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Study of Factors Associated with Anemia among Women in Reproductive Age in Kolda (Senegal)

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Abstract

<u>Introduction</u>: Anemia in women of reproductive age is a common health problem in the region of Kolda (Senegal). The objective of this research was to study the risk factors of anemia among women in reproductive age in Kolda (Senegal). <u>Methodology:</u> A cross-sectional, descriptive and analytical study of women in reproductive age and their households was conducted in the Kolda region between October and December 2015. This was a three-stage random sample survey. The data was collected during an individual interview. Logistic regression was used to identify the factors of this anemia. <u>Results:</u> In this study, 968 women of reproductive age were surveyed. The average age of women was 27 years with a standard deviation of 7.4 years. There were 10% of pregnant women, 36.3% of lactating women and 53.7% of women neither pregnant nor lactating. The average size of the households surveyed was 14 people and the 36.3% had an average economic level. The majority of households were equipped with traditional latrines (76.9%). Women were neither pregnant nor lactating in 53.7%, were uneducated in 70.7% and 81% used micronutrient-rich foods. The prevalence of anemic women was 55.2%. The factors associated with anemia in women in Kolda were the use of traditional latrines (ORa = 1.48 [1.0 - 2.1]), the woman's pregnancy status (ORa = 5 [2.7 - 9.8]), non-education of the woman (ORa = 1.52 [1.1 - 2.0]), the existence of income-generating activity for the woman (ORa = 0.69 [0.5 - 0.9]), the processing of local products in the household (ORa = 0.5 [0.3 - 0.9]) and the use of at least one micronutrient rich food in the household (ORa = 0.73 [0.49 - 1.0]). <u>Conclusion:</u> The prevalence of anemia among women in reproductive age is still high in the Kolda region. To combat this phenomenon, awareness campaigns on iron and folic acid supplementation should be stepped up, the use of modern latrines should be promoted and the empo-

werment of women should be strengthened.

Keywords

1. Introduction

Anemia is a real public health problem in our developing countries. According to World Health Organization (WHO), in 2014, an estimated 1.62 billion people worldwide suffer from anemia. Children and women of childbearing age are unfortunately the most exposed, with a global prevalence of 43% in children under five, 38% in pregnant women and 29% in non-pregnant women aged 15 to 49 years [1] [2].

In Senegal, according to EDS-MICS 2010-2011, the prevalence of anemia among women is 54% compared to 31% among men. Kolda had a percentage of women anemic at 55.8% [3].

The consequences of anemia on the health are multiple. Anemia decreases physical capacity, causes a state of weakness, fatigue, affects the feeling of well-being. It reduces intellectual performance and work capacity thus slowing down productivity. In addition, it reduces the resistance to infections and increases the risk of death during the gravid-puerperal period, resulting in health expenses that could have been avoided. In short, it has major negative consequences for human health and social and economic development [4] [5] [6] [7].

The health sector is one of the priorities of Senegal. This is evidenced by the increase in the ministry's budget (29 billion in 2000 to 108.4 billion in 2010) and by the objectives set in the PNDS 2009-2018. Despite all efforts, anemia remains a public health problem more for women and children under 5 years [3]. The Kolda region is one of the most affected regions.

This study contributes to the fight against maternal and infant mortality and morbidity. It aims to study the risk factors associated with anemia in women of childbearing age in Kolda.

2. Materials and Methods

2.1. Framework of the Study

This was carried out in the Kolda region which is located in southern Senegal. This region covers 13,721 km^2, with a population of 748,451 inhabitants of which 43.7% are women. The number of women of reproductive age is 58,589 women. Administratively, the region of Kolda is composed of the departments of Kolda, Medina Yoro Foula and Vélingara [8]. This region is predominantly rural and is among the most disadvantaged regions of Senegal. According to the results by region of EDS-MICS 2010-2011, indicators of maternal and child

health are worrying. The mortality rate of children under 5 years in Kolda is 154‰ against 72‰ in Senegal. The prevalence of Kolda chronic malnutrition is 24% against 16.5% in Senegal. Only 36.6% of the population in Kolda have access to basic social and health services. The lack of resources available to support the most vulnerable groups, especially women, are factors contributing to this situation and to the deterioration of the living conditions of the poorest [3].

2.2. Type of Study

It is a cross-sectional, descriptive and analytical study. It was made between October and December 2015.

2.3. Study Population and Sampling

This study concerned all women of reproductive age. Included were all women aged 15 to 45 living in the Kolda region and having freely accepted to participate in the study. The sample size was calculated from the adjusted Schwartz formula. It was appreciated based on the prevalence of iron deficiency in women published in the EDS-MICS 2010-2011 which was 54% and a proportion of non-respondents of 5%. Schwartz's formula is as follows: n = $(\varepsilon a^2, pq)/i^2$ with εa = 1.96: reduced deviation corresponding to the risk accepted (a = 5%, εa = 1.96); p = prevalence of anemia in women = 54%; q: complement of p = 1 − p; i: accuracy = 4%; n = sample size; N = n + 5% (n) = number of women to be surveyed by health district.

The sample size that maximizes the estimates is 320 women per department. In total, the sample size is 960 individuals for the three departments. For the choice of statistical units, a three-stage random survey was carried out. From the National Agency for Statistics and Demography (ANSD) census database, 16 census districts (CDs) were randomly selected by department. In each CD, 20 concessions were drawn from the census base. Finally, in each concession, the enumerator had identified all the eligible women and from this list, he selected a woman from 15 to 45 years old. In choosing women, he respected the proportionality of two pregnant women, six lactating women and twelve women who were neither pregnant nor breastfeeding. This proportionality was derived from the report on maternal status of women in Senegal of EDS-MICS 2010-2011 [3].

2.4. Data Collection

The data collection was done on the basis of electronic series of question made on the CSpro software. The investigators were responsible for collecting the data directly on the tablets. They were organized into 18 teams of four investigators and one supervisor per department. After four days of training, the investigators conducted a pilot survey to test the questionnaires and masks before starting the actual collection. The measurement of anemia was made by hemoglobinemia which was determined by the HemoCue© device. It is a portable hemoglobinometer

used to quantify the hemoglobin level of the person in less than a minute, from a drop of capillary blood. The woman is considered anemic if the hemoglobin is less than 11g/dl. For pregnant women, anemia will be considered mild if the hemoglobin level is between 10.0 and 10.9 g/dl [3]. As in the 2010-2011 EDS-MICS of Senegal, anemia levels were set at the following intervals [9]:

- Severe anemia = hemoglobinemia < 7 g/dl,
- Moderate anemia = 7g/dl ≤ hemoglobinemia < 10 g/dl,
- Mild anemia = 10 g/dl ≤ hemoglobinemia < 11 g/dl

The data collected focused on:

– the characteristics of the woman such as maternal state, education, autonomy, level of knowledge, attitudes and practices in nutrition;
– and information on household characteristics such as marital status, ethnicity, availability of resources, socio-economic level, household size and availability of modern latrines.

2.5. Data Analysis

The data were analyzed with software R. The qualitative variables were described with absolute and relative frequencies and the quantitative variables by mean and standard deviation. Bivariate tests were made using Chi-square for comparison of proportions, Student or ANOVA for comparison of means. When parametric test conditions were not observed, Kruskall Wallis non-parametric tests or Fisher's exact test were used. A multivariate analysis was performed with a simple logistic regression for the determination of anemia-related factors, with an adjustment to the independent variables while ensuring the applicability conditions with a significance threshold set at 5%. Variables with p less than 0.25 in bivariate analysis were used for modeling [10]. The lrtest (likelihood ratio) and AIC allowed the choice of the latter with the step-down method. Finally, the Hosmer Lemeshow test made it possible to test the adequacy of the final model [11]. Associations were measured by odds ratios with their confidence intervals.

2.6. Ethical Considerations

The approval of the National Ethics Committee for Health Research (CNERS) of Senegal was obtained before the start of field activities. Participation in this study was free. Free and informed consent was obtained from all women aged 18 and over. For women under the age of 18, consent of their legal guardian was obtained before their own consent. An information sheet was administered to each woman (and the legal guardian for minors), before signing the consent form. No compensation or compensation was given to the people surveyed. Women who have been diagnosed with anemia have been referred to the health center closest to home for treatment and follow-up. The collected data was personal. The identification of people who agreed to take part was not mentioned on the tools collection. Wherever the results are used, the anonymity has been

respected.

3. Results

3.1. Women' Reproductive Age Characteristics

In all, 968 women of reproductive age were surveyed. The average age of women was 27 years with a standard deviation of 7.4 years. There were 10% of pregnant women, 36.3% of lactating women and 53.7% of women neither pregnant nor lactating. The majority of women were uneducated with a frequency of 70.7%. The study also showed that 28.3% of women had an income-generating activity (IGA). Only 4.4% of women had a bank account and 40.9% were members of a for-profit association. Women had poor knowledge of the anti-anemia products of pregnancy (68.9%) and good culinary practices (63.3%) and hygienic practices (31.3%). Only 8.9% used enriched flour in their culinary preparations. Regarding hygiene, 47.8% of women had a bad hand washing attitude (see Table 1).

3.2. Characteristic of the Households Women Surveyed

The majority of women lived in rural areas (72%) with households of more than 6 persons (83.9%). Monogamous brides represented 51.8%. The economic level was poor in 29.8% of households. The major ethnic group was Al-Poular with 73.3%. The means of processing local products were not readily available. Only 28.1% of households had access to irrigated parcels. The percentage of families with modern latrines was only 16.4%. The majority of families had access to a source of drinking water within one kilometer (89.6%) (see Table 2).

3.3. Anemia in Women of Reproductive Age

The study showed that 55.2% (or 534 women) of the women surveyed in the Kolda region are anemic. Of these anemic women, 12.2% had severe anemia and 51% had moderate anemia (see Figure 1)

3.4. Risk Factors Associated with Anemia in Women of Reproductive Age in Kolda

Logistic modeling has found factors related household—such as large family extent and the use of traditional latrines (OR = 1.48 [1.0 - 2.1]). The pregnant woman was five times risquer than the nursing one (OR = 5 [2.7 - 9.8]). The lack of education of women was a factor of exposure to anemia (OR = 1.52 [1.1 - 2.0]). Processing of local products (OR = 0.5 [0.3 - 0.9]) is a protective factor against the onset of anemia in women of reproductive age in Kolda (see Table 3).

4. Discussion

Anemia is a major risk of maternal mortality in developing countries. This study allowed us to estimate the prevalence of anemia of women in Kolda region through the use of hemoglobinometer. The main limitation of this study is that

Table 1. Characteristics of the woman of reproductive age in Kolda.

Women's reproductive age characteristics		Frequencies	
		Absolute(n)	Relative%
Maternal state (n = 968)	Pregnant women	97	10.0
	Lactating women	351	36.3
	Women Neither pregnant Nor Lactating	520	53.7
Instruction	Educated	284	29.3
	No educated	684	70.7
Share of household expenditure controlled by women	Woman controling less than 50% of the spents	777	80.3
	women controling at least 50% of the spents	191	19.7
Income generating activity	yes	274	28.3
	No	694	71.7
Bank account	yes	42	4.4
	No	926	95.6
Members of women profit making association	yes	396	40.9
	No	572	59.1
Knowledge of antianaemic of pregnancy	good	67	6.9
	fair	234	24,2
	weak	667	68.9
Knowledge about nutritional practices	good	155	16
	fair	562	58.1
	good	251	25.9
Knowledge about good hygiene practices	Bon	155	16
	fair	510	52.7
	weak	303	31.3
Knowledge about culinary attitudes	good	11	1.1
	fair	344	35.6
	weak	613	63.3
Use of enriched flours in culinary practice	yes	86	8.9
	No	882	91.1
Local product transformation	yes	62	6.4
	No	906	93.6
Using at least one food rich in micronutrient	yes	784	81
	No	184	19
Washing hands attitudes	bad attitudes	463	47.8
	acceptable attitudes	374	38.7
	good attitudes	131	13.5

Table 2. Household characteristics of women surveyed in Kolda.

Household Characteristics		Frequencies	
		Absolute(n)	Relative %
Social Environment	Rural	698	72
	Urban	270	28
Size of the families	>6 persons	812	8.9
	≤6 persons	156	16.1
Matrimonial situation	Monogame	502	51.8
	Polygame	445	46
	Divorcees or Widows	19	2
	Unmarried	2	0.2
Ethnic group	Al-Poular	710	73.3
	Ouolofs	125	12.9
	Mandingue	85	8.8
	Minority Ethnic group	48	5
Position of economic welfare	Very riche	30	3.1
	Riche	104	10.7
	Average	351	36.3
	Poor	288	29.8
	Very poor	195	20.1
Availability of irrigated parcels	yes	273	28.2
	No	695	71.8
Availability of transformation's means of the local products	yes	247	25.5
	No	721	74.5
Accessible to drinking water	<1 km	867	89.6
	≥1 km	101	10.4
Treatment of water drink	yes	805	83.2
	No	163	16.8
Availability of latrines in the concession	Traditional	809	83.6
	Modern latrines	159	16.4

Table 3. Factors associated with anemia of women of reproductive age in Kolda (by logistic regression).

Variables	ORajusted	IC 95%	pvalue
Characteristics of the family			
Lenght of the family			
≤6 persons	-	1	
>6 persons	1.44	[0.9 - 2.1]	0.07
Types of latrines			

Continued

Modernes	-	1	
Traditionnals	1.48	[1.0 - 2.1]	0.03

Woman characteristic

Maternal state

Breast feeding women	-	1	
Pregnant women	5.0	[2.7 - 9.8]	<0.0001
Neither pregnant nor breast feeding woman	0.86	[0.6 - 1.1]	0.33

Instruction level

educated	-	1	
No educated	1.52	[1.1 - 2.0]	0.008

Incomegeneratingactivy

No	-	1	
yes	0.69	[0.5 - 0.9]	0.02

Local product transformation

No	-	1	
yes	0.5	[0.3 - 0.9]	0.04

Using at least one Food rich in micronutrient

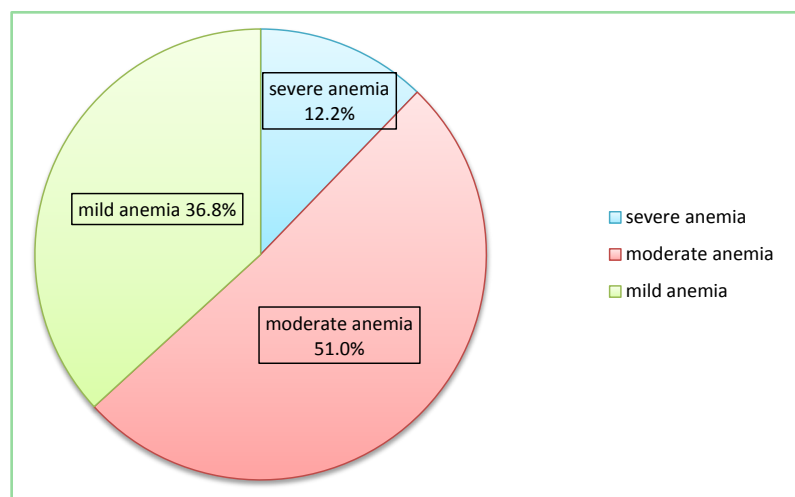|			
No	-	1	
yes	0.73	[0.49 - 1.0]	0.11

Figure 1. Distribution of anemic women by level of severity (N = 534).

the cause of anemia has not been sought. The prevalence of anemia among women of reproductive age in the Kolda region is 55.2% (or 534 women), 51% with moderate anemia, 36.8% with mild anemia and 12.2% with severe anemia. It reaches 83.5% of pregnant women and 55% of breastfeeding women. According to the ongoing EDS 2010-2011, in Senegal, the prevalence of anemia among

women is 54%, of which 61% among pregnant women 49% among those who are breastfeeding [3]. Overall, 49% of women in Guinea Conakry suffer from anemia, 65% of pregnant women and 52% of breastfeeding women [12]. In Côte d'Ivoire, the EDS-MICS 2011-2012, recorded 54% of anemic women, 64% of pregnant women, and 55% of breastfeeding women [13]. Indeed, the Vitamin and Mineral Nutrition Information System (VMNIS) classifies the prevalence of anemia greater than or equal to 40% as severe [14]. This study found several risk factors for anemia in women of reproductive age in Kolda. Factors relate to the quality of family cleanness, the woman's maternal status, her level of autonomy and her nutritional attitudes and practices.

The presence of traditional latrines increases the occurrence of anemia. Women whose households have traditional latrines are 1.48 times more likely to suffer from anemia than those equipped with modern latrines. This result could be explained by the pathogenic effect of intestinal parasitosis, the transmission of which is particularly favored by defective hygiene, particularly the fecal danger. Unlike modern latrines, traditional latrines have a bad evacuation and hand washing system, which exposes them to intestinal parasitosis. Helminthiases are the most frequent parasitosis and increase the frequency and severity of anemia [15]. As a result, these women are at high risk of water-borne and unsanitary infections [16].

It has been found in Kolda that 83.5% of pregnant women are anemic. EDS-MICS 2010 2011 states that Senegalese pregnant women are more often anemic (61%) than those who are breastfeeding (49%) or those who are neither pregnant nor breastfeeding (56%) [3]. According to the Bayebie study, 66.1% of pregnant women in the Dakar region have anemia [17]. The WHO estimated in 2015 worldwide that 43% of pregnant women were anemic compared to 33% of non-pregnant women [18]. Leke and Kremp noted that in Africa, 66.6% of pregnant women were anemic [19]. Miguel found that in Costa Rica, 60% of pregnant women are anemic [20]. In Kolda, the risk of anemia is multiplied by five in pregnant women. For Sharmanov, the prevalence of anemia was twice as high among pregnant women as among other women [16]. This high prevalence of anemia in pregnant women may have several explanations: iron and folic acid deficiency, the needs of which are increased with a diet that is not very diversified, and low female adherence to prenatal consultation (CPN) and supplementation programs, the lack of access to health facilities and the low decision-making power of women. Khadim *et al.* have shown that among pregnant women who are on iron and folic acid supplementation, only 56% are adhering to iron and folic acid for 90 days. The level of education and accessibility of CPN services were key factors in this uptake of iron and folic acid [21]. A good level of education of the woman would also protect against the occurrence of anemia in women. The proportion of educated and anemic women (48.9%) differs from the proportion of uneducated and anemic (58.9%). In Ivory Cost, anemia is more common among women with no education (55.3%) than among those with primary (54.3%) and secondary (48.8%) [13].

This study showed that women with an income-generating activity (IGA) have fewer cases of anemia than those without an IGA. Income-generating activity appears to protect against anemia (OR = 0.6 [0.5 - 0.9]). The financial autonomy of the woman increases her decision-making power over her medical follow-up. Jn 2006, Anorlu's study in Nigeria found that socio-economic status was significantly associated with anemia (p < 0.0001) with higher prevalence among women of low socioeconomic status [22]. The survey in Mauritania revealed that the percentage of anemic subjects is slightly higher among women who do not work (50.2%) than among women who work (46.8%) [23]. In 2013, Bayebie in Dakar found that economic activity reduced the risk of anemia [17]. A good level of socio-economic well-being is a protective factor against anemia. According to EDS 2010-2011, the prevalence of anemia is 58% for women in the poorest households against 53% for those of the richest households [3]. Anemia is therefore a health problem related to the socio-economic level of the countries. A good socio-economic level would be a protective factor against anemia through a better nutritional status.

The transformation of local products has a significant protective effect on the occurrence of anemia (OR = 0.5 [0.3 - 0.9]). In Senegal, diets are often based on cereals, roots and tubers that contain significant amounts of iron but also inhibitors of its absorption, especially phytates. Also, Senegalese dishes have a low bioavailability of iron, based on millet in villages and rice in cities [24]. Traditional practices such as dehulling cereals, soaking and fermentation increase the bioavailability of iron [25] [26]. The implementation of food fortification and diversification strategies is necessary to successfully cover the micronutrient intake of vulnerable populations.

5. Conclusion

Anemia is the most common abnormality in hematology. Clinical signs of anemia are inconsistent and may be associated with signs of tissue hypoxia (asthenia, dizziness, paleness, palpitations, dyspnea) and those related to compensatory mechanisms (tachycardia). It is a major public health problem particularly in developing countries and frequently affects women aged 15 to 49. Kolda is a poor region with a low rate of urbanization, 72% of households are rural. The average household size is 14 people. This study showed that the prevalence of anemia of woman in reproductive age in the Kolda region is 55.2% (534 women), of which 51% had moderate anemia, 36.8% a mild anemia and 12.2% a severe anemia. The study showed that a good level of education, the existence of income-generating activity, the use of modern latrines and the use of local processing and enrichment methods are elements that should be promoted to combat the high prevalence of anemia in women of reproductive age and especially pregnant women. Interventions incorporating these factors should be implemented in the Kolda region in a multisectoral, multidisciplinary and at all levels of the health pyramid to combat the scourge of woman anemia.

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References

[1] Branca, F., Mahya, L. and Shireen Mustafa, T. (2014) The Lack of Progress in Reducing Anaemia among Women: The Inconvenient Truth. *Bulletin of the World Health Organization*, **92**, 231. https://doi.org/10.2471/BLT.14.137810

[2] Stevens, G.A., Finucane, M.M., De-Regil, L.M., Paciorek, C.J., Flaxman, S.R., Branca, F., *et al.* (2013) Global, Regional, and National Trends in Haemoglobin Concentration and Prevalence of Total and Severe Anaemia in Children and Pregnant and Non-Pregnant Women for 1995-2011: A Systematic Analysis of Population-Representative Data. *The Lancet Global Health*, **1**, e16-e25. https://doi.org/10.1016/S2214-109X(13)70001-9

[3] Agence Nationale de la Statistique et de la Démographie (ANSD) du Sénégal. Enquête démographique et de santé à indicateurs multiples—2010-2011—Rapport FINAL. Dakar, février 2012. https://dhsprogram.com/pubs/pdf/FR258/FR258.pdf

[4] WHO, UNICEF, UNFPA and the World Bank (2007) Maternal Mortality in 2005. Geneva, 16-18.

[5] Leslie, J. (1991) Women's Nutrition: The Key to Improving Family Nutrition in Developing Countries? *Health Policy and Planning*, **6**, 1-19. https://doi.org/10.1093/heapol/6.1.1

[6] Lemonnitv, D. and Ingenblwk, C.I.Y. (1989) Nutritional Deficiencies in Developing Countries. Third Day of the GIRM. KARTHALA. ACCT, Paris, 280-284.

[7] Ayoubi, J.M., Hirt, R., Badiou, W., Hininger-Favier, I., Zraik-Ayoubi, F., Berrebi, A. and Pons, J.C. (2012) Nutrition and Pregnant Woman. EMC Obstetric Gynecology, 5-7.

[8] Agence Nationale de la Statistique et de la Démographie (ANSD) du Sénégal. Situation Économique et Sociale régionale de la région de Kolda - 2013. http://www.ansd.sn/

[9] DeMaeyer, E.M. (1989) Preventing and Controlling Iron Deficiency Anemia through Primary Health Care: A Guide for Health Administrators and Programme Managers. Genève.

[10] Collett, D. (2003) Modeling Binary Data. CRC Press, London, 387 p.

[11] Hosmer, D.W. and Lemeshow, S. (1989) Applied Logistic Regression. John Wiley, New York, 307 p.

[12] Ministère du Plan (2012) Enquête démographique et de Santé et à Indicateurs Multiples (EDS-MICS)-République de Guinée. Rapport Final, 196-197.

[13] Ministère de la Santé et de la Lutte contre le SIDA. Enquête démographique et de Santé et à Indicateurs Multiples-Côte d'Ivoire, 2011-2012. Rapport Final, 202-203.

[14] Benoist, B., *et al.* (2008) Worldwide Prevalence of Anaemia 1993-2005. WHO Global Database on Anaemia, Genève, Organisation mondiale de la Santé. http://apps.who.int/iris/bitstream/10665/43894/1/9789241596657_eng.pdf

[15] Kalenga, M.K., Nyembo, M.K., Nshimba, M. and Foidart, J.M. (2003) Etude de

l'anémie chez les femmes enceintes et les femmes allaitantes de Lubumbashi (République Démocratique du Congo). *Journal de Gynécologie Obstétrique et Biologie de la reproduction*, **32**, 647-653.

[16] Tiné, S.C. (2011) Facteurs d'agrégation de l'anémie dans les ménages au Cameroun 2011. Montréal, 178 p.

[17] Bayebié, B. (2013) Analyse des déterminants socioéconomiques de l'anémie ferriprive chez la femme enceinte au Sénégal: Cas de la région de Dakar. Economie de la santé, Dakar.

[18] (2014) Bulletin de l'Organisation mondiale de la Santé, 92, 231.

[19] Leke, L. and Kremp, D. (1989) Impact des carences nutritionnelles sur l'anémie de la femme enceinte. Développement et Santé, 84.

[20] Miguel, F.M.D. (1990) La femme enceinte et l'anémie. In: Mères et Enfants, La Nutrition Maternelle, Vol. 9.

[21] Niang, K., Faye, A., Tine, J.A.D., Diongue, F.B., Ndiaye, B., Ndiaye, M.B., Ndiaye, P. and Tal-Dia, A. (2017) Determinants of Iron Consumption among Pregnant Women in Southern Senegal. *Open Journal of Obstetrics and Gynecology*, **7**, 41-50. https://doi.org/10.4236/ojog.2017.71005

[22] Ministère de la Santé et de la Lutte contre le SIDA. Enquête démographique et de Santé et à Indicateurs Multiples-Côte d'Ivoire, 2011-2012. Rapport Final, 202-203.

[23] Anorlu, R.I., Oluwole, A.A. and Abudu, O.O. (2006) Sociodemographic Factors in Anaemia in Pregnancy at Booking in Lagos, Nigeria. *Journal of Obstetrics and Gynaecology*, **26**, 773-776. https://doi.org/10.1080/01443610600963846

[24] El Hafed, C., Dehah, M.O., Benzerroug, A. and El Ghadi, I.O. (2001) L'Anémie chez la femme en âge de procréer Wilaya du Gorgol (Mauritanie). Appui OMS, 23 p.

[25] Berger, J. (2004) Enrichissement des aliments en micronutriments: Elément d'une stratégie intégrée de lutte contre les carences en micronutriments, en particulier en fer, dans les pays en développement. Presses Universitaires de Ouagadougou, Paris, 563-575.

[26] Berger, J. and Dillon, J.C. (2002) Stratégies de contrôle de la carence en fer dans les pays en développement. *Cahiers d'études et de recherches francophones/Santé*, **12**, 22-30.