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Variation of women dietary diversity according to Burkina Faso agricultural periods

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Abstract

Introduction: The increasing of the foods variety and food groups in the diet helps to ensure adequate intake of essential nutrients and promotes good health. The challenge is to maintain adequate nutrients intake during the year. In the present study, the main objective was to determine the women dietary diversity during three agricultural periods of year in Burkina Faso.

Methods: A 24 hours open recall was used to collect all foods eaten by women in Centre-West Region. The dietary diversity score (DDS) equals the number of consumed food groups according to food and agriculture organization (FAO) recommendations for women in 2016. Three dietary diversity classes were determined using the women minimum dietary diversity score as average. Women dietary diversity was low if their DDS < 5, average if their DDS = 5 and high if their DDS > 5. Women food consumption profile was determined by food items or groups consumed by at least 50% of them according to FAO guide.

Results: The study was conducted in 985 households three times in the year 2017. During agricultural mitigation, welding and increase periods respectively 83.7%, 74.0% and 78.6% of women had minimum dietary diversity score (DDS ≥ 5).

Respectively 44.5%, 37.1% and 35.6% of women had a high dietary diversity (DDS > 5) during agricultural mitigation, welding and increase periods. The period who most of women had the highest dietary diversity score was mitigation followed by welding. This revealed poor dietary diversity of women during agricultural increase (crops) period. During mitigation, vitamin A-rich foods of animal origin were consumed by more women (39.8%) than any other periods. Vitamin A-rich foods of vegetable origin were consumed by most of women (97.6%) in welding period than other periods. The majority of women (94.0%) during agricultural increase period consumed iron rich food groups than other periods of the year.

Conclusion: Most of women (at least 50%) consumed during the three agricultural periods of the year 2017, starchy staples, beans and peas, fishes, vitamin A-rich vegetables and fruits and other vegetables. Another five foods groups were consumed by a minority (less than 50%) of women.

Keywords: food, women, dietary diversity, agricultural periods

1. Introduction

Nutritional deficiencies are not only the result of low food quantities consumed, but also of poor dietary quality and diversity. In fact, the level of dietary diversity was shown to be a good indicator of people's broader nutritional status in many situations [1, 2].

Dietary assessment estimates can be obtained at individual or household levels and their results can be presented as energy and nutrient adequacy, dietary quality, food patterns, intakes of individual foods and food groups, intakes of macronutrients and micronutrients, and diet composition. These estimates are obtained via direct and indirect retrospective or prospective assessment methods. 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 [3].

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 [4, 5].

The increase of food diversity is associated with a higher socio-economic status and the household food security level [6]. 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 [1, 2, 7-11]. 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 [9, 14-16].

It is important to evaluate the quality of the diet at national and local level in different periods of the year. The information gathered is then used to inform various purposes, including target setting, risk assessment,

monitoring and surveillance of food consumption patterns and analysis of diet and disease relationships. The information is also useful for the development of a range of food-based indicators for policy process across governmental departments such as agriculture, health, education, finance, planning, trade, etc.

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].

The study was conducted in 2017 during the period of agricultural mitigation (January to June), agricultural welding (July to September) and agricultural increase (October to December) in Burkina Faso [19].

2.2 Type and study population

It was a cross-sectional study on women' food consumption. The study population consisted of households and women in childbearing years.

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 [20]. One woman was selected per household. The KISH grid [21] has been used in cases where there are several women in a household.

The survey was performed exclusively on women who provided a written informed consent. Have been excluded, the women 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 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 women was used in households. Each woman was interviewed on the foods and drinks that she consumed the last 24 hours. The 24 hours cycle lasted from the time she got up in the morning yesterday until the time she got up in the morning today. Both inside and outside home food consumption were counted. 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) [22] has been used by integrating questions more wide that include the characteristics of women. 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 19 food items/groups was used [23, 24]. The corresponding foods was underlined in the list under the appropriate food group. For any food groups not mentioned, the respondent was asked if a food item from this group was consumed. One point was allocated for each food item or group consumed and Zero if not consumed. No minimal amount was required for a food item to be included. The data was collected from 22 to 28 February; 22 July to 04 August and 07 to 20 November 2017.

2.6 Processing and statistical analysis of data

All collected data were computed and analyzed using IBM SPSS Statistics 20 software for Windows [25].

The dietary diversity score of women (DDSW) equals the number of food groups consumed by woman. The analysis includes different food groups depending on the target. Thus, the recommendation, the DDS of women includes 10 foods groups [26]. These food groups are: Starchy staples: cereals, roots and tubers; beans and peas; nuts and seeds; flesh foods: meat, offal, fish, rodents and insects; eggs; dark green leafy vegetables, other vitamin A-rich fruits and vegetables, other vegetables and other fruits.

The minimum dietary diversity score of women (MDDSW) is a dichotomous indicator based on 10 foods groups. Women who ate at least 5 of 10 food groups were classified as having minimum dietary diversity score [26].

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.

WDDS were divided in three classes around the average score in low, average and high.

Bivariate descriptive analyse was used. Variables were expressed as frequencies, percentages, mean ± standard deviation (SD) with one decimal. The estimated proportions were presented with their confidence intervals 95%. Difference was significant at $p \leq 0.05$.

Food consumption patterns were used to know what eat most of women. Therefore, the foods items or groups consumed at least 50% of women were retained.

3. Results

The study was conducted in 34 villages and 3 towns.

In agricultural mitigation, welding and increase periods, respectively 985, 930 and 936 households were involved in the study. Thus, 971, 928 and 936 women were interviewed respectively in mitigation, welding and increase periods.

3.1 Women food consumption profile according to agricultural periods

The figure 1 in this section highlight the women food items/groups consumption during three agricultural periods as measured by 24 hours recalls.

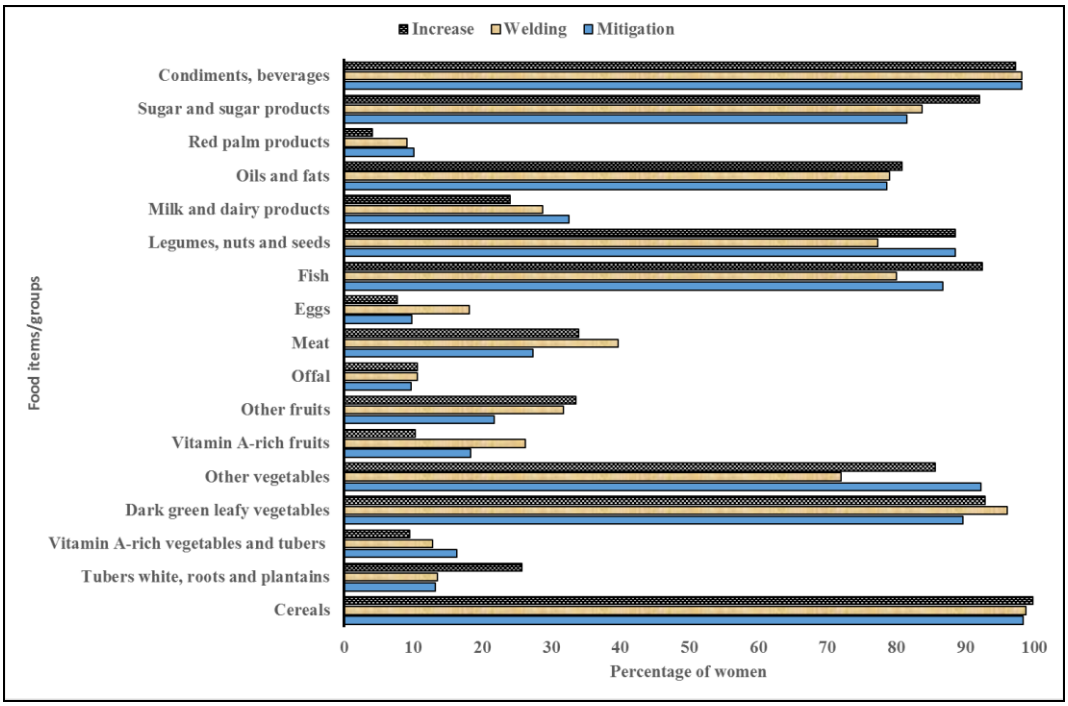

Fig 1: Foods items/groups consumed by women during the year 2017

Figure 1 indicates that the women diet consisting of cereals, condiments/beverages, dark green leafy vegetables, other vegetables, oils/fats, legumes/nuts/seeds, sugar/sugar products and fish. During agricultural welding, 18.2% of women were consumed eggs. During agricultural welding period, dark green leafy vegetables, vitamin A-rich fruits, eggs and meat were consumed by more women than the two other periods. Contrary, during agricultural mitigation period, red palm products, other vegetables, milk and dairy products were consumed by more women than the two other periods. Also during the increase agricultural period, there were more women who consumed cereals, other fruits, fish, oils and fats, tubers white, roots and plantains than the two other periods.

The table 1 shows the women food groups' consumption proportion during three agricultural periods as measured by 24 hours recalls.

Table 1: Comparison of FG consumption between the three agricultural periods of year

Food groups of women	Mitigation (N=971)		Welding (N=928)		Increase (N=936)		p-value
	n	%	n	%	n	%	
All starchy staples	960	98.9	920	99.1	693	100.0	<0.001
Beans and peas	860	88.6	719	77.5	829	88.6	<0.001
Nuts and seeds	883	90.9	85	9.2	38	4.1	<0.001
Milk and dairy products	316	32.5	268	28.9	225	24.0	<0.001
Flesh foods	864	89.0	762	82.1	566	60.5	<0.001
Eggs	95	9.8	169	18.2	72	7.7	<0.001
Vitamin A-rich dark green leafy vegetables	871	89.7	894	96.3	869	92.8	<0.001
Other vitamin A-rich vegetables and fruits	335	34.5	298	32.1	121	12.9	<0.001
Other vegetables	896	92.3	664	71.6	802	85.7	<0.001
Other fruits	211	21.7	296	31.9	314	33.5	<0.001

Table 1 indicates that the vitamin A-rich dark green leafy vegetables were consumed by more women in welding period (96.3%) than other periods.

The starchy staples group was consumed by most of women during increase (100.0%), mitigation (98.9%) and welding (99.1%).

Nuts and seeds were consumed by most of women (90.9%) during agricultural mitigation period than welding (9.2%) and increase (4.1%) periods.

3.2 Women micronutrients-rich food consumption according to agricultural periods

The table 2 provide the women nutrients-rich food groups' consumption frequency and proportion during three agricultural periods as measured by 24 hours recalls.

Table 2: Comparison of nutrients-rich food groups between three agricultural periods

Food groups consumption	Mitigation (N=971)		Welding (N=928)		Increase (N=936)		p-value
	n	%	n	%	n	%	
Consumption of VGVA	894	92.0	906	97.6	875	93.5	<0.001
Consumption of ANIVA	387	39.8	325	35.0	304	32.5	0.006
Consumption of VITA	910	93.7	906	97.6	879	93.9	<0.001
Consumption of iron	861	88.7	762	82.1	880	94.0	<0.001

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

Table 2 indicates that during mitigation vitamin A-rich foods of animal origin were consumed by more women than any other periods. Vitamin A-rich foods of vegetable origin were consumed by most women in welding period than other periods. The iron rich foods groups were consumed the most since 94.0% during increase than other periods of the year.

Table 3 provides the number of food groups consumed by the women during three agricultural periods.

Table 3: Number of food groups (FG) consumed by women during the year 2017

Number of FG consumed	Mitigation (N=971)		Welding (N=928)		Increase (N=936)	
	n	%	n	%	n	%
1	5	0.5	4	0.4	0	0.0
2	11	1.1	88	9.5	23	2.4
3	25	2.6	39	4.2	71	7.6
4	47	4.8	104	11.2	245	26.2
5	72	7.4	290	31.3	359	38.3
6	351	36.1	164	17.7	178	19.0
7	217	22.3	110	11.8	54	5.8
8	186	19.2	51	5.5	5	0.5
9	42	4.3	30	3.2	1	0.1
10	15	1.5	48	5.2	0	0.0
Total	971	100.0	928	100.0	936	100.0
p-value	<0.001					

In table 3, the majority of women (81.9%) during mitigation consumed between 6-9 food groups, while in the welding and increase periods the values were respectively 38.2% and 25.4%. In agricultural mitigation period only fifteen women consumed food from all the ten food groups during the 24 hours preceded the data collection period. In agricultural increase period zero women consumed food from all the ten food groups.

The period with the highest food group diversity was mitigation followed by welding.

3.3 Woman dietary diversity scores

Table 4 shows descriptive statistics of women dietary diversity scores.

Table 4: Descriptive statistics of women dietary diversity scores

DDSW	Mitigation (N=971)	Welding (N=928)	Increase (N=936)
Mean [CI, 95%]	6.5 [6.4-6.6]	5.5 [5.3-5.6]	4.8 [4.8-4.9]
Median	6.0	5.0	5.0
Variance	2.2	3.9	1.2
Standard deviation	1.5	2.0	1.1
Minimum	1.0	1.0	2.0
Maximum	10.0	10.0	9.0

In table 4, the mean of women dietary diversity scores during agricultural mitigation, welding and increase were respectively 6.5 [6.4-6.6], 5.5 [5.3-5.6] and 4.8 [4.8-4.9].

Table 5 indicates women dietary diversity scores classes according to agricultural periods.

Table 5: Classes of women dietary diversity scores

DDSW	Mitigation (N=971)		Welding (N=928)		Increase (N=936)	
	n	%	n	%	n	%
Low (<5)	158	16.3	244	26.3	200	21.4
Average (=5)	381	39.2	342	36.9	403	43.0
High (>5)	432	44.5	344	37.1	333	35.6

The table 5 shows that agricultural mitigation and welding periods were the periods who women consumed most diversified foods than the agricultural increase period.

The period with the highest dietary diversity score was mitigation followed by welding.

In the last 24 hours preceded the survey, there were less women who had high DDS during increase agricultural period than welding and mitigation periods. This revealed poor dietary diversity of women during crops period.

During agricultural mitigation, welding and increase periods, respectively 44.5%, 37.1% and 35.6% of women was classified with high dietary diversity score.

The majority of women during agricultural mitigation (83.7%), welding (74.0%) and increase (78.6%) periods had the minimum dietary diversity score (DDS ≥ 5).

3.4 Minimum dietary diversity score as function of food groups

Table 6 present the women minimum dietary diversity scores (MDDS) along the three agricultural periods.

Table 6: Minimum dietary diversity score as function of women food group consumption

Food groups of women	Mitigation (N=971)	Welding (N=928)	Increase (N=936)	p-value
	MDDS n (%)	MDDS n (%)	MDDS n (%)	
All starchy staples	875 (90.1)	686 (73.9)	472 (50.4)	<0.001
Beans and peas	837 (86.2)	630 (64.9)	574 (59.1)	<0.001
Nuts and seeds	855 (88.1)	81 (8.3)	36 (3.7)	<0.001
Milk and dairy products	309 (31.8)	259 (26.7)	206 (21.2)	<0.001
Flesh foods	826 (85.1)	664 (68.4)	417 (42.9)	<0.001
Eggs	94 (9.7)	168 (17.3)	71 (7.3)	<0.001
Vitamin A-rich dark green leafy vegetables	826 (85.1)	683 (70.3)	586 (60.4)	<0.001
Other vitamin A-rich Vegetables and fruits	327 (33.7)	290 (29.9)	113 (11.6)	<0.001
Other vegetables	845 (87.0)	611 (62.9)	572 (58.9)	<0.001
Other fruits	207 (21.3)	290 (29.9)	243 (25.0)	<0.001

Nuts and seeds, starchy staples, beans and peas, flesh foods, vitamin A-rich dark green leafy vegetables and other vegetables were the important food group to access the minimum dietary diversity score of women during the agricultural mitigation period. Starchy staples, beans and peas, flesh foods, vitamin A-rich dark green leafy vegetables and other vegetables were the important food group to access the minimum dietary diversity score of women during the agricultural welding period.

4. Discussion

Women food consumption

Not all the essential nutrients present in a single food can cover the nutritional needs of people [26]. To cover all the nutritional needs a variety of foods is necessary. The food nutritional quality improves with the increase in the number of foods products and foods groups [27].

Results in the present study (figure 1, table 1) show that women's diet was largely dominated by cereals followed by condiments/beverages, dark green leafy vegetables, other vegetables, oils/fats, legumes/nuts/seeds, sugar/sugar products and fish during the three periods of the year. These findings were similar to most another studies in West Africa [28-30].

A few proportion (less than 50%) of women consumed eggs, meat, offal, fruits (vitamin A-rich or not), red palm products, milk and dairy products, tubers white, roots and plantains, vitamin A-rich vegetables and tubers during the year 2017. The poor consumption of these food groups can explain by their availability during the year and the preference or cultural beliefs. Another other's explain that by preference or certain values and cultural beliefs [31], the religion [32], financial causes [33] and individual personality, character and attitude [34-36].

Like most study, women's diet varied according to the periods of the year [37-39].

During agricultural mitigation period, red palm products, other vegetables, milk and dairy products were consumed by most of women than the two other periods [40]. Nuts and seeds were consumed by most of women (90.9%) during agricultural mitigation period than welding (9.2%) and increase (4.1%) periods (table 1). That explained the high proportion of women who consumed vitamin A-rich foods of animal origin in this period than another's (table 2). In this period, the majority of women (81.9%) during mitigation period consumed between 6-9 food groups, while in welding and increase periods the values were respectively 38.2% and 25.4% (table 3).

During agricultural welding period, dark green leafy vegetables, vitamin A-rich fruits, eggs and meat were consumed by most of women than the two other periods [41]. These food groups consumption explain the high proportion of women who consumed vitamin A-rich foods of vegetable origin than other periods (table 2).

In this welding period, the guinea fowl eggs were more available than another period in rural area, which explain that 18.2% of women were consumed eggs.

Also during the agricultural increase period (harvest period), there were more women who consumed cereals, other fruits, fish, oils and fats, tubers white, roots and plantains than the two other periods. That justify that most of women (94%) was consumed iron rich foods groups during increase period than other periods of the year.

Women dietary diversity

In the present study, the women DDS mean ± SD has grown from 6.5 ± 2.2 food groups in mitigation period to 5.5 ± 3.9 in the welding period and 4.8 ± 1.2 during increase period. The poor dietary diversity during agricultural increase period might be justified by the few consumption of eggs, meat, offal, vitamin A-rich vegetables and tubers, vitamin A-rich fruits, milk and dairy products, nuts and seeds.

The Centre-West region women' DDS mean ± SD was similar to that find at Bengladesh (5.1 ± 1.4) [42].

The Centre-West region women' DDS mean ± SD was high than those find at rural Mali 3.82 ± 0.05 [43], Bangladesh 4.5 ± 1.1 [12], periurban area of Philippians 4.2 ± 1.5 [3], Malawi in the post-harvest season 4.7 ± 1.2 and in the preharvest season 4.0 ± 1.0 [44], Kenya 3.78 ± 0.99 [45] and rural Zambia 4.39 ± 0.03 [46].

The Centre-West region women' DDS mean ± SD was low than those find at Kenya 6.84 ± 1.46 [47]. This difference can explain that, the present study women (pregnant or not) were selected at home in the household contrary for the pregnant women attending antenatal clinic at Nanyuki Teaching and Referral Hospital in Laikipia County, Kenya. Difference might be because of the fact that another studies

setting was only rural and women sociodemographic characteristics were different. The women education level strongly influence their knowledge skills and practices towards food, the use of health care, for themselves and their children [48-51].

In the present study, table 5 shows that during agricultural mitigation, welding and increase periods, respectively 44.5%, 37.1% and 35.6% of women was classified with high dietary diversity score (DDS > 5). The majority of women during agricultural mitigation (83.7%), welding (74.0%) and increase (78.6%) periods had the minimum dietary diversity score. Witch mean that women who reach a minimum dietary diversity are likely to have more adequate micronutrient contributions have eaten a food of animal origin, a legume or nut and two fruits or vegetables, on the last 24 hours [26, 27]. The table 6 indicates that nuts and seeds, starchy staples, beans and peas, flesh foods, vitamin A-rich dark green leafy vegetables and other vegetables were the important food group to access the minimum dietary diversity score of women during the agricultural mitigation period. Starchy staples, beans and peas, flesh foods, vitamin A-rich dark green leafy vegetables and other vegetables were the important food group to access the minimum dietary diversity score of women during the agricultural welding period. The poor dietary diversity during agricultural increase period might be justified by the few consumption of flesh foods, nuts and seeds, and starchy staples. Of course, the achievement of the minimum food diversity of women does not guarantee the adequacy of food intake of micronutrients, especially if the quantity of food consumed is too small compared with the recommendations and necessary individual [26].

A low dietary diversity has a negative impact on health favoring development of various chronic diseases such as diabetes [52, 53] and the diseases coronary [54].

A nutrition-sensitive agricultural programme is necessary to increase diversity in agricultural production and to a lesser extent access to nutritious foods [55]. More diverse production systems may contribute to more diverse household diets [56].

As advantages, the 24 hours 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 women being surveyed. The future study must consider the quantity of food consumed.

5. Conclusion

This study aimed to assess women DDS in Centre-West Region during three agricultural periods in the year 2017. Women's diet was largely dominated by starchy staples. Women's diet varied according to the periods of the year. The period with the highest food group diversity was agricultural mitigation followed by welding period. Women reaching the minimum dietary diversity consumed nutrient-rich foods, such as animal source foods and vitamin A-rich fruits or vegetables.

Women with low DDS must improve their dietary diversity. Therefore, it is necessary to formulate and implement policies to ensure a healthy diet.

To improve the levels of food diversity of women, it must improve the availability and access to food, improve the food environment and ensure that people have a sufficient level of knowledge nutritional during the year. Nutrition education could be an essential element to change eating habits and improve the consumption of foods rich in nutrients such as fruits and vegetables.

6. List of Abbreviations

DDS: dietary diversity score, DDSW: dietary diversity score of women, 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, FAO: food and agriculture organization.

7. Conflicts of Interest

All the authors have no conflicts of interest.

8. Author's Contributions

Ouédraogo O., Compaoré E. W. R., Amouzou E. K. S., designed and carried out the study. Ouédraogo O., Compaoré E. W. R., Amouzou E. K. S. participated in the collection, analysis and interpretation of the data. Ouédraogo O., Compaoré 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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