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Determination and characterization of women, infants and young children dietary diversity in period of Burkina Faso agricultural welding

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Abstract

Introduction: The increasing of the variety of foods and food groups in the diet helps to ensure adequate intake of essential nutrients and promotes good health. In the present study, the main objective was to determine the quality of the diet of women, infants and young children in Burkina Faso.

Methods: A 24-hours open recall was used to collect all foods eaten by women, infants and young children in Centre-West Region. The dietary diversity (DD) score equals the number of consumed food groups according to WHO recommendations for infants (6-23 months) and FAO for women and young children (24-59 months). Three dietary diversity classes were determined using the individual DD average. For each dietary diversity class, food consumption profile was determined by food items or groups consumed by at least 50% of women, infants and young children according to FAO guide.

Results: The study was conducted with a sample of 928 women, 546 infants, and 200 young children.

Dietary diversity scores were grouped in three classes named low (< 5), average (= 5) and high (> 5) which respectively represented 26.1%, 36.8% and 37.1% of women, and 20.6%, 42.2% and 37.2% of young children.

For infants, this score was classified in low (< 4), average (= 4) and high (> 4) representing respectively 27.1%, 14.3% and 58.6%. In agricultural welding period, 35% of women, 41% of infants and 42% of young children were consumed vitamin A-rich foods of animal origin. There were 82% of women, 68% of infants and 86% of young children who consumed iron rich-foods.

Conclusion: The dietary diversity score increased gradually as the age of woman, young children and infant increased. In agricultural welding period, people consumed more iron rich-foods than vitamin A-rich foods.

Keywords: food, women, children, dietary diversity, welding period

1. Introduction

Obtaining detailed information about the access of households to food or on individual diet can be expensive. In recent years, simplified and reliable tools have been developed to evaluate the household or individual 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 diversity is a qualitative measure of food consumption that reflects household access to a variety of foods and is also a proxy of nutrient adequacy of the diet of individuals [1].

A variety of foods is necessary to cover all the nutritional needs. Thus, the nutritional quality of food improves with the number of food products and food groups [2, 3].

The increase of food diversity is associated with a higher socio-economic status and the household food security level [4]. Validation studies conducted in low and middle-income countries have consistently shown that dietary diversity scores are associated with nutrient intake adequacy and nutritional status among women and young children [5-11]. The dietary diversity score has been validated for several age groups / gender as constituting a measure approached the adequacy of diet macronutrients or micronutrients. These scores were correlated positively with the adequacy of the density of micronutrients to foods in addition to infants and young children [12], and the adequacy of the supply of macronutrients and micronutrients in the diet of not breastfed children [13] adolescents and adults [7, 14-16].

Sahelians diet was evaluated only or mainly based on cereal availability but not on dietary diversity. It is important to evaluate the quality of the diet at national and local level in different period of the year. This is what justifies the conduct of this study in the Region of the Centre-West of Burkina Faso.

2. Materials and Methods

2.1 Study framework

The study was conducted in the Centre-West Region located from one hundred kilometres from Ouagadougou the capital of Burkina Faso. This Region includes the provinces of Boulkiemdé, Sanguié, Sissili, and Ziro. The Centre-West Region total population was estimated at 1 554 040 inhabitants (715 996 men and 838 044 women). These population was distributed in 119 541 households with 87% residents in rural areas [17]. The poverty of the Region was 41.3% in 2011. It was the seventh poorest Region of the

country [18]. At the Centre-West Region in 2016, the prevalence of acute malnutrition, chronic malnutrition and underweight are respectively 8.8%, 25.1% and 19.0% [19].
The study was conducted in 2017 during the period of agricultural welding (July to September) in Burkina Faso [20].

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

2.3 Sampling
A survey at two (2) degrees was conducted in each province of the Region, with first place, the draw of the villages/areas with probability proportional to their population size, followed by a systematic draw random households per village/areas.
The number of households was estimated with OpenEpi (version 3) proportion sample size calculation [21]. One woman and one child from 6 to 59 months were selected per household. The KISH grid [22] has been used in cases where there are several women, infants and young children in a household. The survey was performed exclusively on individuals who provided a written informed consent. Have been excluded, the individuals who were sick or unable to answer the questions.

2.4 Ethical considerations
The study was approved by the Ethics Committee for Health Research of Burkina Faso. The study objectives were clearly explained to participants, selected household heads and local authorities. An informed written consent was obtained from all adults' participants and from parents of minors' participants.

2.5 Methods, tools, and period of data collection
Investigators (37) and previously trained supervisors (7) have collected data from individuals in the households. The face-to-face interview with people concerned was used in households. For each child, the mother or caregiver was interviewed on his food consumption. Individual food consumption data was recorded by a recall of all foods/drinks eaten by women, infants and young children in the last 24 hours (day and night). The atypical days (local feasts or celebrations), market and illness days were not included in the recall.
The standard questionnaire of food diversity of food and agriculture organization (FAO) [23] has been used by integrating questions more wide that include the characteristics of the households. Based on this open recall, the interviewer checked which food groups were consumed using a predefined list of food groups.
According to the West African and Burkina Faso food composition tables, a list of food items/groups surveyed was 19 [24, 25].
One point was allocated for each food item or group consumed and Zero if not consumed. The data was collected from 22 July to 04 August 2017.

2.6 Processing and statistical analysis of data
All collected data were computed and analyzed using IBM SPSS Statistics 20 software for Windows [26].
The individual dietary diversity score (IDDS) equals the number of food groups consumed by individuals. The analysis includes different food groups depending on the target. Thus, the recommendation, the DDS of the infants (DDSI) of 6-23 months includes 7 food groups [27, 28]. Are these food groups: starches, legumes/nuts/seeds, milk and milk products, meat food, eggs, fruits and vegetables rich in vitamin A and oil of red palm, other fruits and vegetables.
The DDS of the young children (DDSYC) from 24 to 59 months includes 9 foods groups [1, 27]. Are these foods groups: starches, dark green leafy vegetables, vitamin A-rich foods, other vegetables and other fruits, offal, the meat/fish/rodents/insects, eggs, legumes/nuts/seeds, milk and dairy products.
The minimum DDS of women (MDDSW) is a dichotomous indicator based on 10 foods groups [29]. 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, the other vegetables and other fruits.
Women who ate at least 5 of 10 food groups were classified as having adequate minimum food diversity [29].
The vitamin A-rich foods of vegetable origin (VGVA) were: dark green leafy vegetables, vitamin A-rich vegetables and roots, vitamin A-rich fruits and red palm products.
The vitamin A-rich foods of animal origin (ANIVA) were: offal, eggs and milk and dairy products. The vitamin A-rich foods of animal and/or vegetable origin (VITA) were the VGVA and/or ANIVA.
All IDDS were divided in three classes around the average score in low, average and high.
In this study, the individual dietary diversity score has been crossed with some variables likely to influence individuals feeding behaviour. A descriptive analysis was used to describe various socio demographic characteristics of women, infants and young children, by province and describe the distribution of individual's dietary diversity.
The estimated proportions were presented with their confidence intervals 95%.
Pearson Chi-square test was used for comparison of the proportions according to the characteristics at the 5% significance level.
Food consumption patterns were used to know what eat people (women, infants and young children) with a low dietary diversity and what more consume those having a higher dietary diversity. Therefore, the foods items consumed at least 50% of the individuals for each DD class (low, average and high) were retained.

3. Results
The study was conducted in 34 villages and 3 towns, 930 households, 928 women, 546 infants, and 180 young children.

3.1 Characteristics of individual food consumption
There were in total 69% (n=638) of women, 89% (n=488) of infants and 95% (n=189) of young children who had at least three meals in the last 24 hours preceded the survey.
In times of agricultural welding of 2017, 35% (n=325) of women, 41% (n=223) of infants and 42% (n=84) of young children were consuming vitamin A-rich foods of animal origin. There were 82% (n=762) of women, 68% (n=372) of infants and 86% (n=171) of young children who consumed iron rich-foods. According to figure 1, the women, infants

and young children diet consisting of cereals, condiments/beverages, dark green leafy vegetables, other vegetables, oils/fats, legumes/nuts/seeds, sugar/sugar products and fish.

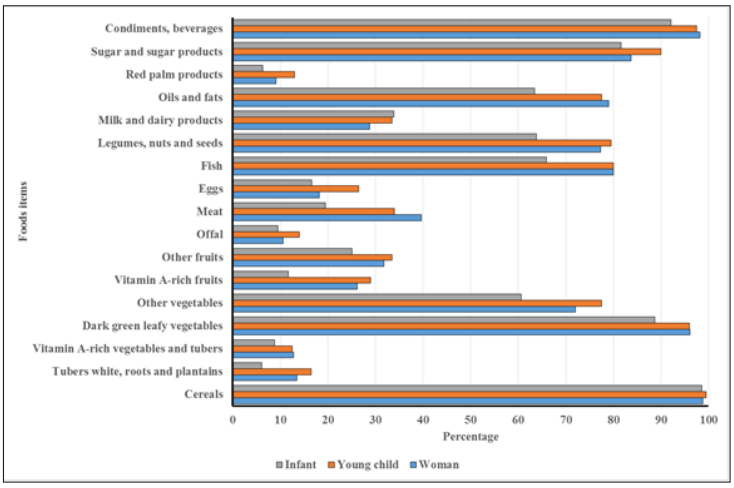

Fig 1: Food consumption profile of people during agricultural welding

3.2 Individual dietary diversity

Table 1 shows individual dietary diversity scores.

The DDSW was low (< 5), average (= 5) and high (> 5) respectively at 26.1% and 36.8% and 37.1%. Thus, 73.9% of women had consumed at least 5 foods groups (minimum adequate food diversity). DDSI was low (< 4), average (= 4) and high (> 4) respectively at 27.1%, 14.3% and 58.6%. It appears that, at least 72.9% of infants had consumed 4 food groups (minimum dietary diversity). The DDSYC was low (< 5), average (= 5) and high (> 5) at 21.6%, 42.2% and 37.2%.

Table 1: Individual dietary diversity score (IDDS)

Class of IDDS	Women (15-49)		Infants 6-23 months		Young Children 24 à 59 month	
	n	%	n	%	n	%
Low IDDS	242	26.1	148	27.1	37	20.6
Average IDDS	342	36.8	78	14.3	76	42.2
High IDDS	344	37.1	320	58.6	67	37.2
Total IDDS	928	100.0	546	100.0	180	100.0

3.3 Characteristics of individual dietary diversity

According to table 2, the age of woman, infants and young children had an influence on their DDS with a significant Difference. The dietary diversity score increased gradually as the age of woman, young children and infant increased.

Table 2: Individual dietary diversity score (IDDS)

Individual group		n	IDDS mean	Mini-maxi	P[a]
Women (15-49)	14-19 age	37	5.05	[1-9]	0.002
	20-29 age	361	5.07	[1-9]	
	30-39 age	335	5.24	[1-9]	
	40-49 age	195	5.60	[2-9]	
	Whole	928	5.24	[1-9]	
Women (15-49)	Pregnant	74	5.86	[1-9]	0.004
	None pregnant	854	5.19	[1-9]	
Young children (24-59 years)	24-35 month	82	5.29	[2-9]	0.016
	36-47 month	62	5.68	[3-9]	
	48- 59 month	36	5.80	[0-9]	
	Whole	180	5.59	[0-9]	
Infants (6-23 years)	6-11 month	195	4.34	[1-7]	0.000
	12-17 month	246	4.15	[0-7]	
	18-23 month	105	4.94	[2-7]	
	Whole	546	4.48	[0-7]	

[a]: chi square *test*

Table 3 shows characteristics of dietary diversity score of women (DDSW). In urban areas, 82% of women had a minimum dietary diversity score (DDSW ≥ 5) compared to 72% in rural areas with a significant difference ($p < 0.001$).

According to women micronutrients rich-food consumption, a significant difference was noted in their DDS between those who consumed and another not consumed.

DDSW significant difference was also noted between provinces, women main activities, education level, breastfeeding status, market gardening practice and food

consumption out-of-home.

Table 3: Characteristics of dietary diversity score of women (DDSW)

Variables	Choice	n (women 15-49)	% of women with [DDS < 4]	% of women with [DDS = 5]	% of women with [DDS > 5]	P[a]
Areas	Rural	753	28	41	31	0.000
	Urban	175	17	19	63	
Province	Boulkiemdé	426	32	38	30	0.000
	Sanguié	202	26	35	39	
	Sissili	150	14	39	47	
	Ziro	150	20	34	46	
Breastfeeding woman	Yes	481	34	34	32	0.000
	No	447	17	40	43	
Consumption of VEGVA	Yes	906	24	38	38	0.000
	No	22	100	0	0	
Consumption of ANIVA	Yes	325	3	11	85	0.000
	No	603	38	51	11	
Consumption of VITA	Yes	906	24	38	38	0.000
	No	22	100	0	0	
Consumption of IRON	Yes	762	13	42	45	0.000
	No	166	84	13	2	
Market gardening practice	Yes	203	15	32	53	0.000
	No	725	29	38	33	
Animal possession	Yes	888	26	37	37	0.630
	No	40	33	33	35	
Consumption out-of-home	Yes	246	15	26	59	0.000
	No	682	30	41	29	
Women main activities	Farmer	323	38	31	31	0.000
	Stockbreeder	24	4	75	21	
	Trader	34	9	35	56	
	Public salaried	2	0	50	50	
	Private salaried	1	0	0	100	
	Housewife	518	21	39	40	
	Student	19	11	42	47	
	Market gardening	1	0	100	0	
	Pedi/manicure	6	33	33	33	
Women education level	None	680	30	38	33	0.000
	Primary	113	16	40	44	
	Secondary	20	5	30	65	
	Superior	32	25	25	50	
	Alphabetized	2	0	50	50	
	Koranic	81	17	30	53	

[a]: chi square *test*

Table 4 shows characteristics of dietary diversity score of infants (DDSI). According to gender, 68% of male infants had a high dietary diversity score compared to 50% in those female with a significant difference ($p < 0.001$). In urban areas, 65% of infants had a high dietary diversity score compared to 57% in rural areas with a non-significant difference ($p = 0.297$). According to infants' micronutrients rich-food consumption, a significant difference was noted in their DDS between those who consumed and another not consumed. DDSI significant difference was also noted between provinces, household market gardening practice, household head education level, infant breastfeeding status, and infant's porridge and out-of-home food consumption and the number of meal eating.

Table 4: Characteristics of dietary diversity score of infants

Variables	Choice	n (infants 6-23)	% [DDSI < 4]	% [DDSI = 4]	% [DDSI > 4]	P[a]
Areas	Rural	443	28	15	57	0.297
	Urban	103	24	11	65	
Province	Boulkiemdé	236	28	20	53	0.001
	Sanguié	130	30	12	58	
	Sissili	102	17	7	76	
	Ziro	78	35	12	54	
Household market gardening practice	Yes	134	16	11	73	0.000
	No	412	31	15	54	
Animal possession	Yes	523	27	14	59	0.932
	No	23	30	13	57	
Household head education level	None	352	29	12	59	0.039
	Primary	69	29	14	57	

	Post primary	15	27	0	73	
	Secondary	14	21	36	43	
	Superior	1	0	0	100	
	Koranic	25	28	12	60	
	Alphabetized	70	17	27	56	
Gender of infant	Male	257	23	9	68	0.000
	Female	288	31	19	50	
Infant consumption out-of-home	Yes	491	22	15	63	0.000
	No	54	72	6	22	
Infant breastfeeding	Yes	492	29	14	57	0.011
	No	52	10	19	71	
Number of meals eating by infant	≤ 2	58	36	28	36	0.000
	3	236	17	14	68	
	≥ 4	252	34	11	55	
Infant porridge consumption	Yes	390	16	15	68	0.000
	No	155	54	12	34	
Consumption of VGVA	Yes	489	20	14	65	0.000
	No	55	85	13	2	
Consumption of ANIVA	Yes	223	6	5	89	0.000
	No	310	42	21	37	
Consumption of VITA	Yes	503	21	15	64	0.000
	No	42	95	5	0	
Consumption of IRON	Yes	372	4	16	80	0.000
	No	170	75	11	14	

[a]: chi square *test*

Table 5 shows characteristics of dietary diversity score of young children (DDYC). In urban areas, 100% of young children had a dietary diversity score ≥ 5 compared to 77% in rural areas with a significant difference ($p < 0.001$).
According to young children micronutrients rich-food consumption, a significant difference was noted in their DDS between those who consumed and another not consumed. DDSYC significant difference was also noted between consumption out-of-home and number of meals consumed by young children. DDSYC significant difference was not noted between province, household animal possession, household market gardening practice, household head education level, children breastfeeding status, porridge consumption and gender.

Table 5: Characteristics of dietary diversity of young children

Variables	**Choice**	**n (young children)**	**% [DDSYC < 5]**	**% [DDSYC = 5]**	**% [DDSYC > 5]**	**P[a]**
Areas	Rural	156	23	46	31	0.000
	Urban	24	0	21	79	
Province	Boulkiemdé	60	27	37	36	0.188
	Sanguié	49	25	39	37	
	Sissili	16	25	38	38	
	Ziro	55	7	53	40	
Number of meals consumed by young children	≤ 2	9	12	87	1	0.001
	3	109	15	37	48	
	≥ 4	62	29	47	24	
Consumption of VEGVA	Yes	174	19	43	39	0.049
	No	6	50	50	0	
Consumption of ANIVA	Yes	74	12	14	74	0.000
	No	105	26	63	11	
Consumption of VITA	Yes	176	19	43	38	0.002
	No	4	100	0	0	
Consumption of IRON	Yes	153	10	48	42	0.000
	No	26	81	8	11	
Household market gardening practice	Yes	35	9	50	41	0.185
	No	145	23	41	36	
Household animal possession	Yes	176	20	43	37	0.504
	No	4	25	25	50	
Household head education level	None	126	24	43	33	0.255
	Primary	19	16	47	37	
	Post primary	6	17	33	50	
	Secondary	1	0	0	100	
	Koranic	7	0	71	29	
	Alphabetized	21	9	29	62	
Consumption out-of-home	Yes	37	11	19	70	0.000
	No	143	22	49	29	
Gender of children	Male	110	20	44	36	0.832
	Female	70	20	40	40	

Children breastfeeding	Yes	77	27	34	39	0.050
	No	103	14	49	37	
Children porridge consumption	Yes	149	22	42	36	0.558
	No	31	16	42	42	

[a]: chi square *test*

3.4 Food consumption profile of people of Centre-West Region

For each class of dietary diversity score (low, average and high) the food items or groups consumed by at least 50% women, infants or children were retained. All the foods items were consumed by very small proportions (< 50%) of women and young children with a low, average and high dietary diversity.

Infants who had a high DDS consumed cereals, green leafy vegetables, other vegetables, fish, condiments/beverage, sugar/sugar products and read palm products.

Table 6: Food consumption profile of Centre-West Region people

Dietary diversity score	**Low**			**Average**			**High**		
People (%)	**W**	**I**	**YC**	**W**	**I**	**YC**	**W**	**I**	**YC**
Cereals	26	27	21	36	14	42	37	58	38
Tubers white, roots and plantains	0	0	0	2	0	2	11	6	15
Vitamin A-rich vegetables and tubers	0	0	1	1	1	0	12	8	12
Dark green leafy vegetables	23	18	19	36	13	40	37	58	38
Other vegetables	6	1	8	32	6	36	33	53	34
Vitamin A-rich fruits	1	0	0	5	2	6	20	9	23
Other fruits	2	1	2	9	2	9	22	22	23
Offal	0	0	0	0	0	1	11	10	14
Meat	3	0	3	9	2	9	23	18	22
Eggs	0	1	1	1	0	2	17	16	24
Fish	10	3	8	34	10	37	35	53	35
Legumes, nuts and seeds	10	2	9	33	2	37	35	30	34
Milk and dairy products	1	4	5	3	8	4	25	51	26
Oils and fats	13	0	11	32	0	36	34	6	31
Red palm products	0	12	0	1	13	0	8	57	13
Sugar and sugar products	15	12	17	33	13	37	36	57	37
Condiments, beverages	25	20	20	37	14	41	37	58	37

W= woman ; I= infant ; YC= young child

4. Discussion

Not all the essential nutrients to meet the nutritional needs of people are present in a single food [29]. 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 foods products and foods groups [30]. The assessment of quality and quantity of nutritional status is necessary. Results in the present study show that the diet of women and young children of 24 to 59 months was weakly diversified in the Region of Centre-West during agricultural welding period. A nutrition-sensitive agricultural program is necessary to increase diversity in agricultural production and to a lesser extent access to nutritious foods [31]. More diverse production systems may contribute to more diverse household diets [32].

Women in this Region had a higher food consumption frequency in agricultural welding period in 2017 than in lean season of 2008 [33]. So, in June 2008 there were 43.8% of women who had consumed more than 2 meals from 53.4% in agricultural welding period of 2017.

Women in the Centre-West Region had a higher DDS in agricultural welding period than in lean season of 2008 [34]. Thus, in June 2008, there were 5.4% of women who had a high DDS against 37.1% in agricultural welding period of 2017.

They had a higher DDS than those of the East Region in March 2002. Indeed, in March 2002, the mean of DDSW was 5.1 in the East Region of Burkina Faso [35].

In Mali, in the Region of Mopti, the mean of DDSW was 4.26 in November 2014 [36] against 5.24 in Burkina Faso Centre-West Region in agricultural welding period.

In Nigeria, in the State of Abia, the majority (84.6%) of women in rural areas had low DDS [37], against 26.1% in rural areas of Burkina Faso Centre-West Region during welding period.

It appears that infants of 6 to 23 months have a high DDS (58.6%) compared to children of 24 to 59 months (37.5%) in this Region. The young children have a better food consumption than older [38, 39].

The mean of DDS of young children 24 to 59 months (5.59) in the Centre-West Region during agricultural welding is higher than that of the pre-school children (3.11) in the Centre-South Region of Burkina Faso in June 2017 [40].

Like most studies [35, 37, 41]), 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. There was a difference in consumption of these foods according to the importance for each group.

Province, household market gardening practice, household head education level, infant micronutrients rich-foods consumption, infants consumption out-of-home and infants number of meals consumed per day were decisive in improving his DDS. As recommended by the world health organization in 2011, it takes at least 2 meals for infants of 6 to 8 months and 3 meals for infants 9 to 23 months.

Nutrient-rich foods from diverse diets are important elements in child feeding that supports dietary needs and adequate growth during their early years of life. Further, a diverse diet, with foods from all food groups, is necessary

for population groups to meet their requirements for essential nutrients. Increasing dietary diversity is a specific recommendation for children of 6 months to 2 years of age.

Areas of residence, children micronutrients-rich foods consumption, children number of meals by day and out-of-home consumption were decisive in improving the young children DDS. In addition consumption of products derived from livestock (meat and milk) increased the DDSYC and also the possession of livestock improved index of wealth, and consequently the food security of households [42].

According to the determining, areas of residence, province, household market gardening practice, woman main activities, woman education level, woman micronutrients-rich foods consumption and out-of-home consumption improve their DDS.

As in several studies [35, 43], gender was not a factor in the improvement of food diversity of children. As in the Centre-West Region, several studies confirmed that education level was decisive in improving the IDDS [34, 44].

The women education level strongly influence their knowledge skills and practices towards food, the use of health care, for themselves and their children [45].

More women in urban areas have a good DDS, compared to rural areas. This is due to the disparity between food availability and the socio-economic level of the provinces in the Region. As well as the food access, women food diversity declines with age, conversely it increases with woman education level and the household socio-economic level [38, 42, 44].

As advantages, the 24-hour recall is less prone to errors, requires less effort to the interviewees. The determination of dietary diversity score is quick and easy.

It should be noted that this study has limitations. The diet cannot be considered as usual for these people being surveyed. To determine their usual diet, we must determine dietary diversity in different seasons at different years.

5. Conclusion

This study aimed to assess women, infants and young children DDS in Centre-West Region during agricultural Welding period. The characteristics like micronutrients rich-foods consumption and out-of-home consumption improve women, infants and young children dietary diversity.

The diet of mothers, infants and young children was slightly different. But, the diets of women and young children were very less diversified in the Region of Centre-West. A variety of foods is necessary to cover all the nutritional needs. Individuals with low DDS must improve their food diversity. Therefore, it is necessary to formulate and implement policies to ensure a healthy diet. The individual's food consumption profile with a high dietary diversity score can serve as target for those with a low and average dietary diversity score. A dietary diversity assessment during different seasons is necessary to have a much more significant view on the diet variability in the studied region.

6. List of Abbreviations

DDS: dietary diversity score, IDDS: individual dietary diversity score, DDSW: dietary diversity score of women, DDSI: dietary diversity score of infants, DDSYC: dietary diversity score of young children, MDDSW: minimum dietary diversity score of women. VGVA: vitamin A-rich foods of vegetable origin, ANIVA: vitamin A-rich foods of animal origin, VITA: vitamin A-rich foods of animal and/or vegetable origin.

7. Conflicts of Interest

All the authors have no conflicts of interest.

8. Author's Contributions

OUEDRAOGO O., COMPAORE E. W. R., AMOUZOU E. K. S., designed and carried out the study. OUEDRAOGO O., COMPAORE E. W. R., AMOUZOU E. K. S. participated in the collection, analysis and interpretation of the data. OUEDRAOGO O., COMPAORE E. W. R., AMOUZOU E. K. S. wrote the draft of the manuscript. The final manuscript is approved by DICKO M. H. All authors have read and approved the final manuscript.

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