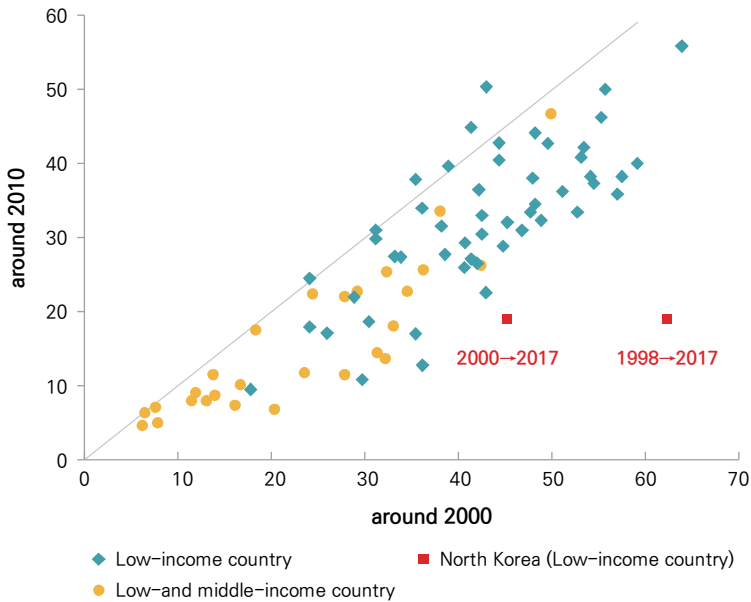
<Figure 2> International Comparison of the Chronic Infant Malnutrition Rate around 2000 (Unit: %)



<Figure 3> International Comparison of the Chronic Infant Malnutrition Rate around 2010 (Unit: %)



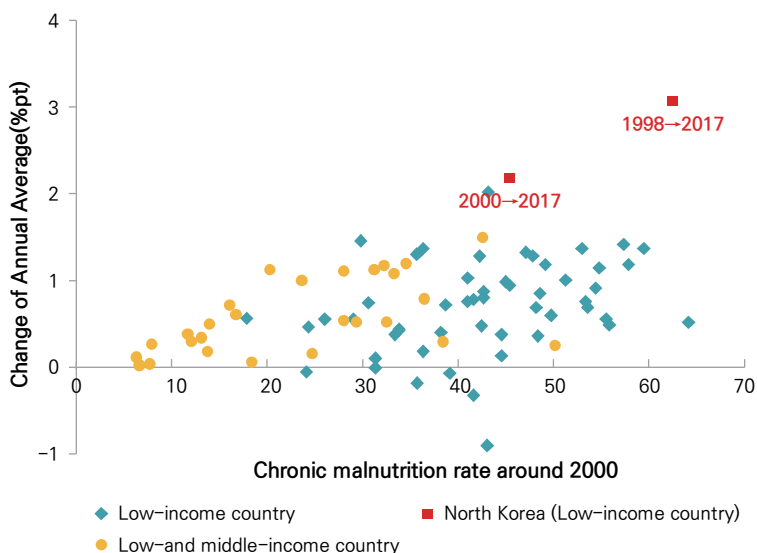
<Figure 4> Change of Rate of Chronic Malnutrition by Country (Unit: %)



Data: Please refer to the text.

Figure 4 and 5 highlight a change of North Korea’s malnutrition rate. Two dots (in red: North Korea) are presented with the use of survey findings of 1998, 2017, 2000, and 2017 in Figure 4 and 5. North Korea’s chronic infant malnutrition rate decreased at an unprecedented pace, or at least very rapidly, over the last 20 years compared to countries in the similar level of economic development around 2000.

<Figure 5> Change of Annual Average Chronic Malnutrition per Country



Data: Please refer to the text.

However, a possibility cannot be ruled out that such an analysis may be a result of rather overstated changes of North Korea since the most recent survey findings (2017) were utilized only for North Korea amid the decreasing trends of chronic malnutrition rate observed in each country. To address such concerns, a change of annual average chronic malnutrition rate per country calculated based on the two survey periods was presented in Figure 5, which also confirms that North Korean infant nutritional state has improved relatively more swiftly than other countries.

What also stands out in Figure 4 is that North Korea's chronic malnutrition rate was relatively low among low-income countries. In particular, North Korea showed the second lowest chronic malnutrition rate after Senegal (17.1%) in 2016 when factoring in

28 low-income countries as subjects for comparison. Furthermore, the DPRK's chronic malnutrition rate was among the lowest in 2016 compared to low- and middle-income countries with a higher income level than North Korea.

In sum, the DPRK's infant nutritional condition has rapidly enhanced over the last 20 years, which marks unprecedented shifts even at the international level. As a result of such a shift, North Korea's infant nutritional status is relatively at a sound level when accounting for its income level. The next chapter lays out the factors behind such a swift improvement on its infant nutritional state.

North Koreans' Current Living Conditions
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4. Improvement of North Korean Infant Nutrition: Factors and Implications

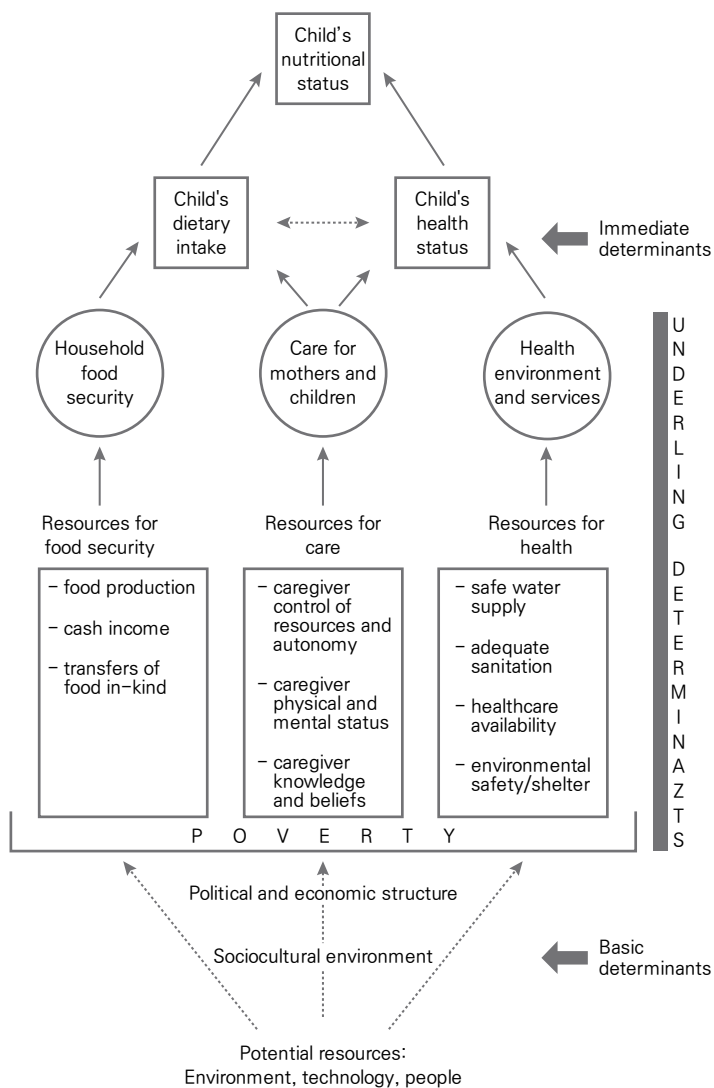
The most generally-used analysis method for discovering the factors for improvement of infant nutritional status is qualitative analysis utilizing raw data of international surveys. Unfortunately, however, such a method is not fit for North Korea's case. Besides, an analytic approach is not easily deployable since not enough statistics are accessible that may help analyze factors on the nutritional improvement given the reclusive nature of North Korean society. Therefore, this chapter utilizes preceding studies on the nutritional improvement in reviewing major variables proven effective affecting the nutritional condition. Based on that, it analyzes contributing factors for rapid improvement of North Korea's infant nutritional condition and discusses some of the issues that have arisen in the process.

A. Factors Impacting the Infant Nutritional Status

Before analyzing factors that have contributed to the improvement of North Korean infant nutrition, one needs to first figure out which factors usually cause the malnutrition. A typical diagram illustrating such factors is presented at Figure 6 pointing out mainly three factors affecting infant nutritional status.⁹⁾

9) This part was written mostly based on Smith, L. C. and Haddad, L., "Reducing Child Undernutrition: Past Drivers and Priorities for the Post-MDG Era," *World Development*, vol. 68 (2015), p. 182.

<Figure 6> Factors Causing Malnutrition



Data: Smith, L. C. and Haddad, L., "Reducing Child Undernutrition: Past Drivers and Priorities for the Post-MDG Era," *World Development*, vol. 68 (2015), p. 183.

First, factors directly affecting the infant nutritional status include nutritional intake (protein, fat, micronutrient, etc.) and health conditions of infants—the two of which interact with each other. Second, there are factors affecting the infant nutritional state through a direct impact at the household level, such as securing food, managing maternal and child health, and providing healthy environment and related service. Third, more fundamental factors are those impacting the households at the international, national, or regional level, which include income level, government capacity, climate, and geological environment. In fact, those factors determine the political and economic structure and socio-cultural environment in a society.

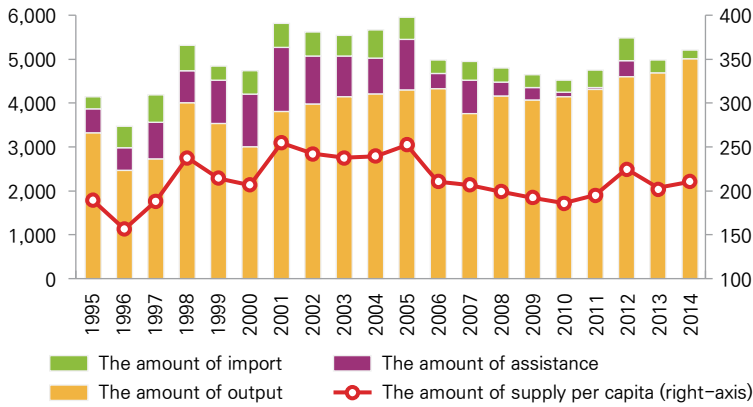
The existence of multi-factors involved in impacting the infant nutritional state suggests that one should look at not only economic factors including the income level and food conditions but also various social factors to fully appreciate the factors that have contributed to the improvement of North Korean infant nutritional status. This chapter largely categorizes factors into economic and social ones.

B. Economic Factors

(1) Improvement of Food Conditions

One of the factors that should primarily be looked into is enhanced food conditions, which can be viewed as the most direct factor. Figure 7 illustrates the amount of grain output, assistance, and import and the total amount of those three categories divided by the number of North Korean population—the trends of changes in the amount of grain supplies per capita.

<Figure 7> Total Amount of Grain Supply and Per-capita Supply (Unit: 1,000 ton, kg)



Note 1: The scope of food assistance from the international community from 2013 to 2014 was not reflected due to a lack of accurate figures of the scope.

Data: Statistics on the amount of grain supply was cited from Yongho Choi, "North Korea's Trends of Agricultural and Livestock Products' Trade and Its Implications," KDI Review of the North Korean Economy, April, 2017 edition (2017), p. 26. (in Korean)

It appears that there had been not enough grain production in North Korea up until 2000, during which a lack of food, caused by slow production, was supplemented by the international assistance. The scope of food assistance toward North Korea, which began in 1995, had dramatically increased up until the early 2000s. That amount represented 20-25% of the total grain supply in North Korea at that time, which far surpassed the grain import. Thanks to the international assistance, the grain supply per capita rapidly soared until the early 2000s after reaching the lowest point in 1996. A changing trend in food supply of that period corresponds to the patterns of improving infant nutrition.

However, statistics of grain supply after the mid 2000 do not conform to the improving trends of infant nutritional state in that

period. The grain supply per capita was showing a decreasing trend after reaching its peak in 2005. It stayed along the similar lines of the mid and late 1990s of severe food crisis from 2008 to 2011.

How should one interpret the situation after the mid 2000 then? First of all, it is possible that the level of increase in North Korea's grain production was underestimated. The statistics of North Korea's grain production, as presented above, were calculated based on FAO data (The Food and Agriculture Organization of the United Nations). FAO statistics were derived with the use of its own estimated output data on North Korea's collective and state-owned farms.¹⁰⁾ However, it becomes more likely that some of the output may have been diverted to the markets along with the advancement of marketization and increasingly rampant corruption. So it is fair to state that the North Korean authority's own statistics are likely to underestimate the level of increased output drawn from its collective and state-owned farms.

Another cause for falling grain supply after the mid 2000 is that the qualitative and quantitative growth of individual farming was not really reflected in measuring the agricultural statistics. Not only collective farming but also individual farming are well-established in North Korea, through which North Koreans produce staple grains and other non-staple agricultural and livestock products. Although such an output is estimated to be on the increasing trends, FAO statistics fail to reflect such trends. In addition, it is also necessary to consider a possibility that North Korea may see

10) Tae-Jin Kwon, "Agriculture and Food," Analysis of Current Issues per Sector in North Korean Economy and Its Implications on Policy toward North Korea (in Korean) (Sejong: Korea Development Institute, KDI, 2014), p. 159.

an improvement of food conditions, aside from staple grains, thanks to an expanded output of non-staple agricultural and livestock products earned through individual farming and the development of food processing and the distribution industry.

There also exists a need to factor in the increased efficiency of distribution of resources thanks to an advancement of marketization compared to the past. The DPRK's food production has reduced and its rationing system has also practically collapsed after the mid 1990s. The food crisis and the collapse of the rationing system, which occurred in the face of the not-so-well established market system, brought about fatal consequences, such as nutritional deficiency of residents including infants and millions of people who starved to death. However, the food crisis is not a likely scenario now even if the amount of food supply stays the same as before since North Korea's marketization has advanced to a significant extent resulting in the enhanced efficiency of resource distribution.

(2) Improvement in Income Level

Second reason for the rapidly enhanced North Korean infant nutritional status is a rise in income level.¹¹⁾ Preceding studies suggest that an improved income level is recognized as necessary conditions for boosting the nutritional status in the underdeveloped world. In particular, the economic growth and improved nutritional conditions generally go hand-in-hand in underdeveloped countries.¹²⁾

11) Headey, Derek D., "Turning Economic Growth into Nutrition-sensitive Growth," Shenggen Fan and Rajul Pandya-Lorch (eds), *Reshaping Agriculture for Nutrition and Health* (Washington, DC: IFPRI, 2012), p. 43.

12) Headey, Derek D., "Developmental Drivers of Nutritional Change: A Cross-Country Analysis," *World Development*, Vol. 42, p. 84.

In fact, there exists some consensus that the economic development plays a positive role in reducing the occurrence of stunted growth for infants.¹³⁾

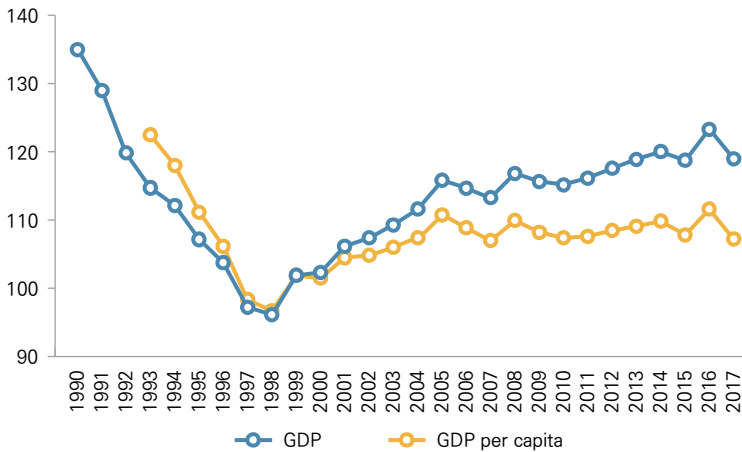
There are largely two routes, through which the income level affects the nutritional conditions. First route is where a decrease in poverty of individual household leads to an improvement of food conditions, hygiene environment, and the level of utilizing health care service. Second route is where a rise in domestic income level leads to an enhancement of public services such as health care service, social protection, and education.¹⁴⁾

Therefore, one can easily predict that an enhanced income level of North Koreans has contributed to a swift improvement of infant nutritional status to some extent. However, North Korea's real GDP and per capita GDP, measured by the Bank of Korea, demonstrate patterns that deviate from such predictions (See Figure 8).

13) Aguayo, Victor M., and Purnima Menon., "Stop stunting: Improving child feeding, women's nutrition and household sanitation in South Asia." *Maternal & Child Nutrition*, vol. 12 (2016), p. 3.

14) Smith, L. C. and Haddad, L., "Reducing Child Undernutrition: Past Drivers and Priorities for the Post-MDG Era," p. 182.

<Figure 8> North Korea's GDP and Per Capita GDP (1998-2000, Average=100)



Note 1: Figures per each year are indexed based on an average point of 1998-2000 at 100.

Note 2: The real GDP was calculated with 2010 as a base year.

Data: Korean Statistical Information Service (KOSIS) operated by Statistics Korea (kosis.kr) (data accessed: September 29, 2018).

Per capita GDP had gradually gone up in the early 2000s and the scope of change had been moderated after 2005. As a result of that, real GDP had increased only by 24.0%, for per capita GDP 10.8% for nearly 20 years from 1998 to 2017. It means that the average growth of North Korea's economic development stays in a mere 1% range and for an increase of per capital income level less than 1% range. To that end, the DPRK's per capita income in 2017 failed to return to the income level of the 1990s before the economic crisis.

Then how one should interpret the situation where an income level rise had not been as dramatic as the nutritional improvement over the last 20 years? In particular, how should the stagnation of income level increase after the mid 2000 be viewed? First of all, it

can be understood that other factors too, not just the income level, have contributed to the swift nutritional enhancement since a change of income level is not the only variable determining the level of nutritional improvement. Such a possibility cannot be completely ruled out given that it must have been relatively easier for North Korea among other underdeveloped countries to obtain social factors required of the boosting of nutritional status.

However, it is difficult to take the result at face value that the income level has long stagnated despite a continuous enhancement of nutritional conditions. It is because, as stated above, an income level change is a necessary condition for nutritional improvement and an increased income level tend to coincide with an improved nutritional status especially in underdeveloped countries. Furthermore, many claims have already been raised through various preceding studies on the way that the Bank of Korea calculated North Korea's GDP.¹⁵⁾ In that context it appears reasonable to cast a doubt of its calculation.

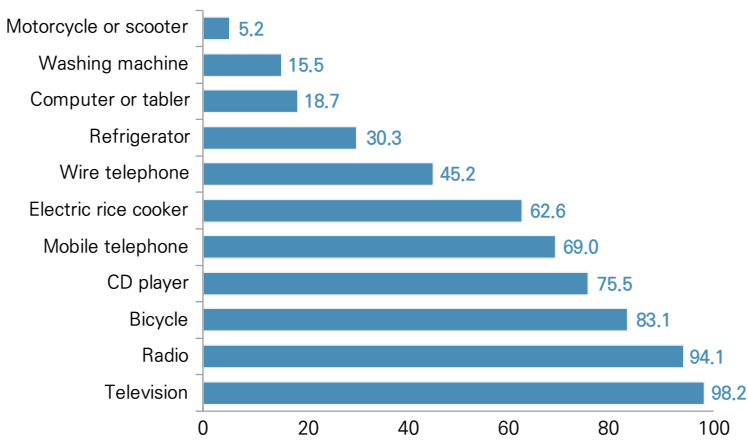
The 2017 MICS findings also raise a doubt on the statistics that North Korea's income level has stagnated for a long period of time. Figure 9 illustrates some of the survey findings on household-owned property, a survey of this kind conducted for the first time in a 2017 MICS survey.¹⁶⁾ According to the survey result, 98.2% of households own a television, for cellphones 69.0%, rice cooker

15) Jea Hwan Hong, *North Korean Economy in the Kim Jong-un Regime: Based on Its Economic Policy* (Seoul: Korea Institute for National Unification, 2017), pp. 26~29 (in Korean); Un-Chul Yang-Hyung Soo Chang, "The Bank of Korea's Evaluation on Growth Estimates of the North Korean Economy," *Sejong Policy Briefing*, vol. 2017-21 (2017) (in Korean).

16) A related survey was carried out with an aim to identify the scope of household properties and categorize the findings into a different social class (the lowest 20%, the middle 40%, and the highest 40%).

62.6%, and refrigerator 30.3%. Those figures were higher than expected although the survey figures could possibly be overestimated due to a false reporting of respondents as specified before. It is also challenging to compare this result to that of the past because unfortunately a survey of this kind was first launched in 2017. However, it is estimated that figures were prominently higher at least when compared to a period right after the Arduous March, which indicates a possibility of the improved income level in North Korea over the last 20 years.

<Figure 9> Properties Owned by Households (Unit: %)



Data: DPRK CBS, DPR Korea Multiple Indicator Cluster Survey 2017, Final Report, 2018, p. 18.

Given those aspects, it is fair to estimate that a change of North Korea's real income and consumption level may have been larger than the Bank of Korea's calculations. However, even with that, it is difficult to assure that an improvement of North Korea's income level was predominantly huge compared to other underdeveloped

countries. Therefore, it can be concluded that North Korea's income level boost is not highly likely to have served as a decisive factor in an unprecedented enhancement of infant nutritional conditions.

C. Social Factors

(1) North Korea's Social Development Experience

Up until the 1980s, North Korea's socio and economic situation was reportedly sound compared to other developing countries. The DPRK's socialist system was working to some extent until the 1970s and the level of social development was relatively decent compared to developing countries. It was attributable to its focus on education and healthcare sector even though after the 1960s North Korea became increasingly lagging behind South Korea, which experienced a rapid growth. Although North Korea's economy seemed to have contracted into the 1980s, the North Korean regime nevertheless guaranteed at least a minimum standard of living for its residents.¹⁷⁾

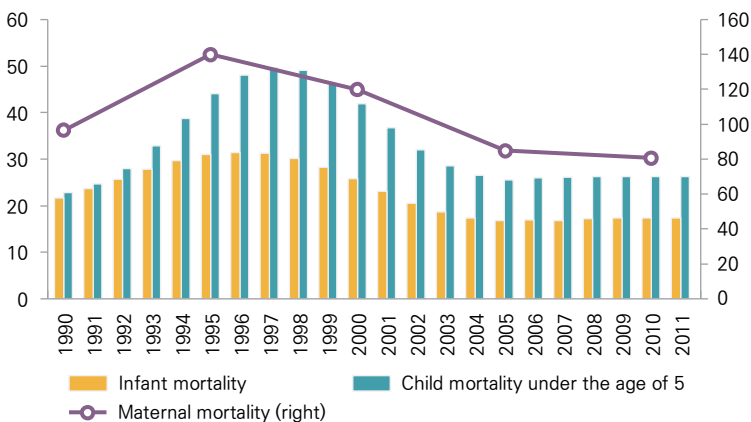
However, Pyongyang underwent severe economic and food crisis in the 1990s. The entire social system became dysfunctional owing to one crisis after another as follows: 1) dramatic reduction in trade caused by the collapse of socialist bloc, 2) weakening agricultural production due to a series of natural disaster, and 3) mounting uncertainty after the death of Kim Il Sung. Moreover,

17) Suk-Jin Kim, "North Korean Economic System after Liberation and Comprehensive Evaluation on Its Economic Performance," *EXIM North Korea Economic Review*, vol. Spring-2015, p. 12. (in Korean)

serious side effects ensued such as the collapse of rationing system and the weakening health and medical system.

Reasons for such weakening indexes on its infant nutritional state in the late 1990s may be attributed to crisis situation facing its society at that time. It is highly likely that infant nutritional status was much better before and around the early 1990s compared to the late 1990s. Figure 10 shows the trends of infant and maternal death, which are closely correlated with the infant nutritional state. It illustrates a common trait of increasing mortality rate starting in the early 1990s and reaching a peak in the late 1990s.

<Figure 10> North Korean Infant and Maternal Mortality



Data: Korea Foundation for International Healthcare (KOFIH), White Paper on North Korean Healthcare (Seoul: KOFIH, 2013), pp. 317-318.

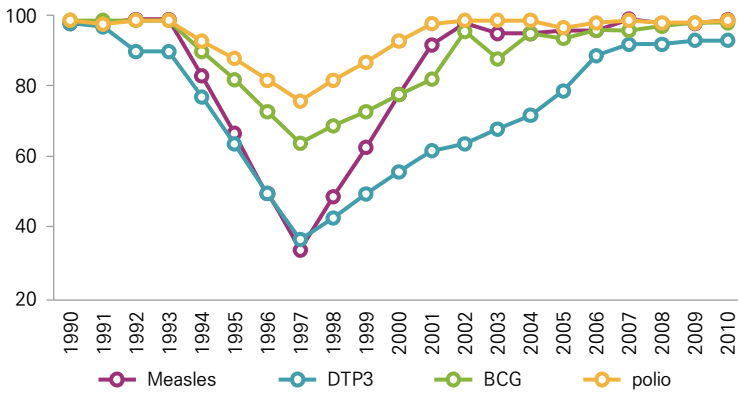
Such findings suggest a possibility that nutritional index of the late 1990s was not indicative of an average situation in the North at that time, but an exceptional phenomenon worsened by economic and food crisis. This means that the enhancement process of North

Korea's infant nutrition could be different in nature from that of other underdeveloped countries.

Underdeveloped countries including Sub-Saharan Africa or South Asia, where infant nutritional issue is the most severe, usually lack a variety of social and economic elements that are crucial for the infant nutritional state mostly owing to their inexperience in social and economic development. To that end, it is necessary to transform this environment into a new one and improve it, which takes a lot of time and energy.

North Korea needed to create part of social elements required of reinforcing its infant nutritional status just as other underdeveloped countries did. However, there were elements simply needed to "return" to the past status-quo, the foundation of which was already laid in the past development process but got worsened with the crisis. On the other hand, there were other elements among social factors affecting infant nutritional status, which remained intact from the economic crisis and therefore did not require a recovery. A case in point is women's high level of education and a low level of Total Fertility Rate (TFR). This suggests that it could have been relatively easier for North Korea to secure social factors required of infant nutritional improvement.

<Figure 11> Child Vaccination Rate at the Age of 1 in North Korea (Unit: %)



Data: Korea Foundation for International Healthcare (KOFIH), White Paper on North Korean Healthcare (Seoul: KOFIH, 2013), pp. 317-318.

Figure 11 demonstrates a vaccination rate of North Korean child at the age of one, which underpins the reasoning above. The vaccination rate for all four items including measles and BCG already reached a peak of 100% but rapidly spiraled down after the late 1990s and then dramatically rebounded to the level of normal year thereafter. North Korea was able to have a vaccination rate swiftly bounce back to the higher level in a short period of time because it has maintained the health and medical system in place along the way.¹⁸⁾

(2) Improvement of Social Factors

As was described above, North Korea experienced social and

18) Sang-min Park *et al.*, “The Current Status of North Korea’s Maternal Health and Effective Assistance,” KDI Review of the North Korean Economy, August 2014, p. 12. (in Korean)

economic development, which appeared to have made it relatively easier for them to obtain various social factors boosting infant nutritional state. However, there were some part needed to be supplemented for the improvement of infant nutrition. The international recommendations or assistance are also evaluated to have played a positive role in enhancing infant nutrition.

To clearly understand the factors behind the improved infant nutrition, it is necessary to differentiate between those two aspects, which is not easy given the limited relevant data available. International survey on North Korea's living conditions started in the late 1990s so it is a challenging task to obtain indexes that give clear insights into the past situation. Statistics on vaccination rate and infant mortality, as analyzed above, fall into a very exceptional case.

Therefore, while this paper reviews the improved social variables, it does not factor in whether such an improvement can be viewed as recovery. Table 2 organizes some items related to infant nutritional state—items drawn from an international survey on North Korea's living conditions. Items are largely classified into hygiene, food intake, disease, nutritional supply, and maternal health maintenance. Statistics related to vaccination were omitted since those were presented in the above text. The below is the details of items.

<Table 2> Change of Factors Involving Infant Nutritional Status

Classification	Detailed Items	1998	2000	2002	2004	2009	2012	2017
Hygiene Level	Indoor water supply plant	72.3	79.7		82.0	86.6		55.6
	Flush toilet or squat toilet	18.5	52.8		56.5	62.6		56.9
Food Intake	Only breast-feeding (under 6 month-old)	85.0	90.7	69.6	65.1	88.6	68.9	71.4
	Adoption of weaning food at an appropriate time (6-8 month-old)	18.4			31.4	28.9	66.0	78.2
Disease	Diarrhea	20.3	20.2	19.1	18.9	13.8	8.5	11.4
	Anemia	31.7					28.7	
Nutritional Supply	Iodine sodium		1.7		40.2	48.0		37.5
	Vitamin A supply		80.2	98.6	98.2	98.0	97.8	
Maternal Health	Maternal Vitamin A supply		20.2	33.1	33.5	97.5		
	Maternal anemia	34.7		33.6	34.7		31.2	
	Low-weight birth	9.3	6.4	6.7		5.7		3.1
	Maternal MUAC			32.0	32.4	25.6	23.2	

Data: Please refer to the text.

First, hygiene related items are divided into whether a safety source of drinking water is secured and a clean toilet is installed. In terms of securing safe drinking water, the rate of installment of indoor water supply plant was set as standard, which is on a growing rise. The rate, however, drastically plummeted in 2017 seemingly due to different methods of survey, therefore it requires additional investigation.

A flush toilet or squat toilet was set as standard when it comes to the installment of a hygienic toilet. According to a survey, around 50~60% of households have that type of toilet since 2000. The problem is that the percentage of households equipped with those toilets had skyrocketed almost three times between 1998 and 2000 probably due to the way that survey questions are organized.

Second, the survey results on infant nutritional intake were presented as follows: 1) the percentage of infants only breast-fed for the first six months after birth, and 2) whether infants start eating weaning food around six to eight months after birth. As to the first one, the percentage decreased since the 2000s except for 2009. Therefore, it cannot be said that breast-feeding for the first six months after the birth is a factor behind the improvement of North Korean infant nutrition. The percentage of whether weaning food was given between six and eight months after birth significantly rose, which appears to have made a positive contribution to a rapid improvement of infant nutrition in the 2010s.

Third, diarrhea and anemia are presented in the category of disease. Anemia, which was surveyed only in 1998 and 2012, is not showing a prominent change. The prevalence of diarrhea has been in decline after the late 2000s, which seems to have partially contributed to a rapid enhancement of infant nutritional status during that period.

Fourth is nutritional supply. The supply of micronutrients such as iodine, iron, and Vitamin A during the infant period also impacts the infant development. For that reason, the international community recommended that micronutrients be additionally supplied to infants and also undertook a project to provide micronutrients to underdeveloped countries. It appears that North Korea saw the overall improvement of micronutrients supplied to the country compared to the past.

Last is an analysis of maternal health. Maternal health status significantly impacts infant nutritional status. It could be categorized as health management and health conditions. In terms of health management, North Korea's basic antepartum care system appears

to have been working even though figures were not specified in the Table above. The rate of antepartum care has been recorded at almost 100% since a 1998 survey. However, the quality of care seems to be lacking. In the meantime, the percentage of mother who gave a birth and was given Vitamin A supplements soared to 97.5% in a 2009 survey. It hints a possibility that maternal health has been better managed after the late 2000s.

Anemia, one of the indexes on maternal health status, has stayed in the 30% range, not showing a significant change. On the other hand, the percentage of low birth-weight infant dwindled from 9.3% in 1998 to 3.1% in 2017, which indicates an improvement of maternal health and nutritional conditions. A representative index on evaluating women's nutritional conditions is the percentage of women whose mid-upper arm circumference (MUAC) is less than 225mm, which signals an enhancement of North Korea's maternal health and nutritional status.

D. Geographical and Climatic Factors

So far the analysis was made on identifying economic and social factors that have driven the rapid improvement of North Korea's infant nutrition to the sound level in relation to its income level. This process, however, was only focused on uncovering causes behind dramatic improvement of infant nutritional status. It did not fully address the reasons behind the relatively sound level of enhancement compared to other developing countries, in particular underdeveloped world except for a brief mentioning regarding the aspect of North Korea's social development. It is because it is hard to find such factors only by using the comparison to international

cases with the limited resources and data available.

This chapter, therefore, aims to present one possibility as a hypothesis regarding the above mentioned issue, which is a likelihood of geographical and climatic factors contributing to bringing about such an improvement. Geographical and climatic factors are worthy of analysis because a significant number of low-income countries are located in South Asia and Africa's tropical climate areas while by contrast North Korea's climate is relatively good. In other words, those countries are plagued by tropical disease including malaria and dengue, which negatively impact the infant nutrition. In North Korea, however, such a phenomenon is not a serious issue, which could serve as a factor behind the relatively sounder level of infant nutritional status given its income level. International community such as World Health Organization (WHO) recently started to stress the importance of the eradication of tropical disease for infant nutritional enhancement and launched related initiatives, all of which back such an assumption.¹⁹⁾

There exists no coherent view, however, on the relations between tropical diseases and nutritional conditions in spite of the prolonged-attention drawn to this issue by scholars.²⁰⁾ For example, there are conflicting research findings as to whether malaria affects infant nutritional status.²¹⁾ The biggest reason for contentious opinion lies in the significant overlapping between areas stricken by tropical diseases and those with the poor infant nutritional

19) There are more than 10,000 malaria patients per year in North Korea, which is a far better situation than Africa.

20) Prendergast, A. J., & Jean H. H., "The stunting syndrome in developing countries," *Paediatrics and International Child Health*, vol. 34, no. 4. 2014, p. 254.

21) For more detail, please refer to Jackson, Bianca D., and Robert E. Black, "A Literature Review of the Effect of Malaria on Stunting," *The Journal of Nutrition*, vol. 147, no. 11, pp. 2163s-2168s.

conditions. Therefore, it is difficult to identify the causal relationship as to whether tropical diseases have an impact on infant nutritional status or the bad infant nutritional state serves as a factor driving up the tropical disease infection.²²⁾

As such, the relationship between tropical diseases and infant nutritional conditions is blurred and is therefore not easy to be proven. However, it seems only appropriate to view it as mutually-reinforcing relationship, not a linear causal relationship. In short, there emerges a vicious cycle in tropical climate regions, in which the worsening nutritional conditions drive up the tropical disease infection and vice-versa. This chapter emphasizes that North Korea's relatively sound infant nutritional conditions vis-a-vis its income level could be explained by its climatic advantage. As mentioned above, however, this is a controversial issue, so this chapter will not go any further and simply explore the possibility of such factors at play.

E. Conclusion: Overall Evaluation

Various factors impacting infant nutritional state have been reviewed in each chapter of this paper. The patterns of changes on economic and social factors among other related factors were analyzed to discover the causes behind North Korea's infant nutritional enhancement. This final chapter will comprehensively organize and present the findings of all the analysis made in this studies.

The first point of emphasis is that North Korea experienced

22) Prendergast, A. J., & Jean H. H, "The stunting syndrome in developing countries," *Paediatrics and International Child Health*, vol. 34, no. 4. 2014, p. 255.

social and economic development in the past, which contributed to have secured social factors necessary for nutritional improvement compared to other underdeveloped countries. This could partially explain the reasons for its sounder level of infant nutritional improvement that unfolded at an unprecedented and fast pace vis-a-vis its income level.

Second, enhanced nutritional circumstances seemed to have contributed to its infant nutritional improvement in the early 2000s. The food assistance of the international community had played an important role in the process. Although the statistics of grain supply per capita show a declining trend after the mid 2000s in contrast to recovering trends of infant nutritional status, the nutritional circumstances are estimated to have actually improved during the same period.

Third, even though improved income is known as a prerequisite for infant nutritional enhancement, a rise in income level had not been prominently observed in the process of rapid infant nutritional progress in the North. This seems to be explained by underestimation of North Korea's economic growth. Even factoring in this, however, an increase of income level does not seem to have played as an important variable in the process of North Korea's infant nutritional advancement.

Fourth, this research looked into changing patterns of major variables related to infant nutritional state among other items covered in a survey on people's living conditions. The findings suggest that there were contributing factors to the enhancement of infant nutritional situation after the mid 2000s such as the adoption of weaning food at an appropriate time and a change of Vitamin A supplied to mothers. Such factors, however, do not

indicate the extent of their contribution due to limited data available.

Fifth, geographical and climatic factors seem to have served as an important role in the sound progress of North's infant nutritional status compared to its income level. For example, there are many infants who have contracted the tropical diseases including malaria in South Asia and Africa due to climatic conditions. This negatively impacts the infant development in Africa whereas a climatic factor does not affect North Korea as much.

North Koreans' Current Living Conditions
Based on UNICEF Survey Results:
With a Focus on the Status of Infant Nutrition

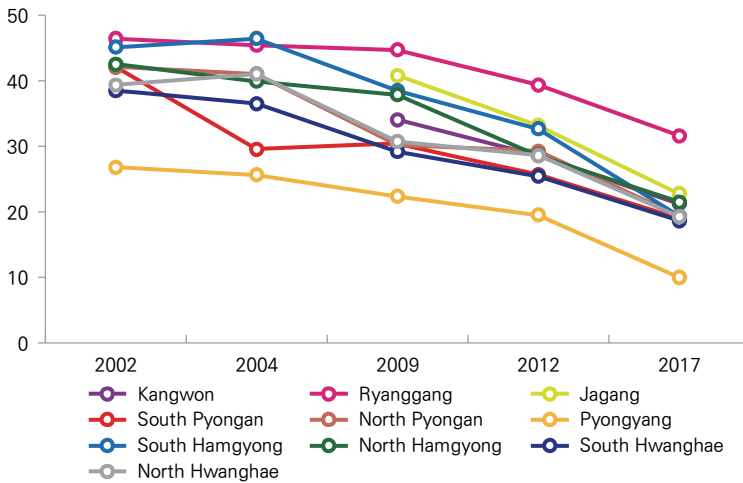
5. Regional Comparison Regarding North Korea's Infant Nutritional Conditions

This paper reviews how a regional gap on infant nutrition has changed over the long haul. Such a review could promote an understanding of the regional gap in North Korea. In fact, the gap between Pyongyang and non-Pyongyang areas is known to be massive. In recent years, the gap is perceived to have increasingly been widening because Pyongyang residents' living conditions have seemingly improved remarkably under the Kim Jong Un era as reported by the media.

The information on non-Pyongyang regions, however, is significantly lacking except for some North Korea-China border areas and several cities and provinces because it is hard for the outsiders to have access to North Korean region aside from its capital, Pyongyang. Therefore, a widening regional gap between Pyongyang and other regions has mostly been reported based on circumstantial evidence and thus such an evaluation was not sufficiently backed by objective data.

The international survey generally covers almost all the regions of the DPRK and provides related statistics per region. To that end, utilizing such surveys could be of help to more objectively appreciate North Korea's regional gap.

<Figure 12> Infant Chronic Malnutrition per Region in North Korea (Unit: %)



Data: Please refer to the text

Figure 12 shows the percentage of infant chronic malnutrition per region identified through international surveys from 2002 to 2017. The starting year was set as 2002 since province-based statistics were only available after a 2002 survey.

There are several characteristics in Figure 12 as follows. First, there has been a continuous decline for chronic malnutrition rate across all regions. Although it was varied per region as to when the decline was the most severe, the common trait was that all regions saw a fall of a minimum 15% pt to the maximum of 26% pt over the last 15 years. As of 2017, Pyongyang, South and North Pyongan, South Hamgyong, and South and North Hwanghae showed a low chronic malnutrition rate. North Hamgyong, Kangwon, and Jagang were recorded a high rate when viewed from the WHO criteria. Only Ryanggang Province showed a very high percentage.

Such a result indicates that an advancement of North Korea's living conditions is not only a regional phenomenon but also a nation-wide one. In fact, North Korea's state finance was significantly weakened with a de facto collapse of the rationing system since the Arduous March in the 1990s. Therefore it makes a sense to predict that chronic malnutrition rate in some regions with relatively vulnerable food insecurity could have gone up. The opposite patterns, shown against such an assumption, are well-explained by an evaluation that the DPRK's advanced marketization has enhanced the efficiency of resource distribution.

Second, it is fair to assess that the regional gap between Pyongyang and non-Pyongyang areas has somewhat increased. Although the gap between Pyongyang and other areas except for Ryanggang Province had narrowed in a 2017 survey compared to the early 2000s, the gap still exists. Changes that took place under the Kim Jong Un era could be discovered by utilizing the survey findings of 2012 and 2017, which cannot be easily identified only with Figure 12.

To get a more accurate picture, Table 3 shows a change of chronic malnutrition rate under the Kim Jong Un era with regions divided between Pyongyang and non-Pyongyang areas. Although the range of change does not significantly differ, the rate of change was higher in Pyongyang at 48.5% vis-a-vis non-Pyongyang areas at 30.4%. Table 3 reinforces the generally-held perception that the gap between Pyongyang and non-Pyongyang areas has been much more widening under the Kim Jong Un era.

<Table 3> Change of Regional Gap in Chronic Malnutrition Rate under the Kim Jong Un Era

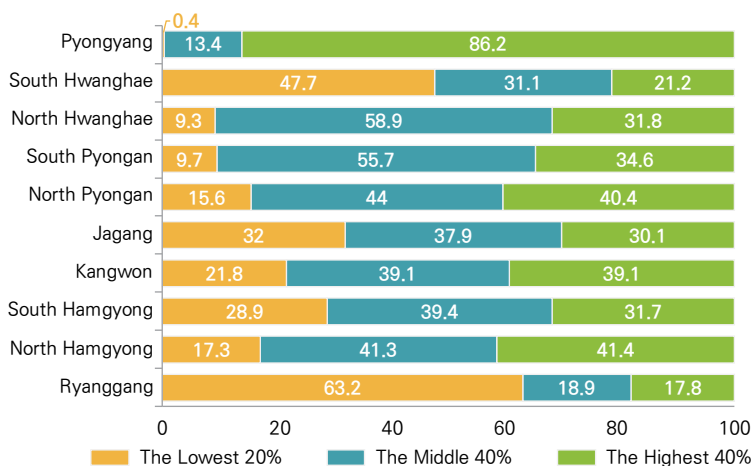
	2012(A)	2017(B)	Range of Change (B-A)	Rate of Change (1-B/A)
Across the Country	27.9%	19.1%	8.8%pt	31.6%
Pyongyang	19.6%	10.1%	9.5%pt	48.5%
Non-Pyongyang	29.2%	20.3%	8.9%pt	30.4%

Data: DPRK CBS, Democratic People's Republic of Korea Final Report of the National Survey 2012, 2013; DPRK CBS, DPR Korea Multiple Indicator Cluster Survey 2017, Final Report, 2018.

Third, it is noticeable that the chronic malnutrition rate had standardized in all regions except for Ryanggang Province and Pyongyang in the 2010s. In a 2009, 2012 and 2017 survey, the chronic malnutrition was the highest in Jagang Province among eight provinces except for Ryanggang Province and Pyongyang while South Hwanghae Province recorded the lowest chronic malnutrition rate. The gap between Jagang and South Hwanghae Province has been in decline. Then why the chronic malnutrition rate shows declining patterns in all regions except for Pyongyang and Ryanggang Province? Why chronic malnutrition in Ryanggang Province is especially high?

It is not easy to carry out an analysis on those issues since North Korea's regional information is very limited and the time series data is all the more difficult to obtain. From the bigger perspective, however, some of the causes can be uncovered with the use of regional gap in food production, income level, and the level of marketization. However, it could not provide enough explanation for those questions.

<Figure 13> Class Distribution per Region (Unit: %)²³⁾



Data: DPRK CBS, DPR Korea Multiple Indicator Cluster Survey 2017, Final Report, 2018.

For example, there exist two causes behind the unusually high chronic malnutrition rate in Ryanggang Province. When factoring in the size of properties in Ryanggang Province as specified in Figure 13, the lowest 20% of class was fairly higher than other areas in Ryanggang. In addition, market density, calculated by the number of markets divided by dimension, is evaluated to be the lowest. This could be indicative of relatively lagging access of Ryanggang Province residents to markets.

Such data, however, does not sufficiently explain why the chronic malnutrition rate tends to be in decline in all regions

23) A survey on the level of property was conducted in a 2017 MICS. The criteria of evaluating the property level include the number of rooms per household, the possession of electronic products such as TV, electronic rice cooker, and refrigerator, the ownership of agricultural land and livestock, and the possession of motor cycle, computer, and cell phone. The findings were categorized into the upper 40%, middle 40%, and lowest 20%.

except for Pyongyang and Ryanggang Province, which requires further research.

What should be highlighted regarding regional comparison is that there still exist vulnerable areas within North Korea. Ryanggang Province seems to be in poorer situation compared to other regions in terms of either the percentage of infant chronic malnutrition or the rate of the lowest 20% population. However, the DPRK is evaluated to be not capable of taking actions to improve such a vulnerable situation at the central government level in those regions. In other words, there still exist some vulnerable regions in need of outside assistance even though infant nutritional state has rapidly advanced in North Korea.

Equally important to note is that there remains a gap on infant nutritional status between North Korea and other advanced countries including South Korea, even with the North's relatively sounder level of infant nutrition among underdeveloped countries. As of 2017, North Korea's infant malnutrition rate was quite higher compared to middle-income countries (6.4%) and high-income countries (2.5%).²⁴⁾ Such figures indicate that although the DPRK's living conditions have advanced from the past, there is a long way to go with many unresolved tasks lying ahead and that the international community needs to continuously provide active assistance for the betterment of people's living conditions in North Korea.

24) UNICEF, "Levels and Trends in Child Malnutrition," 2018, p. 10.

