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## *Assessment of Some of the Feeding Practices and Local Infant Flours' Consumption by 6 to 23 Months Children in the City of Ouagadougou, Burkina Faso*

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### ABSTRACT

**Background:** From birth to 6 months, children must be exclusively breastfed, and from 6 months, food diversification starts to supplement breast milk. This cross-sectional study aims to evaluate some of the feeding practices regarding children aged 6 to 23 months in the city of Ouagadougou. **Methods:** First, data were food consumption data as well as recalling meals over the past 24 hours were collected. Then, technological and labeling data regarding infant flours produced locally and sold in Ouagadougou were obtained. For analysis, data were entered into Sphinx V5 and IBM SPSS Statistics 20 software, and means were compared using XLSTAT 2016 software. **Results:** In total, 33 local infant flours were evaluated, and all the formulations contained cereals. Fruits and legumes (30.30%), milk (30.30%), and eggs (0.00%) were the least used materials. Instant type flours were rarely encountered (9.09%), and packaging in plastic bags was consumed the most (57.57%). Regarding labeling information, batch number (28%) and the method of preservation (32%) were the least identified. With respect to food consumption, 94.84% of the children were breastfed and 98.33% aged 6 to 8 months consumed solid foods. At least 85.28% of women considered the age of 6 months for introduction of solid foods. Concerning consumption of infant porridges, imported infant porridges were preferred the most (37.44%). **Conclusion:** Concerning local infant flour, some of them did not meet WHO guidelines. With regard to food practice indicators in Ouagadougou, some of them are relatively satisfactory; however, there is still a need to raise awareness regarding feeding practices.

**Keywords:** Breast feeding; Child; Flour; Meals; Burkina Faso

### Introduction

The purpose of feeding is to provide body with essential elements it needs for proper functioning and growth. World Health Organization (WHO) recommends that the children be fed exclusively with breast milk

during the first six months of life (World Health Organization, 2003). However, from the age of six months, breastfeeding becomes qualitatively and quantitatively insufficient and must be supplemented by a diversified and high

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nutritional complementary diet to meet and complete the particularly high needs of the children (Stewart *et al.*, 2013, World Health Organization, 2021). The adoption of good feeding practices are therefore particularly important to reduce the risks of dietary imbalances, chronic diseases, morbidity, and mortality rates (Victora *et al.*, 2010). In many developing countries, poor feeding practices are the main factors that impair physical growth and mental development of children (Black *et al.*, 2017, World Health Organization, 2015). Complementary food is often introduced earlier or later than the recommended period, and they are often inadequate in relation to health and nutrition (Dimaria *et al.*, 2018, World Health Organization, 2015). Several foods are used in food diversification among which infant flours are predominant. Locally produced infant flours are generally cereal-based mixtures, reduced to flour and intended for the preparation of porridge for infants and young children feeding (Fanny *et al.*, 2020). Nationally and internationally, standards for infant food production exist and give essential specifications in terms of the composition of infant flours, packaging methods, and indications for the labeling (Burkinabe Agency for Standardization Metrology and Quality (ABNORM), 2014, World Health Organization and Food and Agriculture Organization, 1981, 1991). In Burkina Faso, studies have shown that local infant flours were widely consumed, but some of them did not comply with standards in Burkina Faso (Fanny *et al.*, 2020). Therefore, some mothers would hesitate about their consumption because of doubts about their quality (Colin *et al.*, 2017). This cross-sectional study aims to assess the application of standards in the

production of local infant flours and some of the food practices regarding children aged 6 to 23 months in the city of Ouagadougou. The results of this study will provide new data on specific aspects of feeding practices.

## Material and Methods

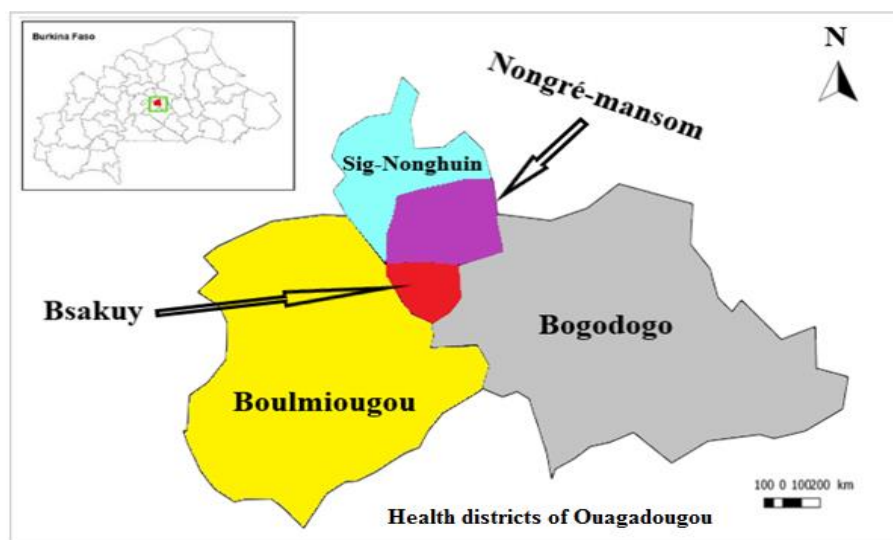
**Study site:** The study was carried out in maternities in the city of Ouagadougou. The choice of the city of Ouagadougou is justified by the fact that it comprises almost all the social groups of the regions, making it possible to create an image of regional practices. In 2019, the population of 0 to 2-year-old children was estimated at about 188,185 (United Nations Statistics Division (INSD), 2022). Ouagadougou is an urban municipality with a special status located in the province of Kadiogo in the Center Region of Burkina Faso. In terms of health facilities, the city is divided into 5 health districts with very different coverage sizes. The sample size was obtained from the following formula (population greater than 10,000):

$$n = \frac{t^2 p(1-p)}{d^2}$$

n=Sample size; t=Confidence coefficient (t=1,96), Confidence interval (95%); d=Allowed error rate (d=5%); p=Expected prevalence (p=50%); N=Children population (N

≈ 188 185 0 to 24-month Infants, based on INSD (2022) data

The initial sample size included 436 mother-child pairs. However, public support for the study made it possible to enroll 640 mother-child pairs during the survey. The distribution of mother-child pairs was made according to the relative size of each health district. All the five health districts were involved in the survey. **Figure 1** illustrates the coverage of the five health districts of the city of Ouagadougou.



**Figure 1.** Health map of the city of Ouagadougou. **Source:** Adapted from Nikiema *et al.* (Nikiéma *et al.*, 2020).

*Sampling and inclusion criteria:* 64 samples of local infant flours were collected in 36 shops and supermarkets and 16 drugstores and health centers throughout the city. An adaptation of cluster method used in smart surveys was employed with random selection of shops and drugstores in each cluster. Thus, the city of Ouagadougou was divided into four axes, taking into account the cardinal points, and in each area, 9 supermarkets and 4 drugstores were surveyed. In each zone, drugstores, shops and food stores were randomly chosen to cover the entire zone considering only the positive sites. In other words, at the level of the axis, when a chosen site did not market local infant flours, this site was considered negative; therefore, the researchers continued the investigation in the next sites of the same area. The samples of local infant flours were codified, and data were obtained from the labels and recorded on collection forms. Additional information was collected from technical forms produced by some production units. Two production units were also surveyed to complete sampling information.

The inclusion criteria for the sites consisted of the following:

- Marketing at least one local infant flour
- Using local infant flours
- Producing local infant flour

The inclusion criteria for the flours consisted of the following:

- Flour produced exclusively for feeding infants and young children
- Flour from local production

*Data collection for inventory:* Data recorded from the label included: the exact brand name attributed to the local infant flour, the list of ingredients mentioned on the label, indications on the type of infant flour and preparation of the porridge, target age of consuming the infant flour, manufacture date of the infant flour, expiry date of the infant flour, nutritional composition, energy value, method of conservation and batch number.

Concerning packaging, the following data were recorded: the type of packaging, contrast of the packaging, the tightness of the crimping and the filling of packaging. On technical data sheets, in addition to the information displayed on labeling, the indications on technical accompaniments and the seniority of the company have been noted.

*Data collection for nutrition practices:* Individualized face-to-face interview method was applied to collect data regarding children's weighing and vaccination centers. A collection form was developed using Sphinx V5 software, with respect to WHO IYCF practice evaluation indicators (World Health Organization and United

Nations International Children's Emergency Fund (UNICEF), 2011) . Thus, the reminder of the previous 24 hours made it possible to collect data on IYCF practices. The selection of mother-children pairs was carried out using the systematic sampling method described in 2018 (Bodjrénou *et al.*, 2018). The civil status data was obtained from the children's weight books and mothers' identity cards (World Health Organization and United Nations International Children's Emergency Fund (UNICEF), 2008). Data on feeding practices were obtained from mother's experiences. However, rephrased questions made it possible to verify some important statements as the interview progressed. Data were collected regarding 640 children from the five health districts in the city of Ouagadougou. The agreed error rate was 5%, and confidence coefficient was 1.96 for a confidence interval of 95%, while the prevalence rate retained was 50%.

*Target population:* The population consisted of mother-child pairs with 6-23 months' children. The inclusion criteria for children were as follows:

- Age of the child: between 6 and 23 months' old
- Health status: being in good health
- Mother going to health center in the study area regularly
- Obtaining formal and voluntary consent of the mother through an informed consent form.

*Ethical considerations:* Permission from the ethics committee of the Ministry of Health was obtained, and authorizations were granted by Regional Direction of the Ministry of Health in the Center Region.

*Data analysis:* Data entry and the generation of numbers and frequencies were performed on Sphinx V5 software. Graphs were made on Microsoft Excel 2016 software. The frequencies were compared using Student test, Kruskal-Wallis test, and the Mann-Whitney test to calculate p-value using XLSTAT 2016 software. In addition, the threshold of statistical significance was set at P-value < 0.05.

## Results

*Types of ingredients used in formulation:* The results on the composition of local infant flours enabled the authors to list 28 different ingredients in formulations, mainly in local products (**Figure 2**). Minerals were the most common ingredients used while corn and millet were the most frequently used cereals for the production of local infant flours. Groundnut was the most commonly used oilseed while soybean was the most frequently used protein source. Other ingredients such as vegetable oil, sugar, and vitamins have also been widely identified in the formulations. Cassava, sesame, coconut, cocoa, soumbala, legumes, baking soda, citric acid, and ammonia were the least identified ingredients.

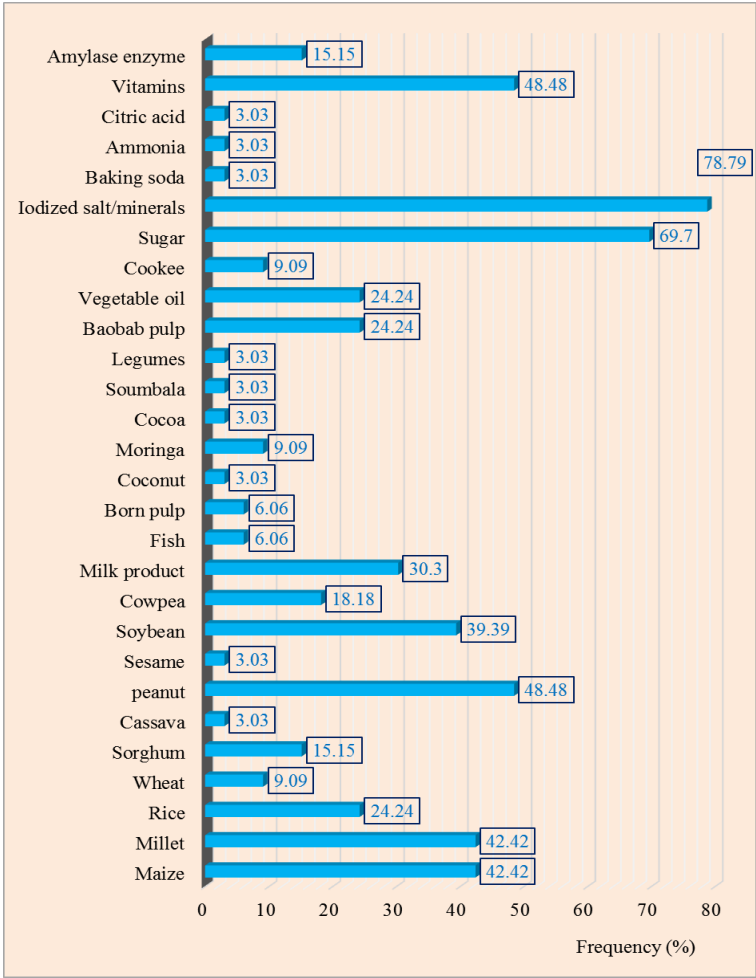


Figure 2. Type of ingredients used in formulations.

Diversity of ingredients used in formulation:

All formulations included at least food from the cereal group (Figure 3). Foods from the legumes and nuts group and foods from the fruits and legumes group which were rich in vitamin A

were also used in a large majority of the formulations. This was while meat products were used very little in the formulations. The egg group was not identified in any formulation (Figure 3).

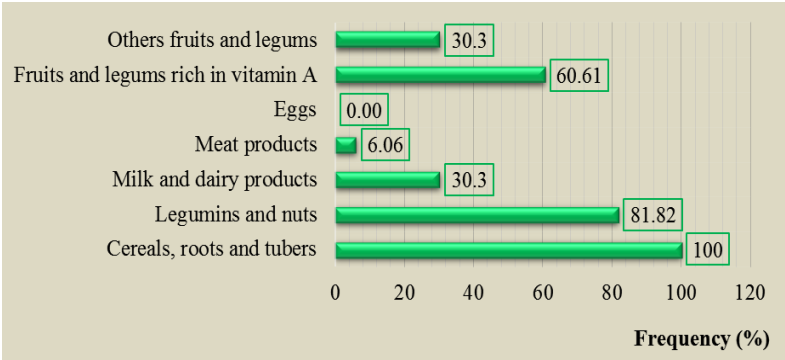


Figure 3. Diversity of ingredients incorporated into formulations.



**Packaging typology:** The local infant flours sampled had mostly small packaging, but a small part was stored in large transparent plastic bags and in plastic basins. All the local infant formulas packaged in small packages were labeled, while those stored in large bags and in plastic basins did

not have labels (**Figure 4**). Concerning packaging utilization, four types of packaging have been listed. Plastic bag packaging was the most common, while aluminum was the least common for packaging the local infant flours sampled (**Figure 4**).

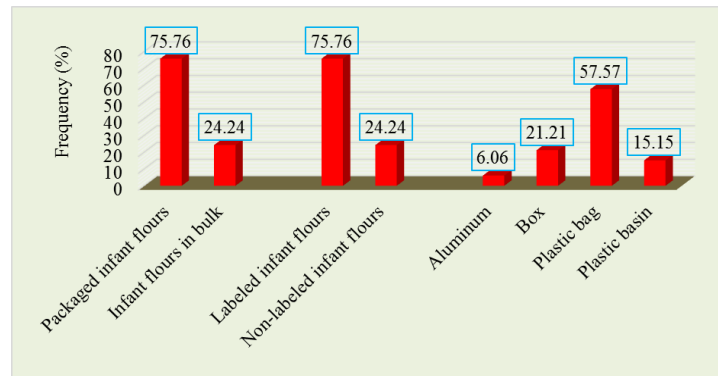


Figure 4. Method of packaging and labeling.

**Characteristics of flour labeling information:** The results showed that the majority of local infant flours were cooking flour type (**Figure 5**). Regarding labeling information, nutritional and usage information was mentioned the most.

Preparation method, nutritional composition, energy value, and production and/or expiration dates were also mentioned a lot. The least mentioned information on the labels concerned the storage method and batch number (**Figure 5**).

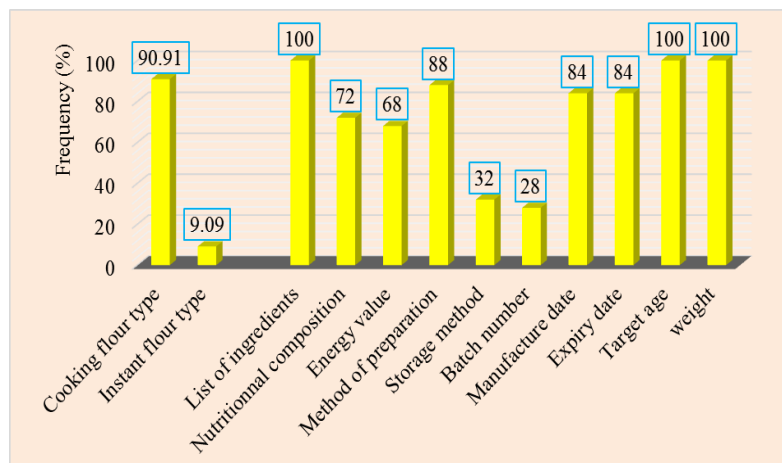
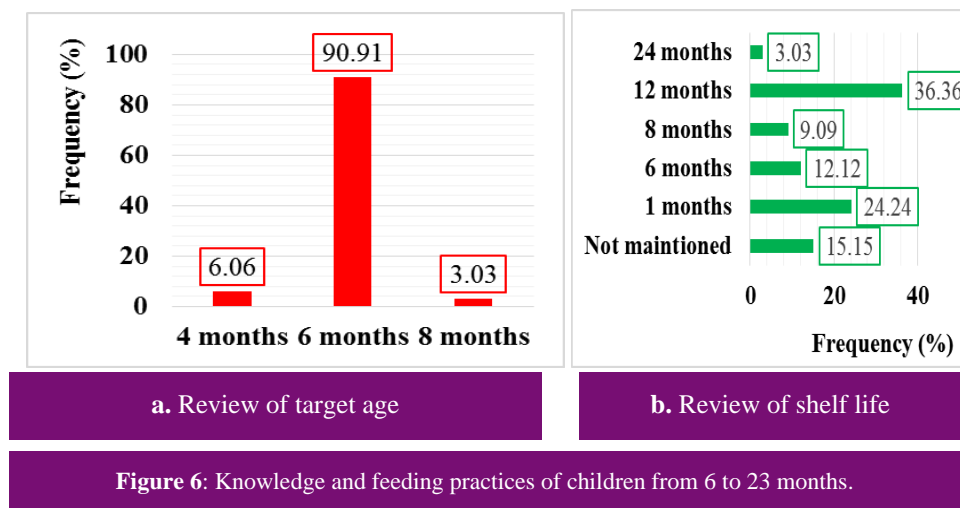


Figure 5. Label information.

**Review of target ages and shelf life:** The majority of labels mentioned 6 months as the target age for consumption. The lowest target age was 4 months while the highest target age was 8 months (**Figure 6a**). Regarding shelf life, the longest identified shelf life was 24 months while the

shortest one was 1 month (**Figure 6b**). The most common shelf life was 12 months. Unfortunately, a significant number of labels did not include complete information to determine the actual shelf life. On these labels appeared either the production or expiration date.



*Socio-demographic characteristics of mothers and their children:* The majority of the mothers were between 26 and 35, but the difference was not significant (**Table 1**). Regarding marital status, there were more married mothers. Regarding health districts, the district of Bogodogo and those of Boulmiougou surveyed more women. The majority of women had a secondary education with a significant difference. Regarding mother's occupations, most women were housewives; however, the difference was not significant. Concerning the age of children, the majority of them were between 6 and 11 months, but again, the difference was not significant.

*Breastfeeding practice of the children according to mother's statements:* Overall, the assessment of the feeding pattern for children aged 6 to 23 months showed that children were extensively breastfed. Women with primary education breastfed the children more than those with the higher education levels (**Table 2**). Concerning mother's occupation, housewives breastfed the infants more than those in the informal sector. Non-breastfed children were mainly encountered among mothers with higher education and those in the informal sector. In all cases, there were significant relationships between breastfeeding practices and mother's situations

**Table 1. Sociodemographic characteristics of the population.**

Variables	n(%)	P-value <sup>a</sup>
Mother's age (year)		0.06
17 to 25	226(35.31)	
26 to 35	308(48.13)	
36 to 44	82(12.81)	
Marital status		0.33
Single	30(4.69)	
Married	610(95.31)	
Health district		0.001
Baskuy	80(12.50)	
Bogodogo	197(30.78)	
Boulmiougou	200(31.25)	
Nongré-Mansom	82(12.81)	
Sig-Nonghuin	83(12.97)	
Mother's education		0.01
No schooling	139(21.72)	
Primary education	152(23.75)	
Secondary education	260(40.63)	
Higher education	89(13.91)	
Mother's occupation		0.06
Housewife	287(44.84)	
Employee	134(20.94)	
Informal sector	219(34.22)	
Child's age (month)		0.06
6-11	421(65.78)	
12-17	146(22.81)	
18-24	73(11.41)	

<sup>a</sup>: Mann-Whitney test.

**Table 2.** Breastfeeding practice of children according to mother's statements.

Variables	Breastfeed children		Non-breastfed children	
	n(%)	P-value <sup>a</sup>	n(%)	P-value <sup>a</sup>
Mother's education level		<0.0001		0.01
No schooling	132(94.96)		7(5.04)	
Primary education	146(96.05)		6(3.95)	
Secondary education	238(95.20)		12(4.80)	
Higher education	81(91.01)		8(8.99)	
Mother's occupation		<0.0001		0.01
Housewife	275(95.82)		12(4.18)	
Informal sector	205(93.61)		14(6.39)	
Employee	127(94.78)		7(5.22)	

<sup>a</sup>: Mann-Whitney test.

*Assessment of some feeding practices indicators of children:* The results regarding children feeding practices have been recorded in **Table 3**. Breastfeeding according to age concerned children from 6 to 23 months who were breastfed and received complementary foods the day before; breastfeeding continued until age 1 regarding children from 12 to 15 months who were breastfed the previous day.

This was while 20 to 23-month- children continued to be breastfed at 2 who were breastfed the previous day. With regard to the introduction of solid foods, children aged 6 to 8 months received solid foods the day before the survey, while the use of bottle concerned children aged from 6 to 23 months who used a bottle the day before. All of these indicators showed high levels of practice.

**Table 3.** Assessment of some feeding practices.

Variables	Age group (month)	n(%)
Breastfed according to age (n= 633)	6 to 23	590(93.21)
Continued breastfeeding to 1 year (n=146)	12 to 15	141(96.58)
Continued breastfeeding to 2 years (n=14)	20 to 23	7(50.00)
Introduction of solid, semi-solid or soft foods (n=240)	6 to 8	236(98.33)
Bottle use (n=633)	6 to 23	33(5.16)

*Assessment of knowledge regarding the age of introducing solid, semi-solid, and soft foods according to mothers:* In general, the majority of diversification was achieved in 6 to 8 months age group, but late introductions (after the 8th month) and early introductions (before 6 months) had also been observed. Women in higher education mainly introduced solid foods

in the age group of 6 to 8 months, while women with no schooling more frequently made early and late introductions (**Table 4**). In the same line, women in the informal sector introduced food earlier, before 6 months, or later, after 8 months. Nevertheless, the comparisons did not show any significant relationships (**Table 4**).



**Table 4.** Knowledge of solid, semi-solid, or soft foods introduction according to mothers' education and occupation.

Variables	0 to 5 months	6 to 8 months	9 to 12 months	P-value <sup>a</sup>
	n(%)	n(%)	n(%)	
Mother's education				0.99
No schooling	24(18.05)	103(77.44)	6(4.51)	
Primary education	19(12.84)	127(85.81)	2(1.35)	
Secondary education	38(14.90)	208(81.57)	9(3.53)	
Higher education	11(12.36)	75(84.27)	3(3.37)	
Mother's occupation				0.99
Housewife	40(14.34)	228(81.72)	11(3.94)	
Informal sector	34(15.89)	173(80.84)	7(3.27)	
Employee	18(13.64)	112(84.85)	2(1.52)	

<sup>a</sup>: Kruskal-Wallis test.

*Profiles of infant flour consumption according to mother's situation:* Imported infant formulas were the most preferred by children who started complementary feeding regardless of mothers' situation. The results presented in **Table 5** also show that some children (around 22.08%) do not prefer any type of infant flour. The results

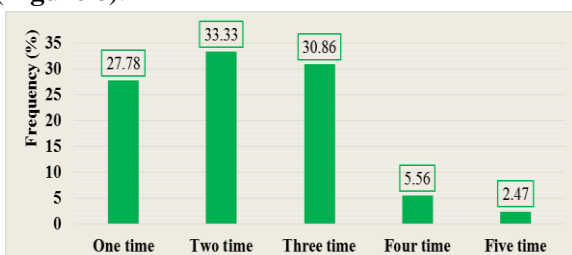
presented in **Table 5** also show that some children (around 22.08%) do not prefer any type of infant flour. On the other hand, 4.96% of children do not sort any type of infant flour. Mothers' level of education and occupation had no significant influence on the preference for infant flours.

**Table 5.** Infant flour consumption according to mother's situation.

Variables	No porridge	No remark	Imported flour	Local flour	Not sorting	P-value <sup>a</sup>
	n(%)	n(%)	n(%)	n(%)	n(%)	
Mother's education						0.18
No schooling	39(6.24)	33(5.28)	36(5.76)	21(3.36)	4(0.64)	
Primary education	33(5.28)	25(4.00)	55(8.80)	29(4.64)	6(0.96)	
Secondary education	56(8.96)	44(7.04)	103(16.48)	42(6.72)	10(1.60)	
Higher education	10(1.60)	10(1.60)	40(6.40)	18(2.88)	11(1.76)	
Mother's occupation						0.40
Housewife	68(10.88)	54(8.64)	102(16.32)	48(7.68)	7(1.12)	
Informal sector	50(8.16)	36(5.76)	76(12.16)	39(6.24)	12(1.92)	
Employee	19(3.04)	22(3.52)	56(8.96)	23(3.68)	12(1.92)	

<sup>a</sup>: Kruskal-Wallis test.

*Daily consumption of local infant flour porridges:* The majority of children consumed local infant flours, two or three times a day (**Figure 8**).

**Figure 8.** Daily consumption of local infant flour porridges.

In fact, more than two thirds of the children consumed the local infant porridge two or three times a day, while consumption above three times a day was very low (**Figure 8**).

## Discussion

*Characteristics of some of local infant flours:* A great variety of local ingredients were noticed in the formulation of local infant flours. This could be explained by the wide availability and accessibility of these ingredients as well as their relatively low prices, especially in the post-harvest period compared to the imported

ingredients (Group For Research and Technology Exchanges (GRET), 2012). The use of cereals complies with Codex guidelines on the composition of fortified infant flours (World Health Organization and Food and Agriculture Organization, 1981, 1991). For the other types of raw materials, the low level of consumption could be due to technological issues; The reason was the lack of mastery over the best techniques and conditions for incorporating certain ingredients such as oils, eggs, and fish whose high fatty acid composition of unsaturated fats could accelerate the oxidative degradation of infant flours (Dagmey, 2020). The trend towards the use of maize is in clear progression compared to the results of other studies which reported 25% use of maize against 75% regarding millet (Songré-Ouattara *et al.*, 2016). Maize is better appreciated; it is cheaper and available on the market compared to millet (Ministry of Agriculture, 2021). Overall, the incorporation of minerals, vitamins, and enzymes is still insufficient for good availability of these essential micronutrients in formulations. The low incorporation of amylase could be explained by its low accessibility and high cost at the national level because it was produced and distributed exclusively by the GRET (Fanny *et al.*, 2020). The use of plastic bag packaging was increasing according to some studies which reported 50% plastic bag packaging in 2020 (Fanny *et al.*, 2020). However, one of the disadvantages of using transparent plastic bags is that they do not protect the product from light. Cardboard packaging and aluminum packaging would better protect food against light, humidity, and would be more attractive on the shelves. Regarding labeling, information on brand, weight, and the list of ingredients was in line with relevant Codex guidelines (World Health Organization and Food and Agriculture Organization, 1981). However, efforts still need to be made concerning the indication of nutritional value, the method of preservation, and the batch number. Their registration rates remained in the same order compared to those reported by the

literature, which respectively accounted for 75%, 40%, and 30% of labels in 2020 (Fanny *et al.*, 2020). Nevertheless, a slight increase in the rate of displaying information regarding the method of preparation, the production and expiration dates, and the target age of use were observed. In terms of traceability, most production units got their supplies from local traders who bought the cereals in bulk (Fanny *et al.*, 2020). Therefore, tracing by batch number was difficult. However, the batch number could allow companies to find information on incriminated products. In terms of the quality of some information, non-compliance was observed in the recording of the nutritional value as well as the target age of consumption in some labels in relation to WHO and WFP guidelines (World Food Programme (WFP), 2018, World Health Organization, 2021). The production of instant flours is in sharp decline compared to the recent data, indicating that at least two different companies were manufacturing infant instant flours in Ouagadougou (Songré-Ouattara *et al.*, 2016). This situation could be due to the cost of the equipment materials regarding the implementation of cooking-extrusion technology (Bruyeron, 1998). The storage life of local infant flours was short, compared to the imported ones, most of which could be kept for more than twenty-four months. This is largely related to some ingredients used. In the literature, contaminated ingredients in production of infant flours have already been reported (Sanou *et al.*, 2017, Waré, 2018) and these ingredients could be responsible for most of the degradations.

*Knowledge regarding feeding practices of children:* The large number of women surveyed in the districts of Bogodogo and Boulmiougou confirmed the data from statistical yearbook of the Ministry of Health of Burkina Faso, which accounted for 30.17% of the population living in the district of Bogodogo and 33.49% in the district of Boulmiougou in 2019 (Ministry of Health, 2021). Concerning mothers' education level, the high rate of mothers with secondary

education could be explained by the free education policy adopted in Burkina Faso, which contributed to increasing the rate and level of schooling for girls (from 25.9% in 2013 to 39, 1% in 2020) (United Nations Statistics Division (INSD), 2021). Food practice indicators were satisfactory. The rate of breastfed children in the present study was higher than that obtained in a similar study, in Dakar which was 86.1% (Ba *et al.*, 2019). The improvement of this indicator is very fundamental as it reflects WHO's guideline recommending the practice of breastfeeding during the first months of children's life (World Health Organization, 2003). In addition, the level of introduction of solid foods between 6 and 8 months was at a satisfactory level compared to the national rate of 77.4% (Ministry of Health, 2020). In contrast, continued breastfeeding until age one and age two were relatively low compared to national rates of 96.4% and 80.1% (Ministry of Health, 2020). A worrying increase in the rate of bottle use compared to the 1% reported by Somé in 2019 was also observed ;however, it was still low (Somé, 2020). Regarding food diversification, the overall rate of introduction from 6 months was satisfactory; but this amount was lower than the 92.42% obtained in Lubumbashi in the Democratic Republic of Congo in 2018 (Mavuta *et al.*, 2018). Unfortunately, the results revealed a high rate of early introduction before the recommended age of 6 months, thus corroborating the results obtained by Colin *et al.* who found a 14.4% rate of early introduction in Burkina Faso (Colin *et al.*, 2017). Regarding the consumption of infant flours, imported infant flours were the most preferred compared to local infant flours, as was previously reported in the literature in Ouagadougou (Colin *et al.*, 2017). Nevertheless, according to some authors, food consumption habits, the mode of consumption, and mother's own preferences would influence the choice of complementary foods (Songré-Ouattara, 2009). Indeed, most imported infant flours are of the instant type and are easy to use compared to local infant flours which generally

require additional cooking before consumption (Fanny *et al.*, 2020). Moreover, the presence of milk in some imported infant formulas would be more suitable for the child (World Health Organization, 2021). The composition of local infant flours reported in the literature clearly shows the absence of milk in their formulations (Sanou *et al.*, 2017). Nevertheless, the present study illustrated an acceptable frequency of consumption regarding local infant flour porridges, mostly beyond two times per day reported by Hama in 2012 (Hama, 2012). However, about a third of children did not consume the food item twice a day, thus being at risk of food insufficiency due to the lack of meal diversification observed in most Burkinabè families in 2010 (Nikiéma *et al.*, 2010). However, these rates must be qualified because they concern only the city of Ouagadougou, where the populations have greater access to health services and manufactured food products.

### Conclusion

The formulations were diversified in terms of raw materials which essentially used local ingredients. Regarding packaging, the preferred type was plastic bags. The information on labels makes it possible to deduce that several of the local infant flours did not follow the indications in terms of labeling of infant flours. In terms of the type of infant flour, the instant flour types were poorly presented. The analysis of the results for local infant flours showed that some of them did not comply with WHO indications on the production of infant flours. Regarding the indicators of feeding practices, breastfeeding, continued breastfeeding until age and age two have been widely practiced. Concerning the introduction of solid foods, the majority of women introduced solid foods after 6 months which was recommended for dietary diversification. However, some women continue to introduce solid foods early before the age of 6 months. Compared with local infant flours porridges, imported infant flours porridges were preferred the most. Overall, the indicators

showed relatively satisfactory rates in Ouagadougou. However, these rates must be qualified because they concern only the city of Ouagadougou, where the populations have greater access to health services and manufactured food products. To be more representativeness at the national level, it is recommended that authors extend the research to other less favored localities and also different periods of the year.

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### Authors' contributions

Sanogo B designed the survey forms, carried out the study, analyzed data and wrote the manuscript. Fidèle T, Souleymane Z, Oumarou Z, Bakary T and Mahamadé G read and revised the manuscript. Laurencia Touloumé SO and Aly S had the main responsibility for the final content. All authors read and approved the final manuscript.

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The authors declared no conflict of interest.

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