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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

**Background:** 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 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 consumed 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 participants, respectively. Thus, 83.7 percent of women consumed at least five food groups (minimum adequate food diversity). The results indicated 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:** According 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,

respectively. 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 ( $\text{DDSW} \geq 5$ ) 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  $\geq 5$  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.

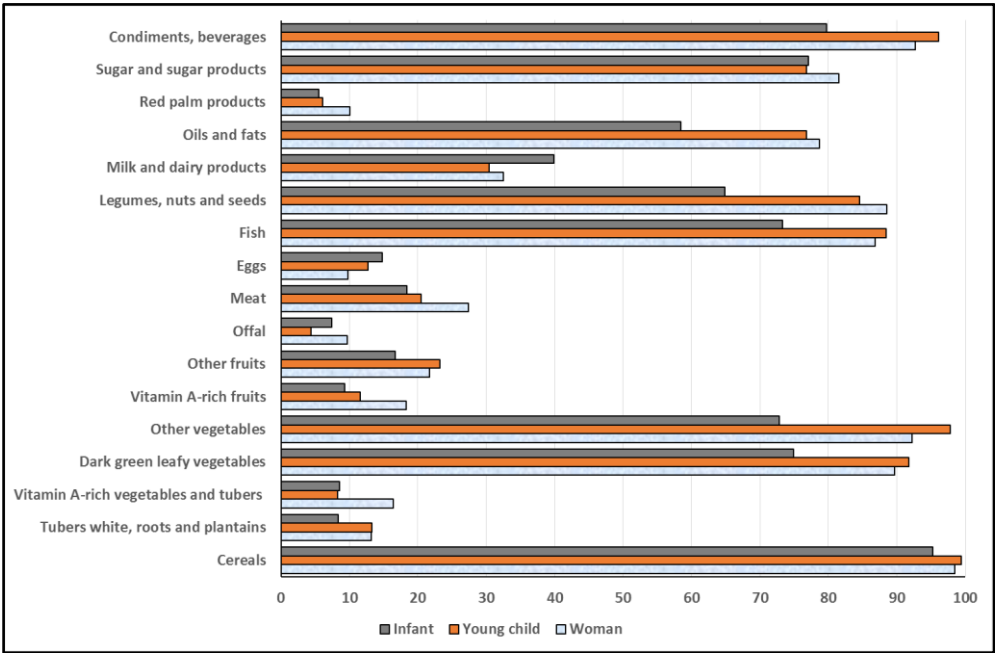


Figure 1. Food consumption profile of people during agricultural mitigation period

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 <sup>a</sup> |
|----------------------------|-----|-----------|-----------|----------------|
| 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                     |     |           |           |                |
| Whole                      | 189 | 5.36      | 1-9       |                |
| 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                      |     |           |           |                |
| Whole                      | 419 | 4.67      | 0-7       |                |

<sup>a</sup>: 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 <sup>a</sup> |
|---------------------------|------------|--------------------|---------------------------|---------------------------|---------------------------|----------------|
| 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 |       |

<sup>a</sup>: chi square test

**Table 4.** Characteristics of dietary diversity score of infants

| Variables                        | Choice       | N   | %<br>[DDSI < 4] | %<br>[DDSI = 4] | %<br>[DDSI > 4] | P <sup>a</sup> |
|----------------------------------|--------------|-----|-----------------|-----------------|-----------------|----------------|
| 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  |       |

<sup>a</sup>: chi square test

**Table 5.** Characteristics of dietary diversity of young children

| Variables                                  | Choice       | N   | %<br>[DDSYC < 5] | %<br>[DDSYC = 5] | %<br>[DDSYC > 5] | P <sup>a</sup> |
|--|--------------|-----|------------------|------------------|------------------|----------------|
| 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               |                |

<sup>a</sup>: 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%) in comparison 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 household 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 as young 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 characteristics such as province, household 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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