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ISN: 13089

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REPUBLIC OF NIGER
MINISTRY OF RURAL DEVELOPMENT
NIGER RANGE AND LIVESTOCK PROJECT

HEALTH AND NUTRITION IN A GROUP OF
WODAABE (BORORO) HERDERS IN CENTRAL NIGER

Rapport préliminaire - Discussion paper

Number 1

L. Loutan
February 1982

Niger Range and Livestock
Project
Tahoua, Niger

Projet Gestion des Pâturages et Elevage
Niger Range and Livestock Project

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B.P. 85
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Republic of Niger

I would like to address my sincere thanks to,

- The Ministry of Public Health and Social Affairs and the Tahcua Department Health Service for the support and assistance they provided to this study.
- The Wodaabe who participated to make this work possible.
- Dr. J.M. Lamotte who from the beginning of this research, generously gave me the benefit of his experience and advice.

Photographs - J.Chiasson - L. Loutan

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1. I N T R O D U C T I O N

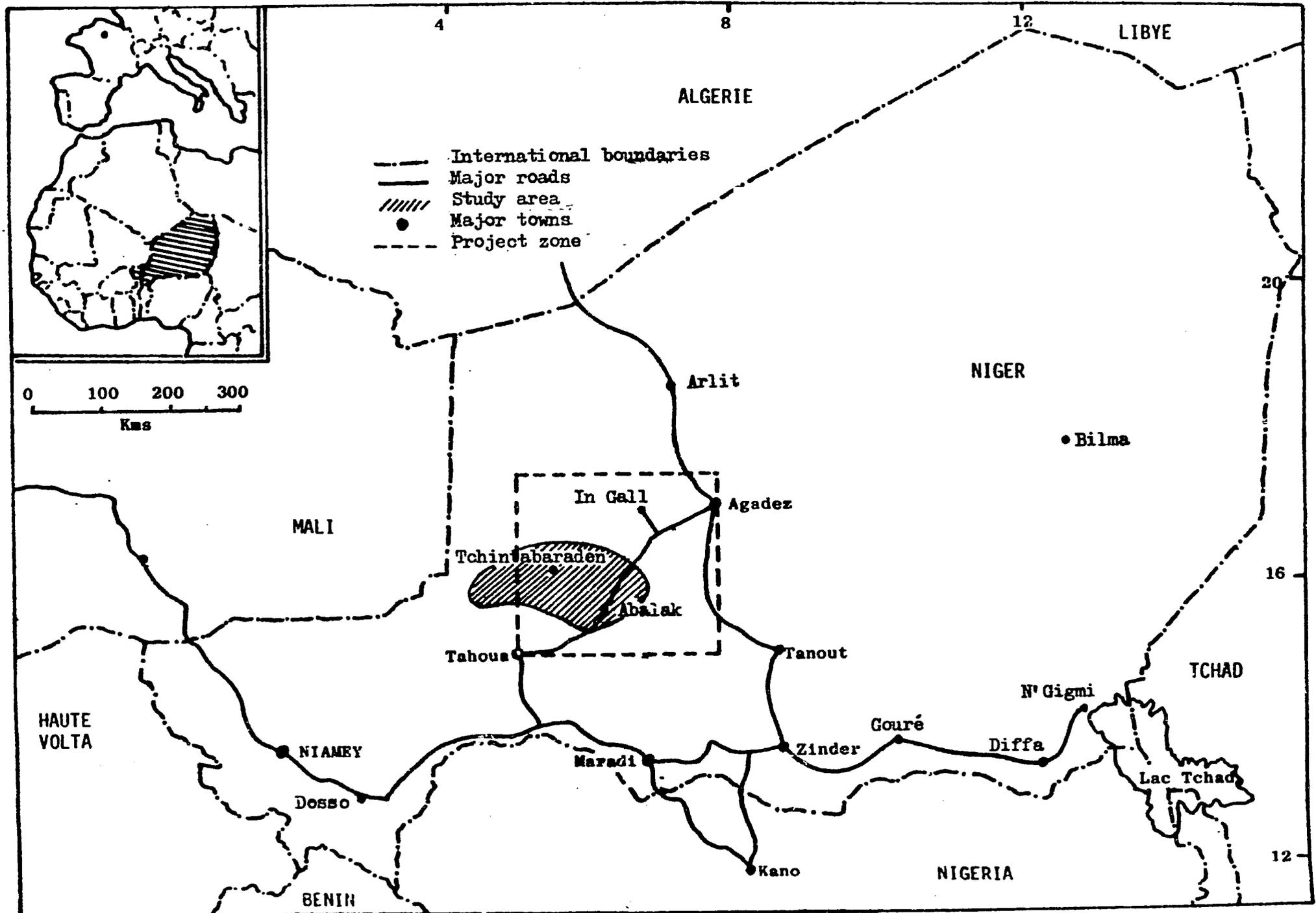
Three development projects of the Government of Niger are at present working in the pastoral zone. The Niger Range and Livestock (NRL) Project, financed by USAID, is located in the center of this zone. It consists of two years of observations and investigations with small scale interventions preceding a longterm production phase.

In 1979, President Seyni Kountché defined the options and reforms that will take place in Niger in the years to come : the establishment of the Development Society. This will permit better participation by rural people in the running of the country structures for self-management and autonomous development in villages. These structures will be represented at different administrative levels of the country. Pastoral zone inhabitants are encouraged to organize themselves into herders' associations. Such associations, based on cooperative principals, will include animal and human health, and education activities.

The NRL Project was given a mandate to provide information and concrete proposals on the feasibility of such associations. It was decided to include health and nutrition research in order to provide information for the health aspect of such a development program. At present, little information is available on the situation and health needs of the populations in the pastoral zone. Detailed research would reveal the present situation and make possible future evaluation of the real impact of development programs in this zone.

.../...

Map 1: Location of NRL Project zone and nutrition study area



Background :

The pastoral zone in which the NRL Project works lies between the Sahara Desert and the south Sahelian agricultural zone. It is a semi-arid region, located approximately between 200 and 400 mm of rainfall. In Niger, the zone covers about 1,500 km, from the border of Mali in the west to Lake Chad in the east, making up a quarter of the national territory.

At this latitude, the year is divided into four principal seasons : a rainy season, from July to the beginning of September ; a short hot season from September to the end of October ; a dry cold season from November to February ; a dry hot season from March to June. It is one of the hottest regions in the world, with for example an annual average temperature of 27.6°C at Agadez, where the maximum often exceeds 40°C and rises each year above 45°C at the peak of the hot season in April through May. Table 1 gives the temperatures at Tahua for the months when research was underway. These temperatures are comparable to those encountered in the bush.

Table 1. Average maximum and minimum temperatures at Tahua (°C)

Month		max	min
August	1980	37.6	23.7
November	1980	35.7	20.6
February	1981	34.0	17.5
May	1981	40.9	21.4

The vegetation is sparse, consisting principally of bushes and of annual grass pasture. Small thorn bush forests grow in the depressions around ponds, formed during the rainy season, or in valleys.

.../...

The seasonal weather variations greatly affect vegetation and the availability of water. During the rainy season, surface water is abundant. Pools are full and are the main water supply for people and animals. Pastures are green, providing rich and abundant forage in normal times.

At the end of the rains, the pools dry up progressively, and water must be drawn manually from shallow sand wells or from deep wells. The pastures are dry from September to June. As the dry season progresses, the quality and quantity of forage diminishes. The extreme climatic conditions and variability impose a very mobile lifestyle. It is often necessary to move in search of pasture. From the first rains of June, people and herds follow the growth of new pasture. Some groups move north to the salt cure areas around Ingall or Tiguidan-Tessoum.

The rainy season is the time when large gatherings and festivals take place. When the rains end, herders disperse and return to their dry season areas. The routes are relatively fixed from one year to another ; each family, each Twareg or Fulani clan, spends the dry season around wells in a region it considers a home base.

The population is dispersed and mobile, made up mostly of Twareg and Fulani herders*. Formerly predominantly Twareg, the Fulani settled permanently in this region after the French colonization.

Fulani society is organized into primary lineages, subdivided into clans, which are family groups with a common ancestor. Each clan has a chief at its head (arDo).

Fulani pastoral society includes two distinct cultural groups : the woDasBe**, commonly called Bororo, the majority of whom live all year in the pastoral zone, and the Fulbe, the majority of whom spend the dry season in the south of the country and come back to the pastoral zone during the rainy season. The Wodaabe live essentially from cattle herding. Their per capita income is low.

* Herders in this context means nomadic herders.

** Fulfulde has an implosive b and d. The transcription for this adopted in the text is capital B and D, except for the proper name Wodaabe where the ordinary spelling is retained.

Location of the survey :

The NRL Project area is defined by the towns of Agadez, Tassara, Tahua, and Aberbissinat. It covers an area of more than 80,000 square kilometers.

Most of the research reported here was carried out in the west of the project zone in the arrondissement of Tchintabaraden (see map). This arrondissement covers two-thirds of the Tahua department, or 73,340 square kilometers. Its average altitude is 450 m. The main town, Tchintabaraden, with 2,000 inhabitants, is located in the center of the arrondissement, and is connected to the administrative posts of Tilia, Tassara, and Abalak by dirt roads open all year round. One laterite road finished recently connects with the Uranium road, to the south, through the village of Kao. Tchintabaraden has a sub-prefecture, gendarmerie, different departmental services, and a secondary school. The bulk of its economic activity happens on Sunday, market day. Kao and Abalak also have a weekly market and are the two other principal supply centers of the region.

Except for some millet and sorghum fields to the east of Tchintabaraden, to the south of Abalak, and to the west of Kao, this zone is purely pastoral. More than 90 percent of its population, estimated at 103,790 for the whole arrondissement in 1977, are herders.

Objectives :

Little information is available on the health needs, or the food and nutritional status of Sahelian herders. Important seasonal variations influence their environment and profoundly affect their way of life during the year. Difficult periods for herders are not the same as those for farmers. It is important to identify these constraints and to measure their impact on food, health, and nutritional status.

.../...

This gives a better understanding of the real situation of herders, and helps adapt health programs to their particular circumstances.

Nutritional status is an indication of a population's social and economic well-being. It is relatively simple to quantify. It enables immediate identification of the population at risk in a given group, and, over the long-term, an estimation of the impact of changes. The 1973 drought is an example.

Several nutritional surveys were carried out in 1973-75, to evaluate the seriousness of the situation or the effect of aid programs (1, 2, 3, 4). The lack of information on the populations concerned under normal conditions made it difficult to interpret the results. As a result, the present survey had the following objectives :

- to determine the nutritional profile of one group of herders located in the NRL Project zone and their food habits.
- to identify the subgroups at risk, the critical periods and situations.
- to determine the prevalence of malnutrition by attempting to identify its relationship to socio-economic factors and seasonal variations.
- to identify key indicators able to measure nutritional status.
- to identify critical seasons from a nutritional and health point of view ; to see how herders adapt or try to reduce the effects, and to what extent improvements are possible.
- to define the problems and the health needs of the population.
- to make recommendations for priority actions on health, in particular primary health care.

This research contributes to achieving the national objective set by the Ministry of Health : health care for everyone by the year 2000.

.../...

Methodology :

The survey was longitudinal, requiring five visits to the sample families at three-month intervals. The survey lasted one year, from August 1980 to September 1981, and was carried out in the Tchintabaraden arrondissement, north of Tahua. At each visit, a standard questionnaire was filled out. It was made up of three sections :

- data card on family composition.
- data card on family food consumption, water supply, and camp location.
- data card on individuals including questions on sickness, frequency of clinic visits, clinical observations, breast-feeding practices, and anthropometric measurements.

In addition to these visits, longer stays in the camps enabled additional data to be collected through observation and discussion.

The sample was composed of 54 Wodaabe families, divided into three groups according to lineages and personal affinity*. This choice made it easy to find camps again during the year. The location and composition of the families varied during the course of the year, creating considerable logistical problems.

The survey team was very small : two interviewer-translators and the author. They travelled in a four-wheel drive vehicle. The methodology and anthropometric measurement techniques are described in detail in Appendix 1.

* The number of families varied slightly at each visit since it was not always possible to find every family.

II. SAMPLE POPULATION

Characteristics of the study population

The population studied totalled 397 persons in 53 families at the end of August 1980. Its composition is summarized in Table 2.

Table 2. Breakdown of the sample population by age and sex (August 1980)

Age years	M n	F n	M + F n (%)
1	7	9	16 (1)
1 - 4	29	26	55 (14)
5 - 9	27	36	63 (16)
10 - 14	23	17	40 (10)
15 - 19	15	22	37 (9)
20 - 49	77	76	153 (39)
50 +	13	20	33 (8)
Total	191	206	397 (100)

It is a young population : 18 percent are less than 5 years old and more than half are under 20 years old. There are more women than men, with a sex ratio($\frac{\text{men}}{\text{women}}$) of 0.96 (calculated from the average annual population), although this figure means very little in such a small population.

Definition of family

The term "family" as it is used in this report corresponds to the Fulfulde term wuro and can be defined as the group of people composing one or several cuuDi, directed by a family head, depending most often on a single herd and communally organizing pastoral production tasks.

.../...

The Wodaabe are polygamous. Each wife has her own family shelter (suudu s., cuuDi pl.). The head of the famil, buys most of the cereals consumed by the wuro as a whole. Most of the time, the adult men of the wuro eat together food cooked in each suudu, as well as the milk which comes from each component suudu of the wuro. Thus defined, the wuro consists most often of one man accompanied by his wife or wives, their children, and sometimes their grandchildren. Often the father or mother of the head of the family lives in his camp once he or she is widowed. Brothers, a sister, or a cousin can also live there.

The social organization of production and consumption among the Wodaabe is very complex and varies according to seasons and economic conditions. A more detailed definition of wuro (translated as household) is contained in the socio-economic report of the NRL Project.

Among the Wodaabe, the head of the family is responsible for replenishing his wife's or wives' millet and sorghum supply. Each one receives her portion. Each one pounds a certain amount each day and milks her cows. This food is in turn distributed among the different family members. Milk production and consumption as one unit is easily measurable. As a result, it was used as the basic unit for the sample*.

Family size

The average size of a family as thus defined is 7.3 persons (average over the year). If on the other hand, the basic unit

* In some families, a son already living with his wife does not constitute a distinct production and food consumption unit. For example, the daughter-in-law has not yet made her suudu and simply helps her mother-in-law to pound and prepare the meals. In this case, the son and his wife were included in the father's family. It is also necessary to

is defined as a restricted conjugal family (husband, wives, unmarried children), the sample comprises 57 families of 7 persons.

Polygamy

Polygamy exists among the Wodaabe. It is mainly a function of the husband's economic wealth. Of the 57 men living with their wives, 32 percent are polygamous, as follows :

Table 3. Frequency of polygamy and the number of wives per restricted family unit by marriage.

Number of wives	1	2	3	4	Total
Number of restricted family units	39	11	5	2	57
Percent	68	19	9	4	100

Population dynamics

During the year of the survey, 23 births and 5 deaths were recorded*.

To calculate the birth and death rates of such a small population is statistically meaningless. Nevertheless, this year had a large number of births, and deaths among children were rare.

* (following of note p. 9) specify that a family defined in this larger sense does not necessarily correspond to an independant economic unit. For example, G., son of B., herds his father's herd. The latter, for his part, furnishes his son the amount of cereals necessary to cover the food needs of his family, which itself constitutes a distinct food consumption unit. G. depends economically on his father.

* five deaths : 3 old women ; 1 five-year old girl following a fever, one 15 year old boy attacked by degeneration of the central nervous system.-

.../...

This is probably explained by the absence of measles or meningitis and by normal food conditions.

Commentary

In general, nomadic populations have a lower birth rate than sedentary populations, and a lower death rate. The result is a less rapid population growth than that in villages. Table 4 shows this for the very diverse populations of Niger.

Table 4. Dynamics of the different populations of Niger.

Population	Birth rate (%)	Death rate (%)	Rate of natural increase (%)
<u>Fulani :</u>			
- Wodaabe (nomads)	30	19	11
- Farfaru (semi-sed.)	49	26	23
<u>Twareg :</u>			
- Twareg (nomads)	47	36	11
- Bouzous (nomads)	41	17	24
- Bouzous (sedentary)	58	23	35
<u>Farmers</u> (sedentary)	57	32	25

Sources (6.7)

Comparable rates have been found among herders in Somalia, Sudan, and Mali. The reasons remain unclear. But probably social control mechanisms play an important role. The ratio of men to women is higher in herder populations than in agricultural populations (7,8).

It would be interesting to carry out a detailed demographic survey among pastoralists in order to see if the higher birth rate suggested in this sample is confirmed. Carried out

.../...

simultaneously among farmers south of the pastoral zone, such a demographic study would throw some light on whether and how the agricultural population grows faster than the pastoral population.

Family size depends in part on the definition used. Wodaabe families in a study carried out at Tanut, defined as independent economic units, had 7.8 members per family (9). This type of unit corresponds to our definition of a consumption unit. In contrast, these families are much larger than those found in studies based on a unit composed of husband, wife, and children : 4.06 (7) and 5.24 (10). It is clearly important to define with precision the family unit on which food needs per family are estimated, particularly when food aid programs are organized, for example in case of a drought : the needs of a family of 4 persons are not the same as those of a family of more than 7 people.

III. H A B I T A T



Photo 1 : Camp with sand storm approaching

Methods

The families in the sample were visited at three-month intervals. Their location on the map was noted at each visit. The distance between each camp and its water source was measured with the vehicle's odometer. The arrangement and layout of camps in relation to one another and in relation to the well was obtained with the help of a compass

.../...

and by reconstruction at the end of the visit. The majority of the information presented here is drawn from observations made in the field during measurement-making tours and prolonged stays in certain camps.

Shelter

Among the Wodaabe, the shelter or suudu is limited to the west by a rope to which the calves are attached (daangol) and to the east by a screen of branches and dry bushes arranged in a semi-circle (fig. 1). The latter protects the bed (leeso) and table (saga) on which calabashes and other utensils are arranged.

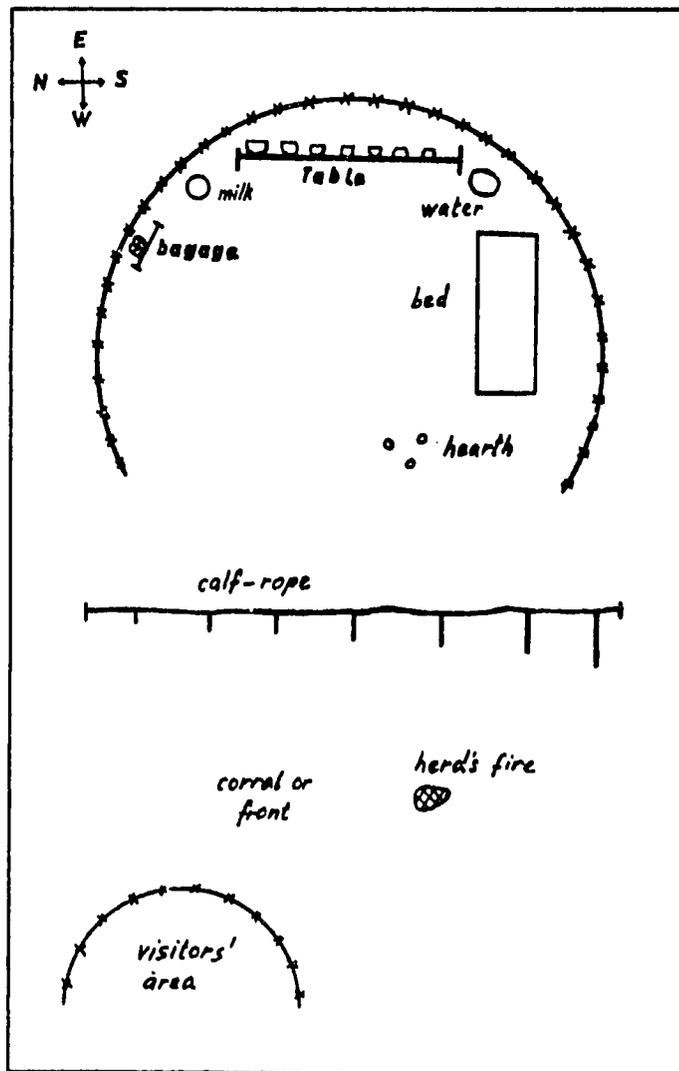


Fig. 1 Shelter or suudu

The calf-rope marks the separation between the family shelter to the east and the area where the herd is kept to the west. It is also to the west of the suudu that visitors are received and lodged in a small shelter, the daDDo, about fifty meters from the camp. Occasionally, the branch screen may be circular with two small side entrances. The calf-rope is then placed inside or outside the circle. This occurs frequently during the cold season when camps change their place less often. In contrast, at the beginning of the rainy season, when the Wodaabe change location frequently, the branch screen may be lacking or be made up of only a few bushes (photo 2).



Photo 2 Suudu ; the table, bed and calf-rope

In the great majority of cases, there is no covered shelter. If everyone leaves the camp to go to the wells, for example,

.../...

the table and calabashes are covered with a mat as a means of protection against the sun and dust. Nevertheless, during the rainy season, some women build a small circular hut (2 m in diameter) made of a curved branch frame covered with mats and sheets of plastic as protection from the rain. The bed is then placed inside the shelter. In the absence of a hut, if it rains, the women and small children take refuge on the bed and cover themselves with mats or with a plastic sheet.

In the cold season, some people build square straw huts, in imitation of the Twareg. These protect them from the cold and wind.

Some Wodaabe have adopted Twareg leather tents. Others possess tarpaulin or plastic tents.

The table is constructed of six legs buried in the ground, forked at the top on which three wooden cross pieces and four lengthwise pieces are placed (photo 3).



Photo 3 boDaaDo woman in front of the table

The knee-high "platform" is made of a rigid mat. On this mat the calabashes, utensils, and other personal belongings of the family members are arranged.

The bed, constructed by Twareg blacksmiths, is placed to the west and to the south of the table. Two thick cross timbers with ends in the shape of a drum support 5 or 6 lengthwise timbers on which two rigid mats are unrolled.

The two cross timbers are placed on 4 dumbbell-shaped feet raising the bed to a height of 30 cm. They thus protect occupants from insects, humidity, or cold ground (photo 2).

The area between the branch screen and the calf-rope is swept and cleaned during the rainy season if the woman is tidy.

The fireplace is placed in front of the bed, level or dug in the ground to avoid embers being scattered by the wind.

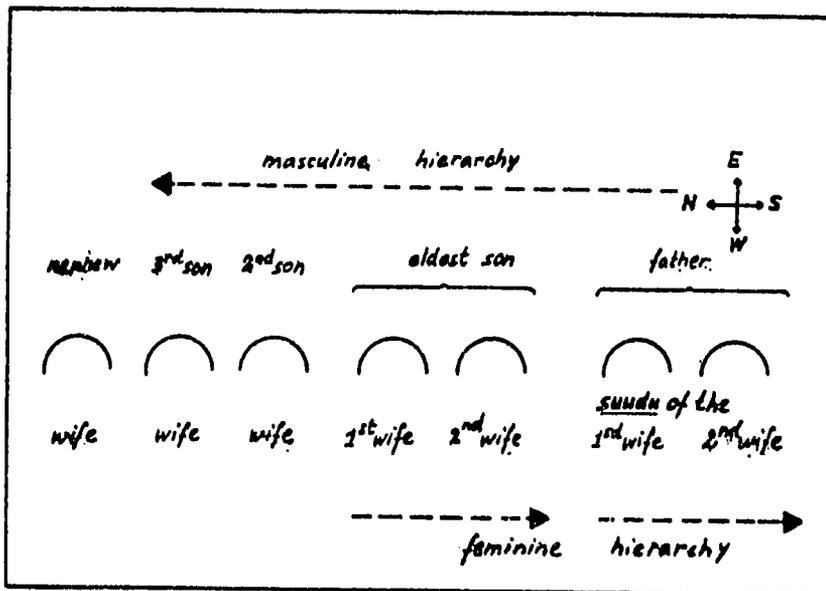
The calf-rope, secured by a stake at each end, limits the suudu to the west. The calves are attached there by a string around their necks at the end of the day before the cows arrive in the camp, at night until the morning milking, and when the cows leave for pasture. This rope cannot be stepped over by anyone who is not connected to the suudu. To walk over the calf-rope is an insult to the visited family.

About twenty meters west of the calf-rope, the boDaaDo herder lights a fire after the evening milking, around which the cows gather and spend the night. This practice takes place only during the rainy season, to drive away insects.

Each married woman or widow has her own suudu. A man with two wives will have two cuuDi. They are arranged according to a specified hierarchy. The first wife always takes her position to the north of the others. The female hierarchy thus runs north to south. However, when a man has two wives and the second wife, not yet having a child, does not have her own suudu, the latter sleeps on a mat some distance from the suudu or her co-wife. A head of a family with three wives

.../...

thus has three cuuDi. These three cuuDi make up a wuro. Several households can position themselves side by side. They form a hoDoorde, as in the case of a father and his sons. There too, the arrangement of households follows a strict hierarchy, this time going from south to north ; the oldest man in the family or lineage positions himself in the south (fig. 2).



Dupire (11)

Fig. 2 Layout of 5 gure* of a hoDoorde

The Wodaabe's shelter is extremely simple, adapted to the environment and their condition of life. The bed and table are easily dismantled. The timbers are wrapped in bundles in mats, placed on the flanks of a pack donkey or a pack ox. Attached underneath are the calabashes, stacked one inside the other and protected by a mat cover, the cooking pot, the fireplace tripod, the mortar and pestle. All of the

* wuro (pl. gure)

.../...

property of the suudu is carried on the backs of two donkeys, on which the woman or small children travel.

The cleanliness of the suudu greatly depends on the woman who lives in it. Some are meticulous, others are careless. Small animals, kids and lambs, can quickly become invaders. They eat the leftover food, overturn calabashes, or graze the mats. The Wodaabe do not raise any poultry, the cause of

 dirtiness in some village compounds. One of the major factors of cleanliness is of course the frequency of movement. Even in the cold season, a family rarely stays more than two weeks in the same place. If the area where they keep the animals is deemed too dirty, they will move a certain number of meters.



Photo 4 Movement of a camp

The choice of campsite

The quality and abundance of pasture are by far the most determining factors. A boDaaDo herder does not hesitate to position his camp far from a water point to take advantage of good pasture. He also does not hesitate to move frequently in order to offer his animals the best forage.

Water also plays an essential role in the choice of campsite. Certain pastures remain unavailable to herders because of lack of water points during the entire dry season. They are only utilizable during the rainy season when ponds are present.

As the pasture does not regenerate during the entire dry season, from September to May, herders must find a compromise between pasture and water. In this season, water is rare and each herder depends on a water point. He cannot move too far away from wells where he supplies himself and can only have access to pastures within approximately a twenty km radius from the well.

During the rainy season, water is available from numerous ponds. It is not a limiting factor. Herders can freely choose suitable pastures.

The distance between camps and their water source was measured at each visit. The seasonal tendencies are portrayed in Figure 3.

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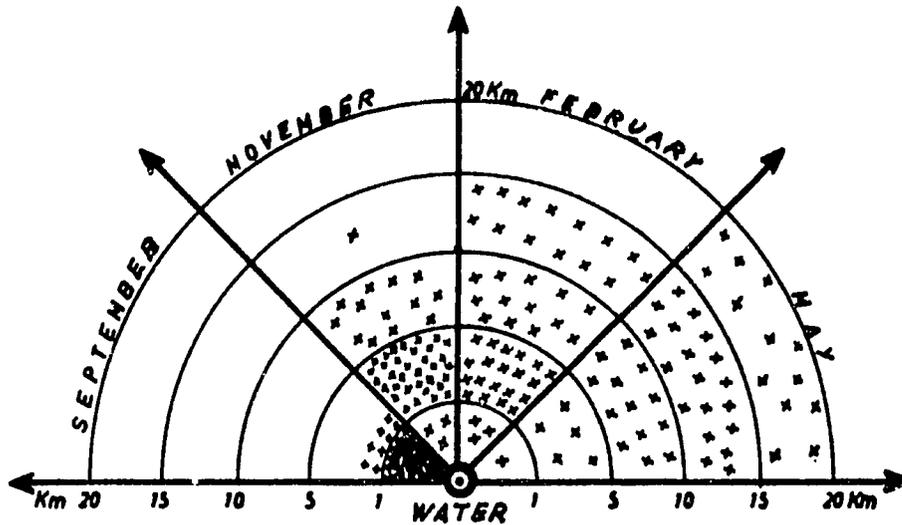


Fig 3 Distance of campsites from water area

x = 1 campsite

During the rainy season (July-September), camps are situated around ponds. More than 80 % are set up less than 500 m, the others are located between one and two km. As the pastures close to water points are grazed, the herders are forced to move further and further away. Already in November 25 % of the camps were more than 5 km away. This movement away from water sources increases, reaching its maximum in May-June. At this time, 60 % are more than 10 km away, some residing up to 20 km from wells. With the formation of ponds and the appearance of new pasture, this centrifugal movement stops and camps are once again set up near them.

The large distances covered in the dry season between camp and water point impose enormous constraints on animals and humans, and are responsible in good part for the herders' precarious life at this time.

.../...

Choice of site

The location in a given area depends on the season. During the rainy season, the camp is beside a pond on the slope of a dune in order to benefit from the wind and to avoid mosquitos. As the camp does not provide any protection against the sun, it is often located near an isolated tree, which shades the women during their domestic work. The midday heat is usually spent in the shade surrounding the pond.

In the cold season, the suudu is built to the west in hollows on the edge of small forests. Sometimes they even set up in the forests to better protect themselves from the east wind, keeping out the cold and dust. The branch screen is thicker and higher, to assure better protection.

In April-May, at the peak of the hot season, camps are newly set up on hills to profit from the wind. Protection against the sun is often limited to the simplest means : canvas, a mat, or a cloth thrown on a bush assures a small area of shade.

A camp is never built on a site possessing traces of an old camp. Women say that they catch ticks there.

Movements

- Background

It is important not to confuse migrations with movements. Migrations represent the movement of a faction or a clan toward new territory, until then unused. They can be motivated by a drought, political troubles, etc. They are of two types : the perol, a true migration that can take little time, and the baartol, which is a slow progression toward new regions over several years (12).

Movements, goncol, are the successive movements of camps in search of pastures. Movements carried out in the course of the

.../...

year depend on several factors : pastures and water points, the availability of millet in markets, certain livestock diseases common to a region (lack of Vitamin A), disputes between lineages, fear of school, etc.

It would be false to believe that herders are constantly moving. The Wodaabe have a feeling of belonging to a region : they call it ngendi. The ngendi is a region where a lineage spends the dry season year after year, as long as the conditions there are favorable.

- The movements of three groups of Wodaabe over a year

Five maps retrace the camp positions of 54 Wodaabe families at three-month intervals. The arrows, of which the thickness is proportional to the number of families having followed the same itinerary, schematize the movements carried out since the preceding visit. The dotted lines indicate the distance between camps and water supply points. Three groups are represented on the maps : each family is represented by a symbol common to all families in that group (*, Δ, O).

Consider the first family group (*) : during the rainy season (August 1980) the families were gathered to the southeast of Tchintabaraden. In September all the camps move to the north, about fifty km to the east of Tchintabaraden, where their worso takes place (annual gathering of the clan). Then, each one positions himself by shallow sand wells of his choice during the dry season. In November, the majority are near Akarana. Some have gone to the east or south.

In February, at the end of the cold season, the camp-locations are essentially the same. However, the distance between camps and wells has increased appreciably. Some have changed places and water at neighboring wells.

At the end of May, the shallow wells of this region are dry and the pasture has disappeared. The dispersion of families reaches its maximum. Some have gone north, others to the

.../...

northwest. The majority are to the southwest of Tchintabaraden. While some continue to water at sand wells to the northwest and southeast, the greater part have retreated to cement wells (Anuzegre) or pumping stations (Tchintabaraden, N'Kao-kao, Tofamenir). At this point in time, camps are far from water points. This lasts until the rains begin. When the first ponds are formed, herders water their animals there. But new pasture has not yet regenerated and the camps remain very far from ponds where they continue to find old pasture. This is the case, for example, of families visited in the extreme west.

As the rains become more frequent, grasses grow. After a period of continuous movements in search of new pasture, the camps gradually draw closer to one another. In September 1981, at the end of the rains, all the families of Group 1 found themselves again to the southwest of Tchintabaraden, with the exception of one that remained near Tofamenir. The annual cycle is completed.

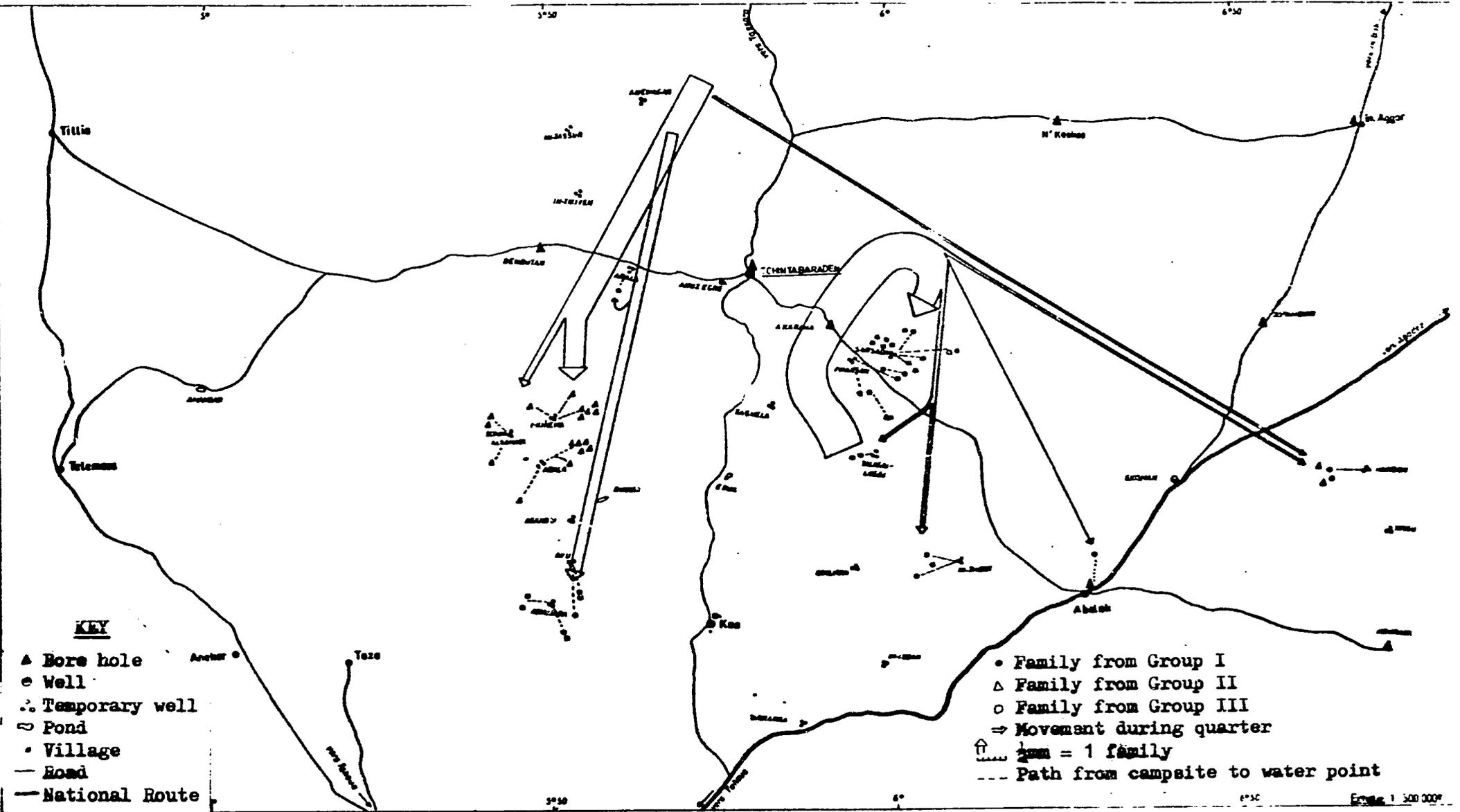
Over the course of a year there is thus an expansion and dispersion of the families that increases as the dry season advances, followed by a convergence during the rainy season, culminating at the time of the annual gathering, the worso. There are, of course, general tendencies. The itinerary of each family or clan can vary from one year to the next according to pasture. This year the pasture was good to the southeast of Tchintabaraden. All the families returned there during the rainy season. If there had been a scarcity in this region, the gathering would have taken place at another place, next to more abundant pasture.

The two other groups of families followed essentially the same cycle of movements. However, the principal movement between the dry season and the rainy season formed more along

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Quarterly Movements of 54 woDaaBe Families

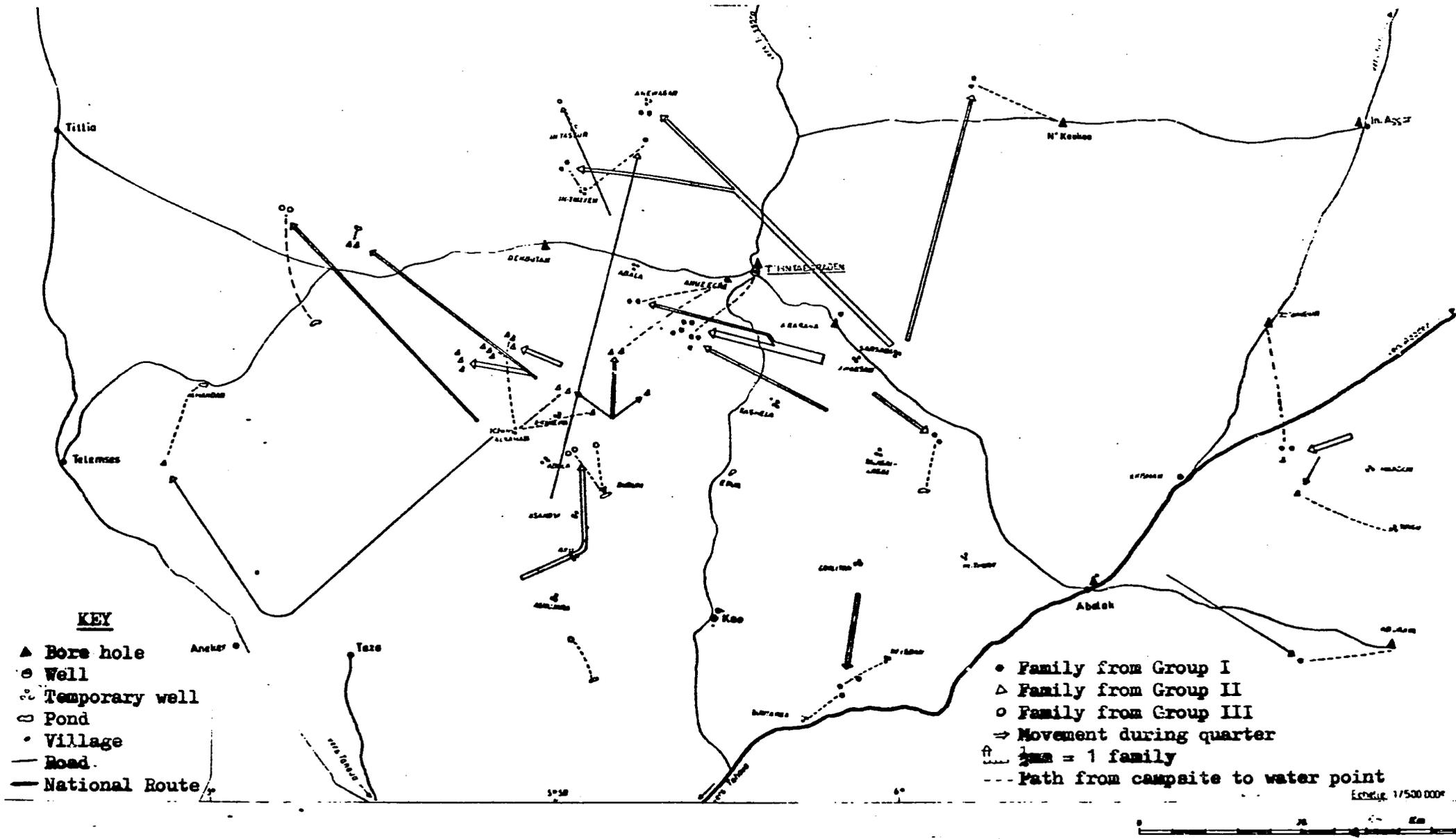
Camp locations at end of November 1980



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Quarterly Movements of 54 WoDaaBe Families

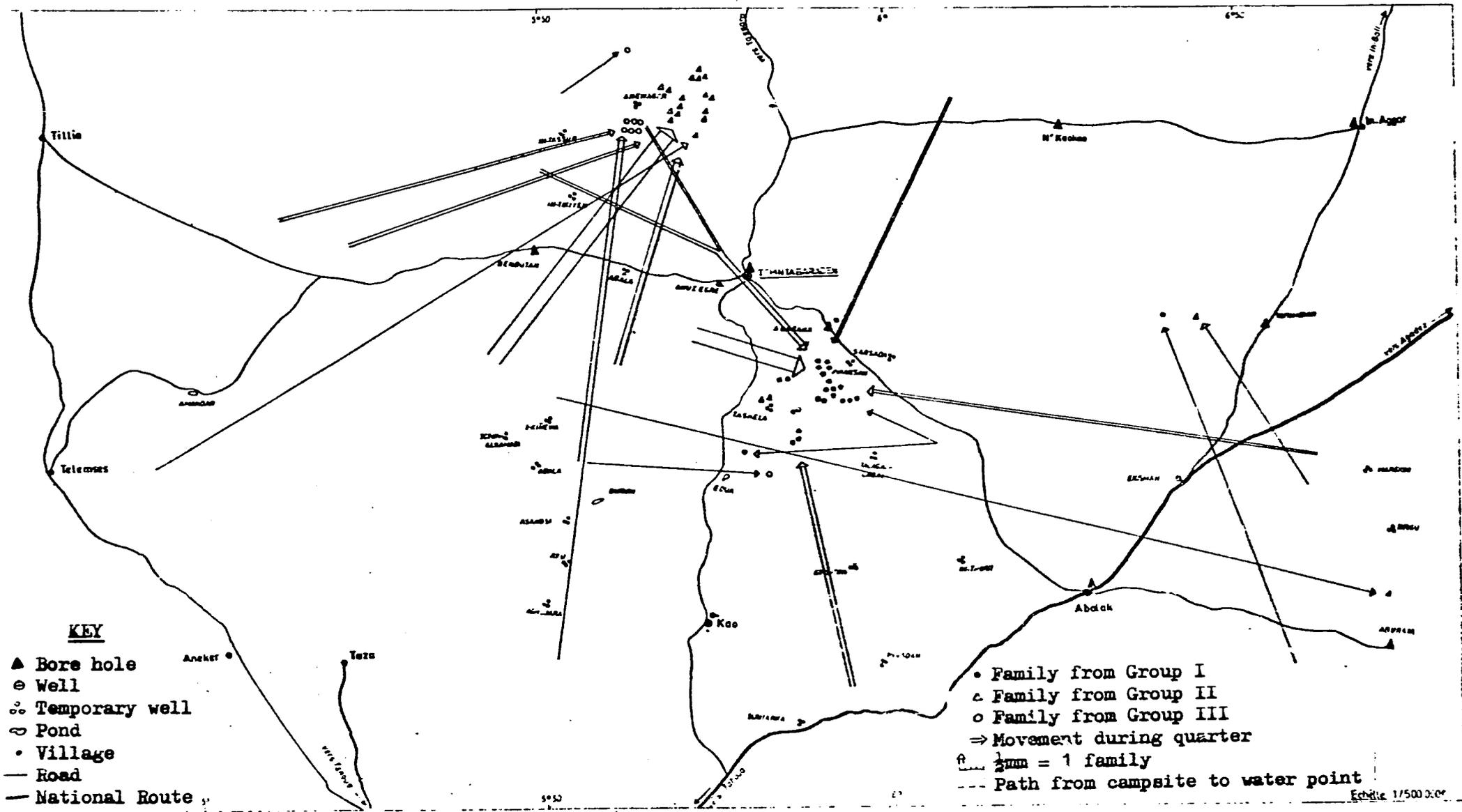
Camp locations at end of May 1981



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Quarterly Movements of 54 woDaaBe Families

Camp locations mid-September 1981



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a south-north axis of about sixty km. Group II spent most of the dry season at the shallow sand wells around Abalak ; Group III resided in the mountains around Aghujara. After the extreme dispersion period in May (some had gone more than 100 km), they gathered together in September to the north of Tchintabaraden, as in the preceding year. Not all of the Wodaabe follow the same herd movement cycle. Some follow a north-south itinerary of great amplitude, others move along a east-west axis (12).

Methods of movement

The Wodaabe cannot move whenever they wish. Certain days are strictly forbidden, others in contrast, are favorable. To move on a forbidden day risks bringing misfortune to the herd (13). These days differ from one lineage to another. For example, the Jijiiru move on Tuesday, Saturday, or Sunday. The Gojanko'en can move everyday except Monday. But on Friday, they only move to the north, south, or west. The east is forbidden to them.

Very often, the departure is decided upon the same morning after a discussion between family chiefs. Women have the entire responsibility of striking camp, with the help of the children. Folding up the suudu and loading the donkeys takes between 2 and 3 hours. Movements take place in the morning, after the cows are milked and the meal has been eaten. The remaining milk is poured into a calabash that a woman carries on her head during the move. The distance covered varies from 500 meters in the case where the camp-site is deemed too dirty, to several kilometers during a period of herd movement.

In the majority of cases, the new site is found around noon. It is the head of the family who decides upon the new loc-

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ation. The donkeys are unloaded, but the suudu is often built only at the end of the day, the hot hours being spent in the shade. In the hot season, some move at night to avoid overexerting the animals and humans.

The frequency of movement varies a lot from one season to another, low during the cold season and greater at the beginning of the rainy season when herders look for the first pastures. In December, camps may remain at the same place for several weeks. In June, some move every two days.

Conclusions

This chapter describes the Wodaabe's shelters, how they are oriented in relation to each other according to a definite order, how several criteria function in the choice of a camp-site depending on the season.

It shows that the distance of camps in relation to wells increases during the dry season, attaining a critical point in the months of May-June, reaching up to 20 km. Movements are influenced by several factors : the search for good pasture is the most important. The movements of the 54 families of the sample are reported here in order to show the annual herd movement cycle of a group of herders.

The Wodaabe's life is rough and without comfort. Devoted by necessity to their animals, they lead a life that enables them to make the best of a difficult environment. Their shelters are conceived as a function of this mobility and reflect it in their simplicity, offering little protection with respect to the surrounding environment.

However, the dispersion of camps and their frequent relocations give them the advantage of reducing contamination and contagion problems which are associated with proximity and permanence of homes, and to slow down and limit the spread of epidemic diseases.

Movements and the annual herd movement cycle follow a specific logic, dictated by seasonal constraints and by herders' preference for certain known regions.

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IV. FOOD AND NUTRITION

I. The diet

The food base of Wodaabe herders is composed of milk and cereal products. In addition, tea and sugar are consumed daily by adults, as well as leaves in the sauce. Meat plays a negligible part in their diet. Harvested products are sporadically consumed.

The availability of different foods varies according to the season. During the rainy season, the diet can be exclusively milk products, as long as the herd production is sufficient. During the months that follow the rainy season, milk production continues to be high. Part of the milk is consumed, the other part is exchanged for fonio or sorghum in the bush with the Twareg and the Hausa. Some families can live like this until the cold season without buying millet at the market. As the dry season progresses, milk production diminishes, until it is entirely absent from March to June. This is due to poor pasture, the long distances to the wells, and the fact that the dry season corresponds with the end of the cows' lactation period (who normally give birth at the beginning of the rainy season) (14). Food is at this time essentially of a cereal base.

Milk products. Fresh milk, sour milk, butter, cheese.

Milk is consumed during or between meals in different forms each day. Fresh milk is highly sought after and the most prized food of the Wodaabe. For them it is the source of health and strength. A number of diseases occurring in the dry period are attributed to lack of milk. Butter is cooked and consumed with the sauce. Wodaabe do not make cheese and rarely consume it.

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Cereals. Millet, sorghum, rice, fonio.

Millet and sorghum are the two cereals most consumed. Produced in the south pastoral zone, they are sold in the local market. Generally, millet is valued more than white sorghum and fonio. The Wodaabe do not like the taste of red sorghum, to which they attribute digestive troubles. Rice, in contrast, is very valued but its high price limits its consumption.

Meat.

A sheep or ram is slaughtered on special occasions : the arrival of a stranger, a ceremony, or when an animal is going to die of weakness or disease.

Tea and sugar.

Tea has appeared in the Wodaabe's diet in the last 20 years. Introduced among the Twareg of Niger since the beginning of the century, the sweetened green tea progressively was adopted by the Wodaabe as the contacts between these two groups became more frequent. At present, many Wodaabe drink tea in the morning and at night, or when strangers arrive. The serving of the green tea, boiled and strongly sweetened, follows a whole ceremony inspired by the Twareg. Tea plays an important role in the social relations and contacts between people and its caloric contribution is not negligible. As for leaves and other harvested products, as well as salt, see the chapter "Food Technology".

The Wodaabe benefit in normal times from a food supply high in nutritional value. The combination of cereals and milk products assures them the necessary caloric intake and also access to animal protein. However, this combination is not constant ; it undergoes large fluctuations over the year.

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Table 5. Edible plants harvested by the herders

Scientific name	Name in Fulfulde	Name in Tamasheq	Harvest season	Part consumed	Method of preparation	Method of storage
<i>Corchorus tridens</i>	Turgunu	Amris	July-Sept	leaf	cooked sauce	dried
<i>Corchorus olitorius</i>	Laalo	Malokhia	July-Sept	leaf	" "	dried
<i>Entada sudanica</i>	Tafassa	Ebazey	July-Sept	leaf	" "	dried
<i>Amaranthus graezans</i>	Gasia	Tajalanhitet	July-Sept	leaf	" "	-
<i>Leptadenia hastata</i>	Yadia	Arenked	June-Oct	fruit	raw+cooked	-
<i>Tapinanthus globiferus</i>	Sotoore	Akawat	all year	leaf	raw+cooked	-
<i>Balanites aegyptiaca</i>	Tanni	Aboragh	Nov - Feb	fruit	raw	-
<i>Boscia senegalensis</i>	Anzahi	Tadent	June-July	fruit nut	raw cooked	dried
<i>Citrullus lanatus</i>	Gunaaru	Aleked	Aug - Sept	fruit	cooked	-
<i>Grevia flavescens</i>	Ciiboligursuhi	Tarakat	Sept-Jan	fruit	raw	dried
<i>Sclerocarya birrea</i>	Eedi	Tuwila	May - June	fruit	raw	-
<i>Ziziphus mauritiana</i>	Jaabe	Ajeyn	Nov - Feb	fruit	raw+cooked	cooked : akuri
<i>Cenchrus biflorus</i>	Kebbe	Wajag	Aug - Nov	seed	cooked	dried
<i>Panicum laetum</i>	Sabeeri	Ishiben	Sept-Nov	seed	cooked	dried
<i>Acacia laeta</i>	Dibehi	Tazeyt	all year	sap	raw	dried
<i>Hyphaene thebaica</i>	Balol	Tageyt	all year	root	cooked	-
<i>Tribulus terrestris</i>	Tuppere	Agarof	all year	seed	cooked	dried

Food in time of scarcity.

In a period of scarcity, the food replacements are few in number. Fonio is normally consumed and permits the people to survive the months following the rainy season. Cramcram grains (Cenchrus biflorus), Tribulus terrestris, and the fruits of Boscia senegalensis are also consumed, as well as the heart of doumpalm roots in the southern regions of the pastoral zone. Some people in times of extreme destitution are forced to pound calabashes or cook pieces of leather.

Recent additions to the Wodaabe diet.

With the numerous trips that men and women make to cities in the south in order to sell traditional medicines or to work plaiting hair, the eating habits change gradually. Macaroni, bread, rice, canned tomato sauce, bouillon cubes, onions, cookies and other sweets make their appearance in the diet. Some buy powdered milk during the hot season, but the majority do not like it and attribute a number of intestinal troubles to it. Canned foods, fish, fresh fruit and vegetables are not consumed. The Wodaabe are very conservative and do not voluntarily sample new foods. The end of the 1981 dry season registered an unprecedented increase in millet and sorghum prices. Many herders bought rice and pasta which had more favorable prices. If such price fluctuations happen again, one must expect to see profound modifications of eating habits of herders and other rural populations in Niger. This would have important economic consequences for a nonwheat-producing country which is already a rice importer and dependent on food imports.

2. Food technology

Utensils

Cooking utensils are very simple : different size calabashes (tummuDe) sometimes decorated with geometric motifs engraved with an awl, a cast iron cooking pot (gahere), a small sauce pan (gahe'el lio), a stick for stirring the paste (layirgal), a soup ladle (horde) (oval, half-calabash), wooden spoons carved by Twareg, one or two wooden bowls, one or two white enamel cups, a knife, flat circular covers (beDi) woven locally, a clay water canister.

The majority of utensils are bought at the market.

Calabashes cannot be cleaned on certain forbidden days. Among the Gojanko'en, for example, they cannot be washed on Friday and Saturday. The spoons and small calabashes for drinking milk are washed before each meal. The inside of the calabash is brushed with water and sand, using **bark** from Acacia laeta (dibeehi), until the traces of food are completely gone. The outside rim is also "grated", then tinted white with kaolin powder or sour milk. The calabash in which they collect milk (Birdude) must be absolutely dry when it is used. To milk a cow with a wet Birdude risks bringing ill omens to the cow.

Food storage

Because of their itinerant life Wodaabe cannot store much food. Sacks of cereals are bought according to the rate of consumption. This makes the people highly dependent on price fluctuations over the course of the year. Few people can buy several sacks at harvest time when prices are low, store them with a merchant, and reclaim them in April-May when prices are higher. At the camp, the sack of millet is kept on the table, unsheltered from mice who help themselves, going as far as gnawing the calabashes.

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During the rainy season, in the bush the women harvest the leaves of Corchorus tridens and Colitorius and dry and preserve them in a sack. These leaves are used in the preparation of the sauce.

One original form of preservation is akuri. Akuri is a hard bread with a jujube flour base that they add to various meals (see Harvested Foods). This bread is a high energy food which can be kept for numerous months and constitutes a source of vitamins A and C during the dry season when milk, the principal vitamin source, is lacking.

The Wodaabe do not make cheese, although many profess knowledge of production techniques.

Cooking

Cooking is done over a wood fire. In general, wood is not scarce in the bush. The fireplace, located toward the south entrance of the area of the suudu, is level or dug in the ground. The cooking pot is placed on a tripod (kaatane) or on the sides of the dug fireplace. Very little wood is burned. It is rare to see a large fire for warming oneself, in the cold season.

Milk products

- Milking

Each woman milks her own cows ; the milk that she draws belongs to her.

Milking of cows takes place two times a day ; in the morning and at the end of the day. The calves are detached from the calf-rope one at a time. Each time a woman calls a cow, she detaches its calf, lets it milk from its mother for a few moments, then draws it away from the udder and attaches it by the neck to the right front foot of the cow. The woman positions herself to the right of the cow and milks it in a

crouched position, holding a small calabash, Birdude, between her knees, in which the milk is collected (photo 5). The milking finished, the calf is detached and allowed to drink the remaining milk. The next cow is called, her calf detached and so forth. Each time the milk contained in the Birdude is poured into calabashes near the table.



Photo 5 Milking

Letting the calf suck a few moments before milking has a double effect : to stimulate the milk let-down and to clean the udders. Sometimes the milk let-down is obtained by vaginal stimulation of the cow, carried out by a second person during the milking.

The quantity of milk left to the calf is estimated at one third of the milk produced (11). This quantity varies from one season to another. Generally, cows are not milked during

the seven days following a birth. In the dry season, this period is prolonged. At the end of May, all of the milk produced is reserved for calves until the growth of new pasture. The women only take a little bit of milk for the children or when a stranger comes. In the rainy season, when plants are abundant, milking starts as early as the second week.

- Milk

The woman divides the fresh milk into three parts : for her children, for the rest of the camp, and for herself. The part kept by her is either consumed immediately or soured in order to separate the butter (nebbam).

Milk is never cooked. It is always consumed raw : fresh milk (BiraaDam), sour full-cream milk (DaniDam), or sour milk after the butter has been extracted (pendiiDan). Milk is soured either spontaneously by the heat, and fermenting agents retained in the pores of the calabash, or by adding a little old sour milk.

- Butter

After the morning meal, women prepare butter. Sour milk from the preceding day is poured into an oblong calabash and covered with a lid (faandu) (photo 6).

The bottom of the calabash rests on a bed of supple bark and a cloth is shaken back and forth for one hour to separate the butter from the milk. When the butter collects in little curds at the surface of the milk, the contents are poured into a calabash. With the use of a ladle (horde), the butter is collected and stored in a calabash.

Once the butter is drawn, they beat the milk with a beater (buruugal), a stick about 40 cm long bearing four little pieces of weed arranged two on each side and perpendicular to one of the ends (photo 6).

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Photo 6 Preparation of butter

The sleeve of the buruugal is rolled between the palms until the sour milk is well mixed and creamy, ready for consumption. Raw butter is used to grease hair, wood, or leather. Cooked, it becomes a golden oil and is consumed in the sauce or used to fry millet (gomma).

Cereals

Millet, sorghum and fonio are pounded in a mortar (wowru). Women successively pound and winnow several times depending on the meal to be prepared. The winnowing is done with a circular basket made in the camp with braided doum leaves. Sitting, the woman separates the bran from the flour by sifting the flour into a calabash.

Meat

The Wodaabe will only eat the meat of a slaughtered animal. On this point they follow the Muslim custom. One portion of the meat is grilled and one part is cut into pieces and cooked in water with onions, some salt and butter being added at the end. Sometimes the entire animal is cooked in the embers. Meat consumption from hunting is presently nonexistent due to the prohibition of hunting in Niger and to the diminution of fauna in the pastoral zone. The Wodaabe were never a hunting people, but formerly some trained dogs to hunt gazelles and rabbits and constructed snares to trap bustard, guinea-fowl, ducks, and pigeons.

Meat was prepared as described above. Sometimes children trap birds that come to drink near wells, by constructing a series of small snares made of hairs from cow tails, weighted with clay bowls. If successful they grill and eat the birds. Sheep are slaughtered for the naming ceremony of a newborn and to confirm the marriage of a woman (tegal) (second wife and those following).

The first marriage (koobgal) traditionally involves the sacrifice of three bulls. The meat is cut up in a very precise way. Men receive the pieces from the anterior part of the animal (anterior legs, sides, anterior parts of the liver, the intestines, first stomach). The posterior pieces are reserved for the women (posterior legs, lower vertebral column) as well as the internal organs (rumen, uterus, stomach).

Young people receive the organs where strength is located : the neck and the chest. The young girls receive the heart, center of sentiments and feminine affection ; to women, the pieces relating to procreative functions ; to men, virile organs ; to old women, the lungs and hooves, and the two most senior each receive an extra rib (beccal) in consideration of their age (11).

Some pieces are reserved : an anterior leg with half of the ribs for the notables invited (ndottii'en), which they will take away ; a posterior leg for the camp of the paternal family of the fiancé who offered the animal. The animal's skin is equally divided between the two families.

Eggs

There are no rules against eating eggs as in a number of African societies. During the rainy season, numerous species of birds come to nest in the pastoral zone. Consequently, sometimes the Wodaabe consume bustard, guinea-fowl, duck, ibis, or ostrich eggs, although the latter have not been seen in Tchintabaraden since the 1973 drought. Eggs are cooked with butter and salt, in a form of omelette. These are highly appreciated dishes, but very rarely consumed.

Salt

Salt (lamDam) consumed by the Wodaabe of Tchintabaraden comes from two principal sources : Tigidan-Tessoum to the north of Ingall and Bilma to the east of Agadez. One also finds sea salt in the market in crystal form and sometimes salt from Tawdeni (a salt mine located north of Timbuctu, Mali). Presently the caravan salt routes persist, although of less importance, and herders always prefer Saharan salt. Sea salt is accused of causing stomach aches and pain in the back or in the eyes, and of reducing cows' weight if consumed. Bought in the form of plaquettes or leaves, the salt is ground to powder in a mortar and added to food. Generally the dishes are lightly spiced and lightly salted. Salt is used in the sauce, or in millet paste, when sauce is unavailable. The

Wodaabe say they consume more salt during the hot season to flavor the paste when milk is lacking.

The sauce

When milk is abundant, they do not prepare the sauce (li'o). In contrast, the sauce becomes an important food element during the cold and hot seasons. It is prepared in a small cooking pot (gahe'el li'o). They boil water, in which they put leaf powder derived from laalo (Corchorus oritorius) or from turgunu (Corchorus tridens). Then they add salt and butter, cooked separately. The composition of the sauce may vary. Some women put in leaves from the baobab (Boki) (Adamsonia digitata), the tafassa (Entada sudanica), or the gombo (Hibiscus esculentus), dried tomatoes, onions, and even bouillon cubes. All the ingredients are bought at the market. The Wodaabe prefer milk to sauce. "If one eats sauce, one must drink lots of water, which distends the stomach".

Harvested foods

A certain number of seeds from fruits and leaves harvested in the bush are consumed by the Wodaabe (see Table 5). They represent only a sporadic contribution to the diet, but provide a great amount of vitamins and minerals. For example, yaaDya (Leptadenia hastata) is rich in iron. The jujubes are rich in vitamins A and C as are the fruits of Balanites aegyptiaca (15). When the leaves are eaten raw, they are crushed and mixed with some salt and cream. Certain leaves are dried in quantity during the rainy season and make up the base of the sauce during the following months. At the end of the rainy season, the colocynth (Citrullus lanatus) are consumed in the form of a stew. Cut in pieces, they are cooked with some salt and butter.

The Wodaabe and the Tamasheq have an original method of preserving jujube (Ziziphus mauritiana) during the entire year : in a "loaf" form called akuri. In December-January, children and women harvest the fruit of the jujube by throwing pieces

of wood in the branches to make the fruit fall. The jujubes, small orange prunes a centimeter in diameter, have a large main pit. The jujubes are dried and pounded to extract the pits and to reduce the fleshy part to powder. This flour is then moistened and set on a piece of mat or on leaves of Calotropis procera in a hot area of the fireplace, from which hot embers were removed. The balls of flour are covered with a calabash or leaves from Calotropis procera, which have been covered with cow dung or mud : this hermetically seals the flour from air. It is left standing for some hours in order to let the flour "rise" and form a sort of rosy and crumbly block, called akuri. This akuri cake, about 20 cm in diameter and 6-7 cm thickness, can be kept for months, even years. It can be eaten as is, or can be ground and mixed with milk, gappal, nyamri, or dogga. An excellent preparation is the gomma akuri : akuri flour cooked in melted butter. Akuri retains a slight acidulous taste from the jujubes. Analyses are being performed to determine its percentage of vitamins A and C. Akuri is highly valued for increasing weight or as a medicine for certain diseases.

Meals

The Wodaabe eat two meals per day, one in the morning and one in the evening. Generally, the only hot meal is eaten at night, shortly after the sun sets. In April-May when camps are very far from wells, the women return from the drudgery of drawing water towards 10.00 p.m. The meal is then eaten late in the evening.

The women pound and cook millet once a day, at the end of the afternoon. Sometimes they pound and cook a new meal in the morning, when a stranger visits, for example. In general,

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the morning meal only uses the cold leftovers from the meal of the night before.

Meals are eaten communally by age-class and sex. Women and small children eat in the suudu. The men eat in the daDDo, to the west of the suudu.

Once the meal is prepared, the woman divides the millet paste (nyiri) or sorghum into several portions : hers, those of the small children, and those of the men (photo 7). Then, she brings the men's portion in a calabash or in a large wooden bowl (le'al) that she puts with a calabash filled with milk near the men. The apportioning is carried out by the head of the family who divides the paste and milk by age-class and by rank in the lineage : the elders, the adult men, the young people. Each group receives a calabash of paste and milk. Guests are seated on mats, with the calabashes near them on the ground. They eat with their backs turned to the light of the fire, using wooden spoons that are passed from one guest to another counter-clockwise. The millet paste is covered with sauce. Once the sauce is consumed, they pour fresh milk on the paste. This mixture of paste and milk, the gurtel, is what the Wodaabe prefer. Once satisfied, everyone withdraws from the circle and drinks a large gulp of milk from the calabash, but stays nearby until everyone has finished.

The herder who leaves for the wells or for pasture often does not bring anything to eat with him, only a little bit of water in a container suspended at the end of a stick. If he does eat a quick meal, it will be a little sour milk or some dough.

Sometimes women prepare an extra meal in the middle of the day, called gappal. This dish is made for the children, for a stranger passing by, or for people staying in the camp.

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Children eat more frequently, basically at their request. They are the first to drink the fresh milk in small calabashes (luttirkon bilki'en) and pick at the dishes. At the time of festivals or the arrival of an important guest, several camps participate in the preparation of the meal. The millet paste and the milk calabashes are assembled at one point where the designated men proceed with the division of food.

The dishes

- Nyiiri

Nyiiri is the meal most frequently prepared. It is made of millet paste (gawri), sorghum (bayeeri), or fonio (sabeeri). Millet is pounded the first time (yiki) with a little water. It is then winnowed to separate the bran (sa'anyo). The bran is only consumed in times of drought. In normal times, it is given to the animals. Once the bran is separated, they pound and winnow two more times (untaaki) to obtain flour. The coarsest flour is added to boiling water. Once cooked, the rest of the flour is added and stirred with a layiirgal, a big wooden spatula. The cooked paste is then divided among three calabashes (tummuDe): the children's (tummuDe bilki), the women's (hitorde yeyri'en), and the men's (le'al ndotti'en). The sauce is poured on the three portions. The quantity prepared is estimated by each woman with her own measures: a small enamel bowl and a small oval calabash (rottirde).

- Nyamri

Millet or sorghum flour pounded three or four times and steamed in a perforated calabash (giteere). This giteere is sealed in the cooking pot with cow dung, some bran, or moist sand and suspended in boiling water. Once cooked, this finely

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granulated paste is chilled in cold water in a calabash. Next, they pour out the water and add some butter and salt. This highly esteemed cold meal is eaten with fresh milk.

- Cobbal

Millet or sorghum flour is finely pounded, moistened, and shaped into balls the size of an orange. Cooked in water, these balls are then pounded in the mortar, then poured into a calabash. They add sour milk and a little red pepper. It is a liquid dish consumed in the middle of the day.

- Gappal

They prepare this only with millet. It exists in two forms :

a) whole millet is fried with a little water in the cooking pot, then coarsely pounded. It is then poured into a calabash and mixed with sour milk, water, and red pepper.

b) they pound millet in order to separate the bran. The millet is washed in water, dried, then pounded again. Sour milk and water are added subsequently.

- Mba jungu

It is simply millet or whole sorghum cooked in boiling water to which they add salt and butter once cooked . This dish is often prepared in the day for children and women.

- Dogga

Millet or sorghum flour made into paste by adding hot water. Women shape small balls the size of a date which are then thrown into boiling water. Once cooked, they pour salt and melted butter on top. The dish is eaten dry or with milk.

- Gomma

Millet flour cooked in salty butter and a little milk for several minutes. This dish is eaten as is.

- Kunu

Kunu is the dish served particularly to women who have just given birth. The visitors who came to congratulate the mother eat some, too. Millet or sorghum flour is divided into two parts : one part is shaped into small balls and thrown in boiling water, while the other part is diluted in cold water and then poured in the water containing the balls. They add Bilma salt, some natron, and some red pepper. The paste is mixed with some milk to attain the consistency of thick cream. When the hot calabash (dde kunu) is brought to the woman, she covers her head with a cloth and breathes the vapors that escape from the calabash until the kunu becomes cool, then she eats.



Photo 7 Division of millet paste

3. Water

In one of the driest and hottest regions of the world, water plays an essential role. A person engaged in normal physical activity at temperatures higher than 40° C in the shade, drinks 4 to 5 litres per day. Nobody in the bush can claim that he was never faced with the problem of thirst. Water is extremely precious. It is the first thing offered to anyone arriving at a camp.

Method of study

During each trimester visit (except in August 1980) the women are asked about :

- the type of water source being used,
- the number of water-skins brought back to the camp daily,
- the volume of the water-skins (large, medium, small),
- the amount of water given to small animals remaining in the camp.

The amount in litres has been calculated from the values obtained by weighing 25 water-skins, the latter containing on average 40, 30, or 20 litres, according to their size. In September, when most of the women get their supplies from ponds many times a day with containers of variable sizes, it was not possible to calculate the amount of water used.

Source of supply

The sources of water vary from one region to another and across the year. Near Tchintabaraden, shallow wells constitute the major source during the dry season. In other regions, shallows wells are replaced by traditional or cement wells. Figure 4 shows the percentage of families in the sample getting their supply from different types of water point.

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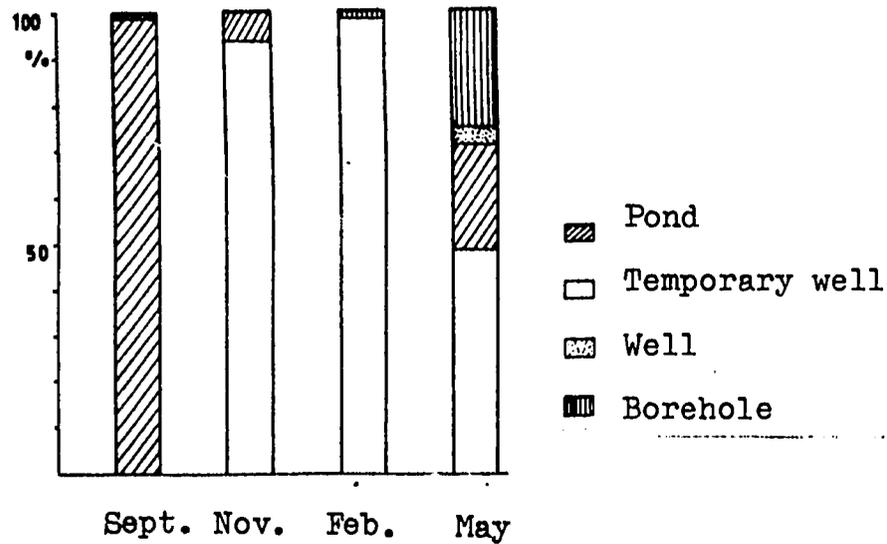


Fig 4 Frequency (percent) of water sources of 54 Wodaabe families during one year

During the rainy season (September) almost all the families drink pond water. From the cold season until at least February they use sand wells. At the end of the dry season, many shallow wells are dry and the herders use wells or boreholes. In the survey year the rains started early, at the end of May. This enabled a quarter of the families visited then to get their water from the surface ponds which had already filled. At the well family water needs are met after those the herd. The animals are watered first, then the water-skins are filled. The women and the donkeys leave the well at the same time as the animals, around 4 p.m. However, if family supplies have been used up, the water-skins are filled first and the women go back to camp immediately.

.../...

Water from the shallow wells is often muddy. But after a few hours of sedimentation, it becomes clear. Though the Wodaabe prefer the clear water of the boreholes, they are forced to drink water from wells or ponds most of the time. During the rainy season water comes exclusively from ponds. There again, the animals come before people. Cows get in the water and dirty it, but sheep and goats drink at the edge and respect the pond. The women look for clear ponds and are often forced to travel a few extra kilometers.

When they draw water, they choose the place where it is clearest : among the weeds, or areas unaffected by animals. But quite often, at the end of the rainy season the water is muddy and full of animal urine and excrement. Even though the Wodaabe dislike drinking this kind of water, they are obliged to do so. In the Dakoro area, some decant water with leaves of Boscia senegalensis.

Many filter the water from ponds with fabric or a rudimentary wicker filter to get rid of eggs and insect larva. On the other hand it is likely that, as the camps are far from water sources, contamination by human feces or domestic waste is certainly less frequent than in villages.

Transport of water

Water is carried to the camp in water-skins slung under the donkey's belly.

The water-skins are made of goat or sheep skin. Bought in the market, they are coated with butter in order to make them watertight. This does not prevent the water from seeping through the leather, but such evaporation makes it cool. The life-span of a water-skin is from 6 months to a year. The size of the water-skin varies a great deal. A large one holds on average 40 liters, a medium one 30 liters, and a small one 20 liters.

.../...



Photo 8 Donkeys leaving the well with full water-skins

Donkeys play an essential role in the lives of herders : the amount of water available in a given camp depends on the number of water-skins brought back and therefore on the number of donkeys each woman has. In the dry season, poor families with few donkeys, are not able to move away from the water source, since the women in charge of water would be forced to make many trips. This dependence limits the herds' access to good pastures which are far away at this time.

The availability of water

The availability of water in the camp is influenced by several factors :

- the distance between the source of supply and the camp,
- the transport capacity of the family,

- the number of small animals to be watered in the camp. During the rainy season, when the camp is near a pond, the women get their water there several times a day, whenever they need. Water is unlimited. When the ponds are dry, they must go to the wells, and the water brought back to the camp is limited to the household's transport capacity, i.e. the number of donkeys and water-skins.

In the camp, the amount of water for human consumption depends also on the number of animals to watered. In the dry season, young animals cannot cover the long distances from the camp to the well, so they stay in the camp. Until the age of 3 to 5 months calves do not go to the well. The importance of the amount of water drunk by the animals is shown by the fact that calves do not go to the well.

Table 5 shows the quantities of water drunk daily by each family at different periods of the dry season.

Table 5 Availability of water in the camp

	Nov	Feb	May
Number of families	46	46	46
Size of families	7	7.1	7.3
Water brought back to camp (1)	77.2	78.4	92.2
Total human consumption (1)	65	52.8	52.9
Average individual consumption (1)	9.3	7.4	7.2

(1) = liters

The amount of water brought back to the camp each day varies little during the dry season. Between February and May, it

.../...

increases only by about ten liters. The amount available per person diminishes between November and February and remains unchanged between February and May.

Water needs vary considerably by season. At the height of the dry season, the heat and the long journeys in the sun make people and animals very thirsty. Water consumption increases. However the amount of water brought back to the camp in May does not increase very much, and certainly not in proportion to the increased needs. This is because of the limited capacity to carry water, determined by a fixed number of donkeys and water-skins. Furthermore, it should be noted that the extra water brought back to the camp in May is meant for animals : the quantity available for people is exactly the same as in the cold season. In relation to their greatly increased needs, the water available per person in May is less than in the cool season.

In fact, the quantities available are certainly lower than are shown here since the figures in Table 5 do not take account of losses incurred during transport.

It is highly probable that each person does not have more than 5 liters at his disposal per day during the months of April and May. When one realises that 60 % of the camps are more than 10 km away from the water points in May and that the possibilities of stocking water for several days are non-existent, one can better understand the precariousness of the situation. The vulnerability of the camp is even greater for the many camps which depend on the same water points. This situation is especially acute around the pumping stations. Each station supplies water to a significant number of herders and herds. Thousands of animals are supplied with water every day. Should such a station suffer a sudden mishap, the situation can rapidly become disastrous. This is not the case around wells and shallow wells where the water drawing is manual,

.../...

as the number of camps and herds depending on them is much more restricted. Furthermore, the drying up which is generally progressive, gives the herders some time to look for another water point.

Water use

In the camps, the water is conserved in water-skins hanging from a tree. Some people pour part into clay or metal containers.

The women conserve water as much as possible. For example, the water for cooking is very limited. About 600 ml of water is needed to pound 2.8 kg of sorghum, plus 3 to 4 liters for cooking the paste and the sauce and 5 to 6 liters more to wash the calabashes, and prepare a special dish for the children and make the morning and evening tea.

One hardly washes in the camp. Upon waking, the adults wash their faces, their fore-arms, their hands and rinse their mouths. The real washing is at the well or the pond. The children are also washed at the well ; among the Wodaabe the children must be washed once a day, but soap is rarely used. On the other hand, detergents are used to wash clothes, also at the water point.

4. Food consumption

This survey of family consumption deals only with cereals, milk, and meat. It is based on the estimates provided by each head of family and by his wife or wives.

Cereals

The survey examines millet and sorghum consumption which together constitute the staple cereals of the Wodaabe diet composed of $\frac{2}{3}$ sorghum and $\frac{1}{3}$ millet. Two methods are used.

.../...

a) Each woman is asked about the amount of cereals pounded the day before or the preceding days under usual family conditions (in the absence of visitors).

b) The head of the family is asked about the number of sacks bought and consumed since the preceding visit.

a) The daily amount of millet or sorghum pounded corresponds to the daily consumption of cereals per family. The results reported in Table 6 provide the average quantity reported at the three visits of the dry season. During the rainy season (September) no woman pounds regularly. The food supply is purely milk.

Table 6 Quantity of cereals pounded daily per family for 3 visits in the rainy season

(1980 - 1981)	November	February	May
N of families	39	38	51
Size of family	7	7.1	7.3
Pounded cereals kg/day/family	7.33	5.06	5.56
(SD)	(± 5.35)	(± 2.28)	(± 2.9)
Cereals consumed gr/individual/day	1,047	713	762

These results show a substantial consumption in November, followed by a drop in February, then a slight increase in May. Even though November is a period of nutritional recovery corresponding to a greater food consumption, these figures seem **exaggerated**. Probably, two factors distort the results.

.../...

First, in November 1980, the women could not be questioned. In fact, they remained silent and let their husbands answer although only they can give a correct estimate of the quantities. On the other hand, some heads of family tended to overestimate the quantities, thinking that the Project would supply the families in the sample with cereals. The figures recorded in February and March, however, seem close to reality. Even if the values obtained during these two periods are high, they correspond to those obtained for agricultural populations who are solely dependent on cereals. In fact, the study of food consumption in Niger in 1964 records 781 gr of millet consumed per day and per person (16). These figures illustrate the minor part milk has in the diet of the Wodaabe from February to June.

b) If the number of sacks of cereals bought and consumed every three-month period is added up, the quantities of cereals that each family must buy for the whole year can be assessed. The figures reported below were gathered from 40 families questioned 4 times and represent an average quantity per family.

Table 7 Quantity (kg) of cereals bought per trimester per family

	November	February	May	September	Total
Method a	220	330	476	272	1,298
Method b	-	-	-	-	940

.../...

One observes a gradual increase of purchases until the month of May when the consumption of cereals reaches its highest. The values reported in September, in fact, correspond to the quantities bought in the period from June to mid-July, when milk production has become sufficient enough to discontinue consumption of cereals.

In fact, these figures indicate the quantity of cereals bought and not the total consumption. In November, 40 % of the families still barter and the amount of cereals thus obtained is not taken into account. The real consumption between August and November 1980 is therefore higher than the 220 kg reported.

With this kind of survey (a), one notices that a Wodaabe family of 7.3 people, buys 1,3000 kg of millet and sorghum per year. This method has the advantage of recording the fluctuation in purchases over the course of the year. But it is possible that the three-month intervals overlap in the memory of people and that the sacks are counted twice. This expected bias increases the reported consumption.

On the other hand, during the last visit, when 29 heads of family were asked about the total quantity of cereals bought since the beginning of the survey, a year ago (b), the average figure per person and per year was 129 kg. This corresponds to 940 kg per family of 7.3 people, i.e. 360 kg less than the other estimate. This type of survey risks omitting a few sacks and would therefore tend to underestimate the real figure. These facts do not permit a more sophisticated analysis. We can only conclude by that very probably the quantity of cereals bought per person and per year is between 129 kg and 178 kg. Few comparative studies have been undertaken. The one carried out among 33 Fafaru and Wodaabe Fulani families (Fulbe) for 10 months (7), indicates an average daily consumption of

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340.4 gr of cereals and 837 gr of milk per person. This is equal in value to a consumption of 124 kg of cereals per person and per annum. The other survey carried out in 1978 in the arrondissement of Tanout (9) among 33 Wodaabe families indicates a yearly consumption of 160 kg per person, i.e. 438 gr of cereals per person and per day. The survey obviously shows a sharp increase of the purchases of cereals by the Wodaabe herders compared to the survey in 1964 which was carried out before the drought. The increase is probably due to a lesser quantity of available milk, the herds not yet having reached their 1964 size. The results of both surveys are compared to the ones obtained from Tchintabaraden in Table 8.

Table 8. Quantity of cereals bought per person per annum.
Comparative table

	Tahoua (1964) Tanout (1978) Tchintabaraden (1981)			
			(a)	(b)
Cereals				
Kg/pers/year	124	160	178	129

Sources (7.9)

The results presented are not different. Their interpretation will be made easier by the detailed data of the budgetary survey currently being carried out among some of the sample families.

Milk

There hardly exists any data on the production of cow milk in the pastoral zone. Dupire quoting K. Kone mentions 5 liters

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per day and per cow during the rainy season (11). According to the same sources, the Bororo Zebu (ox) produces an average of 558 liters the first 6 months of lactation. It is difficult to give an estimate of the amount of milk produced by the cows belonging to one family. Milk production varies according to seasons, pastures, the age of the calf and the age of the cow. The only way to come up with reliable data would consist of measuring the amount for each family, which is materially impossible. However, in order to have an idea of the seasonal variations of milk production of one cow, we report in Table 9 the results of measures in four families at different periods.

Table 9 Milk production of Bororo cows at various seasons

	August	Nov.	Feb.	May (1980-1981)
Number of cows milked	6	21	17	0
Average quantity of milk obtained per cow and per day in liters	2.35	1.35	0.64	0

Production is at its highest in the rainy season ; as soon as the pastures dry up in September, it drops rapidly by half each trimester, to become nil for many cows in May.

The quantity of milk available per family follows, of course, the same tendency. Table 10 indicates the quantity of milk obtained daily according to estimates checked by the women in each family.

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Table 10 Average quantity of milk obtained per family and per day at various seasons

	Nov.	Feb.	May	Sept. (1980-1981)
No of families	48	49	51	44
Size of family	7	7.1	7.3	7.5
Milk obtained liters/day/family	9.6	4.7	2.7	18.2
(SD)	(<u>+4.6</u>)	(<u>+2.5</u>)	(<u>+2.6</u>)	1.1)
Milk available liters/individual/ day	1.37	0.66	0.37	2.43

The average quantity of milk available per person per day varies between 370 ml and 2.5 liters. In the rainy season it is at its highest. In November already, milk availability is reduced by half. However, it is probable that the nutritional value of milk in the dry season is higher than in the rainy season, and compensates to a certain extent for the reduction in the quantity available. In fact, from mid-September, the pastures are dry and the milk produced by the animals which graze it is more concentrated. Unfortunately, at the present time no milk has been sampled at various seasons in order to test this hypothesis.

As the dry season advances, the more the milk production diminishes. This reduction of milk availability is compensated by an increase of cereal consumption. For example, between February and May, the amount of milk drops by half. This reduction of energy supply is compensated by a 9 % increase of the daily consumption of cereals. However, even if the caloric requirements are met, the supply of vitamins

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and proteins provided by the milk is not.

Meat

During each visit the heads of families were asked about the number of animals they butchered and ate and the reasons why they did it.

In one year, 141 animals were slaughtered for the whole of the 40 families consulted each trimester. Seventy-five percent are sheep and goats. The remaining 25 % are cattle. In one year, each family slaughtered 3.5 animals on average, that is 2.5 sheep or goats and one cow.

The meat is often consumed during the rainy season, at the occasion of ceremonies and festivals and at the end of the dry season, when more than 70 % of the beasts are slaughtered because of illnesses or exhaustion.

These two causes for slaughtering constitute yearly 1/3 of the animals. The arrival of a visitor to the camp constitutes another third. Naming ceremonies and weddings are the third important cause. Slaughtering motivated by the desire to eat meat accounts for only 8 % of the beasts killed. This year, more than 60 % of the 39 cows slaughtered were killed from April to June because they were ill or dying from exhaustion. The herd of a herder represents his capital as does a field to a farmer. He kills or sells a beast only for economic necessity or social obligation, but seldom for his own consumption. Meat plays a very marginal part in the diet of the Wodaabe. It is not a staple diet. However, at the end of the dry season, the meat obtained from slaughtered sick animals constitutes a sure supply of animal proteins when there is a shortage of milk which meat, nevertheless, does not replace.

Conclusion

These results provide an idea of magnitude of the consumption of the Wodaabe herders. They show to what extent their diet

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is subject to seasonal fluctuations and dependent upon the cereal market.

The critical period for herders is during the dry season, especially between April and June.

During the rainy season, the staple diet is the milk produced by animals. In the months following, this production diminishes but can remain sufficient to allow some to be bartered for cereals. Some families can thus live until the cold season without buying millet at the market. However, for the majority of the herders, bartering is no longer sufficient and they are forced to buy cereals as early as September or October. From then on, they depend on markets and on the fluctuations of the price of cereals. As the dry season advances, the prices become higher. In April and May, the Wodaabe's dependency on cereals is 100 %. But during that season their animals are wasted and weakened from the lack of good pastures and are sold for low prices at the market. The terms of exchange between the sale of animals and the purchase of cereals become very unfavorable to herders. This is all the more so, as the herders have no control at all over the fluctuations of cereal markets and are greatly subject to its effects. It is at this season that intervention programs should be developed in order to diminish the unfavorable consequences due to those fluctuations.

If the food needs of the Wodaabe herders are to be met, efforts aiming at improving this situation should deal with :

- the creation of enough storage areas for cereals in order to cover the needs in the dry season (March to June), (the building of small storage magazines in the villages of the area, or near some water points, storage facilities with some merchants or within the framework of cooperatives, etc.) ;

.../...

- putting into practice a policy of prices which would limit speculation on the cost of cereals in this season ;

- reducing the mortality rate and the forced slaughtering of animals in the dry season by increasing the availability of food complements for animals and by developing more extensively the preventive activities of veterinary services (prevention of vitamin A deficiency) which would have the extra advantage of increasing milk production during this period.

- promoting the reorganization of the livestock in order to ensure a minimum herd of 30 to 40 heads to each Wodaabe family, and in order to get an adequate amount of milk.

Such interventions would have an impact of primary importance upon meeting the food needs of the herders and improving their living conditions.

5. Nutritional survey

Introduction

The prevalence of malnutrition in a given population is an indication of the well-being of that society. The age group which is particularly at risk is that of children under 5. They are right in the middle of their growth, and the development of their immunologic capacities and are subject to many diseases. It is also the critical moment of transition from breast feeding to sharing family food. All these factors make children under 5 an especially vulnerable group, one which is particularly susceptible to the constraints affecting a population at certain periods.

Anthropometric measures are reliable and objective indications of protein and energy malnutrition (PEM). This method of evaluating malnutrition has been used in Africa on several occasions. It was used in Niger during the 1973 drought and recently in the nutrition survey carried out in the department of Niamey in 1980 (17). It has the advantage of making possible comparisons between populations.

The reference values used in this survey are those of Stuart-Stevenson, derived from the Harvard standards (18). The level of malnutrition is therefore shown as a percentage of the median value. The lower the value and the further it is from the median (100 percent), the greater the degree of malnutrition.

Study method

At intervals of three months throughout the year all the children present in each camp aged between 0 and 5 were measured. The following anthropometric measures were made : weight, height, arm circumference, and tricipital skin fold. More details on the techniques employed are given in Appendix I.

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Anthropometric indices

The three parameters used are weight/height, height/age, and weight/age.

- Weight/height

The ratio weight/height is an indication of acute malnutrition. Acute malnutrition is a nutritional deficiency which started a few weeks before.

The child's weight decreases because of loss of fat and muscle without any change in height. This measure has the advantage of being independent of age among children under 5 (19). This is particularly useful when the exact age cannot be determined. A child with a weight/height index of less than 80 percent of the reference is suffering from acute malnutrition.

- Height/age

When a child is subject to nutritional deficiency for a prolonged period, his growth is slowed and his height no longer increases normally. A below average height can be seen as resulting from chronic malnutrition. To calculate this ratio, it is necessary to know the exact age of the child. A child whose height/age is below 90 percent of the standard is considered to suffer from chronic malnutrition.

- Weight/age

The weight of a child measured on several occasions over a prolonged period can indicate when and how long the child has been malnourished. That index cannot distinguish between the various types of chronic and acute malnutrition. A child is considered malnourished as soon as he is under 80 percent of the standard.

Results

- Weight/height : acute malnutrition, emaciated children.
Table 11 shows, in a group of 29 children followed throughout

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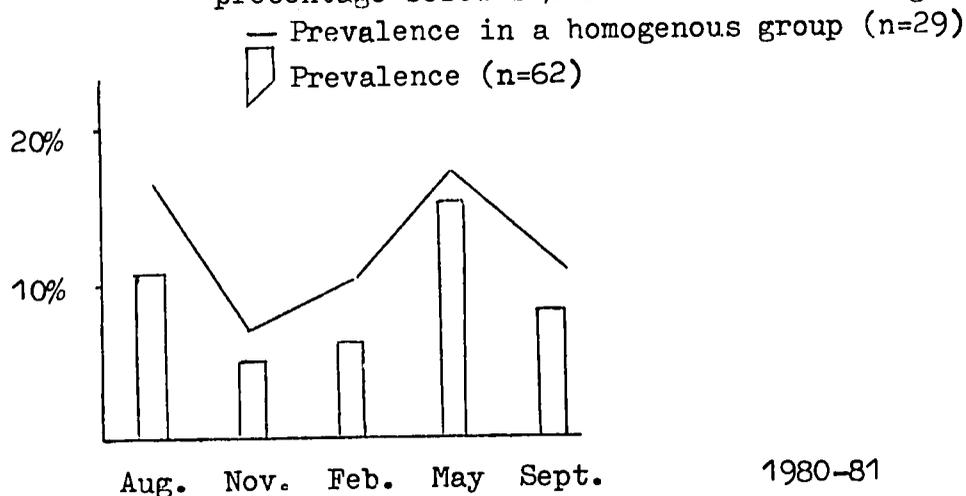
the year, the number in each class in relation to the reference standards. It shows the incidence of various degrees of malnutrition in this group of children observed at each visit.

Table 11 Prevalence of acute malnutrition (weight/height) over one year (1980-1981), indicated as percent of standard, among children under 5

	August	Nov.	Feb.	May	Sept.
N	29	29	29	29	29
100 %	1	1	1	0	0
90 - 99 %	9	13	11	9	12
80 - 89 %	14	13	14	15	14
70 - 79 %	4	2	2	5	3
60 - 69 %	1	0	1	0	0
% 80 %	17	7	10	17	10

The values are shown in figure 5 and compared with the rates of prevalence of acute malnutrition calculated during each visit. The average age of the children at the first visit is 27 months.

Figure 5 Prevalence of acute malnutrition in two groups of children from 0 to 5 years expressed as the percentage below 80% of standard for weight/height



The seasonal variations in the two sets of incidence rates agree and show an increase of acute malnutrition in the dry season followed by a gradual decrease during the rainy season, which continues until the cold season (November). The sample is too small to show more than the trend in that age group. It cannot be confirmed statistically. The rate of acute malnutrition, that is, that less than 80 percent of standard, varies from 7 to 17 percent during the year.

- Height/age : chronic malnutrition, children with stunted growth. Table 12 shows variations in the prevalence of short children (under 90 percent of the standard).

Table 12 Prevalence of chronic malnutrition (height/age) over one year (1980-1981) expressed as percent of standard among children under 5

	August	Nov.	Feb.	May	Sept.
N	30	30	30	30	30
100 %	4	4	3	4	4
90 - 99 %	13	15	17	17	17
80 - 89 %	13	11	10	9	9
% 90 %	43	37	33	30	30

There is no obvious seasonal variation like that in the case of wasted children since this measure is an indication of chronic malnutrition. There is a reduction in prevalence between the first and last measures.

The hypothesis that this represents a slow recovery from a preceding unfavorable year seems unlikely. Recovery from a low weight/height ratio takes years, not months. Given the size of the sample, this decrease is not significant*.

* The difference between the percentages of August 80 and September 81 is not significant (calculated on Rosenbaum's normogramme (20)).

It can however be said that each child taken separately follows the same pattern throughout the year, and it is rare for a child to shift categories. In fact, the increase in height is not particularly influenced by seasonal factors. It is more a measure of the adequacy or inadequacy of food consumption over several years. The average number of short children over the year is high : one child out of 3 (35 percent). An ethnic factor can hardly be the only cause. Studies have shown that socio-economic factors play a much greater determining role (21).

On the other hand the parents may have overestimated the age of children, thus increasing the proportion of undernourished children.

- Weight/age

Variations in the incidence of this index are shown in Table 13. They follow the same tendency as the weight/height ratio, with more underweight children at the end of the 1980 rainy season and during the 1981 dry season. The proportion of children less than 80 percent of standard (62 percent)

Table 13 Prevalence of children with insufficient weight (weight/age) during one year (1980-1981) expressed as percent of standard among children under 5

	August	Nov.	Feb.	May	Sept.
N	26	26	26	26	26
100 %	2	1	0	0	0
90 - 99 %	4	5	4	3	6
80 - 89 %	2	5	8	5	5
70 - 79 %	10	10	10	13	11
60 - 69 %	8	5	4	5	4
% 80 %	69	58	54	69	58

and 70 percent of standard (21 percent) is much higher, probably because of overestimation of age.

Weight gain

A more sensitive measure of the fluctuations of weight gain during the year is obtained by calculating the gains in weight of the children at intervals of three months (Fig. 6).

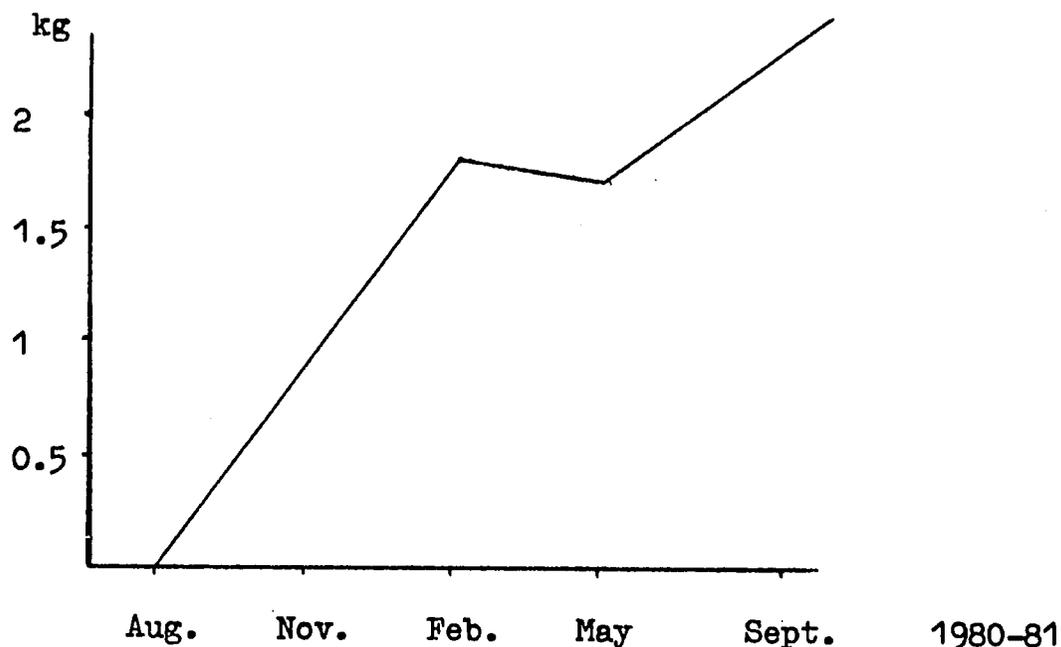


Fig 6 Weight gain in 32 Wodaabe children aged 1 to 5 years by trimester -

These gains were measured in a group of 32 children aged between 1 and 5 years and under observation for a year. Younger subjects were excluded because the gain in weight is much faster during the first year (18). Normally, the child's weight increases three fold during the first year, whereas between 1 and 5 the yearly gain is on average 2.1 kg. This allows comparison of the weight gains of children of

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differ at ages in that group. The tendency is for weight gain: which are more or less regular, with a pause during the hot season. From February to May, the children do not gain weight and some even lose. During the rainy season, the gain in weight resumes. The average yearly gain of 2.4 kg is comparable to the standard values.

- Waterlow's diagram

Waterlow (22) has proposed a classification of the various types of malnutrition in terms of weight/height and weight/age indices by comparison to international standards (14). This classification differentiates cases of chronic malnutrition (stunted children) from acute malnutrition (wasted children). It allows the identification of children at high risk, among whom an episode of acute malnutrition is added to a state of chronic malnutrition.

Table 14 Malnutrition : Waterlow's diagram
Weight/height (in % of the international norm)

		80 %	80 %
Weight/age (% of international standard)	90 %	Normal	Wasted
	90 %	Stunted	Stunted + wasted

Table 15 shows changes in the distribution of 29 Wodaabe children during the year.

Table 15 Prevalence of various forms of malnutrition during a year (based on Waterlow's diagram)

	August	Nov.	Feb.	May	Sept.
N	29	29	29	29	29
Normal	15	17	16	15	17
Wasted	1	1	3	5	3
Stunted	9	10	10	9	9
Wasted + Stunted	4	1	0	0	0

There is a slight increase in wasted children in May, whereas the proportion of the stunted ones remains stable all year. In August 1980, 4 children suffered from both forms of malnutrition at the same time, without it being possible to clearly establish the cause. It is interesting to note that these 4 children at risk recovered spontaneously during the following months. Since the sample was the same at each visit, the fluctuations recorded could not be attributed to deaths or to the birth of new babies.

- Other anthropometric measures

The extent of malnutrition can be determined by the reduction of arm circumference and the loss of subcutaneous fat. The prevalence of children aged between 6 months and 5 years showing a reduction in arm circumference and a loss of subcutaneous fat in various seasons is summed up in table 16. The reference standards are those used in the Nutrition Survey carried out in Niger in 1980 (17). The percentage of children with skinny arms, that is below the cut-off point defined

Table 16 Skinny arms and loss of subcutaneous fat by age : prevalence in each season among Wodaabe children aged between 6 and 59 months

		August	Nov.	Feb.	May	Sept.
		<u>Arm circumference</u>				
N		58	56	55	58	45
N	82.5 %	6	11	10	10	3
%	82.5 %	10	20	18	17	7
		<u>Skin fold</u>				
N		54	56	55	58	45
N	60 %	7	4	3	19	7
%	60 %	13	7	5	33	16

as 82.5 percent of the median reference standard varies between 7 and 20 percent during the year. Apart from a slight reduction during the two rainy seasons (not significant), the values are more or less identical. There are no important seasonal variations.

On the other hand, repeated measurements of skin fold show a sharp loss of fat in May ($P = 0.01$), which confirms the increase of acute malnutrition in that season.

- Pretibial Oedema

The search for bilateral ankle oedema which is a cardinal manifestation of kwashiorkor has been given special attention. No cases were observed.

Discussion

Waterlow's table sums up the general situation. More than half of the children fall into the category of normal values and stay in it all year long. On the other hand, there are some short children, 1 out of 4, the real proportion of which was perhaps biased by overestimation of age. These are the children at potential risk. Subject to chronic malnutrition, they grow less rapidly and also gain weight less rapidly. This is the reason why the weight/height ratio does not necessarily diminish. To some extent they adjust and settle down at a lower level. However, they risk slipping more easily into the most critical, wasted-stunted category, in case an acute infection or any other extra burden is added, for their resistance and their reserves are lower than children with normal values. Although the yearly weight gain remains normal, there are seasonal fluctuations, with no weight gain for many children during the dry season. As a result then, there is an increased proportion of wasted children (weight/height below 80 percent). This loss of weight is due to a significant reduction of subcutaneous fat (skin fold below 60 percent). In August 1980,

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four children suffered from acute and chronic malnutrition from causes probably linked to the situation prevailing in the months before the survey, but there was no sign that, in the critical period in May, other children passed into this high risk category. This seasonal fluctuation of weight can therefore be considered acute malnutrition which, if the critical period is extended, leads to real chronic malnutrition. The increase in acute malnutrition observed at the end of the dry season results from the interaction of several factors. There are factors which concern herders in general : the environment, nutrition, and the socio-economic situation in that season. There also exist factors which affect children more specifically.

In May men's and women's work increases. The great heat and distance to water increase their work time and effort. Even if children under 5 do not do household chores, they are indirectly affected by the constraints on their parents, whose availability decreases sharply. Then women no longer have time to prepare extra meals for their children, and they pay less attention to them. This is reflected in their hygiene. Milk is scarce. Millet paste eaten without milk is less digestible. Food quantity and quality is reduced. In addition, women who are working hard have a reduced amount of breast milk. This also contributes to infant malnutrition.

The increase in frequency of some diseases in this season also plays a part. The relationship between infectious diseases and malnutrition is well known. Measles and whooping-cough are frequently responsible (23). When water is short, diarrheas are an important cause of acute malnutrition (24.25). In May the prevalence of diarrheas among Wodaabe children rises and contributes to the increase of acute malnutrition observed at that period ; during the cold season the majority of children suffer from respiratory ailments. Quite often the children

.../...

suffer from a chronic cough which lasts from then until the dry season. This weakens the children and makes them less able to resist later disease attacks, especially diarrheas. Table 17 compares the results of this survey with those of other surveys undertaken in the Sahel.

Table 17 Results from nutritional surveys undertaken in several Sahelian countries

			Weight/height (percent of population below 80 %)	Population (age in years)
(26)	Northern Mali	1976	18	0-5
(26)	Upper Volta	1978	16	0-5
(27)	Northern Cameroon	1978	1.4	0-5
(17)	Niger	1980	8.6	0-5
	Niger	1981	12.4 nomads	0-5
*(4)	Upper Volta	1973	38 sed. 49 nomads	0-9
*(3)	Mauritania	1973	8 sed. 16.6 nomads	6
*(2)	Mali	1974	10.7	6
*(2)	Niger	1974	11.4	0-10
*(1)	Niger	1974	11.9 sed. 1.9 nomads	6
*(2)	Chad	1974	22.5	

* survey undertaken during the 1973-1974 drought

Surveys of Sahelian pastoral children are scarce. All were undertaken during the 1973 drought, among populations much

.../...

affected by starvation (4) or living in rehabilitation camps (1). The values observed are not therefore representative of the nutritional status of these populations under normal conditions. Malnutrition rates recorded in these studies are higher than the values recorded in this study.

Other surveys have been undertaken among Sahelian farming populations in recent years, but all these studies are cross-sectional, i.e. they consist of one series of measures at a given moment. None follows a group of children for several months in order to observe seasonal variations.

A survey was undertaken in Niger in 1980 in the arrondissement of Filingué and Ouallam in the north of Niger (17). The prevalence of acute malnutrition is 8.6 percent and corresponds to the rate observed among herders in the present study.

However, it is below the prevalence recorded in May, and which, in the current survey, rises from 10 to 17 percent.

The measures were taken in Filingué and Ouallam in July, at the beginning of the critical period for farmers. This season is for farmers the equivalent of the hot season in April-May for herders. It is possible that a visit in September would have shown an increase of malnutrition among those children. Chronic malnutrition (height/age) observed in Filingué and Ouallam affected 17 percent of the children. These values are below those recorded among the herders of Tchintabaraden.

The nutrition of new-born and young children

During the first two days of life, the new-born child drinks cow milk. His mother is not thought to have enough milk during that period. On the third day, the mother extracts a few drops of milk which she lets fall on the previously-heated blade of an axe. If the milk is white and flows on the iron, it is considered good. From that moment the mother starts breast feeding the infant who drinks the colostrum, and is fed on demand. If the milk is not good or insufficiently abundant, some women resort to a healer who prepares

.../...

a solution in which the breasts are bathed and massaged. She is made to drink an infusion of various plants (delbehi, burungel be'j, bagahi and sabarahi)*. The bark of bulbi infused with cooked millet husks (nyaande) also stimulates lactation. During the period when milk is inadequate, the child is given pure cow milk or milk mixed with water. Sometimes another woman can breast feed the child, but this is rare.

The infant does not drink water before he is two months old. The first food given to him in addition to maternal milk is cow milk. Goat milk is drunk only when there is a shortage of cow milk, as happens for example in the hot season. The Dubanko'en never drink goat milk because they think that it gives leprosy. Sometimes the Gojanko'en drink it, watered down to avoid the sore throat they believe it causes. Cow milk is first given around the ninth month, unless maternal milk is inadequate, in which case it is given earlier. Cereals are not given until the infant has teeth.



* See the alphabetic table of plants in the annex.-

Weaning is done by preventing the child from sucking and generally takes place when the mother is two or three months pregnant. However, it cannot be done during the two forbidden months (lebbi haramji) which follow the Tabaski feast (third moon after Ramadan).

Figure 7 summarises 279 longitudinal observations made over one year among children under 5.

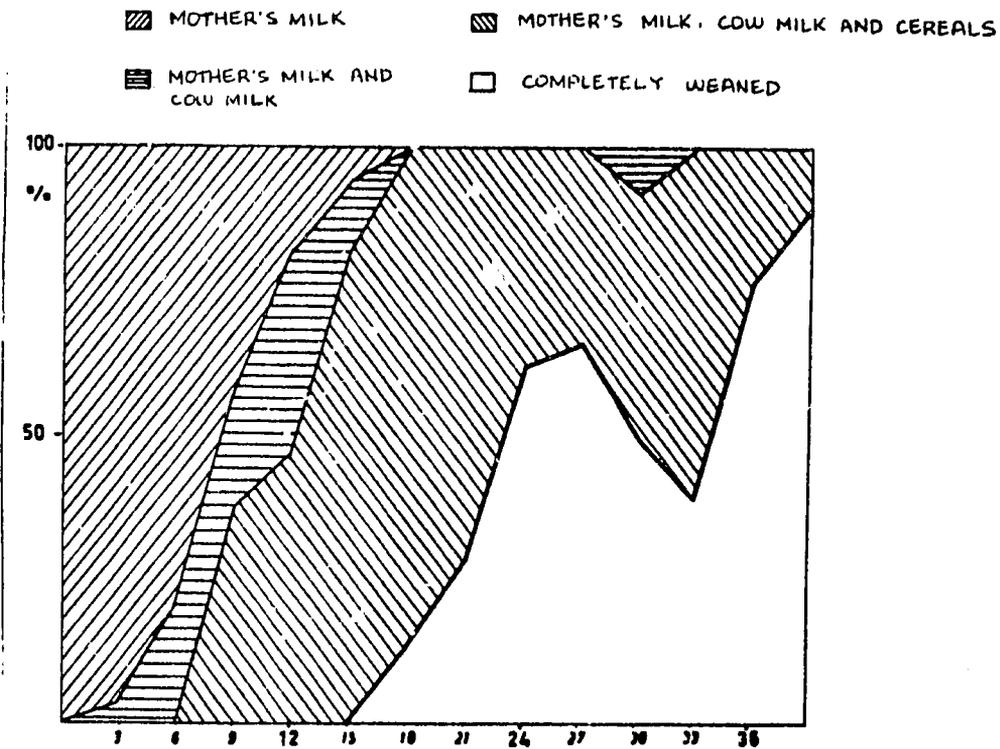


Fig 7 Food of Wodaabe children aged 0 to 30 months

The age in months is shown on the X axis ; the percentage of children with a given diet on the Y axis. This diagram shows the proportion of children of a given age with each type of diet.

Cow's milk is introduced from the third month ; by the ninth month more than 50 percent of infants drink it in addition to...

.../...

their mother's milk. Cereals are introduced as early as the seventh month, and at one year, 50 percent eat cereals. Only half of the children are weaned at the age of two.

The transition to adult food is very slow : the child is not subject to a sudden change of diet at weaning, since family meals have enough proteins, thanks to milk. Often, this is not the case in farming areas where the weaned infant shifts suddenly from a milk diet to a cereal diet with insufficient protein.

Conclusion

This nutritional survey is based on anthropometric measures which were made at intervals of three months over one year (1980-1981) among children aged from 0 to 5 years in 54 families of Wodaabe herders. The survey shows that herders' children are at risk of malnutrition in present Sahelian conditions.

The quality of their diet is good because of the presence of animal proteins, milk and cereals. The weaning of infants is progressive and covers a period of one year or more. Nevertheless, these children are subject to seasonal constraints linked to the herders' way of life, with a sharp reduction in the quality and probably the quantity of food intake at the end of the dry season. This, coupled to an increase of diarrhea observed in this period, results in an increase in malnutrition. The frequency of observed acute malnutrition rises from 8 percent in November to 17 percent in May.

The more critical the economic situation of a population, the more the impact of external constraints is felt. An important number of families in the study have not yet recovered from the 1973 drought. The majority of them do not for this reason have the minimum herd necessary to support a family. The results reflect the poverty of many herders.

6. Seasonal variations of adult weights

By definition, an adult is someone who does not get any taller and his weight is no longer influenced by this growth. Weight loss in an adult is the indicator of an imbalance between his energy needs and actual intake, and among people who are not obese, it is an indication of a nutritional deficit. Measuring the weight of adult men and women at regular intervals permits identification of critical periods in the year.

Survey method

All adult men and women present in the camps visited were weighed at three-month intervals. All men or women aged 18 and over were considered as adult, 18 being the age at which growth in height ends (28).

Only data from men and nonpregnant women measured five times during the year were analysed.

Results

Table 18 and Figure 8 show the variations recorded during the year.

The general tendency in seasonal weight variations observed, shown in Figure 8, has two phases : a peak in February and an abrupt drop between February and May. There is a gradual increase in weight during the rainy season that continues into February. From February to May, the weight loss for men is 3.1 kg, 2.4 kg for women, a reduction of 5 percent and 4.5 percent respectively. The average height of men was 176.1cm, that of women, 164.6 cm. Of 55 men measured between February and May, 10 lost more than 5 kg. Three lost 8 kg, a 13 percent reduction in their body weight.

Although women lose less weight than men, they recuperate less rapidly during the rainy season.

.../...

Table 18 Seasonal weight variations of adult Wodaabe men and women

	Aug.	Nov.	Feb.	May	Sept.
<u>Men</u>	n:32	32	32	32	32
Average weight in kg	57.7	59.5	59.9	56.8	58.2
(Standard deviation)	(+6.8)	(+6.9)	(+7.5)	(+7.2)	(+6.5)
Average difference		-1.7*	-0.5	3.1*	-1.4*
<u>Women</u>	n:30	30	30	30	30
Average weight in kg	52.7	52.4	53.8	51.4	51.4
(Standard deviation)	(+7.6)	(+8.0)	(+8.9)	(+8.3)	(+8.8)
Average difference		0.3	-1.5*	2.4*	0.0

(* test significant at p = 0.05)

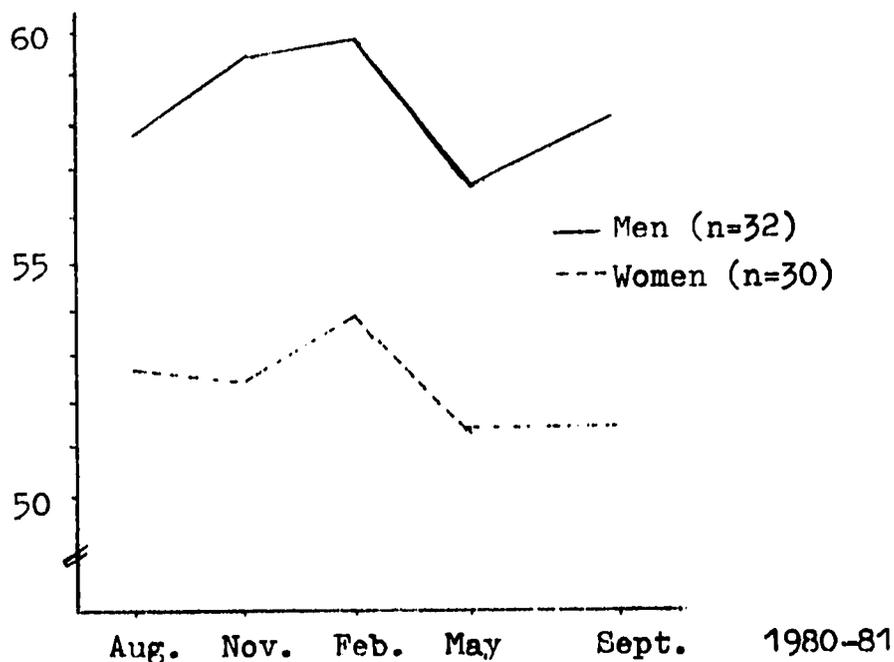


Figure 8 Seasonal changes in the mean weight of adult Wodaabe men and women

Discussion

These few figures clearly demonstrate the stress to which herders are subject from March to June. The rapid and considerable weight loss in May is the result of the interaction of several factors.



For adults, the hot season is the period of greatest work and physical activity :

- long distances between camp and well,
- long and exhausting work : the water needs of animals are increased by the heat of the season ; well water is less abundant, increased work in the sun in the middle of the

day*,

- frequent camp movements in search for new pasture and ponds, with the advent of the first rains.

Among adults sickness plays a less important role than for children. Although there is an increase in cases of diarrhea declared in May, the proportion of people who declared an illness of some sort (53 percent of the population aged 5 years and over) and persons confined to bed (32 percent) during this period do not reach the maximum values observed in the cold season. May's values are even below the annual average.

Human physical activity and environmental constraints increase to the point where food intake is no longer sufficient to cover these needs, because in this season :

- milk is almost totally lacking. The food base is millet or sorghum paste. As herders are not used to consuming this dish without mixing it with milk, it is less appetizing, less digestible, and less balanced. Further, intake is not sufficient. An obvious reduction of food quality is associated with a quantitative reduction in relation to increased needs.
- economic factors intervene. Terms of trade deteriorate during the hot season. The price of cereals increases, whereas the saleprice of animals, emaciated in this period, diminishes. This unfavorable situation pushes herders to reduce their expenditures and limit their purchases of cereals.
- access to markets is more difficult. Camps are not necessarily farther from centers, but camels and donkeys, which transport sacks of cereals, are weak and are less and less able to make the long trips. Thus herders tend to space out their trips to market as much as possible.

* The work hours of Twareg herders in the Adrar n Iforas, in Mali, increases during the dry season according to the type of animals herded. It doubles between the months of February and June, going from 50 to 100 hours per man and per month in order to water and milk a herd of 25 cattle (29).

This situation continues until herders have access to new pasture, milk production rises and their dependence on cereals diminishes.

The interrelations between the different factors that are involved in Wodaabe herders' weight loss are illustrated in Table 19.

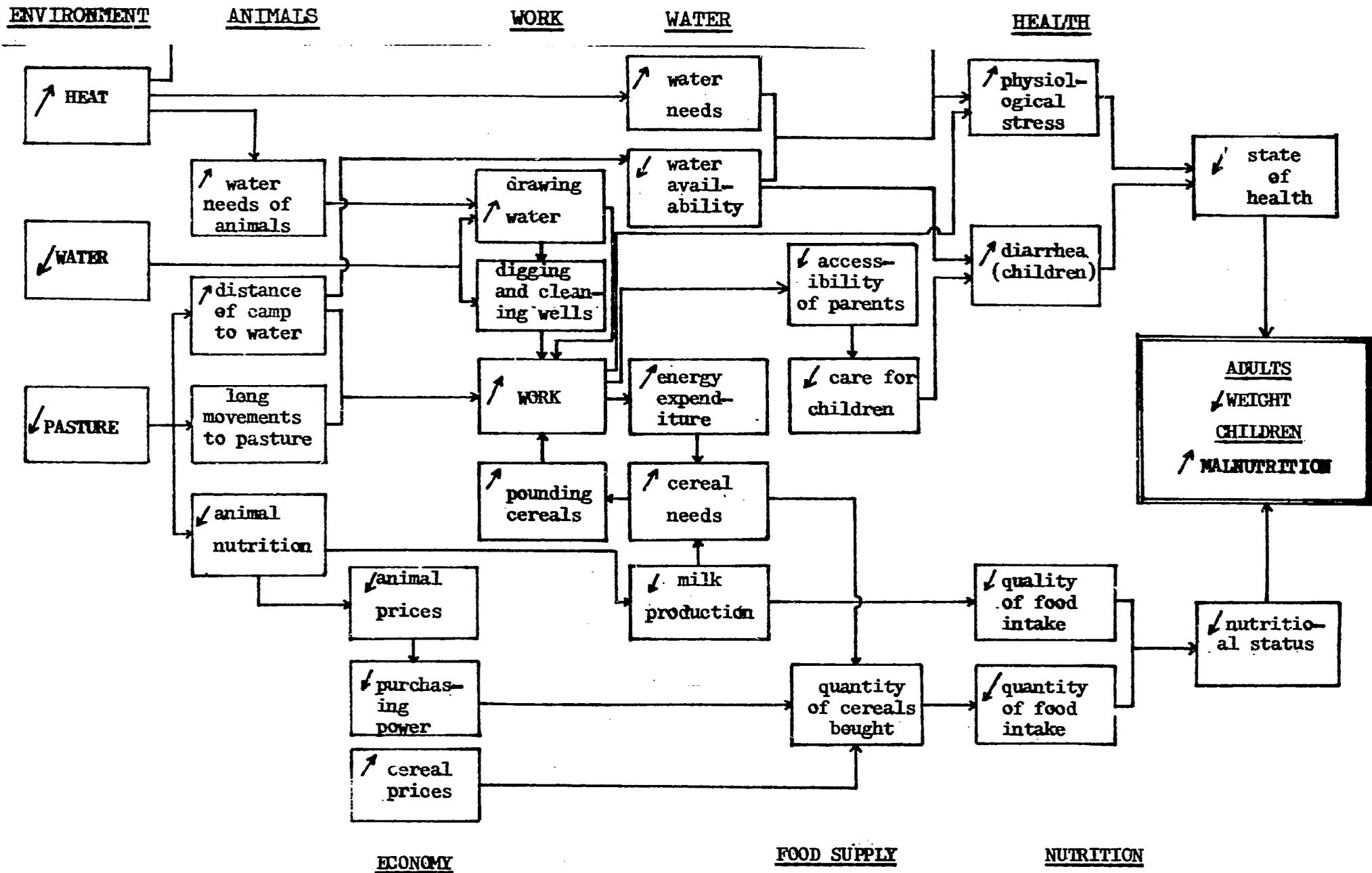
Thus in the hot season, there is on one hand an increase in energy requirements, due to environmental constraints and to the increase in work, and on the other insufficient supply caused by the reduced quantity and quality of herders' food. The observed weight loss results from this imbalance. This weight loss probably continues until the end of June, or the beginning of July. The very frequent movements which they make with the first rains in their search for the first green pastures, associated with insufficient food intake, prolongs this state of imbalance. It is only at the end of July that movements become less frequent, since pasture becomes abundant. From then on, people begin to recuperate. Although the majority of cows calve at the beginning of the rainy season, the Wodaabe do not milk them before the appearance of new pasture, in order to give the calves the maximum chance of survival (13). This practice, which is justified in terms of the future of the herd (and those who depend on it), postpones the time when milk again becomes an important part in food supply. In 1981, it was only in the middle of July, or even the end of July, that women stopped pounding millet and that milk became the only food.

The weight loss in these months among adults is rapid. By contrast, recuperation is slow and extends over seven months, up to February. It is particularly important in the months that follow the rainy season (September to November).

During the rainy season, the exclusively milk diet of the herders largely covers protein needs, but it takes 4 to 5 liters of milk a day to meet the caloric needs of an adult

.../...

Table 19 Factors causing Wodaabe adult weight loss and child malnutrition at the end of the dry season.-



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man. Such large quantities cannot be drunk easily ; in any case in many families they are not available. With the introduction of cereals in September, the diet becomes richer, leading to more rapid recuperation.

Herders are not the only people who suffer from seasonal weight variations. Several studies carried out in West Africa in peasant communities show similar variations, but at different seasons.

In the Gambia, Fox recorded a loss of more than 2 kg among adult men and women between the months of July and November (30). This period corresponds to major activities in the fields. Such weight variations have also been recorded in Ghana (31), Upper Volta (32), and other African countries (33). Weight losses take place at the time of most agricultural work, before the harvest, in the period called the soudure, when food reserves are low. At this time, daily energy expenditures of men rise by more than a third, as shown by recent work among Mossi peasants in Upper Volta (32), a country with climatic conditions similar to those of Niger. In the period of little agricultural activity (March, April), the needs are 2,410 Kcal/day for men and 2,320 Kcal/day for women. In August, during cultivation, needs increase respectively to 3,460 Kcal/day and 2,890 Kcal/day.

Populations whose food staple is a single commodity, for example millet, are more vulnerable, facing price fluctuations on the markets and variations in availability of this commodity from one year to another, or from one season to another. Greater weight variations are recorded among such populations than those having a more diversified diet or not depending on a single annual harvest.

This is for example the case in Ghana (34). The northern savanna populations show large weight variations, more than 4 kg. By contrast, lower variations are recorded in southern populations where harvest seasons are less distinct

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since bananas and plantains are harvested all year, and where people fish ; as a result, there is less dependance on agriculture as a source of food.

Herders' energy expenditure has never been measured. But the weight losses recorded at the height of the hot season, when drawing water is at a peak, indicate that their expenditure is similar or greater.

7. Conclusions

Various aspects of Wodaabe life have been described in this chapter. The information here comes from the results of a nutritional survey and observations made in the field.

The nutritional survey included a standard questionnaire completed by the 54 families in the sample at three-month intervals during one year. It shows the food consumption of each family and the food supply of newborn children. Anthropometric measurements (weight, height, arm circumference, tricipital skin fold) were carried out at each visit on all individuals present in the sample.

This study concentrated on a single herding population. Twareg and Arab herders living in the pastoral zone have somewhat different styles of life. Their herding techniques, habitat, and diet include unique characteristics. But the environment and the constraints to which they are subject remain the same. Everyone must pass the critical dry season period, and most of the findings made among the Wodaabe probably apply to other groups of herders.

The Wodaabe diet principally consists of milk, millet and sorghum. It undergoes important modifications over the course of the year : it is exclusively milk during the rainy season, but relies almost solely on cereals from April to June. Thus, the Wodaabe live on food they themselves produce only during the rainy season. The more fortunate can live until the cold season on their milk and the cereals they obtain in exchange, but the majority is obliged to buy cereals from October to July. Consequently, they are affected by cereal price fluctuations, which reach their highest price in May-June.

This is the most critical time for herders. Their purchasing power is low because their animals are emaciated at this season and sell poorly, while cereals are expensive. It is also the period of most physical effort and energy expenditure:

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the heat is extreme, the camps are far from wells (10-20 km) and drawing water takes many hours. Water available in the camp is reduced, at the time the needs of people and animals are increased.

This results in an increase in acute malnutrition, with a momentary halt in weight gain between March and May among children less than 5 years old. Among adults, there is a weight loss of 3 kg in the space of three months.

These observations show that even if the Wodaabe lifestyle is well adapted to a difficult environment, this adaptation is not without cost. Each year at the end of the dry season, herders find themselves in a highly vulnerable situation. It is at this time of year that development programs should concentrate on reducing the constraints.

It is not a question of changing the herders' way of life, but improving it, in order to maintain these people in conditions acceptable to them.

The improvements which should be provided are of three types : increase milk production, ensure an adequate cereals supply, diversify the food supply.

1) increase milk production :

- improve the food supply of animals in the dry season by supplements such as cotton seed, which furnishes an additional protein supply at a time when forage contains only cellulose. These food supplements should be given selectively to calves and to lactating or pregnant cows.
- improve animal health by developing veterinary services in the pastoral zone : training veterinarian auxiliaries, preventing vitamin deficiencies, in particular A, and vaccinations.
- see to what degree a more diversified herd would ensure a better availability of milk. Goats and camels can make use of browse during the hot season. Because of this, their milk production is greater than that of cattle at this time.

2) improve access to cereals :

- increase the quantity of millet, sorghum, and rice in existing centers and create other temporary supply centers during the dry season.
- diversify sources of food supply to ensure continuity, via the government organization (OPVN), merchants, cooperatives, even farmers themselves.
- set up some price control to discourage speculation, while allowing a reasonable profit margin to producers and merchants.
- develop the facilities in the pastoral zone for stocking cereals bought at a low price at harvest time, to assure a minimum amount of cereals per family in the hot season.

3) diversify the food supply :

The diversification of herders' food supply depends above all on the range of products offered on the local market, the accessibility of these products, and the financial resources of the herders. Food habits play an equally important role.

To introduce commodities contrary to herders' food habits or to promote perishable foods such as fruit or fresh vegetables, given the limited means of transport, does not make sense. On the other hand, measures to increase access to foods that are easily transported, produced in Niger and already sold in the pastoral zone, should have priority. For example, a policy favoring the introduction of cow peas, peanuts, or other leguminous plants on the local market at acceptable prices would be beneficial. This new supply should concentrate on the months from March to June. It would diminish herders' dependence on cereals alone.

Such programs should be accompanied by information campaigns, and should especially make sure of herders' active participation. Herders should be encouraged to play an active role in the management of food supply in the pastoral zone.

V. ILLNESSES AND HEALTH

Little is known about the health needs and problems of herders. Their way of life and their environment have unique characteristics which influence the health of these people.

This survey provides additional data on the illnesses most frequently encountered in the pastoral zone. It provides data for the development of the national primary health care program ("Autoencadrement Sanitaire") in this region of the country.

1. Health Survey

Method

The data presented here, based on a standard questionnaire filled in at three-month intervals during one year, are observations in the field and from interviews with herders. The sample included all members of 54 Wodaabe families, or a total of 397 people in August 1980.

All the subjects in the sample present in the camps visited by the survey team were questioned on the frequency in the preceding three months of illnesses, accidents, days confined to bed, and visits to the dispensary. Parents of children less than 5 years old were questioned more specifically on the following diseases : isolated fever, cough, diarrhea, conjunctivitis, and measles.

The questionnaire also required clinical observations, in particular a systematic search for goiter and vaccination scars.

At each visit, additional questions were asked of particular subgroups within the sample on measles, urethritis, scorpion stings, and snake bites.

.../...

Results

Children from ages 0 to 5

Figures 9 and 10 illustrate the seasonal variations of the prevalence of the most common complaints among children less than 5 years old.

	N = 61	60	62	68	52
NUMBER OF HEALTHY CHILDREN	27	15	8	16	17
NUMBER OF COMPLAINTS	43	30	62	73	35

FIGURE 9. SEASONAL PREVALENCE OF THE 5 MOST COMMON COMPLAINTS AMONG WODAABE CHILDREN AGES 0 TO 5.

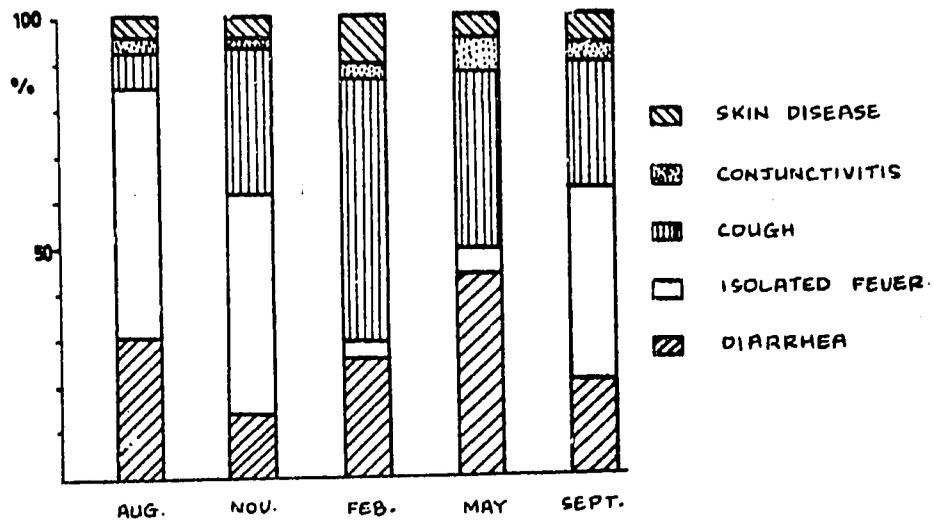
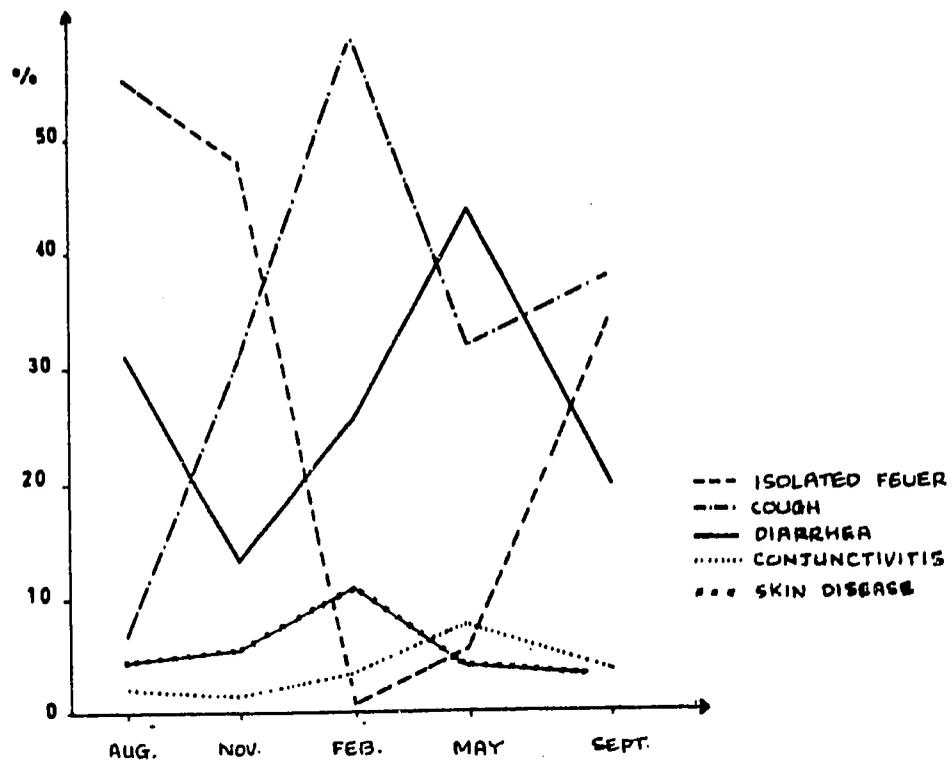


FIGURE 10. SEASONAL VARIATION IN PREVALENCE OF ILLNESSES AMONG WODAABE CHILDREN AGES 0 TO 5.



Fever is dominant during the rainy season and the following months (August, September, November), but is reported very little in February and May (1 percent and 5 percent).

Cough is present all year long and reaches its peak during the cold season in February. At this time, 59 percent of the children cough.

Diarrhea is reported increasingly from November, reaching maximum values during the hot season in May (44 percent), whereas in the rainy season it does not represent more than a fifth of the diseases reported.

Although the author has remarked on the high frequency of skin rashes in the cold season, these are little reported as is conjunctivitis.

In the cold season, one observes a renewed outbreak of the group of illnesses. In this period, only 8 percent of the children have not become sick, whereas in September, 32 percent do not report any illness.

No case of measles was reported during the whole length of the survey. In questioning the parents on the past record of measles of their children less than 10 years old, it was established that only 4 percent of the children below 5 years old (3 out of 76) and 28 percent of children aged 5 to 9 (17 out of 61), had contacted it, in total, 15 percent of the children less than 10 years old.

- Children more than 5 years old and adults

Table 19 reports the prevalence of the 5 diseases the most frequently reported at each visit, and Figure 11 permits better visualization of the seasonal variations of these complaints.

One does not observe significant seasonal variations of the ensemble of illnesses reported. On the average, 59 percent of the subjects reported having been sick in the course of

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the three months preceding the visit, and the women more than the men.

The complaints totalled over one year (August 1980 to May 1981) are by order of importance : fever (221 cases), cough (206 cases), bonejoint pains (146 cases), diarrhea (91 cases), skin diseases and wounds (65 cases).

Fever predominates during the rainy season and in the months that follow (30 to 40 % of the complaints), then drops during the cold season and the hot season. Cough is at its maximum prevalence during the cold season, making up more than 50 % of the complaints. Bone-joint pains are present all year with a small renewed outbreak in the hot season and in the rainy season. Diarrhea follows similarly, slightly increasing in the month of May. With regard to skin diseases, they are little reported. A slight increase in frequency is noted during the cold season and hot season. Conjunctivitis is also infrequently reported (2 to 4 %).

The peak time of being confined to bed observed in February coincides with the highest prevalence of cough. Forty-five percent (45 %) of people of work age (12 years and over) had to be confined to bed at least once, and cough was the cause in 64 % of the cases.

- Vaccination scars

The systematic observation of shoulders and forearms in the search for vaccination scars (smallpox and B.C.G.), among herders aged 20 and older, shows that 80 % carry scars, for the most part on the forearm.

It turned out that in 80 % of the cases, these were scars from smallpox variolation done traditionally at times of smallpox epidemics. This practice existed in numerous African societies. A drop of pus was collected with a needle from the lesions of a person with smallpox, and introduced under the forearm skin of a healthy subject. This practice, according the old people, provoked the sickness, but in a less virulent way.*

* The last 6 cases of smallpox reported in Niger date/1969 (35)

Table 19 Prevalence of the most frequent complaints registered every three months during one year (subjects age 5 and older)

	Aug.	Nov.	Feb.	May	Sept.
	n (%)				
n	343	324	320	343	278
Subjects sick	200 (58)	192 (59)	213 (67)	183 (53)	163 (59)
Episodes of all illnesses	269	241	268	240	214
Fever	108 (40)	75 (31)	17 (6)	21 (9)	58 (27)
Cough	2 (1)	24 (10)	145 (54)	35 (15)	30 (14)
Rhumatisms	52 (19)	32 (13)	22 (8)	40 (17)	27 (13)
Diarrhea	23 (9)	15 (6)	14 (5)	39 (16)	24 (11)
Dermatitis, wounds	13 (5)	14 (6)	21 (8)	17 (7)	13 (6)

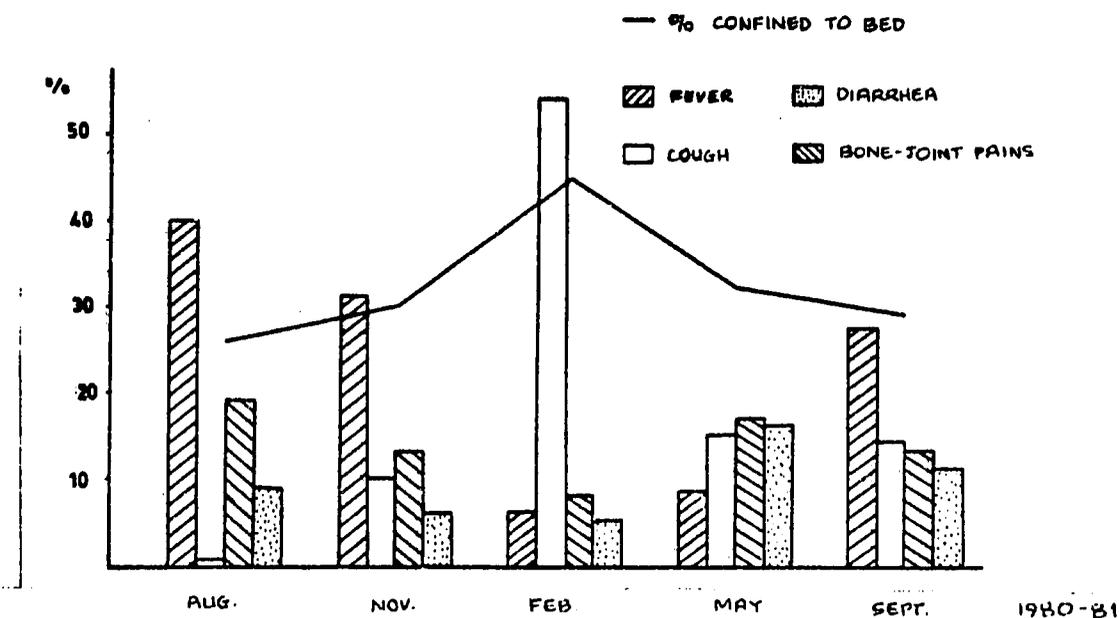


FIGURE 11. SEASONAL VARIATION IN THE PREVALENCE (%) OF THE FOUR MOST FREQUENT COMPLAINTS VARIATION IN THE RATE OF INCAPACITATION.

Goiter

In the November 1980 visit, all the necks of the women were examined using hyperextension according to Perez' technique (18). No goiter was observed. This disease is rare in the pastoral zone. At the time of visits in the bush, only one case was observed.

It is possible that the absence of goiter among herders is related to their consumption of Saharan salts. Unfortunately the author, despite numerous searches was not able to obtain precise information on the amount of iodine consumed.

Discussion

Each season brings its share of illnesses. Fever dominates during the rainy season and the months that follow : cough prevails during the cold season and diarrhea is most frequent during the hot season.

With a one to two month delay, fever follows the seasonal cycle of the presence of mosquitos in the pastoral zone. As soon as the ponds are full and the pastures green, the mosquitos appear, in general, in the month of July. They are present until the end of September and disappear as soon as the pasture dries. The bush is then devoid of mosquitos until the following rainy season.

The presence of mosquitos during these three months explains only the strong prevalence of the fever observed from August to November and its sudden drop in the cold season. Although no parasitological survey has been conducted, this high prevalence could be attributed to malaria which spares neither children nor adults.

From August to November, malaria constitutes a priority health problem in the pastoral zone. Many herders are afflicted at the time of the rainy season movements, and fever attacks oblige them to stay in bed for several days, upsetting the progression of the herds.

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A survey carried out among the Malian herders of Gourma (36) at the end of the dry season, revealed a high plasmodium index (63 % of thick smears). These results suggest the importance of malaria among herders, even in a region where mosquitos are absent nine months out of twelve.

Cough constitutes among small children a constant complaint over the course of the year, with a peak in the cold season. Among adults and older children, its prevalence is equally maximal in the cold season, but is rarely reported the rest of the year.

Cough is a particularly debilitating condition to herders. It constitutes the principal cause of confinement to bed in the cold season, where half the individuals of working age are obliged to go to bed for a few days, at least once in three months.

The high prevalence of cough in the cold season is related to the scant protection against the cold and wind which predisposes herders. While some construct straw huts, the majority has no other protection against the east wind except the branch screen which demarcates the suudu and the small thorny forests to the west of where they establish their camps. Their clothing is very limited and many do not even possess blankets. Further, small children are rarely dressed and often sleep on a mat on the soil itself. Together these conditions make the majority of children and adults cough and suffer respiratory diseases from December to March.

Diarrhea affects particularly children less than five years old, with an increased prevalence in the hot season. At this time, this disease represents 44 % of the reports. This increase in May is related to the reduction in availability of water when camps are far away from water points and the capacity to transport water is limited, although the needs are increased.

Caused by diverse agents (enterovirus, adenovirus, rotavirus, salmonella*, shigella), in the majority of cases, diarrhea stops in a few days. It nevertheless remains an important pediatric problem because of the risks of dehydration, particularly high in April and May, when the extreme heat triggers the appearance of cases of acute malnutrition observed in this season.

Skin diseases and conjunctivitis are greatly underreported. Nevertheless, in the cold season, numerous herders have deep crevasses in their feet. The cold and dry air, the dust, and especially the work of digging and cleaning the sand wells, where feet are in water, dry up the skin which cracks. These injuries are painful and sometimes infected.

Children frequently develop boils and skin rashes fostered for weeks by the dust, the lack of care, and by application of traditional plasters.

Conjunctivitis is common throughout the dry season, in particular from the cold season until the first rains. The author is struck by the frequency of ocular injuries observed among adolescents and adults, in particular the strong prevalence of pterygium. The wind, dust, and the intensity of light rays maintains over years an inflammatory state that gradually produces this hardening of the conjunctiva.

Only 15 % of the children less than 10 years old were reported to have contracted measles. The incidence is low, sometimes nonexistent in certain years. But this disease may be serious and is recognized as such by the Wodaabe. The epidemics, when they occur, touch not only children, but also adolescents. If one wishes to compare these results with the observations

* Salmonella in animals, notably in camels and frequently observed in this species, can infect humans.

made in the dispensaries of the arrondissement of Tchintabaraden, it is necessary to know that one is comparing totally different populations, with different styles of life and food supplies, even if they live in a same region and under the same climatic conditions.

For example, in a locality like Tchintabaraden, in the heart of the pastoral zone, mosquitos are present all year, even in the cold season. They are found particularly in houses where the temperature is warmer. Transmission can occur all year long. This is a possible reason why fever is the most frequent diagnosis during the whole year (12 %)*.

Diarrhea does not show a clear seasonal variation in the arrondissement as a whole. By contrast, in the regions located further south and in Niger in general, the prevalence of diarrhea increases during the rainy season**.

These results show that the distribution of illnesses over the course of the year is appreciably different in villages or agricultural regions. Health development programs in the pastoral zone should take that into consideration, in particular as it concerns the medicines put at the disposition of health auxiliaries.

They also show that diseases like cough or fever often force herders to stop their activities. Thirty percent (30 %) of herders are incapacitated several days in each trimester, with an increased rate during the cold season. In a family, each adult and child of work age plays an essential, active role. When one of them is confined to bed because of diarrhea or bronchitis, his work must be carried out by another. A sick person in a family is an enormous burden, all the heavier when the family is far from other camps and cannot count on the help of close relatives. Movements become difficult, and often impossible.

* Trimestrial reports of medical care from the Medical Center in Tchintabaraden.

** Report of Activities 1977-79 Ministry of Public Health and Social Affairs, Republic of Niger.

Complementary surveys

- Urethritis

For many nurses working in the pastoral zone urethritis is considered one of the major problems affecting herders. So, at the time of the May 1981 visit, all men older than age 15 were questioned on their past history of urethritis. In order to avoid the obvious embarrassment of reporting this disease in public, each man was removed to a distance and interviewed as discretely as possible.

Of 73 men questioned, 63 % (n = 46) reported having experienced at least one case of urethritis. Among them, half (n = 24) were attacked three times or more. Seventy-six percent (n = 35) among them sought care at dispensaries and 17 % (n = 8) were treated both in the bush according to traditional methods and at the dispensary.

Urethritis, whether its origin is bacterial or parasitic, is frequent among the Wodaabe. According to the old people, it is much more widespread since the young people have gone to work in the large southern cities and, according to their statements, it sometimes reaches epidemic proportions.

The social rules of Wodaabe society, in other respects very strict, authorise a man to court other women than his wife, and vice-versa, in particular during festival occasions and especially before his household is constituted. This results in an opportunity for more frequent contacts between different partners than in other societies. Thus, it is not astonishing that illnesses are frequently **sexually** transmitted.

The majority of men affected go to the dispensaries to be cured. Since the Wodaabe rarely seek treatment for other diseases, urethritis is a disproportionately represented reason for consultation. For this reason, nurses identify it as the major health problem in the zone.

Each year the Bororo Festival is held near Abalak. It is a

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large gathering of Wodaabe herders over several days. The Departmental Hygiene and Mobile Medicine Team (DEHMM) from Maradi provides the health coverage. If one consults the activity reports, urethritis represents 6 % to 11 % of the consultations (reports of 1978-1980).

These few data confirm that urethritis constitutes an important health problem that merits being investigated in depth. Systematic samplings carried out in dispensaries would reveal the true frequency of gonorrhoea in relation to urethritis of other origins so that treatment can be adjusted accordingly.

Presently, all urethritis seen at the dispensary is treated with penicillin. But often the injected doses are too low and need to be repeated to be therapeutically effective.

The introduction of an effective therapeutic program requiring a single dose of 4.8 million IU of procain penicillin injected intramuscularly and 1 gram of probenecid taken orally would permit treating a patient once. It would avoid partial cures of those being treated by complicated therapeutic programs and who live too far from the dispensary to come back the next day.

- Scorpion stings and snake bites

Continually living in the bush, and moving often at night without lighting, herders are a particularly exposed population.

Questioned about the number of scorpion stings and snake bites occurring in their life, 74 % of the adults, age 20 and older (120/163) reported having been stung by a scorpion. Only 4 % of the children below age 5 had been stung (2.52). No mortal cases were reported.

The sting is described as very painful for a few hours but leaving no after-effects or presenting complications. It is interesting to note that very few children are stung, although constantly running in the bush.

Snake bites are less frequent, but bring more risks. They occur exclusively among adults. No children less than 10 years (n = 107) and only one subject between 10 and 20 years old (n = 67) is reported to have been bitten. Of the 161 adults older than 29 years, 39 subjects, a quarter of this population, were bitten a total of 53 bites. Men and women are equally attacked. In 81 % of the cases, the bite was located below the ankle, and a moderate swelling, occasionally significant appears in 42 % of the cases. Half of the subjects are incapable of walking for a few days. Signs of trouble with blood coagulation (spitting or urinating blood) are reported by a quarter of the subjects bitten. The majority of people are bitten at night, during movements. Over the course of the year's survey, three snake bites were reported, without the question being specifically asked each time. For a population of 400 persons, this gives a 7.5 per thousand incidence.

If scorpion stings do not represent a real health problem, it is different for snake bites.

Snakes frequently encountered in this region are types of vipers : Echis carinatus, Causus, and more to the north, Cerastes cerastes. Naja nigricolis is more rarely seen.

The figures reported show that morbidity is high. A quarter of the herders are bitten in their life and one half the bites immobilize the victims an average of one week.

These values correspond to those found in regions of sparse population density in the north of Nigeria (37). In the Benue valley, the incidence is 5 per thousand, and the mortality due principally to the Echis carinatus viper is estimated at 12.2 percent of those bitten.

Unfortunately, it is not possible to estimate the mortality caused by snakes in the pastoral zone.

Presently, the dispensaries are not equipped to fight against the complications from snake bites. Serious cases must be

evacuated to departmental hospitals which provide the serum and other therapeutic modalities.

Some improvements could be made. They could be of three orders :

- better inform herders, using the intermediary of health auxiliaries, of the preventative measures against infection at the level of the bite ;
- to encourage the diffusion and use of the black stone or another method of absorbing the venom ;
- to improve the prophylactic treatment of bite complications at the dispensary level.

Conclusion

By questioning all 54 Wodaabe families every three months for one year, one obtains an image of the seasonal variations of the prevalence of the most frequent diseases.

Fever shows a peak during the rainy season and the following months, cough is at its maximum frequency during the cold season, and diarrhea increases particularly among children in the hot season. Rheumatism and muscular pains are reported all year long. Skin diseases are more frequent during the cold season and conjunctivitis is present especially from January to June.

These seasonal variations are connected to environmental changes and climatic variations over the course of the year. They are also influenced by food supply, habitat, and the lifestyle of the Wodaabe herders.

In their turn, the illnesses mark the Wodaabe's life. They often force herders to cease their activities and constrain them to remain in bed. Fever and respiratory diseases are the principal causes.

Elsewhere, they influence the nutritional status of children, in particular diarrhea, which triggers the malnutrition observed at the end of the dry season.

Illnesses restrict the mobility of Wodaabe herders. When the head of the family is confined by an attack of malaria, the family can no longer move, and his wife is compelled to assume more of his domestic activities, the tasks of herding. The family is an autonomous unit which functionally depends on the participation of all. Each individual has his role. When one person is sick, his share of work must be taken charge of by someone else. It is the basis of the family's survival. To arrange to provide herders with medications such as aspirin or chloroquine can have a major impact by avoiding prolonged bed confinement and by maintaining the functioning family unit. One such objective can be easily reached by developing the Primary Health Care Program (Autoencadrement Sanitaire) in the pastoral zone.

The geography and the division of the population in the pastoral zone presents certain epidemiological characteristics. Many parasitic diseases are absent from this arid region because conditions are unfavorable to their development. This explains the absence of the different filariases, intestinal worms, and trypanosomiasis*.

The dispersion of camps protects them from large epidemics. For example, measles can be absent for years or remain localized in small regions. But it is possible that this situation is in the process of changing.

We are, in fact, experiencing a large mixing of populations in the pastoral zone. Since the drought in 1973, emigration has greatly increased. Many Wodaabe and other herders leave the zone to go work or sell traditional medicines in the southern cities during the dry season. The extension of the road network and the development of centers in the pastoral zone favor the exchanges and the contact of populations of different origins.

* By contrast, schistosomiasis is endemic in the localities bordering large ponds in the south of the pastoral zone.-

These movements risk modifying the health profile of this region and favor the appearance of illnesses absent or rarely seen in the zone (intestinal parasites).

With the development of transport means and the roads, the pastoral zone will lose its isolation. This new opening will change the health situation of herder populations in this region, but should equally permit a wider development of the health services.

2. Other sicknesses

Considered in this chapter are certain diseases frequently reported among herders and those whose prevalence is highest in populations living in close contact with animals.

Vitamin A deficiency

In May 1981, 12 women in the sample complained of night blindness. All of them were pregnant or nursing an infant. This vitamin A deficiency is attributed to a lack of milk, main source of vitamins for herders, a frequent situation at the end of the dry season. Night blindness, called by the Wodaabe danndumi, is also linked to the low concentration of vitamin A in cows' milk in this season. It is due to the lack of provitamin A supply to the cows since the disappearance of green pastures in September. By March, their reserves are exhausted and the signs of vitamin deficiencies appear. In some regions of the zone there are bushes which remain green during the hot season (Maerwa crassifolia, Boscia senegalensis, Salvadora persica). Animals who browse on these leaves thus obtain a certain supply of provitamin A which delays the onset of signs of deficiency. But this supply is often insufficient, and the intervention of the Livestock Service is necessary, because this condition is deadly for the calves in this season. A campaign to supply vitamin A to animals, organized by the Livestock Service, would have the advantage of preventing this high mortality.

Vitamin A deficiency appears first among animals, then among humans, affecting particularly pregnant women and those who are nursing.

During the 1973 drought, 40 % of the herders had eye problems due to vitamin A deficiency as opposed to 25 to 30 % in the rest of the country (38). We know that vitamin A deficiency combined with measles, for example, is an important source

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of blindness in Africa. Traditionally, herders treat themselves by applying goat or lamb's liver on their eyes and by eating a bit after having grilled it.

Tuberculosis

If one agrees with the hypothesis that the incidence of tuberculosis in the pastoral zone should be identical to that observed in the rest of Niger, three new cases per thousand inhabitants should be diagnosed each year. That makes 300 new cases for the entire arrondissement of Tchintabaraden, occupied by a little more than 100,000 inhabitants.

Elsewhere, in 1979, a survey carried out at the central dispensary of Niamey by the Centre National Antituberculeux (CNAT)* shows that 15 % of the patients older than 15 years showed pulmonary symptoms suspected of tuberculosis, and among them, 19 % had a sputum examination positive for tuberculosis. However, at Tchintabaraden, of more than 2,200 cases of chronic cough reported in 1980, only 7 cases of tuberculosis were diagnosed.

These results show the importance of carrying out systematic sputum examinations within this population in order to effectively detect this disease. Since 1981, the Centre Médical of Tchintabaraden has been equipped with personnel and the necessary material to perform and to interpret the smears on the premises.

In Niamey at the CNAT, a high proportion of the patients with bony or cervical tubercular adenitis are herders (personal communication of Dr Pestiaux). Very often, these forms of tuberculosis have milk as a source of contamination. Each year, a BCG vaccination campaign takes place. However, the coverage rate of rural populations is variable as the

* Rapport d'Activités 1979 - Ministère de la Santé Publique et des Affaires Sociales, Niamey.

1979 activities report on the BCG vaccination campaign* reports. In 1978, the global coverage did not go beyond 59 % of the children, but in the schools, 90 % of the children were vaccinated. In the Tanua department, 40 % of the children less than 15 years old had scars. Of 110 herders' children observed, 21 % showed a scar. This figure of 21 % is certainly higher than the real coverage, because the sample was taken only from children examined near wells or pumping stations located close to dirt roads where vaccination teams pass. Reality is probably closer to the 10 % (children from 0 to 15 years) observed in the present survey. Vaccination coverage is low.

There is no doubt that tuberculosis exists in the pastoral zone and that it should be actively searched out according to the recommended strategy.

Syphilis

Very often, the venereal and endemic form are confused. Due to this, it is difficult to interpret the observations recorded in the dispensaries. Further, no representative epidemiologic survey has been carried out in the pastoral zone. The only data available come from the activities reports of the dispensaries and some earlier surveys.

- Venereal syphilis

In 1979, when venereal syphilis was less than 2 % of the clinical diagnoses made throughout Niger, it was 5 % at Tchintabaraden. In 1980, it represented 2.3 %

If one considers other arrondissements in the pastoral zone (Tera, Tillabery, Tanout, Goure), all have a rate lower than 1 %*. Thus, one cannot speak of a higher incidence of the

* Rapport d'Activités 1979 - Ministère de la Santé Publique et des Affaires Sociales, Niamey.-

illness throughout the whole pastoral zone, but only of a particularity observed in Tchintabaraden.

At the Bororo Festival, the diagnosis represented 1 to 7 %* of the total diagnoses. There too, it is difficult to know the real frequency of the disease. Very often the diagnosis is presumed and as the nurse has no serological means to confirm it, he records it as such.

- Endemic syphilis

Endemic syphilis is often discussed but its endemicity is much less than before. Two surveys carried out in Ingall in 1953 and 1968 permit better detection of change in frequency. The results were obtained from populations who sought medical treatment, thereby creating a selection bias and increasing the real frequency of the sickness.

In 1953, of 1,474 subjects examined, 17 % showed lesions characteristic of syphilis, and 33 % were former syphilitics. Thus, at least 50 % of the subjects had contacted syphilis (40). In 1968, of 100 herders consulted, 4.2 % of the subjects showed clinical signs of endemic syphilis (41).

The change observed between these two surveys suggests a net reduction of the endemicity of endemic syphilis since the generalized use of penicillin.

At present, in Niger, this disease represents 1 % of the total diagnoses made in 1979, and 3 % in Tchintabaraden, Arlit, and Agadez**.

The epidemiological summary of WHO (1981) cites results from sero-clinical surveys (nonspecified) to give 2 to 6 % of the advanced clinical cases among farmers, 8 to 15 % among herders, with ranges of positive serology (nonspecified) from 8 to 19 % and 18 to 26 % respectively (42).

* Rapports d'Activités de l'EDHMM de Maradi, 1978-1980

** Rapports d'Activités 1977-1979 Ministère de la Santé Publique et des Affaires Sociales, Niamey.-

In the survey carried out in 1979 among herders from Gourma, Mali (36), 6 % of the people examined showed clinical signs of nonvenereal treponematosi s and 42 % had a positive T P H A test. The prevalence is higher among the Twareg, Bella, and Maures than among the Peul. Unfortunately, the results are biased by the type of survey used. Only patients who came unsolicited for examination and treatment were examined. This gives rise to a high incidence of the disease within such a sample as compared to the real incidence within the entire population.

Endemic syphilis exists, but since the intensive use of penicillin, the chronic deforming forms have disappeared. It would be important nevertheless to conduct a representative and controlled serological survey in order to know the real incidence and to adopt therapeutic interventions.

Brucellosis

With unspecific clinical symptomology among humans, brucellosis is difficult to diagnose without the help of a laboratory.

Due to this there is a paucity of reported cases. However, the few serological surveys carried out show that brucellosis exists in Niger (Ibeceten, Toukounous, Kirkissoye) (43).

Thirteen percent of the animals had a positive serology, being one animal in 10 that contracted brucellosis.

It is, however, difficult to extrapolate these results to the entirety of the pastoral zone, knowing that the incidence of this disease is probably lower than at the ranches, where the density of animals is greater than in the bush.

In 1981, 1,018 human sera were collected from schools, from slaughter house workers, from the OLANI diary workers, and in the village at the Toukounous ranch (44). Of the subjects, 10.6 % were positive with a 13.4 % rate for the slaughter house and OLANI personnel, particularly exposed by their profession. Another survey carried out in Malian Gourma in

1979, in the herder populations (36), observed a 24.8 % rate (305 cases out of 1,228) of positive subjects, tested by the rose bengal test (21.7 % of 166 serological exams were positive by immunofluorescence).

Without knowing the exact incidence of this disease in the pastoral zone, these results give an idea. It is strongly possible that certain prolonged, recurrent febrile states have brucellosis at their origin ; or that one boDaabo encountered with history of lumbar abcess resulting in partial paralysis of the left leg was a brucellosis complication (or, Pott's disease).

Presently, the means of detecting brucellosis are nonexistent in the dispensaries and the long treatment with tetracycline (one month) makes all treatment on an empirical basis. A joint action between the Livestock Service and Health Service should be envisioned to evaluate its incidence in the pastoral zone and to control the disease.

Anthrax

Anthrax and black leg are among the most frequently reported diseases of cattle in the pastoral zone. Anthrax strikes the animals particularly during the rainy season. The Wodaabe know this disease well. They call it garsa or henndu, and when an animal dies of anthrax, they cover it over with branches in order to prevent other animals from approaching it and from infecting themselves. They also know that man can catch the disease by touching or by consuming the meat of an infected animal. Some do not eat this meat, others consume those portions of the meat that are unaffected by the disease.

The prevalence of anthrax among herders is not known. No case was reported in the clinics. However, this disease certainly exists and should be researched among herders.

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Rickettsiosis

The number of cases reported annually in Niger is very low (a maximum of 28 in 1960), since the diagnosis is serological. A survey was carried out among 50 herders in Maradi. No serum was positive for other forms of rickettsiosis (45). This suggests a certain degree of endemicity of these diseases, particularly in populations in close contact with animals.

Foot and mouth disease

These epidemics regularly attack herds in Niger. Herders can be contaminated.

Rabies

Each year, approximately 100 bites suspected of rabies are reported for the whole of Niger, but that is as much as we know of the incidence of this sickness. In 1980, no case of rabies was noted at Tchintabaraden.

Parasitosis connected to cattle

- Tenia saginata is very probably present. The consumption of poorly cooked beef is the source of the contamination.
- Hydatid cyst is very rarely noted. Absent in the autopsies done on small ruminants and cows at the Tahua and Niamey slaughter houses, it exists among camels (13 % at Tahua) (personal communication, Dr Tager, INRAN). This said, camel meat is hardly consumed, and in order for humans to become infected, it is necessary that the parasite complete its life cycle in dogs. Hydatid cyst probably is not a medical problem, even among herders.
- Liver fluke occurs among animals along the river and in the dallols. Only people consuming green vegetables (cress) can contract it. This sickness is probably absent in the pastoral zone.

Conclusion

There is very little available data on diseases in the pastoral zone. Epidemiological surveys are necessary in order to determine the incidence of these illnesses and to be able to define the actions to undertake and the priorities to give to health programs in the pastoral zone.

3. Traditional practices

These remarks were collected from conversations with Wodaabe women from the Tchintabaraden and Filingue arrondissements. The author tried to best retranscribe the practices such as they were described to him, in order to better understand the customs and conceptions of the Wodaabe.

Pregnancy

For the Wodaabe, pregnancy lasts 10 lunar months. Sometimes the child is born before. If he comes in seven months, something very rare, he is so small that one cannot carry him on the back. He is placed in a calabash.

Pregnancy is not subdivided into distinct periods. The Wodaabe recognize certain particularities in the pregnant woman : vomiting at the beginning of pregnancy (pepere), her emotionalism, her desires to consume certain plants or to ingest the earth from termite nests, a symbol of fecundity. The skin of pregnant women is redder and one distinguishes a slight swelling of the tip of the nose. Her urine is less abundant. According to some women, a pregnant woman must not eat meat or sweets nor drink tea. That would be bad for the child. Others feel she can eat everything, including salt. Without knowing what is the exact position of the child in the stomach, they think that it turns in the belly until the head descends at the time of birth.

For some women, complications in pregnancy do not exist ; others indicate that if the ankles swell, it is the woman's fault, the latter not having done what was necessary at the time of previous pregnancies. No treatment is known. In the case of hemorrhages, the old women recite verses (ayaare) ; the cause of the harm to them is unknown.

At the fifth month of her first pregnancy, the boDaaDo woman goes back to her mother's household. She stays there one year or more, sometimes until the weaning of her child. During this period, she is called bofiDo. Her mother supplies her

with a long necklace carrying numerous talismans. These will ease the birth of the child. It is during this long period away from her husband that she learns how to care for her child.

For subsequent pregnancies, the woman stays with her spouse, but some women go back to their mother, accompanied by their small children, for the period of the birth.

Birth

If the woman is assisted the first time by her mother, she gives birth afterwards alone or helped by a woman present in the camp. There are not traditional **midwives** as in the southern villages. For example, a woman having had fourteen children was assisted by her mother at her first delivery and by her sister at the second. But for the twelve children that followed, she gave birth alone.

When the woman suffers the first pains, she goes away from the camp so as not to be seen and takes shelter behind a thorny tree with one or two assistants (11). If labor commences during a displacement, she withdraws and gives birth, very often without assistance.

During labor, the woman does not eat anything and drinks little. If another woman is present, she spits in her hands and applies them afterwards on the body of the woman in labor while reciting incantations (ayaare). Sometimes, one makes her drink bark decoctions of noomayel gorel (Indigofera), kahi (Kaayia senegalensis) and roots of yaaDya (Leptadenia hastata), with a metal needle deposited in the bowl, in order to calm the pains. A potion with a base of goat excrement and cotton seeds pounded in water is administered to accelerate the birth because often the birth is long, sometimes lasting up to two days. The woman gives birth kneeling on the soil, and the baby is received by the woman who assists. No mat is used. Immediately

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after the placenta is **delivered** the umbilical cord (sibiiru) is cut to the length of a finger with the help of a razor blade or knife. The baby is kept flat on his stomach in order to avoid the blood reentering in his stomach ; this would kill him. The cord bleeds little. No ligature is made. One applies next a plaster made of doum leaves boiled in water which remains for two days. Following, one applies powder from pounded pottery. Some women simply wash the cord with water. Others, in order to dry it out faster, apply sand taken from under the fire's embers.

The newborn is washed in cold water : three times if he is a boy ; four if she is a girl. Cold water is used the first day and hot water the following days.

One does not breathe in the nostrils of a newborn to unblock the airway.

It is normal that the woman bleeds abundantly at the time of the birth. If such is not the case, this signifies that the blood has reentered her body and will make her sick.

The placenta, commonly called minyiraawo (the brother), is buried, covered with a stone, near the cord where the calves are attached, in front of the suudu. If the placenta does not come, this signifies the death of the woman. Then people perform the ayaare (incantations and spittings) on her stomach and on the water that she drinks. Sometimes, they try to provoke its release by inducing the new mother to vomit with the help of a spoon introduced to the base of the throat.

The days following the birth, the woman is relieved by her co-spouses, her sisters-in-law or near relations, of her domestic activities. She receives visits from neighbors and her parents, to which men, in general, are not admitted.

They prepare her a special diet based on millet generously mixed with milk, Bilma salt, natron, and red pepper, the kunu.

One week after the birth, they shave the skull of the child, and then again the second and third week.

The giving of a name to the child takes place one week after

its birth or at the time of the worso, when the whole family is gathered. For the firstborn, boy or girl, the father will slaughter a bull or a cow. For the other children, he may simply slaughter a ram or an ewe. "Without this bloodshed, the child remains nameless, without a father, he is nothing" (13). After the birth of a child, a nine-month period of sexual abstinence is the rule. But very often, the reality is quite different.

Some women think that is good to have children every year, but many prefer to space out births at intervals of two to three years.

Common illnesses according to the Wodaabe

The tables which follow enumerate the illnesses which the Wodaabe complain of the most frequently. Included are : the name used by the Wodaabe ; the symptoms that they recognize ; the supposed cause of the disease ; the treatment that they apply.

The order in which the different illnesses appear in the chart does not follow a traditional classification, but groups the diseases according to the primary symptoms.

Knowing the practices and names used by the Wodaabe can be a big help for the nurses in charge of training Wodaabe health auxiliaries. This permits them to use terminology understood by the candidates, and makes new information that they are teaching them more accessible and better able to be integrated with their traditional knowledge.

NAME	SYMPTOMS AND CAUSES	TREATMENT
<p><u>Bantooje</u> <u>malaria</u></p>	<ul style="list-style-type: none"> - fever + headache + vomiting + joint pains - fever one out of two days during 7 to 15 days - during the rainy season and the months that follow <p><u>cause</u> : unknown</p>	<ul style="list-style-type: none"> - washing several nights in in cold water - scarification of the forehead if the child loses consciousness - go to the clinic
<p><u>Yontere</u> <u>fever</u></p>	<ul style="list-style-type: none"> - heat throughout the body - lasts several days - serious disease ; can kill - sometimes with cough, diarrhea, etc. - occurs all seasons <p><u>cause</u> : unknown, consumption of certain plants (<u>kinemugu</u>)</p>	<ul style="list-style-type: none"> - drink cool water containing <u>sabarahi</u> flowers - when a child has fever, cover him
<p><u>Zafi</u> <u>Dankanoma</u> <u>Wulo-wulo</u></p>	<ul style="list-style-type: none"> - heat throughout the body - begins in afternoon ; maximum during the night ; clears in the morning - sometimes headaches - no diarrhea - comes in one to two week periods - Exacerbated by washing at night - particularly during the dry season, when the earth is hot <p><u>cause</u> : the heat of the sun</p>	<ul style="list-style-type: none"> - wash in water early in the morning - wash with cold decoction of <u>boDaaDi</u> bark - drink an infusion of <u>nyangal buubi</u> ; some water with some <u>akuri</u> = jujube cake ; some black soap with some water - drink ; wash the anus with "soap" of millet cob ashes base
<p><u>Kiikel</u> <u>Kiiku</u> asthma, chronic bronchitis</p>	<ul style="list-style-type: none"> - difficulty in breathing - as if has birds in the chest that make a "kyu-kyu" noise - begins in childhood or later - especially during the rainy season ; crises more spaced out during the dry season <p><u>cause</u> : crises especially during the rains because the earth is humid and one drinks a lot of whole milk (too fat)</p>	<ul style="list-style-type: none"> - roots of <u>sabarahi</u> + chicken eggs + sour milk : let set 3 days in closed container (<u>jolooru</u>) ; drink to induce vomiting - drink sour milk instead of whole milk

NAME	SYMPTOMS AND CAUSES	TREATMENT
<u>Kiikel</u> (continued)	<ul style="list-style-type: none"> - if parents have the sickness, children risk having it - <u>Memri</u> can provoke <u>kiikel</u> 	
<u>Mura</u> tracheitis cold	<ul style="list-style-type: none"> - runny nose - cough with or without sputum - fever - not a head cold <p><u>cause</u> : if one eats lots of jujubes (Note : they are ripe in Oct-Nov, the time when one catches <u>mura</u>) cold wind use of a spoon contaminated by someone with <u>mura</u></p>	<ul style="list-style-type: none"> - fumigations with <u>anzahi</u> leaves - drink a decoction of <u>yaaDia</u> leaves and lianas and millet flour - eat sauce with a lot of red pepper (to make the nose run) - place in nostrils <u>allali</u> leaves to induce sneezing - camphorated "Sabon Rob" pommade applied beneath the nose
<u>Memri</u> allergic rhinitis	<ul style="list-style-type: none"> - nose and eyes weep and sting - involves the head - sore throat - during the rainy season and cold season <p><u>cause</u> : milk dust if parents have it, children catch it</p>	<ul style="list-style-type: none"> - pounded <u>loorengadu</u> plant mixed with milk or water ; drink or apply to body
<u>Memri</u>	<ul style="list-style-type: none"> - joint and bone pains - sometimes swollen joints 	
<u>Anago</u> joint pains	<ul style="list-style-type: none"> - chronic joint pains without swelling - follows <u>amajer</u> 	<ul style="list-style-type: none"> - wait for it to pass - go to the clinic
stomatitis, glossitis, buccal erosions	<ul style="list-style-type: none"> - burn, painful mouth 	<ul style="list-style-type: none"> - chew raw <u>gabari</u> leaves - application of camphorated pommade

NAME	SYMPTOMS AND CAUSES	TREATMENT
<p><u>Anago</u> (continued) skin rashes</p>	<ul style="list-style-type: none"> - skin rashes with itching - depigmented spots on skin <p><u>cause</u> : lack of milk skin rashes and dry mouth appear at the time when one resumes drinking milk after not having had it</p>	<ul style="list-style-type: none"> - drink a mixture of pounded leaves and seeds of <u>taane</u> <u>fufu</u> and milk
<p><u>Amajer</u> canker boil bejel (endemic syphilis)</p>	<ul style="list-style-type: none"> - localized cutaneous erupt- ion with discharge - joint pains develop <p><u>cause</u> : if one comes in contact with a place where someone with <u>amajer</u> has washed himself</p>	<ul style="list-style-type: none"> - go to the clinic ; an injection clears the cutaneous lesion
<p><u>Massar</u> <u>Tumjere</u> syphilis</p>	<ul style="list-style-type: none"> - pustules, ulcers on genit- al organs, on the internal surface of the lips - accompanied by a fever in the beginning - inflammation and pustules under the arms and in the groin <p><u>cause</u> : sexual contact</p>	<ul style="list-style-type: none"> - the sick person is bound and the wounds are burned with camel dung or lit <u>almameeri</u>* cotton <p>* false cotton</p>
<p><u>Pewri Kendu</u> gonorrhoea</p>	<ul style="list-style-type: none"> - pain in lower stomach - burning while urinating - pus discharge from the penis (<u>mbordi</u>) - difficulty in urinating - after some years, one cannot urinate at all - holes in genital organs - women have burning while urinating, then difficulty in urinating - women can no longer have children <p><u>cause</u> : sexual contact caught in south- ern cities</p>	<ul style="list-style-type: none"> - go to the clinic - eat red pepper, which cause clots to be excreted

NAME	SYMPTOMS AND CAUSES	TREATMENT
<p><u>Caarol</u> <u>Dogguru</u> <u>Niwru</u> diarrhea</p>	<ul style="list-style-type: none"> - one often catches diarrhea in years when it rained little because the earth is not replenished and this heat hurts the body - frequent during the cold and dry seasons 	<ul style="list-style-type: none"> - drink infusions of <u>boDaaDi</u> (barks) - drink milk containing <u>turahi</u> (plant)
<p><u>Cakaaru</u> ordinary diarrhea</p>	<ul style="list-style-type: none"> - pains mid-belly - diarrhea ; sometimes vomiting - is not serious <p><u>cause</u> : if one eats meat, millet, cow peas if one drinks milk</p>	<ul style="list-style-type: none"> - when a child has diarrhea, the mother continues to allow him to drink
<p><u>Hoyoore</u> <u>Baawrude</u></p>	<ul style="list-style-type: none"> - wound, boil, lump in the stomach that provokes a dangerous bloody diarrhea - fever at night - when has been defecated, gets better ; but one can also die from it <p><u>cause</u> : from birth, diarrhea is touched off by eating fats (butter, etc.)</p>	
<p><u>Fatdooru</u> dysentery</p>	<ul style="list-style-type: none"> - pains in lower stomach, then vomiting and heavy diarrhea - one can die from it very quickly - it is a very bad dysentery <p><u>cause</u> : unknown</p>	<ul style="list-style-type: none"> - no treatment
<p><u>Buccuru</u> colic</p>	<ul style="list-style-type: none"> - pain that twists the stomach - no diarrhea - after the rainy season or during the cold season <p><u>cause</u> : change of diet</p>	<ul style="list-style-type: none"> - drink water with natron

NAME	SYMPTOMS AND CAUSES	TREATMENT
<p><u>Nawdum</u> <u>noppi</u> otitis</p>	<ul style="list-style-type: none"> - earache - pus (<u>mbordi</u>) draining from the ear <p><u>cause</u> : unknown</p>	<ul style="list-style-type: none"> - place in the ear a few drops of melted butter previously fried with a date pit or cowrie shell
<p><u>Katatti</u> <u>Nawdum</u> <u>gitte</u> conjunct- ivitis</p>	<ul style="list-style-type: none"> - burning eyes - runny eyes - during the cold season <p><u>cause</u> : flies alight on the affected eye then pass on the sickness to someone else by landing on his nose or his hands</p>	<ul style="list-style-type: none"> - wash the eyes morning and night with a bark of <u>gabari</u>
<p><u>Dandumi</u> night blindness vitamin A deficiency</p>	<ul style="list-style-type: none"> - one sees poorly at night - during the hot dry season <p><u>cause</u> : lack of milk when the cows graze in zones devoid of certain bushes</p>	<ul style="list-style-type: none"> - eat or apply to the eyes fried sheep or goat liver
<p><u>Nduyohon</u> <u>Pestel</u> measles</p>	<ul style="list-style-type: none"> - small pimples all over the body - if one has few pimples, this signifies that the disease enters the body and provokes a bad diarrhea - can attack the eyes - only contracted once in life <p><u>cause</u> : caught in villages or market if one uses a blanket or shirt of someone affected</p>	<ul style="list-style-type: none"> - isolate the child if other children in the camp have not yet had it - apply bran to the child's body - continue to breast feed
<p><u>Yowru</u> <u>bilki</u> <u>Agalamba</u> whooping cough</p>	<ul style="list-style-type: none"> - cough with vomiting or loss of consciousness ; during 3 months (boys), 4 months (girls) - contracted once in a life - not highly contagious 	<ul style="list-style-type: none"> - eat millet paste with uncooked butter

4. Use of Health Services

Survey

At three month intervals, all sample family members, on average 298 subjects, were questioned on the number and the reasons for consultations at the dispensary.

The average number of consultations by trimester is 8 percent. There is no seasonal variation. It is especially adults who go to the dispensary (12 percent against 4 percent for those under 5 years).

The reasons for consultation are in order of importance : bone-joint pains, fever, and skin diseases. In February, when 29 percent of the people are confined to bed because of cough, only 2 percent of consultations were for this reason.

The dispensary is far from the camps and it is rare for someone to make the trip only for a consultation. People visit the clinic while going to the market, as is shown by observations made at the Abalak and Tchintabaraden dispensaries.

During one entire day, the nurse asked patients where they came from. This procedure was repeated on several occasions. On the five non-market days measured, 12 percent of the new patients came from the bush and all were Twareg or Wodaabe herders. On the eight market days, or following the market day investigated, the average of new patients from outside the village was 49 percent, also herders.

Thus, the number of new patients from outside the village where the dispensary is located is very small on ordinary days, but increases on market days to constitute half of the new patients coming to the dispensary.

The impact of the health services can also be estimated by the proportion of people with vaccination scars.

Of all subjects older than 5 years, only 15 percent had a

vaccination scar from the health services. This rate is even lower in children. Only 3 percent (2 out of 66) of the children under 5 years and 10 percent (7 out of 130) of the children less than 10 years have a vaccination scar. Living far from the centers, herders are little affected by vaccination campaigns. This results in a very low vaccination coverage.

These observations show that :

- herders rarely go for consultations at the dispensary (8 percent per trimester),
- there is no increase in consultations when morbidity and the rate of bed confinement increases, for example in the cold season,
- herders consult especially on the market day,
- vaccination coverage is very low.

The availability of Health Services

Services offered and location of health services

At present, the health service has four types of activity in the NRL project zone.

a) Medical centers (CM) and dispensaries

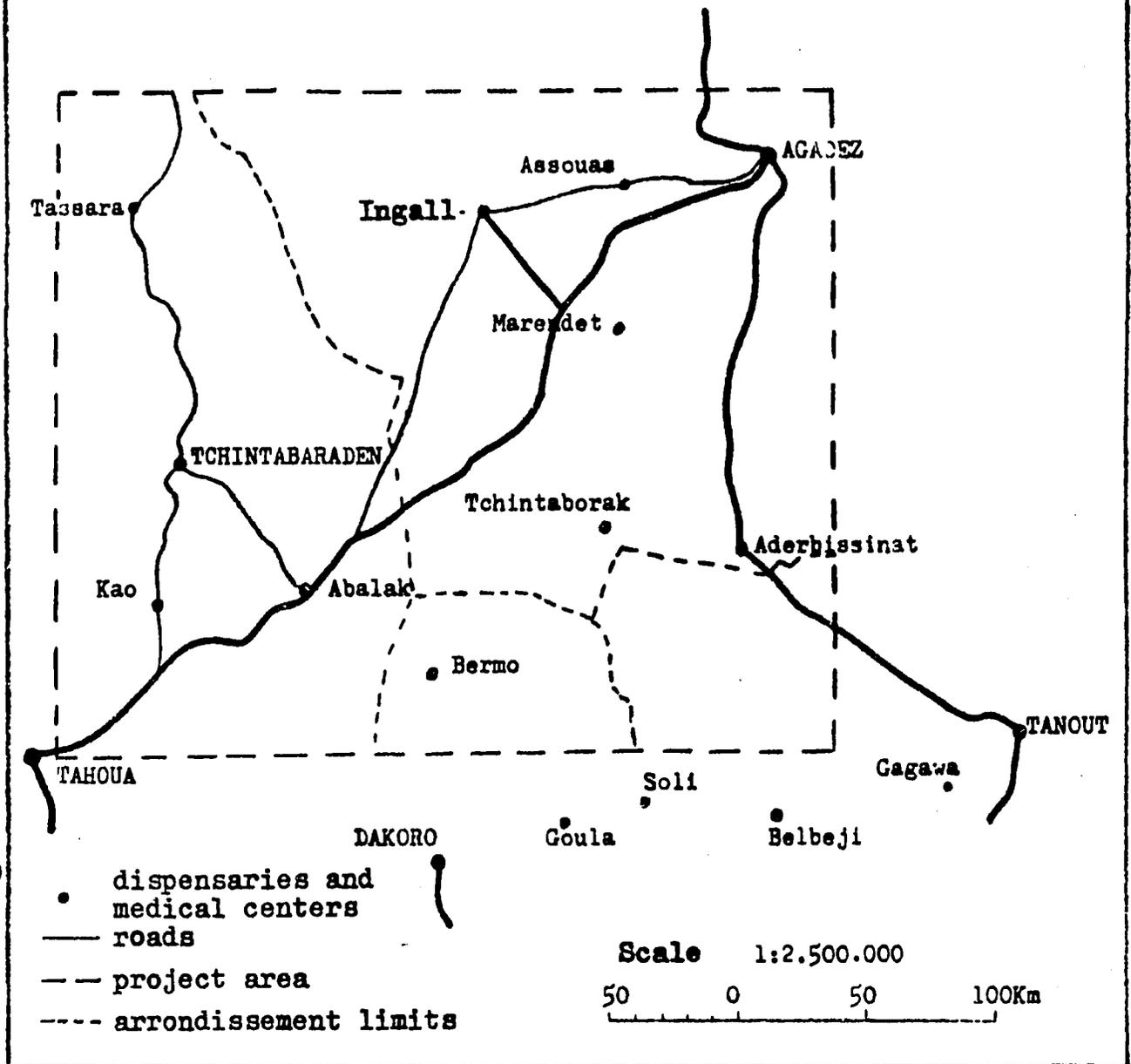
Medical centers

This is the arrondissement reference center. It comprises a consultation room, a pharmacy, a PMI, and a maternity. Each CM has available an average of 15 beds for short hospitalizations. It is administered by a Head of the CM, a diploma nurse from ENSP. The latter has the responsibility for curative and preventive actions carried out at the CM and in all the clinics of the arrondissement.

- curative activities : out-patient consultations, hospitalization, deliveries, evacuations ;

.../...

Map 2 - Dispensaries and Medical Centers in the NRL zone



- preventive activities : PMI (Mother and Child Protection) : prenatal consultations, health and nutritional education, demonstration of diets ; antimalarial chemoprophylaxis ; training and supervising health auxiliaries and midwives ;
- administrative activities : epidemiological surveyance, supervision of clinics.

Dispensary

It is administered by a nurse with a diploma (ENSP or a certificate ENICAS). He assures out-patient consultations, evacuations if he has a vehicle, and supervises the health auxiliaries and midwives (ESV) depending on the dispensary. Some dispensaries have a few beds, and some PMI sessions are organized there.

Location of CM and dispensaries

They are located for the most part in the important villages and markets in the zone. All CMs have a vehicle, as do some clinics (Abalak, Ingall, Tassara), which increases their radius of action. The distances between the closest dispensaries is 72 km ; it is 105 km from the dispensary to this reference CM*.

The dispensaries and CM of the zone are the following (see map 2) :

- | | | |
|-----------------------|---|---|
| . Agadez arr. | : | Agadez, Aderbissinat, Assouas, Ingall, Marendet, Tchintaborak ; |
| . Tchintabaraden arr. | : | Tchintabaraden, Abalak, Kao, Tassara ; |
| . Dakoro arr. | : | Bermo (Dakoro, Goula, Soli) ; |
| . Tanout arr. | : | Tanout (Belbeji, Gagawa). |

* These distances are calculated from the 11 medical posts and CMs located in the NRL Project zone. By way of comparison, the distances are respectively 25 and 38 km for the whole of the Maradi department, 13 and 17 km in the Madarunfa arrondissement.-

The dispensaries in brackets are located outside of the pastoral zone.

b) Departmental Mobile Hygiene and Medicine Team (EDHMM)

Each department has such a service, equipped with four-wheel drive vehicles, which works throughout the department.

Its functions are :

- to intervene in case of an epidemic,
- to be responsible for all vaccinations,
- to ensure the health coverage at large public gatherings,
- cure and prophylaxis of venereal and skin diseases,
- to identify and treat **leprosy**.

For many years, the EDHMM has gone to Ingall in August at the time of the salt cure, and has visited the main camps, in order to vaccinate and treat herders. Organized from Niamey, the campaign brings together the EDHMM from Agadez, Diffa, Niamey and Zinder. Previously the teams stayed in the area for one to two months, but in the last three years the activities have been limited to two weeks.

Since 1977, the EDHMM of Tahua and Maradi have provided **health coverage** for the Bororo Festival, a large gathering of Wodaabe organized by the government at the beginning of September. For two weeks, herders receive vaccinations and care. Each year, vaccination campaigns are organized. In the zone they principally reach schools and villages. The EDHMM also acts in epidemics.

c) Village Health Teams (ESV)

The ESV are composed of voluntary health auxiliaries and midwives recruited among the local populations. The health auxiliary, after a week of training at the CM, is capable of treating fevers, simple cases of diarrhea, conjunctivitis and wounds. He receives a case containing four types of pills

(aspirin, chloroquine, sulfaguanidin, ophtalmic ointment, and dressings). At the moment, in the pastoral zone, medicines obtained at the dispensary and distributed by health auxiliary are free*. The medical knowledge of the health auxiliary is very limited. All serious cases must be evacuated to the dispensary or the Medical Center.

At the moment the majority of ESV trained in the pastoral zone live in villages. However, recently more herder health auxiliaries have been trained. They are linked to the following medical posts :

. In gall (Agadez arr.)	15 health aux.
. Tchintaborak (Agadez arr.)	3 health aux.
. Bermo (Dakoro arr.)	5 health aux.
. Tanout (Tanout arr.)	5 health aux.
. Abalak (Tchintabaraden arr.)	2 health aux.
. Tchintabaraden (Tchintabaraden arr.)	9 health aux.

All the midwives trained in the pastoral zone live in villages.

d) Teacher health auxiliaries

In some villages without a dispensary or an ESV, teachers take a ten day health course at the CM. They receive a kit comparable to those of the health auxiliaries and are authorized to administer care to their students.

The accessibility of health services

Access to a given service depends on several factors.

- Geography

The distribution of medical posts and CMs in the Project

* In the agricultural regions, the medicines are sold by the health auxiliaries at a very modest price.-

zone is relatively homogenous, but remains very diffuse. The density of health services in the pastoral zone is low. Most villages in this region have a dispensary, so there is no need to build any new ones, except at Tofemanir or at In-Waggar, in order to fill the void that separates Abalak from Ingall. The creation of a dispensary in one of these places is important, because they are located on the rainy season transhumance routes towards the northern salt cure area. But creating medical posts isolated in the bush is not desirable.

Despite this well developed infrastructure, the distances between dispensaries remain great, and the herders living in these zones are too far to benefit from them daily. Another limiting factor is related to herders' movements; since they move, they do not always depend on the same dispensary, nor the same nurse. Knowing the nurse, establishing a repeated contact with him, plays an important role in the frequency and especially in the regularity of visits to the dispensary.

It is equally important to understand that for a herder, to go to the dispensary is not a matter of minutes, as is the case in a village where the dispensary is located next door.

In the pastoral zone, a visit to the dispensary takes several hours or several days. Rare are the herders who can be gone for such a time.

These reasons make the herders wait until market day for medical consultations, in order to reduce travel as much as possible.

- Economic factors

Care is distributed freely. The cost of consultations or medicines is not thus a constraint on going to the dispensary.

- Professional factors

A herd needs daily work and supervision which a herder cannot escape. A herder cannot be absent for several days, because the animals must be pastured every day and watered regularly.

Except for the old people, no one is inactive in a family. All men and women of working age have their occupations and their own responsibilities. This is true for all families. As a result, if someone must be absent, it is difficult to find a kinsman or a friend to carry out his work, because this means an additional task that he cannot take on in addition to his own work.

The task of herding imposes very strong constraints on the freedom of herders to visit dispensaries.

- Cultural factors

The herder, like all rural people in remote regions, hesitates to come to the dispensary for several reasons :

- He hopes always that the illness will cure itself. That is in fact true of most diseases, which disappear after a few days ;
- He first uses plants and traditional practices, because he knows them, because they are available on the spot, and because he can use them himself without the help of others ;
- There is also fear of the dispensary. It is seen as mysterious and strange, something he does not understand or control ;
- The person who attends the patients is often unknown ; he does not use the same name and classification of illnesses as the patient. He handles medicines which are also foreign : the patient does not know their names, nor their effects.

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And there is the fear a sick and weak person feels. He is vulnerable to someone who knows sickness. He fears having to stay at the dispensary a few days or being sent to the hospital. This is important for him, far from his own people and his own environment, with the fear of dying alone, a stranger.

- Factors determining the efficiency of treatments

Very quickly, patients know which diseases the dispensary is well equipped for and treats efficiently, and which ones it **does** not. An injection of penicillin cures an infection, a few chloroquine pills treat an attack of malaria. Aureomycine ointment takes care of conjunctivities. In contrast, methylene blue does not suppress stomatitis and medicines for cough and colds are of little use.

Thus comes about a selection of disease for which people take advice. A patient will easily overcome his fear when he knows that urethritis will be cured by an injection of penicillin or when an attack of malaria will disappear with a few pills. This selection develops also as a function of the efficiency of traditional practices. Patients rarely come to the clinic for psychological troubles. For this they consult a marabout.

Conclusion

Few herders use the health services, although there is already a quite evenly distributed infrastructure. The dispersal of the population, the great cultural constraints limit their accessibility.

An important information effort remains. There would be better mutual understanding if herders were informed of the possibilities offered by the medical posts, nurses there were informed of the habits and lifestyle of herders and of the seasonal constraints on them.

At the moment, the health services in the pastoral zone are

based on the same criteria as in agricultural regions with high population densities. The pastoral zone has some special features which must be understood if these services are to be efficient.

The dominant characteristic of this region of Niger is distance : distance between villages, distance between camps, distance between camps and villages. The basic features of this region and the dispersal of its populations influence all activities.

To provide communications always means time and effort.

If a service is to be adapted to this region, it must be able to reduce and master to the maximum this distance. This does not only mean equipping the services with vehicles and sufficient quantities of gasoline. It also means creating an organization and structure that avoids the need constantly to cover these distances. This means decentralization, the creation of small, autonomous, mobile units.

At the moment, no one will live permanently in the bush away from the inhabited centres. This is easily understandable. Only the herders, who are used to such difficult living conditions, will work there all year. So it is essential to integrate them in an extensive service in order to fill the large gaps between villages.

Niger has a well developed instrument for this : the national Primary Health Care Program. This can be adapted to the pastoral zone and developed on a large scale. Only this, with the support of the other health services, will make possible an efficient health coverage at an acceptable price in the pastoral zone.

5. Conclusion

The survey covered one year, with visits at three month intervals ; it showed the seasonal variations in the prevalence of the most common diseases.

A brief review of the illnesses that generally affect populations in contact with animals, shows how few data there are : epidemiological surveys are required to better evaluate their real frequency and impact on the herders' life.

Illnesses impose definite constraints on the herders, affecting their capacity to work and forcing them to confine themselves to bed at moments of great activity or at the time of rainy season movements. They directly influence the productivity of herding, which depends above all on the available family labor force.

In addition, illness among children, particularly diarrhoea, **tiggers off** malnutrition which increases at the end of the dry ^{season.} The dispersal of camps in the pastoral zone and their remoteness from service centers limits the spread of epidemics such as measles, and to a certain degree shelters herders from diseases which are common in densely populated regions.

On the other hand, this remoteness greatly penalizes herders in regard to access to health services, established in some villages in the zone. The frequency of visits to dispensaries is low, and vaccination coverage is minimal.

If this vast region of Niger is to benefit more effectively from the existing services, the services must enlarge their zone of influence by **creating** small autonomous units in the bush, for example, in the context of the Development Society. In the health field, the national primary health care program offers promising perspectives.

It makes basic medicines available to herders in the bush, by the intermediary of health **auxiliaries**. It makes the herders responsible for these activities, allows them to participate in service activities, and reduces their isolation.

APPENDIX 1

Methodology

a) The type of survey

A one-year longitudinal study was chosen in order to record the seasonal variation of economic, social, nutritional, and health parameters.

Two methods of information gathering were utilized :

- Survey at repeated visits. It was decided to make five visits at three-month intervals to the same group of herders over the course of which a standard questionnaire was filled out. These visits correspond to the different seasons of the year.
- The gathering of data from discussions and observations in the field during prolonged stays in the camps.

The two methods complement each other. The questionnaire furnishes data obtained in an identical fashion in all camps. The observations and discussions permit a better interpretation of the results and give information in other domains, particularly on the traditional practices and beliefs.

b) The questionnaire

It includes three sections :

- a tally of family composition at the time of the first visit to be revised at each subsequent visit in order to record the variations of its composition over the course of the year.
- a family record of food consumption, water supply, and the position of the camp.
- an individual record of sicknesses, food supply of infants, the length and causes of bed confinement, the frequency of visits to dispensaries, and clinical observations.

The precoded questionnaire is in French. Some questions relate to the actual time of interview, but the majority record events

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having occurred in the three months preceding the visit. The individual questioning was conducted in Fulfulde. Parents were interrogated about their children or a close relative if the question is considered forbidden. This situation is particularly frequent among the Wodaabe where the parents cannot pronounce the name of their first three children, nor their spouse. Questions on food consumption were asked to the head of the family. The quantity of cereals pounded the day before and the daily milk production are asked of the women who pound millet and milk the cows. A standard measure is presented to them, and the quantity is evaluated by the number of full measures.

The quantity of milk produced in one day is also estimated with the help of the same measure. The conversion to kilograms and liters was later calculated by the author.

The questionnaire was tested out at the time of the first visits to the camps, then was slightly modified to assume its definitive form in November 1980.

The age of people, that of children in particular, was obtained at the first visit with the help of a calendar of local events established by the herders themselves and by crosschecks during the following visits.

c) The choice of the sample

- The place

After several trips to the bush, the area chosen was the region of Abalak, Kao, and Tchintabaraden for the following reasons :

1. Concentration of Twareg and Peul herder populations, facilitating simultaneous work in the two groups.
2. Place of residence of numerous customary chiefs with which the NRL Project works.
3. Relatively easy access from Tahua.

In other respects, this region presents interesting characteristics :

1. A passage zone of numerous herders coming from the south,

.../...

returning again during the rainy season towards the northern salt lands.

2. Presence of important livestock markets.
3. Zone of rapid changes due to the construction of the paved route connecting Tahua to Agadez and Arlit.

It was originally anticipated to cover the two herder communities of the regions : the Wodaabe and the Twareg. But it rapidly became impossible to conduct the two surveys simultaneously due to lack of time and means. It was decided to concentrate on a group of Wodaabe (Peul Bororo).

The majority of the Wodaabe population of the Tchintabaraden region is under the authority of the chief (lamido) of the 9th administrative group. The socio-economic survey and health study were officially presented to him by a literacy-training official of the arrondissement as proof of the government's endorsement. The team was introduced at this time by the intermediary of a chief (arDo) of a neighboring faction and following the traditional ways. The lamido immediately gave his agreement and support.

The basis of choice for the sample was first of all administrative, with the 77 families composing his faction, about 320 persons. The choice of a sample of families randomly chosen was abandoned, considering the small size of the faction, the very reduced size of the survey team, and particularly the logistic problems of following itinerant families for one year, especially among the Wodaabe where the camps are small (one or two families), mobile and separated from one another.

Elsewhere, it appeared important to us to work in an atmosphere of confidence and collaboration in order for the survey to be a success. The Wodaabe herders are distrustful of strangers, more so when they come to ask questions. As the work took place in camps far from trails and in regions of difficult accessibility, it was necessary to find families not too

dispersed and in contact with each other over the year. These conditions were met by choosing the families of this faction. At the time of the first stay in the bush in July 80, instead of a presurvey, the initial examination of the faction in its entirety revealed itself unsatisfactory and presented serious practical inconveniences. In mid-rainy season, the period of the year when all related families are gathered in the same region, close to half of the faction was dispersed. It was then decided not to take the faction in its totality, but to work with three family groups, to which we were introduced by the brother of the chief. These families, reunited during the rainy season, stay grouped or in close contact during the dry season ; this permits easily finding them again all year long. The 400 persons of the sample are divided into 54 families all of the same primary lineage, the Gojanko'en, but belonging to two different factions, the Ute'en Wodeebe and the Ute'en Baleebe.

This choice to follow close family groups turned out to be wise. Without bonds of friendship or parentage, it would have been impossible to find families separated by more than 200 km in the middle of the dry season.

d) The personnel

The number of interviewers and material were reduced to the minimum. It was important to form a small team so as not to disturb too much the life in the camps and also to create a climate of confidence favorable to exchanges. A single four-wheel drive vehicle was adequate to transport the team and materials. At the time of the first visit, the team was composed of the doctor in charge, accompanied by his wife, a socio-economist, and two Nigerian interviewers, the latter three speaking Fulfulde fluently. Later, only the leader and the two interviewers conducted the four other visits.

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e) The nutritional survey

- Measuring equipment

The height of children was measured on a graduated horizontal plank if they were less than 90 cm ; that of adults and taller children was carried out by means of a vertical measure. For the two methods, the precision was ± 0.5 cm.

Children less than 20 kg were weighed with a Salter balance, the child being suspended by a harness. The precision was ± 0.1 kg. Heavier adults and children or those children who were too active to be suspended from the harness, were weighed with the help of an ordinary Testut bathroom scale, of a precision of ± 0.5 kg. Each morning, the bathroom scale was calibrated with a 33 kg spare tire. Simultaneously, the leader weighed himself and over the course of the day, readjusted the bathroom scale to his morning weight.

The arm circumference was measured with a plastic graduated tape (Zerfas tape) ; the precision was to ± 1 mm. Finally, the tricipital skin fold was estimated by a plastic caliper (Adipometer, skinfold caliper, Ross lab), the precision was to ± 2 mm.

- Method of anthropometric measures

All measurements carried out by the two Nigerian interviewers were verified by the leader during the first week of the survey. After that, checks were regularly made during the course of the session. The results were retranscribed by the leader.

Height, weight, arm circumference, and tricipital skin fold are the most frequently measured parameters to estimate a child's growth. To be significant, these measurements must be made with as much precision as possible, and must rigorously follow the sequence of operations to be carried out (46).

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- Height

- Children under 90 cm, being less than 2 years.
 - 1) The graduated board was placed horizontally on the ground.
 - 2) With the help of at least two assistants, the child was placed with his back against the board and head beside the end with the fixed edge.
 - 3) An assistant kept the head against the fixed edge, the face turned toward the sky in the Frankfort plane (a perpendicular plane to the body, drawn by a line passing between the lowest point of the edge of the eye socket and the high point of the opening of the ear).
 - 4) The other assistant held in one hand the child's two knees, stretched the legs and pressed the sliding base against the heel (the child's feet being **bare** and perpendicular to the board).
 - 5) The result was read to the closest half-centimeter and recorded on the questionnaire by the person in charge of measurements.

- Children over 90 cm and adults
 - 1) The measuring tool was placed in a vertical position.
 - 2) The subject was placed barefoot on the horizontal platform of the base.
 - 3) With heels together, the legs straight and the head kept in the Frankfort plane, the assistant placed the sliding base in contact with the top of the head and read aloud the result.
 - 4) The measurement was entered on the questionnaire by the leader.

- Weight

- Children less than 20 kg
 - 1) The balance (25 kg Salter scale) was suspended from a tripod.
 - 2) The father or the mother put the nude child in the harness and suspended it from the balance.
 - 3) The suspended child must not touch anything. The result

was read by the leader, and transcribed on the paper.

- Children more than 20 kg and adults

- 1) The subject stepped onto the bathroom scale (Testut) placed on a horizontal base.
- 2) He placed his bare feet in a balanced way on each side of the window of the scale.
- 3) The assistant read the result out loud.
- 4) The weight was transcribed on the paper.

- Arm circumference

- 1) The left arm was uncovered.
- 2) With the elbow bent at a right angle, the half-way point between the acromion (shoulder) and the end of elbow was marked on the posterior surface of the arm, with the help of a tape measure (Zerfas tape).
- 3) The arm was then extended and the perimeter measured at the mark with the tape measure.
- 4) The result was read out loud by the assistant and was retranscribed by the leader.

- Tricipital skin fold

- 1) The left arm was extended and relaxed.
- 2) The half-way point between the acromion and the end of the elbow (pen mark), on the axis between these two points, the assistant pinched the skin covering the triceps.
- 3) He pulled sufficiently to separate the skin from the underlying muscle mass.
- 4) With the other hand, he pressed the caliper jaws on the fold of the skin thus formed, and tightened them until the indicated pressure was reached.
- 5) Reading of the result two seconds after the application of the caliper.
- 6) Transcription on the paper.

Remarks

- In the itinerate conditions of such a survey, it is necessary to have sturdy material. The sand, the dust, and the high ambient temperature can cause important precision variations. The scales must be checked and readjusted regularly in the course of a session.
- The adults were weighed dressed, and the weight of clothing 1.5 kg on average, was not subtracted. The Wodaabe always wear the same clothes.
- The participation of parents in the measuring of their children greatly facilitated the tasks of the interviewers, notably the ones concerning the board and scale.

f) Method used in the field

The team was officially introduced in the presence of the chief of the 9th group, following a two-week stay in his camp. This stay permitted progressive contact with the surrounding camps. Afterwards, his brother introduced us to other families in the sample, bringing with him the chief's guarantee of our respect. Without such a guarantee, it is very difficult to rapidly obtain the participation of the members of his faction. Once the first contact was established, it was possible to return to visit a camp independently. The next step was more or less always the same at each visit :

We arrived at Tchintabaraden on market day, in order to meet a family member who came to the market. Considering the existing connection between families, any member of the sample can indicate to us the position of all camps. An itinerary was established according to the location of families. It is necessary to be aware of the market days, and during the rainy season, although many families gather and are reunited, it is impossible to work because of the festive atmosphere.

We always found someone from the group who could guide us from camp to camp. This was a necessity. Without the particip-

ation of the herders, it is impossible to find camps in the bush where all the hills and forests look alike.

Once arrived at the camp, the car stopped a good distance away and the team waited for the head of the family to come greet it. The work was explained in detail, as were its objectives and its methods. Then the measuring equipment was set in the place indicated by the head of the family.

At first, on the suggestion of the old people, the measurements were carried out at a point where the people of the neighboring camps converged. This method was very quickly abandoned because :

- the people came all at the same time and impatiently waited,
- the families were mixed, imposing tedious work of classing the sheets,
- numerous persons did not come,
- it was impossible to see the characteristics of each camp.

The method adopted afterwards of going from camp to camp was much more efficient and acceptable. The contact with the people was more relaxed and conducive to obtaining correct responses.

g) The acceptability of the survey by the herders

The objectives of the survey were explained several times to each head of a family. It is highly probable the vast majority did not understand just what it was about, but consented voluntarily to this survey out of graciousness and in the hope of drawing a few benefits from it, knowing that the NRL Project is going to engage in a production phase in their zone. The repeated visits had a clearly positive effect. With each visit the initial distrust wore away little by little and the information obtained increased in quality and in exactitude. The fact of always asking the same questions to everyone likewise helped. Without a certain degree of confidence and mutual good intent, a survey of this type is impossible to carry out. For example,

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sometimes one passes near a camp without seeing it. Without the help of the people of the camp, one often cannot find it. In order to carry out the measurements within an acceptable time frame, it was sometimes impossible to respect the Wodaabe's rules of hospitality. It was necessary to leave the host camp early in the morning. Sometimes, it was necessary to begin the measurements after barely having arrived in the new camp. This breach of customs, badly resented by some, was probably compensated for by stays with the families of the sample between the measurement periods.

Everyone at first felt a certain annoyance at being measured, particularly the women. In the measure that it was possible, these latter were measured and questioned apart from the men and the old people. The same procedure was followed for young people when their parents-in-law, from whom they must hide, were present. At the time of the third visit, the large majority were accustomed to the measurements, although some had refused to step up on the bathroom scale, attributing an evil effect to it.

The children feel very strongly the fears of their parents, for example, to see them taken away by force to school. At first, the arrival of the vehicle provoked a virtual panic, and all the children ran to hide. Very quickly, our vehicle was recognized, and these flights into the bushes disappeared. At the time of the visits during the dry season (November, February, May), most of the measurements were made in the camp in the morning and evening (sometimes even at night, lit by a lamp run on the vehicle's battery). In the middle of the dry season, it was necessary to work very early in the morning, before the herders left the camp to go water their animals.

In fact, as early as 9.00 a.m., the camps were deserted. Toward 10 - 11.00 a.m., the herders were at the wells ; but very often, they were very tired from the work of drawing

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water and the heat. The questionnaire at this time was unwelcome. The work was continued at the end of the afternoon in other camps.

Since during this season the animals were watered every other day, it was necessary to organize the journey in such a way as to visit the camps on the day when the animals were not watered, because the herders stay in camp longer before leading their animals to pasture. This gives more time to carry out the measurements.

During the rainy season, the people are much more free, permitting work more or less at any hour of the day.

The night was spent in a camp ; the team set up in the place indicated by the head of the family, generally about a hundred meters to the west of the camp. In order to simplify the team's work and to respond to the hospitality rules, meals were taken with the herders. These later were compensated for by a gift of rice, some tea, or some sugar. This formula seemed to suit everyone. Before leaving a camp, treatment and medicines were distributed as necessary. Each family received at each visit, some tea and sugar in thanks for its participation in the survey.

h) Calendar and characteristics of the measurement visits

Five visits were carried out at the following dates, departing from Tchintabaraden :

1st tour :	15 August - 1 September	1980	15 days of measurements
2nd tour :	17 Nov. - 1 December	1980	14 days of measurements
3rd tour :	16 Feb. - 2 March	1981	12 days of measurements
4th tour :	18 May - 13 June	1981	19 days of measurements
5th tour :	8 - 21	September 1981	12 days of measurements

The average length of the tours in the bush was 14 days.

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The distance covered in each visit varied enormously from one season to another. In September, at the end of the rainy season, families were close to one another ; 380 km sufficed to visit 48 families. On the other hand, in May-June 1981, in the middle of the hot season, the dispersion of camps is maximal, and it was necessary to cover 2,480 km to find the 52 families again (that included a trip to Tahua to refill the gas tank. See map).

The average number of families visited per day was 4 families per day in September and 2.6 in May.

The work conditions were very variable from one season to another. The ambient temperature varied a lot from one season to another.

During the rainy season, work was complicated by the frequent displacements of herders (every two or three days) and by the rains, sometimes making the terrains passable only with difficulty. On the other hand, it was facilitated by the proximity of families and the great availability of the people.

The easiest visits were those in November and February ; the ambient temperature was cooler, the displacement of camps less frequent (every 7 - 10 days), and the relative proximity of the wells greatly facilitated the work.

The visit during the hot season was by far the most difficult. This trip was long and hard because of ambient temperatures greater than 40° C, the extreme dispersion of camps over distances greater than 170 km as the crow flies, the frequent and unforeseeable displacements of camps upon the arrival of the first rains, the remoteness of water points and the absence and unavailability of people who were tired from the work of drawing water and the long walks up to the wells.

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Is this survey representative ?

No similar survey has been carried out in other Wodaabe herder groups. Thus, it is difficult to make a decision about the representativeness of this study.

However, the visits to other regions of Niger and the information collected by persons with great knowledge of other Wodaabe groups permits us to say that the observed seasonal variations in habitat, food supply, weight loss, malnutrition, and sicknesses represent the tendencies found in the other groups.

The amplitude of the variations certainly differs from one group to another, from one family to another, from one year to another. But the tendencies persist because the constraints are the same.

NIGER RANGE AND LIVESTOCK PROJECT

Since 1979, the Niger Range and Livestock Project, jointly administered by the Government of Niger, the Ministry of Rural Development and USAID, has conducted extensive research in the pastoral zone of Central Niger. The project's final report of research findings will be published in December 1982.

Discussion Papers

The discussion paper series presents preliminary research results, consultants' reports, and selected chapters of the final report.

These papers represent their authors' perspectives and do not necessarily reflect the position of the Government of Niger or USAID.

It is hoped that the circulation of these discussion papers will generate commentary and dialogue.

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