Association between maternal-related factors and malnutrition in infants and children aged under-five in Kampala

A cross-sectional survey research, carried out in Kampala, Uganda

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Abstract

Introduction: Almost half of the children aged under-five in Uganda is currently suffering from malnutrition. Two important maternal related factors regarding malnutrition are 'duration of breastfeeding' and 'maternal education-level'. However, no substantive research about these factors has been done since 2008. The associations between these factors and child malnutrition could have changed, due to a transformation in Africa with regard to perspectives on child and maternal health. It is therefore necessary to gain information about the aforementioned factors in relation to child malnutrition.

Methods: The design of this study was a cross-sectional survey research. Information was obtained through structured interviews with 109 mothers, which were done according to a questionnaire especially designed for this research. The outcome was malnutrition in children, based on their MUAC (mid-upper-arm-circumference) and the main determinants were 'duration of breastfeeding' and 'maternal education-level'. To analyze the data, a logistic regression model was used.

Results: The research population consisted of 109 mothers. Of every mother, one child was examined with regard to malnutrition. 47 out of 109 children were malnourished. There was no significant relationship between 'maternal education-level' and child malnutrition. The association between 'duration of breastfeeding' and child malnutrition was statistically significant: children, who have been breastfed less than 12 months, have a lower risk (OR 0.219; CI 0.060 – 0.806; p = 0.022) of being malnourished compared to children who have been breastfed between 12 and 18 months, with correction for 'age of the child', 'sex of the child' and 'HIV-status of the mother'.

Conclusion: Children who have been breastfed for a period between 12 and 18 months, have a higher risk of being malnourished, compared to children who have been breastfed for less than 12 months. A mother should not breastfeed for a period longer than 12 months. Future research should focus on the duration of breastfeeding with smaller categories than used in this study, on 'use of health services' and 'complementary foods' as possible confounders, and on HIV-status of the mother in relation to malnutrition in infants and children aged under-five.

Introduction

Malnutrition is currently one of the leading causes of morbidity and mortality in children aged under-five in developing countries throughout the world (Amsalu, Tigabu, 2008; Stadskleiv Engebretsen, Tylleskär, Wamani, Aramagi, & Tumwine, 2008; WHO, 2014). Almost 150 million children aged under-five in the developing world still suffer from malnutrition (UNICEF, 2007). It contributes to 2.2 million deaths and 20% of all disability-adjusted-life-years lost worldwide yearly (Stadskleiv Engebretsen, Tylleskär, Wamani, Aramagi, & Tumwine, 2008). Moreover, malnutrition affects the development of children negatively in terms of intellectual development, health and more dimensions of household welfare (Zere & McIntyre, 2003). Malnutrition is one of the measures of health status that the World Health Organization (WHO) uses for assessing equity in health (WHO, 2014).

Sub-Saharan Africa is often mentioned in studies on malnutrition. According to UNICEF, 15 out of the 21 countries with the highest prevalence of malnutrition in children aged under-five worldwide are Sub-Saharan African countries (UNICEF, 2013). Among these countries, Burundi has the highest prevalence (58%) and Guinea the lowest (40%). Uganda is also part of Sub-Saharan Africa and belongs to the least developed countries in the world (UBOS & ICF International Inc., 2011; UNICEF, 2013). According to the rapport "Improving Child Nutrition", conducted by UNICEF, Uganda is the 13th country on the list of the countries with the largest number of children aged under-five who are suffering from malnutrition. Nutrition and health reports in Uganda indicate that almost half of the children aged under-five is suffering from malnutrition (Abwola Olwedo, Mworozi, Bachou, Garimoi Orach, 2008; Kikafunda, Walker, Collet, Tumwine, 1998; WHO, 2014; Vella, Tomkins, Borghesi, Mgliori, Ariko & Crevatin, 1992; Zere and Macintyre, 2003). The WHO also states that the under five-mortality rate in Uganda is 69 per 1000 life births (WHO, 2014). All the aforementioned implicate that the situation in Uganda regarding malnutrition in 0-5 years olds is not yet improving, considering the large numbers of children who are still currently malnourished (WHO, 2014). To reduce and prevent malnutrition in Uganda is it necessary to gain knowledge about factors associated with malnutrition.

A study conducted by Kikafunda, Walker, Collet & Tumwine (1998) in Uganda, and a study conducted by Bicego and Boerma (1993) in 17 Demographic and Health Survey-countries (USAID, 2015), both state that the maternal-related factors 'duration of breastfeeding' and 'maternal education-level' are highly associated with malnutrition in infants and children aged under-5. According to Lartey (2008), women of childbearing age and infants and young children are the most vulnerable with regard to nutrition. Moreover, children who have been breastfed for too short (<12 months) or too long a period (>18 months) have a higher risk of being malnourished compared to children who have been breastfed for a period between 12 and 18 months (Kikafunda, Walker, Collet

3

& Tumwine, 1998; Lartey, 2008). This implicates that the duration of breastfeeding is associated with malnutrition in infants and children aged under-five (Abwola Olwedo, Mworozi, Bachou & Orach, 2008; Kikafunda, Walker, Collet & Tumwine, 1998; Lartey, 2008).

Furthermore, 'maternal education-level' has also been associated with nutrition-status in children aged under-five. Maternal education-level is a strong predictor for the prevalence of malnutrition in children aged under-five (Abuya, Ciera & Kimani-Murage, 2012). In a study about maternal education and child survival, it was found that children of women lacking any education fare worst with regard to their nutrition-status (Bicego & Boerma, 1993). Also, in a research conducted by Kikafunda, Walker, Collet and Tumwine (1998) lower education of the mother was significantly related with a low mid-upper-arm-circumference (MUAC) of her child. MUAC is strongly correlated with nutrition-status in children, which implicates that maternal education-level is associated with malnutrition in infants and children aged under-five (WHO, 2014).

Despite the aforementioned, research with regard to the association of maternal-related factors 'duration of breastfeeding' and 'maternal education-level' in relation to malnutrition is outdated. No substantive nutrition-survey has been done in Uganda since the last researches from Lartey and Olwedo, Mworozi, Bachou & Orach in 2008. At the moment, Africa is going through a transformation with regard to sociodemographic factors, among which child- and maternal health in relation to education and breastfeeding (Bain, Kum Awah, Geraldine et al, 2013). This could mean that the associations between 'duration of breastfeeding' and 'maternal education-level' in relation to child malnutrition have changed, compared to eight years ago. This is illustrated by the following: improvements in education of women in Africa accounted for 43 percent of the reduction in malnutrition among children between 1970 and 1995. This shows that there is a strong relationship between changes in education among women and malnutrition in children. Regarding the fact that the last research on the association between maternal education-level and child malnutrition is eight years ago, that association could have changed remarkably. Furthermore, among mothers, perceptions of the ideal duration of breastfeeding are influenced by local, regional and ethnic differences, religious beliefs, structure of the mother's daily activities, health of the child and opinions from health care professionals (Dettwyler, 2004; Lartey, 2008). All of these factors influence the perspectives on the ideal duration of breastfeeding, and therefore the relationship between breastfeeding and malnutrition in children.

It is therefore necessary to gain insight into the current relationships between the two maternal-related factors 'duration of breastfeeding' and 'maternal education-level' and malnutrition in infants and children aged under-5 years in Kampala, Uganda, which is the objective of this research. In this report, two main research questions will be answered: "What is the association between 'duration of breastfeeding' and malnutrition in infants and children aged under-five?" and

"What is the association between 'maternal education-level' and malnutrition in infants and children aged under-five?". Expected is that children whose mothers have received education, have a lower risk of being malnourished. Furthermore, expected is that a duration of breastfeeding between 12 and 18 months decreases the risk of malnutrition the most. The results of this study will be used to provide recommendations with regard to preventing malnutrition in infants and children aged under-5 years in Kampala, Uganda.

Methods

Design

The design of this research was a cross-sectional survey research, carried out in Kampala, Uganda during the months of March, April and May 2015. Information was obtained through a structured interview, which was done according to a questionnaire especially designed for this research. This questionnaire was based on the 2011 Uganda Demographic and Health Survey (UBOS & ICF International Inc., 2011). The questionnaire used in this study is attached in Annex 1. The questionnaires were conducted by way of structured interviewing, by a Dutch and a Ugandan researcher, for two reasons. First: that the Mid-Upper-Arm-Circumference (MUAC) of the respondents had to be taken independently by the researchers, and secondly: the respondents were often unable to read or write in English, which was the language of the questionnaire. Ugandan researchers, who cooperated in this study, translated the questions during the interviews.

Population

The study population consisted of mothers and their child aged under-five. To determine whether the infants and children were suffering from malnutrition, their mid-upper-arm-circumference was measured, which will be explained beneath.

Exclusion criteria included infants and children with diarrhea, fever, measles, skin infection, cough, and HIV because these factors could all cause malnutrition apart from maternal related factors and could influence the relation between the determinants and the outcome in this research (Abwola Olwedo, Mworozi, Bachou, & Garimoi Orach, 2008; Amsalu, & Tigabu, 2008; Kikafunda, Walker, Collet, & Tumwine, 1998). Further exclusion criteria included children aged 5 years and older and a lack of mother or caregiver to answer the questions in the questionnaire.

Sampling procedure

The mothers were approached in several public and private health clinics, governmental hospitals and in several slums, and were interviewed immediately after approaching them.

Anthropometric measurements

The measurement used to determine whether the children were suffering from malnutrition was the Mid-Upper-Arm-Circumference (MUAC). WHO standards for MUAC-for-age show that in a well nourished population, infants and children aged 6-60 months have a MUAC more than 115 mm (World Health Organization, 2009). Therefore, a cut-off point of 115 mm for MUAC was used to distinguish the malnourished children from the well-nourished children.

Dependent variable: outcome

The primary outcome of this study was malnutrition in infants and children aged under-five. Of each mother who was interviewed, one child was examined with regard to malnutrition, according to the aforementioned MUAC-cut-off points. The outcome was dichotomized, and therefore two groups were conducted: a group in which the infants and children were suffering from malnutrition, and a group in which the infants and children were well nourished.

Independent variables: main determinants

Two main independent variables were included in this research: 'duration of breastfeeding' and 'maternal education-level'. Information about 'duration of breastfeeding' and 'maternal education-level' was obtained in a structured interview according to the questionnaire. The two main determinants were categorized in advance.

The categories of 'duration of breastfeeding' were: breastfeeding <12 months, breastfeeding >12 and <18 months, and breastfeeding >18 months. In this case, the reference-category was breastfeeding >12 and <18 months. Literature states that breastfeeding for too short (<12 months) or too long a period (>18 months), creates a higher risk of being malnourished in children aged under-five (Kikafunda, Walker, Collet and Tumwine, 1998; Lartey, 2008).

The results of 'maternal education-level' were categorized based on the educational system of Uganda (The World Bank, 2013). The categories were: no education, primary education and higher education. "No education" was used as reference-category.

Effect modifiers

The relationship between the independent variables and the outcome could be different with regard to several possible effect modifiers, which are described below.

Maternal education-level

For de relationship between this main determinant and the outcome, there were three possible effect modifiers:

1. HIV-status mother. Members of HIV-affected households are often forced to drop out of school, and they have little chance of ever going back (Bennell, Hyde & Swainson, 2002).

2. Work of the mother. The level of education often determines the nature of the work someone does (Abuya, Ciera & Kimani-Murage, 2012).

3. Age of the mother. The age of a mother when she got her first birth, could determine whether she went to school or not. If she is still young, she might have dropped out of school due to the birth of her baby. If she is older, there is a good chance that she finished a higher level of education before her baby came (Nida, DePersio, Lorenz et al, 1995).

Duration of breastfeeding

For the relationship between this main determinant and the outcome, there were four possible effect modifiers:

1. HIV-status mother. Due to being HIV-positive, mothers sometimes do not breastfeed their children because, in this way, they could infect them. Therefore, breastfeeding practices are influenced by HIV-status of the mother (Bland, Rollins, Coutsoudis & Coovadia, 2002; Langa, 2010).

2. Work of the mother. This possible effect modifier is linked to socio-economic status: if a mother does not have a job, and therefore income, she could lack resources for complementary foods. In this way, it could be possible that she breastfeeds her child for too long (Gibson, Ferguson, & Lehrfeld, 1998).

3. Age of the child. According to the WHO, there are certain standards regarding until what age children have to be breastfed to stay well nourished. This implicates that there is a difference in the prevalence of breastfeeding among different aged of the child (WHO, 2013).

4. Sex of the child. There is a difference in prevalence of malnutrition between boys and girls aged under-5, according to the research of Sen & Sengupta (1983).

Confounding variables

Several possible confounders could influence the relationship between the independent variables and the outcome. Those are described below.

Maternal education-level

For this main determinant, there were three possible confounding variables:

1. Age of the child. In a research of Kikafunda, Walker, Collet, & Tumwine (1998) it was found that education had no significant relationship with infant malnutrition. However, when the age of the child was controlled for, there was a significant relationship between maternal education and

malnutrition of their child (p-value of .045). If the child is for example 4 years old and the mother is also very young, it could be possible that she quit her education due to the birth of her child. If another mother, who is the same age, has a child of 2 months, it may be possible that she could have finished her education before her child was born.

2. Use of health services for mother and for the child. When mothers are less educated, they know less about health and health status (Bicego & Boerma, 1993). Furthermore, the utilization of health services in developing countries is positively correlated with the poor quality of the health services (Haddad & Fournier, 1995). This could affect the health status, and therefore nutrition-status, of mothers and their children.

3. Sexual debut of the mother. Education is negatively correlated with sexual debut among young females (UBOS 2011; Gupta & Mahy, 2003). Furthermore, a research by Manzini (2001), suggests that young women in Africa are increasingly sexually active at an early age. This increases the risk of an unplanned pregnancy at early age (Manzini, 2001). An (unplanned) pregnancy at early age could result in the fact that a woman quits her education prematurely (Ferre, Gerstenblüth, Rossi, & Triunfo, 2009)

Duration of breastfeeding

For this main determinant, there were four possible confounding variables:

1. Complementary feeding. Complementary feeding influences both malnutrition and the duration of breastfeeding (WHO, 2003; Delgado & Matijasevich, 2013). This influence could be either positive or negative.

2. HIV-status mother. Breastfeeding practices are influenced by HIV-status of the mother (Bland, Rollins, Coutsoudis & Coovadia, 2002; Langa, 2010). HIV-status of the mother compromises her own nutrition-status. Maternal-malnutrition could endanger the nutrition-status of the child (Lartey, 2008).

3. Sex of the child. There is a difference in prevalence of malnutrition between boys and girls aged under-5, according to the research of Sen & Sengupta (1983). Furthermore, the sex of the child could influence the duration of breastfeeding (Jayachandran & Kuziemko, 2011).

4. Age of the child. It is likely that when the child ages, mothers stop breastfeeding. Also, age of the child is correlated with malnutrition, as older children are less often malnourished (Kikafunda, Walker, Collet and Tumwine, 1998).

Statistical analysis

To analyze the data, a logistic regression model was used. This regression was done in SPSS (Statistical Package for the Social Sciences) version 22.

Descriptive analyses

At first, variables 'age of the child' and 'sexual debut' were checked for normal distribution by comparing the mean and median and looking at their normality plots (histogram and normal Q-Q plot). 'Age of the child' was distributed normally; therefore it was not necessary to perform a log transformation. 'Sexual debut' seemed to be distributed differently, namely slightly tilted to the right. Therefore, a log transformation was performed, to see if the distribution would improve. This was not the case, and therefore the original variable was used, without the log transformation.

Furthermore, these two variables were also checked for linearity by transforming them into quartiles and performing a logistic regression analysis with the outcome. The variables were not linear with the outcome and therefore they were transformed into categorical variables. 'Age of the child' was transformed into tertiles and was used in the further analyses as a dummy-variable with two dummies. 'Sexual debute' was transformed into quartiles and was used in the further analyses as a dummy-variable with three dummies.

Besides that, the variable 'use of health services' was checked for normal distribution within the variable. As this was a categorical variable, the distribution among the categories within the variable was checked. The categories 'traditional practicer', 'pharmacy' and 'other' were relatively small when compared to the other categories. Therefore they were merged into the category 'other health services'.

Crude analyses

After the descriptive analyses, two crude analyses were done, in which the associations between the main independent variables ('duration of breastfeeding' and 'maternal education-level') and the outcome (child malnutrition) were analyzed. The regression coefficients are important in this respect, because they assume a specific value that is meaningful to determine possible confounding. This value was memorized.

Effect modification

After assessing the crude models, the associations between the main determinants and the outcome were checked for effect modifiers. At first, effect modification was checked for the main determinant 'maternal education-level'. Possible effect modifiers were: 'HIV-status of the mother', 'work of the mother' and 'age of the mother'. A model using logistic regression was made, in which interaction terms were made of each possible effect modifier, combined with the main determinant. If the p-value of an interaction variable was significant ($p < 0.05$), the results would be stratified for that variable. None of the aforementioned possible effect modifiers turned out to be an actual effect

modifier. Therefore, the results of the association between 'maternal education-level' and the outcome did not need to be stratified.

Secondly, effect modification was checked for the main determinant 'duration of breastfeeding'. Possible effect modifiers were: 'HIV-status mother', 'work of the mother', 'age of the child' and 'sex of the child'. The aforementioned process was repeated. None of the aforementioned possible effect modifiers turned out to be an actual effect modifier. Therefore, the results of the association between 'duration of breastfeeding' and the outcome did not need to be stratified.

Confounding

Furthermore, the associations between the main determinants and the outcome were checked for confounding. First, another association model using logistic regression was made, in which the relationship between 'education of the mother' and the outcome was examined, controlling for the possible confounding variables 'age of the child', 'use of health services' and 'sexual debut of the mother'. The confounders were put in these models separately. The strongest confounder would be included in a model with the main determinant, and the search for possible confounding would continue with the confounders left. All the variables turned out to be confounders. Therefore, the final model consisted of the main determinant 'maternal education-level' and the three aforementioned confounding variables.

Secondly, an association model using logistic regression was made, in which the relationship between main determinant 'duration of breastfeeding' and the outcome was examined, controlling for the possible confounders 'complementary food', 'HIV-status mother', 'sex of the child' and 'age of the child'. The aforementioned process was repeated. All the variables turned out to be confounding variables. But in the final model, complementary food was excluded: this will be explained in the discussion-paragraph.

Results

The research population consisted of 109 mothers. Of every mother, one child was examined with regard to malnutrition. 47 out of 109 children were malnourished. The minimum age of the mothers was 16 years; the maximum age was 43 years with a mean age of 27.4 years (SD=6.2). The participants all had different religions, the largest group being protestant (27.5%). The most of the participants belonged to the Muganda tribe (48.6%), followed by the Musoga tribe (17.4%) the Myankole tribe (8.3%) and the Ateso tribe (5.5%). 74.3% of the participants was married, followed by 11.9% being divorced or separated and 6.4% being a widow. With regard to the outcome (malnutrition), 47 out of 109 children (43.1%) were malnourished. Concerning 'maternal education-level', the largest group consisted of participants who completed primary education (45%), followed

by higher education (43.1%) and no education (11.9%). The oldest women are educated the highest (mean 27.7, SD 6.6). The largest group of women from the Muganda tribe is educated on primary level. Most married women are primary educated and the largest percentage of women that have a job is found in the category "higher education". Most malnourished children are found in the category primary education (n=25). (Table 1)

Table 1 Baseline characteristics of main determinant 'maternal education-level', stratified for categories 'no education', 'primary education' and 'higher education'

Baseline characteristic	Overall (N=109)	No educ. (N=13)	Primary educ. (N=49)	Higher educ. (N=47)
Year of birth mother, mean (SD)	1987 (6.21)	1987.7 (7.7)	1987.2 (5.8)	1986.5 (6.3)
Age mother, mean (SD)	27.4 (6.5)	26.2 (8.2)	27.3 (6.0)	27.7 (6.6)
Protestant, No. (%)	30 (27.5)	2 (15.4)	12 (24.5)	16 (34.0)
Muganda Tribe, No. (%)	53 (48.6)	9 (69.2)	25 (51.0)	19 (40.4)
Married, No. (%)	81 (74.3)	9 (69.2)	37 (77.1)	35 (76.1)
Divorced/ Separated, No. (%)	13 (11.9)	3 (23.1)	5 (10.4)	5 (10.9)
Widowed, No. (%)	7 (6.4)	1 (7.7)	4 (8.3)	2 (4.3)
HIV-positive, No. (%)	35 (32.1)	5 (38.5)	18 (39.1)	12 (25.5)
Sexual debut, mean (SD)	17.5 (2.5)	15.6 (1.8)	17.2 (2.3)	18.5 (2.4)
Has a job, No. (%)	41 (37.6)	3 (23.1)	18 (37.5)	20 (43.5)
Age child, mean (SD)	1.5 (1.1)	2 (1.5)	1.4 (1.0)	1.38 (1.1)
Sex child boy, No. (%)	56 (51.4)	5 (38.5)	20 (40.8)	31 (66.0)
Malnourished child, No. (%)	47 (43.1)	4 (30.8)	25 (51.0)	18 (38.3)

With regard to the duration of breastfeeding, out of the 109 participants, 35 breastfed their child for less than 12 months (32.1%), 47 participants breastfed their child for a period between 12 and 18 months (43.1%) and 18 participants breastfed their child for more than 18 months (16.5%). 8.3% of the participants did not breastfeed their child. Most of the married mothers breastfeed their child for a period between 12 and 18 months (n=22). A number of twelve HIV-positive women breastfeed their child for a period less than 12 months, and as many HIV-positive women breastfeed their child between 12 and 18 months. Women who breastfeed their child for a period between 12 and 18

months started having sex at the highest age (mean=17.8 years). Most malnourished children are found in the category breastfeeding between 12 and 18 months (n=26).

Table 2 Baseline characteristics of main determinant 'duration of breastfeeding', stratified for categories '<12 months', 'between 12 and 18 months', '>18 months' and 'did not breastfeed'

Baseline characteristic	Overall (N=109)	<12 months (N=35)	Between 12 & 18 months (N=47)	>18 months (N=18)	Did not breastfeed (N=9)
Year of birth mother, mean (SD)	1987 (6.2)	1989.9 (5.3)	1985.1 (6.1)	1987.4 (4.4)	1985 (8.8)
Age mother, mean (SD)	27.4 (6.5)	24.2 (5.5)	29.4 (6.4)	26.7 (4.6)	29.8 (8.7)
Protestant, No. (%)	30 (27.5)	10 (28.6)	14 (13.0)	3 (16.7)	3 (33.3)
Muganda Tribe, No. (%)	53 (48.6)	18 (51.4)	22 (46.8)	9 (50.0)	4 (44.4)
Married, No. (%)	81 (74.3)	30 (85.7)	33 (71.7)	14 (77.8)	4 (50.0)
Divorced/ Separated, No. (%)	13 (11.9)	2 (5.7)	6 (13.0)	3 (16.7)	2 (25.0)
Widowed, No. (%)	7 (6.4)	2 (5.7)	3 (6.5)	1 (5.6)	2 (25.0)
HIV-positive, No. (%)	35 (32.1)	12 (35.3)	12 (25.5)	4 (25.0)	7 (77.8)
Sexual debut, mean (SD)	17.5 (2.5)	17.6 (3.0)	17.8 (2.1)	16.9 (2.6)	17 (2.5)
Does have a job, No. (%)	41 (37.6)	15 (42.9)	18 (39.1)	5 (29.4)	3 (33.3)
Age child, mean (SD)	1.47 (1.1)	0.9 (1.2)	1.7 (0.8)	1.6 (1.4)	2 (0.7)
Sex child boy, No. (%)	56 (51.4)	20 (57.1)	23 (48.9)	7 (38.9)	6 (66.7)
Malnourished child, No. (%)	47 (43.1)	9 (25.7)	26 (55.3)	6 (33.3)	6 (66.7)

Results of the association between 'maternal education-level' and child malnutrition

For the association between 'maternal education-level' and child malnutrition, no effect modifiers were found. With regard to this association, three confounders were found, these included 'age of the child', 'use of health services' and 'sexual debut of the mother'. The crude model without these confounders did not show a significant relationship between 'maternal education-level' and malnutrition in children aged under-five (p=0.177). (Table 3)

Table 3 Crude analysis of the association between 'maternal education-level' and child malnutrition

	Regression coefficient	WALD	OR	*P*-value	95% CI OR
No education (reference)	-	1.821	-	0.177	-
Primary education	0.852	1.638	2.344	0.201	0.636 – 8.636
Higher education	0.334	0.247	1.397	0.619	0.347 – 5.209

The final model, when corrected for the confounding variables, also shows that there is no significant association between 'maternal education-level' and malnutrition in children aged under-five. Table 4 shows that children, whose mothers have followed primary education, have a higher risk (OR 1.638; CI 0.337 – 7.974; p = 0.541) of being malnourished compared to children whose mothers have followed no education at all, with correction for 'age of the child', 'sex of the child' and 'sexual debut of the mother'. It also shows that children, whose mothers have followed higher education, have a higher risk (OR 1.426; CI 0.264 – 7.969; p = 0.680) of being malnourished compared to children whose mothers have followed no education, with correction for 'age of the child', 'sex of the child' and 'sexual debut of the mother'. However, these results are not significant (p > 0.05). (Table 4)

Table 4 Final model of the association between 'maternal education-level' and child malnutrition with correction for 'age of the child', 'sex of the child' and 'sexual debut of the mother'

Maternal education-level	Regression coefficient	WALD	OR	*P*-value	95% CI OR
No education (reference)	-	0.436	-	0.509	-
Primary education	0.494	0.374	1.638	0.541	0.337 – 7.974
Higher education	0.355	0.170	1.426	0.680	0.264 – 7.969

Results of the association between 'duration of breastfeeding' and child malnutrition

For the association between 'duration of breastfeeding' and child malnutrition, no effect modifiers were found. Three confounders were found; these included 'age of the child', 'sex of the child' and 'HIV-status of the mother'. The crude model, without these confounders, showed a significant association in the dummy variable '<12 months' (p = 0.009), which indicates 'children who have been breastfed for less than 12 months, compared to children who have been breastfed for a period between 12 and 18 months'. (Table 5)

Table 5 Crude analysis of the association between 'duration of breastfeeding' and child malnutrition

Duration of breastfeeding	Regression coefficient	WALD	OR	*P*-value	95% CI OR
Between 12 and 18 months (reference)	-	0.530	-	0.467	-
< 12 months	-1.274	6.892	0.280	0.009*	0.108 – 0.724
> 18 months	-0.907	2.446	0.404	0.118	0.130 – 1.258
No breast-feeding	0.480	0.392	1.615	0.531	0.360 – 7.243

* **Significant associations (p<0.05)**

After correction for the confounding variables, the significant relationship remained. Table 6 shows that children, who are breastfed less than 12 months, have a lower risk (OR 0.219; CI 0.060 – 0.806; p = 0.022) of being malnourished compared to children who are breastfed between 12 and 18 months, with correction for 'age of the child', 'sex of the child' and 'HIV-status of the mother'. It also shows that children, who are breastfed more than 18 months, have a lower risk (OR 0.303; CI 0.076 – 1.200; p = 0.089) of being malnourished compared to children who are breastfed between 12 and 18 months, with correction for 'age of the child', 'sex of the child' and 'HIV-status of the mother'. The odds ratio between no breastfeeding and breastfeeding between 12 and 18 months was 2.226, with correction for 'age of the child', 'sex of the child' and 'HIV-status of the mother' (CI 0.411 – 12.068; p = 0.353). (Table 6)

Table 6 Final model of the association between 'duration of breastfeeding' and child malnutrition with correction for 'age of the child', 'sex of the child' and 'HIV-status mother'

Duration of breastfeeding	Regression coefficient	WALD	OR	*P*-value	95% CI OR
Between 12 and 18 months (reference)	-	0.005	-	0.942	-
< 12 months	-1.517	5.221	0.219	0.022*	0.060 – 0.806
> 18 months	-1.195	2.891	0.303	0.089	0.076 – 1.200
No breast-feeding	0.800	0.861	2.226	0.353	0.411 – 12.068

* **Significant associations (p<0.05)**

Discussion

The results of the logistic regression analysis with regard to the variable "maternal education level", after adjustment for confounding variables, indicate that children whose mothers have followed

primary education, have higher risk of being malnourished compared to children whose mothers have followed no education at all. Furthermore, the results indicate that children whose mothers have followed higher education, have a higher risk of being malnourished compared to children whose mothers have followed no education at all. However, both associations are statistically not significant ($p >> 0.05$). The results of the logistic regression analysis with regard to the variable "duration of breastfeeding" indicate that children, who have been breastfed for a period between 12 and 18 months, have a higher risk of being malnourished, compared to children who have been breastfed for less than 12 months. This association is statistically significant ($p = 0.022$). The results also indicate that children, who have been breastfed for a period between 12 and 18 months, have a higher chance of being malnourished, compared to children who have been breastfed for more than 18 months. However, this association is statistically not significant ($p = 0.353$).

With regard to the literature mentioned in the introduction about maternal education-level, it was expected that children whose mothers lack education, have a higher risk of being malnourished compared to children whose mothers have received education (Bicego & Boerma, 1993). Other, not aforementioned, literature also states that when a mother has received higher education, feeding practices of her child improve (Desai & Alva, 1998; Guldan, Zeitlin, Beiser, Super, Gershoff & Datta, 1993). Maternal health knowledge, and especially knowledge about child health, is obtained outside school. However, it is obtained using skills learned inside the classroom, like literacy and numeracy skills (Glewwe, 1999). Furthermore, the findings of a study conducted by Rayhan and Hayat Khan (2006) state that educated mothers are more conscious about their children's health since they are better informed about the factors that could cause, for example, malnutrition. However, these findings contradict the results in this research, which indicate that children whose mothers have followed education, whether it is primary or higher education, have a higher risk of being malnourished compared to children whose mothers lack education. A possible explanation for the inconsistency between the existing literature and the aforementioned findings in this research could be attributed to the social desirability response bias (Holbrook, Green & Krosnick, 2003). This is explained under "limitations".

With regard to the literature mentioned in the introduction about duration of breastfeeding, it was expected that children who have been breastfed for too short (<12 months) or too long a period (>18 months) would have a higher risk of being malnourished compared to children who have been breastfed for a period between 12 and 18 months (Kikafunda, Walker, Collet & Tumwine, 1998; Lartey, 2008). This contradicts the results in this study, which state that children who have been breastfed for a period that extends 12 months, have a higher risk of being malnourished. However, the existing literature itself is not consistent with regard to the association between 'duration of breastfeeding' and malnutrition in children aged under-five. Compared to the literature in the

introduction, other literature states that a period of exclusive breastfeeding for 6 months would be the most ideal (Kramer & Kakuma, 2004; WHO, 2003). Prolonged breastfeeding (for a period longer than 6 months) increases the chance of being malnourished (Simondon, Simondon, Costes, Delaunay & Diallo, 2001). Furthermore, a long duration (>12 months) of breastfeeding can be associated with a greater prevalence of stunting and malnourishment in children (Simondon, Simondon, Costes, Delaunay & Diallo, 2001; Van de Poel, Hosseinpoor, Jehu-Appiah, Vega & Speybroeck, 2007). This is in agreement with the findings in this research: breastfeeding for a period that extends 12 months, increases the chance of malnutrition in children aged under-five.

An explanation for the inconsistency on breastfeeding and malnutrition in the literature and between the findings in this study, could be that certain factors could have been changed remarkably fast over time. No substantive nutrition-survey has been done in Uganda since the last researches from Lartey and Olwedo, Mworozi, Bachou & Orach in 2008. 2008 is almost eight years ago and at the moment, Africa is going through a transformation with regard to sociodemographic factors, among which perspectives on child- and maternal health (Bain, Kum Awah, Geraldine et al, 2013; The World Bank, 2013). Perspectives on the ideal duration of breastfeeding are influenced by local, regional and ethnic differences, religious beliefs, structure of the mother's daily activities, health of the child and opinions from health care professionals (Dettwyler, 2004; Lartey, 2008). This means that the perspectives on the ideal duration of breastfeeding are susceptible to change. In 2008 the leading perspective on the ideal duration of breastfeeding could have been "between 12 and 18 months" and this message would be disseminated to mothers. During the past eight years, the perspective on the ideal duration of breastfeeding nowadays could have changed into "less than 12 months" and propagated to mothers. This could explain the differences between research results from 2008 and before, and results from this study. However, since the absence of current, substantive research into duration of breastfeeding except for this study, this should be further investigated.

Another explanation for the inconsistency between the results of some of the existing literature and the findings in this study could be the fact that the variable "complementary food" has been included in much of the existing studies and not in this study. This is explained under "limitations".

Limitations

The findings in this study differ from the existing literature. An explanation for this inconsistency can be attributed to the social desirability response bias (Holbrook, Green & Krosnick, 2003). Due to the fact that the mothers had to answer the questions in the presence of both a white, female researcher, and a male Ugandan translator, they might have responded differently than they would

16

have done if they had to answer these questions by themselves. Especially questions like "what is your HIV-status" are very sensitive, and mothers could have given answers that did not represent reality. The social desirability response bias could also apply to the inconsistency between the existing literature regarding the association between maternal education-level and child malnutrition, and the findings of this study with regard to this relationship. Mothers could have pretended that they received higher education than they actually did. In this way, mothers who did not receive any education could have been included in the study as 'received primary education' or 'received higher education'. In this way, the association between maternal education-level and child malnutrition becomes distorted.

In the context of generalizability of study results, it can be stated that the research population, or sample, was relatively small. Due to the language- and cultural barriers, respondents were hard to reach. Moreover, gaining permission to conduct research in hospitals was a long process, which did not turn out to be successful. Because of this, mothers with malnourished children had to be found in the slums, which was a lot harder than it would have been when they could have been approached in hospitals. This limited the amount of collected questionnaires with regard to malnourished children.

One of the most important consequences due to the small sample size was the need to exclude the variable 'complementary food'. After looking at the crosstabs between 'complementary foods' and 'duration of breastfeeding', it turned out that the number of respondents in certain categories was very small (e.g. one or two respondents). That caused the logistic regression model to explode. However, with the variable 'complementary food' included in the model, another result was found, namely a significant p-value of the second dummy of breastfeeding, which could be interpreted as followed: "Children who are breastfed for a period longer than 18 months, have a lower risk of being malnourished compared to children who are breastfed for a period between 12 and 18 months". This is a whole different result than the current result of this research and consistent with the literature used in the introduction of this study. By excluding the variable complementary food, the final result of the association between 'duration of breastfeeding' and child malnutrition changed.

Another important consequence due to the sample size was the fact that categories within certain variables had to be made bigger, to ensure that the logistic regression model would not explode. This caused loss of important data. For example: the categories within the variable 'use of health services' had to be merged. Categories "traditional healer", "pharmacy" and "other" were relatively small when compared to the other categories and were merged into one category "other health services". However, the fact that people in Uganda go to a so-called "traditional practicer" when they are sick, would have been very interesting to compare to, for example, going to an private

health clinic with regard to malnutrition in children. A traditional healer practices medicine in a whole different way, than doctors do in a private health clinic and they could, for example, give different advise to mothers about the 'ideal' duration of breastfeeding. Including this variable with a difference in those categories could have influenced the final results.

Furthermore, the results of this study implicate that the chance of being malnourished for a child increases when the duration of breastfeeding increases. However, the differences between the categories of 'duration of breastfeeding' in this research are relatively big, being: <12 months, >12 and <18 months and >18 months. This study implicates that a period of breastfeeding for less than 12 months is best for the nutrition-status of the child. But what is "less than 12 months"? Future research could focus on the association between 'duration of breastfeeding' and malnutrition in children, but with smaller categories within 'duration of breastfeeding'. In this way, the "ideal" duration of breastfeeding, to prevent malnutrition and simultaneously improve the (future) nutrition-status of the child, could be estimated (more accurately).

Strengths

In terms of strengths of this study, the questionnaires are based on the Ugandan Demographic and Health Survey 2011 (UDHS), which is an acknowledged and validated questionnaire. Most of the questions in the questionnaire of this study are taken unmodified from the UDHS. Other questions were modified. In this way, the questions would be slightly different, yet based on the validated UDHS-questionnaire. The questions were not guiding the respondent in a certain direction and they could not be explained in any other way than the question was intended.

Furthermore, there has been found a significant association between 'duration of breastfeeding' and malnutrition in children aged under-five (p=0.022). The results contradict some of the existing research, but at the same time, they also correlate with other existing literature. It can be said that this certainly points out that there is a need for further research on this topic, since there can not yet be drawn one main conclusion. In this respect, this research can be seen as socially relevant, as it will trigger future research to the association between breastfeeding and malnutrition by raising questions like: "Why do these results contradict existing and published literature?" and "Literature states that a longer duration of breastfeeding increases the change of malnutrition in children. Why does this study state that children who have been breastfed for a period between 12 and 18 months, have a higher chance of being malnourished compared to children who have been breastfed for more than 18 months?"

Conclusion

This research aimed to provide an answer to the questions: "What is the association between 'duration of breastfeeding' and malnutrition in infants and children aged under-five?" and "What is the association between 'maternal education-level' and malnutrition in infants and children aged under-five?". In response to the research questions, there can be stated that there is no significant relationship between the maternal-related factor 'maternal education-level' and malnutrition in infants and children aged under-five. However, there is a significant association between the maternal-related factor 'duration of breastfeeding' and malnutrition in infants and children aged under-five, which leads to the conclusion that a mother should not breastfeed her child for a period longer than 12 months.

Prevention malnutrition in Uganda

Findings of this research state that duration of breastfeeding is significantly associated with malnutrition in children. Moreover, despite the lack of a significant association between maternal education-level and child malnutrition in this study, maternal education is important with respect to child health and child malnutrition; this is funded by existing literature. A lack of education creates a lack of knowledge about (the ideal duration of) breastfeeding (Desai & Alva, 1998; Guldan, Zeitlin, Beiser, Super, Gershoff & Datta, 1993; Rayhan & Hayat Khan, 2006). Furthermore, a lack of knowledge about (the ideal duration of) breastfeeding creates a higher risk of malnutrition in children, as mentioned before. An intervention strategy could be to try to get more women to go to school, to increase the number of educated mothers in Kampala. However, education is expensive and there are a lot of people who cannot afford this (UBOS & ICF International Inc., 2011). Therefore, intervention and prevention strategies should focus on informing both educated and non-educated women about breastfeeding and the best ways to improve their child's health and nutrition status, outside of school. In this way, knowledge can be spread among mothers through a different medium than education alone. However, before recommendations with regard to these intervention and prevention strategies can be made, more research into this topic should be conducted.

Future research

Further research should be done with regard to the duration of breastfeeding and malnutrition in children. The existing literature contradicts each other, out of which can be concluded, among others, that there is not enough information about this topic to draw one main conclusion. In this respect, future research can focus solely on the duration of breastfeeding without focusing on other topics, which happened in most of the existing literature in which the duration of breastfeeding is mentioned (Kikafunda, Walker, Collet & Tumwine, 1998; Kramer & Kakuma, 2004; Lartey, 2008;

Olwedo, Mworozi, Bachou & Orach, 2008; Simondon, Simondon, Costes, Delaunay & Diallo, 2001; Van de Poel, Hosseinpoor, Jehu-Appiah, Vega & Speybroeck, 2007).

Future research should focus on 'use of health services' as a confounder in this relationship. Use of health services, and especially use of which health service (traditional healer, private or public health services, herbalists, et cetera), could influence the association between 'duration of breastfeeding' and malnutrition in children. This variable is too important to leave out of future research, and should therefore be studied in the future. Another important possible confounder that had to be left out in this research is 'complementary food'. Complementary foods consist mainly of watery cereal porridges of low energy and nutrient densities (Gibson, Ferguson, & Lehrfeld, 1998). Complementary foods contribute to the nutrition-status of the child: low quality of complementary foods and micronutrient deficiencies contribute to the high morbidity and mortality due to malnutrition among children aged under-five in Uganda. At the same time, high quality of complementary foods in combination with breastfeeding can contribute significantly to the nutrition-status of the child (Lartey, 2008; Vaahtera, Kulmala, Hietanen et al, 2001). Therefore, when including complementary foods into the model, the outcome is different. In this respect, future research should be done to the effect of complementary food on the association between 'duration of breastfeeding' and malnutrition.

Finally, this study also raises questions about HIV-status, since the general thought is that HIV-status compromises breastfeeding (Bland, Rollins, Coutsoudis & Coovadia, 2002; Langa, 2010). But HIV-status turned out not to be an effect modifier in this study: would it be an effect modifier if the sample size would be bigger? Does HIV-status of the child increase, or decrease, the chance of being malnourished? This study did not focus on that, which future research is recommended to do.

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