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FACULTEIT GENEESKUNDE EN LEVENSWETENSCHAPPEN
master in de revalidatiewetenschappen en de kinesitherapie

Masterproef

Factors compromising development of children under five living in extreme poverty.

Promotor :
Prof. dr. Marita GRANITZER

Copromotor :
De heer Berhanu Nigussie WORKU

Myrthe Levenstond , Naomi Pieters
Scriptie ingediend tot het behalen van de graad van master in de revalidatiewetenschappen en de kinesitherapie

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KNOWLEDGE IN ACTION

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Hasselt, June 9 2015. M.L.

N.P.

RESEARCH CONTEXT

This master thesis is situated in the domain of pediatric rehabilitation and is related to the doctoral study of Drs. Berhanu Nigussie Worku. This doctoral study is titled “Developmental and growth status of children (6-60 months of age) in extreme poverty in Jimma town of Ethiopia: effects of developmental stimulation”. The data collection was conducted in Jimma because of the constantly growing population of children in extreme poverty and the high poverty rate. The latter results in a high risk of malnourishment, which has a negative influence on child development. Unfortunately, little is known about the other factors influencing the development of the children. Yet, to reduce inadequate child development, it is important to know those factors to invest in managing this problem.

This research was done by two students with the goal of achieving their master’s degree in “Rehabilitation Sciences and Physical Therapy”, under the leadership of Prof. Dr. Marita Granitzer and Drs. Berhanu Nigussie Worku. The data was collected in Ethiopia by trained and experienced nurses. The preparation of the data for data-analysis was done by N.P. Afterwards, data was analyzed independently by N.P and M.L. Then a comparison was made to look for discrepancies. When an agreement was reached, the results section was collectively written. All the other sections were written by one of the students and were revised, and if necessary rewritten, by the other student. Afterwards, the master’s thesis was revised and based on comments of our supervisors adjustments were made.

1. ABSTRACT

Background and objective

Many children, living in extreme poverty, are at high risk for developmental problems due to an inadequate environment. Yet there is still insufficient evidence on factors such as nutritional status, maternal age and education, psychosocial stimulation, family size and household income, which may compromise the development of those children. The purpose of this research, therefore, is to investigate the correlation between those factors and the development of children younger than five living in extreme poverty within Jimma, Ethiopia.

Study design

Cross-sectional study.

Methods

819 children, registered as children living in extreme poverty, were recruited within Jimma town of Ethiopia. At those children the Denver-II-Jimma was administered to estimate the developmental performance in four domains (fine and gross motor, language and personal-social skills). Information about nutritional status, household income, maternal age, maternal education, crowding and psychosocial stimulation, was obtained by a semi-structured questionnaire. Nutritional status was estimated from height/length and weight by use of Anthro. The correlation between those factors and developmental performance of the children was analyzed by stepwise multiple regression analysis for the whole group and next for the three age categories: 0-18 months, 18 – 36 months and 36-60 months.

Results

Nutritional status and psychosocial stimulation seem to play an important role in the whole group and within all age categories in nearly all developmental domains. Within the youngest age range, nutritional status is only correlated with gross motor ($p < 0,0001$, $r = -,281$) and personal social ($p = 0,011$, $r = -,186$) skills. Psychosocial stimulation only seems to correlate with gross motor skills ($p = 0,004$, $r = ,163$). Maternal age seems to be a factor that correlates with the development of fine motor ($p = 0,015$, $r = -,161$) and personal-social ($p = 0,023$, $r = -,171$) skills, especially when the children are between 0 and 18 months. For the age category of 18 until 36 months, maternal age is only related to fine motor ($p = 0,050$, $r = ,117$).

Conclusion

The predictor variables nutritional status and psychosocial stimulation significantly correlate with the development of the children. Maternal age only seems to play a role for the younger children.

Key words

Extreme poverty, child development, nutritional status, mother-child interaction.

2. INTRODUCTION

For parents all over the world, it is extremely important that their infants develop according to the milestones. An adequate development is a necessity for promoting social, cognitive and visual-perceptual development [1]. Therefore, it is crucial that they satisfy the needs of their children and provide a safe and loving home. Even though parenting is not an easy job for most of the human population, it sure isn't for individuals living in developing countries due to the many negative circumstances they have to encounter.

One of the main concerns of parents in low-income countries is malnourishment. According to WHO, malnourishment can be defined as an insufficient, excessive or imbalanced consumption of nutrients. It concerns not enough as well as too much food, the wrong types of food, and the body's response to a wide range of infections that result in malabsorption of nutrients or the inability to use nutrients properly to maintain health [2]. Three anthropometric indices of malnourishment can be distinguished: 'weight-for-age (WAZ)', 'height-for-age' (HAZ) and 'weight-for-height' (WHZ). These types are expressed in z-scores, which indicate the standard deviation of WAZ, HAZ and WHZ. A standard deviation of -2 implies underweight, stunting and wasting respectively [3]. Likewise, standard deviations of +2 are very common these days in wealthy nations and indicate overweight.

Many children living in developing countries are highly susceptible for malnourishment, especially undernourishment. One of the factors responsible for the high rates of undernourishment in developing countries is poverty. Poverty is one of the main and most common problems in developing countries. Within Ethiopia, one of the poorest countries in Africa, 39% of its population is living below the poverty line [4]. Therefore, many children are malnourished due to an inadequate nutritional status, which is a direct consequence of poverty. Of all children under five, there is 40% stunted, 9% wasted and 25% underweighted [5]. Research has indicated that an adequate nutritional status is very important for a child to gain a normal psychomotor and psychosocial development. It also has been shown that being stunted between 12 and 36 months of age was associated with poorer cognitive performance and lower school achievement in middle childhood [6].

Besides nutritional status, many other factors might contribute to the development of a child. These factors are in particular: maternal education, maternal age, crowding, household income and psychosocial stimulation.

Literature shows that maternal education and maternal age are factors that strongly cohere to each other. It is indisputable that being a teenage mother significantly limits one's ability to gain further education and a higher level of employment, which may in turn affect child development [7]. Furthermore, parents with higher levels of education have a positive influence on their children's academic achievement due to the more complex language and reading interactions with their children and the exposure to increased educational opportunities [8].

Furthermore, it has been demonstrated that crowding is associated with a delayed growth (also for firstborn children), a lower level of intelligence, more dependent behaviour during growing up and a higher morbidity rate [9].

Since Ethiopia is one of the poorest countries in Africa with many children living in extreme poverty, all compromised with these factors, it is important to have data for the government to invest and manage these bottlenecks.

Because scarce evidence is available about the correlation of factors as maternal age, maternal education, crowding, household income and psychosocial stimulation with child development, the purpose of this research is to investigate the degree of correlation of these six factors with the development among children aged 0 – 5 years in Jimma, Ethiopia. The investigators of this research hypothesized that all six factors, especially nutritional status and psychosocial stimulation, will be correlated with the developmental performance of these children. The development domains of language and personal-social were thought to be interacting the most with those factors due to insufficient nutrition and stimulation, given by the parents or other caregivers.

3. MATERIAL AND METHODS

3.1. Study design and setting

The correlation of six factors (nutritional status, household income, age of the mother, education of the mother, psychosocial stimulation and crowding) with the development of children, younger than five, living in extreme poverty in Jimma, Ethiopia was analyzed using a cross-sectional design. Data collection was conducted during March - June 2014 in Jimma, which is the largest city of southwestern Ethiopia with approximately 207,573 inhabitants. Jimma belongs to the Oromia Region, one of the nine regional states of Ethiopia. Data analysis was done at the University of Hasselt, Belgium.

3.2. Study population

All children registered as living in extreme poverty by Women's and Children's Affairs (WCA) Bureau and Kebele administrators were selected as the study population. Inclusion criteria were (a) children younger than 60 months (b) children living in extreme poverty (c) children living with foster mothers, only mothers, only fathers, both parents terminally ill, poor relatives or significant others. Exclusion criteria were (a) children with Severe Acute Malnutrition (SAM children) (b) children with observable physical disabilities that hinder mobility (c) children with severe mental retardation (d) children with hearing and visual impairments. Of the 911 children, younger than five, registered at Jimma Town's Women's and Children's Affairs, 819 children (mean age of 30,83 months ±16.06 SD) were retained to participate in the study.

3.3. Outcomes, measurements and instruments

3.3.1. Outcome measures

Primary outcomes are development, nutritional status and the correlation of the compromising factors with the four dependent variables (fine and gross motor, language and personal-social performance).

3.3.2. Measurements and instruments

Anthropometric measurements. To determine the nutritional status of all the participating children, an estimation was made based on height, weight and MUAC (mid-upper arm circumference). A portable calibrated stadiometer was used to measure body height. Body weight was measured by means of a calibrated electronic weighing scale and mid-upper arm circumference (MUAC) was measured with MUAC tape.

Development measures. The Denver-II-Jimma is a culturally adapted, translated and standardized version of the Denver-II test to the sociocultural context of children living in Jimma and was used to assess the development of children younger than six years of age [10]. Development was assessed in four different domains: (1) gross motor to assess a child's overall movement such as the ability to sit, walk and jump (2) fine motor to assess eye-hand coordination, manipulation of small objects and problem-solving capacities (3) language to assess children's development in terms of hearing, understanding and usage of language and (4) personal-social to assess the level of interaction with

people and the ability to care for their own needs [11]. The test contains 125 items, which are scored based on the performance of the children. Few items are scored based on the report of the caregivers. The test's duration is 20 minutes. Based on the test scores, a performance ratio was calculated and used for data analysis. This ratio indicates the acquired performance of the child in relation to the expected performance according to the age of the child. When the child was born premature, there is a correction made for his age. A performance ratio of 1 signifies that the acquired performance of the child matches the performance of his age (the expected performance). When a child can carry out more components than expected for his age, the performance ratio will be higher than 1, when he carries out less than expected, the performance ratio will be less than 1. The performance ratio is calculated per domain.

Compromising factors. A semi-structured questionnaire was used to list the other five factors i.e. household income, maternal age, maternal education, crowding and finally psychosocial stimulation, which might compromise child development. i) The first factor refers to household income, which gives an indication about the standard of living of the family and is divided in two subcategories, namely: (1) a monthly income of less or more than $50 (2) the occupation of the mother, expressed as unstable work or housemaid. ii) The age of the mother is described as younger or older than 30 years and iii) the educational level of the mother is stated as being literate of illiterate. iiii) Crowding represents the amount of people living in the house and will be categorized in "less than three" or "more than three". iiiii) Psychosocial stimulation is divided in separate subcategories, namely: (1) the frequency of the child's interaction with other children (2) mother-child interaction time during feeding and bathing/toileting (3) mother-child interaction time out of working time (4) whether the child is lonely most of the time or not (5) the availability of different play materials to play with (5) the availability of a special prepared play corner and (6) the time the child spends on play.

3.4. Test procedure and data collection

Data collection was performed in a chronological order by trained and experienced nurses. They were mainly selected on being child friendly. First, the semi-structured questionnaire was introduced to the caregiver. Secondly, the anthropometric measurements of the child were done. Finally, the children's development was tested with the Denver-II-Jimma. The whole duration of the measurements was approximately one hour.

3.5. Ethical considerations

The Ethical Clearance Board of the Jimma University has approved the protocol on 13/02/2013 (reference number: RPGC/36/2013). All the caregivers of the participating children signed the written informed consent.

3.6. Data analysis

Based on the length/height and weight of all the included children, the z-score, that represents the nutritional status, could be generated. The nutritional status was estimated from three different anthropometric scores: 'height/length-for-age z-score', 'weight-for-age z-score' and 'weight-for-length and weight-for-height z-score' using WHO Anthro (version 3.2.2).

To know which factors are correlated with the development of the children, a stepwise multiple regression analysis in SPSS 22 was used. Except for age of the child and the performance ratio's of the four Denver domains, which are numerical, all remaining variables were first recoded to binary/categorical variables. The stepwise multiple regression analysis was first done for the whole study population. Afterwards, the population was divided in three age categories (0-18 months, 18-36 months and 36-60 months) and the same analysis was done.

Statistical significance was reached when the p-value was equal or less than 0,05. Correlation coefficients (*r*) between 0,0 and 0,50 indicate a low correlation whereas coefficients between 0,50 – 0,69 and 0,70 – 1,00 indicate a moderate and high correlation respectively.

4. RESULTS

4.1. Characteristics of the study population

Detailed information about the characteristics of the study population is given in table 1.

Table 1. *Characteristics of the study population.*

Variables	**N (= 819)**	**%**
Child's sex		
Male	421	51,4
Female	398	48,6
Child's age		
0 – 18 months	227	27,6
18 – 36 months	279	34,2
36 – 60 months	313	38,2
Maternal age		
< 30 years	679	82,9
> 30 years	140	17,1
Maternal education		
Illiterate	339	41,4
Literate or education up to 12th grade	480	58,6
Household income		
< 50$	807	98,5
> 50$	12	1,5
Family size ('crowding')		
< 3	46	5,6
> 3	773	94,4
Psychosocial stimulation		
Frequency of child-child interaction		
Sometimes or not at all	413	50,4
More often	406	49,6
Mother-child interaction during feeding/toilet		
Yes	10	1,2
No	809	98,8
Mother-child interaction out of working time		
Yes	294	35,9
No	525	64,1
Is the child most of the time lonely?		
Yes	5	0,6
No	814	99,4
Different play materials to play		
Yes	167	20,4
No	652	79,6
Special prepared play corner		
Yes	265	32,4
No	554	67,6
Time the child spends on play		
Sometimes or not at all	193	23,6
More often	626	76,4
Nutritional status		
HAZ (z- score: height-for-age)		
Normal	494	60,3
Stunted	325	37,7
WHZ (z-score: weight-for-height)		
Normal	792	96,7
Wasted	27	3,3
WAZ (z-score: weight-for-age)		
Normal	684	83,5
Underweight	135	16,5

4.2. Developmental performance of the child

Results showed that 44,4%, 29,2%, 50,8% and 26,9% of the children have a performance ratio score below 1 for personal-social (mean = 0,99, SD = 0,14), fine motor (mean = 1,02, SD = 0,10), language (mean = 0,96, SD = 0,13) and gross motor (mean = 1,03, SD = 0,11) respectively. Histograms of the performance ratios are given in appendix A.

4.3. Compromising factors of the developmental performance

After stepwise regression analysis, results showed that nutritional status, psychosocial stimulation and age of the child in months have the strongest correlation with the children's developmental performance ratio (tables 2-5). Because age is correlated with the performance of the child, the population was divided in three different age categories (0-18 months, 18-36 months and 36-60 months). The first age limit of 18 months was chosen because the children should be able to walk on that age [12, 13]. From the age of 18 months, the children are developing their language skills [14]. Therefore, mother-child interaction, in particular book reading, is of great importance in facilitating the development of the child's vocabulary [15]. The same stepwise regression analysis was done for the different age categories. Results for every domain, both for the whole study population and different age groups, are described below.

4.3.1. Fine motor

For the fine motor performance, results showed that there are four factors with a significant negative correlation: age of the child in months ($p < 0,001$; $r = -,162$), stunting ($p < 0.001$; $r = -,161$), underweight ($p = 0,031$; $r = -,132$) and the availability of a special prepared play corner ($p = 0,040$; $r = -,088$). However, when analysing for different age categories, results showed that fine motor is only correlated with maternal age ($p = 0,015$; $r = -,161$) in children younger than 18 months. For children, aged 18 – 36 months, there are three correlating factors: stunting ($p = 0,000$; $r = -,250$), availability of a special prepared play corner ($p = 0,021$; $r = -,143$) and maternal age ($p = 0,050$; $r = ,117$). All of these factors have a very small correlation with the developmental performance of fine motor. Fine motor performance, in children aged 36 – 60 months, was correlated to the occupation of the mother ($p = 0,012$, $r = -,148$) and the nutritional status, in particular stunting ($p = 0,011$, $r = -,235$) and underweight ($p = 0,047$, $r = -,211$) (table 2).

Table 2. *Stepwise regression analysis with the performance ratio of fine motor as a dependent variable.*

Variables	P value	Correlation Coefficients
	Whole study population	
Age of child in months	,000	-,162
Stunting	,000	-,161
Underweight	,031	-,132
Special prepared playcorner	,040	-,088
	0 – 18 months	
Maternal age	,015	-,161
	18 - 36 months	
Stunting	,000	-,250
Special prepared playcorner	,021	-,143
Maternal age	,050	,117
	36-60 months	
Stunting	,011	-,235
Occupation mother	,012	-,148
Underweight	,047	-,211

4.3.2. Gross motor

Stepwise regression analysis showed that gross motor is positively correlated with the age of the child ($p < 0,001$, $r = ,366$) and negatively correlated with stunting ($p < 0,001$, $r = -,288$). Furthermore, underweight ($p = 0,003$; $r = -,231$) and the child's interaction with other children ($p = 0,011$; $r = ,135$), which are negatively and positively correlated respectively, are two other important factors of gross motor performance. Looking at the different age categories, nutritional status has low negative correlations with gross motor performance in all of the age groups. For children younger than 18 months is the frequency of the child's interaction with other children another correlating factor. In comparison with the different subcategories of the nutritional status is this variable positively correlated with gross motor development ($p = 0,004$, $r = ,163$) (table 3).

Table 3. *Stepwise regression analysis with the performance ratio of gross motor as a dependent variable.*

Variables	P value	Correlation Coefficients
	Whole study population	
Age of child in months	,000	,366
Stunting	,000	-,288
Underweight	,003	-,231
Freq. of child-child interaction	,011	,135
	0 – 18 months	
Stunting	,000	-,281
Freq. child-child interaction	,004	,163
	18 – 36 months	
Underweight	,041	-,267
Stunting	,003	-,266
Wasting	,013	-,210
	36 – 60 months	
Stunting	,000	-,276
Wasting	,032	-,144

4.3.3. Language

Language performance has a linear relation with stunting (p < 0, 001, *r* = -,213). Other correlating factors are: age in months (p < 0,001; *r* = ,176), the child's interaction with other children (p = 0,010; *r* = ,107), mother-child interaction out of working time (p = 0,012; *r* = -,099), the availability of different play materials (p = 0,002; *r* = -,080) and a special prepared play corner (p = 0,002; *r* = -,032). All of these variables have a very low correlation with language development. When looking at the different age categories, there are no correlating factors found for language in the category of children aged 0 – 18 months. In the other two age groups, stunting seems to play an important role due to the high significance (p < 0,001). However, they are very low correlated. Other correlating factors in the age category of 18 – 36 months are: mother-child interaction out of working time (p = 0,001; *r* = -,161) and time the child spends on play (p = 0,002; *r* = ,170). For children aged 36 – 60 months, the correlating factors are: frequency of the child's interaction with other children (p = 0,007; *r* = ,115), child is mostly lonely (p = 0,008; *r* = -,127) and the availability of a special prepared play corner (p = 0,009; *r* = -,111). Apart from the time the child spends on play, which is positively correlated, all other variables have a very low negative correlation with language (table 4).

Table 4. *Stepwise regression analysis with the performance ratio of language as a dependent variable.*

Variables	P value	Correlation Coefficients
	Whole study population	
Stunting	,000	-,213
Age of child in months	,000	,176
Freq. of child-child interaction	,010	,107
Mother-child interaction out of work	,012	-,099
Different play materials	,002	-,080
Special prepared playcorner	,002	-,032
	18 - 36 months	
Stunting	,000	-,191
Mother-child interaction out of work	,001	-,161
Time child spends on play	,002	,170
	36 - 60 months	
Stunting	,000	-,258
Freq. child-child interaction	,007	,115
Child is mostlylonely	,008	-,127
Special prepared playcorner	,009	-,111

4.3.4. Personal-social

Finally, for the personal-social domain, only two independent variables had a highly significant linear relation. The first factor is stunting ($p < 0,001$; $r = -,138$), which is consistent with the other three domains and has a negative correlation. The second factor is wasting ($p = 0,006$; $r = -,104$) and is, like stunting, negatively correlated. When the age of children is taken into account, nutritional status is the prevailing correlating factor of personal-social performance. For the children younger than 18 months is maternal age ($p = 0,023$; $r = -,171$) also of importance (table 5).

Table 5. *Stepwise regression analysis with the performance ratio of personal-social as a dependent variable.*

Variables	P value	Correlation Coefficients
	Whole study population	
Stunting	,000	-,138
Wasting	,006	-,104
	0 – 18 months	
Underweight	,011	-,186
Maternal age	,023	-,171
	18 – 36 months	
Wasting	,004	-,174
	36 – 60 months	
Stunting	,028	-,124

5. DISCUSSION

The objective of this cross-sectional study was to investigate the degree and the direction in which the nutritional status, maternal age, the education of the mother, crowding, household income and psychosocial stimulation correlate with the development among children under five living in extreme poverty in Jimma, Ethiopia. Results have shown that the nutritional status, especially stunting ($p < 0,001$) is negatively correlated with the developmental performance. Although the availability of a special prepared play corner, loneliness of the child and mother-child interaction out of working time are negatively correlated, is the frequency of the child's interaction with other children positively correlated with the developmental performance of children.

5.1. Correlation of nutritional status and developmental performance

Results showed that nutritional status, especially stunting ($p < 0,001$), has a significant negative correlation with the four developmental domains. When analysing for different age categories, nutritional status is mostly correlated with developmental performance when the children are older than 18 months. For the age group of 18-36 months, linear correlations were found for the three different anthropometric indices of malnourishment (stunting, wasting and underweight) in all four developmental domains. Gross motor developmental performance is subjected to all three indices, whereas the other domains are correlated with just one anthropometric measure (fine motor: stunting ($p < 0,000$); personal-social: wasting ($p = 0,004$) and language: stunting ($p = 0,001$)). For the oldest children (36-60 months) stunting is the most prevalent and significant indicator ($p < 0,001$, except for personal-social) in all developmental domains. The youngest (0 – 18 months) show correlations with stunting ($p< 0,000$) for the gross motor performance and with underweight ($p = 0,005$) in the personal-social domain. Although development is dependent on multiple factors, it should be recognized that nutritional status plays a central role in providing the brain with enough resources to develop skills on the cognitive -, fine motor -, gross motor and personal-social domain [20]. Inadequate nutrition results in an inadequate brain development and thus a delayed development, which can lead to a poor school performance [22].

5.2. Correlation of psychosocial stimulation and developmental performance

A significant correlation of psychosocial stimulation was found on fine motor performance ($p = 0,040$), gross motor performance ($p = 0,011$) and language performance (p-values between $p = 0,002 – 0,043$). When different age groups were analyzed, results showed that psychosocial stimulation is a significant correlating factor for language performance in children from the age of 18 months. In children aged 0-18, no significant correlations were found with language performance. This can be explained by the fact that those children have not developed their vocabulary yet. On the other hand, a significant linear relation with psychosocial stimulation was found in these children on the gross motor performance ($p = 0,004$). Additionally, a significant correlation was found on fine motor performance ($p = 0,050$) in children aged 18 – 36 months. A study, who reviews evidence on risk and protective factors for development, also found that nutritional status, in particular stunting, and psychosocial stimulation influence child development [16]. Another study shows that play is essential for the

development of children. It allows children to use their creativity in developing imagination, dexterity and physical, cognitive and emotional strength. However, much of play involves and is controlled by adults, which may result in a loss of benefits for the child, particularly in creativity [17]. Furthermore, another study shows that cognitive stimulation in early infancy is associated with important differences in communication capacities (f.e. eyegazing following, emotion expression) in infancy [18].

5.3. Correlation of maternal age and developmental performance

This study states that the impact of the age of the mother on the child's performance is more important when the child is younger of age. The correlation of maternal age is highly significant when the child is aged between 0 and 18 months for the domains fine motor ($p = 0,015$) and personal-social ($p = 0,023$). Once the child is older (18-36 months) there is only a borderline significant correlation with fine motor performance ($p = 0,050$). Nevertheless, there is a strong association between young maternal age and poor language development [7,19]. One of those studies showed that children born to teenage mothers obtained significantly lower language comprehension ($p < 0,01$) and expressive language ($p < 0,05$) scores [19]. These children may be at increased risk of delayed language comprehension and expression when compared with children born to older mothers. Further, the effect of young maternal age on cognitive development is strongly associated with socio-demographic circumstances that these children are born into [7].

5.4. Correlation of maternal education and developmental performance

This study found no significant correlation of maternal education with the developmental performance of the children, even though 41,4% of the mothers in this study is illiterate. This could be due to the characteristics of the study population, where the difference in education level is not large enough. This is in contrast with other investigations. As shown in previous research, maternal education has a protective influence on early child development [16]. Children of well-educated mothers have higher levels of cognitive development than children of less educated mothers. Correspondingly, high-risk children show a better development when their mothers are better educated. Reports show also that a higher education of the parents has a positive effect on child development [20]. There is also evidence for an inverse relation between maternal education and crowding: a less-educated mother tends to have a more crowded home environment [21].

5.5. Correlation of household income and developmental performance

Furthermore, results showed no effect of household income on the development of children. This result confirms previous findings of two other studies who investigated child development in children aged 8 - 11 years and 24 - 35 months [22, 3]. These findings can be explained by the fact that the majority of the families who participated in our studies lived in economically depressed conditions, which leads to not enough differentiation between the different households whereas they all are low income households [22]. However, other investigations did find an influence of household income on the development. One study determined that family/household income was significantly associated with nutritional status of children under five. Children of low-income families are at higher risk of being

wasted, underweight and stunted than children of better income families [23]. Three studies found consistent results, namely, a strong negative association between family income and stunting [24-26]. When the income is higher, fewer children are stunted. Furthermore, an inverse relation between income and crowding in the US was demonstrated [21].

5.6. Correlation of crowding and developmental performance

Despite the evidence for crowding on a child's development, there were no significant results found in this study about the linear relationship of crowding with the development. This could be attributed to effects that neutralize each other. When there is enough provision of food, crowding will create a stimulating environment for the child, due to the fact that the child is enough fed and the siblings, who often take care of each other, will stimulate the development. On the other hand, when the provision is not sufficient, this will affect the development of the child in a negative manner because the child has not enough energy to play and grow. A large family size was mentioned to be an individual risk factor for child development [20]. Therefore, crowding is associated with a delayed growth, a lower level of intelligence, more dependent behaviour during growing up and a higher morbidity rate [9]. It also tends to reduce the quality of the caregiving environment and is associated with parenting behaviours [27]. Parents tend to be less sensitive, less verbally responsive, and more punitive, which may affect the child's development in a negative way [28].

5.7. Strengths, limitations and implications for future research

Whereas most studies focus particularly on the younger children, this study also considers a large sample of older children (i.e. 18-60 months), where little is known about. For future research, it may be useful to investigate a study population with smaller age intervals. The intervals within this study still contain many different ages. This could bias the correlation outcomes. For instance, it would be favourable to examine children in the age group 24 - 35 months, for the reason that the influence of the environmental factors on these children is larger [3]. Furthermore, children younger than six months should be considered in an extra age interval because they are mostly breast-fed and therefore less at risk for undernourishment.

6. CONCLUSION

Nutritional status and psychosocial stimulation, particularly the availability of a special prepared play corner and the child's interaction with their mother or other children, have the strongest correlation with the developmental performance of children who live in extreme poverty. For the older children, nutritional status is a more important predictor variable whereas for children aged 0-18, maternal age seems to be important in fine motor and personal-social performance.

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APPENDIX A: Histograms of performance ratio's.

1. The ratio of the child's actual performance to the expected performance of the whole study population.

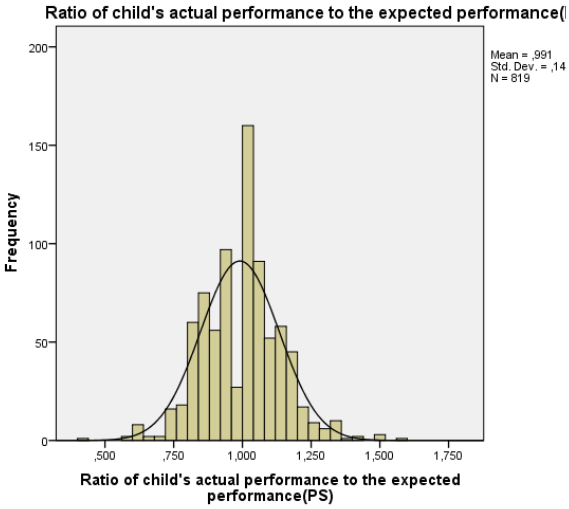

Figure 1. *Performance ratio of the personal-social domain.*

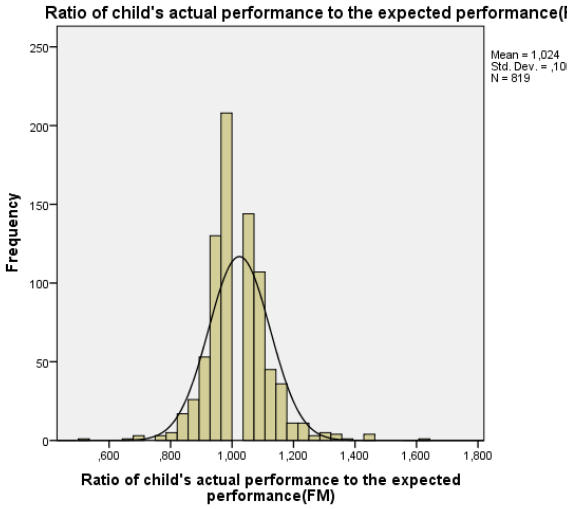

Figure 2. *Performance ratio of the fine motor performance.*

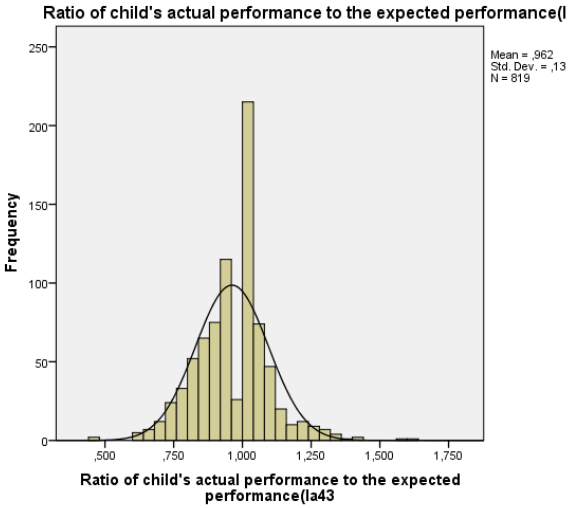

Figure 3. *Performance ratio of the language performance.*

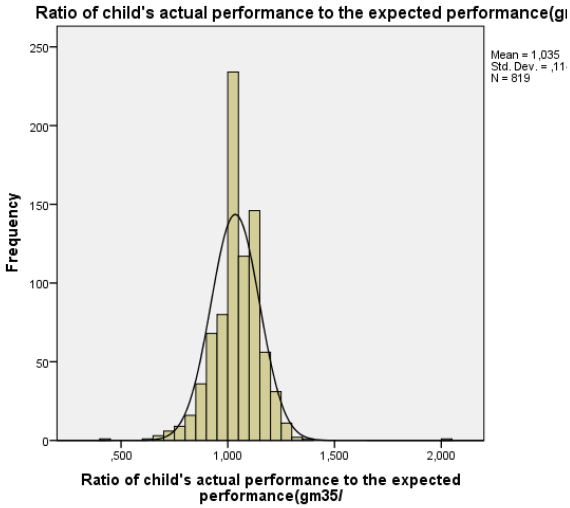

Figure 4. *Performance ratio of the gross motor performance.*

2. The ratio of the child's actual performance to the expected performance according to the different age categories.

2.1. Age category: 0 – 18 months

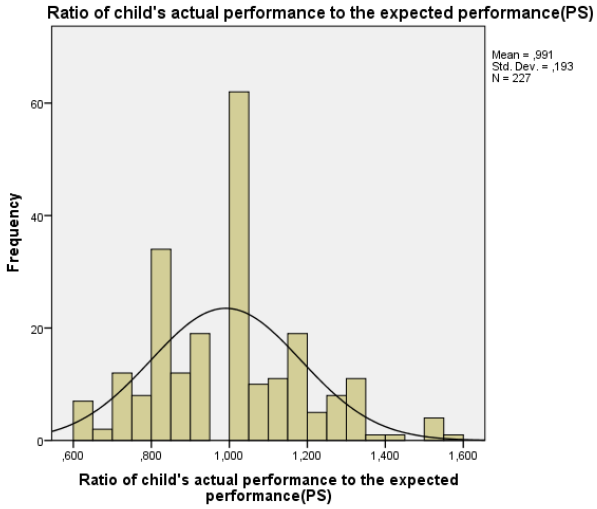

Figure 5. *Performance ratio of the personal social domain in children aged 0 – 18 months.*

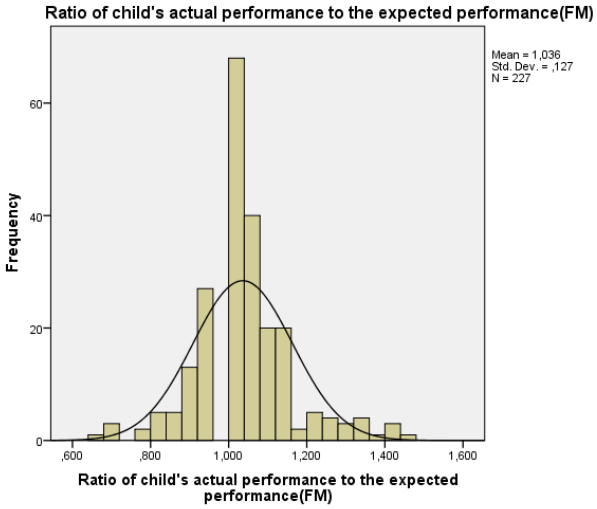

Figure 6. *Performance ratio of the fine motor performance in children aged 0 – 18 months.*

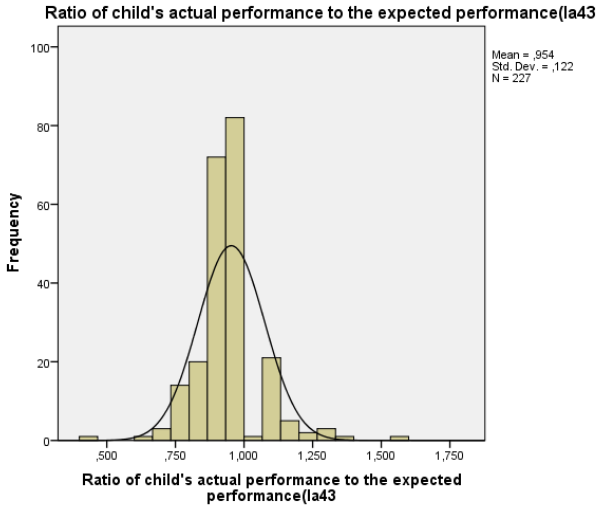

Figure 7. *Performance ratio of the language performance in children aged 0 – 18 months.*

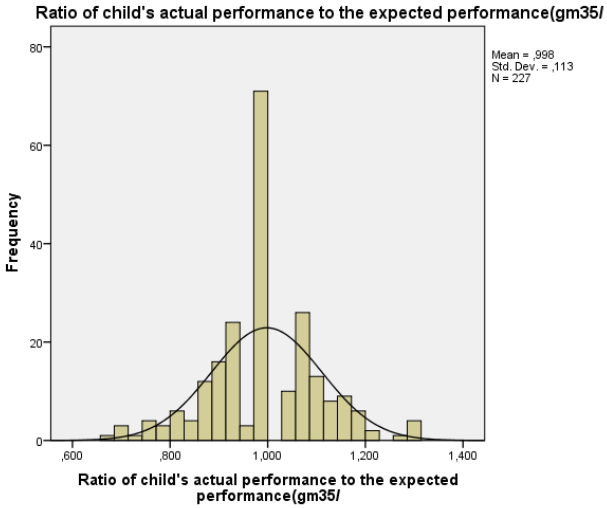

Figure 8. *Performance ratio of the gross motor performance in children aged 0 – 18 months.*

2.2. Age category: 18 – 36 months

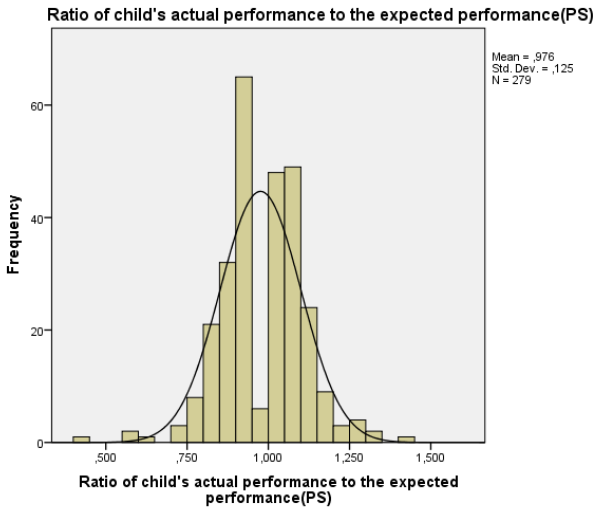

Figure 9. *Performance ratio of the personal-socail domain in children aged 18 – 36 months.*

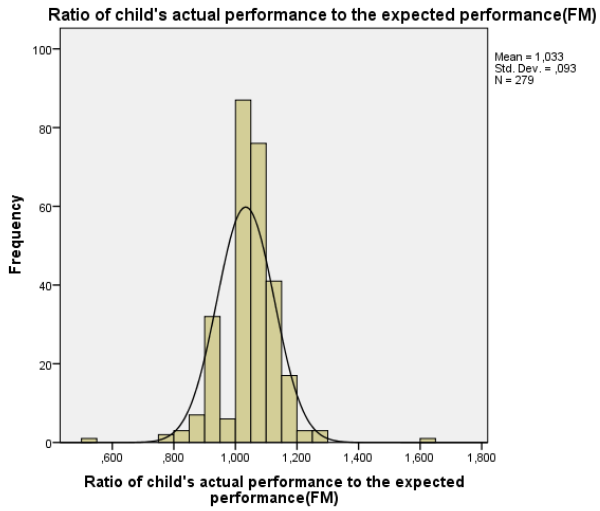

Figure 10. *Performance ratio of the fine motor performance in children aged 18 – 36 months.*

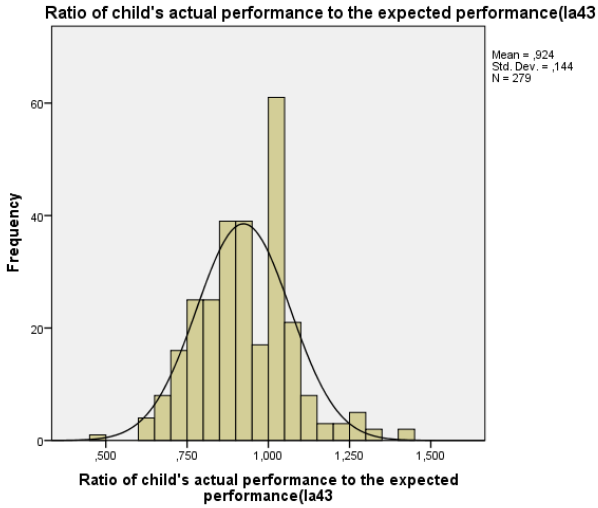

Figure 11. *Performance ratio of the language performance in children aged 18 – 36 months.*

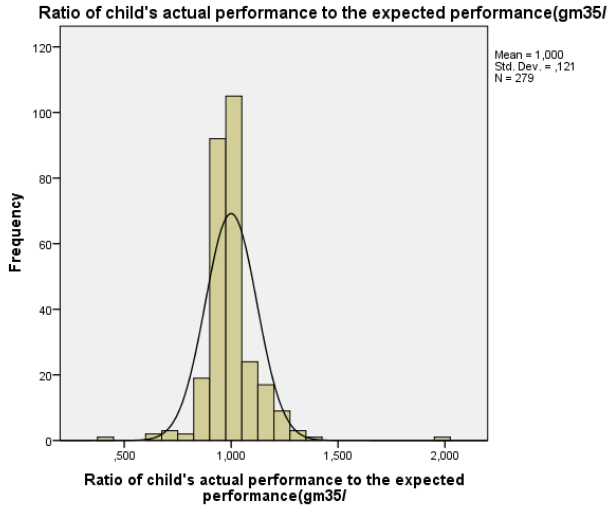

Figure 12. *Performance ratio of the gross motor performance in children aged 18 – 36 months.*

2.3. Age category: 36 – 60 months

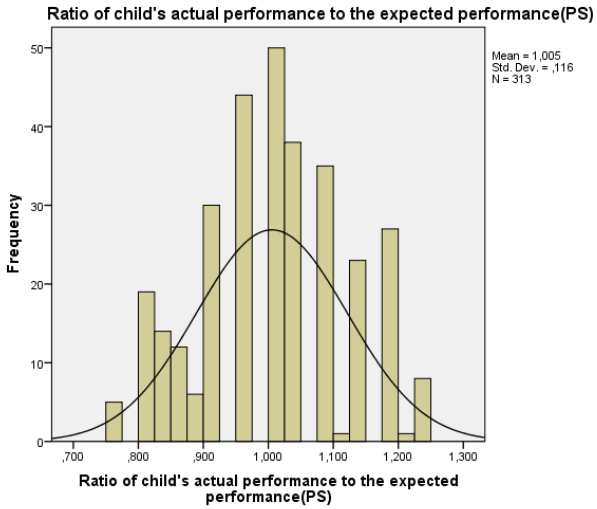

Figure 13. *Performance ratio of the personal-social domain in children aged 36 – 60 months.*

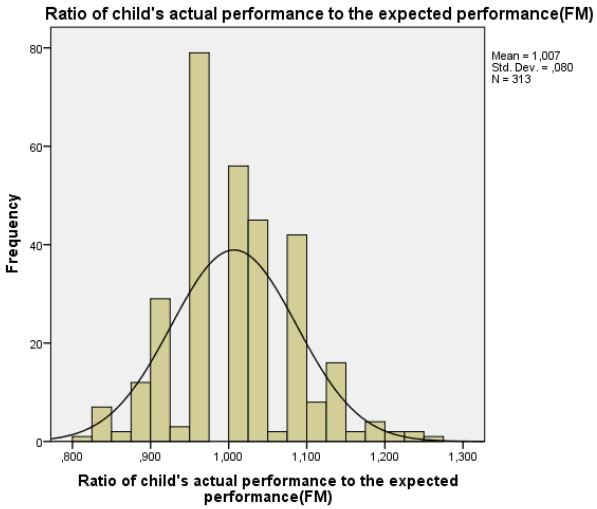

Figure 14. *Performance ratio of the fine motor performance in children aged 36 – 60 months.*

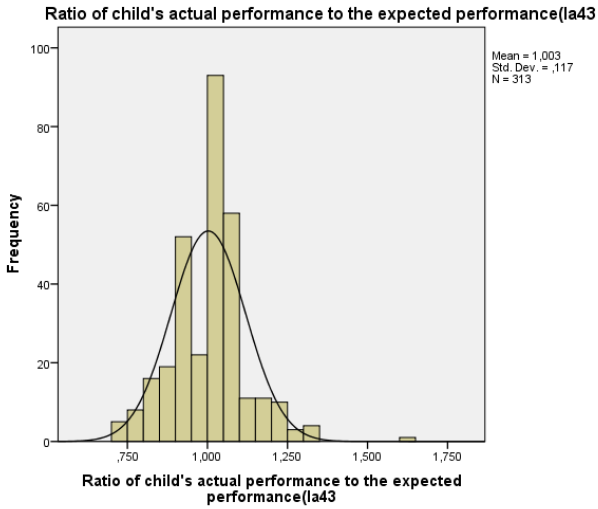

Figure 15. *Performance ratio of the language performance in children aged 36 – 60 months.*

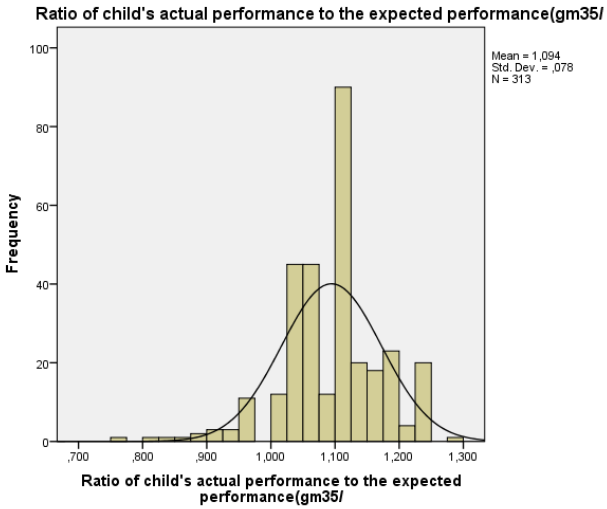

Figure 16. *Performance ratio of the gross motor performance in children aged 36 – 60 months.*

APPENDIX B: Guidelines of the Journal of food and nutrition sciences

Journal of Food and Nutrition Sciences (JFNS), a peer-reviewed open access journal published bimonthly in English-language, aims to foster a wider academic interest in food and nutrition field, and offers an important forum for researchers to exchange the latest results from research on human nutrition broadly and food-related nutrition in particular. Research articles, field process reports, short communications, book reviews, symposia proceedings and review articles are accepted. Generally, review articles on some topic of special current interest will be published.

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Word Processing Formats

Only the following word processor file formats are acceptable for the manuscript document for all of Science Publishing Group journals:

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- Microsoft word 2007/2010(docx)

Manuscript Preparation

Manuscript length should be 6 to 18 pages. Science Publishing Group can exceptionally accept shorter or longer manuscripts, provided that the scientific content is of high value. No additional page charges are required if a manuscript is substantially longer than 17 pages.

All submitted manuscripts must include the following items:

- Title
- List of authors, their affiliations and email addresses
- Abstract
- Introduction
- Main body
- Results and discussion
- Conclusions
- Acknowledgments (optional)
- References

Title - Make sure that the title is specific and concise. Titles should be presented in title case - all words except the first word should be in lower case letters.

List of authors, their affiliations and email addresses - Provide the full names and affiliations of all the authors. Affiliations should include department, university or organization, city, and country. One of the authors should be designated as the corresponding author, and their email address needs to be included.

Abstract - The abstract should briefly introduce the manuscript, not exceeding 400 words. No citations should be included in the abstract.

Keywords - At least 3 keywords or phrases should be included and must be separated by commas to distinguish them

Introduction - The introduction section should provide a context for your manuscript. When preparing the introduction, please bear in mind that some readers will not be experts in your field of research.

Main body - the main body part should include the main proposed ideas, results and discussions.

Conclusions - A conclusion is where you summarize the paper's findings and generalize their importance, discuss ambiguous data, and recommend further research. An effective conclusion should provide closure for a paper, leaving the reader feeling satisfied that the concepts have been fully explained.

Acknowledgments - You as the author are free to decide whether to include acknowledgments or not. Usually, the acknowledgments section includes the names of people who in some way contributed to the work, but do not fit the criteria to be listed as the authors. This section of your manuscript can also include information about funding sources.

References- Science Publishing Group uses the numbered citation method for reference formatting, with sequential numbering in the text, and respective ordering in a list at the end of the paper.

The list should contain at least ten references and should be arranged in the order of citation in text. List only one reference per reference number. In the text, each reference number should be enclosed by square brackets. Citations of references may be given simply as “in [1] ...”, or as “in reference [1] ...”. Similarly, it is not necessary to mention the authors of a reference, unless the mention is relevant to the text.

Multiple citations within a single set of brackets should be separated by commas. Where there are three or more sequential citations, they should be given as a range [2,7-9,13].

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Ik/wij verlenen het wereldwijde auteursrecht voor de ingediende eindverhandeling:
Factors compromising development of children under five living in extreme poverty.

Richting: **master in de revalidatiewetenschappen en de kinesitherapie-revalidatiewetenschappen en kinesitherapie bij neurologische aandoeningen**
Jaar: **2015**

in alle mogelijke mediaformaten, - bestaande en in de toekomst te ontwikkelen - , aan de Universiteit Hasselt.

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