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Child Nutritional Intake Effects on Health Outcomes in Cameroon

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ABSTRACT

The aim of this study is to evaluate the effect of nutritional intake on child health endowments in Cameroon and to verify the heterogeneity effect by household place of residence. The data was obtained from the 2018 Demographic and Health Survey, while the instrumental variable is used to estimate the result. The findings showed the existence of a positive and significant relationship between child nutritional intake and health outcomes and the result is more of rural phenomenon. The study suggest that policy makers should promote the consumption of balance diet among children of under five years old.

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1. Introduction

Childhood is the stage in a human's life associated with growth and development. Growth proceeds rapidly in early life, slows down in middle childhood and accelerates at puberty before linear growth ceases. With increasing age there is also physical and psychomotor maturation, which influences activity, body composition, feeding skills and food choices (Geissler, 2011). Adequate nutrition is essential for growth, health and development of children. Poor nutrition increases the risk of illness, and is responsible directly or indirectly for one third of the estimated 9.5million deaths that occurred in 2006 in children less than 5 years of age. Inappropriate nutrition can also lead to childhood obesity (WHO, 2009).

The UNICEF (2013) emphasize that nutritional status is influenced by three broad factors: food, health and care. Optimal nutritional status results when children have access to affordable, diverse, nutrient-rich food; appropriate maternal and child-care practices; adequate health services; and a healthy environment including safe water, sanitation and good hygiene practices. These factors directly influence nutrient intake and the presence of disease. The interaction between under nutrition and infection creates a potentially lethal cycle of worsening illness and deteriorating nutritional status. Food, health and care are affected by social, economic and political factors. The combination and relative importance of these factors differ from country to country. Understanding the immediate and underlying causes of under-nutrition in a given context is critical to delivering appropriate, effective and sustainable solutions and adequately meeting the needs of the most vulnerable people.

The 2013 Lancet series on Maternal and Child Nutrition estimated that the aggregate global burden of under nutrition causes over three million child deaths per year. Stunting prevalence in children under 5 years also affects at least 165 million children, (Black et al., 2016). Recent reviews of the contribution of agriculture in improving nutrition (Masset et al., 2011) conclude that although agricultural programmes have immense potential to improve nutrition, this potential is yet to be unleashed. Current evidence suggests that limitations in the design, targeting and implementation of agricultural interventions, as well as their lack of clarity in nutrition goals and the exact interventions which are being provided, are partly responsible for this weak evidence Ruel et al (2013).

In Cambodia, 62% of children and 47% of women of childbearing age are anemic National Institute of Public Health (NIPH) (2005). The prevalence of night-blindness, a symptom of vitamin A deficiency, is 0.7% among children aged 18 to 60 months and 8.0% among pregnant women (Black et al., 2016). According to the WHO, this level of night-blindness in a population represents a mild to severe public health problem (WHO, 2009). Furthermore, 37% of children under 5 years of age are stunted (heightfor-age z-score (HAZ)), 36% are underweight (weight-for-age z-score (WAZ)), and 7% are wasted (weight-for-height z-score (WHZ)) (NIPH, 2005). Women and children in Cambodia are clearly at risk for nutritional deficiencies and would probably benefit from well-designed and well-implemented programs to improve micronutrient intake.

Child health has long been a major focus of the human capital analysis in development economics literature, where child health production functions have been estimated using heights and weights as health metrics (Ruel et al., 2013). Households invest in child health because it is a source of both utility and long-run labor productivity (Black et al., 2016). In modern health economics literature, child health is the state of complete wellbeing of children from age 0-59 months, and is determined by four factors: genetics, parents' lifestyles, the environment and the socioeconomic status of households. The health of a child is disrupted by disease, illness, deformity, unwanted events or shocks, injury, and disability (Black et al., 2016).

Many children in less developed countries suffer from poor health and nutrition. The United Nations estimates that one third of preschool age children in less developed countries – a total of 180 million children under age 5 – experience growth stunting relative to international norms (UNICEF, 2013), while hundreds of millions more suffer from tropical diseases, including malaria and intestinal parasites (WHO, 2009).To the extent that poor health and nutrition among children has a negative impact on their education, programs or policies that increase children's health status will also improve their education outcomes. Given the importance of education for economic development (World Bank, 2001), this link could be a key mechanism to improve the quality of life for people in less developed countries.

Many researchers have attempted to estimate the impact of nutrition and child health outcomes, but there are formidable obstacles to obtaining credible estimates. Data are often scarce (although they are much less scarce than in previous decades), but even more importantly there are many possible sources of bias when attempting to estimate relationships between child health and nutrition. This study provides an overview of what has been learned thus far, building on earlier reviews in Amy et al (2017).

Although significant progress has been made, much more research is still needed – especially in estimating the long term impact of child health status on living standards.

Pregnancy represents a unique époque in life with considerable potential to influence not only maternal health but also the health of the next generation. Nutrition plays a major role in maternal and child health and dietary interventions in pregnancy can influence maternal, fetal and infant health. Poor maternal nutritional status, along with maternal body composition, metabolism and placental nutrient supply, are the main factors that can negatively or positively influence fetal development and have been strictly related to adverse pregnancy outcome and expression of fetal genetic potential. Nevertheless, the association between maternal nutrition and birth outcome is quite complex and influenced by different biologic, socioeconomic, and demographic factors, which vary widely in different populations (Ruel et al., 2013). Understanding the relationship between maternal nutrition, pregnancy and birth outcomes may provide a basis for developing nutritional interventions that will improve birth outcomes and long-life health of the new-born, improving the quality of life and reducing mortality, morbidity, and health-care costs.

A number of studies have investigated the relationship between diet and unfavourable obstetric outcomes. This relationship can be examined at the level of nutrients, foods, or dietary patterns. It is immediately apparent that identifying the potential influence of single substances is difficult (Ruel et al., 2013). Nutrients from natural food sources are generally consumed in meals and not as isolated components, so that the usual diet contains thousands of nutrients, while the same substance is present in different foods and foods are not consumed independently of each other. Therefore, the use of dietary patterns, a measure of overall dietary behaviour, has become widespread in nutrition research in recent years as an alternative approach to studying individual components of the diet (Torjusen et al., 2012).

Optimal infant and young child feeding practices rank among the most effective interventions to improve child health. The WHO and UNICEF's global recommendations for optimal infant feeding state that an infant should be exclusively breastfed for the first 6months of life. Nutritionally adequate complementary feeding should start from the age of 6 months with continued breastfeeding up to 2 years of age or beyond (WHO, 2009).Poor breastfeeding and complementary feeding practices are however widespread. Worldwide it is estimated that only 34.8% of infants are exclusively breastfed for the first 6 months of life, the majority receiving some other food or fluid in the early months (Burke et al., 2005).Several studies suggest that obesity in later childhood and adolescence is less common amongst breastfed children, and that there is a dose response effect with a longer duration of breastfeeding associated with a lower risk of obesity (Harder et al., 2005).

Malnutrition is one of the most important health and welfare problems among infants and young children in Cameroon. It is a result of both inadequate food intake and illness. Inadequate food intake is a consequence of insufficient food available at the household level, improper feeding practices, or both. Improper feeding practices include both the quality and quantity of foods offered to young children as well as the timing of their introduction (Amy et al., 2017). Poor sanitation puts young children at increased risk of illness, in particular diarrheal disease, which adversely affects their nutritional status. Both inadequate food intake and poor environmental sanitation reflect underlying social and economic conditions. Malnutrition has significant health and economic consequences, the most serious of which is an increased risk of death (Burke et al., 2005). Other outcomes include an increased risk of illness and a lower level of cognitive development, which results in lower educational attainment. In adulthood, the accumulated effects of long-term malnutrition can be a reduction in workers' productivity and increased absenteeism in the workplace; these may reduce a person's lifetime earning potential and ability to contribute to the national economy. Furthermore, malnutrition can result in adverse pregnancy outcomes.

Nutrition improvement programmes have a unique, essential role to play in efforts to reach the MDGs. Good nutrition makes an essential contribution to the fight against poverty. It protects and promotes health; reduces mortality, especially among mothers and children; and encourages and enables children to attend and benefit from school. By indirectly strengthening communities and local economies, good nutrition contributes to the achievement of other development objectives which in turn impact upon the MDGs (Burke et al., 2005). For example, the increased participation of the poor and vulnerable and of women in the development process that may arise from effective community nutrition programmes will likely lead to more effective demands for improved services and to better use of existing resources. Clearly, comprehensive, mutually supportive policies and interventions designed to achieve the agreed goals and targets of the MDGs are needed. The use of nutritional goals and indicators and of participatory community nutrition approaches to design and monitor

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interventions would facilitate the development and implementation of such interventions (Amy et al., 2017).

It is against this backdrop that the researcher found it necessary to carry out a study on the contributions of nutrition on child health outcome in Cameroon. The research objectives are: to examine the determinants of nutritional intake in Cameroon and to evaluate the impact of nutritional intake on child health endowments and to verify the heterogeneity effect of child nutritional intake on health outcome by place of residence.

2. Literature Review

Many studies address the issue of child nutrition and health outcome in both developing countries and developed countries. We can place these studies very simply in two broad categories: the socioeconomic approach and the health approach. Amber and Barbara (2011) examined the frequency of shared family mealtimes in relation to nutritional health in children and adolescents. Their result shows that the frequency of shared family meals is significantly related to nutritional health in children and adolescents. Children and adolescents who share family meals 3 or more times per week are more likely to be in a normal weight range and have healthier dietary and eating patterns than those who share fewer than 3 family meals together. In addition, they are less likely to engage in disordered eating (Harder et al., 2005). They concluded that educational and public health initiatives aimed at promoting shared family mealtimes may improve nutritional health of children and adolescents. Clinicians may advise their patients about the benefits of sharing 3 or more family mealtimes per week; benefits include a reduction in the odds for overweight (12%), eating unhealthy foods (20%), and disordered eating (35%) and an increase in the odds for eating healthy foods (24%) (Burke et al., 2005).

Laura et al (2004) in their publication titled "Under nutrition as an underlying cause of child deaths associated with diarrhoea, pneumonia, malaria, and measles" whose objectives were to examine whether the risk of dying because of underweight varies by cause of death and to estimate the fraction of deaths by cause attributable to underweight. Data were obtained from investigators of 10 cohort studies with both weight-for-age category and cause of death information. With use of weighted random effects models, we related the log mortality rate by cause and anthropometric status in each study to derive cause-specific rates of dying because of under nutrition. Prevalence of each weight-for-age category were obtained from analyses of 310 national nutrition surveys (Burke et al., 2005). With the used of rates and prevalence information, they then calculated the fraction of deaths by cause attributable to under nutrition. Overall, 52.5% of all deaths in young children were attributable to under nutrition, varying from 44.8% for deaths because of measles to 60.7% for deaths because of diarrhoea. A significant proportion of deaths in young children worldwide is attributable to low weight-for-age, and efforts to reduce malnutrition should be a policy priority (Black et al., 2016).

Breastfeeding and timely introduction of complementary foods were shown to protect against obesity later in life in observational studies. High-protein intake during early childhood however was associated with higher body fat mass and obesity in adulthood. In developed countries, increased weight gain during the first two years of life was associated with a higher body mass index in adulthood (WHO, 2009). However, recent studies in developing countries showed that higher BMI was more related to greater lean body mass than fat mass. Future research on the relationship between breastfeeding, timely introduction of complementary feeding or rapid weight gain and obesity are warranted in developing countries. The focus of interventions to reduce risk of obesity in later life in developing countries could include: improving maternal nutritional status during pregnancy to reduce low birth weight; enhancing breastfeeding (including durations of exclusive and total breastfeeding); timely introduction of high-quality complementary foods (containing micronutrients and essential fats) but not excessive in protein; further evidence is needed to understand the extent of weight gain and length gain during early childhood are related to body composition in later life (Yang and Huffman, 2013).

Scaglioni et al (2018) in his paper titled "Nutrition and Health Outcomes Associated with Food Insecurity and Hunger". His paper explores how food insecurity and hunger relate to health and nutrition outcomes in food-rich countries such as the United States. It focuses on two subgroups of the population for whom data are available: women of childbearing age and school-age children. Special consideration is given to examining how food insecurity relates to these outcomes independently of socioeconomic status and poverty (Grantham-McGregor et al., 2016). In a population-based sample of women of childbearing age, the least severe level of food insecurity (household food insecurity) was correlated with higher body mass index, controlling for other available and known influences on obesity including income level. In low income school-age children from two large urban areas of the U.S., risk of hunger and hunger were associated with compromised psychosocial functioning, controlling for maternal education and estimated household income (Yang and Huffman, 2013). The

nutrition and health consequences of food insecurity comprise a potentially rich area for future, socially relevant research in the field of nutritional sciences.

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3. Theoretical Framework

Theoretically, we used a reduced form of reproductive health function as proposed by Mwabu (2009) to study the determinants of child health in rural Cameroon. As structured by WHO (2009) authors in the health literature, the demand for child health services by a mother is analyzed using a model in which child health production in utero is embedded in a utility maximizing behavior of the mother, this implies the demand for child health care can be analyze within the framework of utility maximization behaviour of the mother.

However, it should be noted that child health and health in general, provides utility not only directly but also indirectly, as it is a key input into many household production processes. Family health, especially child health is an important component of economic growth and poverty reduction because it shapes both present and future human capital, as well as livelihood prospects (Black et al., 2016). Thus, good health at childhood as argued, does not only affect the physical growth potential, risk of morbidity and mortality in later years of life; but also releases potential household savings, medical expenditures and extra time to adult household members to take more advantage of labour market opportunities, as well as the child's capacity to learn and prospects for better future standards of living. In this regards, children's health can be considered as an important input in the well-being production function of the household registering mainly indirect effects on household income via the extra time (Oliveira and Frazão, 2015).

Here, we envisage a framework in which household utility function encompasses child health, which is captured in this study by child health registered in the 2018 Cameroon's DHS data. As observed in Mwabu (2009), anthropometric measurements of child health/nutrition tend to be positively associated in many studies with a child's chances of survival, later health status, subsequent performance in school and eventually productivity as an adult worker. The household provides the environment in which individuals produce and consume health and other goods and services. In addition to providing its members with an environment for production and consumption of private and public goods, the household also provides the mechanism for intra household allocation of essential commodities such as health care, food, clothing and reproductive health services. This allocation mechanism is important because it determines the well-being of all household members (Yang and Huffman, 2013). Thus, estimation of the parameters of the child health production function requires knowledge of inputs into the process and since inputs and outputs are jointly determined, causality might also occur in the other direction. Moreover, many studies have shown that economic development is a key determinant of health outcomes (Laura et al., 2004). Therefore, we will use a conventional method to reduce the problem of endogeneity by using the control function approach which subsumes the instrumental variable (IV) method.

4. Methodology

As implied earlier, the utility maximization behaviour of the mother given the reproductive health production function is subject to a budget constraint where health investment goods are purchased only for the purpose of improving child health, so it enters the mother's utility function only through the health status of the child in utero. The child health production function has the property that it is imbedded in the constrained utility maximization behaviour of the mother; structurally this has been re-expressed to yield health care demand functions (Tambi, 2014).

Generally, good health of household members is one of the critical components influencing the potential of households, it permits individuals in the household to increase their productivities, earnings as adults and so reduce poverty. The 2018 DHS permit joint estimation of models of child health care demand and health production, we estimate demand for nutritional intake simultaneously with a model of child health determination. Changes in prices of health-neutral goods also affect child health through the household budget constraint. Thus, policy-makers need to know the parameters of both child health production technology and associated health input demands to predict health effects of changes in input prices. To obtain such information, health production and input demand parameters must be estimated simultaneously. Such estimation is complicated by the need to identify input demands from health production technology. In our case, the estimation is further complicated by the need to identify the nutritional intake effect of the sample

selection rule to avoid biases in parameter estimates due to non-random selection of children into the estimation sample (Mwabu, 2009).

As concerning measurement issues Tambi (2014) observed that child health is the appropriate indicator for measuring child health as condition by nutritional intake, this explains why in the child health model, nutritional intake is assumed to improve child health in line with the complementarity hypothesis. The key determinants of child health include nutritional status, age of the mother, the quantity and quality of prenatal care services received by the mother, mother's immunization against preventable diseases and behavioural change during pregnancy such as quitting smoking (Black et al., 2016). Other factors such as areas of residence which are proxies for availability of health care and nutrients also affect the health of the child in the utero.

In this case, nutritional intake is endogenous to child health because it is a choice variable. As seen above, the central argument is not that tetanus vaccination directly increases child health but that vaccination is strongly correlated with health care consumption and behaviours that increase child health. By implication, the adoption of a specific behaviour or the uptake of a specific input improves health, creates incentives to engage in other health-augmenting behaviours or consumption that improve child health. Further Black et al (2016) noted that nutritional intake against is used as a proxy for medical care services received by the child. It is also assumed to be complementary to other inputs that improve the health of the child in the womb, such as presumptive malaria treatments and avoidance of risky behaviours (WHO, 2009).

Data Setting

We use the data set of the Cameroonian 2018 Demographic and Health Surveys (DHS). The DHS data were merged with price and infrastructure data from the Ministry of Agriculture and Rural Development. The unit of observation is a child aged 0-59 months. An important feature of our sample is that birth weight information is missing for 21,465 children, comprising 42 percent of the total sample. Also, most of the relevant literature in this study is gotten from searching the internet, books, reports, journal articles, newspapers. All these constitute data gotten from secondary source.

Following the WHO (2009), nutritional intake may be determine by factors such as: wealth index, mother's age at last birth, education, husband's occupation, ever using contraception, fertility preference, wanted last child, having permission to go to hospital/health center, pregnancy complications and mass media exposure for receiving tetanus vaccination. The instruments for tetanus vaccination are needed in order to consistently estimate the effect of vaccination on child health. The instruments for tetanus vaccination are factors that affect demand for food without influencing directly the child health, however, as stated above, child health itself is determine by other factors such as nutritional status, age of the mother, areas of residence..., which are proxies of availability of health care also nutrients affect the health of the child in the uterus. Based on these, the child health production function may take the structural form:

(1)

where, CH is Child health; is a vector of inputs into child health production including Nutritional intake status of the child; is a vector of exogenous covariates (child sex, mother's age…); is the parameter of the potentially endogenous explanatory variables (including nutritional intake) in the child health function, is the vector of parameters to be estimated and is the error term that captures both random effects and unobservable variables. The estimation of the parameter would show the effect of nutritional intake and other inputs into child health production. Following Tambi (2014) the reduced form demand function for inputs (including nutritional intake) into the production of child health takes the form:

(2)

5. Result Presentation

Weighted Sample Descriptive Statistics

Child health in this study is capture at the community level, with about 77.8 percent of children living in different homes were covered among the 21,456 households sampled and in which 45 percent of households had child nutritional intake; 72 percent of married couples in the households while 51 percent of these families watches television.

Table 1. Weighted Sample Descriptive Statistics

Variable	**Weighted Sample Descriptive Statistics**			

	Mean	SD	Min	Max
Outcome variable				
Weight for age z-score	-0.7789353	1.364166	-5.49	5.54
Main endogenous variable				
Child nutrition intake (child consume balance diet)	0.3454193	0.2082308	0	1
Instrument for endogenous variable				
Prices of goods in the market	153.765	33.92115	118	235
Exogenous demographics				
Mother's education in complete years	4.593339	4.046172	0	17
Fertility	4.319169	2.617252	1	15
Mother's age	28.49593	6.975576	15	49
Mother's age at first birth	18.5163	3.58033	12	39
Married couples	0.7263327	.4458592	0	1
Father's presence in the house	0.724314	.4468784	0	1
Mother working in labour market	0.6845337	.4647211	0	1
Father's education	5.056658	4.871342	0	17
Birth interval	37.29092	21.36349	9	227
Household size	10.21253	5.599108	1	13
Family watching television	0.5128643	.4998559	0	1
Children under 5 years in the house	2.783987	1.733515	0	19
Ethnicity	4.614853	2.688757	1	10
Non poor household	0.5383972	.4985447	0	1
Urban residence	0.3943723	.4887363	0	1
Total	21,465			

Source: Computed by author 2018 DHS; Min = minimum, Max = maximum

The descriptive statistics shows that 72 percent of men live in their homes with a maximum family size of 13 persons of which only 39 percent live in urban centers. Also from these statistics, 68 percent of the mother work or participate in the labour market which adds up the household wealth of these households to 53 percent as seen in Table 1.

Determinants of Level of Child Nutritional intake

Based on the reduced form estimates, the determinants of the level of Nutritional intake in Cameroon and its correlates are indicated in Table 2. Here, parental education increases the opportunity cost of spending to have good child nutritional intake in particular and a better child outcome in general. Education acquired helps to improve on child health outcome, hence father and mother variables simply revealed that the more an individual is educated, the more he is ready to pay to avoid any form of economic poor health outcome.

In Cameroon, issues related to health in particular generally known as first aid are gradually being introduced into the primary and secondary education cycles, this is very important in the sense that early awareness can motivate great precautions on the part of the citizens vis-à-vis health problems and so far as child nutritional intakes are concern. This result is consistent with the observation of WHO (2009), who revealed that the more than three million children below five years that die each year from child nutritional intake causes and conditions may be due to parental education/knowledge on nutritional issues as presented in column one of Table 2.

Table 2. Reduced-form parameter estimates of determinants of Nutritional intake

Variable	**Estimation Method: Probit regression**		
	Child Nutritional intake		
	Coeff	Std. Err	Z
Prices of goods in the market	0.43196***	0.1183453	3.65
Mother's education in years	0.0425***	0.0101	4.21
Fertility	0.0705***	0.0260	2.71
Mother's age	-0.0377***	0.0101	-3.72
Mother's age at first birth	0.0306**	0.0122	2.51
Married couples	0.0449	0.0723	0.62
Father's presence in the house	0.1354*	0.0713	1.90
Mother working in labour market	-0.1954***	0.0555	-3.52
Father's education	-0.0020	0.0066	-0.30
Birth interval	0.0044***	0.0013	3.31
Household size	0.0094	0.0082	1.15
Family watching television	0.1744**	0.0722	2.42
Children under 5 years in the house	0.0209	0.0260	0.80
Ethnicity	-0.0249*	0.0129	-1.92

Non poor household	0.1075	0.0848	1.27
Urban residence	0.1891***	0.0715	2.64
Constant	-2.2154***	0.1906	-11.62
Pseudo R2	0.0589	n/a	n/a
Wald	169.94 [15, 0.0000]	n/a	n/a
Observations	21,465		

Source: Computed by the author from 2018 DHS. Note: ***, ** and * indicate 1%. 5% and 10% levels of significance respectively. N/B: Dependent Variable is Child Nutritional intake

From the results of the regression analysis, the coefficient of mother's education in complete years is positive showing a positive relationship between mother's education in complete years and the likelihood for child nutritional intake. Therefore an increase in mother's education in complete years will lead to an increase the likelihood of child nutritional intake. Quantitatively, a unit increase in mother's education in complete years will increase the likelihood for child nutritional intake by the value of its marginal effect of 0.0425. This finding is therefore significant at a 1% level of significance. The coefficient of fertility is positive showing a positive relationship between fertility and the likelihood for child nutritional intake. Therefore an increase in fertility will lead to an increase the likelihood of child nutritional intake. Quantitatively, a unit increase in fertility will increase the likelihood for child nutritional intake by the value of its marginal effect of 0.0705. This finding is therefore significant at a 1% level of significance.

The coefficient of mother's age is negative showing a negative relationship between mother's age and the likelihood for child nutritional intake. Therefore an increase in mother's age will decrease in the likelihood for child nutritional intake. Quantitatively, a unit increase in mother's age will decrease the likelihood for child nutritional intake by the value of its marginal effect of 0.0377. This finding is therefore significant at a 1% level of significance. The coefficient of mother's age at first birth is positive showing a positive relationship between mother's age at first birth and the likelihood for child nutritional intake. Therefore an increase in mother's age at first birth will lead to an increase the likelihood of child nutritional intake. Quantitatively, a unit increase in mother's age at first birth will increase the likelihood for child nutritional intake by the value of its marginal effect of 0.0306. This finding is therefore significant at a 5% level of significance.

The coefficient of father's presence in the house is positive showing a positive relationship between father's presence in the house and the likelihood for child nutritional intake. Therefore an increase in father's presence in the house will lead to an increase the likelihood of child nutritional intake. Quantitatively, a unit increase in father's presence in the house will increase the likelihood for child nutritional intake by the value of its marginal effect of 0.1354. This finding is therefore significant at a 10% level of significance. The coefficient of mother's participation in the labour market is negative showing a negative relationship between mother's participation in the labour market and the likelihood for child nutritional intake. Therefore an increase in mother's participation in the labour market will decrease in the likelihood for child nutritional intake. Quantitatively, a unit increase in mother's participation in the labour market will decrease the likelihood for child nutritional intake by the value of its marginal effect of 0.1954. This finding is therefore significant at a 1% level of significance.

The coefficient of birth interval is positive showing a positive relationship between birth interval and the likelihood for child nutritional intake. Therefore an increase in birth interval will lead to an increase the likelihood of child nutritional intake. Quantitatively, a unit increase in birth interval will increase the likelihood for child nutritional intake by the value of its marginal effect of 0.0044. This finding is therefore significant at a 1% level of significance. The coefficient of family watching television is positive showing a positive relationship between family watching television and the likelihood for child nutritional intake. Therefore an increase in family watching television will lead to an increase the likelihood of child nutritional intake. Quantitatively, a unit increase in family watching television will increase the likelihood for child nutritional intake by the value of its marginal effect of 0.1744. This finding is therefore significant at a 5% level of significance.

The coefficient of ethnicity is negative showing a negative relationship between ethnicity and the likelihood for child nutritional intake. Therefore an

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increase in ethnicity will decrease in the likelihood for child nutritional intake. Quantitatively, a unit increase in ethnicity will decrease the likelihood for child nutritional intake by the value of its marginal effect of 0.0249. This finding is therefore significant at a 10% level of significance. The coefficient of urban residence is positive showing a positive relationship between urban residence and the likelihood for child nutritional intake. Therefore an increase in urban residence will lead to an increase the likelihood of child nutritional intake. Quantitatively, a unit increase in urban residence will increase the likelihood for child nutritional intake by the value of its marginal effect of 0.1891. This finding is therefore significant at a 1% level of significance.

The Pseudo R_2 of 0.0589 shows that 5.89% of variables that affects child nutrition have been included in our model. Therefore 5.89% of variations in child nutrition situation is being accounted for by the variables included in this current study. The Wald chi_2 statistics acting as the F ratio in this case is 6799.50 is far greater than its probability value of 0.0000 showing that the model is globally significant at the 1% level of significance. Therefore the findings from this study are 99% reliable for policy prescription.

Estimates of Nutritional intake and Child Health nexus

From the results of the regression analysis, the coefficient of child nutritional intake is positive showing a positive relationship between child nutritional intake and the likelihood for weight for age z-score which is a proxy for child health outcome. Therefore an increase in child nutritional intake will lead to an increase the likelihood of child health outcome. Quantitatively, a unit increase in child nutritional intake will increase the likelihood for child health outcome by the coefficient value of 0.1462. This finding is not significant implying that child nutrition has effect on child health outcome. The coefficient of mother's education in complete years is positive showing a positive relationship between mother's education in complete years and the likelihood for child health outcome. Therefore an increase in mother's education in complete years will lead to an increase the likelihood of child health outcome. Quantitatively, a unit increase in mother's education in complete years will increase the likelihood for child health outcome by the coefficient value of 0.7792. This finding is therefore significant at a 1% level of significance.

The coefficient of fertility is positive showing a positive relationship between fertility and the likelihood for child health outcome. Therefore an increase in fertility rate will lead to an increase the likelihood of child health outcome. Quantitatively, a unit increase in fertility will increase the likelihood for child health outcome by the coefficient value of 0.0493. This finding is therefore significant at a 1% level of significance. The coefficient of mother's age is negative showing a negative relationship between mother's age and the likelihood for child health outcome. Therefore an increase in mother's age will decrease in the likelihood for child health outcome. Quantitatively, a unit increase in mother's age will decrease the likelihood for child health outcome by the coefficient value of 0.1854.This finding is therefore significant at a 1% level of significance.

The coefficient of birth interval is positive showing a positive relationship between birth interval and the likelihood for child health outcome. Therefore an increase in birth interval will lead to an increase the likelihood of child health outcome. Quantitatively, a unit increase in birth interval will increase the likelihood for child health outcome by the coefficient value of 0.0035. This finding is therefore significant at a 1% level of significance. The coefficient of ethnicity is positive showing a positive relationship between ethnicity and the likelihood for child health outcome. Therefore an increase in ethnicity rate will lead to an increase the likelihood of child health outcome. Quantitatively, a unit increase in ethnicity will increase the likelihood for child health outcome by the coefficient value of 0.0651. This finding is therefore significant at a 1% level of significance.

Table 3. Linking Nutritional intake to Child Health Outcomes

Variable	**OLS**	**2SLS**
	WAZ	
Child nutrition intake	0.1462 (1.89)	0. 6046** (2.12)
Mother's education in complete years	0.0779*** (8.60)	0. 1100*** (5.24)
Fertility	0.0493** (2.44)	0. 1461***(2.59)
Mother's age	-0.0185** (-2.39)	-0. 0526***(-2.58)
Mother's age at first birth	0.0133 (1.40)	0. 0352* (1.93)

Married couples	0.1043 (1.63)	0. 2685** (2.10)
Father's presence in the house	0.0441 (0.76)	0. 1235 (1.25)
Mother working in labour market	-0.0480 (-1.01)	-0. 3325** (-2.13)
Father's education	0.0039 (0.66)	0. 0055 (0.59)
Birth interval	0.0036*** (3.05)	0. 0057*** (2.71)
Household size	0.0086 (1.43)	0. 0157 (1.58)
Family watching television	0.0364 (0.65)	0. 2207* (1.77)
Children under 5 years in the house	0.0037 (0.19)	-.0001 (-0.01)
Ethnicity	0.0651*** (6.23)	0. 0597*** (3.60)
Non poor household	0.3206 (4.74)	0. 3106*** (2.92)
Urban residence	0.0189 (0.31)	0. 1486 (1.30)
Constant	-1.9070*** (-12.26)	-1.8019*** (-7.23)
/uncensored	0.7499	0.9048
Wald/chi2 test	77.18 [11; 0.0000]	41.88 [14, 19842; 0.0000]
Joint F /(p-value) test for Ho: coefficients on instruments = 0/ Wald/chi2	n/a	17.57 [16, 11732; 0.0000]
Weak identification test: Cragg-Donald F-Stat [5% maximal IV relative bias]/ rho ()	n/a	7.233 [16.38]
Sargan statistic (over identification test of all instruments): (Chi-sq(2) P-val)/ sigma ()	n/a	10.721 [0.0011]
Durbin-Wu-Hausmantest for exogeneity of variables in (a) (p-value) above/Wald test of exogeneity	n/a	18.455 [0.0003]
Observations	21,465	

Source: Author, absolute value of robust t-statistics in parentheses beneath estimates. * indicates statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level, n/a = not applicable.

The Pseudo R_2 of 0.1464 shows that 14.64% of variables that affects child health outcome have been included in our model. Therefore 14.64% of variations in child health situation are being accounted for by the variables included in this current study. The Wald test probability value of 41.88 shows that the model is globally significant at 1% level of significant. Therefore the findings from this study are 99% reliable for policy prescription. From our 2SLS regression, we realized that child nutritional intake has a direct effect on health outcome at 5 percent level of significant, which also shows that as mother level of education, fertility, mother's age at first birth, mother's traveling increases, health outcome also increases at 1 percent level of significant respectively. Health outcome also increases as the family watches television together.

Child nutritional intake effect on child health by place of residence

In Table 4, we found out that, both the rural and urban having an effect on child nutritional intake in Cameroon. However, the male migrants seem to be fuelling more as compared to their female counterparts.

Table 4. The child nutritional intake effect on child health by place of residence

Variable	Urban	Rural
	WAZ	
Child nutrition intake	0.0623 (0.85)	0.8915* (1.65)
Mother's education in complete years	0.0352** (2.02)	0.1378*(-1.74)
Fertility	-0.0512 (-1.18)	0.3514** (1.22)
Mother's age	0.0057 **(2.32)	0.1039* (1.85)
Mother's age at first birth	0.0162 (0.99)	0.0512** (2.14)
Married couples	0.1574* (1.71)	0.1046 (0.42)
Father's presence in the house	0. 0401 (0.40)	0.0119*** (3.05)
Mother working in labour market	0.0731 (0.62)	-0.7235 (-1.58)
Father's education	-0.0007 (-0.09)	-0.0287 (-0.89)
Birth interval	-0.0002 (-0.13)	0.0051 (1.03)
Household size	-0.0174 (-1.29)	0.0232 (1.13)
Family watching television	0.0707 (0.65)	0.3511* (1.81)
Children under 5 years in the house	0.0318 (0.87)	0.0281 (0.39)
Ethnicity	0.0816*** (4.22)	-0.0204 (-0.36)
Non poor household	0.1126 (0.1126)	0.6303** (2.28)
Constant	-1.7777 *** (-5.79)	-0.5852*** (-30.62)
R-squared	0.7114	0.8613
LR chi2/F2: Prob> chi2	14.17 [15, 0.0000]	13.13 [15, 0.0000]
Number of observation	10,341	11,124

Source: Computed by the author from 2018 DHS

Further, lesser number of male who left the rural areas to the urban areas because of electricity will be unemployed at 1percent level of significance. Also a greater number of female who left the rural area for the urban areas because of the housing condition will be unemployed at 1 percent level of significant than male who left the rural areas for the same reason. Many women from large family size who migrated from rural to urban areas was faced with the problem of unemployment at 10 percent level of significant than the men who lift the rural areas for the same purpose at 1 percent level of significant.

According to our analysis, we realised that more of the rural residents have mothers who have complete years of education then mothers in the urban resident. This implies that more mothers in the rural residence are more likely to improve on their child nutrition than those mothers in the urban area which helps to give their children a better health outcome. This could be as a result of the abundant of natural food stuff found in the rural area. Ethnicity in the urban residence by results has a positive effect on child nutritional intake which is significant at 1 percent, while non-poor household in the rural resident has a positive relationship with child nutritional intake; likewise fertility in the rural residence. Still regarding rural residence, mother's age has a negative relationship with child nutritional intake implying that the older a mother gets, she becomes negligent to her child nutritional intake.

6. Conclusion

The research study was out to examine the contribution of child nutritional intake on health outcome in Cameroon. Our results show that there are strong and systematic factors that explain the child nutritional intake

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and health outcome in Cameroon. The main finding of the study is that child nutritional intake has a positive influence on health outcome; household health increases with increase in nutritional intake in Cameroon using the 2018 Cameroon Demographic and Health Survey. Data was collected on the major variables which affect child nutritional intake provided by children health outcome per head; these include: child nutritional intake, mother's education in complete years, mother's age, married couples, father's presence in the house, mother working in the labour market, father's education, price of food in the market, fertility and mother's age at first birth. The collected data was analysed using descriptive statistics, probité model, STATA 14 and the treatment of the data to cater for the mission variables.

Our results also reveal that child nutritional intake, mother's education in complete years, mother's age, married couples, father's presence in the house, mother working in the labour market and father's education have a positive effect on child nutritional intake. Children headed by married couple enjoy more nutritional intake than children headed by single parents; children who live with both parents who are working are better off and enjoy more nutritional intake than those living with a single parent who are not working in the labour market and educated persons are more likely to spend more than uneducated persons. On the other hand, price of food in the market, fertility and mother's age at first birth have a negative effect on child nutritional intake. Children with a fairly good, fair and poor nutritional intake will have a lower health outcome compared to those with a good nutritional intake.

Spending more on nutritious food improves overall wellbeing of households by improving their health. Endowments in health make people happy and directly influence the quality of household labour market participation. An increase in health stock implies an increase in market and non-market productivity. This is possible because health can also act as an investment input because good nutrition increases healthy hours at work and therefore earnings, as well as non-market hours for other activities. Healthy household heads will increase household income by working more effective hours and making savings on medical expenditures. In this regard, policies that promote access to nutrition and health practices should be encouraged. Nutrition must be perceived as an investment in human capital that promotes economic growth. Investment in health interventions is just like any other investment in development projects.

Given the current concern about the development of our country, the improvement in the nutritional intake and health outcome will reduction sickness on Cameroonians, this study recommend the following: health systems need to protect children against diseases through sensitisation of the need of balance diet and prepayment schemes, to the extent that such protection can be financed and sustained. The government should take appropriate measures to help cover the cost of treatments by instituting a health risk-sharing system through the development of health mutual benefit associations. Universal coverage should be the ultimate goal and will protect all households against the heavy burden of health expenditures. There is no unique pathway towards universal coverage that is appropriate for all, and certain public programmes must remain the sole responsibility of the government regardless of the choice of health financing options. These include "public goods" and programmes that generate measurable externalities, such as clean water, sanitation, health promotion and immunization.

In addition, governments' responsibilities to ensure that poor and vulnerable groups receive quality health services through a well-functioning primary health care network should not be undermined. These programmes can be financed by the government through taxes and other sources of revenue and, often but not always, are provided through state-owned facilities. Preventive nutrition schemes should be developed and households should be sensitized on taking adequate measures to regularly checking of their children so as to avoid unbearable sicknesses that lead to impoverishment and loss of welfare.

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