Production of flour for infants and young children: a review of experiences in Africa

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1. INTRODUCTION

Based on the description of production units provided by participants in the Alexandria workshop, on data obtained previously, and on the results of additional analyses carried out in IRD laboratories, information on experiences in the production of flour for infants and young children in two North-African countries and eleven Sub-Saharan French-speaking countries was reviewed. Analysis of this information highlights both the common and the distinctive features of these experiences.

2. GENERAL CHARACTERISTICS OF PRODUCTION UNITS (Table 1)

The first experiences took place in Algeria (1966) and Morocco (1972). Some units have been operating for less than seven years (Vitafort in Congo, Bitamin in Niger, Vitafort in Chad, Viten in Togo).

Almost all units were set up at the initiative of government authorities, but in most cases they also received support from foreign nongovernmental organizations (Ouando in Benin, Misola in Burkina Faso, Yéolac in Guinea, Bitamin in Niger, Sosoma in Rwanda) or research organizations (Vitafort in Congo, Nutrimix in Togo). Very few units were set up as the result of private initiative (Viten in Togo, Cérévap in Zaire), but in many cases production was entrusted to the private sector (Superamine in Algeria, Actamine in Morocco, Micaf in Cape Verde); in some cases, the experiment was disseminated, and community (Misola in Burkina Faso, Musalac in Burundi) or private (Vitafort in Congo) production units were set up.

Production capacity varies greatly: smaller pilot units that are to be replicated based on an identical model produce 1–2 tonnes per month (Vitafort-Congo and Nutrimix), whereas units that produce for the country as a whole, have a capacity of more than 250 tonnes per month (Superamine, Cérévap). Several units, particularly among those with the largest capacity (Superamine, Cérévap) have ceased production.

In the majority of cases, the technical processes used before mixing are limited to dehusking, toasting or roasting and milling; in certain cases (Misola and Vitafort-Chad) this can be done without special equipment, using private dehuskers and mills located near the markets where raw materials are sold. Industrial-type units such as those producing Superamine, Ouando Superfarine or Cérévap use hydrothermic processes that provide proper pre-cooking. Vitafort-Congo is the only small-scale unit that uses a process incorporating amylase to allow the preparation of gruel with sufficient energy density.

Table 1
General characteristics of production units

Country and name of unit	Year of launching	Origin and support	Production capacity per month	Special processes	Type of packaging	Comments
ALGERIA						
Superamine	1966	State +private	250 t	drum drying	plastic bags	ceased in 1984
BENIN						
Ouando community	1977	State +coop.	10 t	-	plastic bags	-
Ouando factory	1992	State +NGO	100 t	extrusion cooking	cardboard boxes	industrial
BURKINA FASO						
Misola	1981	State +NGO	Variable	-	plastic bags	dissemination
BURUNDI						
Musalac	1984	State +coop.	42 t	-	plastic bags	dissemination
CAPE VERDE						
Micaf	Project since 1986	State +private	-	-	-	-
CHAD						
Vitafort	1993	State +NGO	10 t	-	plastic bags	-
CONGO						
Vitafort	1992	State +research organism	2 t	amylase	plastic bags	dissemination
GUINEA						
Yéolac	1988	NGO	20 t	-	plastic bags	ceased production
MOROCCO						
Actamine	1972	State +private	50 t	?	plastic bags	-
NIGER						
Bitamin	1991	State +NGO	4 t	-	plastic bags	-
RWANDA						
Sosoma	1985	NGO	60 t	-	plastic bags	ceased production
TOGO						
Nutrimix	1985	State	1 t	-	plastic bags	-
Viten	1991	NGO	20 t	-	plastic bags	-
ZAIRE						
Cérévap	1983	Private	250 t	extrusion cooking	aluminium bags	ceased production

Apart from some exceptions (Ouando Superfarine), the foods are marketed in plastic bags, usually made of low-density polyethylene. Several units use two bags with labels inserted between them.

3. INGREDIENTS OF FLOURS FOR INFANTS (Table 2)

The main source of energy is simply local cereals, usually wheat in North Africa, millet, sorghum or maize in Sahelian countries, and maize in tropical Africa, with the exception of one of the two Vitafort-Congo formulas. Rice, usually in combination with other cereals, is used in Benin, Chad and Togo. Vitafort-Congo is the only unit that uses flour made from roots or tubers; the original formula included the incorporation of cassava flour, processed to prevent the risk of cyanide poisoning.

In all cases, protein is provided by leguminous seeds. With the exception of Superamine, elaborated almost 30 years ago, and flours for infants from some Sahelian countries (Chad and Niger), all compositions contain soya beans, sometimes in combination with groundnuts.

Almost all flours incorporate 5 to 15% of sugar. The use of milk powder has been abandoned in most present-day units. Mineral and/or vitamin supplements are only incorporated in industrial-type units (Superamine, Actamine, Cérévap) or in units that have a high level of technical supervision (Musalac and Vitafort-Congo). It should be noted that in some units salt is added (Misola).

4. NUTRITIONAL VALUE OF FLOURS FOR INFANTS (Table 3)

The energy content of the flours is around 400 kcal per 100 g of dry matter. Only flours that are rich in fat (Misola, Nutrimix "2ème âge" and Cérévap) have a slightly higher energy content.

Crude protein content ranges from 8.2 to 21.3 g per 100 g of dry matter. The earliest developed formulas are those with the highest protein content (Superamine, Actamine); the trend towards lower protein contents reflects progress in the knowledge of protein requirements. Flours with the lowest protein content are the so-called "1er âge" flours, in Benin and Togo (designed for infants 3-6 months).

The fibre content declared varies greatly, but this might depend on the methods used to determine it. The mineral content is low, except in flours to which mineral supplements have been added.

5. ENERGY DENSITY OF GRUELS (Table 4)

For some flours, IRD laboratories measured the viscosity of gruels prepared according to the method given on the label, with different levels of dry matter content. When they are prepared with a dry matter content that provides the consistency appropriate for young children (1 Pa.s for children around 5 months and 2 Pa.s for children around 8 months), all the gruels examined, with the exception of those prepared from Cérévap and Vitafort-Congo, have an energy density that is lower than that of breast milk.

Table 2
Composition of flours for infants and young children

COUNTRY AND NAME OF UNIT	ENERGY SOURCES	PROTEIN SOURCES	ADDITION OF		
			sugar	milk	mineral and/or vitamin supplements
ALGERIA					
Superamine	durum wheat: 28%	chickpeas: 38% lentils: 18%	5%	10%	yes
BENIN					
Ouando "1er âge"	maize: 37% sorghum: 37% rice: 15%		11%		
"Ouando "2ème âge	maize: 33% sorghum: 33%	soya beans: 23% (or beans)	11%		
BURKINA FASO					
Misola	pearl millet: 60%	soya beans: 20% groundnuts: 10%	9%		salt 1%
BURUNDI					
Musalac	maize: 48% sorghum: 22%	soya beans: 20%	8%	2%	yes
CAPE VERDE					
Micaf	wheat: 40% maize: 40%	beans: 20%			
CHAD					
Vitafort	millet, maize, rice or sorghum 57%	cowpeas: 24% groundnuts: 10%	9%		
CONGO					
Vitafort 1	cassava: 43% maize: 30%	soya beans: 19%	8%	no	yes
Vitafort 2	maize: 73%	soya beans: 14%	11%	no	yes

"1er âge": for infants 3-6 months; "2ème âge": from 6 months

Table 2
Composition of flours for infants and young children (continued)

COUNTRY AND NAME OF UNIT	ENERGY SOURCES	PROTEIN SOURCES	ADDITION OF		
			sugar	milk	mineral and/or vitamin supplements
GUINEA					
Yéolac	maize, sorghum	soya beans	yes	yes	
MOROCCO					
Actamine	wheat: 48%	soya beans: 16%	15%	20%	yes
NIGER					
Bitamin	millet: 67%	cowpeas: 20% groundnuts: 10% baobab fruit: 3%			
RWANDA					
Sosoma	sorghum, maize	soya beans	no	no	no
TOGO					
Nutrimix "1er âge"	maize: 35% sorghum: 35% rice: 20%		10%		
Nutrimix "2ème âge"	maize: 60% rice: 10%	soya beans: 25%	5%		
Viten "1er âge"	maize, rice, sorghum		yes		
Viten "2ème âge"	maize, rice	soya beans	yes		
ZAIRE					
Cérévap	maize, wheat, oil	soya beans	yes	yes	yes

"1er âge": for infants 3-6 months; "2ème âge": from 6 months

Table 3
Nutrient content of flours for infants and young children (per 100 g dry matter)

Country and name of unit	Energy	Protein	Fat	Fibre	Calcium	Iron
	kcal	g	g	g	mg	mg
ALGERIA						
Superamine	414	20.9	4.5	2.1	390	15
BENIN						
Ouando "1er âge"	401	9.9	3.1	-	6	13
Ouando "2ème âge"	366	16.0	4.0	7.0	29	9
BURKINA FASO						
Misola	430	18.0	11.5	-	-	-
BURUNDI						
Musalac	417	15.4	7.6	6.6	78	21
CAPE VERDE						
Micaf	434	16.3	5.5	-	850	54
CHAD						
Vitafort	-	11-13	5.5-8.5	8.0-15.0	32-60	2-5
CONGO						
Vitafort	-	12.0	6.3	2.4	380	17
GUINEA						
Yéolac	-	14.9	8.1	5.0	96	11
MOROCCO						
Actamine	357	21.3	-	-	-	-
NIGER						
Bitamin	-	16.2	8.9	2.2	-	-
RWANDA						
Sosoma	400	16.5	7.7	2.2	6	7
TOGO						
Nutrimix 1er âge	426	8.2	2.8	0.9	40	-
Nutrimix "2ème âge"	444	17.6	9.0	2.2	73	-
Viten "1er âge"	-	9.0	3.4	4.2	420	9
Viten "2ème âge"	-	15.5	7.6	4.4	450	9
ZAIRE						
Cérévap	430	15.6	9.2	1.6	382	12

"1er âge": for infants 3-6 months; "2ème âge": from 6 months

Table 4
Energy density of gruels

Country and name of unit	Energy density when prepared to a viscosity of 1 Pa.s	Energy density when prepared to a viscosity of 2 Pa.s
	kcal/100 ml	
BENIN		
Ouando Superfarine "1er âge"	41	55
Ouando "2ème âge"	<60	70
BURKINA FASO		
Misola	62	71
BURUNDI		
Musalac	53	66
CHAD		
Vitafort	50	66
CONGO		
Vitafort	100	122
GUINEA		
Yéolac	60	74
NIGER		
Bitamin	46	56
RWANDA		
Sosoma	50	72
TOGO		
Viten "1er âge"	44	52
Viten "2ème âge"	54	60
ZAIRE		
Cérévap	97	110
CONTROL		
WFP's CSB flour for infants	44	58

"1er âge": for infants 3-6 months; "2ème âge": from 6 months

6. CONCLUSION

The units producing flour for infants that have been established in Africa over the last thirty years show important differences at several levels:

- the size of the units, with a production capacity that ranges from 1 to 250 tonnes a month;
- the technical processes used: although the majority of units simply mill, mix and package raw materials, which have sometimes been toasted or roasted, only three units produce (Ouando) or have produced (Superamine, Cérévap) instant foods;
- the nutrient contents of the flours vary, especially the protein and micronutrient contents;
- the energy density of the gruels obtained when they are prepared to the appropriate consistency differ noticeably.

On the other hand, there are a number of similarities in the type of authority that created the units, usually government bodies, and in the main ingredients used, which in the majority of cases are cereal flours, soya bean flour and sugar.

Regarding the nutritional quality of the products, the following inadequacies should be highlighted in certain foods:

- a protein content that is either too high or too low
- an excessive fibre content (cellulose + lignin > 3 g/100 g dry matter)
- an extremely low mineral content.

In addition, the energy density of gruel obtained with the majority of flours for infants is much too low, often below that of breast milk. Given the limited gastric capacity of infants and the low daily frequency of gruel distribution usually reported, this energy density does not allow gruel to adequately complement breast milk from the age of 6 months; thus, gruel does not play its role as transitional food towards a diet of solids.

Finally, it must be noted that in Benin and Togo flours for infants are proposed for feeding infants aged 3–6 months ("1er âge" flour); this is in contradiction with WHO recommendations on infant feeding and may incite mothers to introduce complementary foods too early, before the age of 4 months. Moreover, the nutritional value of these foods is much too low for children of about 6 months.

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COMPLEMENTARY FEEDING OF YOUNG CHILDREN IN AFRICA AND THE MIDDLE EAST

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