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### RESEARCH ARTICLE

#### CHILD STUNTING AFFECTS MORE MALES THAN FEMALES IN SUB-SAHARAN AFRICA: A META-ANALYSIS ON 20 COUNTRIES.

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#### Abstract

Using the pooled data of recent demographic and health surveys of 20 countries in sub-Saharan Africa, the anthropometric measures collected on under-five year old children indicate that more boys rarely reach their growth potential compared to girls. In 9 countries, this difference is significant and, in the others, except Congo, malnutrition prevalence remains higher in boys, although not significant. This demonstrates that the explanation of child stunting in sub-Saharan Africa should systematically include the sex of the child. Hygiene and the diarrhoea negatively affect growth. Small morphology at birth is more discriminating between sex and has been seen to induce subsequent stunting.

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#### Introduction:-

Stunting is the result of the cumulative long-term effects of inadequate nutrition and poor health. This is not only indicative of a poor nutritional status; it also reflects a limited access to basic needs and therefore absolute poverty (OMS 1995). This is the reason why WHO has recommended at its 2012 General Assembly to proceed to its substitution to underweight, that has long been used as a reference for tracking the overall nutrition situation. This proposal was in fact adopted in the formulation of indicators of 2015-2030 Sustainable Development Goals. It is also embedded in the Rome Declaration at the second International Conference on Nutrition and the World 2016-2025 Decade of Nutrition, proclaimed by the United Nations (Webb 2014; FAO and WHO 2014; OMS 1995).

This revision is accurately justified by the diversity and the severity of the consequences of growth retardation. The negative repercussions include impairment of cognitive ability since childhood. Height deficit during childhood induced a significant decline in IQ of about 10 points at 9 years old (Berkman et al. 2002; Chang et al. 2010). It is associated with a disorder of psychological development with more anxiety, depressive syndromes, a low self-esteem, anti-social behaviour, a decline in attention and hyperactivity (Walker et al. 2007). At adult age, a 1% loss in height is associated with 1.4% reduction in productivity (Hunt 2005). Life expectancy is also affected by the increased risk of chronic disease in adulthood through the phenomenon of "foetal programming" (Turck 2009). The economy is affected, insofar as a decline in prevalence between 1.5% to 1.7% of stunting is associated with a 10% increase in GDP (Harttgen, Klasen, et Vollmer 2013).

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With a stunting prevalence estimated at 40.1% in 2015, Africa has the highest level among all continents (Black et al. 2013). Even if it follows a global trend of lowering level, the pace of reduction is very slow that the total number of stunted children is steadily increasing (Black et al. 2008; Black et al. 2013). Projections indicate that 60.6 million children will be affected by 2025, if nothing is done (Black et al. 2013). In sub-Saharan Africa, the prevalence varies markedly between sub-regions, from 37.7% in the Western, 50% in the Eastern, 41.5% in the Centre and 30.2 % in the Southern (Black et al. 2008).

Growth faltering is particularised by differentiated prevalence by gender in some geographical or continental sub-areas. A study on 81 countries worldwide showed that the risk of stunting is higher in boys than girls, however the difference is not significant (OR = 1.14; IC=[0.83-1.53]) (Black et al. 2013). Another study also noted that in 35 developing countries, 30 had a higher male stunting prevalence (Kothari 2015). In only 10 countries in sub-Saharan Africa considered by Wamani et al. (2007), it has been noted that the boys were most affected. In Asia and the Middle East, the situation is rather reversed. Sri Lanka, India, Pakistan and Egypt present a higher prevalence for girls. This is also the case for a few countries in Latin America such as Guatemala and Bolivia (Arnold 1997).

The previous meta-analyses on the understanding of the differences in prevalence of stunting between gender have investigated many factors. Wamani et al. (2007) have considered only the living standard of the households as a predominant factor of the differences noted. On their part, Arnold (1997) has focused on child morbidities, feeding and breastfeeding. Harttgen, Klasen, et Vollmer (2013) have tried to establish a parallel with the level of the country's economic development based on GDP. Roberge (2013) has opted for the difference in birth-weight and prematurity. Muenchhoff et Goulder (2014) have highlighted the prevalence of infectious diseases by child gender. Other authors have used the resilience capacity of girls facing conditions of widespread food shortages in sub-Saharan Africa (Marcoux 2002; Mbacké et Legrand 1992). The general remark is that the choice of factors to analyse the gender gap of stunting has not always followed a robust approach. In addition, comparisons used only the prevalence indicator. The present study will attempt to fill in this double limitation by also examining the raw values of the z-scores for height-for-age to assess the seriousness of the height deficit. In addition, the selected factors will be the most predominant ones issued from a more objective approach. For this purpose, we rely on the meta-analysis of factors from a research carried out on 137 countries datasets by Danaei et al. (2016) who reached the conclusion that the three main factors of growth retardation are: birth at term with a small weight, the inappropriate environmental hygiene conditions and diarrhoea. This study attempts to determine the prevalence of stunting, examine the existence of a gap in growth between gender and analyse variations based on these above-cited factors. We used a pooled data of the most recent demographic and health surveys from 20 countries in sub-Saharan Africa to establish more robust results, using stunting prevalence and height-for-age zscore. For this purpose, we will proceed by reviewing the sources of each dataset, elaborating analytical methods to determine which stunting factors contribute to gender discrepancy and discussing the findings.

## **Method:-**

### **Type of study**

The study is a descriptive and analytical. It uses the cross-sectional data of demographic and health surveys carried out in sub-Saharan Africa. The choice of 20 countries is based on the existence of a child and mother anthropometry. It has also attempted to balance the spatial distribution of countries in regional subsets: 10 countries in West Africa, 5 countries in East Africa, 4 countries in Central Africa, and 1 country in southern Africa. Some countries with large populations that could affect the quality of data collection have therefore been excluded. Overall, the selected countries account for more than half (53%) of the population of sub-Saharan Africa (United Nations, Department of Economic and Social Affairs, et and Population Division 2015).

The scope of the surveys was nation-wide and the collection period was between 2010 and 2016 (table 1). The size of household samples varied from 7,200 in Guinea to 40,320 in Nigeria. The household response rate ranged from 96.9% in Namibia to 99.9% in Rwanda. The response rates of eligible women (15-49 years) who are mothers of children under 5 years old, ranged from 91.6% for Namibia to 98.2% for Gabon. The size of samples of children ranged from 6,935 in Senegal to 31,482 in Nigeria. Usually, in a subsample of one out of two households, anthropometric data were collected on all eligible women and all under-five year children. This analysis is therefore restricted to these merged subsamples.

### **Method and sampling technique**

The surveys have been generally carried out according to the standardized approach, however there were some adjustments by country. They used the probabilistic method and the two-stage stratified survey technique. The stratification is intended to provide a representative sample by place of residence and administrative regions of the country. For the first step of selection, the clusters represented by the enumeration areas (EA) were selected from an exhaustive list of the EAs delineated during the latest general population and housing census of the country. The selection of clusters corresponded with the first step and implemented on a systematic basis with probability proportional to the size in number of households. After counting all the households in every selected cluster during the first step, then about 20 to 30 households are randomly chosen in the second step. In some cases, some clusters were excluded from the survey due to insecurity, as it has been the case in the centre and the north of Mali, northern Niger and the Sahel region of Burkina Faso.

For the analysis, the complexity of sampling had been taken into consideration by introducing weighting and the structuring of the household selection factors in the calculation of estimates and confidence intervals. A coefficient is introduced to ensure consistency between sample size and size of population of the country on the basis of the 2015 United Nations estimates (United Nations, Department of Economic and Social Affairs, et and Population Division 2015). These parameters have been incorporated into the analysis through the procedure of 'complex sample' using SPSS.

### **Presentation of variables**

The dependent variable which is stunting here is evaluated from the data of height, age and sex. The index generated is the height-for-age z-score that compares the height to that of the norm at the same age and sex (WHO 2006 growth norm). It is the relationship between the difference of the height of the child and the median height of the norm population of the same age and sex divided by the standard deviation of the height of this same norm population. These calculations have been made by the software version 3.2.2 WHO Anthro (M. de Onis et al. 2009). On this basis, a child is considered stunted if the height-for-age z-score is less than -2 according to the categorization of WHO (OMS 1995). Stunting is also referred to as chronic malnutrition because it provides information especially on the child's nutritional condition over a long period of time.

For social characteristics, the sex of the child is in the assessment of nutritional status and also as a principal independent variable. For this purpose, its ability of modification or confusion effects on stunting was assessed. The child's age was also considered and expressed in months as anthropometry changes quickly during infancy and childhood and that stunting is cumulative phenomenon over age (Waterlow 1994).

For the assessment of the family environment, we rely on the method of disposing off children's faeces. The variable has been recoded into three ordinal items. The procedure of grouping adopted the approach elaborated by WHO and Unicef (OMS and Unicef 2017). The new reconstituted items are: adequate facilities (flush toilet connected to a sewage system, to a septic system, to latrines, to something else, to doesn't know where, ventilated improved pits/latrines, composting toilets, latrines with slab, manual flush), and for inadequate facility (latrine without slab/open hole, pit/latrines, bucket, hanging toilets/latrines) and no facility (no toilet/nature).

The weight of the baby at birth has been approximated by the mother's appreciation of the size at birth. It was categorized into three items: big, medium and small. This variable was preferred to the actual birth-weight in order to compensate the frequent lack of birth or health card of children. The relatively high proportion of non-assisted deliveries and the loss of documents increased with the age of the child, rendering the documentary sources less available over time. The use of this proxy is relevant insofar as it is strongly correlated to the actual measure of weight (Blanc et Wardlaw 2005).

For diarrhoea, we considered that the child was affected if s/he had at least three liquid or watery-liquid faeces per day or any number considered by the mother as being abnormally high. However exclusively breastfed babies were excluded from the first case because they could easily have three liquid faeces (ICP 2017).

### **Cross-tabulation of variables**

A first step was to cross-tabulate the dependent variables (Stunting, height-for-age z-score) with the sex of the child to evaluate the variation of the relationship in general and specifically by country. Then, the cross-tabulation was done with the independent variables used in this analysis. The significance test resorted to the khi2 and also to the

Fischer exact test when a cell of cross-table has a number of cases less than 5. We proceeded with analysis of variance when the dependent variable is the height-for-age z-score.

### Results:-

For the twenty countries considered, the curve of the height-for-age z-score of children showed an important lag behind the 2006 WHO norm curve (Figure 1). The shift to the left is indicative that the children are subjects of growth deficit below the standard. The stunting prevalence is actually 33.4% (Table 2). Furthermore, the prevalence is significantly higher in boys than girls (35.4%; IC=[34.7%; 36.1%] vs. 31.3%; IC=[30.6%; 32.0]). This gap is statistically significant in 9 individual countries: Burkina Faso, Burundi, Cameroon, Nigeria, Kenya, Rwanda, Senegal, Tanzania and Zambia. For the others, with the exception of Congo-Brazzaville, male prevalence remains always higher for boys, but the gap is not significant. The strongest differences are recorded in the countries of the Great Lakes with 8.9% in Burundi and 8.1% in Rwanda. However, there is no correlation between the national prevalence and the differences in prevalence between sex in the 20 countries ( $R^2=0.42$ ).

When considering the average index of z-score height-for-age, boys' height growth is significantly lower than girls (-0.23 vs. -1.38) for all the 20 countries. This feature is also valid for countries such as Burkina Faso, Burundi, Kenya, Nigeria, Rwanda, Tanzania, and Zambia. For other countries, the female mean values are higher than that of boys without being significant, except again for Congo-Brazzaville.

The cross-tabulation of the factors considered (birth at term with a small weight, the inappropriate environmental hygiene conditions and diarrhoea) with stunting status showcases the expected correlations (Table 3). Actually, the smaller the size is at birth, the higher is the prevalence of stunting, and overall a subsequent lower height growth. Similarly, suffering from diarrhoea in the last two weeks and living in a household with bad sanitation is associated with faltered height growth. However, astonishingly, households without sanitation have a lower prevalence of stunting or an overall better growth than households with inadequate facility.

It appears that the girls had better height growth than boys, either in terms of stunting prevalence or with the mean values of height-for-age z-score index at equivalent level of size at birth, (Table 3Table 3). This significant favourable situation to girls is still observed for the different items of diarrhoea infection or sanitation quality in household. Actually, whether the children have experienced diarrhoea or not or even regardless of the sanitation of the household, girls have better height growth than boys.

The analysis of gender influence on stunting occurs directly through the differences in height growth between girls and boys as observed previously, but also indirectly through the selected factors. Actually, these variables will be considered as intermediates if they acted with their intrinsic effects and those induced by the differentiated effect by gender. To determine if they were intermediate, we tested the variability of the factors with sex. The bivariate cross-tabulation indicates that among the explanatory factors considered; only the size of the baby at birth is significantly distinct according to the sex of the child (Tableau 4Table 4). Clearly, girls showed a higher prevalence of small morphology at birth. This factor therefore expresses both its own effect and reflects that of the sex of the child on stunting.

### Discussion:-

The analysis of the growth of under 5-year-old children in the 20 countries in sub-Saharan Africa indicates that a third of children (33.4%) had a height that was below what they should have for their age and sex. This stunting level is classified as high by WHO (OMS 1995). This prevalence is below the value of 40.1% found by Black et al. (2013). This difference could certainly be linked to the fact that our estimates are based on 20 countries instead of the 53 countries that they used in their analysis. In addition, unlike the 1979 NCHS/CDC/WHO growth reference used previously, we instead used the 2006 WHO norm reference. Also, one must admit that our data are more recent; they therefore incorporate the general decline in stunting prevalence that is taking place in the developing countries (de Onis and Branca 2016).

We have demonstrated that the stunting prevalence is significantly different by sex. The boys have a higher level of stunting for the overall 20 countries included in the analysis. When considered individually, only Congo-Brazzaville appears to depart from this pattern and in seven countries, the difference is not significant. Our results are confirmed by others who have analysed this phenomenon. In 16 demographic and health surveys conducted in 10 countries,

Wamani et al. (2007) also reached a similar significant difference, but with different rates (40% for boys and 36% for girls). In addition, all 16 surveys present a favourable situation to girls, the difference is not significant between sex for only four surveys. This difference could be attributed to the fact they have considered only English-speaking countries in their study. For Svedberg (1990) who also addressed the question in ten sub-Saharan African countries, only one had presented a higher prevalence for girls, for two countries, the prevalence was the same and seven countries had higher rates for boys. Morrisson and Linskens (2000), also considered 20 sub-Saharan African countries, a little bit different from ours, obtained a significant difference in 12 countries in favour of girls.

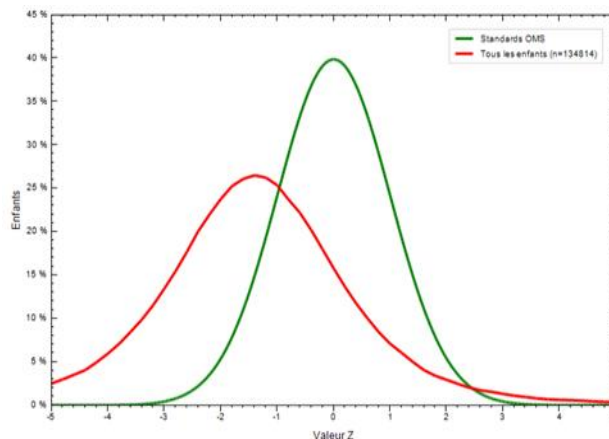
The relations between the growth (faltering) and the selected independent factors are in the expected trends according to the items of qualitative ones and for correlation with the ordinal ones. Indeed, diarrhoea in the last two weeks increases the risk of stunting, as it has been proved by Checkley et al. or by Caulfield et al. (Checkley et al. 2008; Caulfield et al. 2004). Adequate sanitation reduces stunting as demonstrated by Fink, Günther, and Hill (2011) on data from demographic and health surveys from 171 countries or Masibo (2013) on data from four surveys from Kenya. It is established that inadequate environment increases the risk of chronic enteropathy associated with absorption of e-coli present in soil and on hands causing inflammation of the intestinal mucosa and affecting in turn the absorption of nutrients (George et al. 2015; Lin et al. 2013). This may explain the worse situation of the children in household with an inadequate facility than that of children in household without installation. When the household has no installation, people resort to open fields or bush; this avoids close contacts with faeces from the house-members, which is better than the proximity of inappropriate facility.

A limitation of this study is that we resort to the appreciation of small morphology at child birth to approximate the birth at term with a small weight. This approximation may be biased by the inclusion of preterm and small for their gestational age children who were not concerned by the predominant factors of stunting designed by Danaei et al. (2016). The effect of this bias on our results may nevertheless be low because premature babies are in a very small proportion (8.6%) among small children for gestational age (Christian et al. 2013).

Our results indicate that small morphology at birth has an effect on stunting; this is confirmed by other studies (Christian et al. 2013). Moreover, the size of the baby at birth is rather favourable to boys; they present a higher weight at birth (Zeitlin 2002). This difference has been established to starts early during the first trimester of pregnancy or even in the 12 first weeks (Alur 2019; Bukowski et al. 2007). It is therefore a paradox between a higher proportion of size at birth for boys and later worse stature growth in comparison to girls. An empirical explanation was that the girls had a more resilient constitution to infections; resulting in a longer life expectancy (Wondimagegn 2014; Mbacké et and Legrand 1992). This finding is further supported by a better built analysis based on recent datasets and more tangible scrutiny. For example in the context of food and nutrition insecurity, the smaller size and greater adiposity favour the girls than boys before and after birth (Díez Navarro 2018). On the contrary, the big morphology of males requires an important quantity of energy that is not always available in the women who may have suffered from malnutrition during infancy and childhood or facing qualitative food shortage before or during pregnancy. Such a situation may facilitate the onset of malnutrition. During pregnancy, the placenta accelerated aging is known to be deleterious to boys with reduced foetal weight among males but with increased foetal weight among females (Tekola-Ayele et al. 2019). They would be more prone to environmental stress during the gestation, at birth and through childhood, unlike the girls who are more stable (Roy et al. 2014; Díez Navarro 2018). After birth, one element singled out is the rate of lung growth. It appears that foetal male has a lower lung maturity level than the female foetus in the last two months in a normal pregnancy. This explains the higher incidence of of respiratory distress syndrome among boys (Townsel et al. 2017). The situation is worsened by the fact that boys are more prone to big size birth which leads to higher incidence of prematurity; this renders their respiratory system even more vulnerable. The imbalance leads to a male over-morbidity and mortality observed at the age the effects of the family behaviour can be considered as marginal (Drevenstedt et al. 2008).

This study emphasizes the persistence and the multidimensional and multifactorial nature of stunting among children in sub-Saharan Africa. This highlights the complexity of the phenomenon and its impact on the population and the countries that are affected. The symbolic feature of this complexity encompasses social behaviour through hygiene and sanitation in household and the morbidity through diarrhoea. Moreover, if there is a significant sex difference in the occurrence of stunting in sub-Saharan Africa, this can partially be attributed to the gender difference of birthweight. The small size of girls appears to be beneficial to them in the context of the multiple shortages (Walker et al. 2011). It is also a biological dimension underlying resiliency of girls in the face of less favourable living conditions and disease. Unfortunately, few studies in sub-Saharan Africa have been dedicated to

the imbalance of stunting in the occurrence of malnutrition. Quite often, there is a temptation to slide towards the paradigm of domination of the male which corresponds more to the reality of Northern Africa and some parts of Asia and where the biological dimension is completely veiled by a male preference and domination. In sub-Saharan Africa, there is thus a need to include sex as biological dimension and gender aspects as behaviour and culture in all discussions and interventions on child stunting to be in line with the context.



**Figure 1:**-Distribution curve of height-for-age z-score of under-five year old children

**Table 1:**-Characteristics of DHS surveys considered

Countries	Year of collection	Number of households	Response rate of households	Response rate of eligible women	Sample size of children
Burkina Faso	2010	14947	99.2	98.4	15044
Burundi	2010	9030	99.1	96.4	7742
Congo B.	2011-12	11727	99.8	98.0	9329
Côte d'Ivoire	2011-12	10413	98.1	92.7	7776
Cameroon	2011	15050	99.0	97.3	11732
Gabon	2012	10049	99.3	98.2	6067
Ghana	2014	12831	98.5	97.3	5884
Guinea C.	2012	7200	99.5	98.0	7039
Kenya	2014	39679	99.0	96.6	20964
Liberia	2013	9677	99.4	97.6	7606
Mali	2012-13	10743	98.4	95.9	10326
Nigeria	2013	40320	99.0	97.6	31482
Niger	2012	11900	98.0	95.4	12558
Namibia	2013	11004	96.9	91.6	5046
Rwanda	2014-15	12793	99.9	99.5	7856
Senegal	2014	4400	98.7	96.1	6935
Chad	2014-15	17892	98.9	96.1	18623
Togo	2013-14	9899	99.1	97.8	6979
Tanzania	2015-16	13360	98.4	97.3	10233
Zambia	2013-14	18052	97.9	96.2	13457
All		290966			222678

**Table 2:**-Prevalence of stunting by sex and mean value of height-for-age according to countries

Countries	Sex	Prevalence	Conf Interv.		Gap (G-F)	Mean value	Conf Interv..	
Burkina Faso	Male	37.7	35.7	39.7		-1.46	-1.53	-1.38
	Female	32.6	30.7	34.6		-1.30	-1.37	-1.23
	All	35.2	33.7	36.7	5.1	-1.38	-1.44	-1.32
Burundi	Male	62.6	59.9	65.4		-2.30	-2.39	-2.21
	Female	53.7	50.8	56.7		-2.07	-2.15	-1.99

	All	58.3	56.2	60.4	8.9	-2.19	-2.26	-2.13
Congo B.	Male	22.7	20.3	25.0		-0.95	-1.04	-0.86
	Female	24.5	21.2	27.9		-1.01	-1.13	-0.90
	All	23.6	21.7	25.5	-1.8	-0.98	-1.05	-0.91
Cote d'Ivoire	Male	32.4	29.2	35.5		-1.30	-1.41	-1.18
	Female	27.1	24.1	30.1		-1.14	-1.27	-1.02
	All	29.6	27.5	31.8	5.3	-1.22	-1.31	-1.12
Cameroon	Male	35.3	32.8	37.8		-1.31	-1.41	-1.22
	Female	30.3	28.1	32.5		-1.20	-1.29	-1.12
	All	32.7	31.1	34.4	5.0	-1.26	-1.32	-1.19
Gabon	Male	19.9	1.06	23.8		-0.80	-0.95	-0.65
	Female	15.0	11.8	18.2		-0.64	-0.78	-0.51
	All	17.5	14.9	20.1	4.9	-0.72	-0.83	-0.61
Ghana	Male	19.8	17.3	22.3		-0.96	-1.05	-0.86
	Female	17.1	14.5	19.7		-0.85	-0.93	-0.77
	All	18.5	16.5	20.5	2.7	-0.91	-0.97	-0.84
Guinea C.	Male	32.3	29.5	35.0		-1.11	-1.25	-0.97
	Female	29.4	26.6	32.2		-0.98	-1.10	-0.85
	All	30.9	28.8	33.0	2.9	-1.05	-1.14	-0.95
Kenya	Male	29.7	28.3	31.1		-1.26	-1.31	-1.22
	Female	22.2	20.9	23.4		-1.00	-1.04	-0.95
	All	26.0	24.9	27.0	7.5	-1.13	-1.17	-1.10
Liberia	Male	32.9	29.4	36.4		-1.29	-1.42	-1.16
	Female	27.2	24.2	30.1		-1.10	-1.23	-0.97
	All	30.3	28.0	32.5	5.7	-1.20	-1.30	-1.11
Mali	Male	39.2	36.5	41.9		-1.46	-1.56	-1.36
	Female	36.4	33.9	38.9		-1.32	-1.43	-1.21
	All	37.8	35.8	39.9	2.8	-1.39	-1.48	-1.31
Nigeria	Male	37.9	36.5	39.3		-1.38	-1.45	-1.31
	Female	34.9	33.5	36.3		-1.23	-1.29	-1.16
	All	36.4	35.2	37.6	3.0	-1.30	-1.36	-1.24
Niger	Male	44.8	42.3	47.3		-1.71	-1.81	-1.61
	Female	40.5	38.1	42.9		-1.56	-1.66	-1.45
	All	42.7	40.7	44.6	4.3	-1.63	-1.71	-1.55
Namibia	Male	22.7	19.2	26.1		-0.95	-1.07	-0.82
	Female	20.3	17.4	23.2		-0.86	-0.97	-0.75
	All	21.5	19.1	23.8	2.4	-0.90	-0.99	-0.81
Rwanda	Male	42.7	40.2	45.2		-1.72	-1.79	-1.65
	Female	34.6	32.1	37.0		-1.44	-1.51	-1.37
	All	38.7	36.8	40.6	8.1	-1.58	-1.63	-1.52
Senegal	Male	23.7	21.6	25.8		-1.06	-1.13	-1.00
	Female	19.0	17.0	21.0		-1.00	-1.06	-0.93
	All	21.3	19.8	22.9	4.7	-1.03	-1.08	-0.98
Chad	Male	40.7	38.6	42.8		-1.51	-1.59	-1.44
	Female	38.8	37.1	40.5		-1.43	-1.50	-1.36
	All	39.8	38.3	41.3	1.9	-1.47	-1.53	-1.42
Togo	Male	27.5	24.9	30.0		-1.26	-1.34	-1.18
	Female	26.2	23.6	28.8		-1.18	-1.26	-1.09
	All	26.8	24.9	28.8	1.3	-1.22	-1.28	-1.15
Tanzania	Male	32.6	30.8	34.5		-1.32	-1.37	-1.26
	Female	28.0	26.1	29.8		-1.19	-1.25	-1.13
	All	30.3	28.9	31.8	4.6	-1.25	-1.30	-1.21
Zambia	Male	42.3	40.7	43.9		-1.63	-1.68	-1.57

	Female	37.9	36.3	39.5		-1.48	-1.54	-1.42
	All	40.1	38.9	41.4	4.4	-1.55	-1.6	-1.51
All	Male	35.4	34.7	36.1		-1.38	-1.40	-1.36
	Female	31.3	30.6	32.0		-1.23	-1.25	-1.21
	All	33.4	32.8	34.0	4.1	-1.30	-1.32	-1.29

**Table 3:-**Prevalence of stunting according to mother and child characteristics

Sex of child		%	Conf. Interv.		Mean value	Conf. Interv.		
<b>Size at birth</b>								
Wide	Male	32.0	30.9	33.0	-1.17	-1.22	-1.13	
	Female	28.6	27.5	29.7	-1.05	-1.10	-1.00	
	All	30.4	29.5	31.3	-1.11	-1.16	-1.07	
Medium	Male	36.3	35.3	37.3	-1.43	-1.47	-1.39	
	Female	32.1	31.1	33.0	-1.26	-1.30	-1.22	
	All	34.2	33.4	34.9	-1.34	-1.38	-1.31	
Small	Male	44.4	42.6	46.2	-1.71	-1.80	-1.62	
	Female	38.0	36.5	39.5	-1.47	-1.53	-1.41	
	All	40.9	39.6	42.2	-1.58	-1.63	-1.52	
<b>Diarrhoea</b>								
Non infected	Male	34.7	33.9	35.4	-1.33	-1.36	-1.29	
	Female	30.9	30.2	31.6	-1.18	-1.21	-1.15	
	All	32.8	32.2	33.4	-1.25	-1.28	-1.23	
Infected	Male	39.8	38.4	41.3	-1.57	-1.63	-1.52	
	Female	34.0	32.5	35.5	-1.37	-1.43	-1.31	
	All	37.0	35.9	38.1	-1.48	-1.52	-1.43	
<b>Sanitation</b>								
Appropriate	Male	31.1	30.1	32.1	-1.19	-1.24	-1.15	
	Female	27.4	26.4	28.4	-1.06	-1.10	-1.01	
	All	29.2	28.4	30.1	-1.13	-1.16	-1.09	
Inappropriate	Male	41.0	39.5	42.5	-1.58	-1.64	-1.52	
	Female	36.2	34.8	37.7	-1.40	-1.46	-1.35	
	All	38.6	37.4	39.9	-1.49	-1.54	-1.44	
Open	Male	38.7	37.4	40.0	-1.48	-1.54	-1.42	
	Female	34.5	33.2	35.8	-1.31	-1.37	-1.26	
	All	36.6	35.5	37.7	-1.40	-1.45	-1.35	

**Tableau 4:-**Cross-tabulation of prominent factors and sex of child

Factors	Female			Male			All			P-value.
	%	Interv. de conf.		%	Interv. de conf.		%	Interv. de conf.		
<b>Sanitation</b>										
Appropriate	49.8	48.5	51.2	50.1	48.7	51.4	50.0	48.7	51.3	0.748
Inappropriate	23.7	22.6	24.8	23.7	22.6	24.8	23.7	22.6	24.7	
Without installation	26.5	25.2	27.8	26.2	24.9	27.6	26.4	25.1	27.6	
<b>Diarrhoea</b>										
Non infected	86.7	86.2	87.2	86.3	85.8	86.7	86.5	86.1	86.9	0.111
Infected	13.3	12.8	13.8	13.7	13.3	14.2	13.5	13.1	13.9	
<b>Size at birth</b>										
Wide	35.9	35.1	36.8	40.6	39.8	41.4	38.3	37.6	39.0	0.000
Medium	47.7	46.8	48.5	46.1	45.3	46.9	46.9	46.2	47.6	
Small	16.4	15.9	17.0	13.3	12.8	13.9	14.9	14.4	15.3	

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