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RESEARCH ARTICLE

CORRELATION BETWEEN DETERMINING FACTORS AND DIETARY DIVERSITY IN CHILDREN AGED 6 TO 59 MONTHS IN TWO AREAS OF DIFFERENT HORTICULTURAL SPECIFICITY IN NIGER

Hassane Saley Zara[1], Rabiou Maman Moustapha[2], Salifou Ibrahim Alkassoum[3], Aminou Illia M. Nafiou[4], Adamou O. Aboubacar[1] and Sabo Haoua Seini[1]

1. Faculty of Science and Technology, Abdou Moumouni University, Niamey, Niger.
2. Faculty of Science and Technology, Biology Department, Dan Dicko Dankoulodo University of Maradi, Niger.
3. Faculty of Health Sciences, Abdou Moumouni University, Niamey, Niger.
4. Faculty of Technical Sciences and Agro-Food Technology, Boubacar Ba University, Tillabéri, Niger.

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Abstract

An unbalanced diet has been identified as a major cause of morbidity and mortality in children. The general objective is to identify the factors determining the food diversification of children aged 6 to 59 months in two areas of different horticultural specificity. This was a cross-sectional study, conducted in three municipalities, with 214 mothers and or caregivers. A questionnaire evaluating the food diversity was used, followed by statistical analysis of the results. The group of cereals and fruits and vegetables rich in vitamin A is the most consumed. Those of animal origin were low. A significant link between Minimum Food Diversity and certain characteristics such as area, income, mother education, agriculture, gardening and breeding (p 0.01). According to the logistic regression, residence of the child in non-horticultural zone (Dosso commune urbains) (ORa [IC95%] =44.60 [5.90-152.50]; P<0.001) and in horticultural zone of Tillabéri (ORa [IC95%] =30 [7.67-259.40], p <0.001) Increases their chances of having a diversified diet by 44 and 30 times respectively compared to a child in the Dosso horticultural. Efforts to improve food security, especially in vulnerable households, were needed to ensure a balanced diet for children.

Introduction:-

Food diversity is the basis of good nutrition, and an individual's nutritional status has important implications for labour productivity, lifetime incomes and economic development across the country (Shively and Evans, 2021). Undiversified diet leads to malnutrition in the image of marasmus and kwashiorkor (Houndji et al., 2013; Lourme Ruiz et al., 2016; Sanou et al., 2018). Malnutrition compromises the physical and intellectual growth of young children (Kayodé et al., 2012). In Niger, children suffering from acute malnutrition have a rate above the WHO 10% alert threshold and sometimes even above the emergency threshold (15%) (World Health Organization, 2009). This malnutrition is directly linked to inadequate nutrition. However, for a good balance of food, a diversified diet is necessary. It provides the body with most of the nutrients it needs to function properly (Sanou et al., 2018).

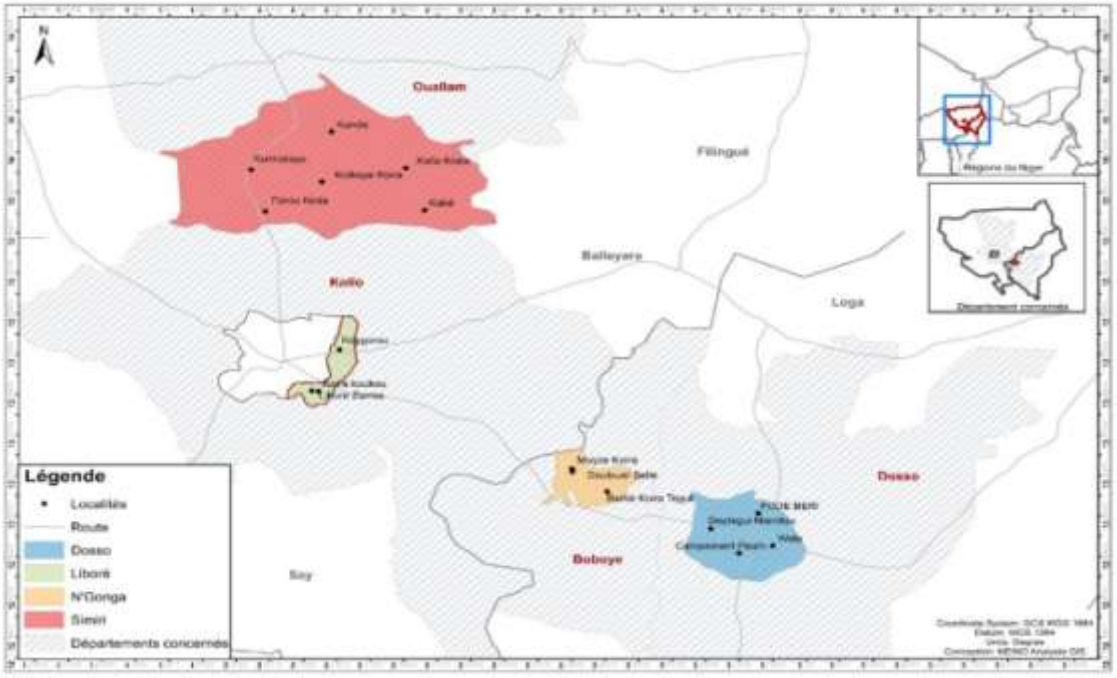
Corresponding Author:- Hassane Saley Zara
Address:- Faculty of Science and Technology, Abdou Moumouni University, Niamey, Niger.

Adherence to a minimum acceptable diet is also essential for reducing macronutrient and micronutrient deficiencies (Jones et al., 2014a; Bougma et al., 2022). According to the SMART 2019 survey, the majority of Nigerian children have a low food diversification with 42.1% consuming at least 4 groups of foods per day and only 31.8% having an acceptable minimum diet (INS, 2019). This situation varies greatly from one region to another. The lowest proportions are in Maradi (3%), Tahoua (8.7%), Tillabéri (9.2%) and refugee camps (4.1%) (INS, 2018). Indeed, several studies have shown that inappropriate infant and young child feeding practices are linked to the socio-demographic characteristics of mothers, but little information is available on the dietary diversity of children for better understand the causes of this malnutrition. This study was initiated to identify the key determinants that influence children's dietary diversity.

Materials and Methods:-

Study area

The present study concerned three municipalities. This is the commune of Liboré located in the department of Kollo region of Tillabéri, between 13° 24 17 latitude north and 2° 11 29 longitude east, in an area of 110 km. The commune of N'Gonga located 30 km south of the chief departmental place Birni N'Gaouré located between latitude 13°1799 and 2.826 13°10'48 ' north longitude and 2°49'34' east longitude with 211m of altitude. The urban commune of Dosso occupies the central part between 13°05 latitudes North, and 1'30 and 30'20 longitudes East on national road 1 (axis Niamey-N'Guigmi) 139 km to the East of Niamey (the capital) with an area of 592.6 km 2. In Figure 1, you can see the map of Niger and the locations of the various communes (HASSANE et al., 2024).



Carte 1:- Location map of the study areas (HASSANE et al., 2024).

Description of the study:

The study was conducted from February 20 to August 5, 2022, and involved mothers/caregivers of children aged 6-59 months. Children should be physically healthy and have resided in the study area for at least 6 months. Parental consent is also obtained prior to the inclusion of the mother/guardian and child in the study.

Sampling

The total number of mother-child couples in the study was determined using ASN SMART 2020 software used in the national nutrition survey to calculate sample size. The formula is N= (1+NR) (D*Z2*p (1-p)) / m2.

The mother/child couples were selected randomly in the three municipalities of Liboré, N'Gonga and Dosso. The study covered a total of 214 mother-child couples.

Tools for collecting data

Data collection, processing and analysis were aligned with WHO guidelines on indicators for assessing infant and young child feeding practices (World Health Organization, 2010) and FAO for measuring At both the household and individual levels, there is a need for food diversity (Gina et al., 2013). A questionnaire has been constructed and focused on the collection of demographic and economic information. The Food Diversity questionnaire was developed based on WHO and FAO guidelines, taking into account the study objectives and country.

Data Collection Tools:-

Data collection, processing and analysis were adapted to the WHO guidelines on indicators to assess infant and young child feeding practices (World Health Organization, 2010) and FAO guidelines to measure Dietary Diversity at household and individual levels. A questionnaire was developed and focused on collecting demographic information (age, sex and education level of mothers or caregivers), socio-economic information (income-generating activities), food consumption (different food groups consumed) and production systems (crops, livestock and gardening). The Dietary Diversity questionnaire was designed in accordance with WHO and FAO recommendations, as well as the study objectives and country. In the households, interviews with the mothers of the children were conducted in person. Based on the open recall, it was checked which food groups were consumed using a predefined list of food groups. A list of 42 food items was used. For every food or food group consumed, one point was given, and zero points were given if none were consumed.

Variables

Variables that include demographic, socioeconomic characteristics, food consumption and production systems. The dependent variable was Minimum Food Diversity with these two subgroups (low and acceptable). The choice of explanatory variables was based on a prior knowledge of the variables likely to influence the level of dietary diversity. The variables examined as determinants of food diversity were the place of residence, sex of the child; the level of education of the mother/guardian, the practice of breeding; the practice of gardening; farmer; and sources of income. In relation to the children's food diversity score (FDSE), it was equal to the number of food groups consumed by children. Based on WHO recommendations, the FDSE selected 7 groups according to WHO and FAO (Gina et al., 2013; World Health Organization, 2010; Ouédraogo et al., 2019; World Health Organization, 2010). Children who consumed daily foods from at least 4 out of 7 food groups defined during the previous day reach the Minimum Dietary Diversity (MDD). Minimum Dietary Diversity (MDD) and the frequency of eating group are dependent variables and were examined according to the areas and characteristics of households, mothers and children. The DAM is divided into two classes, low food diversity score (LFDS), when MDD<4 and Minimum Food Diversity acceptable (MFDA) when FDS >4. The children's dietary diversity was crossed with the household characteristics to determine their association.

Statistical analysis

Study data were collected using the KoboCollect software and processed on STATA MP 16 and SPSS 25. Chi-two association analyses were performed to describe the characteristics of mothers, children and households, the minimum food diversity and types of food groups consumed in relation to residential areas, the p-value of 0.05 was considered statistically significant. A multi-variate logistic regression analysis was performed to predict the probability that a child would belong to an adequate or low level of dietary diversity. The dependent variable was the Minimum Food Diversity with these two subgroups (low and acceptable). The choice of explanatory variables was based on a prior knowledge of the variables likely to influence the level of acceptable Dietary Diversity. Those with a p-value of 0.05 are linked to the dependent variable. The Odds ratios (OR) column indicates how often it influences, positively or negatively, the food diversity and a confidence interval (CI) at 95%. The predictive power of the logistic model, the identification of determinants of children's food diversification was determined to create assumptions and predictions about children's food diversification in the future

Ethical considerations

This study was granted by the health authorities of the region and approved by the National Ethics Committee for Health Research (CNERS) under number 075/2021/CNERS of December 09, 2021. The survey content was explained in detail to participants. Participation was voluntary and each mother or caregiver signed a declaration of informed consent. Data collection and Processing was carried out in a confidential manner during the analysis and reporting of the data.

Results:-

Distribution of children by age group according to zones.

The distribution of children by age group and area is shown in Table 1.

Table 1:- Shows the distribution of children ages 6 to 59 in horticultural and non-horticultural areas.

Age groups	Areas				
	horticultural Dosso	**horticultural Tillabéri**	**horticultural Dosso**	**Total**	**p**
	N (%)	N (%)	N (%)	N (%)	**$<10^{-3}$**
6 to 23 months	35 (47.3)	34 (48.6)	68 (97.1)	137 (64.0)	
24 to 59 months	39 (52.7)	36 (51.4)	2 (2.9)	77 (36.0)	
Sample size	74 (100.0)	70 (100.0)	70 (100.0)	214 (100.0)	

Table 1 shows that overall; children aged 6 to 23 months are most represented (64%). Specifically, children aged 6 to 23 months or more dominant (97.1%) in the non-horticol area (Dosso) Compared with (52.7 %) and (51.4%) children aged 24 to 59 months respectively in the horticol areas of Dosso and Tillabéri. There is a statistically significant relationship between the zones and age groups ($p<0.001$).

Table 2 presents an analysis of the sociodemographic and economic characteristics of mothers or caregivers who care for children aged 6 to 59 months (HASSANE S.Z et al., 2024).

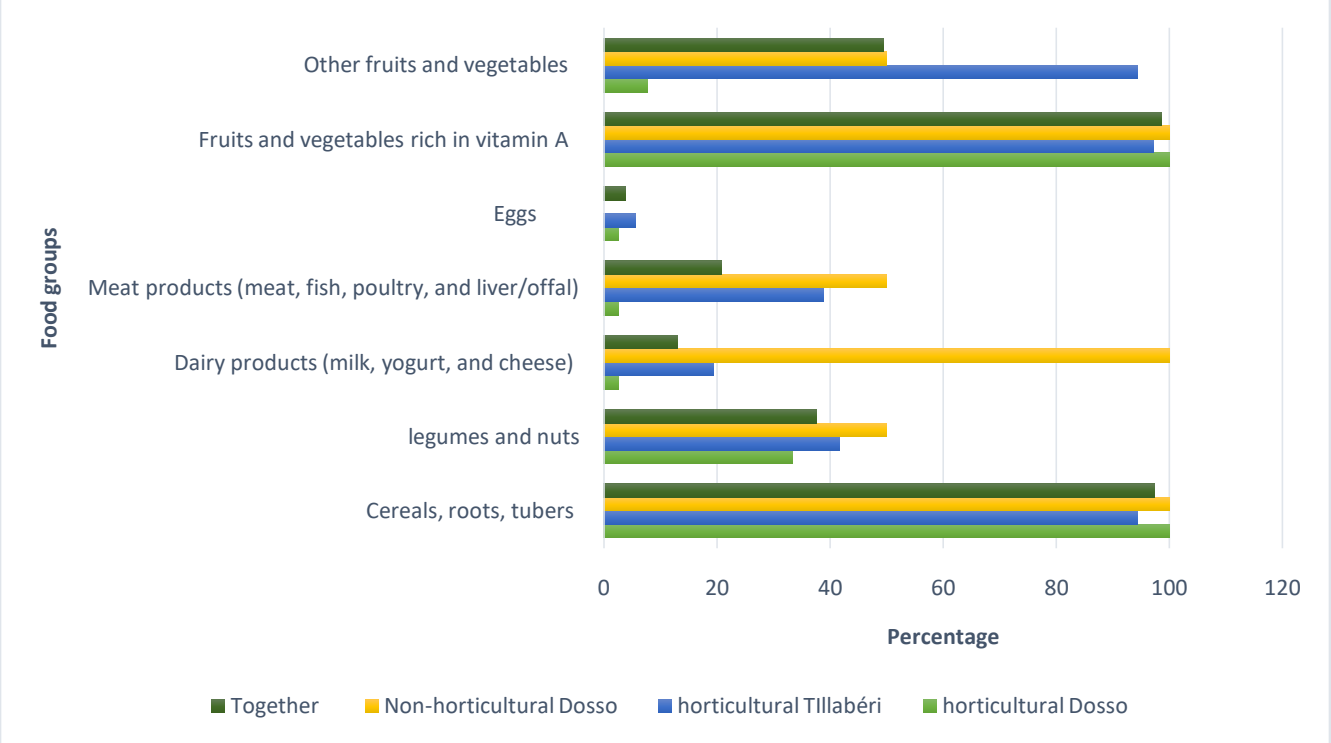
Table 2:- Relationship between the socio-demographic and economic characteristics of mothers or caregivers of children aged 6 to 59 months according to the areas.

Variables		Areas			Total	p
		Horticol DossoN (%)	Horticol Tillabéri N(%)	Non- hortical Dosso N (%)		
Level of education	Schooled	8 (10.9)	40 (57.14)	49 (70)	97 (45.33)	**$< 10^{-3}$**
	Out of school	60 (81.08)	17 (24.29)	17 (24.29)	94 (43.93)	
	Koranic School	6 (8,11)	13 (18,57)	4 (5,71)	23 (10,75)	
Total		74 (100)	70 (100)	70 (100)	214 (100)	
Civil status	Bride	70 (94.59)	68 (97.14)	70 (100)	208 (97.2)	**0.02**
	Divorced	0	2 (2.86)		2 (0.93)	
	Widow	4 (5.41)	0	0	4 (1.87)	
Total		74 (100)	70 (100)	70 (100)	214 (100)	
Source of income	Employees	0 (0.0)	3 (4.29)	10 (14.29)	15 (6.19)	**$< 10^{-3}$**
	Farmers	25 (33.78)	5 (7.14)	2 (286)	32 (14.95)	
	Traders	29 (39.19)	17 (24.29)	21 (29.9)	65 (31.2)	
	Without income	20 (27.03)	45 (64.29)	37 (52.86)	102 (47.66)	
Total		74 (100)	70 (100)	70 (100)	214 (100.0)	
Gardening practice	Yes	64 (86.49)	17 (24.29)	3 (4.29)	84 (39.25)	**$< 10^{-3}$**
	No	10 (13.51)	53 (75.71)	67 (95.71)	130 (60.75)	
Total		74 (100.0)	70 (100.0)	70 (100.0)	214 (100.0)	

This analysis shows that the majority of mothers were married and there is a strong link between zones and marital status (p 0.05). The rate of no income was 47.66%, the difference was also significant (p < 0.001). The rate of non-income was particularly high (52.86%) in the non-horticultural area of the urban municipality of Dosso and in the horticultural area of Tillabéri (64.29%). In addition, 39.25% are engaged in gardening. The proportion of mothers engaged in gardening is particularly low in the non-horticultural zone (4.29%) and in the horticultural area Tillabéri (24.29%), which is also significant (p<0.001). (43.93%) were not in school and this rate was higher at the level of the municipality of Dosso (81.08%), the difference was significant (p < 0.001). There was a significant difference between the two study areas for all characteristics studied (p 0.05).

Food intake for children age 6 to 59 months based on the food consumption score (FCS)

Figure 1 shows the consumption rate of food groups according to the areas of children aged 6 to 59 months. In all areas, starchy foods (cereals, roots, tubers) and fruits and vegetables rich in vitamin A are the most consumed. The foods most consumed include legumes and nuts, dairy products like milk, yogurt, and cheese, meat products like meat, fish, poultry, and liver/offal, and eggs. At the area level, consumption shows disparities depending on the potency and availability of food. Children in the horticultural area of Dosso (N'Gonga) and the non-horticultural area (Dosso urban commune) not only consumed 100% of starchy foods but also fruits and vegetables rich in vitamin A. The difference is no significant between the areas (P>0.05). Other fruits and vegetables were more consumed (94.4%) in the horticultural area of the commune of Liboré (Tillabéri region), a significant difference was observed according to the areas (P< 0.001). In addition, legumes and nuts, dairy products (milk, yogurt, and cheese) and meat products (meat, fish, poultry, and liver/offal) are more consumed in the non-horticultural area of the urban commune of Dosso, so, respectively, 50.0.0% and 50.0%. The proportions were statistically significant according to this area (P<0.05). There were no differences in the consumption of legumes and nuts between the areas, (P>0.05).



The percentages of food groups consumed by area: dairy products (milk, yogurt, cheese): $p<10^{-3}$; meat products (meat, fish, poultry, liver/offal): $p<10^{-3}$; other fruits and vegetables: $p<10^{-3}$

Relationships between variables

The chi-two association's results indicate that the dietary diversity of children was statistically associated with certain sociodemographic and economic characteristics. Table 3 provides details of all these results.

Table 3:- The minimum dietary diversity of children aged 6 to 59 months was influenced by socio-demographic and economic characteristics.

	Less than 4 groups	At least 4 groups	Total	p
	N(%)	N(%)	N(%)	
Areas				
horticultural Dosso	71(95.9)	3(4.1)	74(100.0)	**< 10^{-3}**
horticulturalTIllabéri	32(45.7)	38(54.3)	70(100.0)	
Non-horticultural Dosso	24(34.3)	46(65.7)	70(100.0)	
Total	127(59.3)	87(40.7)	214(100.0)	
Educational level				
Higher level	0(0.0)	7(100.0)	7(100.0)	**< 10^{-3}**
Secondary level	19(46.3)	22(53.7)	41(100.0)	
Primairy level	18(36.7)	31(63.3)	49(100.0)	
Koranic School	16(69.6)	7(30.4)	23(100.0)	
Out of school	74(78.7)	20(21.3)	94(100.0)	
Total	127(59.3)	87(40.7)	214(100.0)	
Main source of income				
Employees	2(15.4)	11(84.6)	13(100.0)	**< 10^{-3}**
Farmers	28(87.5)	4(12.5)	32(100.0)	
Traders	37(56.9)	28(43.1)	65(100.0)	
Without income	61(58.8)	43(41.2)	104(100.0)	
Total	127(59.3)	87(40.7)	214(100.0)	
Agricultural practice				
No	18(34.6)	34(65.4)	52(100.0)	**< 10-3**
Yes	109(67.3)	53(32.7)	162(100.0)	
Total	127(59.3)	87(40.7)	214(100.0)	
Gardening Pratice				
No	60(46.2)	70(53.8)	130(100.0)	**< 10-3**
Yes	67(79.8)	17(20.2)	84(100.0)	
Total	127(59.3)	87(40.7)	214(100.0)	
Briefing Pratice				
No	40(44.0)	51(56.0)	91(100.0)	**< 10^{-3}**
Yes	87(70.7)	36(29.3)	123(100.0)	
Total	127(59.3)	87(40.7)	214(100.0)	
Gender of child				
Male	68(59.1)	47(40.9)	115(100.0)	0.940
Female	59(59.6)	40(40.4)	99(100.0)	
Total	127(59.3)	87(40.7)	214(100.0)	

The analysis reveals that the Dietary Diversity of children aged 6 to 59 months is low in all study areas (40.7%). The proportion of children who consumed at least 4 food groups (adequate dietary diversity) increases as we move from the market gardening areas of N'Gonga (Dosso), the commune of Liboré (Tillabéri) to that of the non-horticultural area of the urban commune of Dosso. It is 4.1% respectively; 54.3% and 65.7%. Regarding the level of education of mothers, children from educated mothers were less likely to have a low dietary diversity compared to their counterparts. Children born to mothers whose main source of income is wages were less likely to be food insecure (84.6%). Regarding practices, children from households engaged in agriculture, gardening or livestock farming have a low food diversity composed of less than four (4) food groups. In terms of sex, it did not influence the Minimum Dietary Diversity of children (P >0.05).

Correlation between food diversity determinants and minimum dietary diversity score of children aged 6-59 months

Relationships between variables

According to the results of the bivariate analysis in figure 2, some characteristics are associated with an increase in the probability that a child has Minimum Acceptable Food Diversity, it is: the area (Market gardener Tillabéri, Not-

market gardening Dosso), Educational Level (secondary level, primary level) and Mains source of income (Employees), (OR>1).

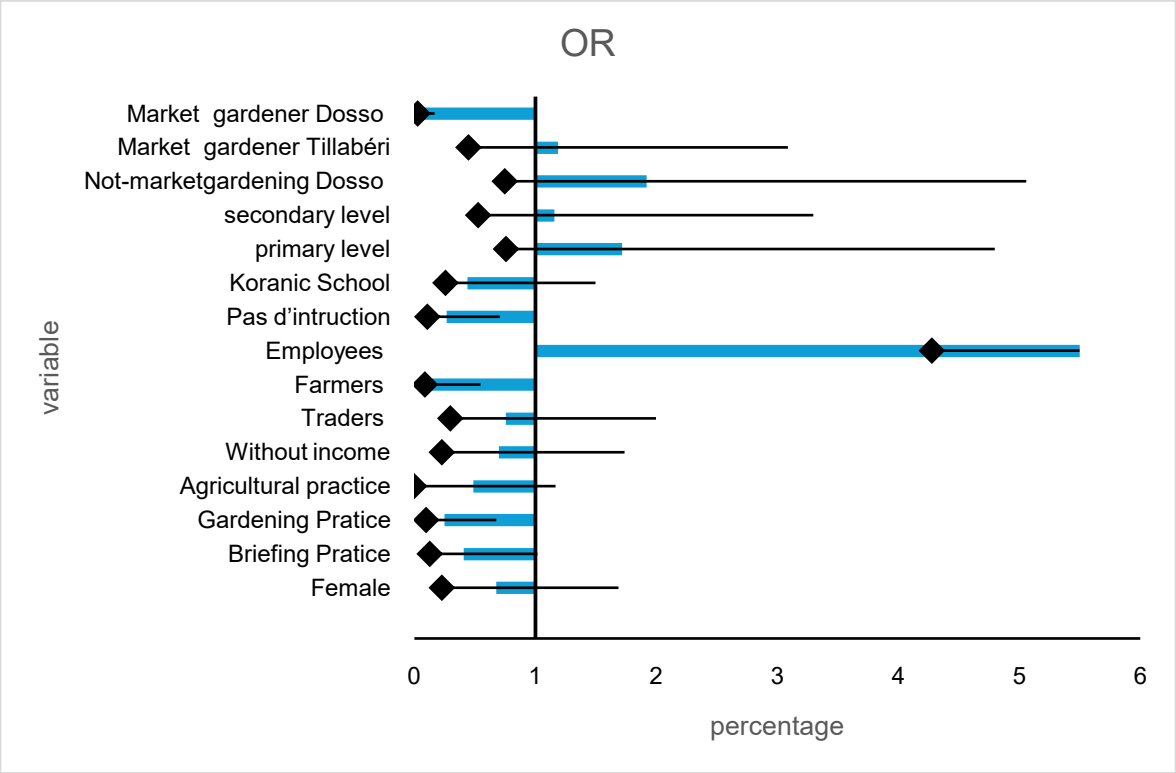


Figure 2:- Relationship between sociodemographic and economic characteristics and Minimum Dietary Diversity of children aged 6 to 59 months according to bivariate analysis.

To study the determinants of dietary diversity in children, a bivariate analysis of selected explanatory variables (figure 2) was performed. Then, using a logistic model, the simultaneous effects of the variables selected in the first step (household characteristics) on the children's dietary diversity are determined.

Table 4presents the factors associated with minimum dietary diversity. The model estimates to identify two relevant variables influencing the dietary diversity of children aged 6-59 months.These are the non-horticultural area "Dosso urban commune" and the horticultural area of Tillabéri "commune of Liboré" which have significant links with the minimum acceptable dietary diversity regime of children (P<0.05).

Table 4:- Logistic regression of variables related to the Minimum Acceptable Dietary Diversity of children aged 6 to 59 months.

Variables	ORa [IC95%]	p
Areas		
horticultural Dosso	1	-
horticultural Tillabéri	30.01[5.90-152.50]	**$< 10^{-3}$**
Not- horticultural Dosso	44.59752	**$< 10^{-3}$**
Educational Level		
Higher level	1	-
secondary level	0.93[0.33-2.59]	0.891
primary level	1.64[0.61-4.39]	0.329
Koranic School	0.75[0.21-2.66]	0.659
Mains source of income		
Employees	1	.
Farmers	0.30[0.03-2.90]	0.300
Traders	0.93[0.15-5.82]	0.939

Without income	0.41[0.07-2.26]	0.306
Agricultural practice		
No	1	.
Yes	0.48[0.20-1.17]	0.107
Gardening Pratice		
No	1	.
Yes	2.30[0.62-8.53]	0.212
Briefing Pratice		
No	1	.
Yes	1.38[0.61-3.09]	0.441
Gender of child		
Male	1	.
Female	1.14[0.55-2.38]	0.725

Areas are a very important feature in the analysis of food diversity. Children aged 6 to 59 months in the non-horticultural area "Urban Dosso " (ORa [IC95%] =44.60 [5.90-152.50]; p=0.000) and the Tillabéri horticultural area (ORa [IC95%] =30 [7.67-259.40], p=0.000) were less likely to have low food diversity compared to their Dosso horticultural area counterpart

Predictive power of the logistic model of minimum dietary diversity in children aged 6-59 months

The results of the estimates of the predictive power of the logistic model, the identification of the determinants of the Minimum Dietary Diversity of children as well as their interpretations are presented in Table 6.

Table 6:- Predictive power of the logistic model of minimum dietary diversity in children aged 6-59 months.

Prévisions	**Minimal dietary diversity in children**			P
	Less than 4 groups n(%)	**At least 4 groups n(%)**	**Total n(%)**	
Less than 4 groups	92 (72.44)	35 (27.56)	127 (100)	0.5000
At least 4 groups	18 (20.69)	69 (79.31)	87 (100)	
Total	110 (51.40)	104 (48.60)	214 (100)	

The ranking table (Table 5) shows that the model has a low predictive power as it predicts the dietary diversification of children at 48.60%. However, it appears that the dietary diversity of at least 4 groups is correctly classified (79.31%) than the minimal dietary diversity of less than 4 groups (72.44%).

Discussion:-

The results show that the most representative age group is 6-23 months with a proportion of 64.0% ($p < 0.01$). This is in disagreement with the INS (2021). According to the analyses, 43.93% of mothers had no formal education. This very high percentage of uneducated women could be due to the Nigerian education system, which is characterized by a low rate of schooling for girls in rural areas. These results are consistent with the national INS documentation (2017; 2021). Furthermore, 24.29% of mothers in the non-horticultural area of Dosso were uneducated, this same percentage was obtained in the horticultural area of Tillabéri. This percentage was significantly lower ($P < 0.01$) than the percentage of mothers interviewed in the horticultural area of Dosso (81.08%). This very high proportion of uneducated women in thehorticultural area of Dosso could be due to the characteristic of the commune, which is a very rural commune, or in rural areas, from a young age, the girl is perceived as a woman destined to perform specific functions such as reproduction (marriage) and maintenance of family members. Among the respondents, 47.66% were without income, and rates varied considerably between zones ($p < 0.01$). The horticultural area of Dosso had a very low rate of no income, which is 27.03% compared to the non-horticultural area of Dosso and the horticultural area of Tillabéri. These results are different from the national INS documentation (2022). This may be due to the nature of the area, which is a natron production area par excellence where almost all women participate in the production and are paid. This is comparable to studies conducted by Berde et al. (2019) in 23 countries in sub-Saharan Africa where 43.8% of women had no formal education and 34.5% were without income. Similarly, our results are similar to the studies conducted by Lucha et al. (2022) in Ethiopia where more than one third (48.6%) of mothers had no education. These results are also consistent

with the study conducted by Jones et al. (2014b) in Madagascar where they found a significant difference for all socio-demographic characteristics.

Analysis of the dietary profile of children shows that cereals and vitamin A-rich fruits and vegetables were frequently consumed in the areas. Physical availability could explain the high consumption of these products in this study. These results are consistent with those of Moursi et al. (2008) and several studies on food consumption and the national INS documentation (2015; 2017; 2019; 2020; 2021). In contrast, animal products are consumed sparingly. Meat is eaten either once a week or monthly. Milk and dairy products are also consumed at low levels. The majority of respondents told us that their children almost never eat eggs. The low consumption of these foods and the predominant consumption of cereals in the diets of children living in rural households such as those in our study has already been observed in other rural communities in Sudan, Niger, Burkina Faso, in Madagascar, and Ethiopia (Workicho et al., 2016; Khalid et al., 2017; Rakotonirainy et al., 2018; Sanou et al., 2018; Ouedraogo et al., 2019; INS, 2022). Although consumption of animal products is generally low, it was higher in the non-horticultural area of the urban municipality of Dosso. This could be explained by the availability of these products, as the area is not only urban (these products are available and accessible), but also parents are more educated so they know the advantage of their children's consumption of these products.

Diets based on the consumption of cereals or starches as staple foods and low in fruits and animal products are common in low-income countries (Jones et al., 2014b; Sanou et al., 2018). The risk of such a diet is micronutrient deficiency and, as a result, malnutrition and poor health Sanou et al. (2018).

The analysis of variables related to the dietary diversity of children aged 6-59 months shows that the area, the source of income and the level of education of mothers have an influence on the dietary diversity of children. Apart from these characteristics mentioned above, the practice of agriculture, gardening and livestock farming are also associated with food diversity. These results are similar to those of Rakotomanana et al. (2017). They found that the main risk factors for low dietary diversity were low levels of maternal education and socio-economic status. These results are similar to those of Arimond et al. (2004) who reported, through their bivariate regression analysis of their study carried out on recent data from EDS surveys (Demographic and Health Surveys) from 11 countries, an association between urban/rural conditions and the nutritional status of children (Arimond and Ruel, 2004). They are also similar to the results reported by Jones et al. (2014b); Workicho et al. (2016).Previous studies have reported the positive influence of horticultural on children's food diversity (Sibhatu et al., 2015; Ouedraogo et al., 2019). The results of the logistic regression show that the area was positively associated with high food diversity. It revealed that the food diversity varied according to place of residence.

It appears that children living in the horticultural area of Tillabéri are 30 times more likely to have an adequate minimum food diversity compared to a child living in the horticultural area of Dosso (ORa [IC95%] =30 [7.67-259.40], p=0.000). These results could be due to the availability and accessibility of food to the population, which is explained by the proximity of the municipality to the capital and the river. In addition, the fact that a child is in the non-horticultural area of Dosso urban commune multiplies by 44 his chance to have a diversified diet compared to a child who is in thehorticultural area of Dosso (ORa [IC95%] =44.60 [5.90-152.50]; P=0.000). These results are different from those of H. Rakotomanana et al. (2017).They found that the main risk factors for low food diversity were low levels of education and low socio-economic status. These results are consistent with studies conducted among Chinese preschool children and children from eleven (11) African countries. These previous studies indicated that food diversity is positively influenced by the urban environment (Mary Arimond and Ruel, 2004; Luo et al., 2012). This data is consistent with the results of a study conducted in eight (8) cities in China by Zhao et al. (2017).

Conclusion:-

In this study, the aim was to establish a correlation between the determining factors of dietary diversification and the Minimum Dietary Diversity of children aged 6 to 59 months in two areas of different horticultural specificity.

The analysis shows that the determining factors are the residential environment (the area) which was correlated with a high dietary diversity for children aged 6 to 59 months. The dietary situation of children aged 6 to 59 months remains a concern. The quality of children's diet during their early years depends mainly on the behavior and decisions of mothers or people who usually take care of the child. Hence the need to develop actions for women's education and awareness-raising integrated into a long-term multi-sectoral development program to increase the diversity of agricultural production and access to nutritious foods.

Competing Interests
The authors state that they have no competing interests with regard to the content of this article.

Authors' Contributions.
The work was carried out with the help of all authors. The authors of this article have read and approved its content.

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Reference:-

1. Arimond M, Ruel MT. (2004). Dietary Diversity Is Associated with Child Nutritional Status : Evidence from 11 Demographic and Health Surveys. J. Nutr.**134(10)**: 2579–2585. DOI: https://doi.org/10.1093/jn/134.10.2579
2. Berde AS, Bester P, Kruger IM. (2019). Coverage and factors associated with vitamin A supplementation among children aged 6–59 months in twenty-three sub-Saharan African countries. Public Health Nutr. **22(10)**: 1770–1776. DOI: https://doi.org/10.1017/S1368980018004056
3. Bougma S, Hama-ba F, Garanet F, Savadogo A. (2022). Sociodemographic characteristics of mothers and complementary feeding practices among children aged 6 to 23 months in north-central Burkina Faso. Afr. J. Food Agric. Nutr. Dev. **22(10)**: 22017–22040 DOI: https://doi.org/10.18697/ajfand.115.22250
4. Gina K, Terri B, Marie C. (2013). Guidelines for measuring household and individual dietary diversity. Food Agric. Organ. U. N. Rome Italy, p.60.
5. Hassane SZ, Alkassou SI, Mamane AN, Mamane MR, Sabo HS. (2024). Connaissances, perceptions et pratiques sur la carence en vitamine A chez les mères/gardiennes d'enfants âgés de 6 à 59 mois dans des zones maraîchères et non maraîchères au Niger. Med.Afr. Francoph. **71:** 501-512. https://www.santetropicale.com/manelec/fr/index.asp
6. Houndji BVS, Bodjrenou SF, Londji SB, Ouetchehou RA, Acakpo A, Amouzou K. (2013). Amélioration de l'état nutritionnel des enfants âgés de 6 à 30 mois à Lissèzoun (Centre-Bénin) par la poudre de feuilles de Moringa oleifera (Lam.). Int. J. Biol. Chem. Sci. **7(1):** 225–235. DOI : http://dx.doi.org/10.4314/ijbcs.v7i1i.19
7. INS. (2022). Enquête retrospective sur la nutrition et la mortalité au Niger, p.103.
8. INS. (2021). Enquête nutritionnelle et de mortalité Rétrospective au Niger (No. rapport finale). Niamey, Niger, p.125.
9. INS. (2020). Enquête Vulnérabilité à l'Insécurité Alimentaire des Ménages (janvier-février 2020) (rapport final). Niamey, Niger; p.139.
10. INS. (2019). Rapport Final de l'Evaluation nationale de la situation nutritionnelle par la méthodologie SMART au Niger (16 août et 25 septembre2019). Niamey Niger, p.139.
11. INS. (2018). Rapport final de l'évaluation nationale de la situation nutritionnelle par la méthodologie SMART 2018. Niger, p.181.
12. INS. (2017). Résultat préliminaire de l'enquête conjointe sur la vulnérabilité à l'insécurité alimentaire des ménages au Niger (décembre 2017). Niamey, Niger, p.184.
13. INS. (2015). Enquête conjointe sur la vulnérabilité à l'insécurité alimentaire des ménages au Niger (décembre 2014- janvier 2015) (rapport final). Niamey/Niger, p.169.
14. Jones AD, Ickes SB, Smith LE, Mbuya MN, Chasekwa B, Heidkamp RA, Menon P, Zongrone AA, Stoltzfus RJ. 2014a. World Health Organization infant and young child feeding indicators and their associations with child anthropometry : a synthesis of recent findings. Matern. Child. Nutr.**10(1):** 1–17. DOI: 10.1111/mcn.12070
15. Jones AD, Shrinivas A, Bezner-Kerr R. 2014b. Farm production diversity is associated with greater household dietary diversity in Malawi: Findings from nationally representative data. Food Policy **46 (C):** 1–12. DOI:https://doi.org/10.1016/j.foodpol.2014.02.00
16. Kayodé AP, Akogou FU, Hounkpatin WA, Hounhouigan DJ. (2012). Effects of processing methods on the nutritional value of sorghum-based supplementary porridge formulations. Int. J. Biol. Chem. Sci. **6(5)**: 2192–2201. DOI: http://dx.doi.org/10.4314/ijbcs.v6i5.25

17. Khalid FA, Ali AK, Ali SA, Mosmar ZY, Salih SS, Salman TK, Desogi MA, Soghaier MA, Mohammed EE, Mohammed AA. (2017). Households' dietary habits and food consumption patterns in Hamishkoreib locality, Kassala State, Sudan. J. Ethn. Foods **4(3)**: 181–186. DOI: https://doi.org/10.1016/j.jef.2017.08.009
18. Lourme R A, Dury S, Martin-Prével Y. (2016). Do we consume what we sow? Relation between production diversity, agricultural income and dietary diversity in Burkina Faso.Cah. Agric.**25:** 65001. DOI:10.1051/CAGRI/2016038
19. Lucha T, Engida T, Ketsela A. (2022). Assessing the potential determinants of national vitamin A supplementation among children aged 6-35 months in Ethiopia: further analysis of the 2019 Ethiopian Mini Demographic and Health Survey. BMC Pediatr.**22(1):** 439. DOI: https://doi.org/10.1186/s12887-022-03499-5
20. Luo R, Shi Y, Zhang L, Liu C, Rozelle S, Sharbono B, Yue A, Zhao Q, Martorell R. (2012). Nutrition and Educational Performance in Rural China's Elementary Schools: Results of a Randomized Control Trial in Shaanxi Province. Econ. Dev. Cult. Change **60(4)**:735–772. DOI: https://doi.org/10.1086/665606
21. Moursi MM, Arimond M, Dewey KG, Treche S, Ruel MT, Delpeuch F. (2008). Dietary diversity is a good predictor of the micronutrient density of the diet of 6-to 23-month-old children in Madagascar. J. Nutr. **138(12):** 2448–2453.https://doi.org/10.3945/jn.108.093971
22. Organization WH. 2010. Indicators for assessing infant and young child feeding practices part 3: country profiles, p.60.
23. Ouedraogo O, Compaore EW. Amouzou SK, Zeba AN, Dicko M H. (2019). Determination and Characterization of Women, Infants, and Young Children's Dietary Diversity in Agricultural Mitigation Period of Burkina Faso. J. Nutr. Food Secur.**4(2):** 114-125; DOI: https://doi.org/10.18502/jnfs.v4i2.774
24. Ouédraogo O, Wendinpuikondo RCE, Kou'santa SAE, Hama DM. (2019). Toddlers' Dietary Diversity and Its Determinants in Different Agricultural Periods. Int. J. Nutr. Sci.**4(3)**:151-161. DOI: https://doi.org/10.30476/ijns.2019.82283.1018
25. Rakotomanana H, Gates GE, Hildebrand D, Stoecker BJ. (2017). Situation and determinants of the infant and young child feeding (IYCF) indicators in Madagascar: analysis of the 2009 Demographic and Health Survey. BMC Public Health**17(1):** 1–9. DOI: 10.1186/s12889-017-4835-1
26. Rakotonirainy NH, Razafindratovo V, Remonja CR, Rasoloarijaona R, Piola PR, Randremanana RV. (2018). Dietary diversity of 6-to 59-month-old children in rural areas of Moramanga and Morondava districts, Madagascar. PLoS One**13(7)**: e0200235. DOI: 10.1371/journal.pone.0200235
27. Sanou S, Ayantunde A, Nianogo AJ. (2018). Household food consumption and determinants of dietary diversity: the case of four communes in the North region, Burkina Faso. Int. J. Biol. Chem. Sci.**13(12):** 1784–1801. DOI: https://doi.org/10.4314/ijbcs.v12i4.21
28. Shively G, Evans A. (2021). Dietary Diversity in Nepal: A Latent Class Approach. Food Nutr. Bull. **42(2):** 259–273. DOI: https://doi.org/10.1177/0379572121998121
29. Sibhatu KT, Krishna VV, Qaim M. (2015). Production diversity and dietary diversity in smallholder farm households. Proc. Natl. Acad. Sci.**112(34):** 10657–10662. DOI: https://doi.org/10.1073/pnas.1510982112
30. Workicho A, Belachew T, Feyissa GT, Wondafrash B, Lachat C, Verstraeten R, Kolsteren P. (2016). Household dietary diversity and Animal Source Food consumption in Ethiopia: evidence from the 2011 Welfare Monitoring Survey. . BMC Public Health. **16(1)**:1192. DOI: 10.1186/s12889-016-3861-8.
31. World Health Organization. (2010). Indicators for assessing infant and young child feeding practices: part 2: measurement. Indic. Pour Évaluer Prat. Aliment. Nourrisson Jeune Enfant Partie 2 Calc, p.91.
32. World Health Organization. (2009.) Global prevalence of vitamin A deficiency in populations at risk 1995-2005: WHO global database on vitamin A deficiency. p.68.
33. Zhao W, Yu K, Tan S, Zheng Y, Zhao A, Wang P, Zhang Y. (2017). Dietary diversity scores: an indicator of micronutrient inadequacy instead of obesity for Chinese children. 2017 May 12 BMC Public Health;**17(1)** : 440. DOI: 10.1186/s12889-017-4381-x