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Determination and Characterization of Women, Infants, and Young Children's Dietary Diversity in Agricultural Mitigation Period of Burkina Faso

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ABSTRACT

Backgroun: The increasing variety of foods and food groups in the diet helps to ensure adequate intake of essential nutrients and promotes good health. The main objective was to determine the diet quality of women, infants, and young children in agricultural mitigation period of Burkina Faso. **Methods:** A 24-h dietary open recall was used to collect all foods taken by women, infants, and young children in Centre-West region of Burkina Faso. The dietary diversity (DD) score was equal to the number of consumed food groups for infants (6-23 months) according to WHO recommendations and for women and young children (24-59 months) according to food and agriculture organization (FAO). Three DD classes were determined for the individual average DD. For each DD class, food consumption profile was determined by food items or groups consumed by at least 50 percent of women, infants, and young children according to FAO guide. **Results:** The study was conducted among 971 women, 419 infants, and 189 young children. Regarding the dietary diversity score (DDS), 16.3, 39.2, and 44.5 percent of women and 12.7, 49.7, and 37.6 percent of young children had low (< 5), average (= 5), and high (> 5) rates, respectively. Furthermore, DDS was low (< 4), average (= 4) and high (> 4) in 22.9, 12.6, and 64.4 percent of infants, respectively. The consumption rates of roots/tubers, dairy products, eggs, and fruits were very low regardless of the women, infants, and young children DDS in times of agricultural mitigation. **Conclusion:** The diet of women and young children was a little more diversified compared to infants.

Keywords: *Food; Women; Children; Dietary diversity.*

Introduction

Collection of detailed information about the food access of households or about the individuals' diet can be expensive. In recent years, simplified and reliable tools were developed to evaluate the households or individuals' diet.

Dietary diversity is defined as the number of different food groups consumed by an individual or a household over a given period of time. Dietary

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diversity (DD) is a qualitative measure of food consumption that reflects the household's access to a variety of foods and a proxy of nutrient adequacy of the individuals' diet (Food and Agriculture Organization, 2011).

A variety of foods is necessary to cover all the nutritional needs of body. Thus, the nutritional quality of food improves with the increase in the number of food products and food groups. Due to this reason, a more varied diet is healthier (Wondafrash *et al.*, 2016, Wright *et al.*, 2015).

The increase of food diversity in in direct relationship with higher socio-economic status and the household food security level (Venkatesh *et al.*, 2016). Studies on different age groups showed that the progression of the DD score was correlated with a better nutritional adequacy of the diet. The DD score, as a measure that approached the adequacy of diet macronutrients or micronutrients, was validated for several age groups and both genders. These scores were correlated positively with the adequacy of micronutrients' density to foods for infants and young children (Moursi *et al.*, 2008). They also were correlated positively with the adequacy of macronutrients and micronutrients in the diet of not-breastfed children (Kennedy *et al.*, 2007), adolescents, and adults (Arimond *et al.*, 2010, Arsenault *et al.*, 2013, Oldewage-Theron and Kruger, 2008, Wądołowska *et al.*, 2008).

Sahelians diet, long evaluated only or mainly based on cereal availability, is based on a range of products with local priority which importance is increasingly recognized. This diet takes a good indication on the foods cosumed by people of a country, or even of each locality of the country. It also investigates the way of food consumption. Considering this justification, this study was conducted in the Centre-West region of Burkina Faso.

Materials and Methods

Study framework: The study was conducted in the Centre-West region of Burkina Faso, 100 kilometres from Ouagadougou, during February 2017, which is a period of agricultural mitigation (January to June) in Burkina Faso (Conseil National de Sécurité Alimentaire, 2016). This region includes the provinces of Boulkiemdé, Sanguié, Sissili, and Ziro. The total population of Centre-West Region was estimated at 1554 040 inhabitants (715 996 men and 838 044 women). This population was distributed among 119 541 households and 87 percent of the population were residents of the rural areas (Institut National de la Statistique et de la Démographie, 2017).

The poverty of the region was 41.3 percent in 2011; it was the seventh poorest region in the country (Institut National de la Statistique et de la Démographie, 2011). At the Centre-West Region in 2016, the prevalence of acute malnutrition, chronic malnutrition, and underweight were 8.8, 25.1, and 19.0 percent, respectively (Ministère de la santé, 2016).

Type and study population: This was a cross-sectional study of individuals' food consumption. The research population consisted of households, women in childbearing years, infants (6-23 months), and young children aged 24-59 months.

A survey was conducted at two stages in each province of the region. The sample size was calculated using the probability proportion according to the population of each area. Then, a systematic random sampling was conducted among the households per village/areas.

The number of households was estimated with OpenEpi (version 3) proportion sample size calculation (Dean *et al.*, 2013). One woman and one child with 6 to 59 months of age were selected per household. The KISH grid (Kish and Wiegand, 1968) was used in cases where a household included several women, infants, and young children.

Participants were provided with study information and procedure; they were also required to sign the informed consent forms. The individuals who were sick or unable to answer the questions were excluded from the study.

Ethical considerations: The study was approved by the Ethics Committee of Health Research in

Burkina Faso. The study objectives were clearly explained to participants, selected household heads, and local authorities. An informed consent was obtained from each participant prior to the enrolment.

Methods, tools, and period of data collection: Investigators and previously trained supervisors collected data from individuals in the households. The face-to-face interviews were conducted to study the people in households. Regarding children's food consumption, their mothers or caregivers were interviewed. Individual food consumption was collected by a recall questionnaire on foods/drinks consumed by women, infants, and young children in the last 24 hours. The atypical days (local feasts or celebrations) and illness days were not included in the recall.

The standard questionnaire of food diversity developed by food and agriculture organization (FAO) (Food and Agriculture Organization & FHI360, 2012) was used by integrating questions that included the households' characteristics. Based on this open recall, the interviewer checked the food groups consumed using a predefined list of food groups. According to the African and Burkina Faso food composition tables, 19 food items/groups were surveyed (Barbara *et al.*, 2012, Ministère de la santé, 2007). One point was allocated to each consumed food item or group, while the non-consumed foods received no score. The data were collected from 22 to 28 February 2017.

Data Analysis: Data analysis was performed by the IBM SPSS 20 (IBM Corp, Released 2011). The individual DD score (IDDS) was calculated as the number of food groups consumed by individuals. The analysis includes different food groups depending on the target. So, according to the recommendations of World Health Organization, the DDS of the infants (DDSI) in the age range of 6-23 months includes seven food groups (World Health Organization, 2009, 2011) of starches, legumes/nuts/seeds, milk and milk products, meat food, eggs, fruits and vegetables rich in vitamin A and red palm oil, as well as other fruits and vegetables.

The DDS of the young children (DDSYC) in the age range of 24 - 59 months includes nine foods groups (Food and Agriculture Organization, 2011, World Health Organization, 2009) of starches, dark green leafy vegetables, vitamin A-rich foods, other vegetables and other fruits, offal, the meat/fish/rodents/insects, eggs, legumes/nuts/seeds, as well as milk and dairy products.

The minimum DDS of women (MDDSW) is a dichotomous indicator based on 10 foods groups (Food and Agriculture Organization, 2016). These food groups are: cereals, roots and tubers, beans and peas, nuts and seeds, meat/offal/fish/rodents/insects, eggs, dark green leafy vegetables, other vitamin A-rich fruits and vegetables, as well as other vegetables and fruits. Women who consumed at least five of 10 food groups were classified as having adequate minimum food diversity (Food and Agriculture Organization, 2016). All individual dietary diversity score (IDDSs) were divided in three classes of low, average, and high according to the average score.

A descriptive analysis was performed to describe various socio-demographic characteristics of women, infants, and young children and to describe the distribution of individual’s dietary diversity. The estimated proportions were presented with a confidence interval of 95 percent. Pearson Chi-square test was used to compare the proportions according to the characteristics at the significance level of 5 percent.

Food consumption patterns were used to study the participants' highly or lowly consumed foods. Therefore, the food items consumed by at least 50 percent of the individuals were retained for each DD class (low, average, and high).

Results

The study was conducted in 34 villages, 3 towns, 985 households, among 971 women, 419 infants, and 189 young children.

Characteristics of individual food consumption: In total, 46.6 percent of women, 20.4 percent of infants, and 12.7 percent of young children who

had one to two meals in the last 24 hours before the study.

During the agricultural mitigation in 2017, 40 percent of women, 23 percent of infants, and 38 percent of young children were consuming vitamin A-rich foods of animal origin. Iron rich-foods were consumed by 89 percent of women, 52 percent of infants, and 94 percent of young children.

According to **Figure 1**, the diet of women in childbearing age consisted of cereals, condiments, other vegetables, dark green leafy vegetables, oils, legumes, nuts and seeds, sugar/sugar products, and fish. The diet of infants consisted of cereals, condiments, other vegetables, dark green leafy vegetables, fish, legumes, nuts and seeds, sugar/sugar products, oils, and milk/dairy products. The diet of young children included cereals, condiments, dark green leafy vegetables, other vegetables, legumes, nuts and seeds, fish, sugar/sugar products, and oils. Infants consumed more milk/dairy products and eggs than women and young children.

Individual dietary diversity: **Table 1** shows the individuals' dietary diversity scores. The DDSW was low (< 5), average (= 5) and high (> 5) for 16.3 percent, 39.2 percent, and 44.5 percent of participnats, respectively. Thus, 83.7 percent of women consumed at least five food groups (minimum adequate food diversity). The results indicaeted that DDSI was low (< 4), average (= 4), and high (> 4) for 22.9, 12.6, and 64.4 percent of participants. It appears that at least 77 percent of infants consumed four food groups (minimum dietary diversity). The DDSYC was low (< 5), average (= 5) and high (> 5) for 12.7, 49.7, and 37.6 percent of participants.

Characteristics of individual dietary diversity: ***A***ccording to Table 2, the age of childbearing woman had no influence on their DDS (P = 0.418), but the age of infants and young children had influence on their DDS. The children's DDSs increased significantly from six to 23 months of age (P = 0.001). The mean scores of DD were 4.27, 4.90, and 4.97 in infants with 6 to 11 months, 12 to 17 months, and 18-23 months of age, resectively. The DDS decreased gradually with the increase in the age of young children from 24 to 59 months (P = 0.005). The mean scores were 5.50, 5.14, and 4.95 in young children with 24 to 35 months, 36 to 47 months, and 48-59 months of age, respectively.

Table 3 shows characteristics of ♀DDS of women (DDSW). In urban areas, 89 percent of women had the minimum DDS (DDSW ≥ 5) compared to 36 percent of women in rural areas; the difference was significant (P = 0.008). The DDSs were significantly different between women who consumed and those who did not consume the micronutrients' rich-food. Furthermore, DDSW was significantly different with regard to provinces, women's main activities, education level, breastfeeding status, and food consumption out-of-home.

Table 4 represents the characteristics of DDS of infants (DDSI). In urban areas, 77 percent of infants had high DDS compared to 63 percent infants in the rural areas, but the difference was not significant (P = 0.031). The DDSs were significantly different between infants who consumed and those who did not consume the micronutrients' rich-food. Moreover, DDSI was significantly different regarding provinces, women main activities, women education level, breastfeeding status, as well as infants' porridge and out-of-home food consumption.

Table 5 shows the characteristics of DDS of young children (DDYC). In urban areas, 78 percent of young children had a dietary diversity score ≥ 5 compared to 89 percent of young children in rural areas and the difference between the two groups was significantly different (P = 0.005). The DDSs were significantly different between young children who consumed and those who did not consume the micronutrients' rich-food. In addition, DDSYC was significantly different regarding provinces, areas, breastfeeding status, young children porridge consumption and household animal possession.

Food consumption profile of people of Centre-West Region: For each class of DDS (low, average

and high), the food items or groups consumed by at least 50 percent of women, infants, or children were retained. It is clear that all foods were eaten by very small proportions (< 50%) of women with a low, average, and high DD. All foods were consumed by very small proportions (< 50%) of women with a low, average, and high DDS, infants with a low and average DDS, and young children with a low and high DDS. Infants with high DDSs consumed cereals, green leafy vegetables, other vegetables, fish, condiments, beverage, legumes, nuts and seeds, sugar products, as well as oils and fats. Young children with an average DDS consumed cereals, other vegetables, condiments, beverage and green leafy vegetables. At least 50 percent of women in childbearing age and infants with a minimum DDS consumed cereals, other vegetables, legumes, nuts and seeds, fish, dark green leafy vegetables, sugar products, oils, fats, as well as condiments and beverage.

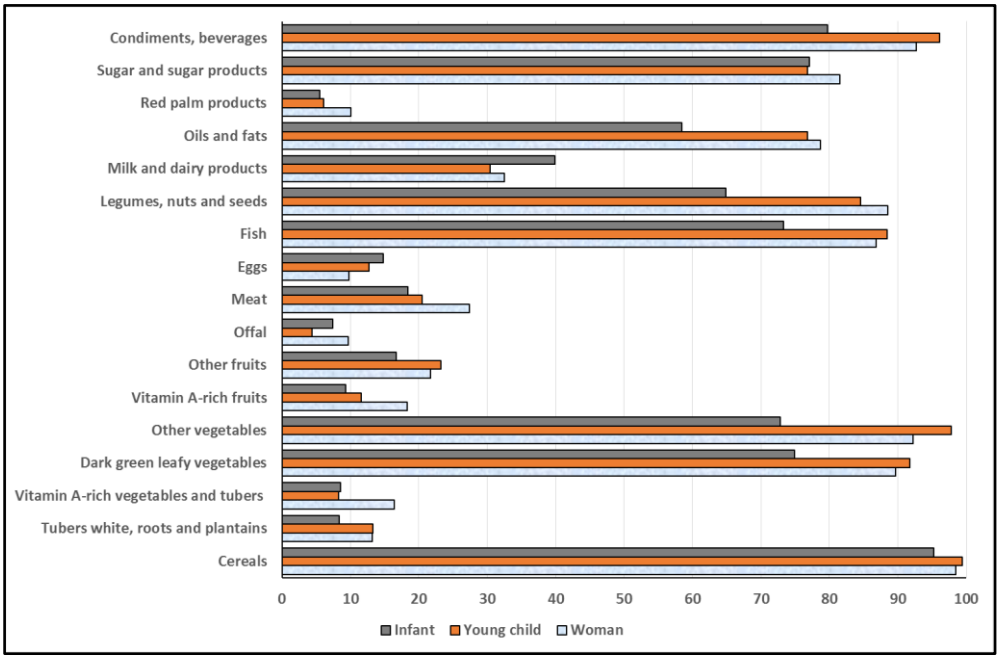

Figure 1. Food consumption profile of people during agricultural mitigation period

Table 1. classification of individuals' dietary diversity score

Class of IDDS	Women (15-49)		Infants: 6-23 months		Young Children: 24-59 months	
	N	%	N	%	N	%
Low IDDS	158	16.3	96	22.9	24	12.7
Average IDDS	381	39.2	53	12.6	94	49.7
High IDDS	432	44.5	270	64.4	71	37.6
Total IDDS	971	100.0	419	100.0	189	100.0

Table 2. Individuals' dietary diversity score in terms of some variables

Individual group	N	IDDS mean	Mini-maxi	P[a]
Women age groups (y)	37	5.40	2-8	0.418
14-19	356	5.40	1-9	
20-29	353	5.50	1-9	
30-39	225	5.50	1-9	
40-49	971	5.45	1-9	
Whole				
Pregnant	96	5.35	2-9	0.022
None pregnant	521	5.45	1-9	
Children age groups(month)	126	5.50	1-8	0.005
24-35	42	5.14	3-7	
36-47	20	4.95	3-9	
48- 59	189	5.36	1-9	
Whole				
Infant age groups (month)	155	4.27	1-7	0.001
6-11	155	4.90	1-7	
12-17	89	4.97	2-7	
18-23	419	4.67	0-7	
Whole				

[a]: chi square *test*

Table 3. Characteristics of dietary diversity score of women

Variables	Choice	Effective of women	% of women with [DDS < 5]	% of women with [DDS = 5]	% of women with [DDS > 5]	P[a]
Areas	Rural	859	17	37	46	0.008
	Urban	112	12	53	36	
Province	Boulkiemdé	441	16	37	46	0.001
	Sanguié	238	17	21	61	
	Sissili	152	27	30	43	
	Ziro	140	3	86	11	
Breastfeeding women	Yes	521	18	34	48	0.002
	No	450	14	45	40	
Consumption of VEGVA	Yes	894	10	42	48	0.001
	No	77	87	10	3	
Consumption of ANIVA	Yes	387	5	10	86	0.001
	No	584	24	59	17	
Consumption of VITA	Yes	910	11	42	47	0.001
	No	61	95	2	3	
Consumption of IRON	Yes	861	10	41	49	0.001
	No	110	67	22	11	
Market gardening practice	Yes	227	15	27	57	0.001
	No	744	17	43	41	
Animal possession	Yes	932	16	39	45	0.052
	No	39	23	51	26	
Consumption out-of-home	Yes	316	12	34	53	0.001
	No	655	18	42	40	

Women main activities	Farmer	262	16	51	34	0.001
	Stockbreeder	39	38	21	41	
	Trader	87	11	62	26	
	Public salaried	1	0	100	0	
	Private salaried	4	25	75	0	
	Housewife	548	16	32	52	
	Student	15	0	13	87	
	Market gardening	12	25	25	50	
	Pedi/manicure	3	33	67	0	
Women education level	None	722	18	40	42	0.001
	Primary	105	14	45	41	
	Secondary	43	12	30	58	
	Superior	1	0	100	0	
	Alphabetized	8	50	38	13	
	Koranic	92	4	32	64	

[a]: chi square *test*

Table 4. Characteristics of dietary diversity score of infants

Variables	**Choice**	**N**	**% [DDSI < 4]**	**% [DDSI = 4]**	**% [DDSI > 4]**	**P[a]**
Sex of infant	Male	214	26	13	61	0.221
	Female	205	20	12	68	
Areas	Rural	389	23	13	63	0.331
	Urban	30	17	7	77	
Province	Boulkiemdé	154	13	12	75	0.001
	Sanguié	146	25	16	59	
	Sissili	80	41	14	45	
	Ziro	39	15	3	82	
Number of meals eating by infant	≤ 2	122	41	9	50	0.001
	3	156	17	15	68	
	≥ 4	141	14	13	73	
Market gardening practice	Yes	114	11	11	78	0.001
	No	305	27	13	59	
Animal possession	Yes	411	23	12	64	0.503
	No	8	13	25	63	
Women education level	None	323	22	12	66	0.009
	Primary	39	41	10	49	
	Secondary	10	40	40	20	
	Superior	1	0	0	100	
	Koranic	5	20	0	80	
	Alphabetized	41	10	12	78	
Consumption out-of-home	Yes	106	10	10	79	0.001
	No	313	27	13	59	
Breastfeeding	Yes	311	26	14	59	0.001
	No	108	13	8	79	
Infant porridge consumption	Yes	118	11	6	83	0.001
	No	300	28	15	57	
Consumption of VGVA	Yes	326	6	13	81	0.001
	No	93	82	13	5	
Consumption of ANIVA	Yes	197	6	10	84	0.001
	No	222	38	15	47	
Consumption of VITA	Yes	349	9	14	77	0.001

	No	70	94	6	0	
Consumption of IRON	Yes	321	5	13	82	0.001
	No	98	81	11	8	

[a]: chi square *test*

Table 5. Characteristics of dietary diversity of young children

Variables	**Choice**	**N**	**% [DDSYC < 5]**	**% [DDSYC = 5]**	**% [DDSYC > 5]**	**P[a]**
Areas	Rural	158	11	47	42	0.005
	Urban	31	23	65	13	
Province	Boulkiemdé	79	22	35	43	0.001
	Sanguié	41	10	29	61	
	Sissili	9	0	22	78	
	Ziro	60	5	87	8	
Number of meals consumed by young children	≤ 2	24	21	33	46	0.171
	3	97	12	57	31	
	≥ 4	68	10	46	44	
Consumption of VEGVA	Yes	179	8	52	40	0.001
	No	10	90	10	0	
Consumption of ANIVA	Yes	71	1	10	89	0.001
	No	118	19	74	7	
Consumption of VITA	Yes	180	8	52	39	0.001
	No	9	100	0	0	
Consumption of IRON	Yes	177	10	50	40	0.001
	No	12	50	42	8	
Market gardening practice	Yes	34	12	50	38	0.983
	No	155	13	50	37	
Animal possession	Yes	177	11	49	40	0.007
	No	12	33	67	0	
Women education level	None	146	14	51	35	0.532
	Primary	20	0	50	50	
	Secondary	7	14	57	29	
	Koranic	1	0	100	0	
	Alphabetized	15	13	33	53	
Consumption out-of-home	Yes	47	6	51	43	0.301
	No	142	15	49	36	
Sex of young children	Male	86	12	51	37	0.899
	Female	103	14	49	38	
Breastfeeding	Yes	69	10	38	52	0.007
	No	120	14	57	29	
Young children Porridge consumption	Yes	44	5	34	61	0.001
	No	145	15	54	30	

[a]: chi square *test*

Discussions

The quality and quantity assessment of nutritional status is necessary. The diets of women and 24-59-month young children were not very diversified in the Region of Centre-West during the agricultural mitigation period. The essential nutrients to meet the nutritional needs of people were not totally present in a single meal of the participants (Food and Agriculture Organization, 2016). In fact, a variety of foods is necessary to cover all the nutritional needs. Thus, the nutritional quality of food improves with the increase in the number of food products and food groups (Martin-Prével *et al.*, 2015).

Women in the Centre-West region had a higher food consumption frequency in agricultural mitigation period in 2017 in comparison with the lean season of 2008 (Loada and Ouredraogo/Nikiema, 2008). So, in June 2008, 43.8 percent of women consumed more than two meals a day; whereas, this rate was 53.4 percent in the agricultural mitigation period of 2017.

Women in the Centre-West region had a higher DDS in agricultural mitigation period than in the lean season of 2008 (Bel *et al.*, 2015). Thus, in June 2008, 5.4 percent of women had a high DDS compared with 44.5 percent of women who had high DDS in agricultural mitigation period of 2017. Our participants had higher DDS than the residents of East Region in March 2002. Indeed, in March 2002, the mean of DDSW was 5.1 in the Region of the East of Burkina Faso (Savy *et al.*, 2006).

In Niger, during the same period of agricultural mitigation in 2015, only 10.4 percent of women had a high DDS (Institut National de la Statistique, 2014). In Mali, in the Region of Mopti, the mean of DDSW was 4.26 in November 2014 (SDA-SCA/AVSF/SAFEM, 2014), while it was 5.45 in Burkina Faso Centre-West Region during the agricultural mitigation period. In Nigeria, in the State of Abia, the majority (84.6%) of women in rural areas had low DDS (Ukegbu Ekebisi, 2016) compared with 17 percent of women in the rural areas of Burkina Faso Centre-West Region.

It appears that infants in the age range of 6 to 23 months had a high DDS (64.4%) i comaprison with elder 24-59-month children (37.6%) in this region. The young children had a better food consumption status than older infants (World Food Programme, 2016, Zaho, 2017). The mean DDS for young children in the age range of 24 - 59 months (4.95) in the Centre-West Region was higher than that of the pre-school children (3.11) in the Centre-South Region of Burkina Faso during agricultural mitigation in June 2017 (Zongo *et al.*, 2017).

Similar to most studies (Kouassi *et al.*, 2013, Savy *et al.*, 2006, Ukegbu Ekebisi, 2016)), the diet of people in the Centre-West region consisted of cereals, condiments, other vegetables, leafy vegetables dark greens, oils, legumes, nuts and seeds, sugar and products sugars, fish. A difference was observed in consumption of these foods according to the individuals' self-importance.

Gender, areas of residence, and animal possession were not decisive in improving the DDSI. On the other hand, province and houshold practices of market gardening, women's breastfeeding and education level, porridge and micronutrients rich-foods consumption, infants' consumption out-of-home, and infants' number of meals per day were decisive in improving DDS. As recommended by the WHO in 2011, infants of 6 to 8 months require at least two meals a day and infants from 9 to 23 months need three meals.

Gender, young children's out-of-home consumptions and their number of meals, household practice of market gardening, and woman's educational levels were not decisive in improving the young children's DDS. On the other hand, province, areas of residence, household animal possession, breastfeeding, as well asyoung children's micronutrients-rich foods and porridge consumption were decisive in improving the young children DDS. In addition, consumption of products derived from livestock (meat and milk) increased the DDSYC. .

The possession of animals in the household was not determinative in improving the DDSW. However, areas of residence, province of origin and practice of market gardening, main activities, education level, as well as motherhood and marital status of the woman had critical effects in the

improvement of the DDSW.

As in several studies (Savy *et al.*, 2006, USAID ICF International Inc, 2014), gender was not a factor in improvement of food diversity of children. In the Centre-West Region, several studies (Bel *et al.*, 2015, Zhang *et al.*, 2017) confirmed that the mothers' education level was decisive in improving the IDDS.

The women's education level strongly influenced their knowledge skills and practices towards food as well as use of health care services for themselves and their children (Ministry of agriculture, 2008). Women in urban areas had a better DDS, compared to the residents of rural areas, which is due to the disparity between food availability and the socio-economic levels of provinces in the studied region. Along with the food access, women's food diversity declined with age; conversely, food diversity increased with women's education level and the household's socio-economic level (World Food Programme, 2016, Zhang *et al.*, 2017).

The strengths of this study included application of the 24-hour recall, which is less prone to errors and requires less effort on the part of the interviewees. The determination of DDS is a quick and easy method. Similar to any other research, this study had some limitations. The surveyed diets were not the usual food habits of the studied people. To determine their usual diets, we must determine DD in different seasons.

Conclusions

This study provided detailed information on the DDS of women, infants, and young children in Centre-West region during the agricultural mitigation period. The participants' DD improved by caracteristics such as province, houshold market gardening practice, breastfeeding status, education level, and micronutrients rich-foods consumption.

The diet of mothers, infants, and young children was slightly different. However, the diets of women and young children had little differences in the Region of Centre-West. A variety of foods is necessary to cover all the nutritional needs and individuals with low DDS must improve their food diversity. Therefore, it is necessary to formulate and implement policies to ensure a healthy diet. The nutritional quality of food improves with the increase in the number of consumed food products and food groups. The individual's food consumption profile with a minimum DDS can serve as a target for those with a low DDS. Other authors are recommended to assess DD during different seasons.

Conflicts of interest

All the authors have no conflicts of interest.

Author's contributions

Ouedraogo O, Compaore EWR, and Amouzou EKS designed and carried out the study. Ouedraogo O, Compaore EWR, and Amouzou EKS participated in data collection, analysis, and interpretation. Ouedraogo O, Compaore EWR and Amouzou EKS wrote the manuscript. Zeba AN made critical revisions on the manuscript. The final manuscript was approved by Dicko MH. All authors read and approved the final manuscript.

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