SOUTH PACIFIC COMMISSION

REPORT ON STUDIES CARRIED OUT BY THE SOUTH PACIFIC COMMISSION IN THE PILOT AREAS OF MALEKULA

(New Hebrides)

by

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PART I

GENERAL INTRODUCTION

The choice of pilot areas in the New Hebrides was made in 1973, following the Fourth Conference of Directors of Health Services and approval by the authorities of the Condominium. Two communities were selected, both in Central District No. 2, on the East coast of Malekula Island, namely :

- Tautu, a village predominantly under British and Presbyterian influence, comprising 182 people and situated near Lakatoro where the British District Agent has his offices;

- Wala-Rano, a group of villages predominantly under French and Catholic influence, comprising some 900 people and situated near Norsup where the French District Agent's headquarters are.

1. Definition of the pilot area concept in relation to the Nutrition Project

Objectives and methods

As we define it in relation to the SPC Nutrition Project, a pilot area is one on which the staff associated with the Project concentrates its investigations and actions, as far as available funds and time allow, bearing in mind its many commitments to information, teaching, training, research and implementation of programmes in other parts of the South Pacific.

The short-term objective of the Project is to make an assessment of the local situation through field surveys and studies conducted by appropriate specialists. The findings of these various investigations are to be combined into one report, so as to form a basis not only for specific action in the pilot area concerned but also, by extrapolation, for action on a wider scale : e.g. in this instance, first in the whole of Malekula, then throughout the New Hebrides.

The representative value of a survey, from the statistical point of view, depends chiefly on the size of the population screened, as compared with the total population, and on the prevalence of the parameters investigated. To obtain valid statistics, a sample of suitable size should be taken at random, the parameters to be studied having been determined by preliminary surveys.

It was impossible to apply the normal procedure in this case, because of

- practical difficulties : widely scattered tiny communities, absence of roads and means of transport, limited time available;

- shortage of pre-existing fundamental statistics, especially lack of previously collected data on nutrition problems.

The Malekula pilot areas were thus chosen not for their intrinsic suitability, but in consideration of what the Administration of the Condominium, the Health Services and the SPC could provide, as well as of certain political factors.

At a later date, the local assessment should lead to concrete applications, which in turn could serve as guide-lines for future recommendations. The SPC's potential for direct action is limited by the modest budget of the Nutrition Project (A$7,000) for the Aitutaki, Cook Islands and Malekula pilot areas). Thus progress will depend largely on how well the people themselves, helped by the Administration, tackle their problems once they have become aware of them through information and education based on the survey findings.

The Special Project on Nutrition was designed to cover a period of three years and to include periodic visits by SPC staff to the pilot areas for the purpose of making complementary investigations and stimulating any actions undertaken, thereby ensuring the continuity of the Project.

Applied research in nutrition

Its objectives and methods are set out in the Report of the Joint FAO/WHO Technical Meeting on Planning and Evaluation of Applied Nutrition Programmes (Rome, 11-16 January, 1965. WHO Technical Report Series No. 340, Geneva, 1966).

Using the procedures advocated, we shall endeavour :

- to assess the geographic, demographic, cultural and social factors that make up the epidemiological environment and to situate nutritional problems within this context;

- to assess the nutritional status of the community : existing nutritional disorders, their connection with environmental conditions, infections and parasites, preventive measures already taken;

- to determine dietary patterns, qualitatively and where possible quantitatively (food-consumption inquiries).

Assessment of the nutritional status, through clinical examination, body measurement, and biochemical tests, makes it possible to determine which are the vulnerable groups in the community and to establish an order of priority for the remedial actions to be taken by Public Health Services and the people themselves.

Furthermore, the causes and effects of the existing nutritional situation are linked to dietary patterns, which are to be studied both in their anthropological and their socio-economic aspects. The relationship between nutritional status and epidemiological context is to be investigated in liaison with the health services of the Condominium.

2. <u>Actions to be undertaken</u> on the basis of the survey findings should include :

- prevention and cure of diseases by medical means, which in many cases simply means reinforcing current Condominium programmes;

- improvement of epidemiological conditions, through environmental sanitation, development of food production with emphasis on nutritionally valuable foods, and health and nutrition education (which are inseparable) of the villagers, of their traditional or religious leaders, and especially of educators.

The Nutrition Project, while it is part of the SPC Health Programme, was designed as an interprogramme operation and every effort has been made to keep it multi-disciplinary in the field.

3. <u>Preparation of surveys of pilot areas</u> (15 June - 15 July, 1974)

Immediately upon his arrival in Noumea on 15 June 1974, the Project Manager, Professor André Raoult, set about defining the programme of each specialist connected with the Project, gathering the necessary survey equipment, and codifying and standardising data collection procedures to be applied in order to achieve some degree of uniformity for the South Pacific area. Using the guide-lines set out in the handbook published by the WHO Regional Office for the Western Pacific (Manila, 1969) he produced a system of coded files :

<u>Individual files</u> (A.B.C.D.E.), for recording :

- identification data, kinship structure, social and professional status, ethnic group, economic position (living standard);

- clinical and anthropometric data, in accordance with methods advocated by WHO (cf. Monograph No. 53 - 1966 by D.B. Jelliffe) and the Joint FAO-WHO Expert Committee on the Assessment of the Nutritional Status of the Community;

- information on psycho-sensory development of the infant.

<u>Community files</u>, for recording :

- data on environmental conditions;

- data on diets, foods available in the Pacific Islands being classified into 5 primary groups and 2 secondary groups.

The latter set of files can be used for qualitative or quantitative assessment of food intake.

On account of the large number and wide variety of data collected, we had hoped to use a computer for sorting, analysis and establishment of correlations. This plan could not be carried out, however.

Documentation on nutritional, dietary and sanitation problems in the New Hebrides was provided by the SPC Medical Documentation Centre directed by Miss Rita Tamson.

4. Preliminary visits

A brief reconnaissance visit to Malekula was made from 11 to 15 February 1974 by the SPC Dietitian, Miss Joan Macpherson, which provided general information on the Norsup area, in particular on Tautu, some basic data on diets, and a rough idea of the practicability of the survey.

Professor Raoult devoted the week from 15 to 27 July to courtesy calls and preparatory conversations in Vila, Norsup, Lakatoro, Tautu and Wala Rano, accompanied by Miss Bushra Jabre, SPC Health Education Officer, and also made arrangements for the inquiry which Miss Margaret Mackenzie, short-term SPC Consultant Anthropologist, was to undertake into the anthropological aspects of food and nutrition. This inquiry began at Tautu on 1st August 1974.

5. Technical co-operation

Technical assistance was provided by :

- Institut Pasteur, Noumea (Dr Chanalet), and
- Hôpital Gaston Bourret (Dr Constant), in particular its Biochemical Laboratory directed by Dr Marc, Pharmacist, for examination of blood samples from the pilot areas.

6. Chronology

12 - 16 August. Professor Raoult met with Public Health, Rural Health and Agriculture officials in Vila to discuss survey arrangements, and prepared a training course for English-speaking students of Tagabe Agricultural School.

1st August. Beginning of Miss Margaret Mackenzie's inquiry at Tautu: Counting and coding of family units - Aspects of nutritional anthropology - Beliefs and customs concerning food - Infant feeding - Qualitative data on local foods - Socio-economic problems.

Miss Mackenzie's study ended on 6 September. She took part in the training course at Tagabe and also contributed to the general nutrition survey at Tautu (measuring of children). Because of university commitments, she was unfortunately unable to visit the Big-Nambas communities of North Malekula and Unmet, which would have provided interesting insights into the food habits and beliefs of this unique Melanesian group.

19 - 29 August (7 working days) was devoted to clinical examination of the Tautu population by Professor Raoult, assisted by Miss Bushra Jabre and Miss Mackenzie who both stayed on till 6 September for further investigations and then attended the Training Course at Tagabe Agricultural School from 9 to 13 September.

17 - 19 September - Misses Jabre and Mackenzie returned to Noumea, while Professor Raoult stayed on to await the arrival of Dr Niiranen, Paediatrician and short-term SPC Consultant on growth of preschool children, in the meantime examining the pupils of Norsup School with Dr Rivière Cazeaux, Doctor-in-Charge of Norsup Hospital.

20 September - Arrival of Dr Niiranen.

23 September - 11 October - Reconnaissance of Wala Rano area by Professor Raoult and Dr Niiranen, codification of families and individuals, anthropometric and clinical survey of the Wala Rano community.

8 - 10 October - Dr R. Ratard, Condominium Medical Officer, joined the survey to carry out haematological and parasitological tests.

8 - 11 October - Examination of pupils of Amelvet Protestant School, situated half-way between Wala Rano and Norsup.

Practical assistance from local staff - field training

At Tautu, Dr Luke, Medical Officer at the Lakatoro dispensary took part in the survey thereby acquiring experience in clinical assessment procedures.

In Wala Rano, Miss Judith, home economics instructor at the Mission School, helped throughout the survey. A two-hour lecture on nutrition problems and their prevention was given to the teachers and nursing Sisters of the Mission. A team of two medical assistants from the Rural Health Service under the direction of Dr Ratard performed tuberculin tests and BCG vaccination during the survey.

Extension of the survey

In order to widen the scope of the Malekula survey, Professor Raoult decided to go as far as Unmet, a village on the North-West coast established fairly recently (10 years ago) by Big-Nambas migrating from their original inland area, which has a school and a dispensary run by a sole Dresser.

Dr Rivière Cazeau intended to accompany him but was prevented by very bad weather. Professor Raoult embarked on the "Rosinante", the Condominium ship which links the northern islands of the New Hebrides. He was accompanied by Mr Delion, Senior Agriculture Officer for Central District No.2, and Mr Le Chapt, Veterinary Officer for the Northern District based in Santo, and later joined by Mr Poudevigne, Head of the Department of Agriculture. Thanks to his travelling companions, Professor Raoult gathered much interesting information about geographic features, environmental conditions, local food crops and agricultural development prospects.

Due to strong winds and rough seas, the ship only stayed at Unmet for three hours, but Professor Raoult was nevertheless able to carry out clinical examinations. The "Rosinante" successively called at Vao, Ambrym, Maevo, the Maskelyne Islands and, after rounding the southern part of Malekula, at Ahamb and Lamap. A rapid survey was conducted at Ahamb, a small island near the Maskelynes with 389 people of Polynesian extraction.

On 25 October, Professor Raoult, accompanied by Mr Delion, visited Boutine, an isolated Small Nambas settlement 50km south of Lakatoro. He examined the whole population of the village : 33 people, adults included.

Dr Niiranen had left Norsup on 15 October to return to Noumea. Professor Raoult left Norsup on 30 October, but remained in Vila till 22 November for discussions with the Chief Medical Officers. He also visited the WHO Community Health Centre at Paunanguis (Efate).

Further activities in 1975

The environmental and medical data gathered during the 1974 survey and the files covering every family in the Tautu and Wala-Rano areas served as background information for the following studies :

(1) Environmental Health Surveys carried out by Mr Eric Dunn, SPC Sanitarian, at Tautu and in Wala-Rano, particularly with a view to the installation of a piped water supply (cf. Report on a visit to the New Hebrides, 15 January - 3 March 1975).

(2) Organization of Health Education in Wala-Rano. Cf. Report on a visit to the New Hebrides, 22 May - 30 June, 1975 by Bushra Jabre, SPC Health Education Officer.

N.B. It had been planned to conduct a food consumption survey of the vulnerable groups of the Wala-Rano community but this essential part of the Project had to be omitted because the Dietitian post was subsequently discontinued for financial reasons. However, the University of Hawaii having graciously agreed to make available a student nutritionist for a period of 2 months, this investigation is likely to be carried out in 1976.

PART II

GEOGRAPHIC AND ENVIRONMENTAL DATA ON TAUTU AND WALA-RANO

by

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Sanitarian

1. ENVIRONMENTAL HEALTH SURVEYS

A complete household to household survey was carried out at the village of Tautu and the villages in the Wala-Rano area with a view to obtaining data regarding :

Type of household;
Type of dwelling;
Composition and size of family;
Kitchen and cooking facilities;
Water supply;
Food storage;
Garbage and refuse disposal;
Excreta disposal;
Animals and livestock;
Pests and insect vectors.

Survey forms were completed in respect of each household, tabulating the information required by Professor Raoult.

2. TAUTU VILLAGE

2.1 This village is situated on an exposed flat promontory between Norsup Bay and Aop Bay, Norsup being to the North and Lakatoro to the South.

To the North, South and East, the village is surrounded by sea, the west side being bounded by the large PRNH coconut plantation, the ground then rising to hills at elevations of 100-200 metres.

2.2 The village is split into two sections: "Large Tautu" and "Little Tautu", and has a total population of 320 people, comprising 56 family units. About 100 children are under the age of 10 years.

Its religious denomination is predominantly Presbyterian with some Catholics.

2.3 Situated within the village are the offices of the North Malekula Local Council, a government primary day school, two co-operative stores, and a community hall.

The school has a maximum capacity of 200 and accepts children from many of the neighbouring villages.

2.4 The site comprises a subsoil of loose coral sand and coral rock topped with a thin layer of topsoil and grass. It is flat and exposed to the NE-SE winds, which seasonally can become very strong.

The sea-shore is a strip of white sand merging to an extensive flat area of hard coral inner reef which becomes exposed at low tide.

2.5 The rainfall in this area is stated to be between 100"-150" (inches) per annum, the rainy season being between December-April, with the driest months in August and September.

2.6 The houses in the "Large Tautu" area are sited along the sea-shore about 40 metres back from high-water mark and laid out in a grid-iron pattern in parallel rows about 10 metres apart, with about 3-4 metres between houses.

The average family size is 6-7 people and each family possesses, on the average, 2 living/sleeping houses, and one external kitchen and a pit latrine.

3. ENVIRONMENTAL CONDITIONS - TAUTU VILLAGE

3.1 Housing. The traditional style of house construction is plaited bamboo walls built at ground level on a loose coral floor and having a leaf roof. Some houses have concrete floors and corrugated iron roofs. The houses are generally partitioned inside with bamboo walls or curtains to provide sleeping and living rooms.

3.2 Natural lighting is generally bad, due to a complete lack of window openings in most cases.

Where windows exist they are generally very small and poorly constructed. Ventilation is likewise poor, relying upon door openings and the cracks in the lattice work of walls.

3.3 Coral floors at, or sometimes slightly below, outside ground level, are difficult to keep clean and often become damp especially in wet weather. They also provide good harbourage for fleas, ants, and other insects.

3.4 Many of the houses in Tautu village are built too close together - some only 3 metres apart, and with this type of village layout there is always a fire hazard to the whole village if houses are built too close together.

3.5 Excreta disposal. Simple dug pit latrines (squatting type) are generally used for the disposal of human excrement. These latrines are usually only 6'0" - 8'0" deep and enclosed with a rough superstructure of bush materials.

The squatting platform covering the pit is usually made of bush timber or wood from packing cases, and the surrounding floor is usually loose coral or soil.

The platform holes are rarely provided with hole covers, thereby allowing easy access for flies, cockroaches, rats, etc.

3.6 The latrines are sited in the bush areas at the east and west ends of the village, which means that some houses may be as far as 150 metres from their latrine.

It is evident that many people, especially children, do not bother to use the latrine but defecate on the beach and in the surrounding bush.

3.7 Latrine pits are often difficult to excavate in this area because the subsoil is composed of soft coral sand and hard coral rock, and the first few feet of excavation often requires shoring or lining with old oil drums.

3.8 Kitchen and cooking facilities. Traditional kitchens are separate buildings constructed of the same materials as the houses and containing an open fire grate and also a ground oven of stones. Kerosene primus cookers are also used in some cases.

3.9 Traditional food storage is a raised platform a few feet above ground level to protect the food against domestic animals.

The food store is frequently situated outside the kitchen, comprising a small platform on poles about 5'0" - 6'0" above ground level and roofed over.

There is usually no protection against rats or insect pests.

3.10 Refuse disposal. The household refuse consists primarily of bottles, tins, plastic containers, paper and cardboard, and quantities of organic material such as coconut husk, coconut shells, vegetable and fruit peelings.

3.11 Some villagers make good use of their bottles by pushing them neck first into the ground to make coloured boundaries around houses and along pathways.

Tins and bottles filled with sand and laid like bricks with a small quantity of cement between, can be used to build boundary walls, and even the walls of houses.

3.12 The practice however, appears to be to burn the combustible refuse and to dump the remainder at sea. Meanwhile the refuse accumulates in small dumps which gives rise to flybreeding, mosquito breeding, and rat harbourage.

3.13 However, it is encouraging to note that in this village the N. Malekula Council has recently commenced a once-weekly refuse collection service, the refuse being taken to the Norsup refuse tip. At present this collection service appears to be rather unreliable, but it is to be hoped that it will become more regular and effective as the people realise the benefits of such a service.

The people should be encouraged to store their household refuse in sacks or containers pending disposal.

3.14 Since refuse collection is infrequent, it would be advantageous if the villagers could be encouraged to adopt a refuse separation technique aimed at separating the combustible and biodegradable elements - e.g. paper, cardboard, garbage, from the non-biodegradable, e.g. cans, bottles, plastics.

This would reduce bulk and ensure that the non-biodegradable elements were given priority during collection.

If necessary the remainder could be easily burnt or composted by the villagers.

3.15 Water supply. Two sources of freshwater are at present available to the villagers of Tautu:

(i) rainwater;
(ii) underground water.

3.16 Many of the villagers have their own roof catchments, the water being collected in open-topped 44 gall. oil drums. A few have their own shallow wells which are totally unprotected and subject to pollution, the water being drawn by means of a tin or bucket on a long pole.

3.17 A large number of the villagers however rely upon drawing water from the Council water tank and the Council well, both of which are situated on the West side of the village, close to the Council office building.

3.18 The water tank is a galvanized steel bolted type tank of about 5,000 gall. capacity. Standing on a concrete base, it collects the rainwater from the roof of the Council office building.

3.19 The community well, constructed by the Council close by the Council office, is used extensively by the villagers.

It is a shallow well, unlined and unprotected, about 10'0" deep. Water is drawn manually by means of a bucket and rope, or bucket on a bamboo pole.

3.20 All of these sources, including the rainwater storage drums are subject to pollution, and do not provide an adequate supply to the villagers, particularly during long spells of dry weather.

3.21 Freshwater is used only for drinking and cooking, and occasionally when rainfall is plentiful, for washing clothes. The villagers use the sea for bathing and washing clothes, and sometimes the Aop creek.

3.22 The provision of an adequate piped water supply to this village is necessary if environmental sanitation and personal hygiene is to be improved, and this matter was investigated by the writer during his visit.

3.23 Enquiries among the villagers elicited the existence of one elevated spring source within reasonable distance of the village, situated in the hills on the west side of the village above the PRNH plantation at an elevation of approximately 100 metres.

The writer visited this source with several of the Tautu villagers.

3.24 The shortest distance from the village to this source would be at least 3 km but the source is on the West slope of the hill, so it was approached from the new cross-island road which considerably increases the distance.

3.25 If this water is to be gravity fed to Tautu village, the pipeline would have to traverse around the lower hill slopes before cutting across the plantation to the Tautu promontory, increasing the length of the pipeline to about 6 km.

3.26 The spring source itself was disappointing, having an estimated flow of only about 1,500 galls/hour at the time of the visit, although this probably fluctuates according to rainfall.

3.27 Whilst this source would appear to be a feasible alternative, the cost would be relatively high, as much of the terrain would be unsuitable for PVC pipe, necessitating the use of galvanized iron pipe. Permission would also be required to run the pipeline across the PRNH plantation.

3.28 The second alternative is the utilization of ground water. That a substantial groundwater aquifer at a reasonable depth exists in this area is evidenced by the existing wells and bores which are supplying water to Norsup township and the PRNH Plantation buildings.

3.29 Whilst the Tautu village promontory itself, being almost surrounded by sea, may not contain very substantial reserves of freshwater, the open ground West of the promontory bordering the plantation could be expected to yield ample freshwater for the village.

3.30 A properly constructed dug well, or a bore, provided with a suitable mechanical pump to lift the water to an elevated storage tank from which it could be reticulated to standpipes in the village, would be a feasible alternative.

3.31 Since this promontory is exposed to the NE-SE winds and appears to receive a substantial number of hours of wind each day, the provision of a suitable windmill pump could be considered, if necessary supplemented by an auxiliary motor pump.

3.32 Rats. Invasion of the houses and kitchens by rats was a universal complaint by all villagers. They cause damage to the fabric of buildings and to stored food crops. In this village, the principal habitats appeared to be within the edges of the coral reef, stone walls, under concrete floors, in leaf roofs, and in the natural coral caves used as pig pens at the end of the village.

3.33 Animals. Some households kept dogs and cats and a few fowls, but they did not appear to constitute much of a nuisance in this village. Some pigs are kept in pens outside the village area, and cattle graze in the adjoining plantations.

3.34 Insect pests and vectors

Mosquitoes. Most of the villagers complained about nuisance from mosquitoes, a few using mosquito nets at night, and insecticide aerosols and repellents.

There undoubtedly exists a considerable number of man-made mosquito-breeding foci in this village. The majority of the rainwater storage drums were found to be breeding culicine mosquitoes, as no attempt is made to screen these drums.

At several households, mosquito larvae were also found in old tins, coconut shells, old tyres and open wells. No anopheline breeding was located in the village area.

3.35 Flies. Houseflies are numerous and a continual nuisance, but their presence seems to be accepted as inevitable by the villagers. No doubt the fly nuisance is associated with the large surrounding cattle population, but other breeding foci are pit latrines, refuse dumps, animal and human excrement, and dead aquatic life along the seashore.

3.36 Bedbugs. A few villagers complained about the presence of bedbugs in the houses, but such complaints were not numerous.

3.37 Lice. Several families admitted to the presence of head lice in the children's hair, and this is probably more prevalent than generally admitted.

3.38 Fleas. A number of families complained about nuisance from fleas. This is not surprising as they are disseminated by dogs and cats, and find a suitable habitat in the sandy coral floors.

3.39 Cockroaches. Nearly all households complain of severe cockroach infestations in the houses and the kitchens.

4 WALA-RANO DISTRICT

4.1 Wala-Rano is located on the North-East coast of Malekula between the Orap river and Pinaloum Point approximately 10 km north of Norsup.

It includes the two small offshore islands of Wala and Rano, approximately 1 km from the mainland and 1 km distant from each other.

4.2 The Wala-Rano area, on the mainland of Malekula, comprises a number of small villages which stretch along the coast from the Orap river in the North to Amelvet village in the South, a distance of approximately 6 km, the division between Wala and Rano being the Catholic Mission complex in the centre.

The villages themselves are small isolated groups of houses or hamlets, varying in size from two or three family units to twenty or more.

4.3 The offshore islands are small almost circular flat islands at an approximate elevation of 20 metres, having a sand and coral subsoil with a topsoil capable of supporting a relatively lush vegetation.

Rano island has the largest area, with a diameter of approximately 1½ km, Wala island being slightly smaller.

4.4 The Wala-Rano mainland coastal strip comprises a foreshore of sand and coral rising sharply for most of its length to a flat plateau of grassland at about 40 metres elevation. A narrow coral motor road runs along the coastal strip, and villages are situated on each side of the road, some on the beach, and some on the plateau.

Inland, the plateau rises to hills of more than 200 metres elevation.

4.5 The mainland Wala area comprises the following villages:

Pentecôte	Pura
Worprev	Sanwaré
Wortatsa	Matanwat
Wowoute	Wetu.
Chipitir	
Melvavara	

It has a total population of 384 people comprising 62 family units. About 120 children are under 10 years of age.

Its religious denomination is predominantly Catholic with some Presbyterians.

4.6 The mainland Rano area comprises the following villages:

Notre-Dame Mission	St Joseph	Paita
Tsiselmambué	St Thérèse	Worlep
Lamap	Santa Maria	Tsinemtenowo
Illie	Wornari	Amelvet.
Woromlaki	St Michel	

It has a total population of 393 people comprising 63 family units. About 126 children are under 10 years of age.

Its religious denomination is predominantly Catholic with some Presbyterians.

4.7 Wala Island contains the following villages:

Bethanie	Leinao
Sareta	Genessaret
Cercer	Sapa
Poton	Bethlehem.
Iripos	

It has a total population of 298 people comprising 56 family units. About 70 children are under 10 years of age. It has a mixed Catholic and Presbyterian population.

4.8 Rano Island contains the following villages:

Melerer	Tsinembris
Bethlehem	Paradiso
Noron	Melsingol
Soucy	Bethany
Tsinenabomé	Potora.
Mission	

It has a total population of 205 people comprising 41 family units. About 60 children are under 10 years of age.

It has a mixed Catholic and Presbyterian population.

4.9 There is a daily traffic of people by canoe between the mainland and the small islands, and some families maintain residences on both island and mainland.

4.10 Since the majority of the population are Catholic, the Catholic Mission has considerable influence in the Wala-Rano area.

Father Soucy, who is presently in charge of the Mission, first came to the area in 1957.

It is interesting to note that at that time the Mission was situated on Wala Island, and the majority of the people lived on the two small islands, the mainland coast being virtually uninhabited.

In fact, the area where the Mission is now located was an ancient burial ground for the people living on the small islands, and was therefore regarded as "Tambu" ground.

4.11 Because of an increasing population and lack of garden land, and the difficulties of communication between the small islands, particularly with regard to the schooling of children, Father Soucy decided to move the Mission to the mainland, and to encourage the resettlement of the villagers in this area.

The Mission was given possession of the old "Tambu land" by the Wala-Rano people, and on this land the Church and Mission buildings were erected.

4.12 The move to the mainland from the small islands was made in 1962 under the direction of Father Soucy in what was apparently a very spectacular religious ceremony, the main theme being the unification of the Wala-Rano peoples.

The establishment of villages along the Malekula coast from the Orap river to Amelvet has continued from that time, and the population continues to expand rapidly.

4.13 The Mission station itself is a large one, located on high ground overlooking the two islands.

All buildings are of permanent materials, most of them being of reinforced concrete or concrete block construction, built by the local people under the supervision of Father Soucy.

The buildings comprise a very fine church of modern design; a large school block capable of accommodating up to 350 children, a cinema hall, a clinic, mechanical workshops, the Fathers' residence and office, the Sisters' residence, kitchen and laundry, and smaller dwelling houses for the teachers and works foreman.

The piped water supply is from a central concrete rainwater storage tank, the supply being augmented when necessary by water pumped from a well near the seashore by means of a "MONO" electrically driven pump. Electricity is provided by the station generator powered by a diesel engine. The station is indeed a magnificent achievement resulting from many years of devoted work by the people of Wala-Rano under the direction of Father Soucy.

5. ENVIRONMENTAL CONDITIONS - WALA-RANO VILLAGES

5.1 Housing. Variable standards of housing exist in this area from permanent type houses of timber-frame construction with Masonite cladding, raised concrete floors, glass-louvred windows, and corrugated iron roofs, to the poorest standard traditional village-type house constructed of bush materials.

Generally however, the houses are of an average traditional village style construction, built at ground level, with plaited bamboo walls, leaf or iron roof, with a coral or concrete floor.

5.2 In this type of traditional house, natural lighting is universally bad or non-existent due to a lack of window openings or inadequate window area.

Ventilation is likewise very poor, relying on door openings and the cracks in the lattice work of walls. A few houses are raised on stumps above ground level, but the majority are built at ground level with coral floors, although the modern tendency is to provide a concrete floor.

5.3 Family units often possess two or three living/sleeping houses, with an outside kitchen, and a covered verandah or portico for sitting and talking. These verandah areas are often roofed over with galvanized iron sheeting to act as separate rainwater catchments.

5.4 Distances between groups of houses comprising family units are usually adequate, but in many cases the houses comprising a family unit are built too close together.

5.5 The areas surrounding some houses are maintained in an excellent condition with fresh sand and coral laid on the surrounding borders and pathways, and boundaries planted with hedges and flowering shrubs. On the other hand, many houses have dirty and untidy surroundings with uncut grass and littered refuse.

5.6 Kitchen and cooking facilities. Most family units possess their own outdoor kitchen of traditional style, a small house constructed of bush materials which contains an open firegrate and a ground oven of stones. A few kitchens also possess kerosene cookers or primus stoves.

Food storage is usually poor, giving protection only against domestic animals, but not against rats, flies, and cockroaches.

Most households appear to have an assortment of aluminium and enamel utensils, and in some instances knives, forks, and spoons are used. Standards of food hygiene are generally poor, mainly due to a lack of sinks and inadequate water supply.

5.7 Excreta disposal. When asked how they dispose of their human excrement, the villagers inevitably claim to possess a latrine. A few however appear to believe that latrines are unnecessary and state that they use the beach.

The latrines however, in most cases are situated a considerable distance from the dwelling house - usually in the adjoining bush.

5.8 Inspection of such latrines often reveals that they are not in regular use. Such tell-tale signs as overgrown tracks, long grass and spiders' webs across the entrance, indicate that they have not been used for many weeks.

5.9 The latrines, which are of the simple dry pit, squatting type, are usually poorly constructed and unscreened. Few have concrete floors or squatting slabs.

5.10 Under these circumstances, it is unlikely that they are used at night, and probably very infrequently by young children who prefer to use the beach.

5.11 Many of the latrines are not dug to a sufficient depth, and if used regularly, fill up rapidly and have to be re-sited and reconstructed. The writer saw many new pits being excavated, and can appreciate the effort involved in having to penetrate hard coral rock with inadequate tools, and the difficulties of stabilizing the sides in loose soil formations.

In the past, old 44 gall oil drums were commonly used to line the top sections of pits, but these are becoming progressively more expensive and difficult to obtain.

5.12 From a health and economic point of view therefore, it is advantageous to construct a latrine which is easily accessible and used by all members of the household, is hygienic and nuisance-free, and possesses a relatively long life potential. A properly constructed pour-flush water seal latrine will meet these requirements, but an adequate and accessible water supply is the first essential.

5.13 Refuse disposal. In all of these villages, refuse disposal presents a problem.

The non-biodegradable constituent of village refuse such as cans (iron and aluminium) glass bottles, and plastic containers, is increasing, and these materials are not easily disposed of by the traditional methods of burning and composting.

Since there is no organised collection in these villages, refuse is usually disposed of by burning or dumping at sea. In some instances however, it is scattered or dumped in the bush.

5.14 In the coastal villages, refuse is often loaded into canoes and taken a short distance out to sea for dumping, but in most cases it is deposited in a convenient foreshore coral creek. Pending disposal however, the refuse is usually stored in small dumps in the village area, providing harbourage for rats and foci for mosquito and flybreeding.

5.15 Water supply. The interviews conducted during the course of this survey made it abundantly clear that the people of Wala-Rano regard the provision of an adequate potable water supply as being their priority requirement.

5.16 At the present time their freshwater supply consists of either rainwater caught in open 44 gall oil drums (very few possess purpose-made water storage tanks) or groundwater drawn from traditional unprotected shallow wells.

A very few of the lucky ones have their houses close to freshwater outcrops along the beach. During long periods of dry weather, the water problem becomes very acute for most of the villagers.

5.17 Almost every family unit possesses one small corrugated iron roof catchment with two or three 44 gall drums.

In the majority of cases, these drums are completely unprotected permitting prolific mosquito breeding, the bottoms often being covered with algae and detritus.

Since taps are not usually provided to draw off the water, utensils are dipped directly into the top of the drum causing varying degrees of contamination.

5.18 A number of shallow wells are located along the coastal strip, but they are of the traditional open-type construction, subject to pollution by surface water runoff, animals, humans and insects.

The water is drawn by rope and bucket or a container on a bamboo pole.

5.19 These freshwater sources are used primarily for drinking and cooking. Personal ablutions are done in the sea or in the Orap river estuary, and clothes washing is done either in the Orap river or in well water.

5.20 Father Soucy has long been conscious of the need for an adequate piped water supply to the whole of the Wala-Rano villages from the Orap river to Amelvet, and has initiated the collection of funds for this purpose.

5.21 A scheme has already been proposed by the Condominium Mines Department utilising an inland spring source, but insufficient money has been made available to permit the scheme to go ahead.

5.22 Whilst working in the Wala-Rano area, I was requested by Mr Lecuyer and Father Soucy to investigate the alternative available water sources, and to give an opinion regarding their suitability as sources for a Wala-Rano piped water supply.

5.23 The following sources were visited:

(i) Source "OUTOUP".
(ii) Source "WORWOR".
(iii) Lake LEMSOU.
(iv) ORAP river.
(v) Coastal outcrops.

5.24 Source "OUTOUP" is the one investigated and proposed by the Condominium Mines Department.

This source is about 3½ km inland from Orap village in the Orap river valley, close to the village of Tomboul.

5.25 From the coast, the terrain climbs steadily to the hills at elevations of over 100 metres. Much of the land to the foothills passes through plantations. Then the land rises steeply to the crest of the hill and down the other side to the river valley.

The "Outoup" spring is located on the West side of the hill and drains into the Orap river.

The villagers are planning to construct a road through the plantations as far as the foothills.

5.26 The spring was completely hidden by overgrown vegetation.

When this was cleared and the source exposed, it revealed a small seepage from a soft coral face with an estimated flow of approximately 2,000 galls/hour. The water however tasted and appeared to be of good quality, and the villagers claim that its flow never varies throughout the year.

5.27 The proposal is to run this water into a small concrete collecting reservoir, and then to pump it up the side of the hill to a 25,000 gall steel storage tank from which it will gravitate down to the coast, and be reticulated through the villages from Orap to Amelvet, a distance of about 10 km.

5.28 The scheme as proposed, is no doubt a feasible one, but the water must be pumped to a considerable height before it can be fed by gravity to the villages.

It is important therefore, to consider the following points:

(i) the total population to be served, including these people on the small islands, is currently about 1,500.

To supply 10 gallons per person per day (15,000 galls), the pump must operate at least 8 hours per day.

If population increases, and water consumption per capita rises (as it usually does when a piped supply is installed), then this source could rapidly become inadequate to meet the demand.

(ii) The pumphouse will be situated in a difficult position on the other side of a steep hill.

Will a reliable person be found to operate the pump each day, and will he require payment?

(iii) Maintenance will be required not only of the pump but the spring source, channels, and collecting reservoir, which are likely to become rapidly overgrown with vegetation. Will someone be available to carry out this maintenance, and who will pay him?

(iv) An inland road from Sanwaré is proposed, but this can only run as far as the foothills.

Who will arrange for regular supplies of fuel to be carried over the hill?

(v) The spring source and the collecting reservoir should be protected against contamination, aquatic life and overgrowth of vegetation.

(vi) A breakdown, or failure to operate the pump for one day will stop the supply to the whole area.

5.29 Source "WORWOR" was the second spring source investigated, and is situated in the hills over 4 km inland from Sanwaré.

The terrain leading to this source is more difficult than that to the "Outoup" source, being more hilly and covered for most of the way by bush and light forest.

The ground is also more generally rocky and craggy.

5.30 The source lies in a steep valley on the far side of two hills, in a location similar to the "Outoup" source. The water springs from fissures in a formation of large stone boulders, the volume of flow being very similar to, or possibly slightly in excess of, the "Outoup" source.

The water tasted and appeared to be of good quality.

5.31 So far as the water source is concerned, there is little to choose between this and the "Outoup" source, but the development of this source would appear to present greater constructional difficulties and would be more expensive.

5.32 The pumping main would be required to traverse more difficult ground and would be longer than the "Outoup" main, necessitating a more powerful pump. In fact, two pumping stages may be required.

5.33 Because of the nature of the ground, the use of PVC pipe would be impractical for much of the way. In order to afford adequate protection PVC pipe must be laid in a trench at least 2'0" deep free from flints and sharp stones.

5.34 For these reasons, the development of this source should not, in my opinion, be considered.

5.35 Lake LEMSCU is situated about $1\frac{1}{2}$ km inland immediately behind the Notre-Dame Mission.

On first sight it might appear to be an obvious source of water for the Wala-Rano area.

5.36 The lake is at an elevation of 38 m and comprises an open area of water of several hectares in extent surrounded by a wide fringe of grass swamp which renders it difficult to approach the open water.

5.37 The writer could obtain no information regarding the depth or quality of the lake water, but the local people state that it diminishes in size considerably during dry periods, which tends to indicate that it is a depression fed directly by rainwater and surface water runoff and seepage, rather than by springs.

5.38 Another smaller area of water - Lake Lepranis is situated about 2 km further north close to the Orap river, but the circumstances here appear similar.

5.39 However, it would be interesting, and perhaps profitable, to obtain ecological, limnological, and water quality data regarding these lakes. To do this, a small boat would be required to carry out observations over a period of at least one year.

5.40 Although the lakes are stated to be well stocked with fish, including tilapia, it is highly probable that the grassy swamp fringes provide breeding grounds for mosquitoes.

5.41 On the information available, and without further extensive investigation, these lakes could not be considered as suitable water sources.

5.42 Orap River. This river rises in the central hills about 9 km inland from Wala-Rano and flows North-East to the sea at Orap village. It forms the Northern boundary of the Wala area

5.43 The mouth of the river at Orap is about 30 m wide, and has a substantial flow and depth of water. The water here is brackish being subject to tidal variations.

5.44 This river could be considered a potential source of water for the Wala-Rano area, but it would undoubtedly require some treatment.

5.45 This river was not investigated higher than the cable ferry at Orap, but it seems likely that a suitable intake could be located a relatively short distance upstream which would yield good quality water. However, the raw water would be subject to fluctuations in quality, especially during the rainy season, and some form of treatment would be required - probably only sand filtration and chlorination.

5.46 An alternative would be the construction of an infiltration gallery in the river valley - possibly even in the mission plantation area or perhaps a little further upstream to avoid salt water intrusion.

Water from such a gallery may require no treatment providing the area is protected from pollution.

5.47 Coastal outcrops of underground water. There already exist a number of shallow dug wells of traditional style along the coast which are used by the people for domestic purposes.

The yield of these wells, and the quality of the water should be investigated.

5.48 At present the wells are completely unprotected and open to pollution, and contain a variety of aquatic life including mosquito and other larvae, worms, and algae.

5.49 Along the Wala-Rano mainland coast one can also observe a number of places at which fresh water of apparent good quality gushes out in substantial quantities from coral fissures.

The village people claim that these flows are perennial with little or no seasonal variation.

This water is used by the villagers for culinary purposes.

These coastal outcrops of fresh water, and the existing wells, would indicate substantial resources of underground fresh water at depths approaching sea level.

5.50 It is strongly recommended that this potential source of freshwater should be further investigated with a view to the construction of wells or bores.

5.51 The construction of a series of pumping stations along the coast to pump water from dug wells or bores to elevated storage tanks on the high ground above could be a more reliable, practical, and economic solution than any of the aforementioned schemes, for the following reasons:

(i) the sites would be located along the coast road and easily accessible for construction purposes;

(ii) the pumps would be easily accessible for operation and maintenance;

(iii) it is anticipated that the underground aquifers would provide a more substantial source of water than the inland springs;

(iv) the non-operation of one pumping station would not put the whole water supply out of action;

(v) output could be increased as required (subject to the yield of the wells) by more pumping hours, or the installation of larger or additional pumps;

(vi) the total overall cost would probably not be any greater, but construction could proceed station by station as funds become available;

(vii) the system would be seen and understood by the villagers whom it was benefitting, and who would be called upon to assist in its maintenance and operation.

Permission, of course, would have to be obtained to construct the pumping stations and elevated tanks on private land, but I understand this would not present any problems.

5.52 In the Wala-Rano area it is unfortunate that there appears to be no water source which could be developed to deliver water to the villages purely by gravity.

Since pumps are inevitable, it would be advantageous if they were situated in positions which are easily accessible for operation and maintenance.

5.53 Water supplies on small islands. The water supplies to the villages on the small islands of Wala and Rano are similar to the villages on the mainland, consisting of rainwater catchments with storage in 44 gall drums, together with a number of traditional shallow unprotected wells.

5.54 Many of the wells apparently yield fresh water of good quality which the village people claim is not salt. However, none are provided with a mechanically operated pump, and there is only one well with a small hand-pump provided by the local council.

The usual method of drawing water is by means of a tin can attached to a long bamboo pole.

5.55 Under these circumstances it is impossible to judge the yield of these wells, or to what extent pumping could be carried out without the danger of salt water intrusion.

5.56 It is likely that both islands possess a substantial underground freshwater lens which could be tapped to provide adequate fresh water for the villagers. It is recommended that test-pumping be carried out on the existing wells and water analyses taken to determine such factors as draw-down, yield, salinity, and general water quality under varying conditions of pumping.

5.57 The construction of properly protected wells provided with mechanical pumps similar to those proposed for the mainland could be considered.

If skilled people are not available on these islands to maintain mechanical pumps (which seems likely) then a series of protected wells equipped with suitable handpumps could be a practical alternative.

5.58 Rats. Rats are a serious problem in the houses and in the gardens particularly in the mainland villages.

They cause considerable damage to coconuts, cocoa, food crops and domestic food stores and will even attack human beings when asleep at night - this is a particular danger to young children and old people.

5.59 Rat habitats are in the bush vegetation, tree roots and hollows, coral rock fissures, coral block walls, the roofs of houses, underneath cement floors, coconut and cocoa plantations, accumulations of refuse, in and around pit latrines and pig pens.

5.60 Improved sanitation in and around the villages would do much in helping to alleviate this nuisance, but an increased awareness of the predisposing factors can only be brought about by increased health education.

5.61 At present two methods of control are practised by the villagers:

(a) the use of rat-block poison which it seems is distributed by the Agriculture Department, and sold through Co-op stores, etc., and

(b) the use of cats as predators.

5.62 Poison rat-blocks contain a bait base such as oatmeal or wheat grains impregnated with "Warfarin" poison and bound together in a block of paraffin wax.

This can be an effective method of poisoning _if_ the villagers are instructed in its use or the poisoning is carried out by trained operators. However, the uncontrolled and haphazard use of these blocks is ineffective, and may in fact do more harm than good, because sub-lethal doses of this poison can build up a resistance in rats.

5.63 It is interesting to note that the use of cats as a predator to keep dwellings clear of rats is now becoming well appreciated by the local people, and there seems to be increasing numbers of villagers keeping and breeding cats as domestic pets.

(In this connection it might be interesting to determine the incidence of toxoplasmosis amongst the villagers - particularly the children).

5.64 Since it is understood that all of the houses in this area are shortly to be sprayed with DDT, in connection with the malaria control programme, it is recommended that the villagers be warned in advance to protect their cats against the effects of this spray. Cats are very susceptible to DDT, and in the Solomon Islands the spraying of village houses with DDT resulted in a high mortality among village cats, which subsequently resulted in a severe increase in the nuisance from rats.

5.65 Animals. Most households keep dogs and chickens, and as already mentioned, cats are increasing in popularity.

Packs of dogs are often kept for the purpose of hunting wild pigs in the central bush. The wild pig population in the interior of the island appears considerable.

5.66 Many households keep a few pigs. These are either kept in small pens adjoining the village or tethered by one leg to a tree.

Pig pens are poorly constructed open enclosures usually muddy and dirty which rapidly become foci for the breeding of mosquitoes, flies and rats.

5.67 Many villagers keep cattle, but these are usually kept in the adjoining plantations or gardens.

Occasionally one also sees a goat tethered to a village tree.

5.68 Insect pests and vectors

Mosquitoes. In the mainland villages there is considerable mosquito nuisance, and this was a general complaint from all households. Many of the villagers use mosquito nets, and many burn mosquito coils or use aerosols at night.

5.69 The most prolific sources of mosquito breeding in the mainland villages are the open 44 gall oil drums used to store rainwater.

Most households retain two or three or more drums for this purpose, and scarcely a drum was found which did not contain mosquito larvae, very often in large numbers.

The drums are usually standing vertically, open ended, and no attempt is made to screen them or to apply kerosene to the surface.

5.70 The easiest way of protecting this type of drum against ingress of mosquitoes is to lay it horizontally on blocks and cut a small hole a few inches in diameter in the side to receive the rainwater. This inlet can then be screened with plastic mosquito gauze. A faucet can be screwed into the threaded hole at the end of the drum in order to draw off water.

In this way the water is protected against contamination and mosquito breeding.

5.71 A better alternative is the use of properly constructed galvanized iron water tanks. A few of the villagers possess those, but it appears that such tanks can only be obtained from Vila or Santo, and shipping as well as cost is a problem.

There would appear to be good business here for an enterprising sheet-metal worker to set up a small workshop locally or in Norsup to manufacture water tanks for the local villagers.

5.72 Since the writer did not have in his possession any larval sampling or identification equipment, except a small kitchen ladle borrowed from the Mission kitchen, he would not attempt to identify the larvae seen in the rainwater drums.

Although the vast majority of them certainly appeared to be culicines, on at least two occasions the writer identified anophelines, and the difference in their resting posture on the surface of the water was pointed out to the villagers.

Anopheles were also identified in small pools in the Sanwaré and Worlep areas.

5.73 It is also important to know whether Aedes are present, - particularly A. aegypti. Since it is easier to identify the adult mosquito than larval forms, it is recommended that larval samples from drums and other breeding foci be taken and kept in gauze covered glass jars until the adults emerge.

5.74 The water in the Sanwaré creek, each side of the road ford across the creek, was searched by ladle dipping, but no larvae of any kind were found. On the face of it this creek would appear to be a potential breeding site, since the ford crossing the creek has interrupted the flow of water, except in times of heavy rainfall when the ford is submerged. However, it was observed that this water supports an abundance of small fish which are probably larvivorous. One odd species appears to be amphibious, using its ventral fins as feet to crawl out of the water on to small rocks.

5.75 The swampy areas along the banks of the Orap river adjoining the Mission plantation would also appear to be potential breeding sites, although no larvae were found by the writer during his brief visit.

5.76 The grass swamp fringes of lake Lemsou are also likely mosquito breeding areas, but larvae were difficult to find when visited by the writer, as recent heavy rains had caused the surrounding fringe to flood.

5.77 The small creek entering the sea between Worlep and Tsinemtenowo was also investigated.

Stone filled river gabions erected by the PWD to provide a crossing have disintegrated and made conditions worse by obstructing the flow and forming pools.

The sides of this creek were searched, but no larvae found, probably because of flushing created by seasonal rains. This creek should be canalized and bridged to prevent the formation of standing water.

5.78 Mosquito nuisance on the small islands is not a serious problem.

Most villagers reported little nuisance which they considered to be mainly of a seasonal character, i.e. after the rainy season. A few people reported they were not bothered at all by mosquitoes.

Rainwater drums showed occasional breeding of low intensity.

5.79 Environmental conditions on the small islands are better than on the mainland. There are no natural water courses, and the porosity of the soil precludes long standing accumulations of water.

Mosquitoes and other insect vectors could easily be eradicated from the islands, and it is significant to note that many villagers stated a definite preference for living on the islands as they considered them healthier.

5.80 <u>Flies</u>. Houseflies are a continuous nuisance in the mainland villages, and present a serious problem.

This is no doubt to a large extent due to the presence of cattle in adjoining plantations, but refuse accumulations, pit latrines, pig pens, and uncultivated surrounding bush also provide breeding grounds.

The fly nuisance on the small islands is not so great, due no doubt to there being fewer animals and smaller population.

5.81 <u>Bedbugs</u>. Some households complained of bedbug infestations, but such infestations did not appear to be of great intensity. The incidence of bedbugs is probably greater than generally admitted, and it is likely that these complaints will increase after the houses have been sprayed with DDT in connection with the malaria control programme.

5.82 <u>Lice</u>. A number of families complained of head lice, particularly in the hair of women and children. This problem is undoubtedly more widespread than generally admitted. Improved personal and home hygiene would help to eliminate this problem.

5.83 <u>Cockroaches</u>. The villagers seem to accept the presence of cockroaches in their houses as inevitable, and the incidence of these pests is undoubtedly associated with the dark, airless, humid housing conditions, unscreened food storage, and poor community hygiene.

Because of ideal environmental conditions - darkness, dampness, and ample food supply, cockroaches are inevitably attracted to such places as pit latrines, septic tanks, and refuse dumps. Under poor sanitary conditions the cockroach problem can become very severe.

As Roth and Willis have observed :

"People living in civilized, highly sanitized areas are rarely aware of the truly tremendous cockroach infestations that may exist under poor hygienic conditions". (1)

5.84 The extent to which cockroaches can become carriers of disease is unknown, but research over recent years has shown that cockroaches can carry infections on the outside of their bodies as well as internally, and are likely to transmit pathogenic organisms if given the chance. Organisms recovered from cockroaches by research workers include those of the Salmonella group, the virus of poliomyelitis, Entomoeba histolytica (amoebic dysentery), the eggs of hookworm, and the larvae of various roundworms.

5.85 The extent to which cockroaches act as vectors of intestinal parasites and infections among the villagers of Wala-Rano is open to conjecture, but it is likely that they represent a significant factor in the transmission of such diseases.

6. HEALTH INFORMATION

6.1 At the suggestion of Father Soucy, before departing from Wala-Rano, the writer gave a health talk to about 200 villagers in pidgin English (Bislamar). This lasted about 2 hours and was given after Sunday church service in the cinema house.

The subjects covered included :

(i) intestinal parasite infections;

(ii) malaria and filariasis;

(iii) mosquito control;

(iv) latrine construction;

(v) aspects of house contruction;

(vi) village water supplies - protection of rainwater drums and tanks, and the construction of sanitary wells.

6.2 In such a short time, these subjects could be covered only briefly, but much interest was shown, and there were many questions.

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(1) Roth L.M. & Willis E.R. (1957) : The Medical and Veterinary Importance of Cockroaches. (Smithsonian Misc. Collect.).

It is strongly recommended that an intensive follow-up health education campaign should be undertaken by the South Pacific Commission in conjunction with the New Hebrides Health Authorities.

7. GENERAL RECOMMENDATIONS

7.1 Water supply. (cf. paragraphs 3.15 to 3.31 and 5.15 to 5.57)
The key to the improvement of sanitation and environmental conditions in these rural villages is the provision of an adequate and wholesome piped water supply.

Apart from the undoubted benefit to health of having a wholesome water supply available for drinking and cooking, it is a necessary prerequisite if significant improvements are to be achieved in methods of disposal of human excrement, and personal and community hygiene. The villagers themselves undoubtedly regard this as their priority requirement.

7.2 As pointed out by Wagner and Lanoix (2) :

"(i) in most small towns and villages in rural areas, more health benefits can be gained from money spent on a water-supply programme than in any other way;

(ii) there will be little public health benefit from a water supply which does not provide water in adequate quantity and quality and in a way convenient to the population".

7.3 It is recommended that further investigations be carried out into the possible development of groundwater resources in the areas of Tautu and Wala-Rano (including the small islands) with a view to providing a piped water supply to these villages, as outlined in paras 3.28 to 3.31 and 5.47 to 5.57.

7.4 To demonstrate the feasibility and methods of constructing such a system, two initial pilot projects could be undertaken - one in a group of villages in the Wala-Rano mainland area, and another on one of the small islands.

Funds might be available from international sources to do this.

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(2) E.G. Wagner and J.N. Lanoix: Water Supply for Rural Areas and Small Communities. (WHO Monograph series No. 42)

7.5 Excreta disposal (cf. paragraphs 3.5 to 3.7 and 5.7 to 5.12)
Many latrines are too far from the houses (100 m. or more) and most of them are badly constructed.

The poor construction, especially of the base and slab which are usually of rough timber permits easy access of rats and insects, and egress of hookworm larvae.

In fact the insanitary floors of pit latrines could be a significant factor in the spread of hookworm larvae.

7.6 Pending the provision of a piped water supply, it is recommended that a number of demonstration model pit latrines be constructed to show the villagers the correct method of constructing a sanitary privy.

7.7 When a piped water supply is provided, the ultimate objective should be the installation of approved water-seal latrines, at least one to each family, situated within reasonable distance of each family unit.

7.8 Housing (cf paragraphs 3.1 to 3.4 and 5.1 to 5.5)
Houses generally are dark, lacking in ventilation, and infested with rats and insects.

Improved methods of house construction should be aimed at alleviating these defects.

It is recommended that :

(i) All new houses be provided with adequate window openings having a total area of at least one-eighth of the floor area and placed so as to provide cross-ventilation.

(ii) The minimum distance between houses should be 7 metres.

(iii) People should be encouraged to build their houses with the floor raised on stumps at least 2'0" above ground level, the tops of the stumps being provided with metal caps.

This will keep the floor dry, make it easier for cleaning, and help prevent the ingress of rats and insects.

Alternatively, a properly constructed raised concrete floor should be provided.

It is important to construct concrete floors correctly, otherwise the underneath becomes a magnificent breeding place for rats.

7.9 Kitchens and food storage (cf. paragraphs 3.8, 3.9 and 5.6). The traditional external kitchen with open fire and ground oven of stones is well established, although people tend to be making more use of kerosene appliances.

Bottled gas equipment is expensive and not easily available at present, but will no doubt become more generally used in the future.

7.10 As an improved cooking device, and to prevent the creation of large volumes of smoke permeating kitchens and the surrounding houses, the introduction of the Fiji-style "smokeless stove" might be considered.

7.11 Although households are not in the habit of storing large quantities of food, the storage facilities which do exist are generally unsatisfactory. Most of the food stored consists of local crops - sweet potatoes, taro, cabbage, bananas, pawpaw, etc., with some purchased foods such as rice, bread, flour, biscuits, etc.

The traditional stores are not protected against depredations by rats and contamination by cockroaches and flies. Greater use could be made of wire mesh, metal gauze, and expanded metal to protect food from these pests.

7.12 Refuse disposal (cf. paragraphs 3.10 to 3.14 and 5.13 to 5.14) Problems associated with refuse disposal become most acute in the large rural village community complex, that is a community which has become too large to be considered a normal village, yet too small to be considered a township or urban area.

The villages on the Wala-Rano mainland could be considered to fall into this category.

7.13 Organised refuse collection and disposal is an expensive public health service which only becomes economically feasible at a certain density of population. Until that time arrives, the responsibility for refuse disposal must rest with the individual householders.

7.14 Just how effectively this is carried out by the villagers depends on many factors, including their awareness of the hazards which can arise from improper disposal, knowledge of the appropriate methods which can be applied, topographical and environmental conditions, pride of the community in its general surroundings, and general motivation.

7.15 In the Wala-Rano area there is no organised collection, and villagers use a variety of ways to dispose of their refuse, including dumping at sea, burning, and scattering in the bush.

Pending disposal, refuse is usually allowed to accumulate in small dumps in and around the villages which attract rats, cockroaches, flies and scavenging dogs.

7.16 Dumping at sea varies between taking the refuse in canoes and dumping it in deep water some distance from the shore, to dumping it in a convenient nearby coral creek or inlet from which it is likely to be washed back on to the beach.

7.17 The writer did not see any refuse pits or village incinerators in use, and it is recommended that the construction of these facilities should be demonstrated.

Small village incinerators, similar to the Fiji type, can be constructed from old oil drums and local materials, and bottles and tins can be salvaged for useful purposes.

7.18 Improvements can only be effected by demonstration and health education.

7.19 Health education. It is the writer's firm opinion that long-term improvements in environmental health can only be achieved in these villages if the following three fundamental requirements are met:

(i) the provision of an adequate piped water supply;

(ii) instruction of the people and practical demonstrations in connection with the construction of simple sanitary facilities such as latrines, incinerators, water storage tanks, protected wells, food stores, kitchen stores, etc., also methods of healthy house construction, and the control of insect pests and vectors, supported by:

(iii) an intensive campaign of health education to be carried out by qualified health educators.

Tautu - edible shells are found on the reef

Tautu - general view of the village

Tautu - main street

Tautu - the environment

PART III

SURVEY OF THE TAUTU PILOT AREA

Chapter I

Assessment of the nutritional status of the Tautu community

1. Body measurements

Birth-weights of Tautu children were noted from the records of the maternity ward of Norsup Hospital run by Dr Rivière Cazeaux (Graph No. 1).

Mean weight for Tautu children was: Boys - 3.100 kg (29)
Girls - 3.100 kg (22)

Mean weight for the whole of Norsup District was: Boys - 3.100 kg (163)
Girls - 3.000 kg (177)

These records covered a period of 5 years, from 1 October 1969 to 31 August 1975 (Graph No.2).

Average birth-weight was satisfactory, although slightly below US standards. However, a sizeable fraction of Tautu infants were substantially underweight at birth:

Birth-weight below 2.500 kg - 10 children out of 51 (approx. 20%).

The majority of Tautu women have their babies at Norsup Hospital of which Dr Rivière Cazeaux is at present in charge.

Population examined.

The Tautu community comprises the population of Tautu proper (called "Large Tautu") and that of "Little Tautu" situated near the PRNH plantation where most of the men work. The age-pyramid for Tautu featured:

(1) a very narrow base, ie. few children between 0 and 5 years;

(2) fewer women over 50 years of age than men (9 as against 21) whereas prior to that age women outnumbered men.

The number of children aged 0 to 3 years was too small (7 children) for a valid pattern to be established for that age group. We divided body measurement data into two sections:

(A) Growing children from 3 to 17 years of age

(B) Adults.

A. Growing Children

1. Weight components:

(a) Body weight

(b) Skinfold

(c) Arm circumference.

(a) Weight of boys: 38 examined, from 3 to 17 years inclusive (Graph No. 3)

Distribution:

$>$ P50 (Iowa standard) : 4/38 = 10.5 per cent
$<$ P50 $>$ 80% of P50 : 26/38 = 68.4 per cent
$<$ 80% of P50 : 8/38 = 21% (malnutrition)

The local mean remained consistently below standard up to $10\frac{1}{2}$ years then rose and reached P50 around 14 years.

Weight of girls: 40 examined, from 3 to 17 years inclusive (Graph No.3bis)

Distribution:

$>$ P50 : 0
$>$ 80% of P50 : 32
$<$ 80% of P50 (malnutrition) : 8 = 20%

(b) Skinfold thickness (Graph No. 4)

Boys (38). The malnutrition line was taken as being the lower reference curve i.e. 80% of the standard mean, in accordance with WHO Monograph No. 53 (1966).

Only 13 boys were above this line i.e. 34.2%
25 boys were slightly or very much below the line i.e. 65.8%

This thinness persists up to 15 years.

Girls (40) (Graph No. 4bis). The pattern was very similar: the local mean was below the malnutrition line. 63% of the girls were undernourished; 4 were below 60% of the standard curve (9.8%). From 11 years onwards, the local mean rose and drew closer to the standard mean.

(c) Arm circumference

Boys (Graph No. 5)

The local mean was far below the reference mean. 6 boys out of 38, i.e. 15%, were below the malnutrition line (80% of standard). It started to rise around 13 years.

Girls (Graph No. 5bis)

The pattern was similar to that of the boys but the mean rose somewhat earlier, from 11 years onwards. 11 girls out of 42, i.e. 25%, were below the malnutrition line.

These measurements concerning body weight and its components (fatty mass, as expressed by skinfold; muscle mass as expressed by arm circumference) indicate considerable caloric deficiency in Tautu children up to puberty. The extreme thinness observed in many subjects is evidence of overall under-nutrition.

Height

Boys (Graph No. 6)

Height retardation was parallel to weight retardation; the local mean lay between the P50 standard and the lower reference curve, P3. 28% of the boys were below P3; one of these had enlarged parotids. The mean moved upwards between 12 and 13 years.

Girls (Graph No. 6bis)

The overall mean was similar but individual retardation was even more pronounced. 41.9% of the girls were below the P3 reference curve.

2. Clinical findings

(a) Protein-calorie malnutrition and its sequelae.

The nutritional (weaning)crisis was evidenced primarily by a drop in the mean and retardation in all the parameters considered, after age 1 year. At 3 years recovery was still far from complete.

Clinical examination showed:

from 1 to 3 years - 1 case of protein-calorie malnutrition with marasmus.

from 3 to 5 years - 2 cases of protein-calorie malnutrition with oedema and depigmentation, out of 13 children, i.e. 15.4%.

Total 1 - 5 years - 3 cases of PCM out of 19 children, i.e. 10.5%.

The muscle wasting generally associated with under-nutrition is most clearly shown by arm circumference measurements (cf. Graph No. 5 and 5bis).

Dyspigmentation and degeneration of hair persist up to adolescence:

From 1 to 3 years : 2 out of 5 = 40%
3 to 5 years : 4 out of 13 = 30%
6 to 9 years : 1 out of 5 = 20%
9 to 13 years: 3 out of 19 = 16%
over 13 years: 0

Parotid enlargement appears after 3 years:

1 case out of 13 from 3 to 5 years = 7.7%
2 cases out of 24 from 6 to 15 years = 8.3%

Liver enlargement was sometimes found associated with spleen enlargement due to malaria, as shown in the following table :

	Liver enlargement	Spleen enlargement
0-1 year	0	1
1-3 years	1/13 (PCM) = 7.7%	0
3-5 years	5/13 = 38.5%	3/13 = 23.1%
6-13 years	6/24 = 25%	2/24 = 8.3%
13-15 years	0 = 0	0 = 0

The influence of malaria on nutritional status is one example of malnutrition-infection interaction. That malaria still occurs at Tautu, is shown by the spleen enlargement figures.

(b) Anaemia:

Accurate diagnosis of anaemia is impossible without laboratory facilities, which were not available at Tautu. However, high incidence of anaemia was obvious from clinical examination alone, both in children and in the adult group, especially in its female fraction.

Prevalence of severe anaemia was as follows:

Children : 0-1 year : 1/2 = 50%
1-3 years : 1/5 = 20%
3-5 years : 4/5 = 80%
6-13 years : 6/19 = 31.5%
13-18 years : 1/8 = 12.5%

Women : 20-45 years : 9/28 = 32%
Over 45 years : 2/11 = 18.2%

N.B. : These percentages merely give a rough idea of overall prevalence and do not differentiate between the various types of anaemia existing: in early infancy it is mainly caused by iron deficiency; in later life by depletion through malaria, hookworm infection or multiple nutritional deficiencies.

Classification according to type necessitates laboratory tests. The environmental context, as described in Part II by Eric Dunn, largely accounts for the prevalence of this condition.

(c) Vitamin deficiencies:

Vitamin A deficiency - No case of corneal xerosis. No case of perifollicular hyperkeratosis. On the other hand (cf. Ocular symptoms) conjunctival changes are very common: diffuse pigmentation with associated thickening of the bulbar conjunctiva; Pterygium, Pinguecula, are more prevalent at Tautu than in any of the other areas surveyed.

Rickets : No case.

Vitamin B deficiency : No case of beriberi.

Riboflavin deficiency : Angular cheilosis was not observed. Dyssebacea (shark skin) was seen in 3 women between 20 and 45 years of age = 10.7%. Various types of glossitis due to multiple deficiencies were very common:

- Raspberry tongue often associated with intestinal parasites:

  3-5 years : 3/13 = 23%
  6-13 years : 9/24 = 37.5%
  13-18 years: 2/8 = 25%

- Central depapillating glossitis (filiform atrophy) and magenta tongue, suggestive of riboflavin or folic acid deficiency:

  6-13 years : 1/24
  13-18 years: 0
  24-45 years : 3/28 = 10%
  Over 45 years : 1/11

- Raw tongue was observed in the adult group:

  2 women out of 28 (7%) showed this symptom, which is associated with pellagrous dermatosis and various deficiencies.

- Pigmented tongue was observed in anaemic women:

  13-20 years : 1/8
  20-45 years : 4/28 = 14%

- Atrophic tongue: 1/7 subjects over 45 years of age.

The above figures point to the existence of multiple nutrient deficiencies caused by inadequate diet and/or parasite infestation, both these factors being involved in most cases.

(d) Ocular symptoms:

(1) Conjunctivitis : in children 3-15 years : 2 cases of follicular conjunctivitis = 3.8%

(2) Blindness : 1 case of bilateral staphyloma, of unknown origin. 3 cases of blindness through corneal lesion were observed in subjects over 45 years of age. 8 cases of cataract in subjects over 40 years of age

High incidence of cataract is part of the general tendency to early deterioration of eye structures observed in the Tautu population: corneal senility was almost universal after 45 years of age. No figures regarding incidence of diabetes were available.

(3) Conjunctival changes :

(i) Pigmentation of the bulbar conjunctiva:

6-13 years : 12.5%
13-18 years : 30%
18-45 years : 32%
Over 45 years : 55%

(ii) Conjunctival thickening with formation of folds

3-6 years : 7.7%
6-13 years : 25%
13-18 years : 30%
Over 20 years : 9%

Bitot's spots indicative of Vitamin A deficiency, were not seen.

(iii) Pterygium : occurred early in life and, in many cases, extended over most of the conjunctiva.

13-18 years : 12.5%
19-45 years : 50%
Over 45 years : 72%

We cannot, at this stage, suggest any reason for the abnormal prevalence of this condition in relatively young subjects.

(4) Pingueculae

These are yellowish, raised, deposits of fatty material in the conjunctival tissue; they were very common:

13-20 years : 12.5%
20-45 years : 25%
Over 45 years : 36.4%

At Tautu, this condition was certainly not related to obesity, which is practically non-existent, but rather to the high intake of saturated fatty acids from the coconut.

(5) Extensive opacities of the anterior segment of the cornea were found in 3/39 adults = 7.7%; their cause could not be determined.

(e) Skin diseases

(1) Pyoderma was rare in spite of aggression by mosquitoes; only one case of infant scabies was observed.

(2) <u>Dermatomycosis</u> was exceedingly common, sometimes spreading over the entire body and giving the skin a blotchy appearance. The causal fungus is usually <u>Pityriasis versicolor</u>:

1-3 years : 40%
3-5 years : 15%
6-13 years : 8%
13-20 years : 0
Over 20 years : 20%

The people appear to accept this condition as natural and do not bother about treating it.

(f) <u>Dental diseases</u>

(1) <u>Melanodontia</u> : not a single case.

(2) Opacities suggestive of mild <u>fluorosis</u> :

3-18 years : 12.5%
20-45 years : 21.4%
Over 45 years : 18.2%

It is likely, as stated in Dr Motha's thesis dealing with the Norsup area, that the brackish drinking water and the local staple foods(particularly taro) have a high fluorine content.

(3) <u>Caries</u>

Pre-school and school-age children : 0
13-20 years : DMF I (less than 3 caries) = 1
DMF II (from 3-10 caries) = 1
Total 2/8 = 25%
20-45 years : DMF I = 5
DMF II = 0
DMF III (more than 10 caries) = 2
Total 7/28 = 25%
Over 45 years : DMF I = 1
DMF II = 9
Total 10/11 = 90%

Oral hygiene is non-existent. The presumed presence of fluorine in water and food appears to protect only the young.

Periodontal diseases, with pyorrhoea and calculus formation occurred only after 20 years of age, but led to loss of teeth after 45 years of age .

Prevalence of periodontal diseases :

20-45 years : 7.1%
Over 45 years : 64%

3. Nutritional status of adults :

Clinical findings for adults have been combined with those concerning children.

B. Body measurements - Adults (over 18 years)

We measured weight, height, and arterial blood pressure.

Weight/height ratio : Average height for men was 1.662 m
Average height for women was 1.565 m
Average weight for men was 57.7 kg
Average weight for women was 48.5 kg

Men and women examined (Graph No. 7 and 7bis) were classified into 3 groups according to their weight/height ratio, as compared with the reference mean.

Men (Graph No. 7) : 37 examined.

Group I ⩽ reference mean (light to underweight) : 75.7%
Group II > reference mean ⩽ 2st. deviation (average) : 18.9%
Group III > 2st. deviation (overweight) : 5.4%

Prevalence of hypertension was as follows :

Group I : Mild hypertension : 25%
Severe hypertension : 1.7%
Group II : Mild hypertension : 28%
Severe hypertension : 0
Group III : Mild hypertension : 0
Severe hypertension : 0

In men, weight was usually proportional to height. Only 5.4% were overweight. Only one case of severe hypertension was found in the 37 men examined. Mild hypertension was more common, but may have been emotional : 8/37 =21.5%

There was no problem of obesity or hypertension in Tautu men.

Women (Graph No. 7bis) : 28 examined.

Group I : average or underweight : 57.1%
Group II : slightly overweight : 25%
Group III : overweight : 17.9%

A slight tendency to overweight exists in a minority of women.

Hypertension prevalence was :

Group I : Mild hypertension ⩽ 15 cm : 12.5%
Severe hypertension > 18 cm : 6.3%
Group II : Mild hypertension : 28%
Severe hypertension : 14.3%

Group III : Mild hypertension: 80%
Severe hypertension : 0

Hypertension is more common in women than in men and is related to overweight.

4. Summary of findings

(a) Growing children

Very slightly underweight at birth compared with US standards, Tautu infants, although breastfed up to about 15 months, are not exempt from the nutritional crisis. This takes the form of overall under-nutrition commencing around 8 months and extending right through the pre-puberty period. Severe protein malnutrition affects about 10% of 1 to 4 year old children, while severe under-nutrition was found in 20% of the same age group.

During early childhood, anaemia is associated with malnutrition. It stems from various interacting causes such as multiple nutrient deficiencies, the effects of malaria and infestation by intestinal parasites.

Nutritional recovery between 3 and 6 years is incomplete. Retardation, often substantial, was seen in all the parameters. Liver and parotid enlargement are common clinical sequelae of malnutrition.

In school-age children, retardation was observed well into the pre-puberty period. Anaemia persisted, and various types of glossitis reflected avitaminosis, in particular riboflavin deficiency.

(b) Adults

Men were rather short, women very short in stature, and both were somewhat underweight. Obesity and hypertension were not serious problems at Tautu.

Eye examination revealed a tendency to early senility and an abnormally high incidence of pterygium. Because of poor oral hygiene, periodontal diseases were common, leading to complete loss of teeth at a comparatively early age.

Skin hygiene was poor, and fungus infections extending over large areas of the body constitute a distinctive feature of the Tautu population.

When people are ill, they can receive treatment either at the British Dispensary at Lakatoro (3 km) or at the French Hospital at Norsup (6 km). Medical care is thus readily available, and diarrhoea, gastroenteritis and acute pulmonary conditions are treated without delay.

(c) Prevention

The usual vaccinations, including BCG, are given systematically. However, chemical prevention of malaria is not carried out in young children with the result that malaria is still endemic.

Environmental hygiene is very poor, but statistical information concerning intestinal parasites was not available. (cf. Mr Eric Dunn's report). The main pre-requisites for improvement in this field are an adequate supply of wholesome water, effective excreta disposal, (cf. Recommendations) and health education.

Special attention should be paid to infants, as well as to pregnant women and nursing mothers, many of whom were found to be anaemic. Systematic distribution of iron and folic acid tablets during pregnancy and breast-feeding is essential.

5. General recommendations

(i) Infants and toddlers

- The present custom of prolonged breast-feeding should be encouraged.
- Wider spacing of births is desirable (birth-control methods have already been introduced).
- Early introduction of caloric supplements, fruit juice and coconut milk, which appears to be a traditional practice, should be continued, but the importance of also giving animal proteins, such as eggs, fish, meat and poultry, and milk or peanut biscuits from an early age (around 7 months) should be strongly underlined.
- Food hygiene should be closely watched; early introduction of cow's milk into the infant's diet could prove dangerous at this stage.

Infectious and parasitic diseases

- Vaccinations should be performed within the first months (before the nutritional crisis).
- Chemical prophylaxis of malaria should be undertaken early and kept up regularly.
- From the age of 3 years, children should be "wormed" systematically at regular intervals (twice a year) with an innocuous anti-parasite preparation.
- Babies and young children should be washed with acid soaps and lotions, to prevent skin fungus infections.

Rate of growth and overall development should be checked systematically at regular intervals, any malnutrition or undernutrition carefully noted and health education given accordingly.

(ii) School-age children

- Growth should be supervised by twice-yearly measuring (at least weight and height) of all children attending school, and findings recorded on a collective chart.
- Distribution at school of food supplements (milk or peanut biscuits) should be organized by the educational authorities.
- Multiple-action anti-parasite preparations should be administered to all school children twice a year.
- The need for personal cleanliness should be emphasized, especially in connection with bowel movements.

(iii) Adults (women)

- Surveillance of pregnant women and nursing mothers, with regular weighing, is important for early diagnosis of nutritional deficiencies.
- Preventive and curative action against anaemia could take the form of distribution of iron and folic acid tablets during the last three months of pregnancy and during lactation.
- Weight and blood pressure should be checked regularly throughout pregnancy, and any sign of oedema immediately dealt with.

(iv) Adults (men)

- Action to control excessive alcohol consumption has already been taken at Tautu by the village leaders, and should be continued.

Environmental sanitation should be improved in the whole of Tautu by the people themselves, supported where necessary by the Administration (cf. Mr Eric Dunn's report).

Health education methods advocated by Miss Bushra Jabre for Wala-Rano (cf. Part VIII of this report) can and should be put in practice at Tautu.

Chapter 2

Comments on this pilot area

(i) Situated very near the British and French administrative centres of Lakotoro and Norsup respectively, Tautu has received much attention in the past, and much effort has already been invested in it.

(ii) Well provided for from the point of view of curative medicine, it also has access to many of the basic facilities needed for preventive action.

(iii) On account of its special economic and political situation, and the structure of its population, which forms a semi-autonomous entity where the ancestral customs of the Small Nambas are still a strong influence, it is a community unlike any other and representative only of intself.

(iv) This community, being very limited in size, both as regards the number of people belonging to it and the surface area it occupies, does not lend itself to extrapolation, to other villages, of findings concerning the development of children and overall nutritional status.

(v) SPC action in this pilot area will necessarily be limited. Agricultural training and extension has already been specifically defined, and is well under way.

- Medical and nutritional recommendations were made during our visit.
- Mr Eric Dunn's report outlines ways and means of improving environmental conditions.
- Miss Margaret Mackenzie's work in the village and Miss Bushra Jabre's advice can be expected to yield good long-term results.

How much will eventually be achieved in these various fields depends largely on how well the people themselves tackle the tasks involved, with the assistance of the Condominium authorities.

The SPC is prepared to :

(a) Stimulate local endeavours by sending its specialists to help and advise.

(b) Conduct a re-assessment of the situation at the end of the Project, in order to determine how much progress has been made in 2 years.

Chapter 3

Acknowledgements

We extend warm thanks to the people of Tautu, particularly to their leaders and chiefs who showed great interest in our survey and persuaded every single person in the village to come for examination; their friendly and willing cooperation enabled us to investigate all problems openly and thoroughly.

We are also much indebted to:

Dr Luke, who assisted us throughout the survey and made us very welcome.

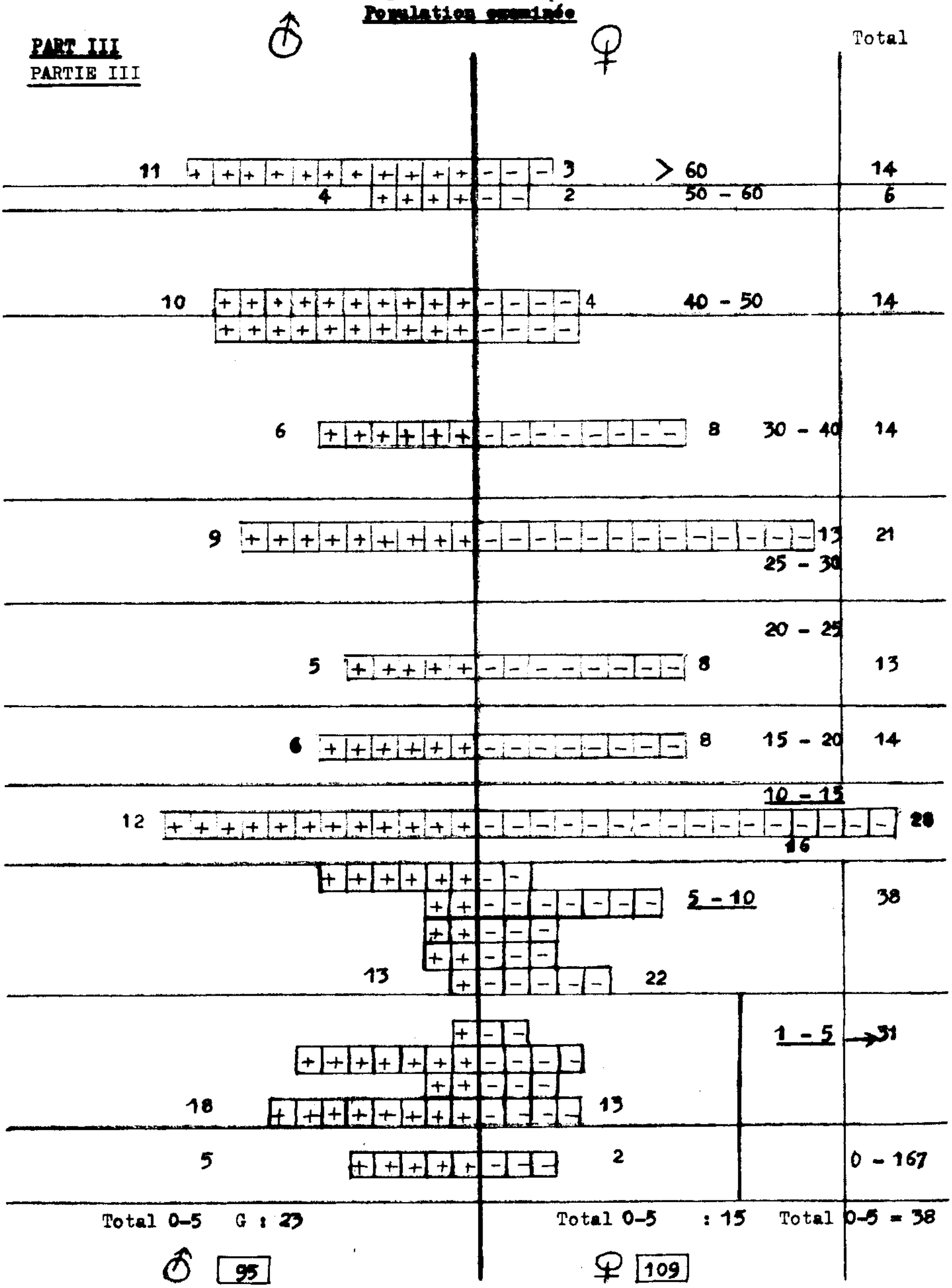
Miss Margaret Mackenzie, whose kindness and deep understanding of the local people greatly facilitated the survey, to which she made many invaluable contributions, living among the people in a village hut, in spite of a serious injury.

Mr Norman Delion, Senior Agriculture Officer, whose scientific knowledge and familiarity with the area, combined with long experience of training and extension work in a spirit of community development, were a continual source of information and inspiration.

Dr Rivière Cazeaux, for his cordial welcome and generous practical support which included arranging transport and providing voluntary secretarial assistance in the person of his wife.

Population examined
Population examinée

PART III
PARTIE III



AGE PYRAMID OF POPULATION EXAMINED
PYRAMIDE DES AGES DE LA POPULATION EXAMINEE

Birth weight of children born in Norsup hospital (October 1969 - August 1974)
Poids à la naissance des enfants nés à l'hôpital de Norsup (octobre 1969 - août 1974 inclus)

Figure n° 1 BOYS / GARCONS — GIRLS / FILLES

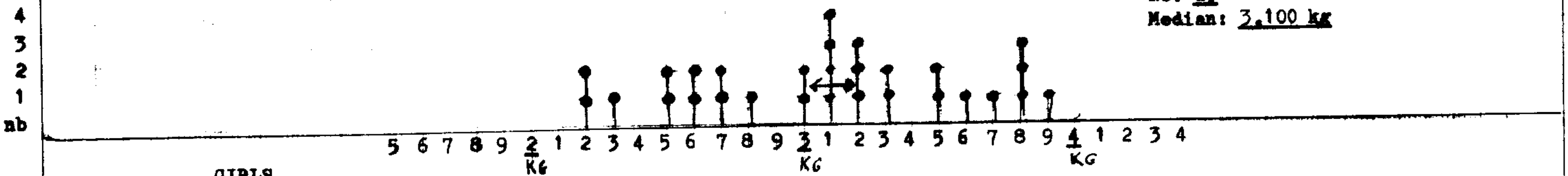
Distribution of birth weight in the pilot area of Tautu (Melanesian population) over 5 years (Maternal clinic Norsup).
Distribution des poids de naissance dans la zone pilote de Tautu (population mélanésienne) sur 5 ans. (Maternité de Norsup).

SPC report on pilot areas in the New Hebrides.
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides. Pr A. Raoult.

29(Octobre 69 - Août 74)
(Maternité de Norsup)

Médiane : 3 kg 100

From maternal clinic in Norsup
Nb: 29
Median: 3.100 kg

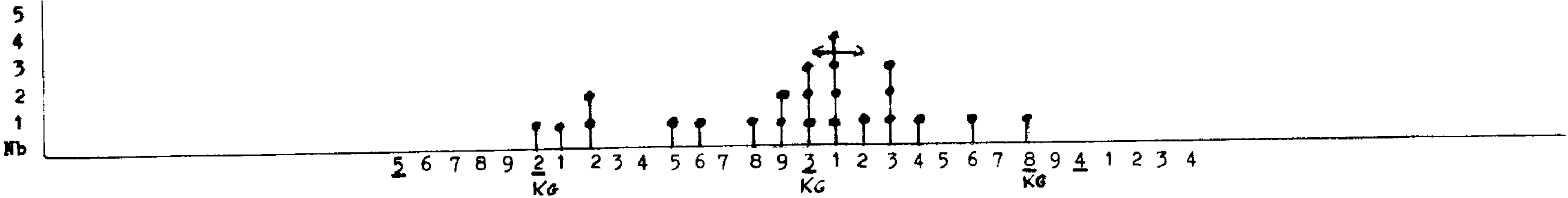


GIRLS

FILLES

Nb.: 22

médiane 3 kg 100



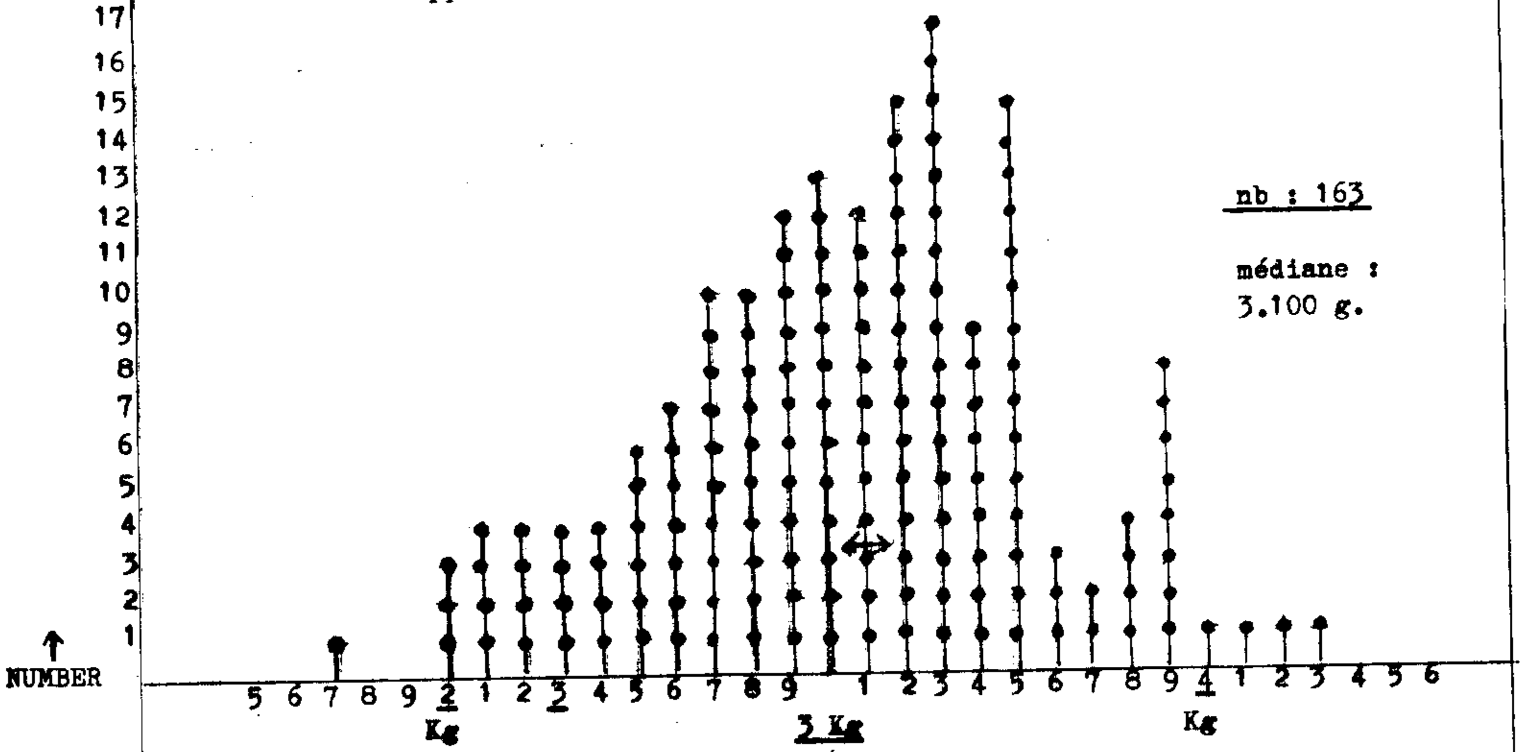
Birth weight of children born in Norsup hospital (October 1969 - August 1974)
Poids à la naissance des enfants nés à l'hôpital de Norsup (octobre 1969 - août 1974 inclus).

Figure n° 2 - Distribution of birth weight in mixed population of Norsup (Wallisians, Melanesians from neighbouring rural areas) over 5 years.
Distribution des poids de naissance dans la population mixte de Norsup (Wallisiens, population rurale périphérique mélanésienne) sur 5 ans.

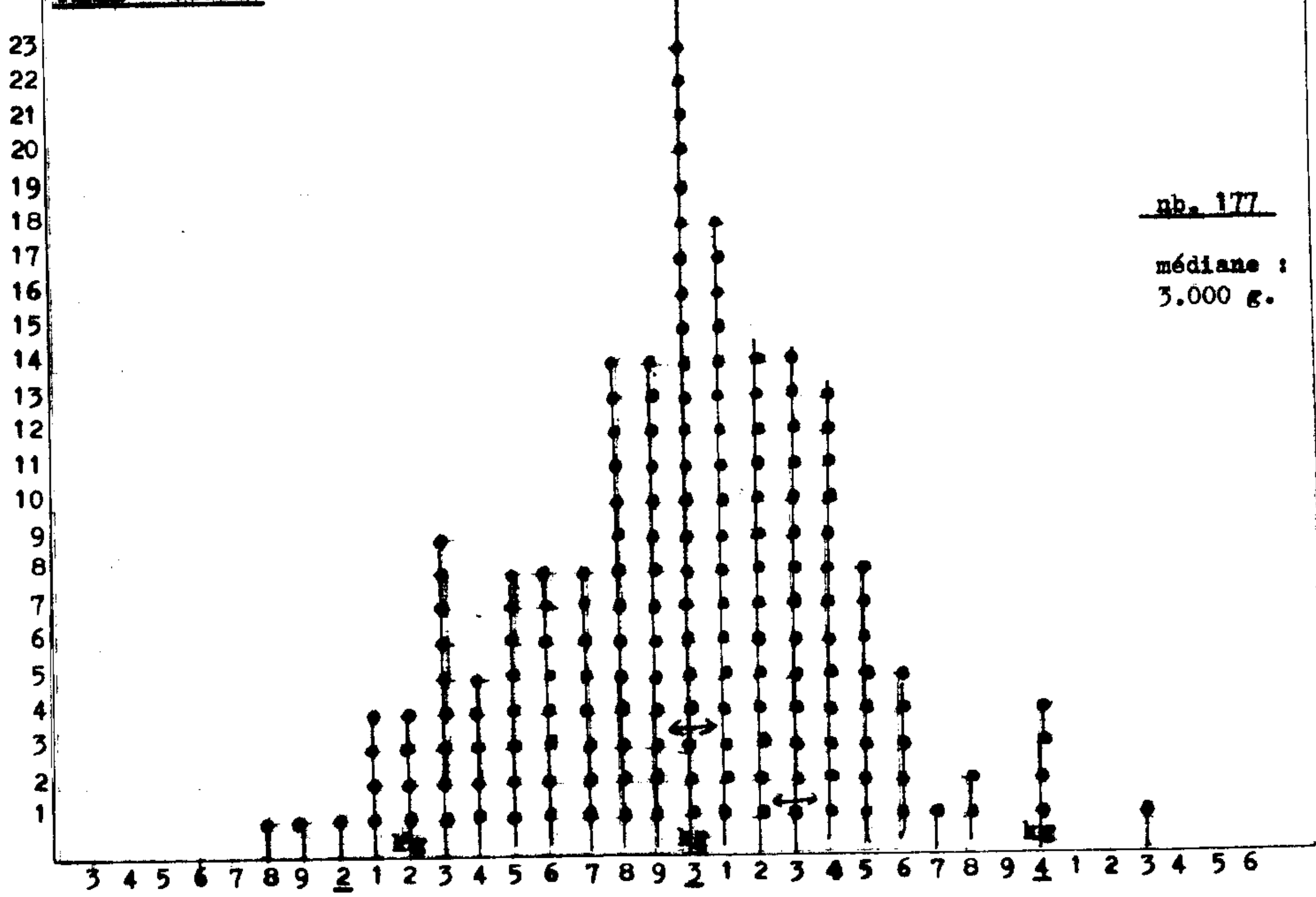
BOYS
GARCONS

GIRLS
FILLES

SPC report on pilot areas in the New Hebrides.
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.



GIRLS - FILLES



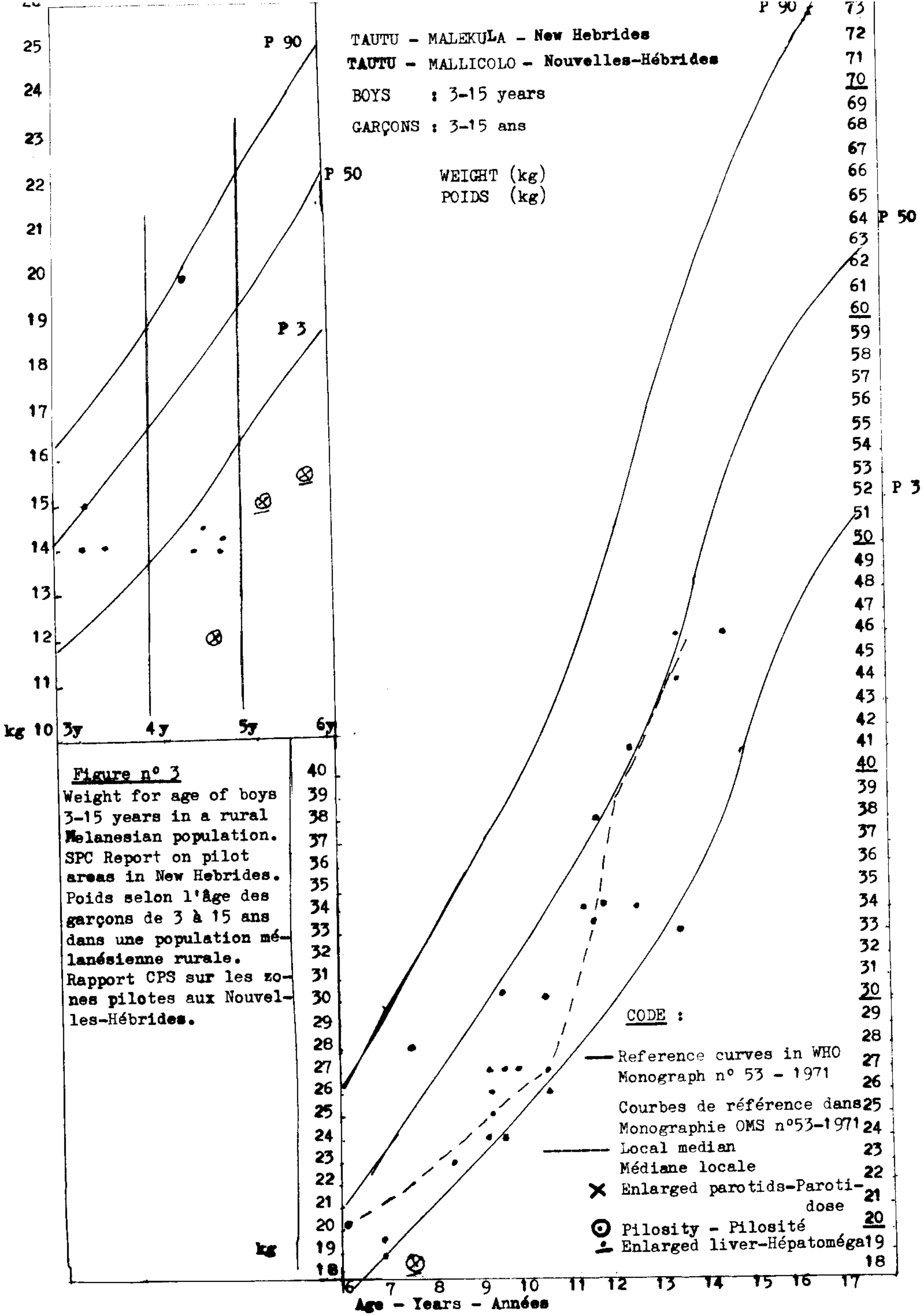


Figure n° 3
Weight for age of boys 3-15 years in a rural Melanesian population. SPC Report on pilot areas in New Hebrides.
Poids selon l'âge des garçons de 3 à 15 ans dans une population mélanésienne rurale. Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

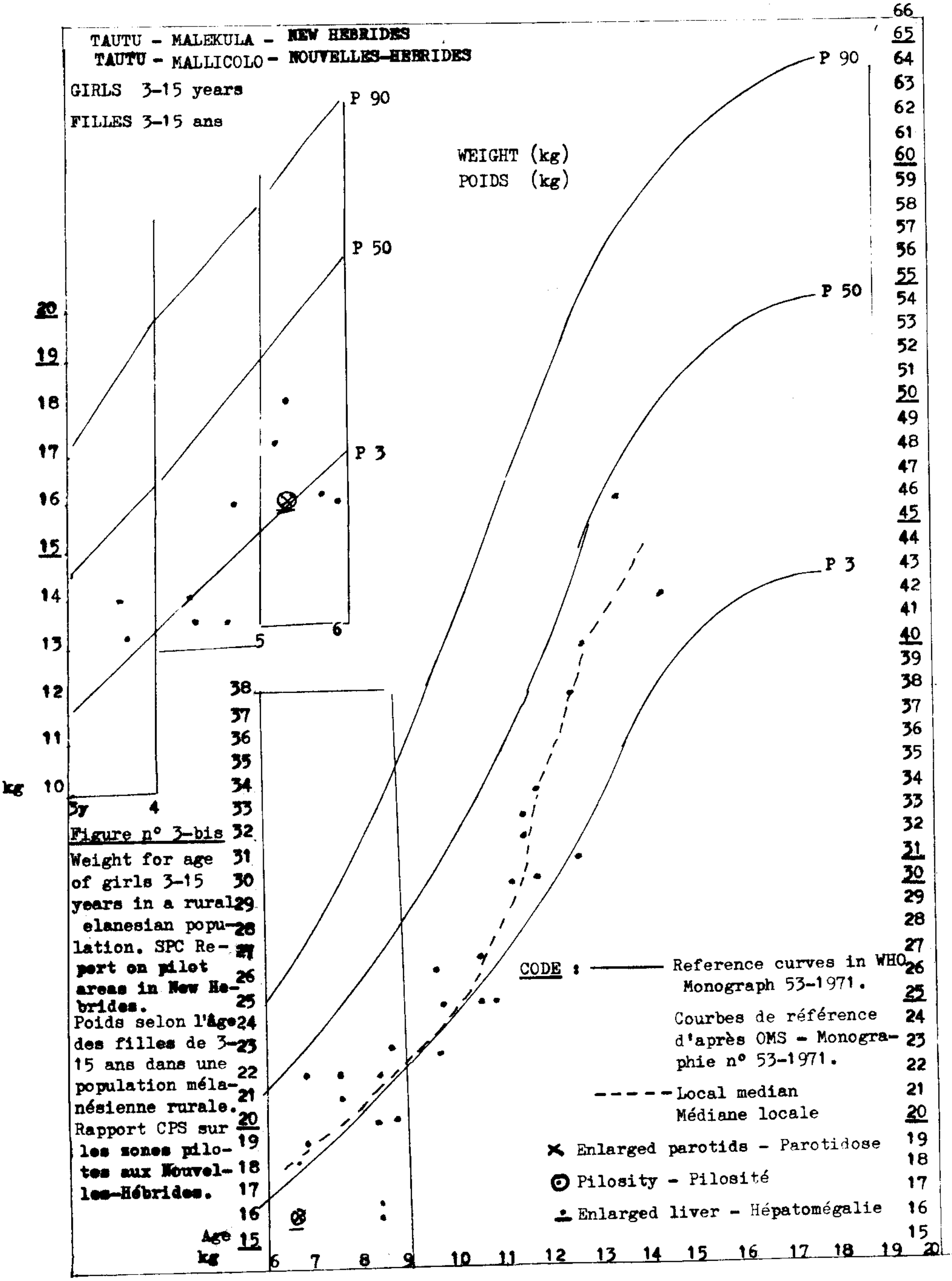


Figure n° 3-bis

Weight for age of girls 3-15 years in a rural Melanesian population. SPC Report on pilot areas in New Hebrides.

Poids selon l'âge des filles de 3-15 ans dans une population mélanésienne rurale. Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

TAUTU - MALEKULA - NEW HEBRIDES

TAUTU - MALLICOLO - NOUVELLES-HEBRIDES

BOYS 3-17 years
GARCONS 3-17 ans

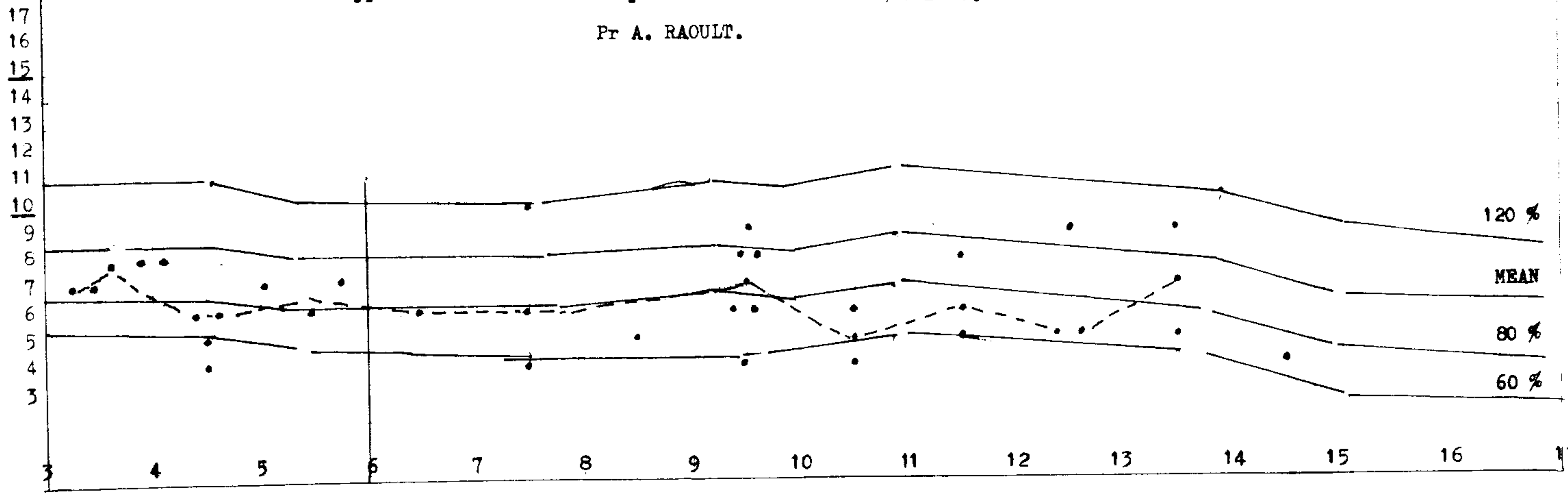
TRICIPITAL SKINFOLD - LEFT ARM (cm)
EPAISSEUR du PLI CUTANE TRICIPITAL (cm)

CODE : ——— Reference lines from WHO Monograph n° 53 - 1971
Lignes de référence dans OMS Monographie n° 53 - 1971

- - - - Local median
Médiane locale

Figure n° 4 - Skinfold for boys in pilot area of TAUTU.
Rural Melanesian population.
SPC report on pilot areas in New Hebrides.
Rapport CPS sur les zones pilotes des Nouvelles-Hébrides.

Pr A. RAOULT.



TAUTU - **MALEKULA - NEW HEBRIDES**

TAUTU - **MALLICOLO - NOUVELLES-HEBRIDES**

GIRLS 3-17 years
FILLES 3-17 ans

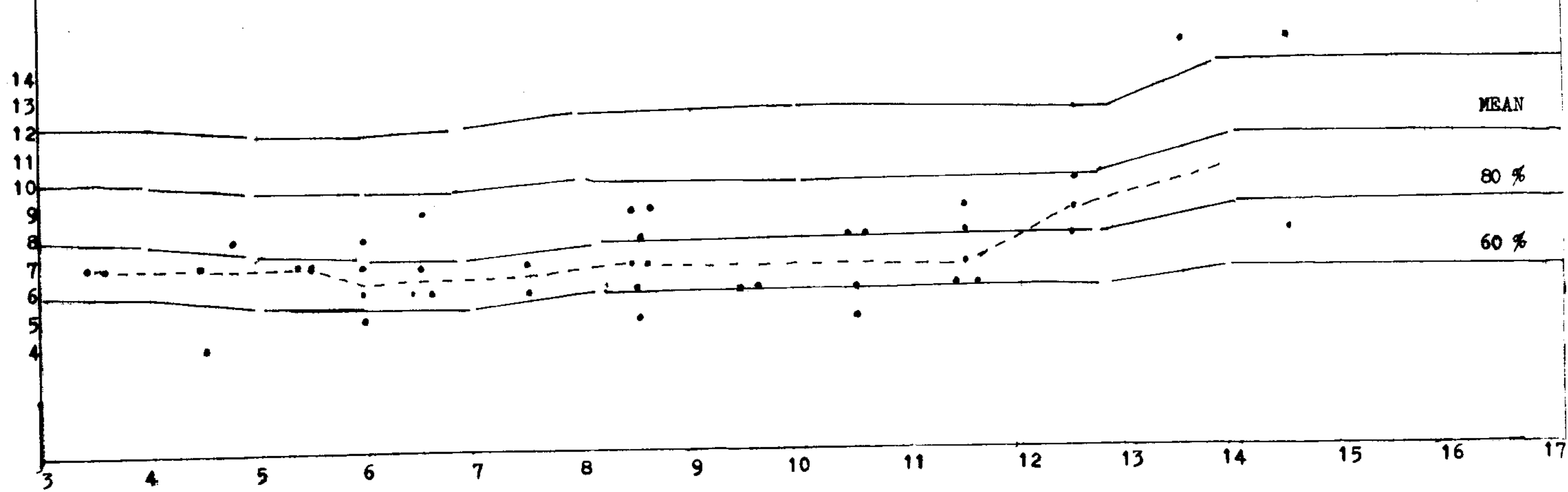
TRICIPITAL SKINFOLD LEFT ARM (cm)
EPAISSEUR du PLI CUTANE TRICIPITAL (cm)

CODE : ——— Reference lines from WHO Monograph 53 - 1971
Lignes de référence

------ Local median
Médiane locale

Figure n° 4 bis - Skinfold for girls in pilot area of TAUTU.
Melanesian rural population (Sept. 74).
SPC Report on pilot areas in New Hebrides.
Rapport CPS sur les zones pilotes des Nouvelles-Hébrides.

Pr A. RAOULT.



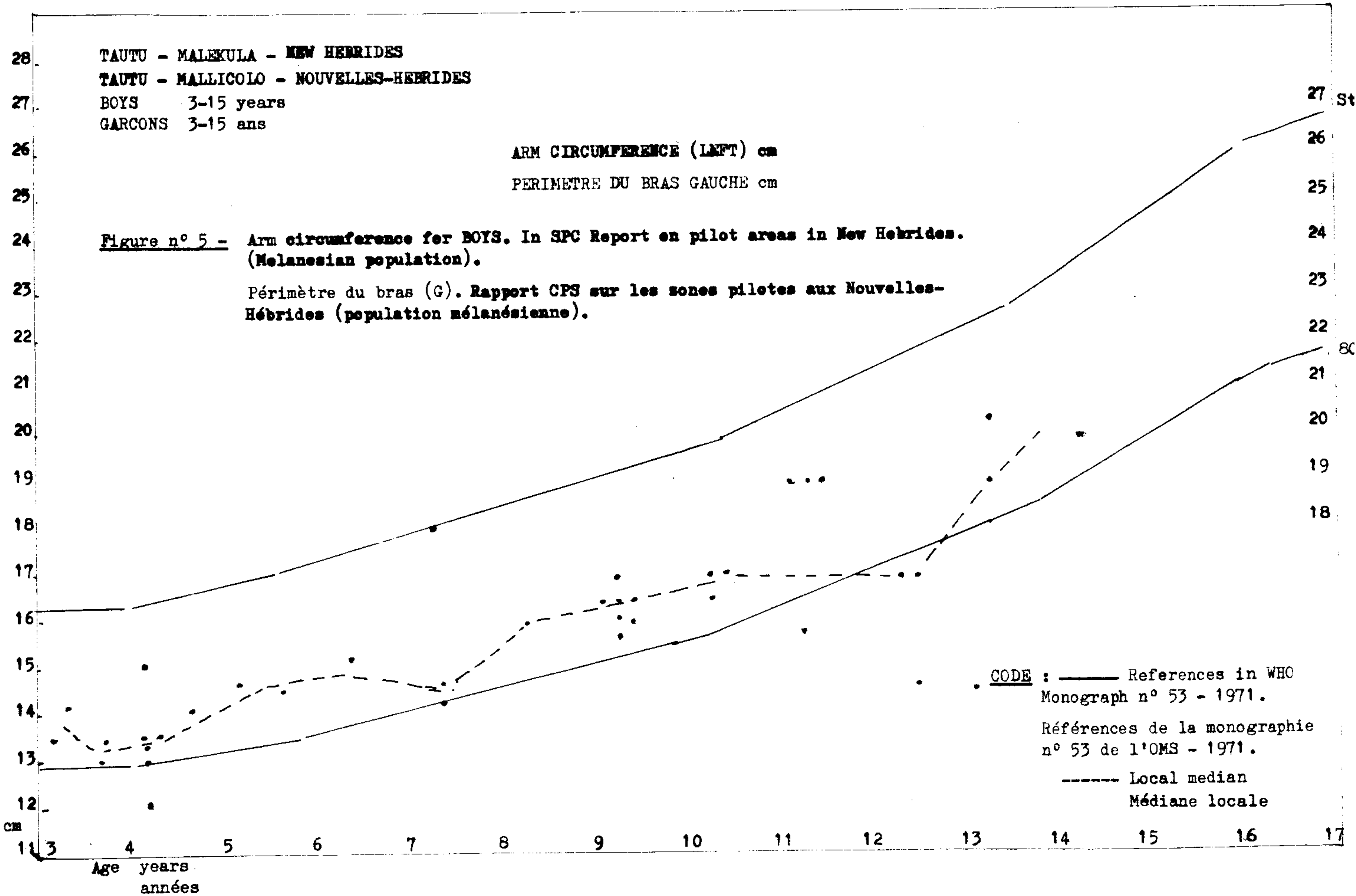


Figure n° 5 - Arm circumference for BOYS. In SPC Report on pilot areas in New Hebrides. (Melanesian population).

Périmètre du bras (G). Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides (population mélanésienne).

TAUTU - MALEKULA - **NEW HEBRIDES**
TAUTU - MALLICOLO - NOUVELLES-HEBRIDES

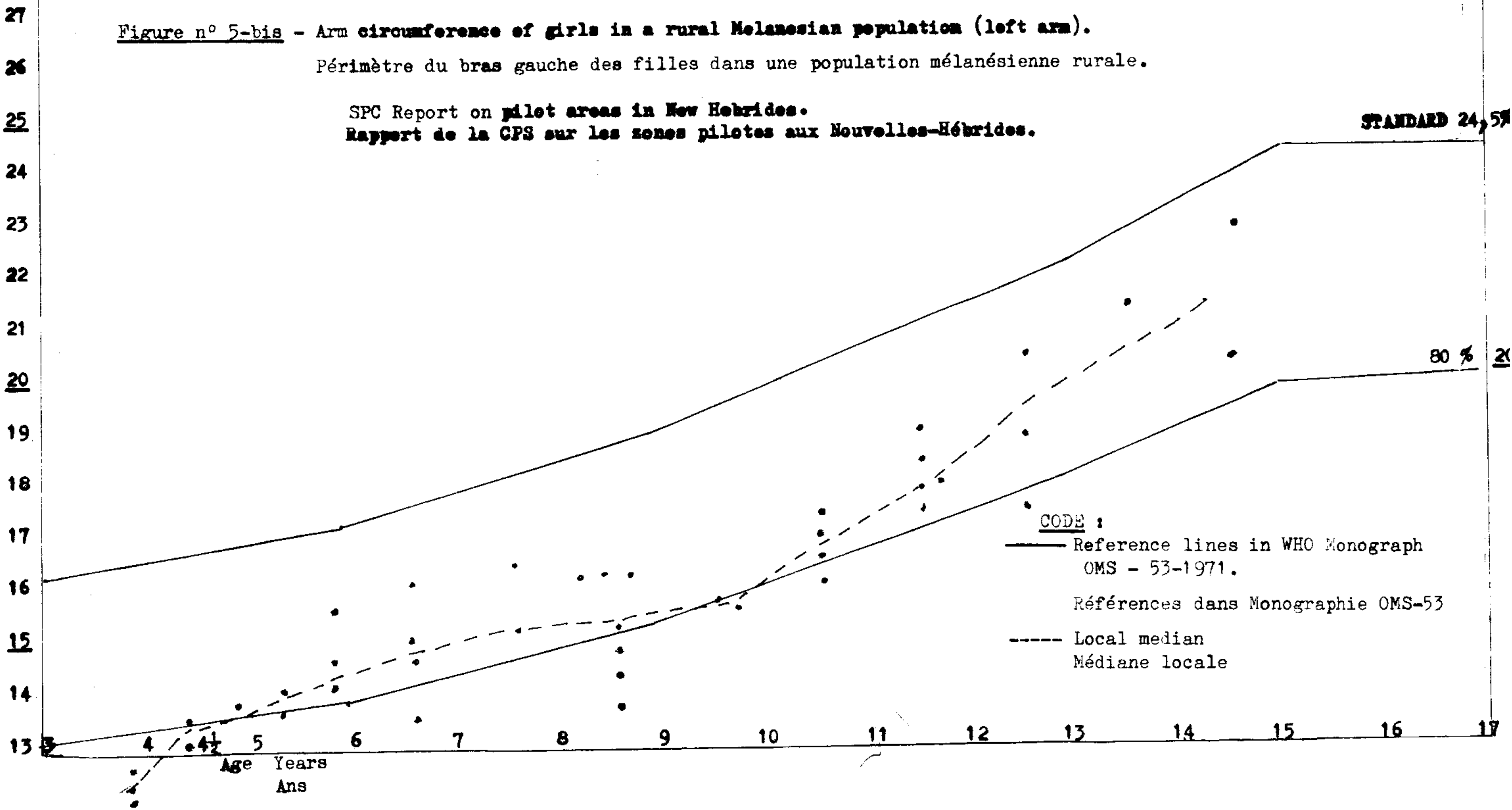
ARM **CIRCUMFERENCE (LEFT) cm**
PERIMETRE DU BRAS (**GAUCHE**) cm

GIRLS : 3-15 years
FILLES : 3-15 ans

Figure n° 5-bis - Arm **circumference of girls in a rural Melanesian population (left arm).**

Périmètre du **bras** gauche des filles dans une population mélanésienne rurale.

SPC Report on **pilot areas in New Hebrides.**
Rapport de la CPS sur les zones pilotes aux Nouvelles-Hébrides.



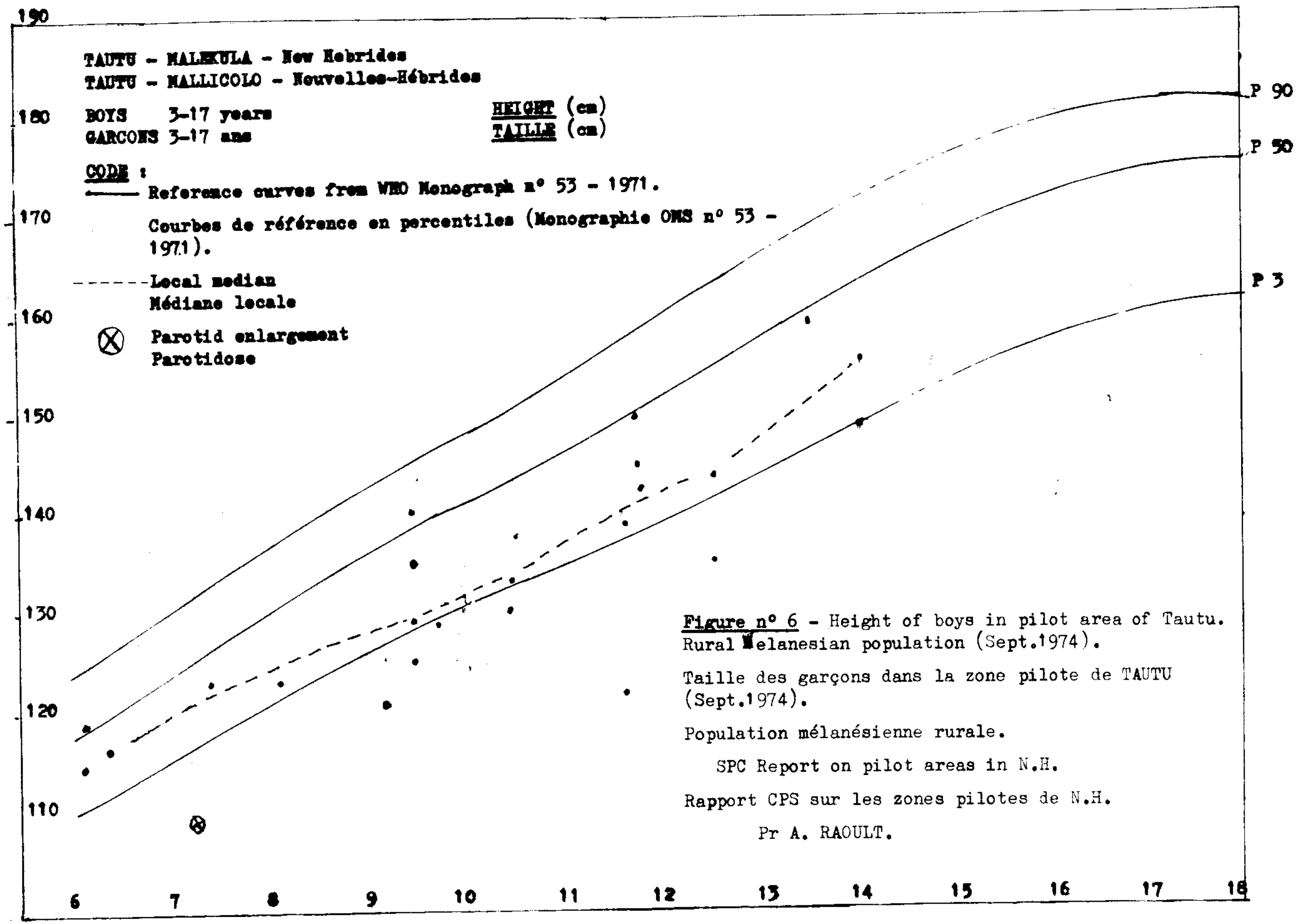


Figure n° 6 - Height of boys in pilot area of Tautu. Rural Melanesian population (Sept.1974).

Taille des garçons dans la zone pilote de TAUTU (Sept.1974).

Population mélanésienne rurale.

SPC Report on pilot areas in N.H.

Rapport CPS sur les zones pilotes de N.H.

Pr A. RAOULT.

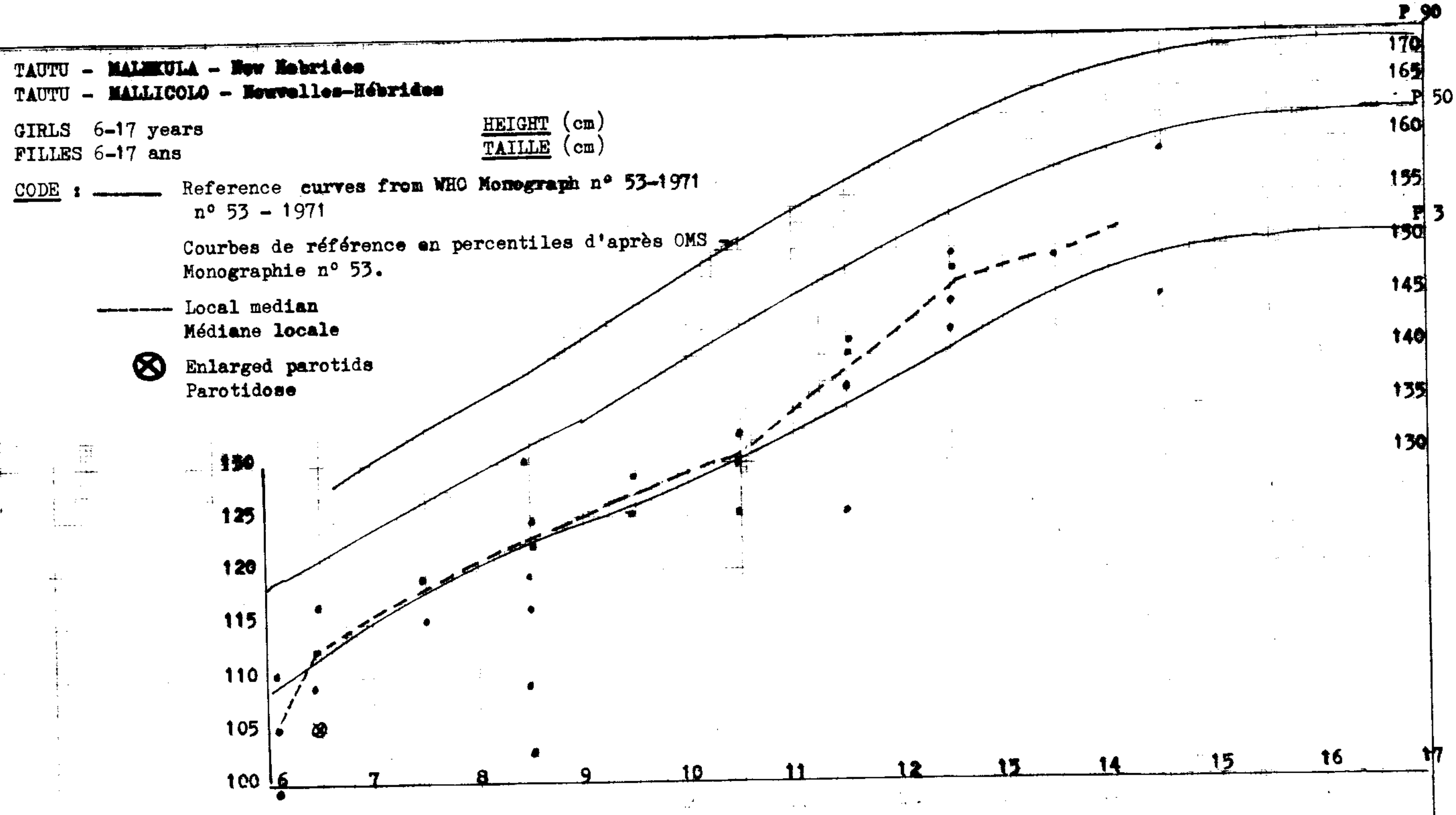


Figure n° 6-bis - Height distribution for girls in pilot area of Tautu- Melanesian rural population.
SPC report on pilot areas in New Hebrides.

Distribution de la taille des filles dans **la zone pilote** de Tautu. Population mélanésienne rurale.
Rapport CPS sur les zones pilotes des Nouvelles-Hébrides.
Pr A. RAOULT.

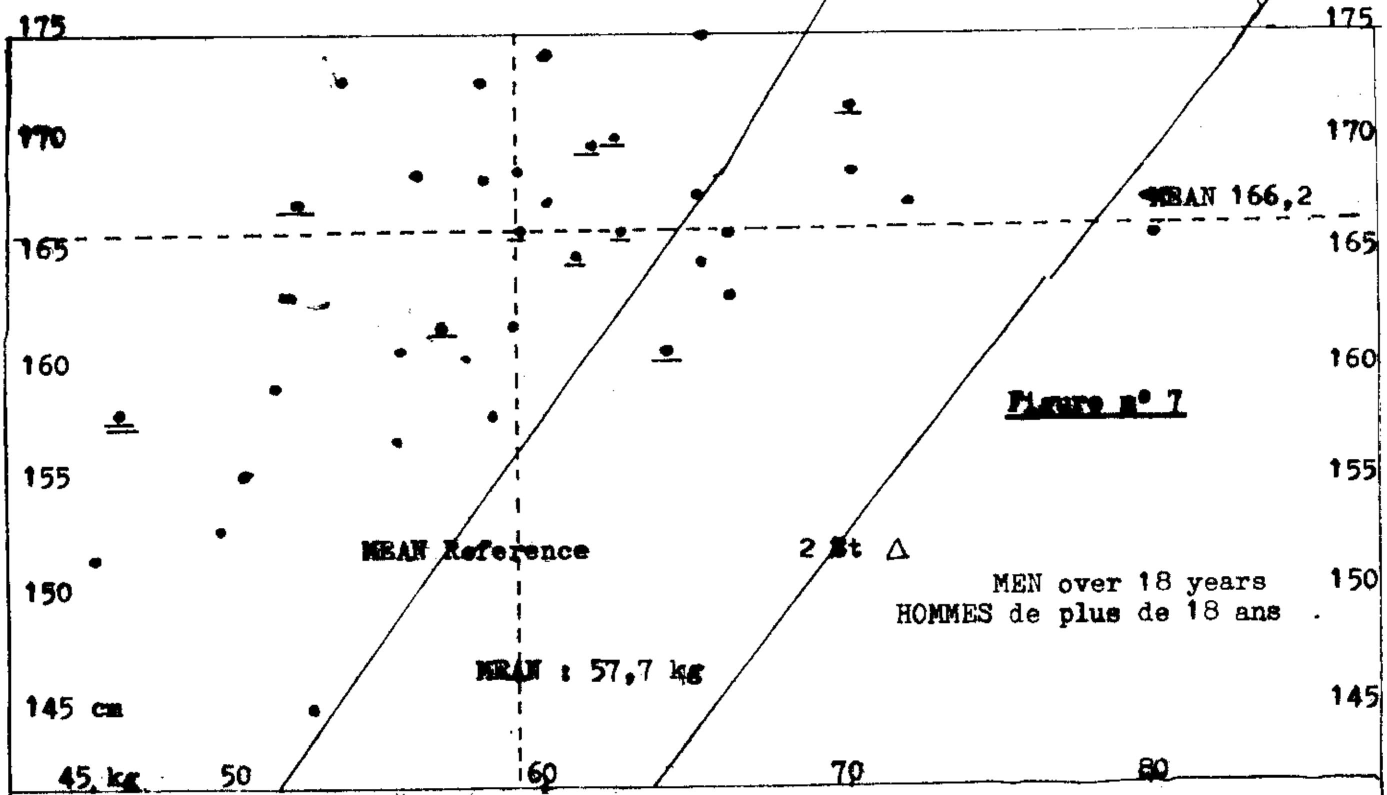


Figure n° 7

TAUTU - MALEKULA - New Hebrides
TAUTU - MALLICOLO - Nouvelles-Hébrides

CODE :
—— Reference lines-Lignes de référence
-----Local median - Médiane locale
Mild hypertension (syst)
Hypertension modérée
High hypertension
Hypertension élevée

Figures n° 7 & 7 bis - Weight for height ratio and hypertension in a rural Melanesian population (N.H)
Rapport poids-taille et hypertension dans une population mélanésienne rurale.

SPC report on pilot areas in New Hebrides
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

Pr A. RAOULT.

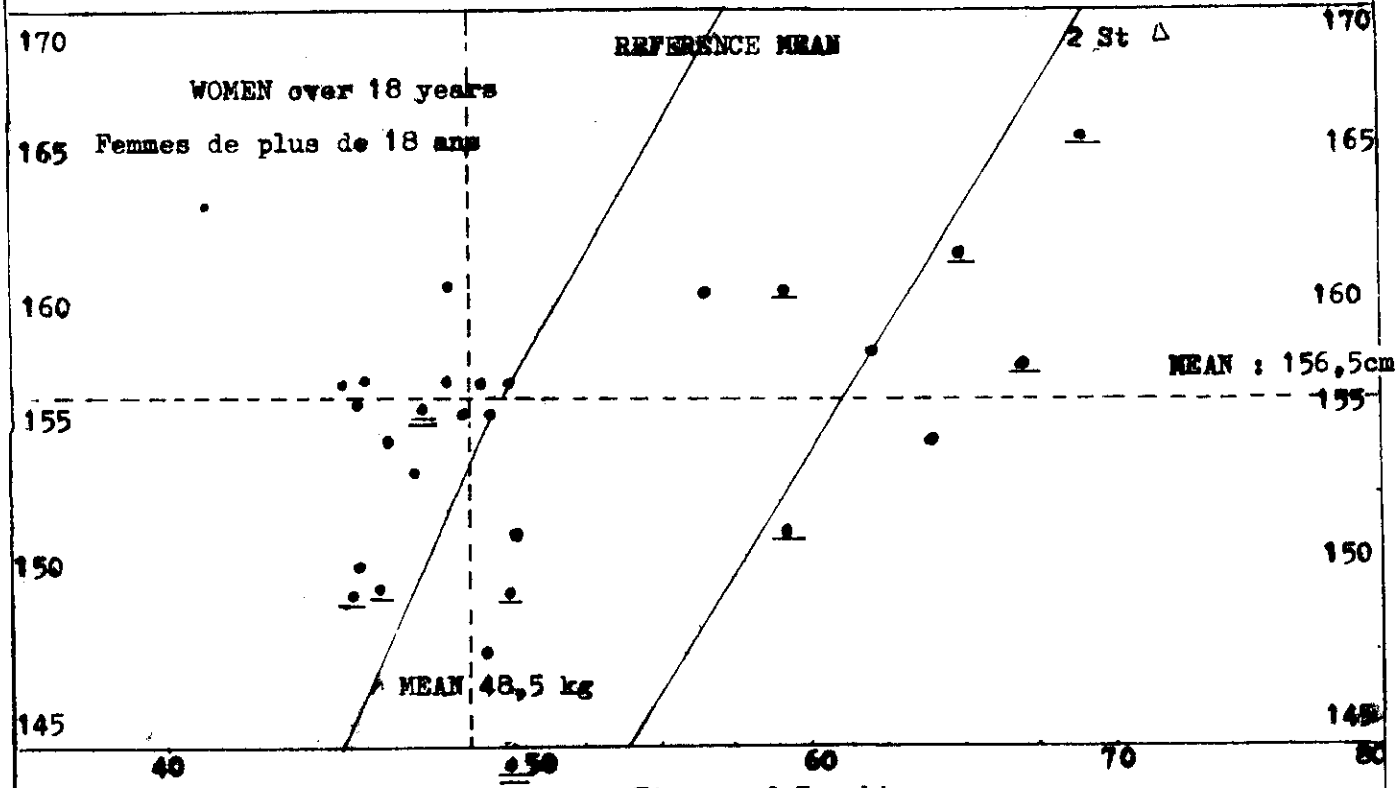


Figure n° 7 - bis.

PART IV

SURVEY OF THE WALA-RANO PILOT AREA

Chapter 1

Preparation of the Survey

Using the Catholic Mission's family files, Professor A. Raoult and Dr A. Niiranen counted and coded the population, classifying it into :

- individuals,
- family units,
- village groups (4 groups).

Dates of birth were checked.

Survey forms were prepared.

A copy of each family file, brought up to date, was given to Father Soucy.

Geographic reconnaisance was carried out, and the Mission map brought up to date.

A map to the scale of 1/15,000 was drawn by Professor A. Raoult (cf. Map No. 1).

This reconnaisance was to serve as a basis for special studies by Dr R. Ratard and Mr Eric Dunn. Other data collected were:

- birth-weights (from the records of Wala-Rano dispensary);

- incidence of childhood diseases.

As our equipment had not yet arrived, a measuring-table for measuring the recumbent length of infants was very efficiently built for us by Father Soucy himself.

The SPC team, Dr Niiranen and Professor Raoult, was greatly helped in this preparatory work by Miss Judith who not only was totally familiar with the area but also proved a most efficient assistant - secretary - interpreter. She was paid by the SPC.

Dr Niiranen examined and measured children from 0-5 years, this age group being her special field of investigation. Her report, Growth Study of Pre-school Children in Wala-Rano, has already been sent to the authorities of the Condominium.

Professor Raoult helped Dr Niiranen with the clinical examination of 0-5 year old children and examined the older part of the population by himself.

Procedures :

For body measurements and clinical examination, we applied the procedures advocated by WHO (cf. Monograph No. 53, D.B. Jelliffe, 1966). All data were recorded on individual coded cards (Folio A, B, B1, B2) which will be used again for follow-up examinations and finally remain in the possession of the Dept. of Health.

Two young home economics instructors from Wala-Rano Mission School helped the SPC team to assemble families and check information concerning them, while all the teachers of the same school assisted in the examination and measuring of school-age children. The village chief and team leaders of the Mission were very helpful in getting people to present themselves punctually and in the order indicated by Father Soucy every Sunday during the Church service.

Chapter 2

Assessment of the nutritional status of the Wala-Rano Community

1. Number of people examined in Wala-Rano and outside the pilot area

A. Wala-Rano	Male	Female	Total
0-5 months	8	8	16
6-11 months	10	7	17
12-35 months	30	28	58
36-59 months	25	22	47
TOTAL 0-59 months	74	70	144
6-9 years	60	51	111
10-13 years	35	42	77
TOTAL primary-school age	95	93	188
14-18 years (puberty and adolescence)	26	36	62
TOTAL young people	195	199	394
Adults	99	126	225
OVERALL TOTAL FOR WALA-RANO	295	325	619

B. Norsup School	Male	Female	Total
6-9 years	21	19	40
10-13 years	40	22	62
14-17 years	2	1	3
TOTAL 6-17 years	63	42	105

MAP Nº1

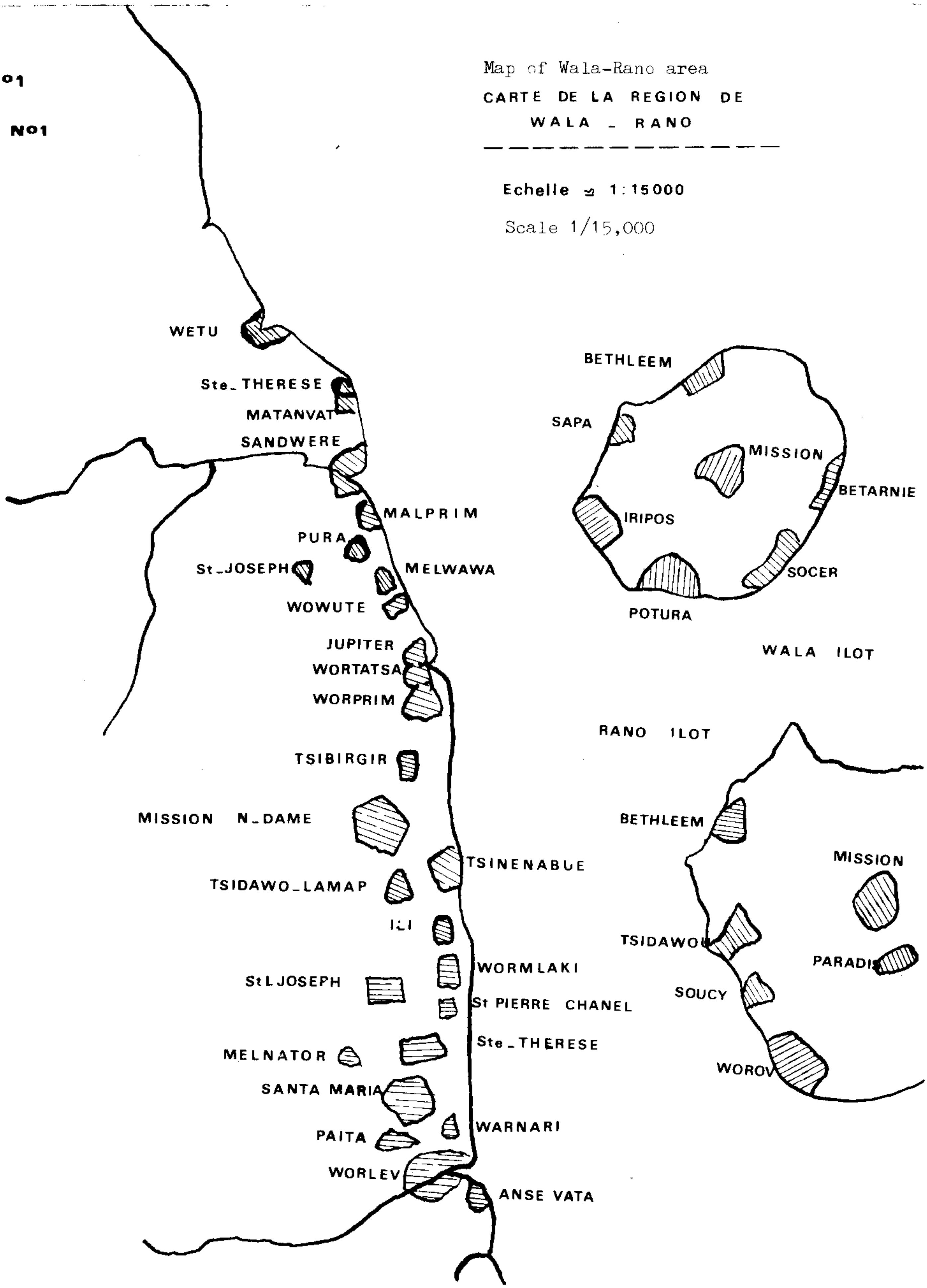
CARTE Nº1

Map of Wala-Rano area

CARTE DE LA REGION DE WALA – RANO

Echelle ≃ 1:15000

Scale 1/15,000



C. Amelvet School	Male	Female	Total
6-9 years	8	9	17
10-13 years	19	21	40
14-17 years	13	7	20
TOTAL 6-17 years	40	37	77

D. Unmet Village (clinical examination only)	Total
0-5 months	7
6-11 months	3
12-35 months	19
36-59 months	19
TOTAL 0-5 years	48
5-9 years	26
TOTAL 0-9 years	74

E. Ahamb Village (clinical examination only)	Total
0-5 months	5
6-11 months	4
12-35 months	27
36-59 months	10
TOTAL 0-5 years	46
6-9 years	18
10-13 years	14
14-18 years	11
TOTAL 6-18 years	43
TOTAL 0-18 years	89

TOTAL POPULATION EXAMINED : 964

2. Birth-weights

Birth-weights for the period March 1970 - August 1974 were noted from the records of the Wala-Rano dispensary and the maternity ward of Norsup Hospital (cf. Graph No. 2).

Mean weight was 3.1 kg for boys and 3.0 kg for girls.

Both in girls and in boys there was a small underweight group (less than 2.5 kg):

10/57 girls = 17.5%
5/72 boys = 6.9%

Chapter 3

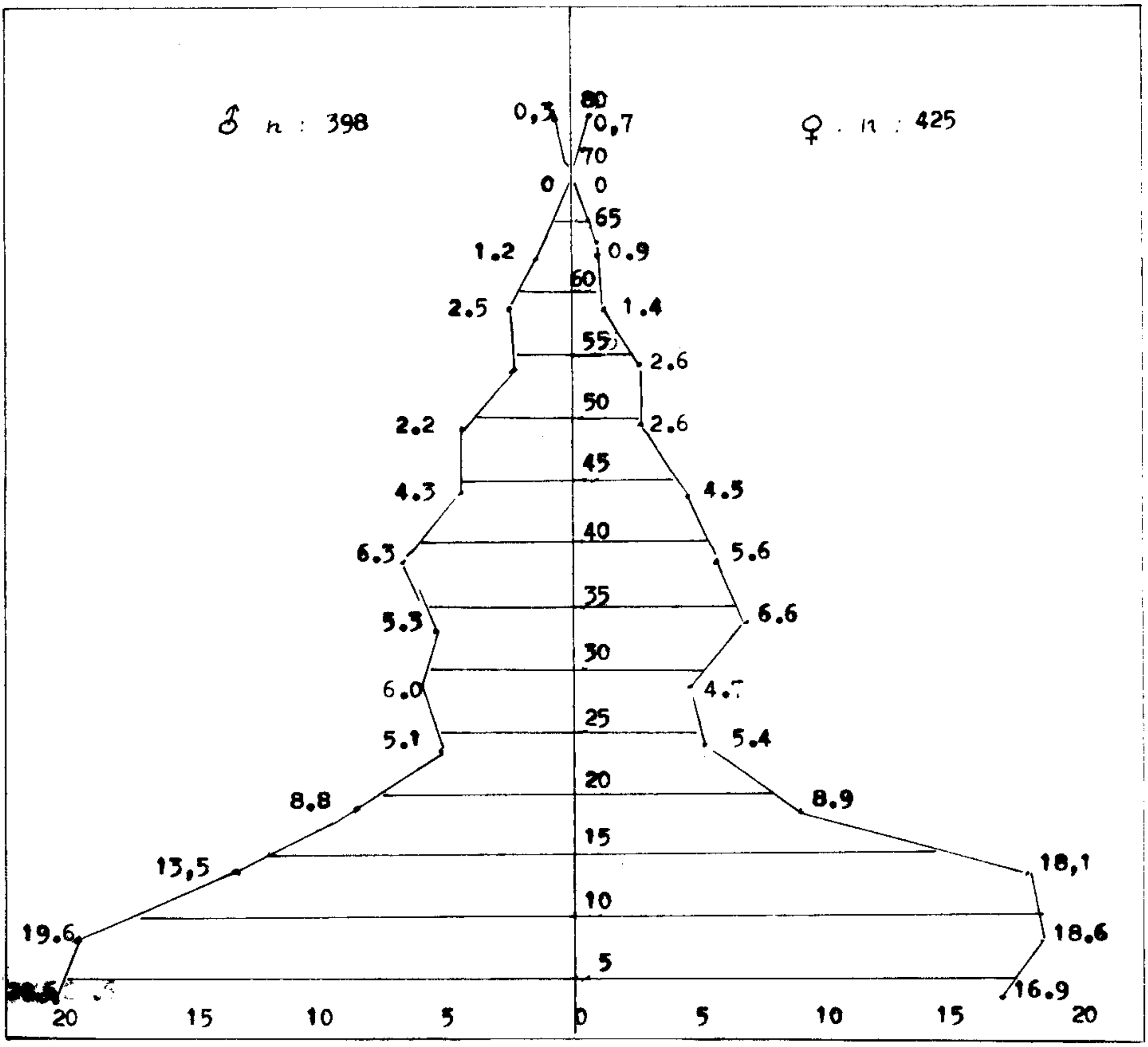
Study of nutritional status during growth - from 0 to 6 years

1. Number of children examined:

Age Months	Boys	Girls	TOTAL
0	0	0	0
1-2	5	2	7
3-5	3	6	9
6-8	5	4	9
9-11	5	3	8
12-17	8	9	17
18-23	6	4	10
24-29	9	7	16
30-35	5	8	13
36-47	9	5	14
48-53	12	6	18
54-59	4	11	15
Total 0-59	74	70	144
5-6 years	10	9	19
Total 0-6 years			163

Fig. n° 1 - AGE PYRAMID : CATHOLIC POPULATION OF WALA RANO (MALEKULA)

PYRAMIDE DES AGES : POPULATION CATHOLIQUE DE WALA RANO



2. Body measurements

Data for this age group were gathered by Dr Niiranen and fully analysed in her report: Growth Study of Pre-school Children in Wala-Rano, Malekula, (New Hebrides), which is reproduced here as Annex III.

Methods of calculation and standards used by Dr. Niiranen are clearly set out in her report; we adopted the same procedures and standards for the subsequent age brackets.

The tables and charts given in her report prove the existence of a nutritional crisis, also called weaning crisis.

Values for weight and arm muscular circumference (cf. Graphs Nos. 3 and 3bis, 4 and 4bis) combine to show that this critical period begins towards the age of 9 months, although 99% of infants were breastfed up to 1 year, 71% were breastfed up to 17 months, and 40% were still receiving some breast-milk between 18 and 23 months. It is noteworthy that mother's milk, while providing the growing baby with high quality protein, does not by itself completely meet the infant's requirements beyond the age of 9 months.

The most significantly underweight group were boys aged 18-23 months, whose mean weight was only 75% of Harvard standards. It must be noted that D.B. Jelliffe (WHO Monograph No. 53, 1966) regards weights that are 80% or less Harvard standards as denoting under-nutrition.

Skinfold and arm muscular circumference followed a developmental pattern very similar to that of weight. Skinfolds were very thin, especially during the second year of life. At the age of 18 months, boys' skinfolds were only 51% of the Harvard standard (i.e. 5mm below the standard) and girls' skinfolds at the same age were 63% of the standard.

Arm muscular circumferences, calculated according to the method described by Jelliffe in WHO Monograph No. 53, were only slightly below standard (the mean was 90% of the standard). This suggests that thinness and underweight are largely due to inadequate fat formation, itself a result of insufficient total food intake, although inadequate muscle development also plays a part.

Height and head circumference (Graphs Nos. 5 and 5bis) were less sub-standard than was weight (the mean was 90% of the standard for both parameters). However, a sharp drop in the mean occurred after 1 year, reflecting the weaning crisis.

Comments on growth patterns observed in Wala-Rano

The representative value of the means calculated by Dr Niiranen is questionable. While she took care to omit from her calculations four obvious malnutrition cases, she included children with anaemia, malaria and intestinal parasites. On the basis of a cursory clinical examination, unconfirmed by laboratory tests, is it really possible to regard as "normal" children whose weight is below the lowest reference curve?

In our opinion, the means calculated from measurements of Wala-Rano children cannot legitimately be used as standards for Melanesian children as a whole. Weight for height ratios are also devoid of significance, since both weight and height were retarded to same extent.

The conclusions to be drawn from Dr Niiranen's report are as follows:

(a) Up to 6 months, the average Wala-Rano baby is on a par with Harvard standards as regards those features that most clearly define a genetic type (height-head circumference). This is unquestionably due to breast-feeding, which supplies adequate amounts of all essential nutrients and also confers immunity against various environmental health hazards. Under satisfactory conditions of diet and hygiene, the growth curves of the different parameters should be regular, and infants who were average or above-standard in the first months of life could be expected to remain at a high level throughout childhood. Such is not the case, however. The Wala-Rano child undergoes several set-backs in the course of its growth, and retardation in some of the parameters often subsists into adulthood.

(b) The patterns established during the first survey merely reflect the present situation, and are subject to change for better or for worse. A follow-up survey in three years' time will enable us to assess whether the actions undertaken in Wala-Rano have brought about any changes for the better.

(c) The nutritional status of pre-school children in Wala-Rano is, on the whole, quite alarming: 41% of boys and 54% of girls have weights for age under 80% of Harvard standards, which leads us to suspect general undernutrition as the main conditioning factor of protein-calorie malnutrition in these children.

(d) An overall mean or average is of limited usefulness, since it tends to gloss over extreme cases of retardation.

3. Clinical findings:

Clinical examination was performed by Dr Niiranen and Professor Raoult, and data recorded on the forms prepared especially for the survey. Only the most salient findings, those that reveal problems which call for urgent remedial action, will be dealt with hereunder.

(a) The nutritional crisis - Protein-calorie malnutrition

As can be seen from Dr Niiranen's report, retardation occurred in all parameters after the age of about 9 months, reflecting overall under-nutrition, or combined malnutrition-undernutrition.

The term Protein-calorie malnutrition refers more specifically to a shortage of protein compared with requirements in early childhood. PCM exists in various degrees, ranging from sub-clinical deficiencies to moderate or severe clinical forms of which oedema is the most characteristic sign, and usually occurs somewhat later, when breast-feeding is stopped altogether.

Depigmentation of the skin and dyspigmentation of the hair are part of the clinical picture of kwashiorkor. They usually denote a shortage of certain amino acids (methionine - cystine), and in dark-haired, dark-skinned ethnic groups often constitute an early sign of malnutrition. Care must be taken when interpreting this sign however, since skin pallor and hair abnormalities may also result from severe anaemia and various non-nutritional factors.

Muscle wasting is a more reliable sign. The degree of muscular depletion is assessed by measuring arm circumference and calculating arm muscular circumference using the formula given in Dr Niiranen's report ($C_2 = C_1 - \pi S$, where C_2 = arm muscular circumference, C_1 = arm circumference, and S = skinfold). In Graphs Nos. 4 and 4bis, the mean representing arm muscle mass can be seen to drop in both sexes, but more markedly in girls, around 18 months, which is the age where all infants are complete weaned and malnutrition is most acute.

Clinical examination revealed 6 cases of pronounced muscle wasting, all of which were associated with skin and hair dyspigmentation and 2 of which also showed pretibial oedema, i.e. a total of 6 cases of PCM out of 58 children in the 12 to 36 months age group : 10.3%.

Without laboratory facilities for biochemical testing, it was of course difficult to diagnose sub-clinical PCM. However, thinness and low body weight resulting from under-nutrition are often an indication of latent malnutrition, and in Wala-Rano 25% of boys between 18 and 23 months, and 28% of girls between 12 and 17 months were clearly sub-standard.

(b) The recovery phase - Symptoms

Besides the clinical signs denoting protein-calorie malnutrition "in progress", there are a number of symptoms which appear towards the end of the acute phase and reflect its sequelae or after-effects:

- Parotid enlargement (nutritional parotidosis)
- Excessive and abnormally distributed hair growth (pilosis)
- Liver enlargement (hepatomegaly - in the absence of malaria)
- Melanodontia (tooth enamel dysplasia).

In the 12 to 36 months age-bracket, we found:

- 8 cases of parotid enlargement : 13.8%
- 16 cases of liver enlargement : 27%
- 8 cases of abnormal hair growth : 13.8%
- 7 cases of melanodontia : 12.1%

Among the lasting effects of malnutrition, one of the most serious is skull development retardation (cf. Graphs Nos. 6 and 6bis, and 11 and 11bis). Up to 6 months in boys, and up to 9 months in girls, the head circumference mean was close to the standard (P 50). It then levelled off and fell below the P 3 curve. Boys were 3.5 cm below the standard at 21 months, and girls 3 cm below at 15 months. Recovery began towards 24 months in both sexes, when the mean rose again, but was far from complete at 3 years, as is borne out by the following clinical symptoms observed in the 36 to 72 months age-group (66 children):

- 13 cases of marasmus-type protein-calorie malnutrition, with pronounced muscle wasting and mild oedema = 19.7%
- Skin depigmentation : 11/66 = 19.7%
- Hair dyspigmentation : 33/66 = 50%
- Parotid enlargement : 15/66 = 22.7%
- Excessive hair growth : 25/66 = 37.9%
- Liver enlargement : 33/66 = 50%
- Melanodontia : 8/66 = 12%

In some cases, liver enlargement was found to be associated with spleen enlargement due to malaria : 6 enlarged spleens were detected, i.e. 9.1%.

The combination excessive hair growth-liver enlargement is the cardinal feature of the"rehabilitation syndrome" described by Gomez, but in Wala-Rano it was difficult to assess the extent to which liver enlargement actually relfected rehabilitation after malnutrition, because of the presence of malaria which is known to be a factor of liver enlargement.

The most significant finding was the high incidence of nutritional parotidosis, i.e. a chronic, painless swelling of the parotid glands, which will be discussed in a later chapter.

(c) Anaemia

Age group	Number examined	Clinically detectable anaemia	Spleen enlargement
0 -6 months	15	1 = 7%	1 = 7%
6 months-1 year	13	3 = 23%	1 = 7.7%
1 - 3 years	58	13 = 22.6%	3 = 5.1%
3 - 6 years	66	26 = 39.4%	6 = 9.1%

Haemoglobin estimations were carried out by Dr Ratard (cf. Annex 1).

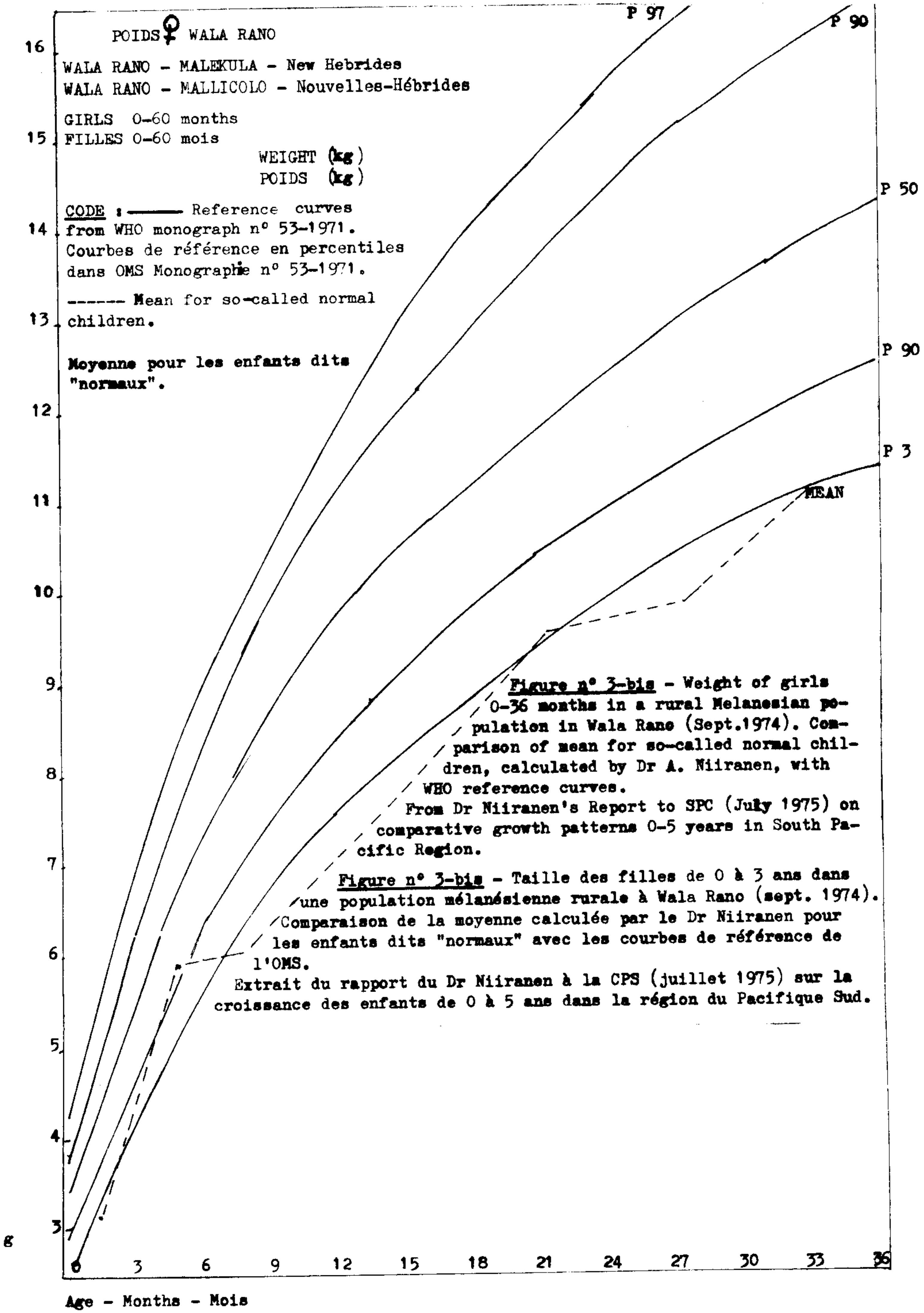


Figure n° 3-bis - Weight of girls 0-36 months in a rural Melanesian population in Wala Rano (Sept.1974). Comparison of mean for so-called normal children, calculated by Dr A. Niiranen, with WHO reference curves.
From Dr Niiranen's Report to SPC (July 1975) on comparative growth patterns 0-5 years in South Pacific Region.

Figure n° 3-bis - Taille des filles de 0 à 3 ans dans une population mélanésienne rurale à Wala Rano (sept. 1974). Comparaison de la moyenne calculée par le Dr Niiranen pour les enfants dits "normaux" avec les courbes de référence de l'OMS.
Extrait du rapport du Dr Niiranen à la CPS (juillet 1975) sur la croissance des enfants de 0 à 5 ans dans la région du Pacifique Sud.

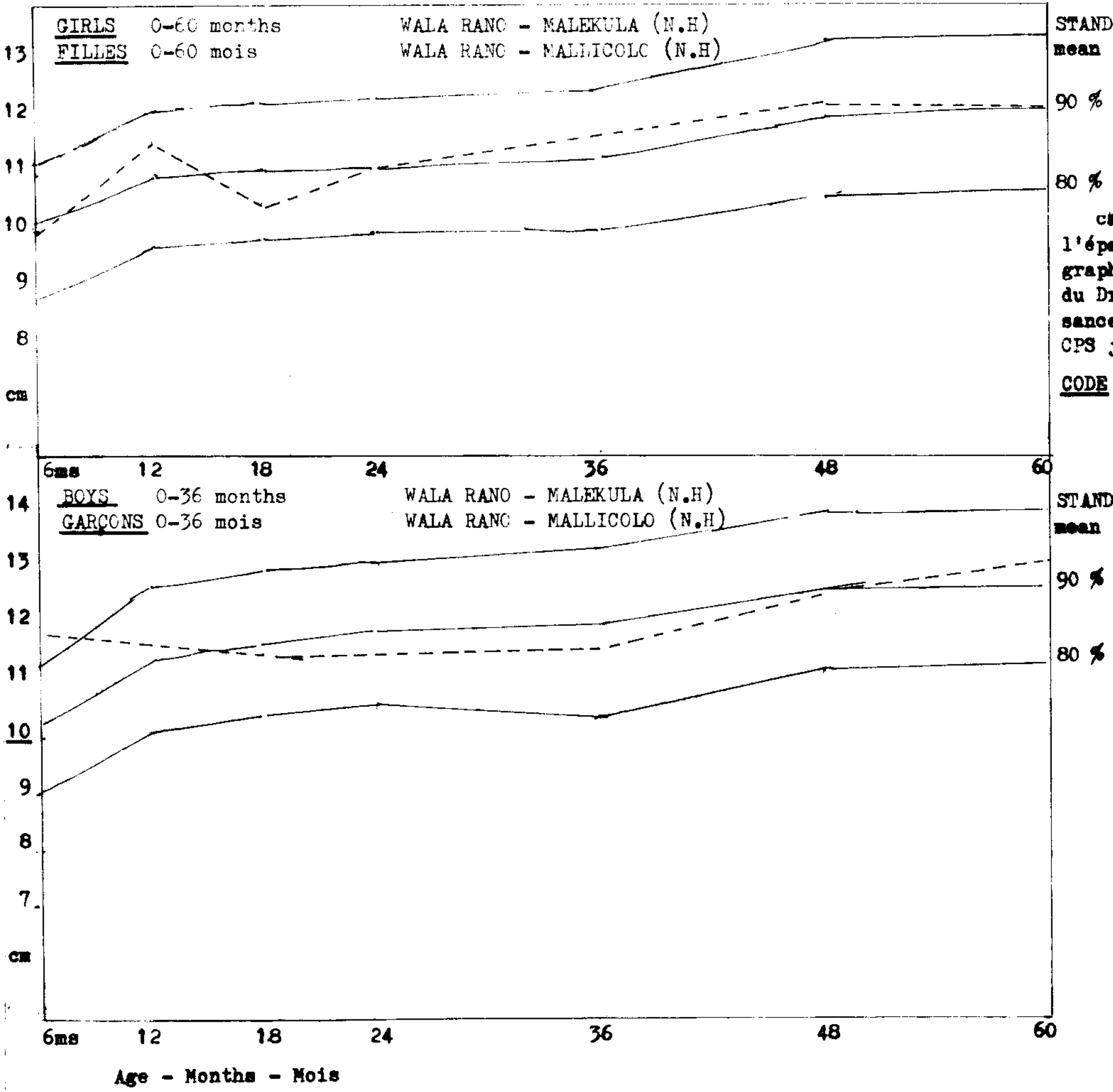


Fig. n°4 et 4-bis

– MUSCULAR CIRCUMFERENCE of LEFT ARM, calculated from mid arm circumference and skinfold (WHO Monograph n° 53-1971) from Dr Anja Niiranen's report on patterns, SPC July 1975.

– Périmètre musculaire du bras gauche calculé à partir du périmètre du bras et l'épaisseur du pli cutané (d'après la monographie OMS n° 53-1971). Extrait du rapport du Dr Anja Niiranen sur l'étude de la croissance de 0 à 5 ans dans le Pacifique Sud, CPS juillet 1975.

CODE : —— Reference lines (WHO).
Lignes de référence (OMS).

- - - - Local median for normal calculated by Dr Anja Niiranen.
Médiane locale pour les enfants normaux calculés par le Dr Anja Niiranen.

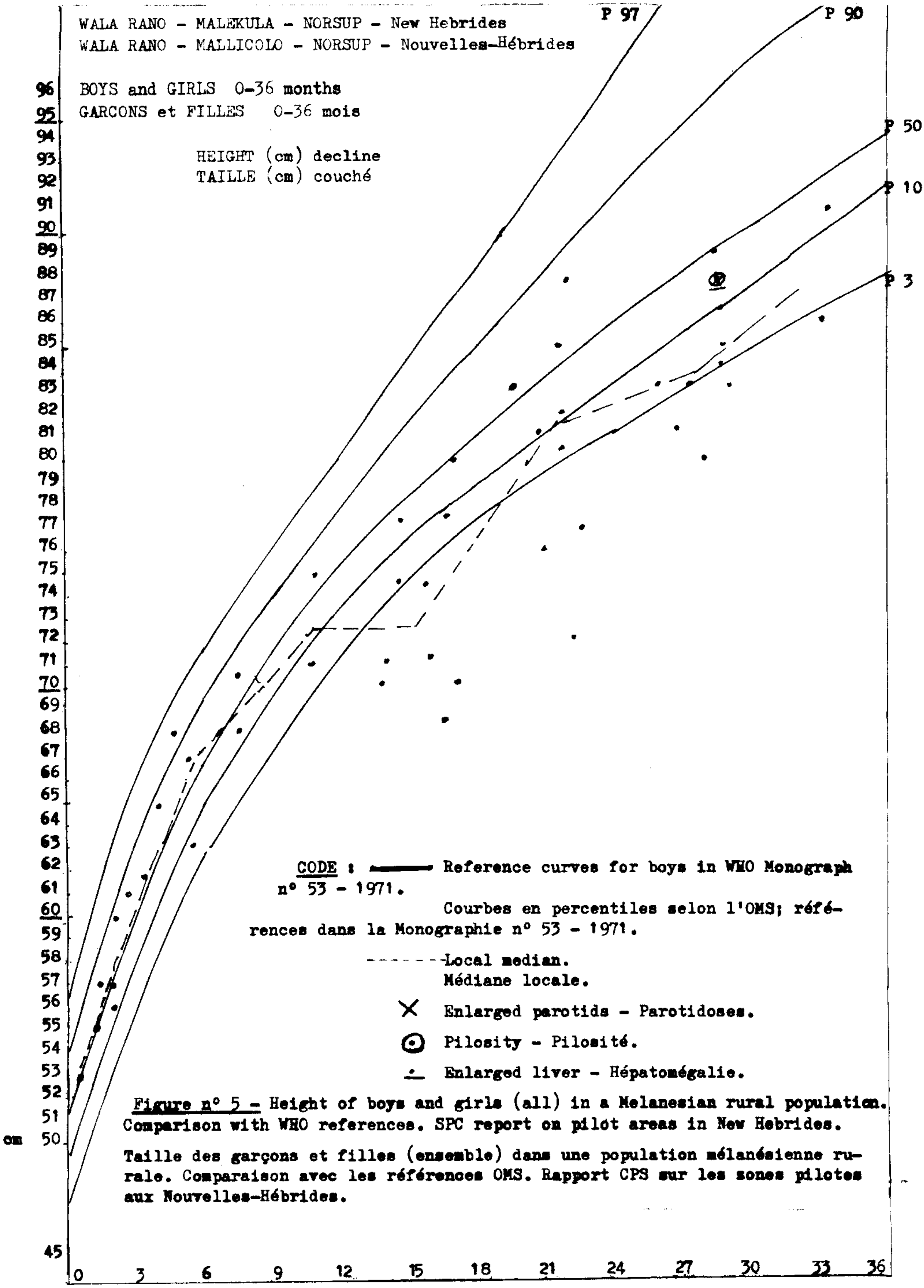


Figure n° 5 - Height of boys and girls (all) in a Melanesian rural population. Comparison with WHO references. SPC report on pilot areas in New Hebrides.

Taille des garçons et filles (ensemble) dans une population mélanésienne rurale. Comparaison avec les références OMS. Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

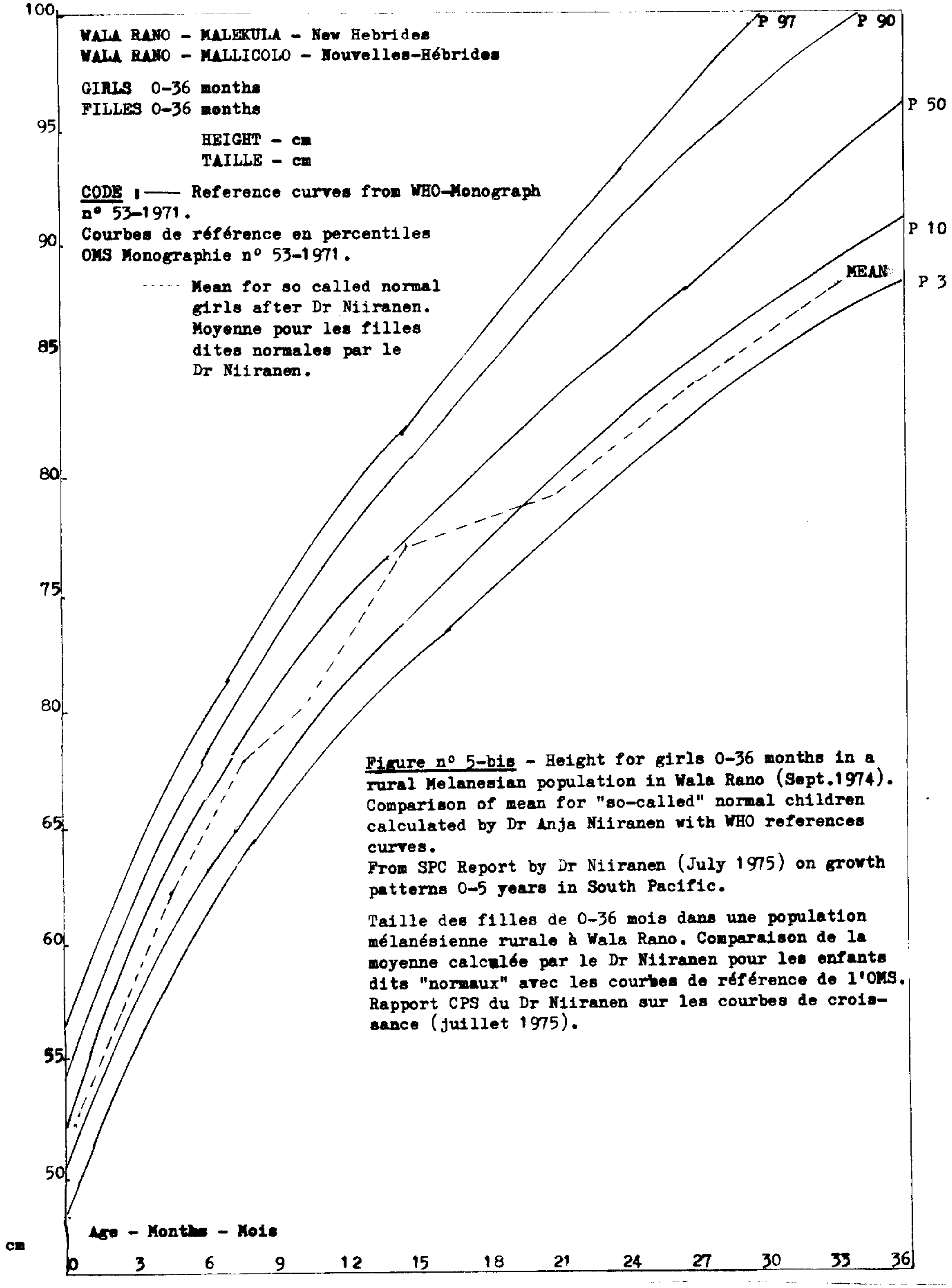


Figure n° 5-bis - Height for girls 0-36 months in a rural Melanesian population in Wala Rano (Sept.1974). Comparison of mean for "so-called" normal children calculated by Dr Anja Niiranen with WHO references curves.
From SPC Report by Dr Niiranen (July 1975) on growth patterns 0-5 years in South Pacific.

Taille des filles de 0-36 mois dans une population mélanésienne rurale à Wala Rano. Comparaison de la moyenne calculée par le Dr Niiranen pour les enfants dits "normaux" avec les courbes de référence de l'OMS. Rapport CPS du Dr Niiranen sur les courbes de croissance (juillet 1975).

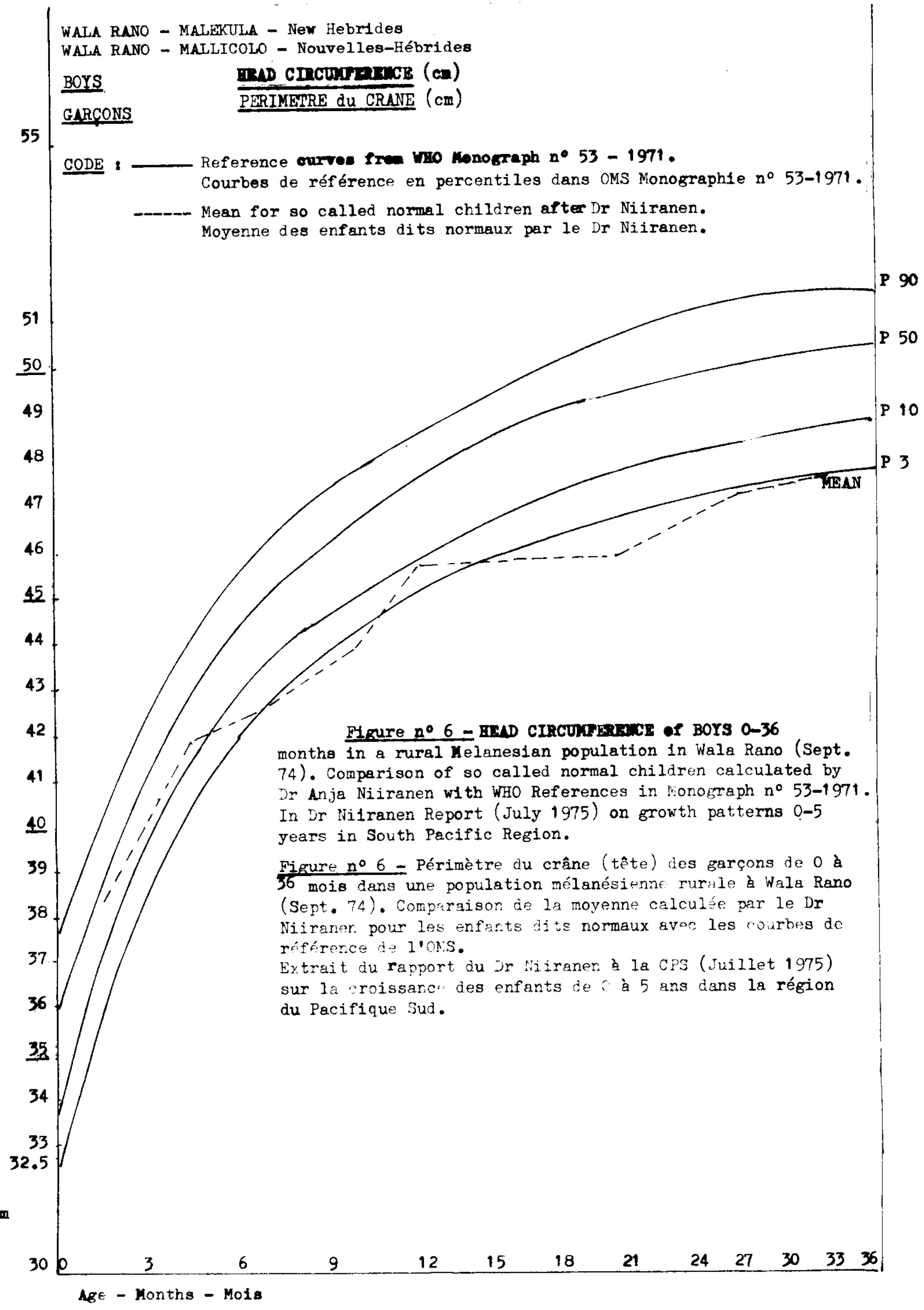


Figure n° 6 - HEAD CIRCUMFERENCE of BOYS 0-36 months in a rural Melanesian population in Wala Rano (Sept. 74). Comparison of so called normal children calculated by Dr Anja Niiranen with WHO References in Monograph n° 53-1971. In Dr Niiranen Report (July 1975) on growth patterns 0-5 years in South Pacific Region.

Figure n° 6 - Périmètre du crâne (tête) des garçons de 0 à 36 mois dans une population mélanésienne rurale à Wala Rano (Sept. 74). Comparaison de la moyenne calculée par le Dr Niiranen pour les enfants dits normaux avec les courbes de référence de l'OMS.
Extrait du rapport du Dr Niiranen à la CPS (Juillet 1975) sur la croissance des enfants de 0 à 5 ans dans la région du Pacifique Sud.

Mean haemoglobin levels, expressed as percentages, are shown hereunder:

Age group	Number of samples taken	Mean haemoglobin level	Standard deviation
0-11 months	6/28	61%	2.2
12-23 months	5/27	68%	12.2
2-4 years	12/53	66%	8.1

Anaemia in these infants and pre-school children was due to a combination of factors:

- iron deficiency, in the first months,
- depletion through malaria, after weaning,
- protein deficiencies, in all cases.

Cytological tests were not performed.

Malaria (as at October 1974):

Age group	Samples examined	Positive
0-11 months	8/28	1 (12%)
12-23 months	5/27	0
2-4 years	18/53	0

Children with malarial fever are usually taken to the dispensary where they are treated with nivaquine.

Testing of stool samples for intestinal parasites was not carried out in infants and pre-school children.

Clinically detectable anaemia in older age groups :

6 - 13 years : 12%
13 - 18 years : 15.9%
20 - 45 years (both sexes) : 25.7%
45 - 55 years : 25%
Over 55 years : 20%

Haemoglobin level (cf. Dr Ratard's report, Annex 1) :

Age group	Number of samples examined	Mean haemoglobin level	Standard deviation
5-9 years	139	72%	11.5
10-14 years	102	91%	6.4
15-19 years	0	0	0
Over 20 years	57	77%	10.1

In children of all ages anaemia was more common in girls. In adults between 20 and 45 years, pregnant and lactating women were most commonly affected. After 45 years, incidence of anaemia rose with age.

In the school-age group, stool samples were taken from 112 children between 5 and 9 years, and 198 children between 10 and 14 years, and tested for intestinal parasites. Hookworm infection was found in 11.6% of the former and in 16.1% of the latter.

Examination of individual files showed hookworm to be associated with all cases of severe anaemia. Hookworm and the other intestinal parasites were not evenly distributed; the centres of high prevalence were identified.

The anaemia problem must thus be tackled on 3 fronts :

(1) Malaria control (an anti-malaria campaign was begun in January 1975).
(2) Control of intestinal parasites (systematic treatment of school children was begun in June 1975).
(3) Improvement of nutritional status : Systematic distribution of iron and folic acid tablets to pregnant women, nursing mothers and babies.

Chapter 4

Nutritional Status After 6 Years

1. Body measurements from 6 to 17 years.

Comparison of the day-pupils of Wala-Rano Private Catholic School with the boarders of Norsup Government School.

Children enter school at 5 or 6 years and remain at school up to 14 years, more rarely up to 17 years. 140 children, 91 boys and 49 girls, were examined and the following measurements taken :

- Weight
- Standing height
- Head circumference
- Arm circumference
- Triceps skinfold

It was interesting to compare the development level and nutritional status of the children attending these two schools, as conditions of attendance are very different. At the Wala-Rano Mission School no school-meals are organised, and the children usually eat nothing between a very light morning meal and the evening meal in their families. At the Norsup Government School on the other hand, children are normally boarders and even those who are day-pupils receive a mid-day meal at the school, so that most in fact get

3 good, well-balanced meals a day, food-intake thus being completely adequate both in quantity and in quality. Considerable discrepancies between individuals existed however, especially at Norsup School where the more recently admitted boarders (of all ages) still showed some degree of the retardation suffered in their native districts or islands (Ambrym - Pentecost - Wallis). Parotid enlargement was found mainly in day-pupils or in those from neighbouring islands who had been boarding at the school only a short while

As a matter of fact, none of the children had really been at the school very long, since it only opened four years ago. Children over 9 years of age therefore had not had the advantage of the good dietary conditions described above during their early school years.

Only the Melanesian pupils of the two schools were included in this comparison. Mean body measurements for each set of children are given in the following pages and will be analysed in relation to anthropometric standards recommended by WHO.

Boys - Standing Height (Graph No. 10 Wala-Rano, and No. 4 Norsup).

Age	Mean height Norsup	Mean height Wala-Rano	Difference
5½ years	1.14 m	1.05 m	- 9 cm
6½ years	1.15 m	1.13 m	- 2 cm
7½ years	1.20 m	1.125 m	- 7.5 cm
8½ years	1.25 m	1.225 m	- 2.5 cm
9½ years	1.34 m	1.275 m	- 6.5 cm
10½ years	1.34 m	1.32 m	- [illegible] cm
11½ years	1.375 m	1.325 m	- 5 cm
12½ years	1.425 m	1.40 m	- 2.5 cm
13½ years	1.50 m	1.425 m	- 7.5 cm
14½ years	1.555 m	1.50 m	- 5.5 cm
15½ years	1.57 m	1.53 m	- 4 cm
16½ years	1.675 m	1.60 m	- 7.5 cm

The statural retardation observed in Wala-Rano pre-school children was still significant in the 5 to 6 year group. It became more marked during the pre-puberty and adolescent period where rapid growth should normally occur, and was carried over into adulthood, the mean remaining below the P3 reference curve (Harvard standards - Stuart and Stevenson).

	Norsup	Wala-Rano
⩾ P50	7.5%	6.3%
< P50 ⩾ P3	48.2%	44.6%
< P3	44.3%	49.1%

In both sets of schoolchildren, height retardation was most pronounced between 10½ and 13½ years of age. In Norsup children however, the mean rose again during adolescence.

In Wala-Rano, average height of male adults was 1.65 m.

Boys - Weight (Graph No. 7 Wala-Rano and No. 1 Norsup)

Age	Mean weight Norsup	Mean weight Wala-Rano	Difference
5½ years	21.0 kg	14.4 kg	- 6.6 kg
6½ years	21.5 kg	17 kg	- 4.5 kg
7½ years	24 kg	19 kg	- 5 kg
8½ years	25 kg	20 kg	- 5 kg
9½ years	27 kg	23 kg	- 4 kg
10½ years	27 kg	24.5 kg	-2.5 kg
12½ years	33 kg	30 kg	- 3 kg
13½ years	37 kg	37 kg	- 0

The difference in mean weight between the two sets of schoolchildren was most marked at 5½ years. It decreased thereafter and disappeared at puberty.

In relation to Harvard standards (Stuart and Stevenson) recommended by WHO, weights were distributed as follows:

	Norsup	Wala-Rano
≥ P50	15.1%	2.6%
< P50 > P3	53.5%	27.1%
< P3	31.4%	70.3%

Nearly all Wala-Rano schoolboys were underweight and more than two thirds were below the severe under-nutrition line (P3 i.e. 80% of P50 - cf. Graph No. 7).

The weight mean for Wala-Rano boys was still well below the P3 curve at 15½ years.

At Norsup, only 31.4% of the boys were below the P3 curve, but even here - in spite of copious school-meals - weight retardation was very marked between 8 and 10 years, which is the age where intestinal parasite infestation (roundworm, hookworm) is most severe.

Girls - Standing height (Graphs Nos. 10bis Wala-Rano and 4bis Norsup)

Age	Mean height Norsup	Mean height Wala-Rano	Difference
5½ years	1.075 m	1.05 m	- 2.5 cm
6½ years	1.115 m	1.11 m	- 4.5 cm
7½ years	1.175 m	1.15 m	- 2.5 cm
8½ years	1.20 m	1.20 m	0
9½ years	1.245 m	1.25 m	+ 0.5 cm
10½ years	1.325 m	1.30 m	- 2.5 cm
11½ years	1.40 m	1.325 m	- 7.5 cm
12½ years	1.425 m	1.42 m	- 0.5 cm
13½ years	1.475 m	1.45 m	- 2.5 cm
14½ years	1.55 m	1.525 m	- 2.5 cm

Height retardation of Wala-Rano schoolgirls compared with their Norsup counterparts was quite marked in the lower forms (5 to 7 years), slight or nil in the middle forms (8 to 10 years), most pronounced during the pre-puberty period, where the spurt of growth that should normally occur is considerably delayed in Wala-Rano, and slight again during adolescence.

In relation to Harvard standards (Stuart and Stevenson) :

	Norsup	Wala-Rano
> P50	10.7%	5.2%
< P50 > P3	60%	62%
< P 3	29.3%	32%

Deviation from the standard was, on the whole, less marked in girls than in boys. As will be seen further,on, clinical malnutrition sequelae were also less common in girls. However, a number of cases of severe retardation were found in both schools, particularly in the pre-puberty age group.

Girls - Weight (Graphs No. 10bis Wala-Rano and No. 1bis Norsup)

Age	Mean weight Norsup	Mean weight Wala-Rano	Difference
5½ years	18.5 kg	16 kg	- 2.5 kg
6½ years	21.5 kg	17 kg	- 4.5 kg
7½ years	24 kg	19 kg	- 5 kg
8½ years	25 kg	20 kg	- 5 kg
9½ years	27 kg	23 kg	- 4 kg
10½ years	27 kg	24.5 kg	- 2.5 kg
11½ years	27 kg	30 kg	+ 3 kg
12½ years	33 kg	30 kg	- 3 kg
13½ years	37 kg	37 kg	0
15½ years	50 kg	49 kg	- 1 kg

Weight retardation of Wala-Rano girls diminished noticeably at puberty, and by school-leaving age most girls had reached a satisfactory weight level. Comparison with Harvard standards however showed individual cases of severe undernutrition to be far more numerous in Wala-Rano.

	Norsup	Wala-Rano
> P50	23.2%	1.7%
< P50 > P3	55.4%	46.6%
< P3	21.4%	51.7%

Weight retardation, like height retardation, was at its maximum between 8 and 10 years in both schools.

As was the case for boys, severe under-nutrition was far more prevalent in Wala-Rano than in Norsup (51.7% against 21% below P3). The weight mean for Wala-Rano girls crossed the lower reference curve, and moved towards P50 only after 14½ years, whereas in Norsup the P50 standard was already reached at 12½ years, with overweight beginning to occur at that age.

Triceps skinfold and arm circumference - Boys

Skinfold thickness (Graphs No. 8 Wala-Rano and No. 2 Norsup)

Arm Circumference (Graphs No. 9 Wala-Rano and No. 3 Norsup)

Age	Mean skinfold thickness			Mean arm circumference		
	Norsup	Wala-Rano	Difference	Norsup	Wala-Rano	Difference
5½	5.5 mm	5 mm	- 0.5 mm	15.8 cm	14.5 cm	- 1.3 cm
6½	6 mm	4.8	-1.2	16.5	15	- 1.5
7½	8 mm	4.5	- 3.5	17.3	14.8	- 2.5
8½	6 mm	4.5	- 1.5	17	16.5	- 0.5
9½	7 mm	5	- 2	17	16.5	- 0.5
10½	9 mm	6	- 3	18	17	- 1
11½	6 mm	4	- 2	18	18	- 0
12½	7 mm	6	- 1	19	18.5	- 0.5
13½	6 mm	5.8	- 0.2	19	18.6	- 0.4
14½	6 mm	5	- 1	20	19	- 1
15½	6 mm	4.5	- 1.5	21	20	- 1

Boys in both schools had thin arms and very little subcutaneous fat. Skinfolds remained sub-standard up to puberty. Only 8.2% of Wala-Rano boys were above the severe under-nutrition line (80% of P50), which means that 91.8% were abnormally thin. Only after 15 years did the Wala-Rano skinfold mean cross over the P3 line and move towards the P50 standard.

At Norsup, the situation was better: only 53.3% of the boys being below 80% of P50.

As regards arm circumference values, differences between the two schools were less striking. 24% of Wala-Rano boys were below 80% of P50, retardation being most marked just before puberty.

Girls

Skinfold thickness (Graphs No. 8bis Wala-Rano and No. 2bis Norsup)

Arm Circumference (Graphs No. 9bis Wala-Rano and No. 3bis Norsup)

Age	Mean skinfold thickness			Mean arm circumference		
	Norsup	Wala-Rano	Difference	Norsup	Wala-Rano	Difference
5½	7 mm	6 mm	- 1 mm	15 cm	(not measured)	
6½	6.5	5.5	- 1	16	-	
7½	5.5	5.8	+ 0.3	16	-	
8½	10	6	- 4	17	-	
9½	10	5	- 5	17.5	-	
10½	9	6.5	- 2.5	17.5	-	
11½	8	6	- 2	19	-	
12½	11	7	- 4	20	-	
13½	12	7.5	- 4.5	20	-	
14½	13	8.5	- 4.5	23	-	
15½	-	-	-	23	-	

Comparison of skinfold measurements confirmed our findings for weights, in that it showed Wala-Rano schoolgirls to have distinctly less fatty tissue than their Norsup counterparts. The difference was most marked in pre-puberty period (8 to 10 years) and in early adolescence, where Norsup girls had already begun to "fill out" while Wala-Rano girls remained thin : 90.4% were below the under-nutrition line (cf. boys = 91.8%).

In Norsup, only 42% had skinfold values below 80% of P50, and from about 12 years the majority was up to or above the reference mean, excess fat appearing in several subjects, which was certainly not the case in Wala-Rano.

Boys

Head Circumference (Graphs No. 11 Wala-Rano and No. 5 Norsup)

Age	Norsup	Wala-Rano	Difference
5½ years	50.5 cm	48.7 cm	- 1.8 cm
6½	51	48.9	- 2.1
7½	52	49.5	- 2.5
8½	52.3	50	- 2.3
9½	52.8	50.5	- 2.3
10½	52.9	50.9	- 2
11½	53	50.6	- 2.4
12½	53	51	- 2

Age	Norsup	Wala-Rano	Difference
13½ years	51.8 cm	52 cm	+ 0.2 cm
14½	53	52.9	- 0.1
15½	54	53.5	- 0.5
16½	54	54	0

Head circumference values were only compared in boys, as the variable thickness of girls' hair makes accurate measuring a problem. As has already been stated, the children of the two schools belonged to the same ethnic group, so that any difference between them would stem mainly from the fact that the Norsup batch were well fed from about 5½ years of age. A possible additional factor may be that the Norsup pupils constitute a sort of élite, being selected from various islands.

Skull formation was substantially retarded in Wala-Rano schoolboys in relation to Norsup pupils of comparable age, but only up to the pre-puberty spurt of growth, during which the Wala-Rano boys catch up with the more precocious Norsup boys. Generally speaking, head circumference values were low in both schools, as compared with the standards established by Watson and Lowry (1958):

	Norsup	Wala-Rano
$\geq$ P50	29%	15.8%
$<$ P50 $>$ 1 Standard deviation	40%	26.8%
$<$ 1 Standard deviation	31%	57.5%

The Wala-Rano mean begins to rise gradually from 11½ years.

The Norsup mean forms a curious pattern : more or less parallel to the P50 curve up to 11½ years, it drops sharply between 12 and 14 years. A possible explanation could be that the boys in this age-group had, prior to becoming boarders at the school and receiving adequate diets, suffered serious retardation which still shows up and differentiates them from the younger age-groups. We shall examine this assumption further when we analyse the clinical data recorded, particularly in connection with parotid enlargement.

Summary and conclusions

Analysis of comparative body measurements showed that:

(1) Growth of Wala-Rano schoolchildren was inadequate and retarded in all parameters.

(2) These inadequacies and retardations stemmed from insufficiency of food intake and dietary imbalance.

(3) The differences in physical development existing between two sets of ethnically identical children confirm the value of rational diets.

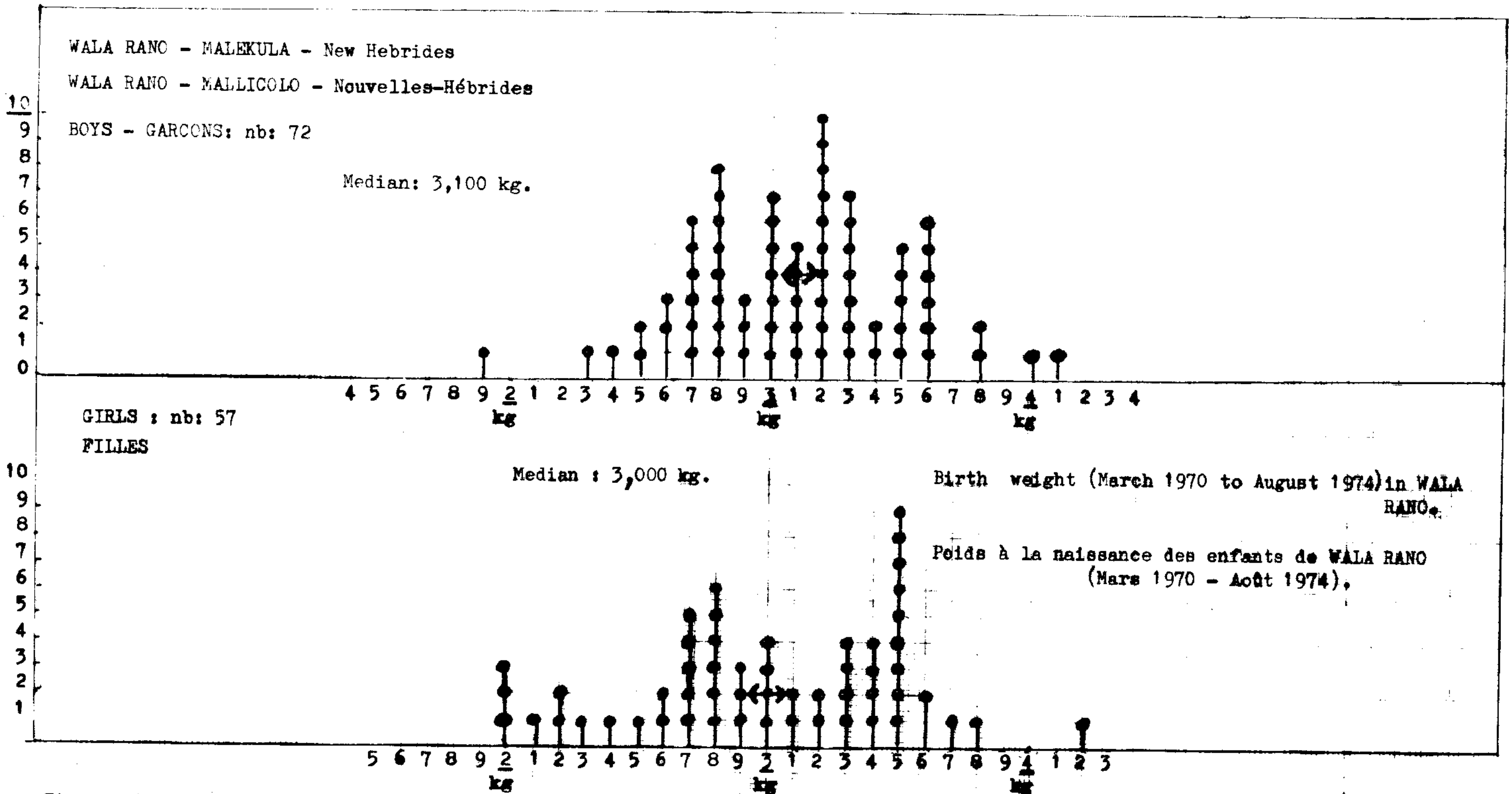


Figure n° 2 - Distribution of birth weight of boys and girls in a rural Melanesian population in Malekula - New Hebrides. Births registered over a period of 40 months ending August 1974 at Wala Rano dispensary.

Distribution des poids de naissance des garçons et filles dans une population mélanésienne de Mallicolo (Nouvelles-Hébrides). Naissances enregistrées sur une période de 40 mois (jusqu'à fin août 1974) au Dispensaire de Wala Rano.

SPC Report on pilot areas in New Hebrides.
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

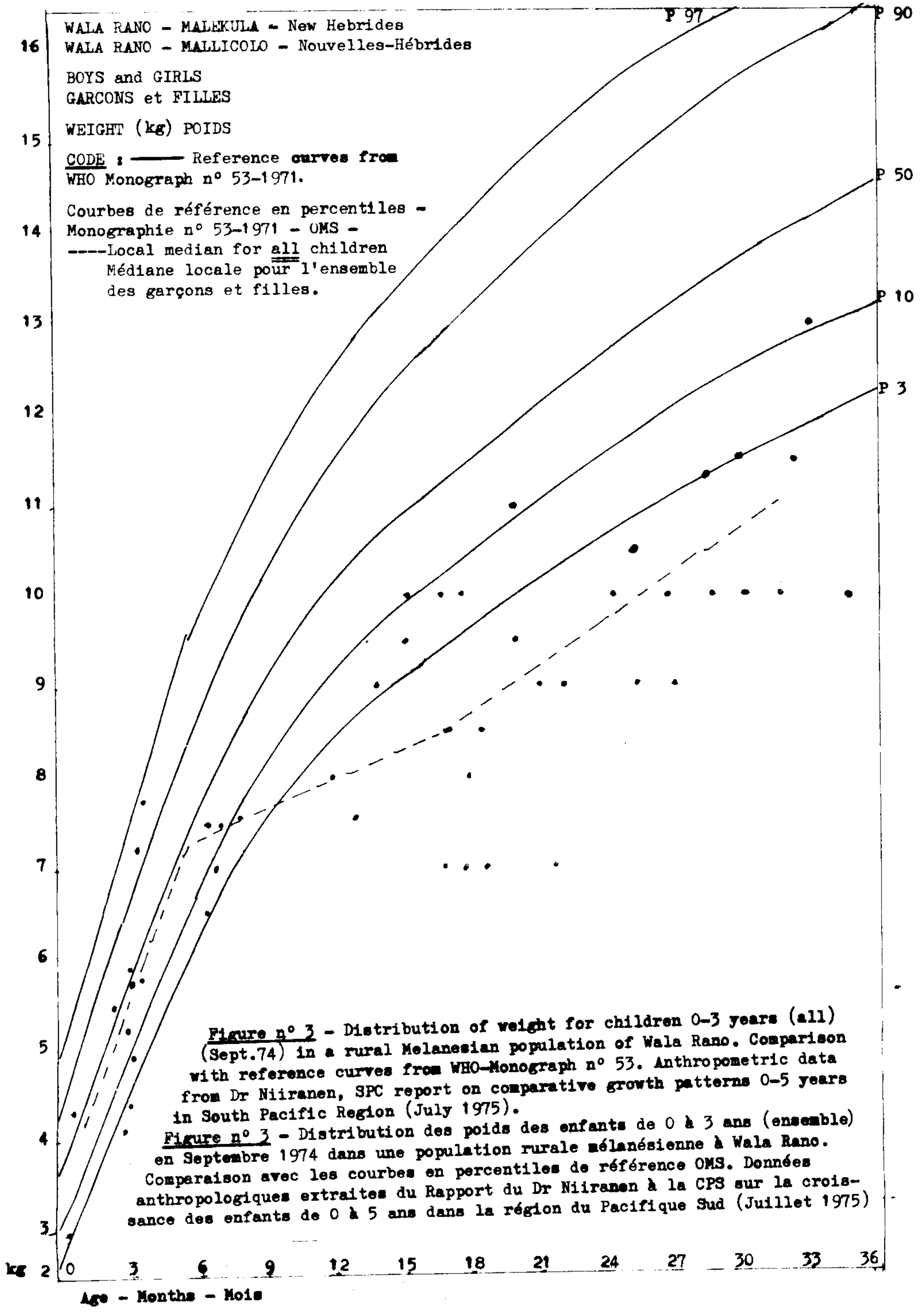


Figure n° 3 - Distribution of weight for children 0-3 years (all) (Sept.74) in a rural Melanesian population of Wala Rano. Comparison with reference curves from WHO-Monograph n° 53. Anthropometric data from Dr Niiranen, SPC report on comparative growth patterns 0-5 years in South Pacific Region (July 1975).

Figure n° 3 - Distribution des poids des enfants de 0 à 3 ans (ensemble) en Septembre 1974 dans une population rurale mélanésienne à Wala Rano. Comparaison avec les courbes en percentiles de référence OMS. Données anthropologiques extraites du Rapport du Dr Niiranen à la CPS sur la croissance des enfants de 0 à 5 ans dans la région du Pacifique Sud (Juillet 1975)

WALA RANO - MALEKULA - New Hebrides
WALA RANO - MALLICOLO - Nouvelles-Hébrides

GIRLS 0-36 months
FILLES 0-36 mois

HEAD CIRCUMFERENCE (cm)
PERIMETRE du CRANE (cm)

CODE : ——— Reference percentile curves from WHO Monograph n° 53-1971 .
Courbes de référence en percentiles. Dans OMS Monographie n° 53-1971.
------ Local median for so called normal children after Dr Niiranen's report -SPC July 1975.

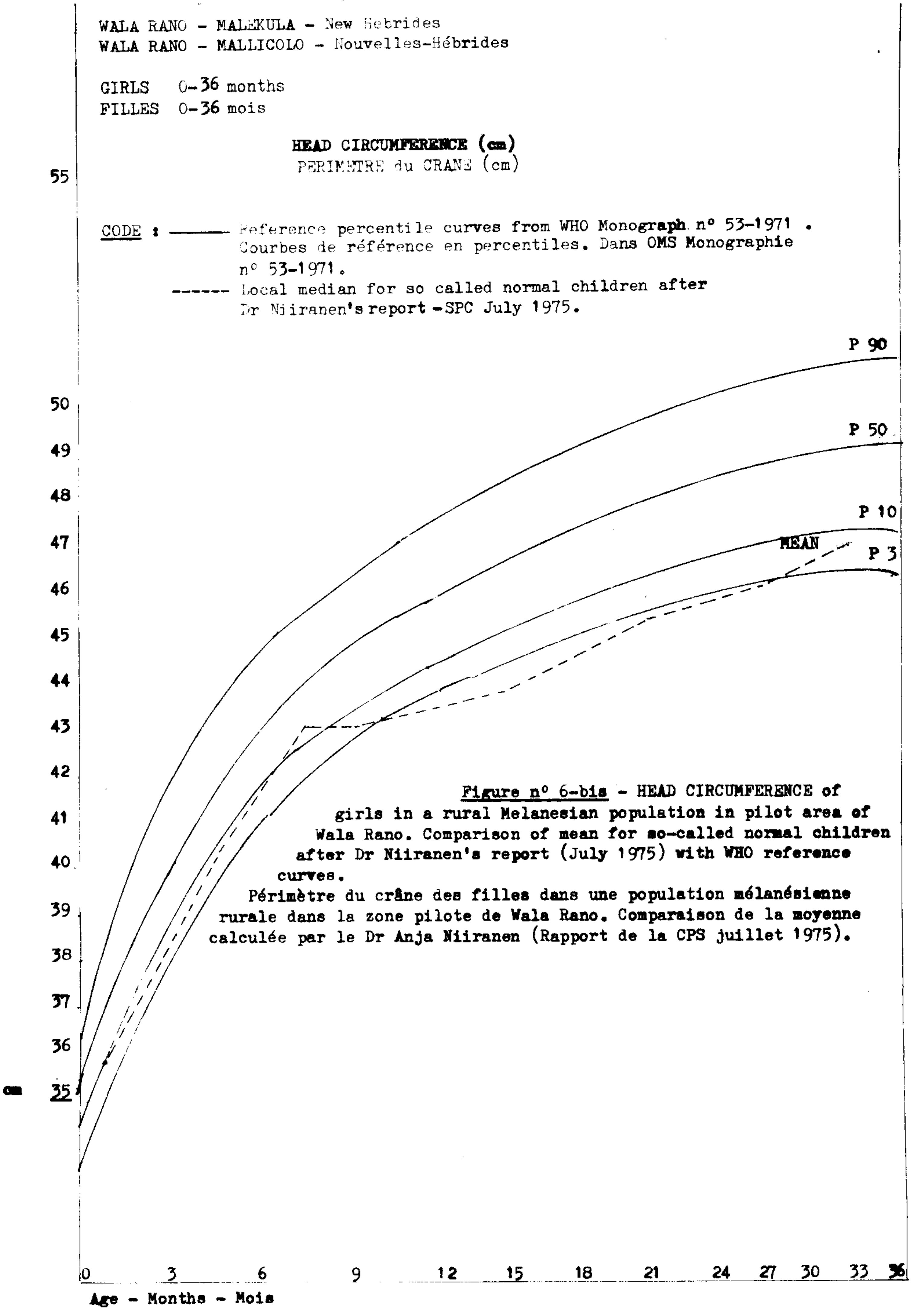
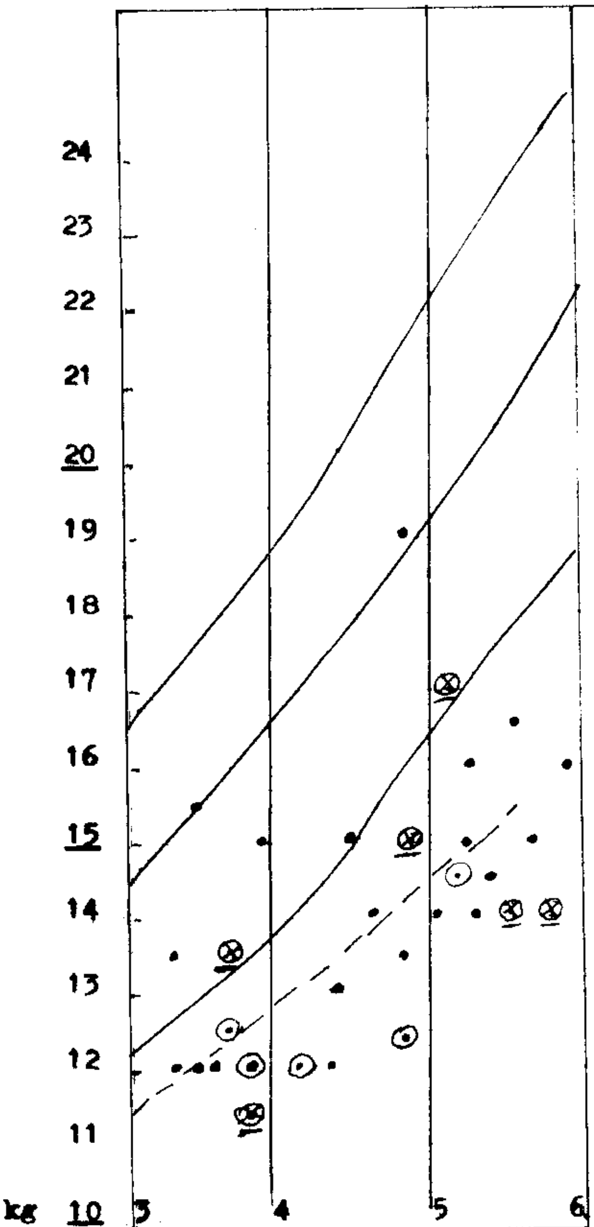


Figure n° 6-bis - HEAD CIRCUMFERENCE of girls in a rural Melanesian population in pilot area of Wala Rano. Comparison of mean for so-called normal children after Dr Niiranen's report (July 1975) with WHO reference curves.

Périmètre du crâne des filles dans une population mélanésienne rurale dans la zone pilote de Wala Rano. Comparaison de la moyenne calculée par le Dr Anja Niiranen (Rapport de la CPS juillet 1975).



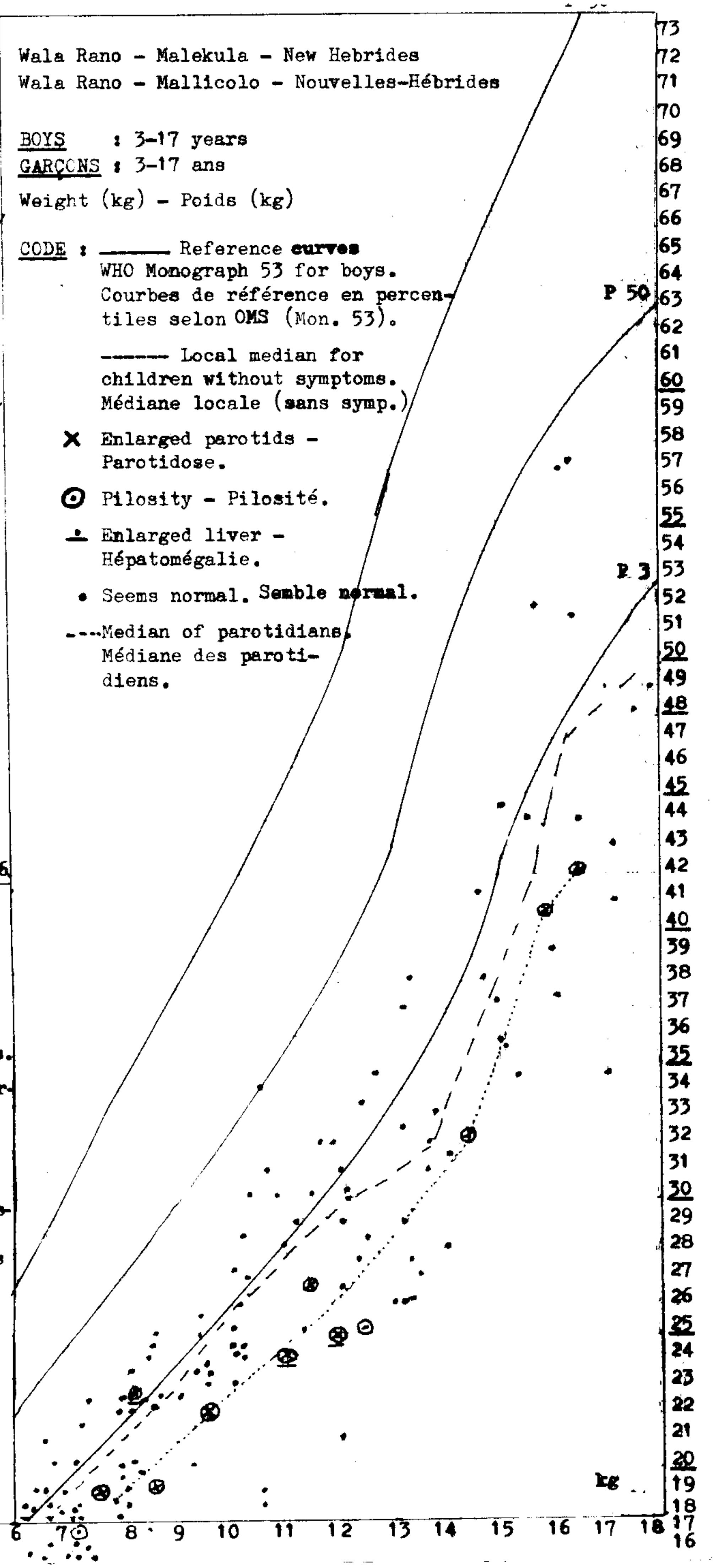


Figure n° 7 – Weight of boys in a rural Melanesian population in Malekula. Comparison of parotidians with others. SPC report on pilot areas in New Hebrides.

Figure n° 7 – Poids des garçons selon l'âge dans une population rurale mélanésienne de Wala Rano.
Dans rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.
Comparaison des parotidiens avec les autres.

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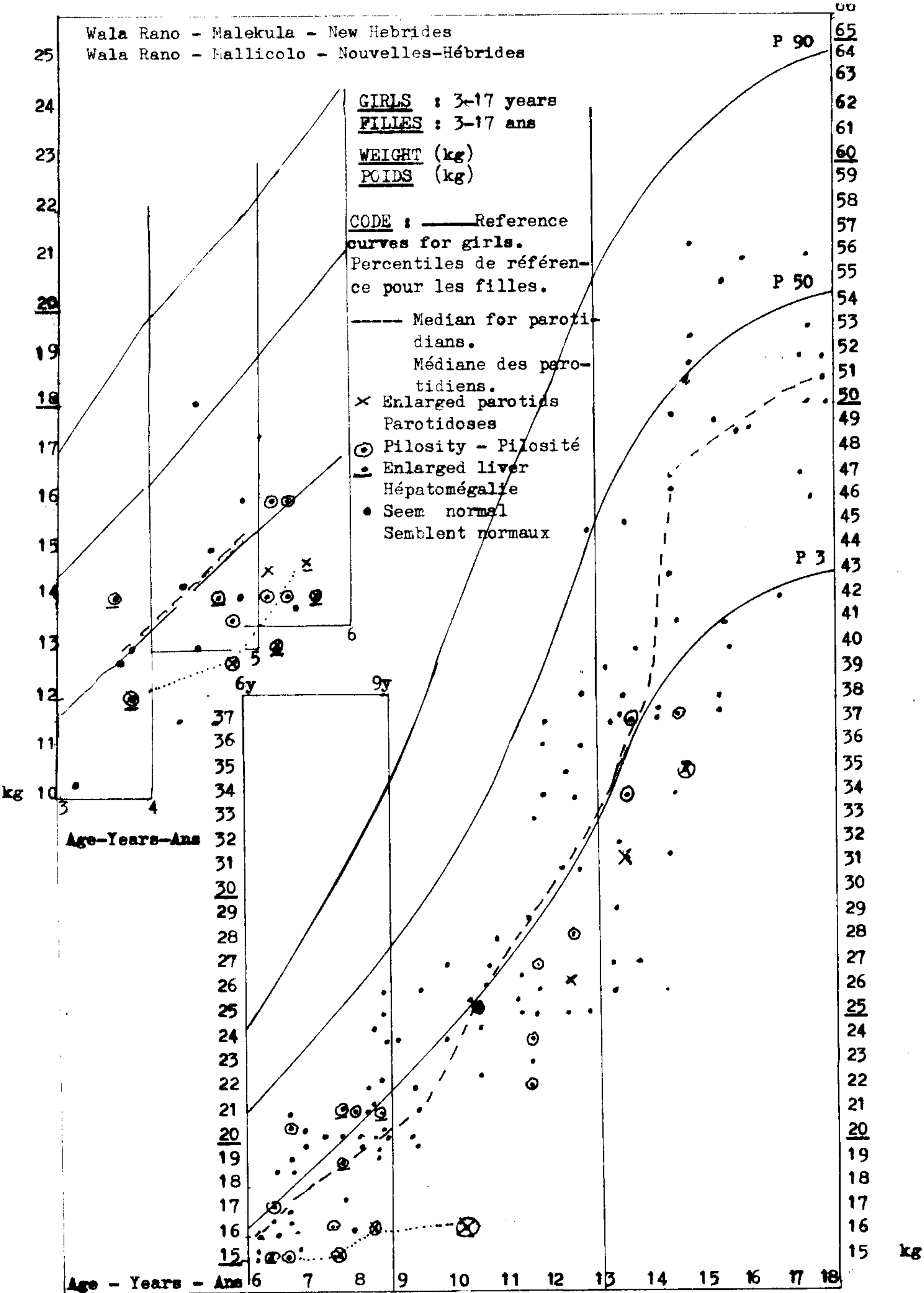


Fig. n° 7 bis - Weight for girls in Melanesian rural area of Wala Rano.
Poids des filles dans la population mélanésienne de Wala Rano.

SPC report on pilot areas in New Hebrides.

Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

Pr A. RAOULT.

WALA RANO - MALEKULA - NEW HEBRIDES
WALA RANO - MALLICOLO - NOUVELLES HEBRIDES

BOYS 3-17 years
GARCONS : 3-17 ans

TRICIPITAL SKINFOLD (mm) - left arm
PLI CUTANE TRICIPITAL (mm) - bras gauche

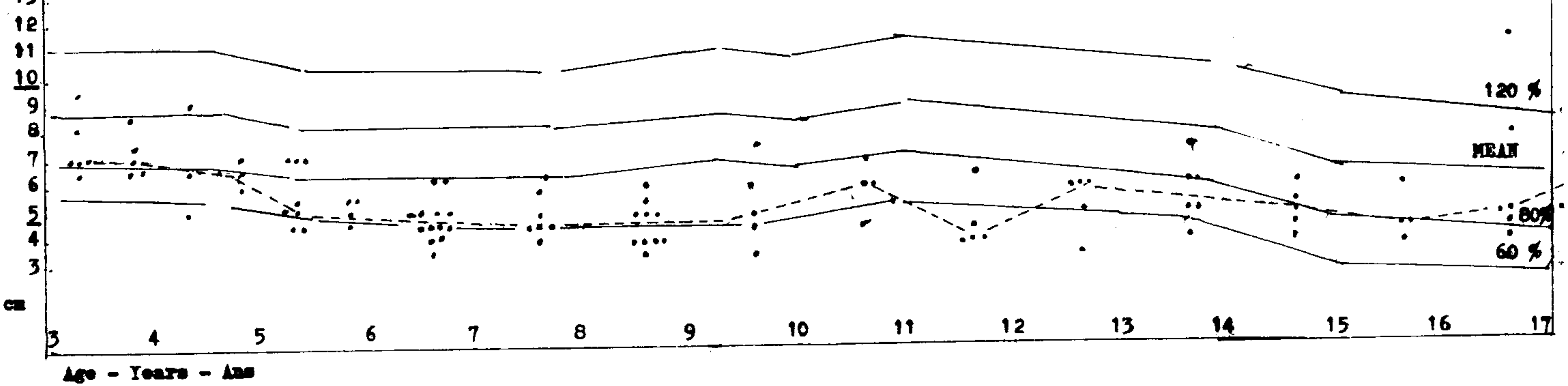
CODE : —— Reference for boys from WHO Monograph 53 - 1971
Référence pour les garçons : Monographie n° 53-1971 OMS

- - - Médiane de l'ensemble des garçons de Wala Rano
Median for all boys of Wala Rano

Figure n° 8 : —— SKINFOLD of boys in a rural Melanesian population of Wala Rano. Comparison with WHO references. SPC report on pilot areas in New Hebrides.

- - - Status in pilot area (September 1974).

Pli cutané des garçons dans une population mélanésienne rurale de Wala Rano. Comparaison avec les références de l'OMS. Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.



WALA RANO - MALEKULA - NEW HEBRIDES
WALA RANO - MALLICOLO - NOUVELLES-HEBRIDES

TRICIPITAL SKINFOLD - left arm (mm)
PLI CUTANE TRICIPITAL - bras gauche (mm)

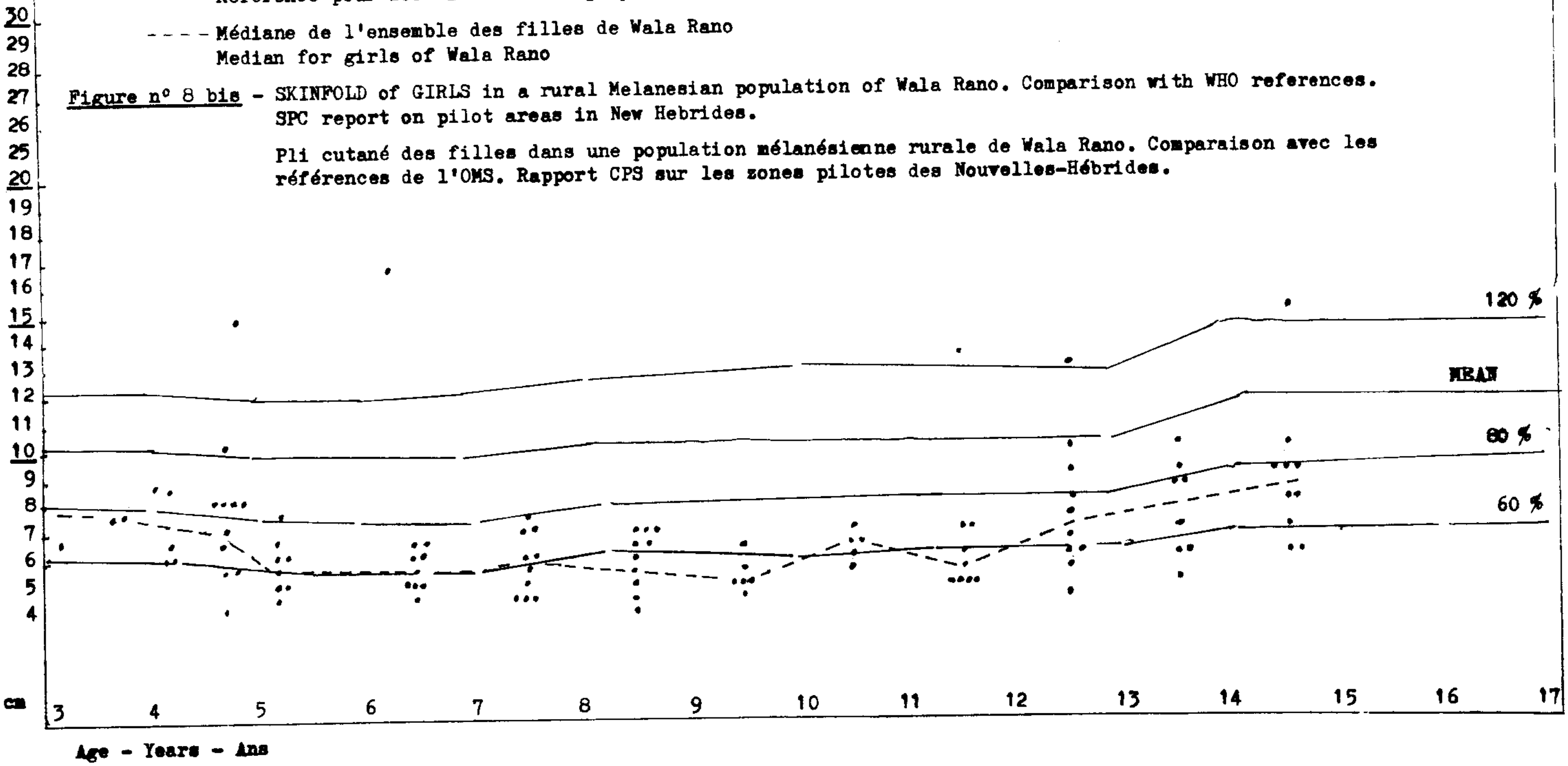
GIRLS : 3-17 years
FILLES : 3-17 ans

CODE : —— Reference for girls from WHO Monograph n° 53-1971
Référence pour les filles : Monographie n° 53-1971 OMS

- - - - Médiane de l'ensemble des filles de Wala Rano
Median for girls of Wala Rano

Figure n° 8 bis - SKINFOLD of GIRLS in a rural Melanesian population of Wala Rano. Comparison with WHO references. SPC report on pilot areas in New Hebrides.

Pli cutané des filles dans une population mélanésienne rurale de Wala Rano. Comparaison avec les références de l'OMS. Rapport CPS sur les zones pilotes des Nouvelles-Hébrides.



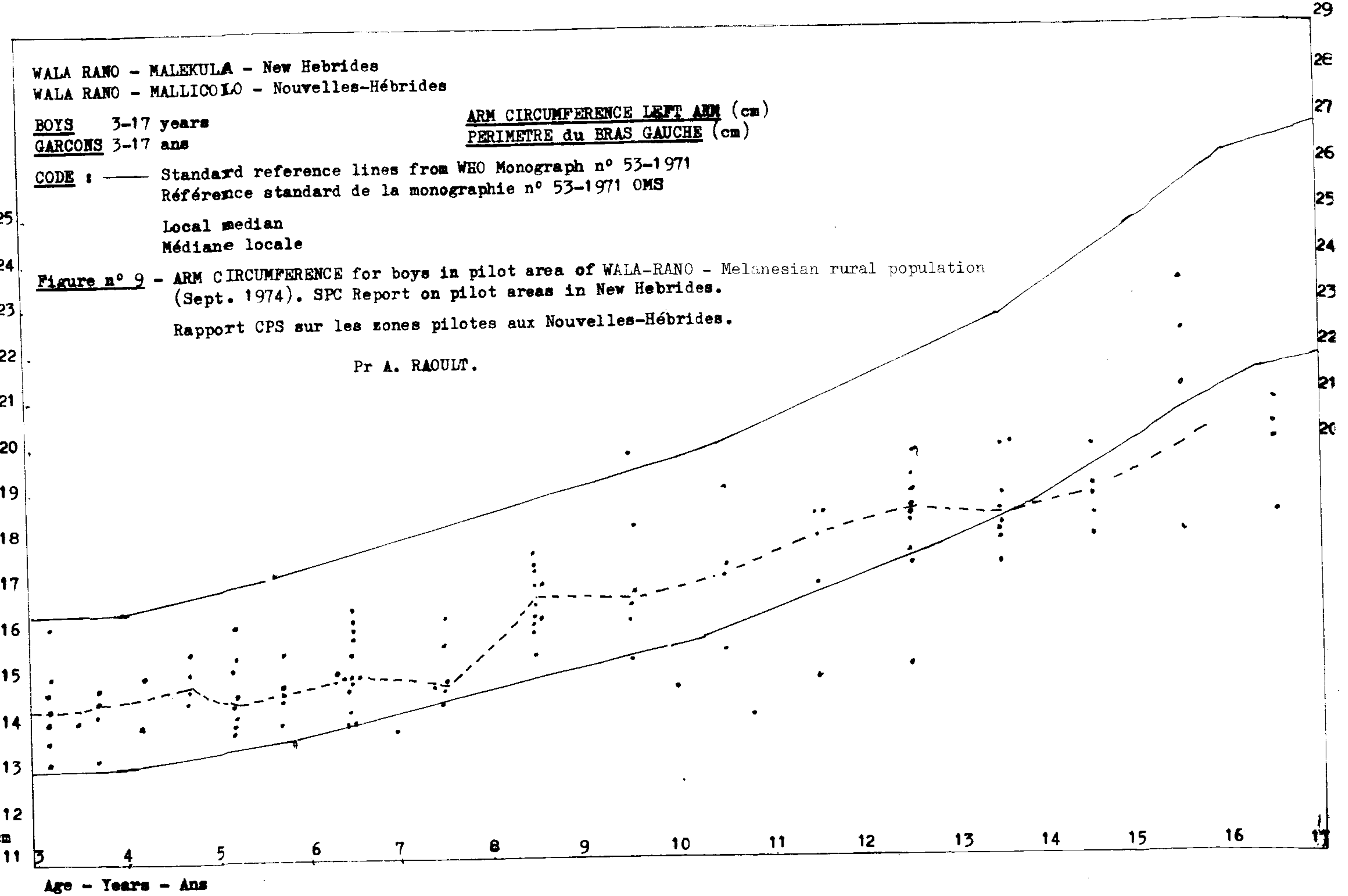


Figure n° 9 - ARM CIRCUMFERENCE for boys in pilot area of WALA-RANO - Melanesian rural population (Sept. 1974). SPC Report on pilot areas in New Hebrides.

Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

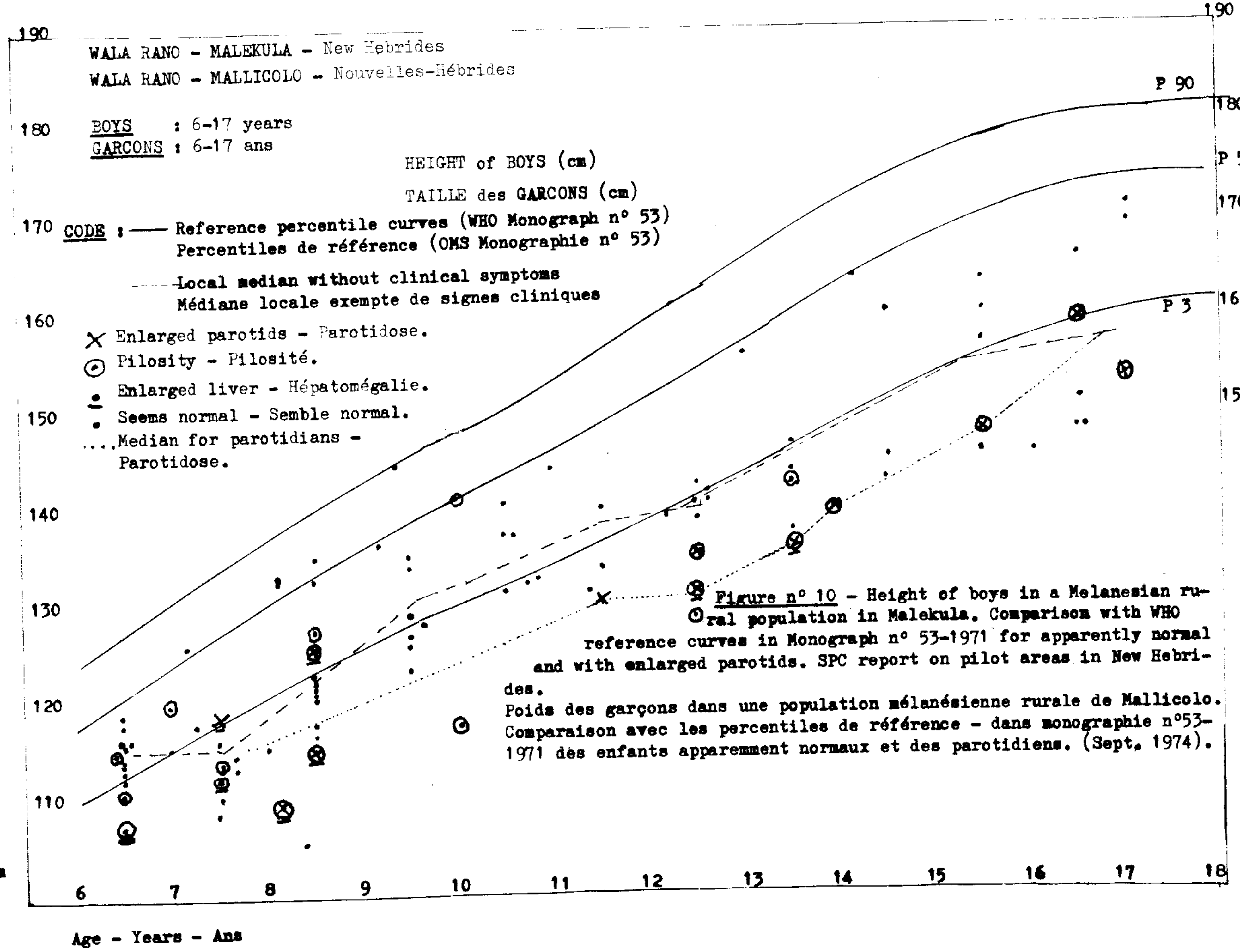


Figure n° 10 - Height of boys in a Melanesian rural population in Malekula. Comparison with WHO reference curves in Monograph n° 53-1971 for apparently normal and with enlarged parotids. SPC report on pilot areas in New Hebrides.

Poids des garçons dans une population mélanésienne rurale de Mallicolo. Comparaison avec les percentiles de référence - dans monographie n°53-1971 des enfants apparemment normaux et des parotidiens. (Sept. 1974).

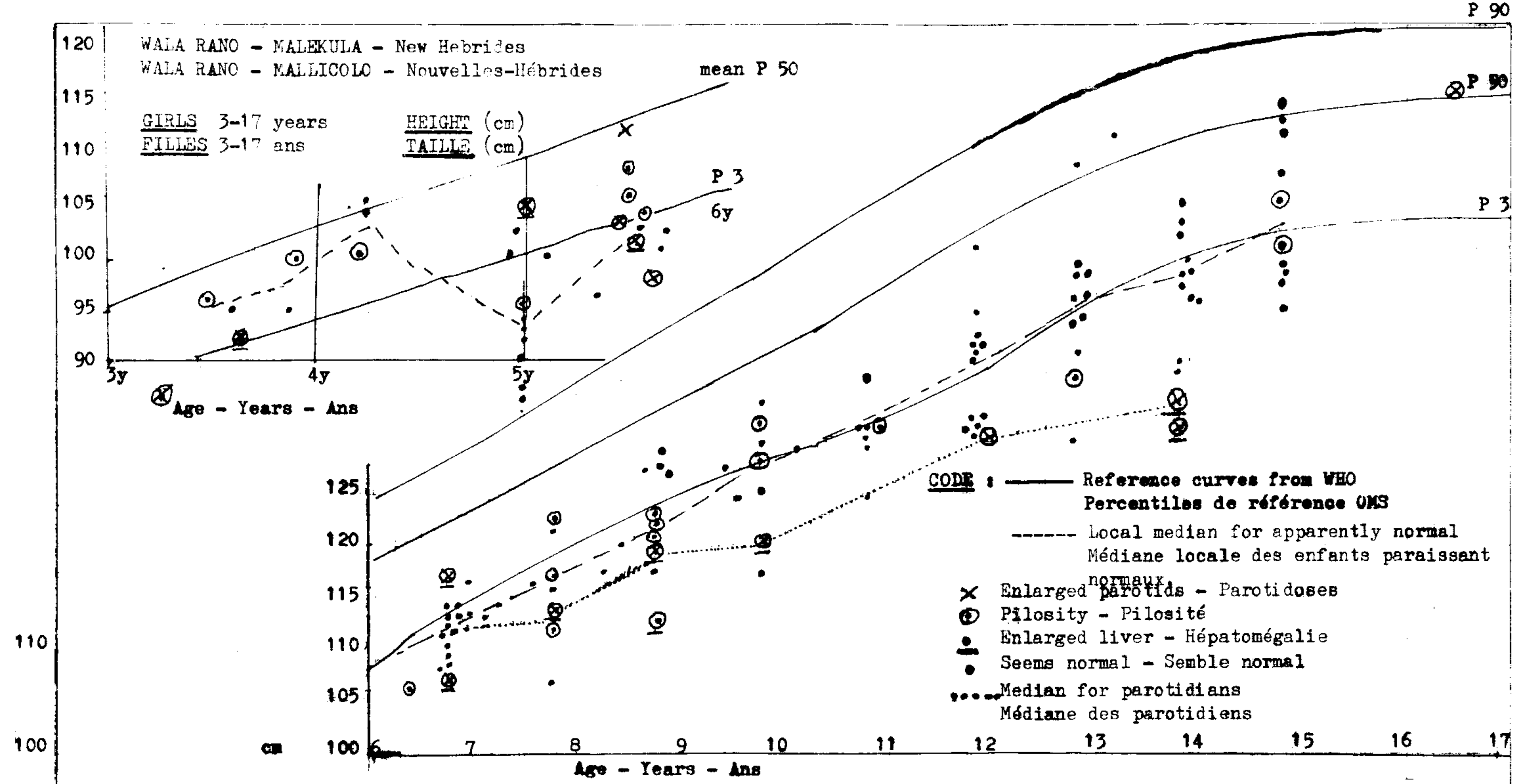


Figure n° 10 bis - Height of girls 3-17 years in a rural Melanesian population in Wala Rano. Comparison with WHO references (Monograph 53-1971). Special mention for children with eblarged parotids. SPC report on pilot areas in New Hebrides.

Taille des filles de 3 à 17 ans dans une population mélanésienne rurale à Wala Rano. Comparaison avec les références OMS. Mention spéciale pour les porteurs de parotidoses. Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

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WALA RANO - MALEKULA - New Hebrides
WALA RANO - MALLICOLO - Nouvelles-Hébrides

HEAD CIRCUMFERENCE (cm)
PERIMETRE DU CRANE (cm)

BOYS 3-17 years
GARCONS 3-17 ans

CODE : ——— Reference lines from WHO-Monograph n° 53-1971
Références dans la Monographie n° 53-1971 - OMS

× Enlarged parotids - Parotidoses.

⊙ Pilosity - Pilosité.

_._ Enlarged liver - Hépatomégalie.

. Without precedent symptoms - Pas de symptômes cités ci-dessus.

- - - Median of children without enlarged parotids.
Médiane sans parotidoses.

...... Median enlarged parotids.
Médiane avec parotidoses.

Figure n° 11 - Head circumference in a rural Melanesian population (boys) compared with WHO references. Special mention of parotid enlargement. SPC report on pilot areas in New Hebrides.

Périmètre crânien des filles dans une population mélanésienne rurale comparée aux références OMS. Mention spéciale pour les parotidoses. Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

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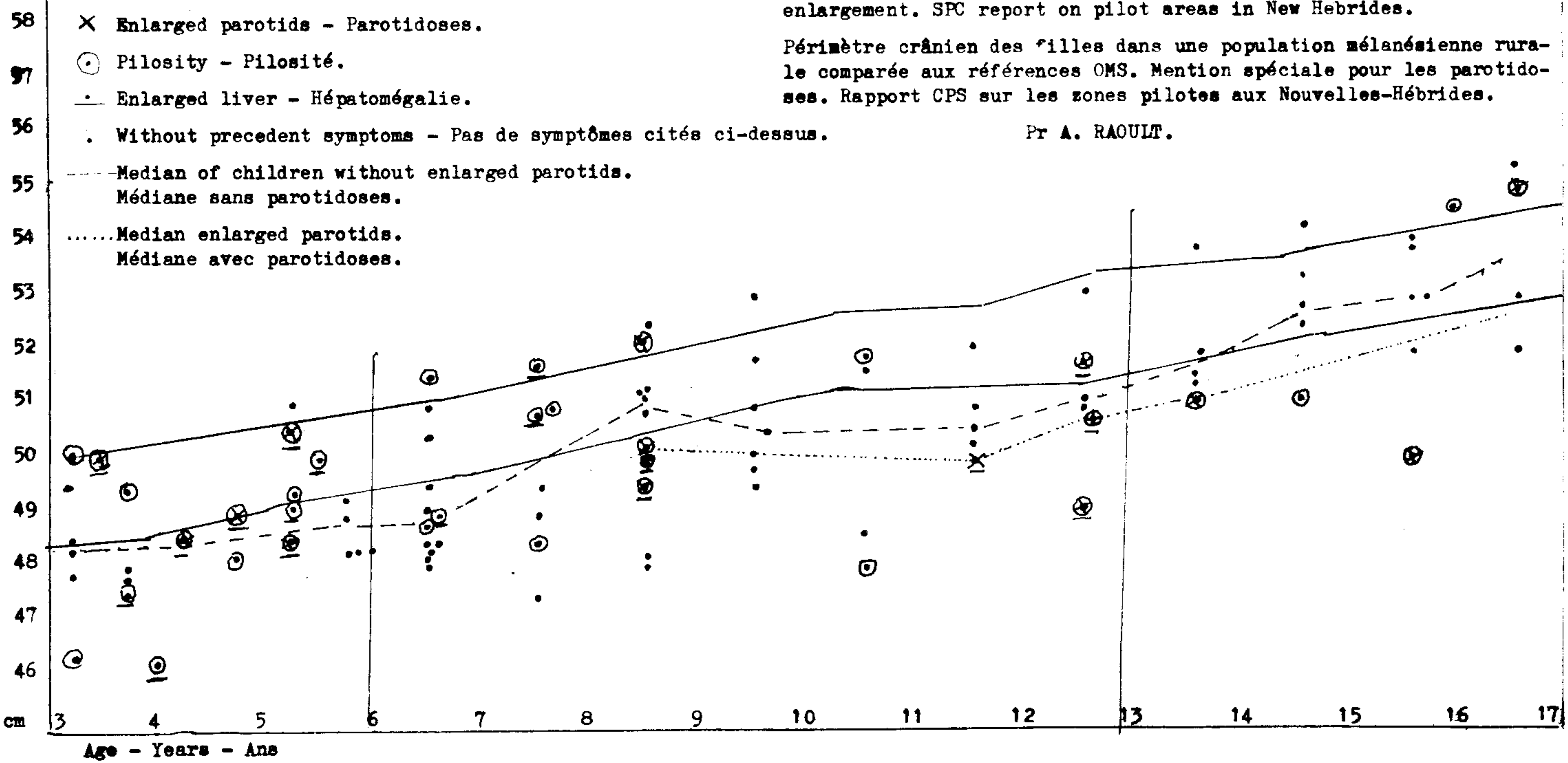

WALA RANO - MALEKULA - New Hebrides
WALA RANO - MALLICOLO - Nouvelles-Hébrides

HEAD CIRCUMFERENCE (cm)
PERIMETRE du CRANE (cm)

GIRLS 3-17 years
FILLES 3-17 ans

CODE : —— Reference line from WHO Monograph n° 53-1971
Référence de la Monographie n° 53-1971 OMS

× Enlarged parotids - Parotidoses

⊙ Pilosity - Pilosité

•̲ Enlarged liver - Hépatomégalie

• **Without previous symptoms**
Sans symptômes précédents

..... **Median for children with parotids enlargement**
Médiane des parotidoses

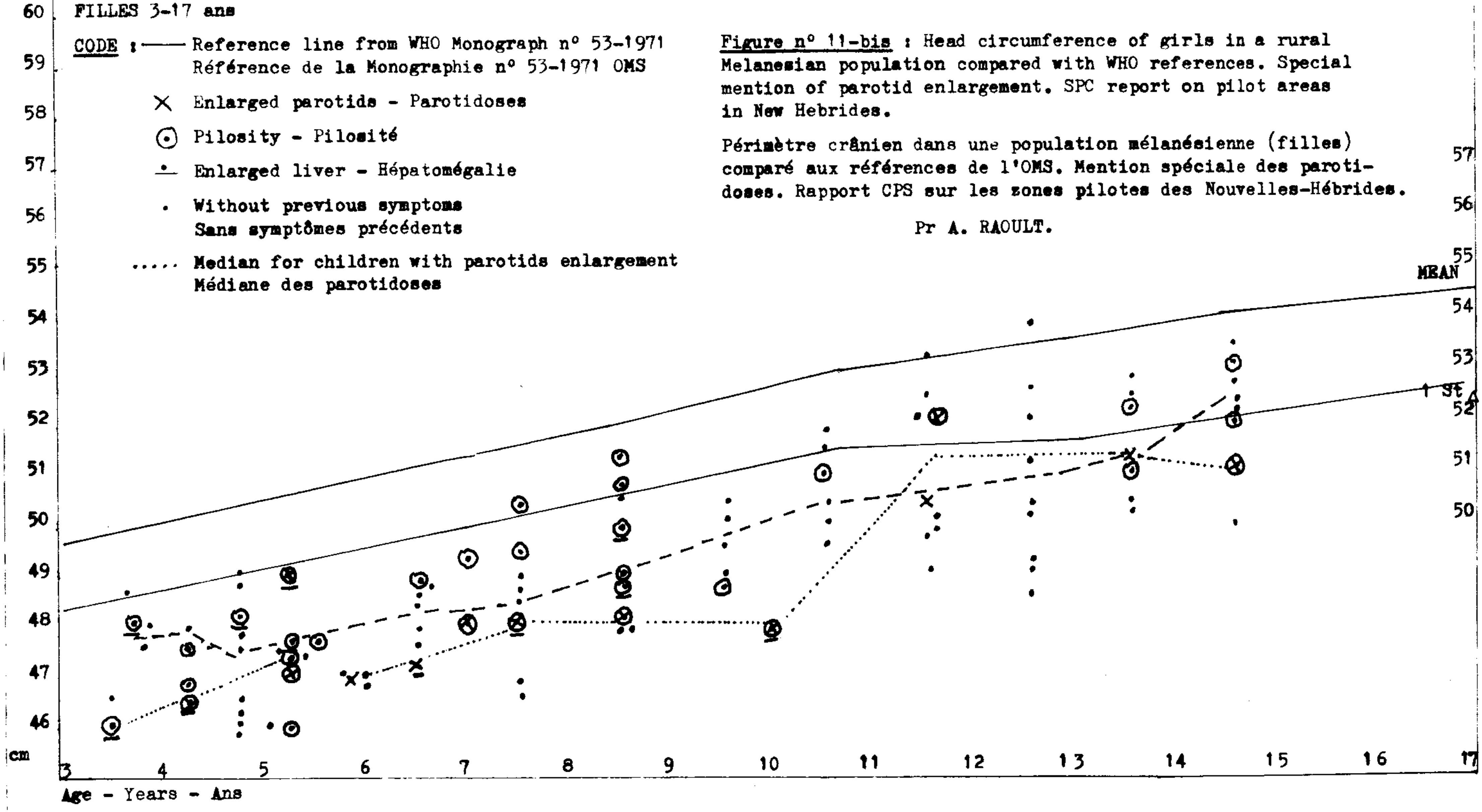

Figure n° 11-bis : Head circumference of girls in a rural Melanesian population compared with WHO references. Special mention of parotid enlargement. SPC report on pilot areas in New Hebrides.

Périmètre crânien dans une population mélanésienne (filles) comparé aux références de l'OMS. Mention spéciale des parotidoses. Rapport CPS sur les zones pilotes des Nouvelles-Hébrides.

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(4) These differences leave no doubt as to the necessity of providing food supplements for Wala-Rano children.

Discussion

Having drawn attention to the dissimilarities between these two groups of Melanesian schoolchildren living in very comparable environmental conditions but differing in the foods they eat, we must now discuss the features common to both.

A. In relation to standards recognized by WHO

- Height retardation, more marked in girls than in boys, existed at school entrance and tended to diminish, without completely disappearing however, during the pre-puberty spurt of growth.

- Where height retardation existed, skull development was almost always retarded as well; head circumference values were low in both schools.

- Under-nutrition was common in both girls and boys, as evidenced by sub-standard weights and thin skinfolds.

- Weight, height and head size remained stationary or increased only slightly between 8 and 10 years, which contrasts with the fairly rapid growth observed in Wala-Rano children between $4\frac{1}{2}$ and $5\frac{1}{2}$ years during the recovery period.

- Wide individual variations occurred in all parameters, and the presence of large numbers of malnourished, substantially sub-standard children kept local means at a low level.

B. Important differences between the two groups

At 6 years of age, the Norsup pupils - who, at the time of our survey, had had the benefit of good school-meals for about 6 months - were less handicapped than their Wala-Rano counterparts. Mean values were higher for all parameters, most strikingly for weight and skinfold.

The pre-puberty spurt of growth occurred earlier in Norsup.

Generally speaking, retardation was more marked in boys than in girls. Chronic under-nutrition prevailed in Wala-Rano throughout the school years, prolonging the ill-effects of the nutritional crisis which was discussed in Chapter 3.

Under-nutrition was less common and severe in the Norsup group because of good school-meals, but the degree of benefit derived from these depended largely on the length of time the children had been boarding at the school, the maxmimum being 4 years, as well as on the deficiencies they already had when they entered. In some cases retardation and clinical sequelae of past malnutrition had completely or partly disappeared, in others they were still very much in evidence.

It must also be emphasised that all boarders go home for the holidays and are thus influenced for about 140 days of every year by the environmental and dietary conditions obtaining in their native districts. (When we examined the Norsup pupils, they had been receiving school-meals for 4 consecutive months.) Although this tends to slow down overall progress, the positive effects of a rational diet - such as is provided at Norsup School - are beyond question, and any programme aimed at improving the health and nutritional status of schoolchildren should include some system of food supplementation.

2. Clinical findings

Our clinical findings for Wala-Rano have been grouped under the following 5 headings:

(a) Anaemia
(b) Avitaminosis
(c) Ocular symptoms
(d) Dental symptoms
(e) Skin affections

(a) Anaemia

Anaemia in pre-school children has been dealt with in Chapter 3.

In the 6 to 15 year age-group, moderate or severe anaemia, which are the only levels clinically diagnosable, still persist.

Its cause may be:
- nutritional (iron, folic acid, protein, vitamin C deficiencies),
- parasitic (malaria, and especially hookworm),
- metabolic (poor absorption of nutrients from the intestine).

Prevalence of anaemia according to age was studied in collaboration with Dr Ratard who took blood and stool samples from Wala-Rano children aged 6 to 18 years.

In 6 to 9 year old children (boys and girls), malaria was still a problem : 28 out of 147 slides examined were positive, i.e. 19%. Hookworm (ankylostomiasis) was found in 11.6%.

Mean haemoglobin level was 64%, and a significant proportion (12.5%) had haemoglobin levels of 50% and under.

The hookworm cases also had a mean haemoglobin level of 64%.

It must be pointed out that only one stool sample was taken from each child and examined without prior concentration, so that the actual number of hookworm cases may well be higher than the figure recorded. Giardiasis does not appear to be a serious problem.

The overall clinical picture for this age-group is distressing. How can an anaemic child with a heavy parasite burden be expected to achieve good results at school? Systematic preventive and curative treatment is called for.

In the 9 to 13 year age-group:

- Malaria was down to 8%.
- Hookworm was up to 16.4%.
- Mean haemoglobin level had risen to 90%, and where anaemia existed (in about 20% of this group) it was in a mild form (80% haemoglobin or slightly under).

The hookworm cases, though more numerous, were not, on the whole, more anaemic than the others, which means that the nutritional improvement which occurs around 10 or 11 outweighs haemoglobin loss through ankylostomiasis.

From 13 to 15 years (adolescents, Fig. 14) improvement continued:

- Malaria had disappeared.
- Hookworm prevalence had increased a little (17.4%), but
- Nutritional status was clearly better, except in a few subjects.

Mean haemoglobin level was 90%. Some 14% of the adolescents examined had haemoglobin levels between 60 and 70%.

The mean haemoglobin level for hookworm cases was 84%, only slightly lower than the overall mean. On the other hand, in the anaemic subjects (60-65%) 3 out of 8 had hookworm.

Adults

Anaemia was clinically observed in 20% of pregnant and nursing women and in 40% of old people.

Mean haemoglobin level for adults (male and female) was 77%, with a standard deviation of 10.1%, but the median for women only (28 subjects, aged 20-50 years) was 74%, and 13/28 i.e. 46% had a haemoglobin level of 70% or under, which corresponds to a moderate degree of anaemia (cf. Fig. 15). Of the women showing clinical signs of anaemia, 43% had pigmented, "black patch" tongue, as will be seen in the following section.

In conclusion : anaemia in Wala-Rano should be regarded as a major endemic disease and treated accordingly. Eradication of malaria will bring about a substantial improvement in the 0-6 and 6-13 year age-bracket. Better sanitation, while it is of course the only way to achieve lasting reduction of intestinal parasites, takes a long time to produce results, and, in the meantime, anti-helminth preparations should be administered to children at regular intervals from the age of 3 onwards. Iron, folic acid, and protein supplements are not very costly and should be given systematically to the most vulnerable groups.

(b) Avitaminosis

(1) Vitamins A and D

Vitamin A deficiency was practically non-existent. No follicular hyperkeratosis nor early corneal lesions were observed, and night-blindness was unheard of. The conjunctival anomalies found, which are discussed under "ocular symptoms", do not seem to be due to vitamin shortages but rather to high consumption of the polysaturated lipids contained in the coconut. Bitot's spots were not seen.

Vitamin D deficiency was similarly rare. Only three cases of rickets were noted : 1 in infants between 3 and 6 months, 1 in a child over 3 years, and 1 (sequelae) in a child over 5 years.

Preventive administration of Vitamins A and D thus does not seem necessary.

(2) Vitamin C

No deficiency symptom was noted.

(3) Group B vitamins

Riboflavin appears to be the only vitamin of this group lacking in the diet. The chief source of riboflavin are animal proteins (particularly offal), which are not normally eaten in adequate quantities.

The signs suggestive of riboflavin deficiency are not absolutely specific:

- Dyssebacea or filiform acne (not to be confused with ordinary acne) is a symptom of prolonged moderate riboflavin shortage. Generally seen in the older child and the young adult (21%) it was most common in female adolescents, as well as in pregnant and lactating women. Interpretation of this sign is very difficult.

WALA RANO - MALEKULA - New Hebrides
WALA RANO - MALLICOLO - Nouvelles-Hébrides

BOYS AND GIRLS : 6 - 8 years
GARCONS ET FILLES : 6 - 8 ans

HAEMOGLOBIN levels (%)
Taux d'Hémoglobine (%)

Nombre : 96

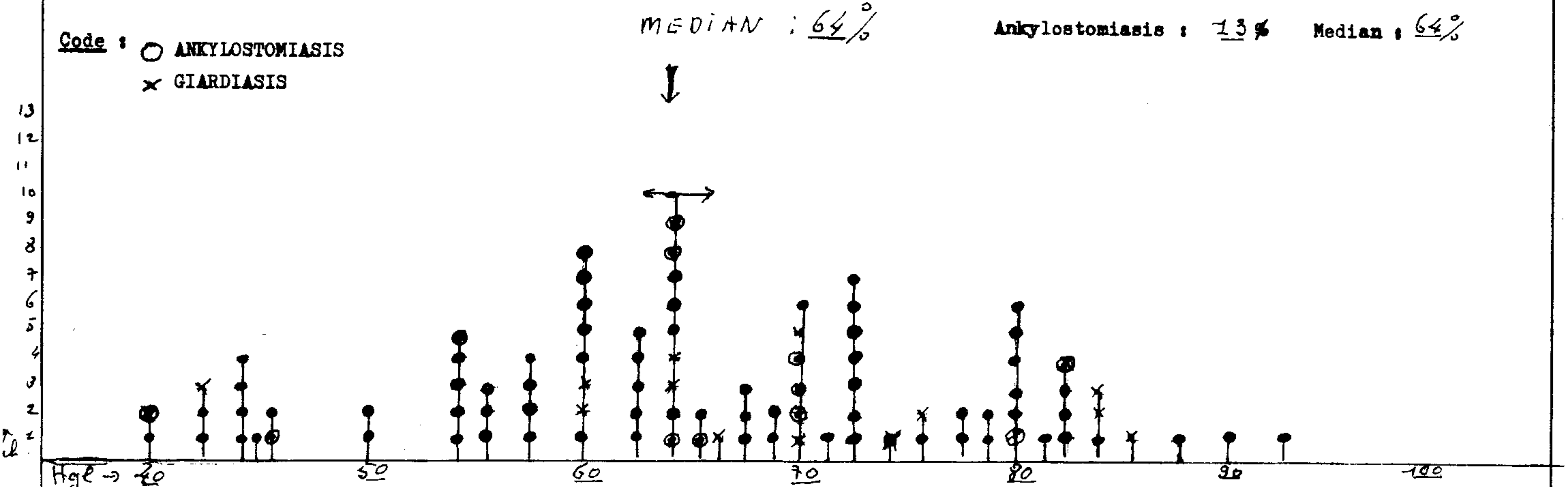
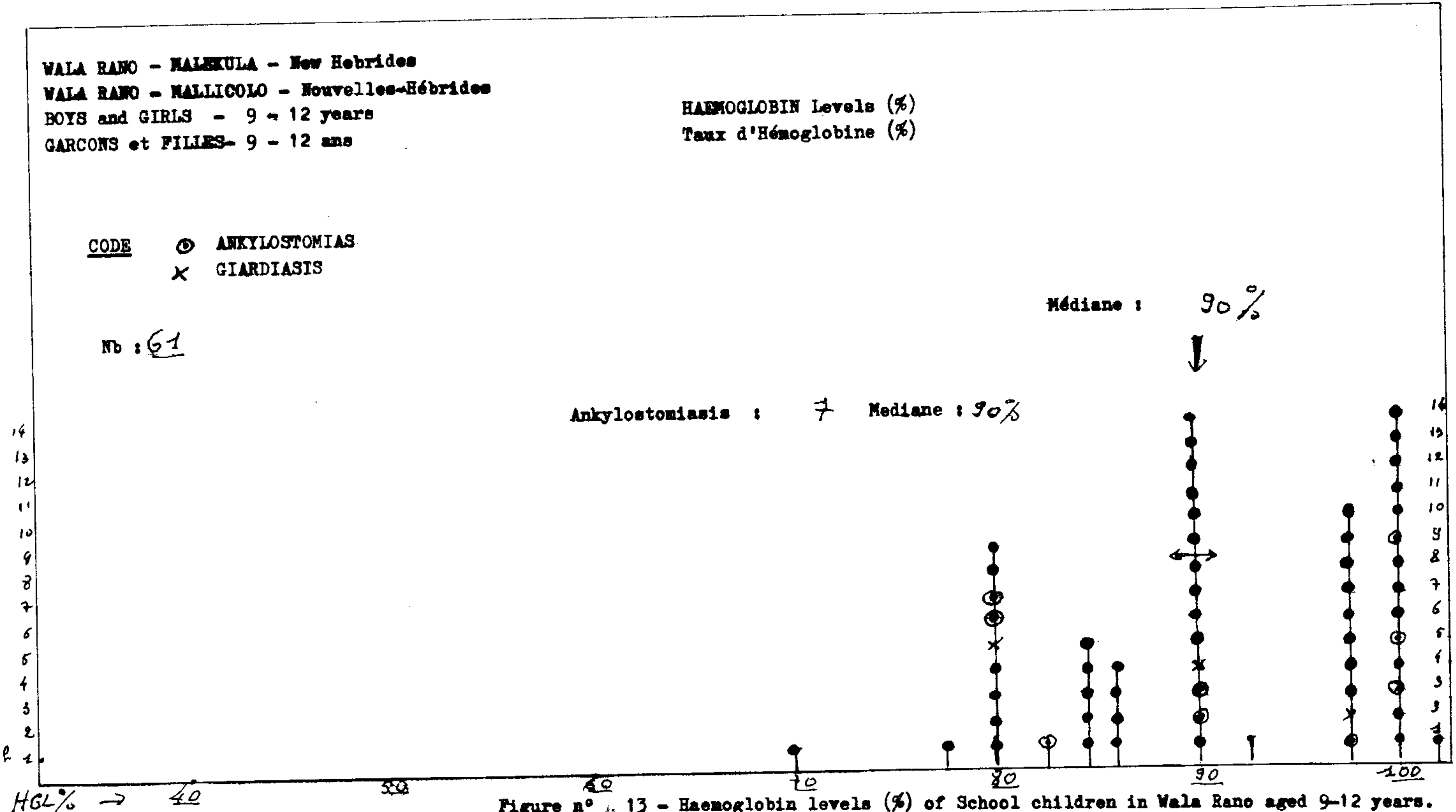


Figure n° 12 - Haemoglobin levels (%) of school children in Wala Rano (N.H) 6-8 years.
Taux d'hémoglobine des écoliers et écolières de Wala Rano.

Stools and blood examined by Dr RATARD, Chief of Rural Medical Service, New Hebrides.
Examens de selles et de sang par le Dr RATARD, Chef du Service de Médecine Rurale, Nouvelles-Hébrides.

SPC report on pilot areas in New Hebrides.
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.



Examens de selles et de sang par le Dr RATARD, Médecin-Chef du Service de Médecine Rurale. Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

Figure n° 13 - Haemoglobin levels (%) of School children in Wala Rano aged 9-12 years.
Taux d'hémoglobine des écoliers de 9 à 12 ans à Wala Rano (N.H).
Examination of stools and blood by Dr RATARD, Chief of Rural Medical Service.
Examens de selles et de sang par le Dr RATARD, Médecin-Chef du Service de Médecine Rurale.
SPC report on pilot areas in New Hebrides.
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

WALA RANO - MALEKULA - NEW HEBRIDES
WALA RANO - MALLICOLO - NOUVELLES-HEBRIDES

HAEMOGLOBIN levels (%)
Taux d'Hémoglobine (%)

BOYS AND GIRLS 13-17 years
GARCONS ET FILLES 13-17 ans

Nb : 86

Code : ⊙ **ANKYLOSTOMIASIS**
× **GIARDIASIS**

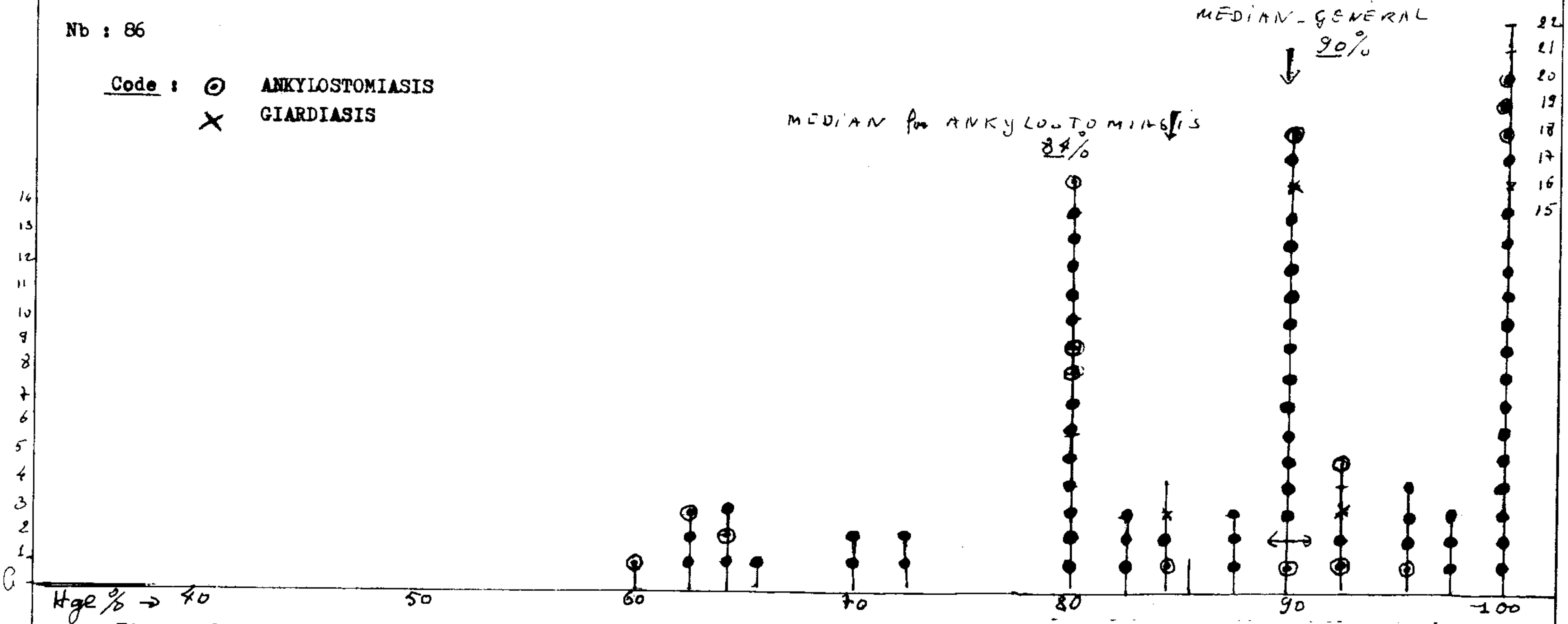


Figure n° 14 Haemoglobin levels (%) of school children (13(17 years) in Wala Rano. Stools and blood examined by Dr RATARD, Chief of Rural Medical Service. SPC report on pilot areas in New Hebrides.

Taux d'hémoglobine des écoliers de Wala Rano. Examens de selles et de sang par le Dr RATARD, Médecin-Chef du Service de Médecine Rurale. Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

WALA RANO - MALEKULA - NEW HEBRIDES
WALA RANO - MALLICOLO - NOUVELLES-HEBRIDES

WOMEN over 18 years > 50 years - Haemoglobin levels %.
FEMMES au-dessus de 18 ans > 50 ans - Taux d'hémoglobine %

Nb : 28

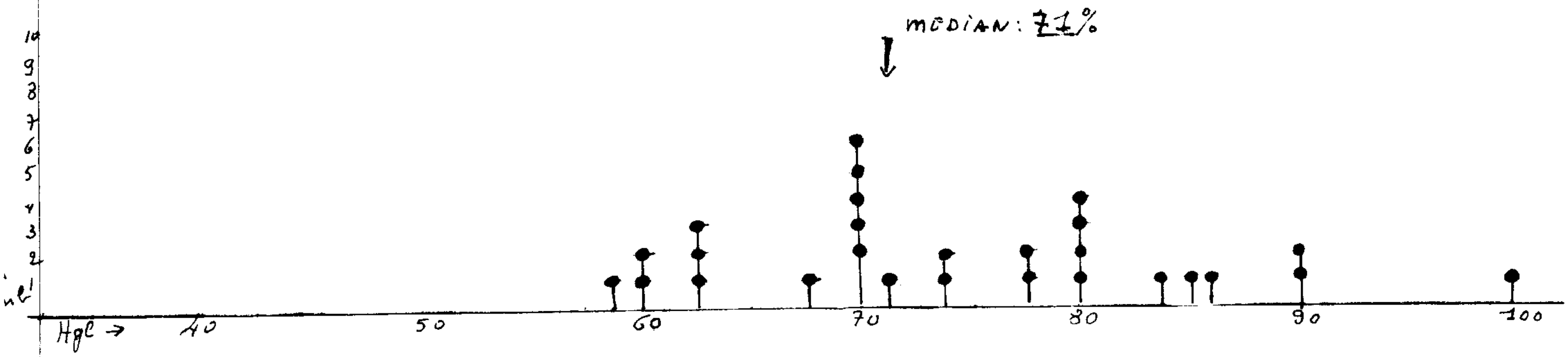


Figure n° 15 - Haemoglobin levels among women 20-50 years in a Melanesian rural village in Wala Rano (New Hebrides) Sept. 1974. Analysis by Dr RATARD - Chief of Rural Medicine Service.
SPC report on pilot areas in New Hebrides.

Taux d'hémoglobine chez les femmes de 20 à 50 ans dans une population rurale du village de Wala Rano (Nouvelles-Hébrides). Analyses du Dr RATARD, Médecin-Chef du Service de Médecine Rurale.
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

- Angular cheilosis, that is non-inflammatory fissures at both angles of the mouth, constitutes a positive sign, but care must be taken not to confuse it with infectious or mycotic stomatitis. It occurred in infancy, where it is related to protein malnutrition, peaked during pre-school age (17.5% in the 3-5 year bracket) and was comparatively common throughout the school years (12% in the 6-13 year group). Incidence then dropped slightly, while remaining significant, but rose again sharply in persons over 55 years (21%).

- Various types of glossitis, often complex and reflecting multiple nutritional deficiencies.

- Raspberry tongue was very common but cannot be regarded as a specific sign of any single deficiency. Its incidence was highest in subjects with helminth burdens (ascaris) and rose regularly with age.

- Central depapillating glossitis(atrophic papillae) is a far more reliable sign of riboflavin deficiency and our experience has shown that, at school age, it can be cured within a fortnight by daily administration of 0.10 mg of riboflavin for 5 consecutive days. This condition occurred in 11% of the schoolchildren examined, and its incidence rose with age, from 15.5% in young adults to 16.7% and 26.1% in the middle-aged and elderly. Women were more liable to be affected, especially those who had gone through repeated pregnancies. Magenta tongue is often associated with depapillating glossitis, but interpretation of this sign is not easy.

On the whole, clinical symptoms suggestive of riboflavin deficiency abounded in the Wala-Rano villages, usually reflecting shortages of various amino acids as well. This is to be expected with a largely vegetarian diet, for plant foods (apart from mangoes) are poor in riboflavin and fresh meat, eggs, shellfish and milk products are hardly ever eaten. In practice, increased consumption of foods of animal origin would be the best means of prevention.

Although the ailments caused by riboflavin deficiency are clinically not very serious, they are worth treating, especially since cure can be achieved rapidly by administration of riboflavin tablets, which furthermore constitutes an excellent diagnostic test.

Nutritional symptoms of undetermined aetiology

Black tongue

This type of glossitis appears to be related to the "pigmented tongue" described by Gillman and Gillman, who regarded it as a specific sign of pellagra. While it does not seem to be simply an ethnical feature, neither can it, in Wala-Rano, be ascribed to pellagra, since none of the skin and mucous symptoms characteristic of this complaint were present.

It was more common in the female fraction of the population, and affected nearly all pregnant women and nursing mothers. It was in most cases associated with anaemia and with hypertrophy of the lingual papillae.

Incidence increased with age and was as follows:

2.9%	between 3 and 5½ years
5%	between 5½ and 13 years
26%	between 13 and 18 years
43%	between 18 and 45 years
39%	over 45 years.

Th condition is due to infiltration of dark pigment into the fungiform papillae, producing uniformly black, clearly demarcated patches on the tip and the edges of the tongue, which tend to converge.

- Vitamin PP

No pellagrous rashes were observed and true pellagra does not appear to occur in Wala-Rano. We did see one sign suggestive of this disease : the raw or "beefsteak" tongue, with deep fissures and scarlet colouring which tends to spread to the surrounding buccal mucosa. It was found in 3 out of 59 people over 45 years of age, but, like the other types of glossitis referred to above, probably indicates a combination of deficiencies rather than any single one.

(c) Ocular symptoms

(1) Common conjunctivitis

None was seen in the infant group.

3 cases of purulent conjunctivitis were found in the 1-3 year group.

1 case in the 3-6 year group.

2 cases in the 6-13 year group.

Follicular conjunctivitis

1 case in the 3-6 year group.

6/170 cases (3.5%) in the 6-13 year group.

The suspected cause of these conjunctival affections were kapok fibres acting as irritants or allergens.

(2) Pigmentation

Diffuse brownish pigmentation of the bulbar conjunctiva, most marked in the exposed parts of the eyeball, was common in older children and adults and often associated with conjunctival thickening (xerosis). It appears to be devoid of pathological significance.

1 to 3 years	7.4%	
3 to 6 years	3%	- thickening : 9.1%
6 to 13 years	27%	- thickening : 37.6%
13 to 18 years	50%	- thickening : 82%
20 to 45 years	51.7%	- thickening : 57%
45 to 55 years	85.5%	- thickening : 6%
Over 55 years	83.6%	- thickening : 37%

(3) Conjunctival thickening (cf. above table)

The condition characterized by folds of keratinized conjunctival tissue, is not easy to identify, but can best be seen when the eyeball is in movement. Its incidence increases steadily with age(reaching 87% after 65 years), but its aetiology is not fully understood. It is usually regarded as a sign of prolonged moderate Vitamin A deficiency, but this cannot be the case in Wala-Rano, where no other symptoms of Vitamin A deficiency - neither Bitot's spots, nor corneal xerosis, nor perifollicular hyperkeratosis - were in evidence.

(4) Pterygium

High incidence and early occurrence of this lesion are well-known facts in our region, where it sometimes appears before the age of twenty. Rate of occurrence in Wala-Rano was :

20 to 45 years	37/118	= 31.4%
45 to 55 years	13/36	= 36%
Over 55 years	11/23	= 47%

(5) Pingueculae

These are yellowish deposits of fatty material within the conjunctiva. They are easy to see, usually on the outer side of the sclera, may vary in thickness, and are sometimes, but not always, associated with Pterygium. They occur more commonly in obese people.

20 to 45 years	31%
Over 45 years	18.5%

The most likely cause of the last three conditions - conjunctival thickening, pterygium and pingueculae - appears to be a metabolic disorder arising from excessive consumption of coconuts, which are rich in saturated fats.

The same hypothesis could also account for early "aging" of the eye (around 45 years) which was noted both in Wala-Rano and at Tautu (senile cornea, greyish limbus).

(d) Dental symptoms

(1) Melanodontia

This condition appears in the upper incisors around the age of $2\frac{1}{2}$ years, tooth involvement becoming more and more marked thereafter until the first teeth fall out.

Incidence: 1 to 3 years : 5/54 = 9.3%
3 to 6 years : 8/66 = 12.1%

Melanodontia is very often associated with other clinical symptoms of malnutrition and with statural retardation.

(2) Caries

The WHO system of classification was used :

Group I : $<$ 3 Decayed - Missing - Filled teeth
Group II : 3 to 10 DMF
Group III : $>$ 10 DMF

Incidence:

1 to 3 years : 0
3 to 6 years : DMF I : 1/66)
DMF II: 2/66) Total : 3/66 = 4.5%

Caries usually affected teeth numbers 4 and 5, bilaterally.

6 to 13 years : DMF I : 3/170)
DMF II : 0) Total : 5/170 = 2.9%
DMF III : 2/170)

In school-age children, incidence of caries was remarkably low, which is no doubt due to the high natural fluoride content of the drinking water and of the locally-grown staple foods. This hypothesis is borne out by the fluorosis (mottled enamel) seen in older children and adults.

The caries found nearly all occurred in the lower pre-molars (numbers 4 and 5).

The permanent teeth were perfect : not a single case of decay was found in adolescents (13 to 18 years).

Caries in adults :

20 to 45 years : DMF I : 3/118 = 25%
DMF II : 6/118 = 5.1%
DMF III : 8/118 = 10%

Total : 17/118 = 14.4%

45 to 55 years :	DMF I	: 3/36 = 8.3%
	DMF II	: 10/36 = 27.8%
	DMF III	: 7/36 = 19.4%
	Total	: 20/36 = 56%
Over 55 years :	DMF I	: 3/23 = 13%
	DMF II	: 5/23 = 21.7%
	DMF III	: 10/23 = 43.5%
	Total	: 18/23 = 78.3%

Caried teeth were far more common in women than in men.

(3) Dental fluorosis

High fluoride content of water and plant foods in the Wala-Rano area, especially in the vicinity of Amelvet (Pinalum Point), causes mild to moderate fluorosis, seen as opaque chalky streaks or stained mottling on the tooth enamel.

Incidence increases with age, as fluorine accumulates in the body:

6 to 13 years	: 2%
13 to 18 years	: 4.3%
18 to 45 years	: 13.6%
45 to 55 years	: 36%
Over 55 years	: 43%

(e) Skin affections

(1) Pyoderma

Impetigo and ecthyma are common, because of poor hygiene and mosquito bites which tend to become infected.

Much of the dispensary staff's work consists of treating these skin affections which are often extensive and ulcerative. Pyodermatosis or eczema sometimes masks the presence of scabies.

Bacterial skin infections were seen mainly in the very young:

1 to 3 years	: 18%
3 to 6 years	: 4.5%
6 to 13 years	: 4.7%

(2) Dermatomycosis

Skin fungus infections were extremely common and very extensive.

The one most frequently seen was Pityriasis versicolor, also known as tinea versicolor or ringworm. No Tokelau (_inea imbricata) was found.

Prevalence of Pityriasis versicolor was as follows :

1 to 3 years	:	21%
3 to 6 years	:	16.7%
6 to 13 years	::	5.3%
13 to 18 years	:	13%
20 to 45 years	:	5.1%
45 to 55 years	:	13.9%
Over 55 years	:	8.7%

(3) Leprosy

2 cases of tuberculoid leprosy were seen, but they had long been recognized and treated.

On the whole, skins were fine,moist and supple. No tendency to dryness and keratinization of the epidermis was observed.

The dermis, too, was firm and in good condition, probably because, as previously mentioned, coconuts - rich in saturated fatty acids - form a major part of the local diet.

Chapter 5

Body Measurements and Additional Clinical Data for Adults

99 men and 126 women over 18 years of age were examined.

Men

Average height was 165.5 cm
Average weight was 60 kg.

Using reference values given by Behnke, we divided the men examined into 3 groups :

Group I : Weight/height ratio equal to or less than the Behnke reference mean, i.e. normal or lightweight: Total number : 68 = 68.7%

Group II : Weight/height ratio between the reference mean and 2 standard deviations, i.e. slightly above-average weight : Total number : 27 = 27.8%

Group III : Weight/height ratio above 2 standard deviations, i.e. substantially overweight: Total number : 4 = 4%

As can be seen from the above summary and Graph No. 16, obesity is not a problem in Wala-Rano men.

Women

Average height was 158.5 cm
Average weight was 57.5 kg.

In relation to Behnke's reference mean for women, Wala-Rano women were distributed as follows among the three groups (Graph No. 17) :

Group I	(normal or lightweight)	: 40/126 = 31%
Group II	(slightly above-average)	: 59/126 = 46.9%
Group III	(overweight)	: 27/126 = 22.1%

Arm circumference and skinfold thickness were measured only in men.

Arm circumference :	median value - 26 cm highest value - 35 cm lowest value - 22 cm
Skinfold thickness :	median value - 5 mm highest value - 20 mm lowest value - 3 mm

On the whole, adults were strong, well-built, and very active in the fields.

Women tended to be rather masculine in appearance after the age of thirty.

Analysis of the age-pyramid showed that there were fewer elderly women in the community than men (3% against 4.7% over 55 years of age).

Symptoms related to weight/height ratio

(1) Arterial hypertension

Systolic blood pressure was measured on the left arm (after a period of rest in seated position).

Men

Group I	: Moderately high blood pressure ($>$ 15 cm $<$ 18 cm)	: 8/68 = 11.6%
	High blood pressure ($\geq$ 18 cm)	: 0
Group II	: Moderately high blood pressure	: 3/27 = 11.1%
	High blood pressure	: 1/27 = 3.7%
Group III	: Moderately high blood pressure	: 1/4
	High blood pressure	: 0

Total :	Moderate hypertension	: 12/99 = 12%
	Serious hypertension	: 1/99 = 1%

Women

Group I	: Moderately high blood pressure	: 3/40 = 7.5%
	High blood pressure	: 0/40 = 0
Group II	: Moderately high blood pressure	: 7/59 = 11.8%
	High blood pressure	: 3/59 = 5.0%
Group III	: Moderately high blood pressure	: 3/27 = 11.1%
	High blood pressure	: 2/27 = 7.4 %
Total	: Moderate hypertension	: 13/126 = 10%
	Serious hypertension	: 5/126 = 4.4%

Serious hypertension is related to overweight. In Wala-Rano it occurred more commonly in women, but was not a real problem in either sex.

Laboratory tests (cf. Figs. F1 and F2) showed blood cholesterol levels to be higher in women (median : 2.35 g per 1,000 ml) than in men (median : 1.95 g per 1,000 ml).

(2) Parotid enlargement

In adults, hypertrophy of the parotid glands is often related to overweight.

In men, not a single case of parotid enlargement was found in Wala-Rano.

In women, parotid enlargement occurred more often after 40 years of age.

Group I : 2/40 = 5%

Group II : 6/59 = 10%

Group III : 3/27 = 11.1%

N.b. The author intends to undertake further research on parotid enlargement and its connection with diabetes and associated conditions at a later date (in Wala-Rano and Aitutaki - Cook Islands).

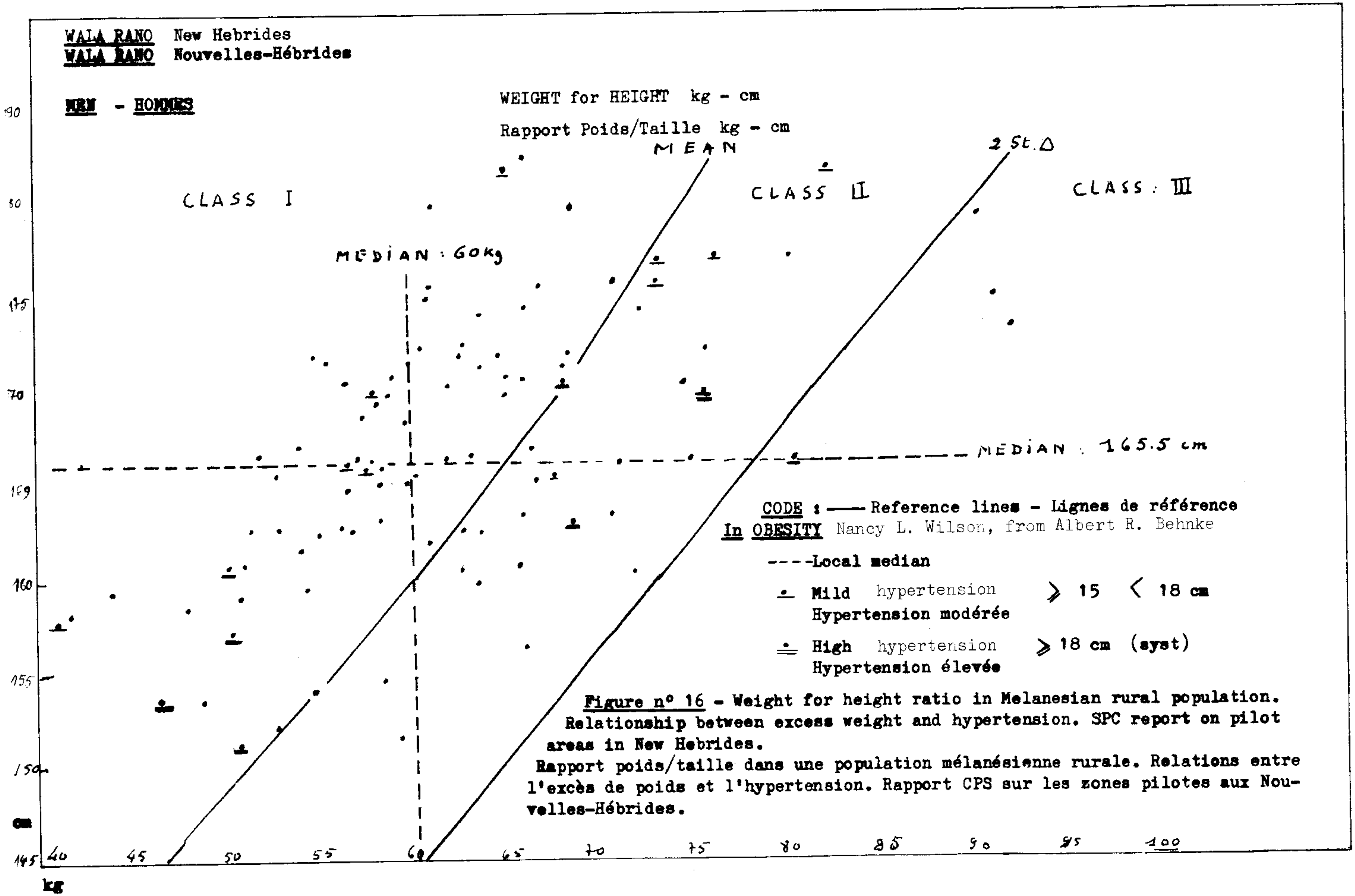


Figure n° 16 - Weight for height ratio in Melanesian rural population. Relationship between excess weight and hypertension. SPC report on pilot areas in New Hebrides.

Rapport poids/taille dans une population mélanésienne rurale. Relations entre l'excès de poids et l'hypertension. Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

WALA RANO (New Hebrides)

WOMEN

FEMMES

WEIGHT for HEIGHT (kg - cm)
Rapport POIDS-TAILLE (kg - cm)

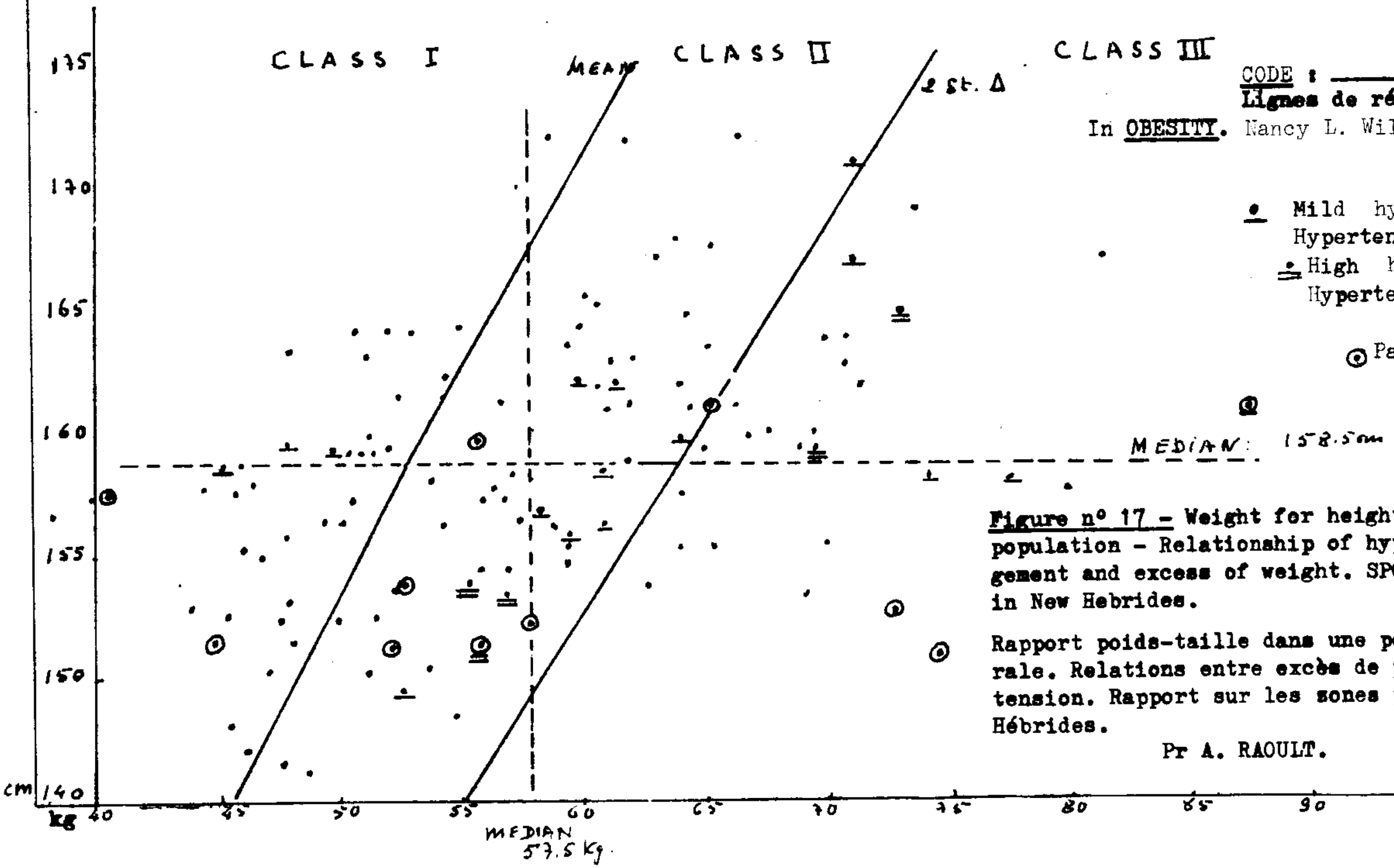


Figure nº 17 - Weight for height ratio - Melanesian rural population - Relationship of hypertension, parotid enlargement and excess of weight. SPC report on pilot areas in New Hebrides.

Rapport poids-taille dans une population mélanésienne rurale. Relations entre excès de poids, parotidose et hypertension. Rapport sur les zones pilotes aux Nouvelles-Hébrides.

Pr A. RAOULT.

WALA RANO - MALEKULA - New Hebrides
WALA RANO - MALLICOLO - Nouvelles-Hébrides

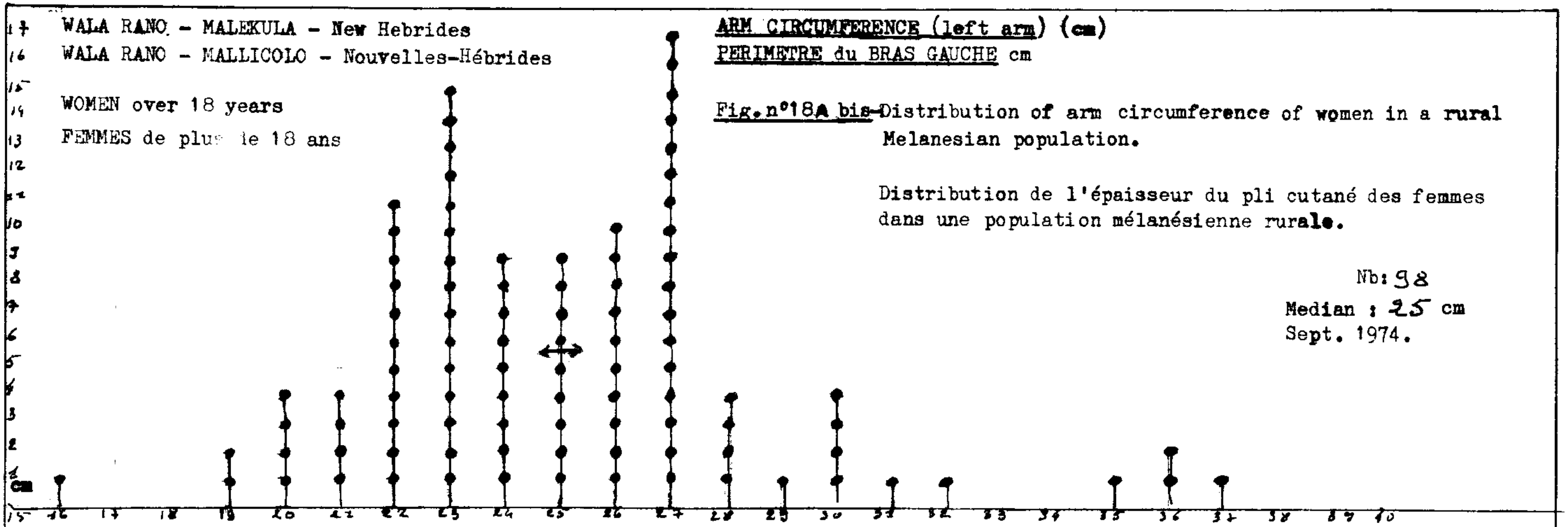
WOMEN over 18 years
FEMMES de plus de 18 ans

ARM CIRCUMFERENCE (left arm) (cm)
PERIMETRE du BRAS GAUCHE cm

Fig. n°18A bis- Distribution of arm circumference of women in a rural Melanesian population.

Distribution de l'épaisseur du pli cutané des femmes dans une population mélanésienne rurale.

Nb: 98
Median : 25 cm
Sept. 1974.



WOMEN over 18 years
FEMMES au-dessus de 18 ans

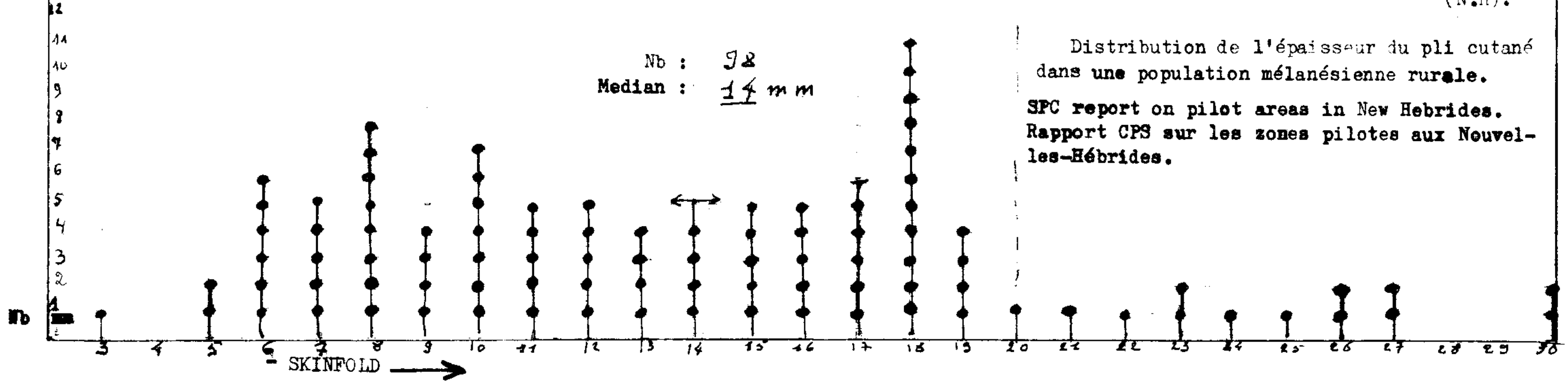
SKINFOLD left arm (mm)
PLI CUTANE bras gauche (mm)

Figure n°18B bis - Distribution of skinfold in women in Melanesian rural population in Wala Rano (N.H).

Distribution de l'épaisseur du pli cutané dans une population mélanésienne rurale.

SPC report on pilot areas in New Hebrides.
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

Nb : 98
Median : 14 mm



WALA RANO - MALEKULA - NEW HEBRIDES.

WALA RANO - MALLICOLO - NOUVELLES-HEBRIDES.

MEN over 18 years
HOMMES de plus de 18 ans
nb: 53
Median : 26 cm

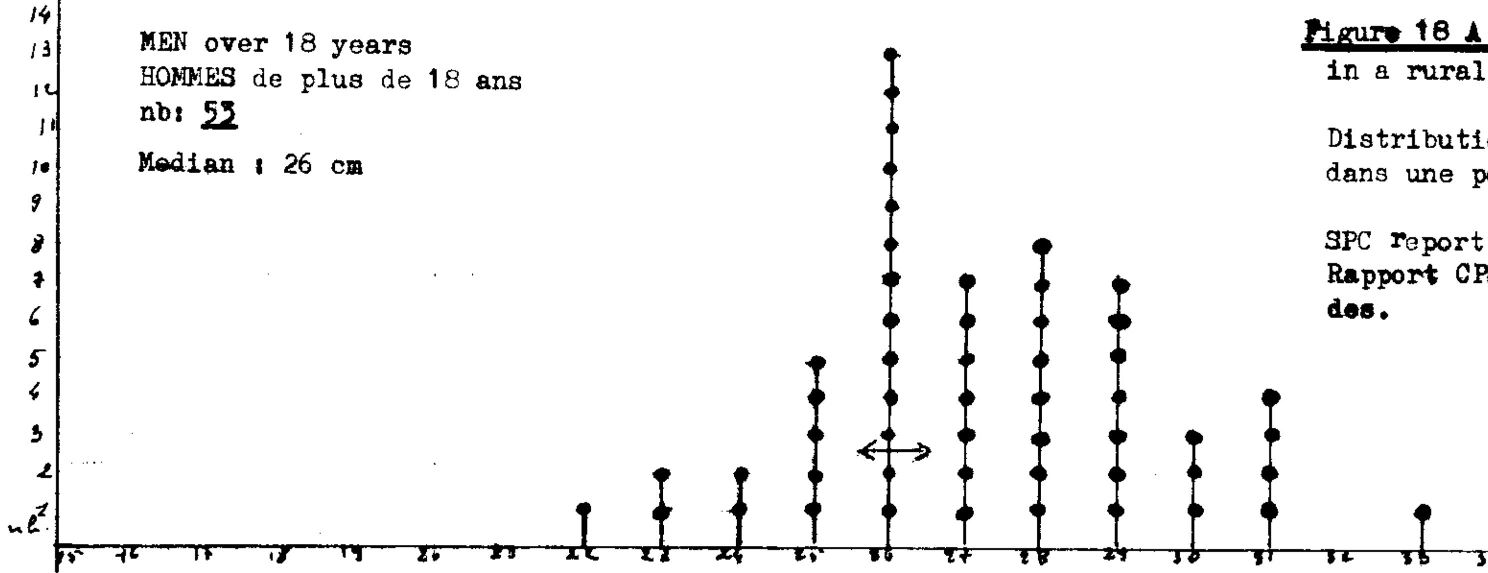


Figure 18 A bis -Distribution of left arm circumference in a rural Melanesian population.

Distribution du périmètre du bras chez les hommes dans une population mélanésienne rurale.

SPC report on pilot areas in New Hebrides.
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

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MEN over 18 years
HOMMES de plus de 18 ans

nb: 53
Median: 5 mm

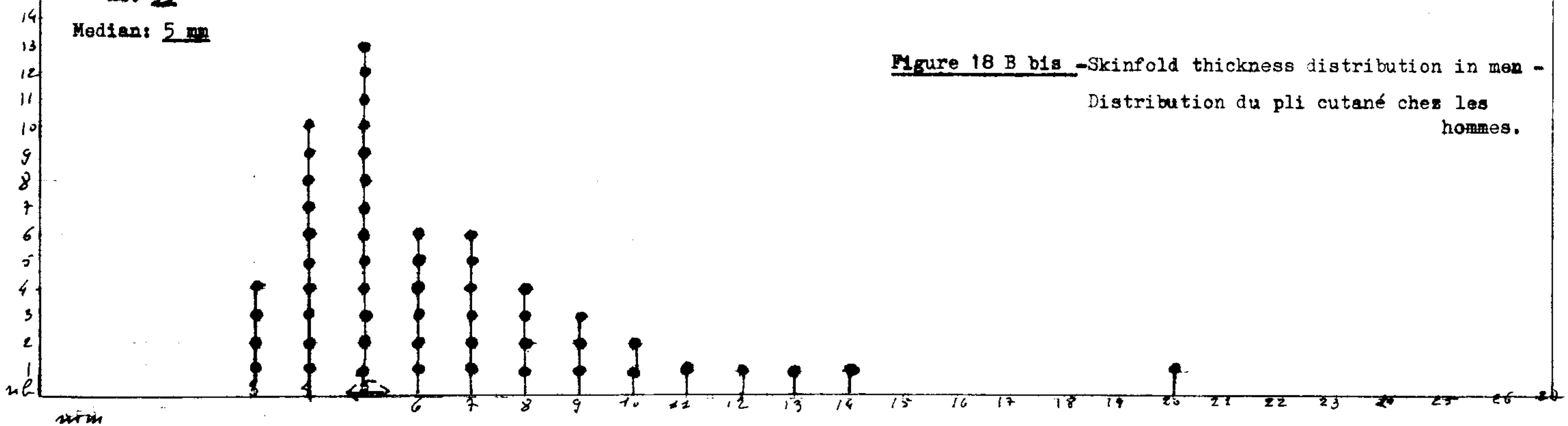


Figure 18 B bis -Skinfold thickness distribution in men - Distribution du pli cutané chez les hommes.

PART V

DATA COLLECTED IN MALEKULA OUTSIDE THE PILOT AREAS

1. Norsup School

Body measurement data collected at this school were set out in Part IV, Chapter 4, and compared with those gathered in Wala-Rano.

To complete this comparison of well-nourished and undernourished school-age children, we have summarized our clinical findings for Norsup School on the following pages.

2. Amelvet School - located half-way between Wala-Rano and Norsup.

Both body measurements and clinical findings have been reported, but measurements could not be used for the purpose of comparison because it was impossible to ascertain the children's age.

3. Unmet village - North-west Malekula.

4. Ahamb village - South Malekula.

Rapid clinical surveys were conducted in these two localities, and a summary of findings has been given in the last two sections of Part V.

1. Norsup School - Clinical findings

A. Boys -

$5\frac{1}{2}$ to 8 years : 15
9 to 13 years: 41
13 to 18 years: 35

Total examined : 91

(a) Anaemia

$5\frac{1}{2}$ to 13 years : 1/56)
13 to 18 years : 1/35) Total : 2/91 = 2.2%

"Black tongue" glossitis : 2/91 = 2.2%

(b) P.C.M. sequelae

- Hair dyspigmentation

$5\frac{1}{2}$ to 13 years : 10.5%
13 to 18 years : 13.2%

- Abnormal hair growth (pilosis)

$5\frac{1}{2}$ to 8 years : 2/15 = 12.5%
9 to 13 years : 3/41 = 7.3%
13 to 18 years : 1/35 = 4.4%

- Parotid enlargement

$5\frac{1}{2}$ to 8 years : 2/15 = 13.3%
9 to 13 years : 2/41 = 4.9%
13 to 18 years : 3/35 = 8.65%
Total : 7/91 = 7.7%

Of the children with parotid enlargement, 4 came from Pentecost Island (out of 20 natives of that island = 20%), 1 came from Amok (Malekula), 1 from Wala-Rano, and 1 from Tautu.

(c) Avitaminosis

(i) Vitamin A deficiency

Conjunctival thickening was quite pronounced and occurred at an early age. Most children in whom this condition was found came from the inland villages of Malekula or from remote islands, especially Pentecost.

One case of Bitot's spot was seen, associated with diffuse follicular hyperkeratosis, (in a child from Pentecost).

Conjunctival thickening :

$5\frac{1}{2}$ to 13 years : 12/56 = 21.4%
13 to 18 years : 22/35 = 62.9%
Total : 37.4%

(ii) Vitamin C deficiency : No symptoms

(iii) Riboflavin deficiency

- Dyssebacea : 1
- Angular cheilosis : 0
- Raspberry tongue : $5\frac{1}{2}$ to 13 years : 1/56 = 1.8%
  13 to 18 years : 10/35 = 28.5%
- Depapillating glossitis
  (atrophic lingual papillae): $5\frac{1}{2}$ to 13 years : 1
  13 to 18 years : 1
  Total : 2/91 = 2.2%

Riboflavin deficiency was far less common than in Wala-Rano schoolchildren.

(iv) Other Vitamin B deficiencies

2 cases of "beefsteack" tongue (2.2%) which, in the absence of other signs can only be attributed to multiple Group B deficiency.

(d) Dental state

Caries :

5½ to 13 years : DMF I : 6
DMF II : 3
DMF III : 1 Total : 10/56 = 17.8%

13 to 18 years : DMF III : 2/35 = 5.7%
Total caries : 11/91 = 12.2%

Fluorosis : 2 cases (from Pinalum)

Gums : normal

(e) Skin affections

Pyodermatosis : 5½ to 13 years : 8/56
13 to 18 years : 3/35
Total : 11/91 = 12.1%

Dermatomycosis : 5½ to 13 years : 7/56 =12.5%
13 to 18 years : 8/35 = 22.9%
Total : 15/91 = 16.5%

B. Girls

5½ to 8 years : 11
9 to 13 years : 25
13 to 18 years : 14 Total examined : 50

(a) Clinical anaemia : 5½ to 13 years : 3/36 = 8.3%
13 to 18 years :2/14 = 14.3%

(b) Malnutrition sequelae

- Hair dyspigmentation : 5½ to 13 years : 2/36 = 5.6%
13 to 18 years : 0/14 = 0
- Abnormal hair growth : 5½ to 13 years : 3/36 = 8.3%
13 to 18 years : 1/14 = 5%
- Parotid enlargement : 5½ to 13 years : 2/36 = 5.6%
13 to 18 years : 0/14 = 0
- Liver enlargement : 0/50

(c) Avitaminosis

(i) Vitamin A deficiency

Conjunctival thickening was the only suggestive sign (and of questionable significance): 5½ to 13 years : 4/36 = 11.1%
13 to 18 years : 2/14 = 14.3%

(ii) Vitamin C deficiency : No symptoms

(iii) Riboflavin deficiency

- Dyssebacea : 0
- Angular cheilosis : 0
- Raspberry tongue : $5\frac{1}{2}$ to 13 years : 3/36 = 8.3%
  13 to 18 years : 6/14 = 42.8%
- Atrophic papillae : $5\frac{1}{2}$ to 13 years : 2/36 = 5.6%
  13 to 18 years : 8/14 = 57.1%

Only this last-mentioned sign can be regarded as specific : 10/50 = 20%.

(iv) Ocular symptoms

- Conjunctivitis : 0
- Conjunctival thickening (already given above) 6/50 = 12%
- Pterygium : 1/50 = 2%.

(v) Dental state

Caries

$5\frac{1}{2}$ to 18 years : DMF I : 5/50 = 10%
DMF II : 2/50 = 4%
DMF III : 0

Total caries : 7/50 = 14%

Fluorosis : 1/50 = 2%

Periodontal symptoms : 0

(vi) Skin affections

- Pyodermatosis (impetigo) : 6/50 = 12%
- Dermatomycosis (pityriasis) : 4/50 = 8%

Summary : Although a great deal better than in Wala-Rano, the nutritional status of Norsup schoolchildren was not uniformly satisfactory. A number of children, usually "new" boarders hailing from neighbouring islands, still bore signs of past malnutrition, in particular enlarged parotid glands. The only noteworthy avitaminosis was riboflavin deficiency, no doubt due to intestinal parasite infestation.

Teeth and gums were, on the whole, in very good condition.

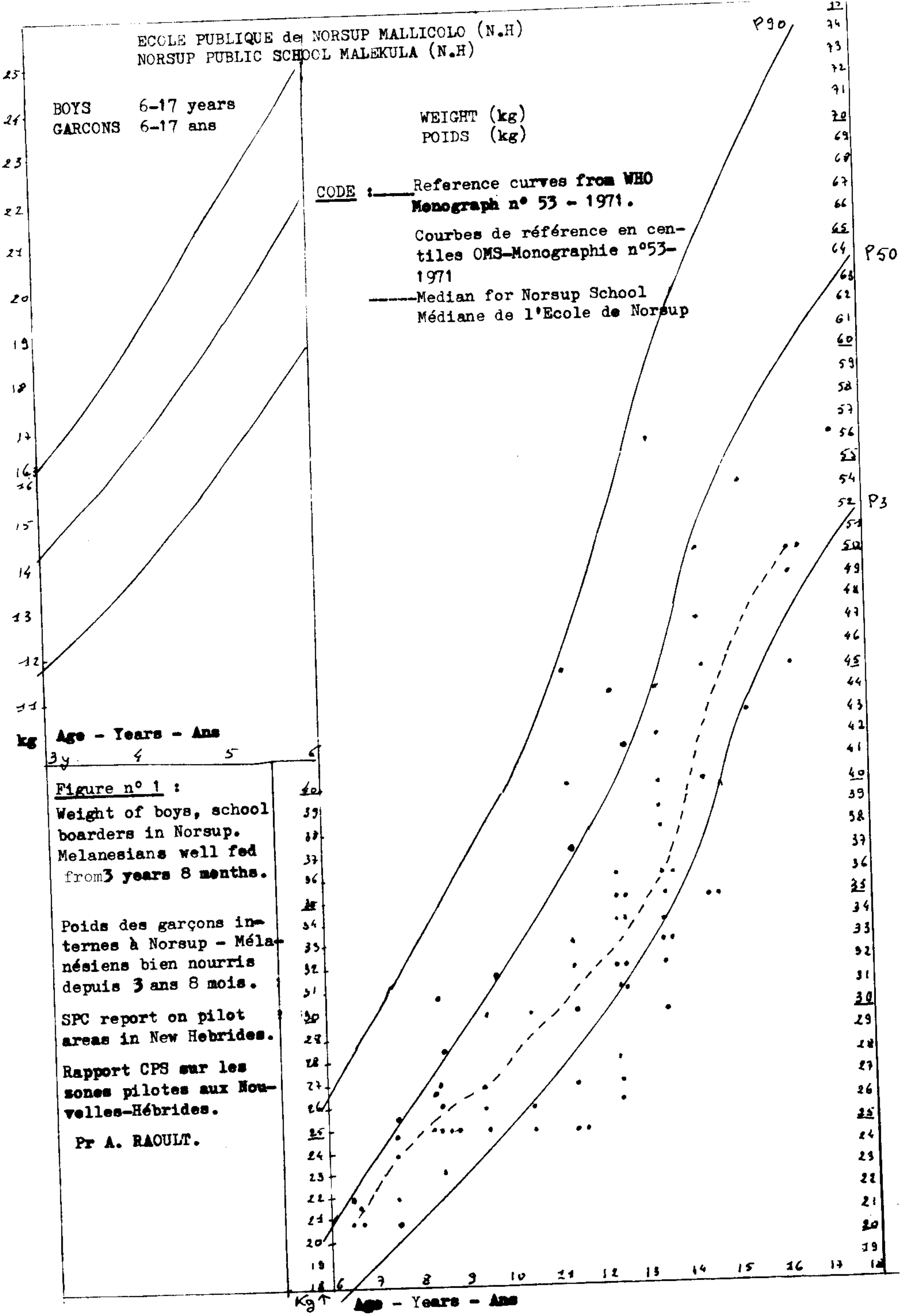


Figure n° 1 :
Weight of boys, school boarders in Norsup. Melanesians well fed from 3 years 8 months.

Poids des garçons internes à Norsup - Mélanésiens bien nourris depuis 3 ans 8 mois.

SPC report on pilot areas in New Hebrides.

Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

Pr A. RAOULT.

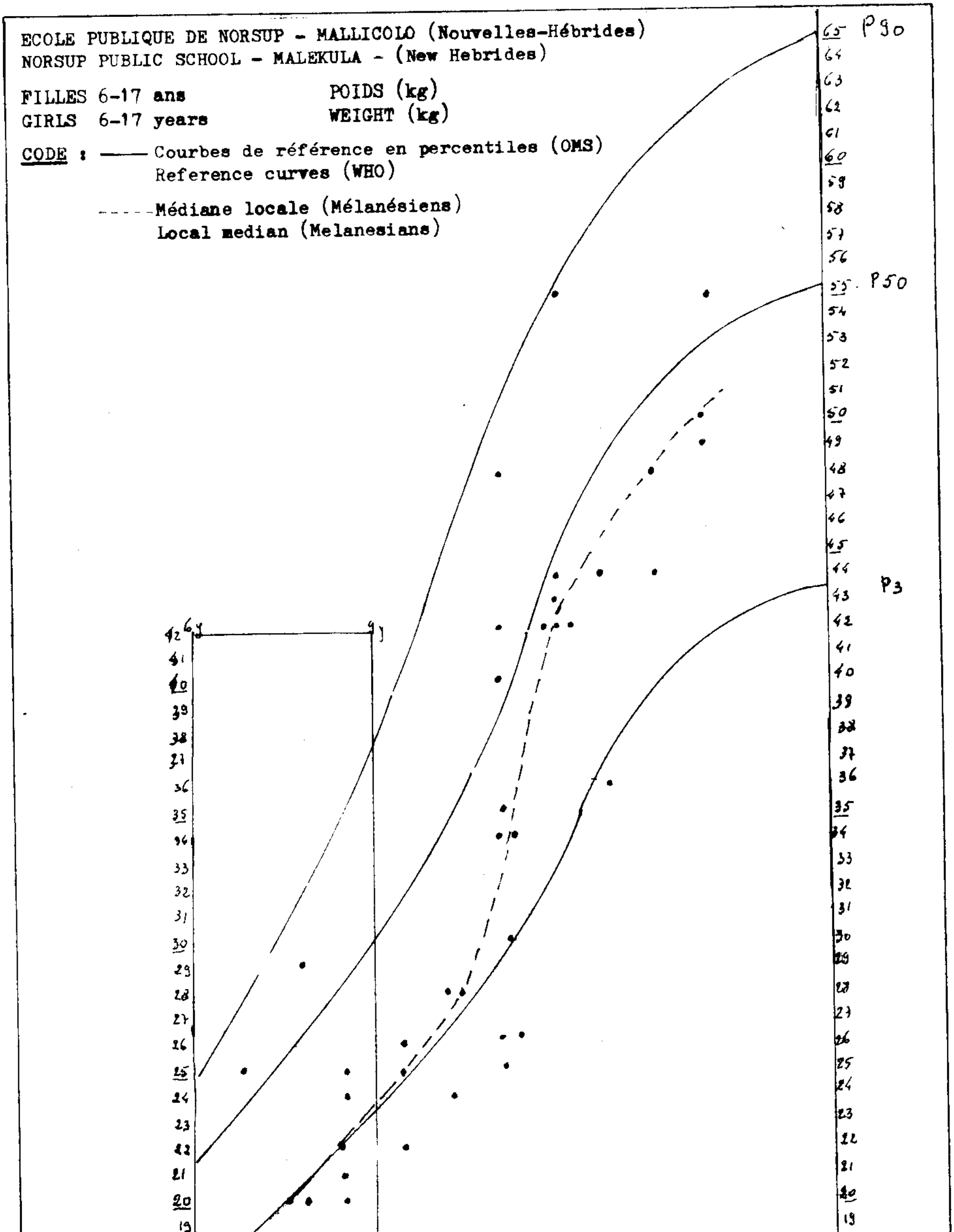


Figure n° 1 bis - Poids des filles de l'Ecole Publique de Norsup.
Weight of girls in Norsup Public School.

Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.
SPC report on pilot areas in New Hebrides.

ECOLE PUBLIQUE DE NORSUP - MALLICOLO - Nouvelles-Hébrides
NORSUP PUBLIC SCHOOL - MALEKULA - New Hebrides

GARCONS 6-17 ans
BOYS 6-17 years

EPAISSEUR DU PLI CUTANE (Tricipital gauche) (mm)
TRICIPITAL SKINFOLD (Left arm) (mm)

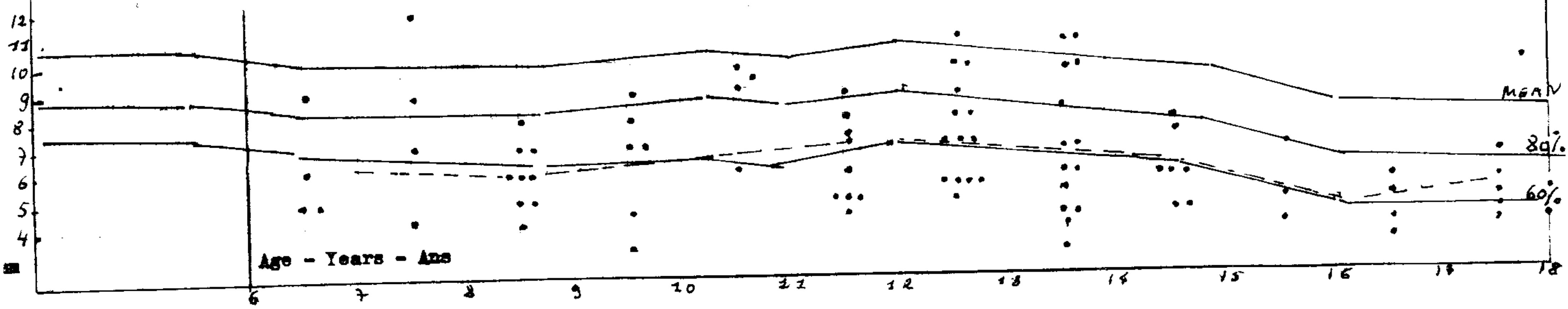
CODE : ——— Références dans Monographie n° 53 - 1971 - OMS
Reference lines from WHO Monograph n° 53 - 1971

- - - - - Médiane pour l'Ecole de Norsup
Median for Norsup schoolboys

Figure n° 2 - Epaisseur du pli cutané des garçons internes à l'Ecole Publique de NORSUP.
Origine mélanésienne provenant de plusieurs îles. Bien nourris depuis 3 ans 8 mois par an.
Comparaison avec les références OMS Monographie n° 53 - 1971.
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

Skinfold for boys, boarders in Norsup Public School. Melanesian origin, from several islands.
Comparison with WHO references (Monograph 53).
SPC report on pilot areas in New Hebrides.

Pr A. RAOULT.



ECOLE PUBLIQUE DE NORSUP - MALLICOLO - Nouvelles-Hébrides
NORSUP PUBLIC SCHOOL - MALEKULA - New Hebrides

FILLES 6-17 ans
GIRLS 6-17 years

PLI CUTANE TRICIPITAL (mm) - bras gauche
TRICIPITAL SKINFOLD (mm) - left arm

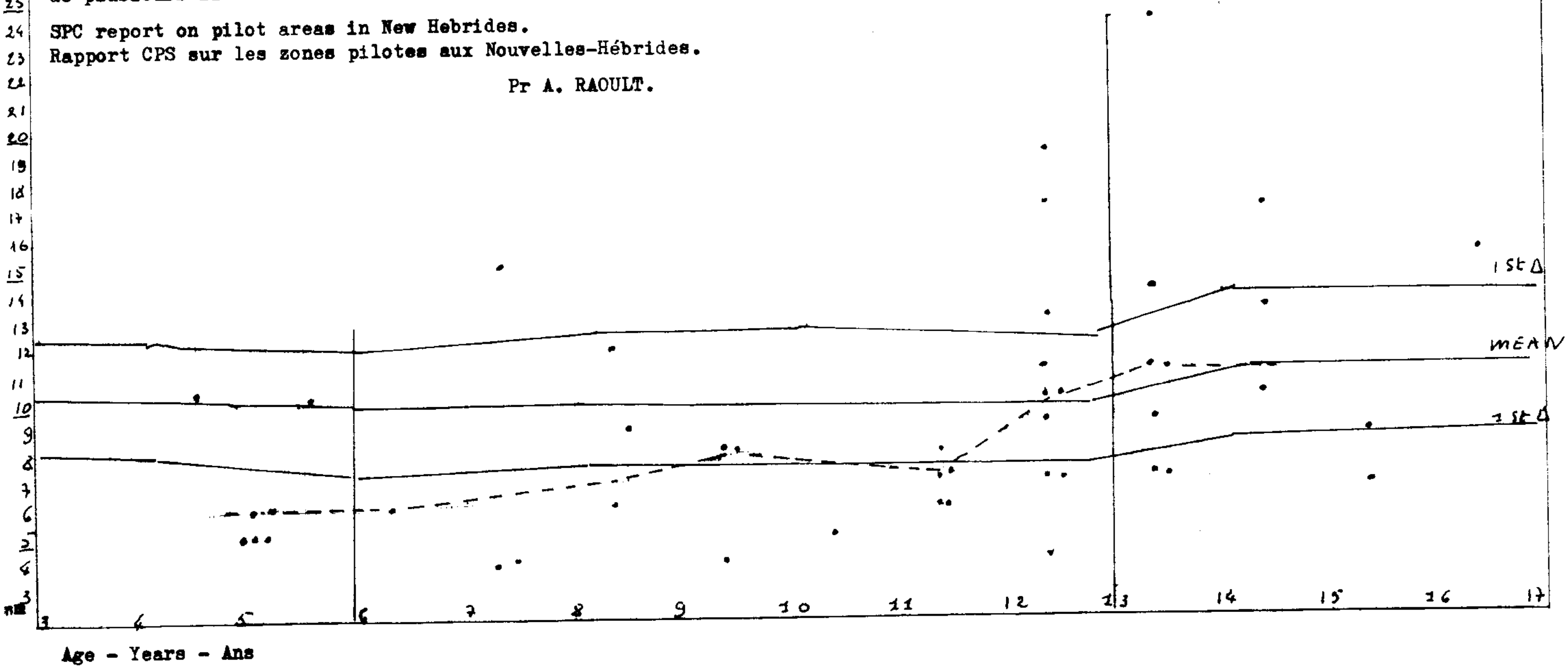
CODE : ——— Reference lines in WHO Monograph n° 53 - 1971
Lignes de référence, OMS Monographie n° 53 - 1971

----- Median for Norsup school
Médiane de l'Ecole de Norsup

Figure n° 2 bis - Skinfold for Melanesian girl boarders in Norsup Public School, Melanesian origin, from several islands in New Hebrides. Well fed from 3 years, 8 months.
Epaisseur du pli cutané des filles mélanésiennes internes à l'Ecole de Norsup, originaires de plusieurs îles des Nouvelles-Hébrides, bien nourries depuis 3 ans 8 mois par an.

SPC report on pilot areas in New Hebrides.
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

Pr A. RAOULT.



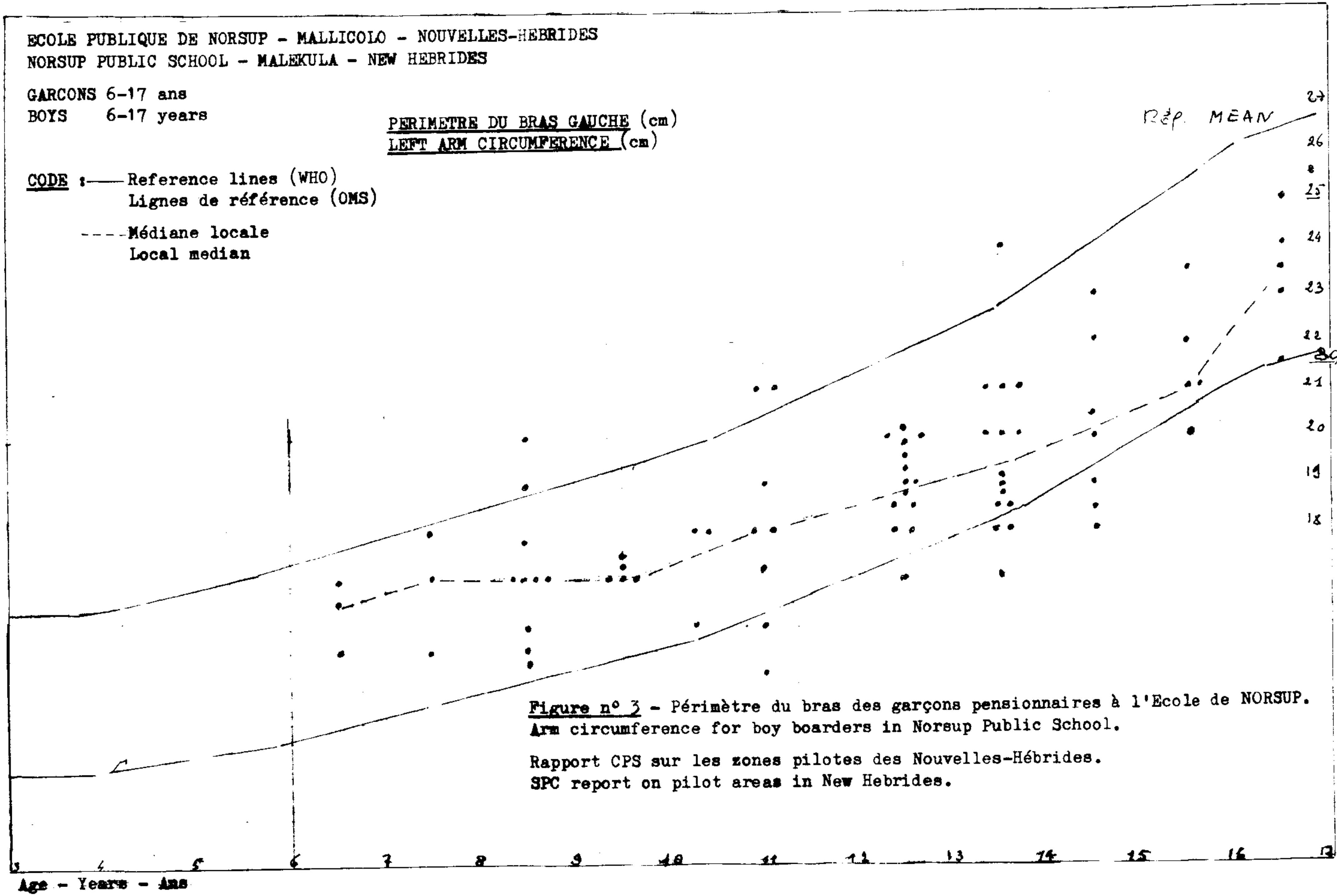


Figure n° 3 - Périmètre du bras des garçons pensionnaires à l'Ecole de NORSUP.
Arm circumference for boy boarders in Norsup Public School.

Rapport CPS sur les zones pilotes des Nouvelles-Hébrides.
SPC report on pilot areas in New Hebrides.

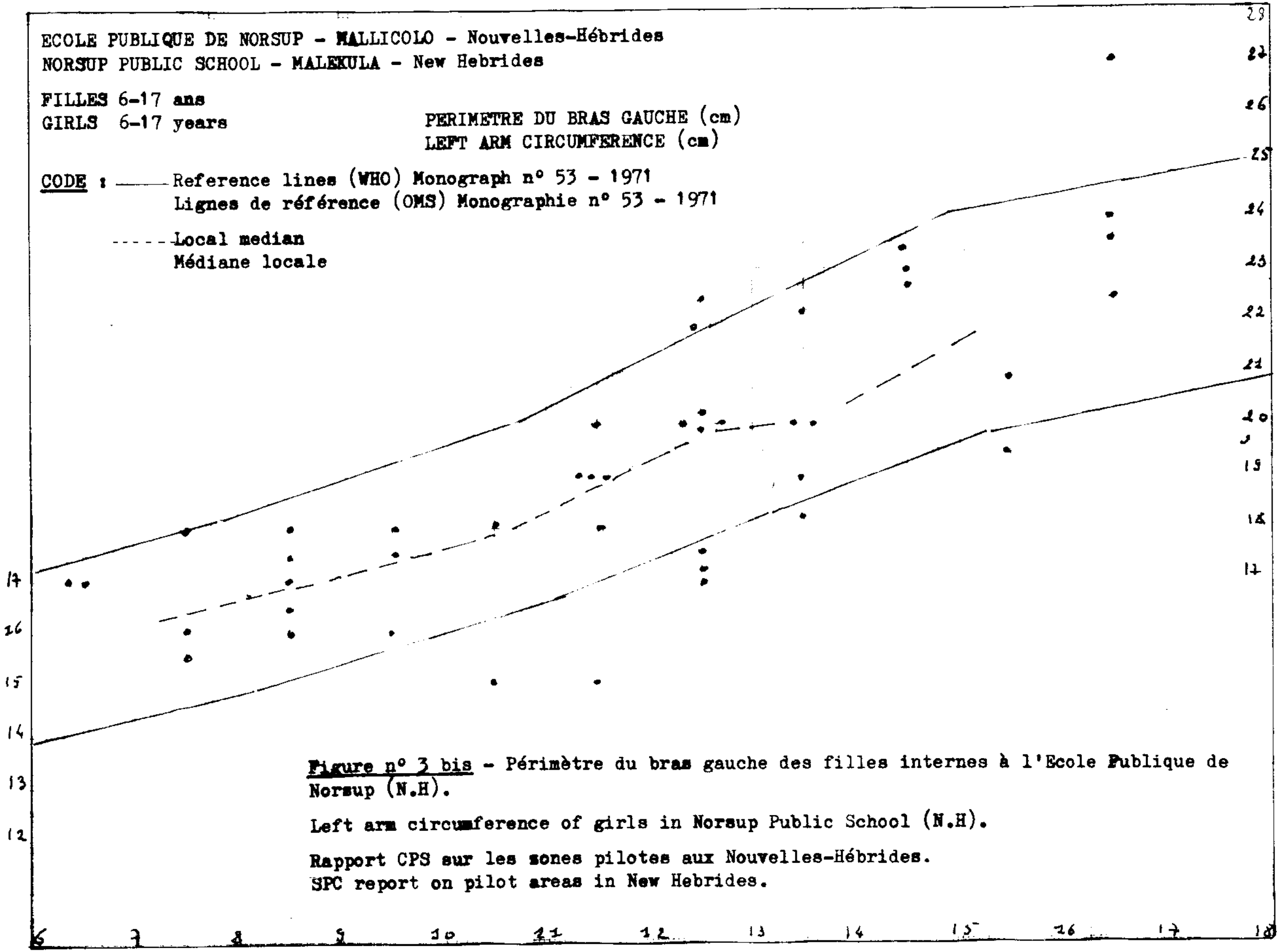


Figure n° 3 bis - Périmètre du bras gauche des filles internes à l'Ecole Publique de Norsup (N.H).

Left arm circumference of girls in Norsup Public School (N.H).

Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.
SPC report on pilot areas in New Hebrides.

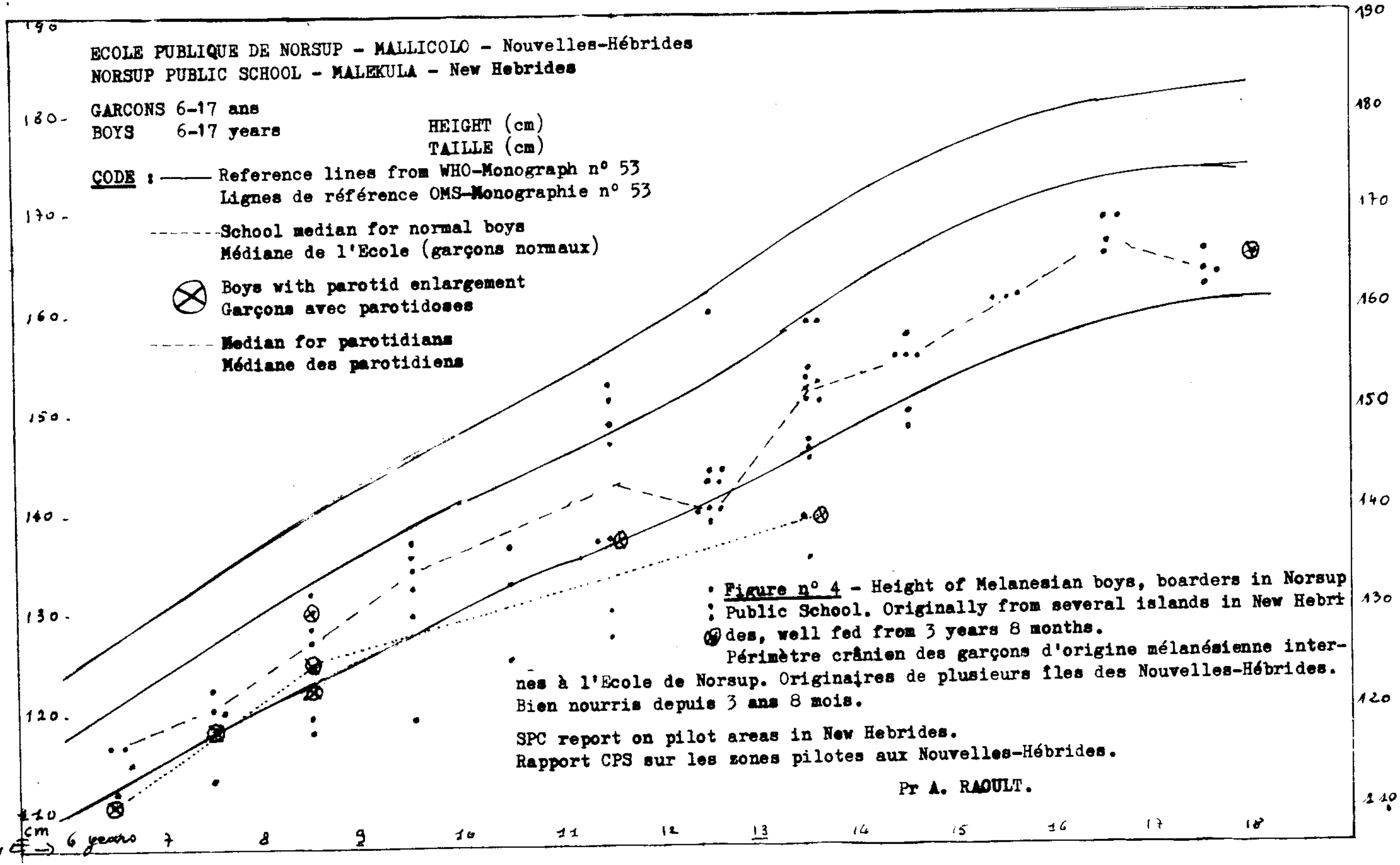


Figure n° 4 - Height of Melanesian boys, boarders in Norsup Public School. Originally from several islands in New Hebrides, well fed from 3 years 8 months.

Périmètre crânien des garçons d'origine mélanésienne internes à l'Ecole de Norsup. Originaires de plusieurs îles des Nouvelles-Hébrides. Bien nourris depuis 3 ans 8 mois.

SPC report on pilot areas in New Hebrides.
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

Pr A. RAOULT.

ECOLE PUBLIQUE DE NORSUP - MALLICOLO - Nouvelles-Hébrides
NORSUP PUBLIC SCHOOL - MALEKULA - New Hebrides

GIRLS 6-17 years HEIGHT (cm)
FILLES 6-17 ans TAILLE (cm)

CODE :
- —— Reference curves (WHO) / Courbes de référence OMS en percentiles
- - - - Normal local median / Médiane locale des normaux
- X Enlarged parotids - Parotidoses
- ⊙ Pilosity - Pilosité
- ± Enlarged liver - Hépatomégalie
- • Seems normal - aspect normal

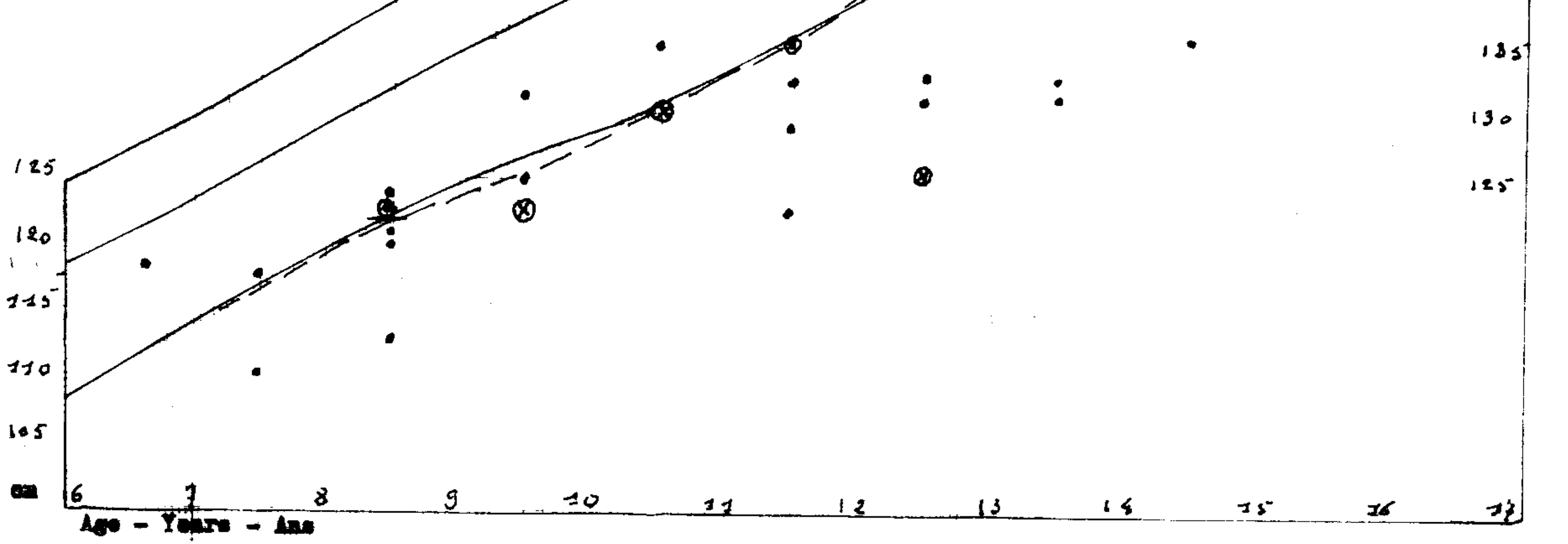


Figure n° 4-bis - Height of girls, boarders in Norsup Public School. Comparison with reference curves (WHO Monograph n° 53 - 1971). Taille des filles pensionnaires de l'Ecole Publique de Norsup. Comparaison avec les courbes de référence en percentiles (OMS Monographie n° 53 - 1971).

SPC report on pilot areas in New Hebrides.
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

ECOLE PUBLIQUE DE NORSUP - MALLICOLO - Nouvelles-Hébrides
NORSUP PUBLIC SCHOOL - MALEKULA - New Hebrides

GARCONS 6-17 ans
BOYS 6-17 years

PERIMETRE DU CRANE (cm)
HEAD CIRCUMFERENCE (cm)

CODE : ——— Lignes de référence OMS - Monographie n° 53 - 1971
Reference lines WHO - Monograph n° 53 - 1971

------ **Médiane de l'Ecole de Norsup**
Median for NORSUP school-boys

⊗ **Parotidose - Enlarged parotids**

..... **Médiane des parotidiens**
Median for enlarged parotids

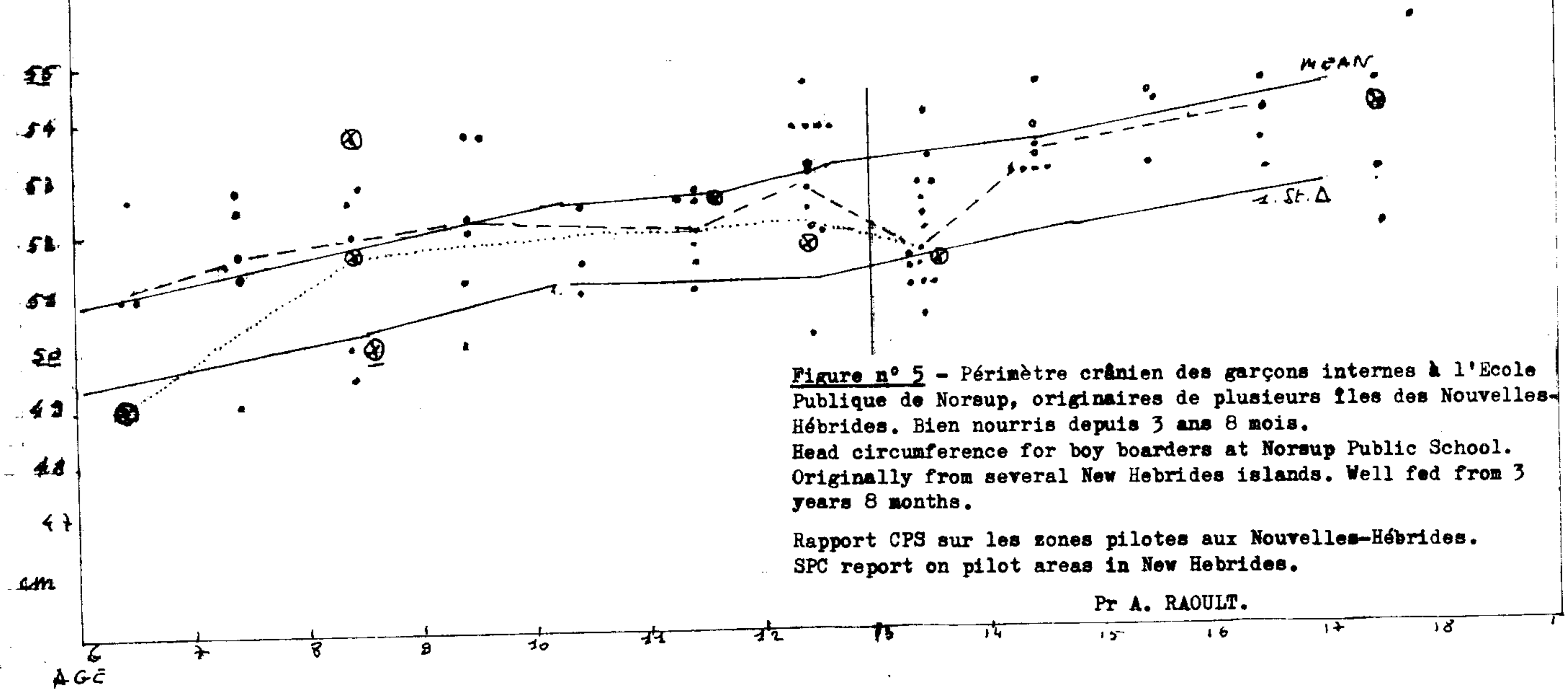


Figure n° 5 - **Périmètre crânien des garçons internes à l'Ecole Publique de Norsup, originaires de plusieurs îles des Nouvelles-Hébrides. Bien nourris depuis 3 ans 8 mois.**
Head circumference for boy boarders at Norsup Public School. Originally from several New Hebrides islands. Well fed from 3 years 8 months.

Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.
SPC report on pilot areas in New Hebrides.

Pr A. RAOULT.

ECOLE PUBLIQUE DE NORSUP - MALLICOLO - Nouvelles-Hébrides
NORSUP PUBLIC SCHOOL - MALEKULA - New Hebrides

FILLES : 6-17 ans
GIRLS : 6-17 years

PERIMETRE du CRANE (cm) - Sept. 1974
HEAD CIRCUMFERENCE (cm) - Sept. 1974

CODE : —— Reference lines WHO Monograph n° 53 - 1971 from WATSON and LOWREY
Lignes de référence : OMS Monographie n° 53 - 1971, d'après WATSON et LOWREY

- - - - Normal median
Médiane des normaux

× Enlarged parotids - Parotidoses

⊙ Pilosity - Pilosité

• Enlarged liver - Hépatomégalie

• Seems normal - Aspect normal

...... Median parotids

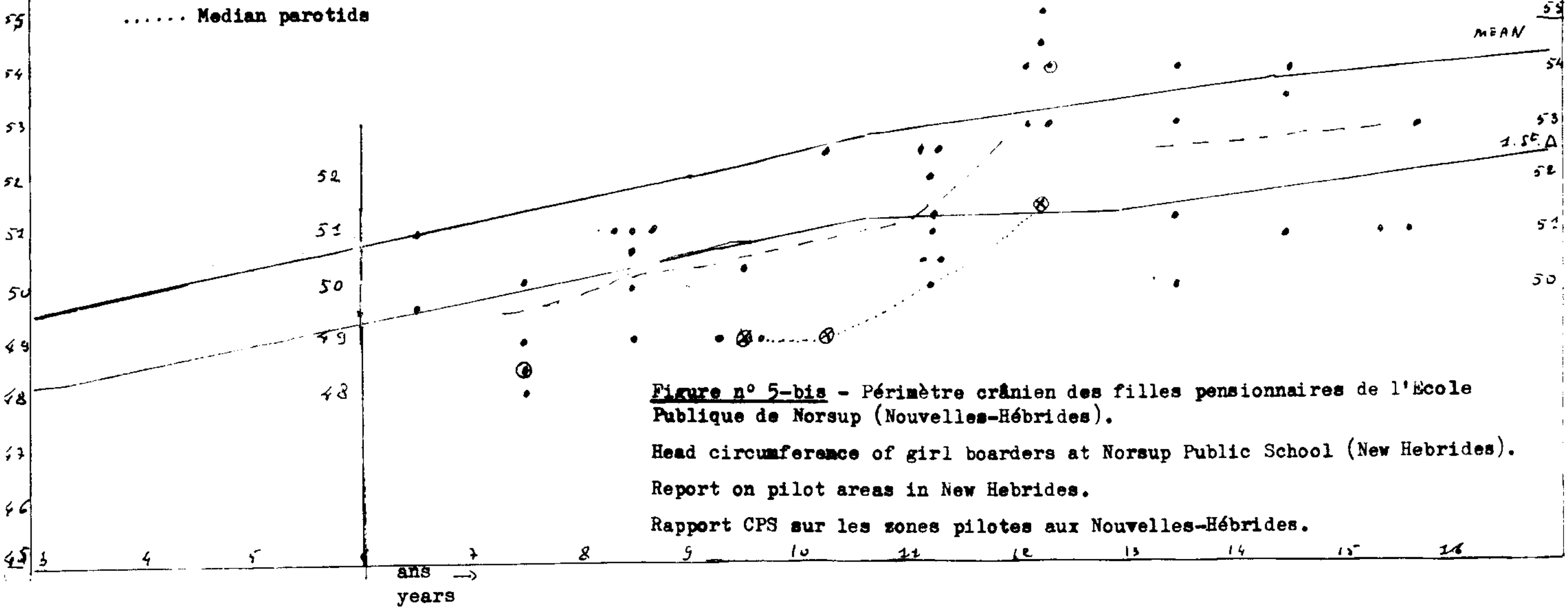


Figure n° 5-bis - Périmètre crânien des filles pensionnaires de l'Ecole Publique de Norsup (Nouvelles-Hébrides).

Head circumference of girl boarders at Norsup Public School (New Hebrides).

Report on pilot areas in New Hebrides.

Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

2. Amelvet School

Amelvet is a village situated half-way between Norsup and Wala-Rano on the coastal road. Its school is attended by Protestant children from near-by hamlets and from Rano Island. In all, it has 77 pupils aged between 6 and 17 years.

No meals are provided by the school, and the children from Rano Island eat practically nothing at lunch-time. Dietary conditions are thus comparable to those at the Wala-Rano Mission School.

The children's ages were not known in many cases, and had to be approximately assessed from examination of their teeth.

Environmental conditions in this low-lying area appeared to be worse than in Wala-Rano. The immediate surroundings of the school were not well-tended.

Number of children examined	Boys	Girls	Total
6 to 9 years (inclusive)	8	9	17
10 to 13 years "	19	21	40
14 to 17 years "	13	7	20
	40	37	77

A. Body measurements

Weight - Boys

The weight mean for boys was well below the lower reference curve (P3) up to 11 years and then rose very slightly.

Distribution was as follows:

$>$ P50		: 6/40 = 15%
$<$ P50	$\geq$ P3	: 17/40 = 48.5%
$<$ P3		: 17/40 = 42.5%

The five boys with enlarged parotids were all below P3 in weight, i.e. in the malnutrition zone.

Weight - Girls

The pattern was very similar up to 11 years, after which age the weight mean soared.

Distribution was as follows :

$\geq$ P50		: 7/37 = 18%
$<$ P50	$\geq$ P3	: 13/37 = 35.1%
$<$ P3		: 17/37 = 45.9%

All the girls with enlarged parotids (7) were below P3.

Height - Boys

The height mean was below P3 and no significant rise occurred at puberty. Height retardation was comparatively more marked than weight retardation.

Distribution was as follows: $\geq$ P50 : 5/40 = 12.5%
$<$ P50 $\geq$ P3 : 15/40 = 37.5%
$<$ P3 : 20/40 = 50%

Height - Girls

$\geq$ P50 : 6/37 = 16.2%
$<$ P50 $\geq$ P3 : 19/37 = 51.4%
$<$ P3 : 12/37 = 32.4%

Of the 6 most seriously retarded girls, 4 were parotid cases.

Head circumference

Mean values were calculated only for girls.

The local head circumference mean approximately followed the P3 curve.

Distribution was as follows: $\geq$ P50 : 6/37 = 16.2%
$<$ P50 $\geq$ P3 : 11/37 = 29.7%
$<$ P3 : 20/37 = 54.1%

All parotid cases were in the lowest group.

Summary : Analysis of body measurement data revealed an alarming situation, more serious even than in Wala-Rano. About 45% of the Amelvet schoolchildren were undernourished.

Stunting of bone growth (skull and stature) was even more significant and longer lasting than weight retardation.

Children with enlarged parotid glands were always among the most retarded. Parotid enlargement can therefore be regarded as a symptom of past or present malnutrition.

Body measurements for Amelvet children are shown graphically on Figs. No. 6 to No. 8.

B. Clinical Findings (Boys and girls)

(a) Anaemia (clinical)

6 to 13 years : 12/57 = 21%
13 to 17 years : 5/20 = 25%

(b) Spleen enlargement (suggestive of malaria)

6 to 13 years : 6/57 = 10.5%
14 to 17 years : 1/20 = 5%

(c) Malnutrition sequelae

(i) Abnormal hair growth : 6 to 9 years : 3/17 = 17.6%
10 to 13 years : 2/40 = 5%
Over 13 years : 2/20 = 10%

(ii) Liver enlargement : 6 to 9 years : 4/17 = 23.5%
10 to 13 years : 0
Over 13 years : 0

(iii) Parotid enlargement

Girls : 6 to 9 years : 4/9 = 44%
10 to 13 years : 2/21 = 9.5%
14 to 17 years: 1/7 = 14.3%
Total : 7/37 = 18.9%

Boys : 6 to 9 years : 1/8 = 12.5%
10 to 13 years : 2/19 = 10.5%
14 to 17 years : 2/13 = 15.4%
Total : 5/40 = 12.5%

Overall total - boys and girls : 12/77 = 15.6%

N.B. For Wala-Rano, the overall total was 10.5%, and for Norsup 5.6%.

Abnormal hair growth, liver enlargement and parotid enlargement are very often associated, especially in younger children :

Girls		Boys
⊗ 3	(triple association)	0 → 3
× 1	(double association)	0 → 1
⊗ 1	(double association)	5 → 6
⊙ 2	(abnormal pilosity alone)	3 → 5

Statural retardation was very pronounced in children with enlarged parotids, especially during adolescence, but many of the clinically normal children were severely stunted as well.

(d) Avitaminosis (boys and girls)

(i) Vitamin A deficiency

6 to 13 years : 2 cases of perifollicular hyperkeratosis (2/57 = 3.5%) were seen, but this symptom is of dubious value when unaccompanied by other signs.

(ii) Vitamin C deficiency

Exceedingly rare in Wala-Rano, Tautu and Norsup, it did occur here.

6 to 13 years : 3 cases of swollen, bleeding gums (3/57 = 5.7%) - a highly significant sign - were found.

(iii) Riboflavin deficiency

This was the most common of the vitamin deficiencies.

- Dyssebacea : 14 to 17 years : 2/20 = 10%
- Angular cheilosis : 6 to 13 years: 1 case) 14 to 17 years: 1 case) Total : 2/77 = 2.6%
- Raspberry tongue : 28/77 = 36.4% (suggestive of severe intestinal parasite infestation).
- Atrophic lingual papillae : 9/77 = 11.7% (a highly significant sign).

(iv) Other vitamin deficiencies

- Black tongue : 0
- Rickets : 0

(e) Dental state

(i) Fluorosis : 3/77 = 3.9%

(ii) Caries : 1/77 = 1.3%

The drinking water around Pinalum Point where Amelvet is situated, is known to have the highest fluoride content in the area, which accounts for the exceptionally sound teeth of these schoolchildren.

(f) Ocular symptoms

(i) Ordinary conjunctivitis : 0
Follicular conjunctivitis : 6 to 13 years : 6/62 = 9.7%

(ii) Pigmentation of the bulbar conjunctiva :

6 - 13 : 11/62 = 17.7%
14 - 17 : 4/23 = 17.4%

(iii) Conjunctival thickening :

6 - 13 : 11/62 = 17.7%
14 - 17 : 9/23 = 39.1% - Highest incidence in the area for this group.

(iv) Pterygium : 1/23 from 14 to 17 years

(v) Pingueculae : 6 - 13 : 3/62 = 4.8%
14 - 17 : 2/23 = 8.7%

(g) Skin affections : 3/85 = 3.5%

Pityriasis versicolor :3

C. Conclusions

The nutritional status of the pupils of Amelvet School is very deficient indeed compared with that of the Wala-Rano and, a fortiori, of the Norsup schoolchildren.

Food intake is grossly inadequate, particularly in the case of the children from Rano Island, who cannot go home during the midday break.

In addition, environmental conditions around Amelvet are the worst in the area, and the immediate surroundings of the school are quite insanitary.

Malarial spleen enlargement was found in 10.5% of the children aged 6 to 13 years, which is the highest rate of occurrence recorded in Malekula.

Remedial measures should include :

- improved sanitation, of the environment in general, and of the school grounds in particular;
- regular treatment of children against malaria and intestinal parasites;
- food supplementation, preferably a school-meal system such as already exists in the Government schools and is about to be instituted at Wala-Rano Mission School;
- health education of village families, and increased communication between them and the teaching staff of this school and other schools.

3. Survey of Unmet

The Unmet community comprises about 300 Big Nambas people, who came down from the Amok area, which is the original home of the Big Nambas, some ten years ago, to till the alluvial land on the North-West coast, between Winfarr and Liwout Points, on either side of the Tembrinn river. It has a dispensary run by a dresser under the supervision of the doctor in charge of Norsup hospital as well as a government school.

As the crow flies, Unmet lies only 12 km from Norsup, but since there is no cross country road, visitors and goods usually arrive by sea.

Professor Raoult was able to spend only two hours at Unmet and, in this time, examined 74 children aged between 0 and 9 years.

Summary of clinical findings

Number examined (girls + boys) Total : 74	0 to 6 months 7	7 to 11 months 3	12 to 35 months 19	36 to 59 months 19	Total 0 to 5 years 48	6 to 9 years 26
Anaemia (moderate & severe)	2	3	14	5	24	20
%	28%	100%	73%	26.3%	50%	76.8%
Enlarged spleen (malarial)	2	2	7	2	11	8
%	28%	66.6%	36.8%	10.5%	45.8%	30.8%
P C M - moderate			2	1	3	
- severe			3	3	6	4
% severe PCM (with oedema +)			15.8%	15.8%		
% total PCM			26.3%	21.1%		15.4%
Dyspigmentation of hair			7	3	10	4
%			50%	15.8%		15.4%
Abnormal hair growth			4	2		1
%			28.5%	10.5%		3.8%
Enlarged parotids				3		5
%				15.8%		19%
Enlarged liver			8	5		3
%			42.1%	26.3%		11%
Melanodontia			2	4	6/38	
%				21%	15.8%	
Riboflavin deficiency						6
%						22%

ECOLE D'AMELVET - MALLICOLO
AMELVET SCHOOL - MALEKULA

BOYS 6-17 years
GARCONS 6-17 ans

WEIGHT (kg)
POIDS (kg)

CODE : —— Reference curves (WHO)
Courbes de référence en percentiles (OMS)

- - - - Median of normal
Médiane normale

× Enlarged parotids - Parotidoses

⊙ Pilosity - Pilosité

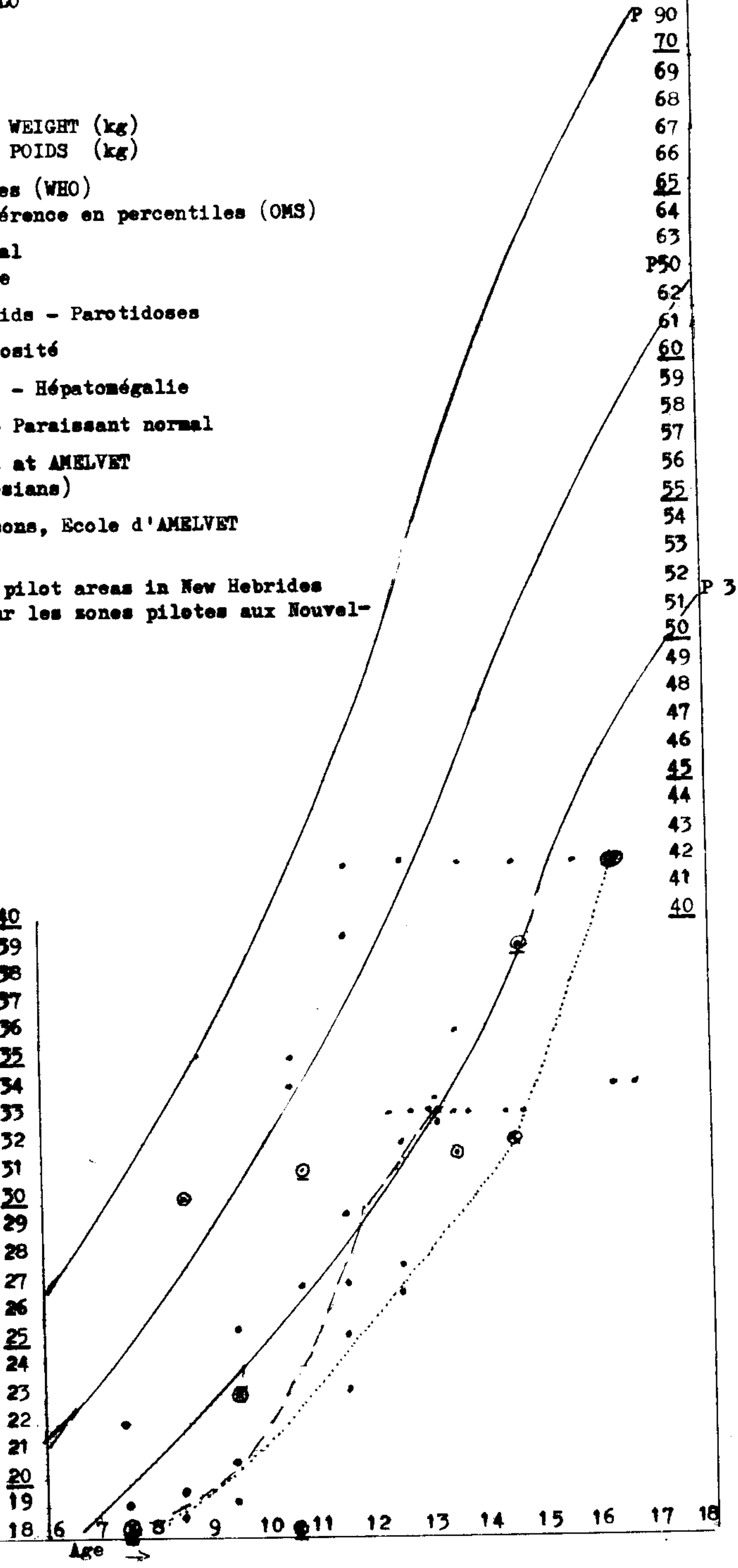
∸ Enlarged liver - Hépatomégalie

· Seems normal - Paraissant normal

Figure 6 : Weight of boys at AMELVET School (Melanesians)

Poids des garçons, Ecole d'AMELVET (Mélanésiens)

SPC report on pilot areas in New Hebrides
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides



Ecole d'AMELVET - MALLICOLO
AMELVET SCHOOL - MALEKULA

FILLES 6-17 ans — POIDS (kg)
GIRLS 6-17 years — WEIGHT (kg)

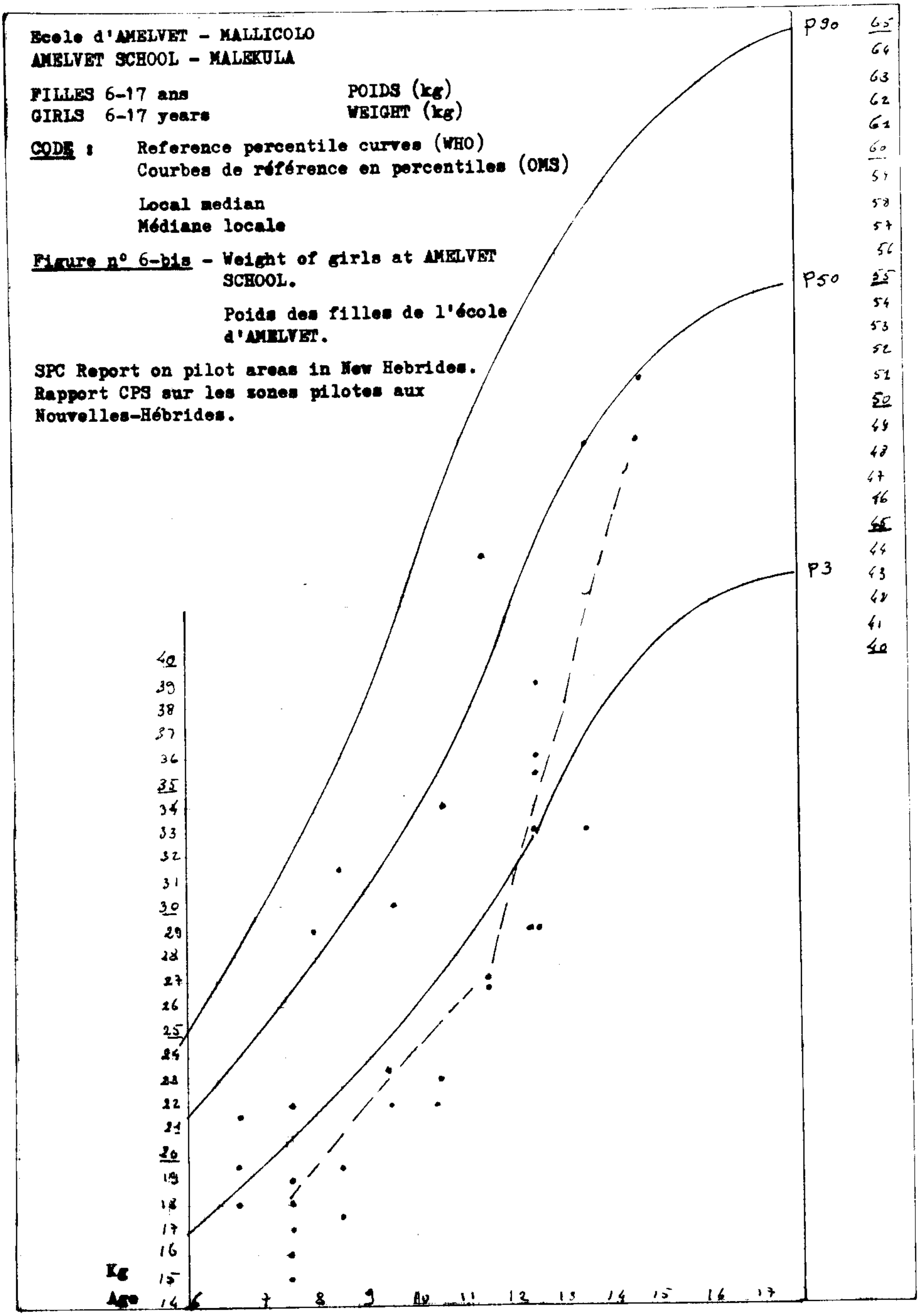
CODE : Reference percentile curves (WHO)
Courbes de référence en percentiles (OMS)

Local median
Médiane locale

Figure n° 6-bis - Weight of girls at AMELVET SCHOOL.

Poids des filles de l'école d'AMELVET.

SPC Report on pilot areas in New Hebrides.
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.



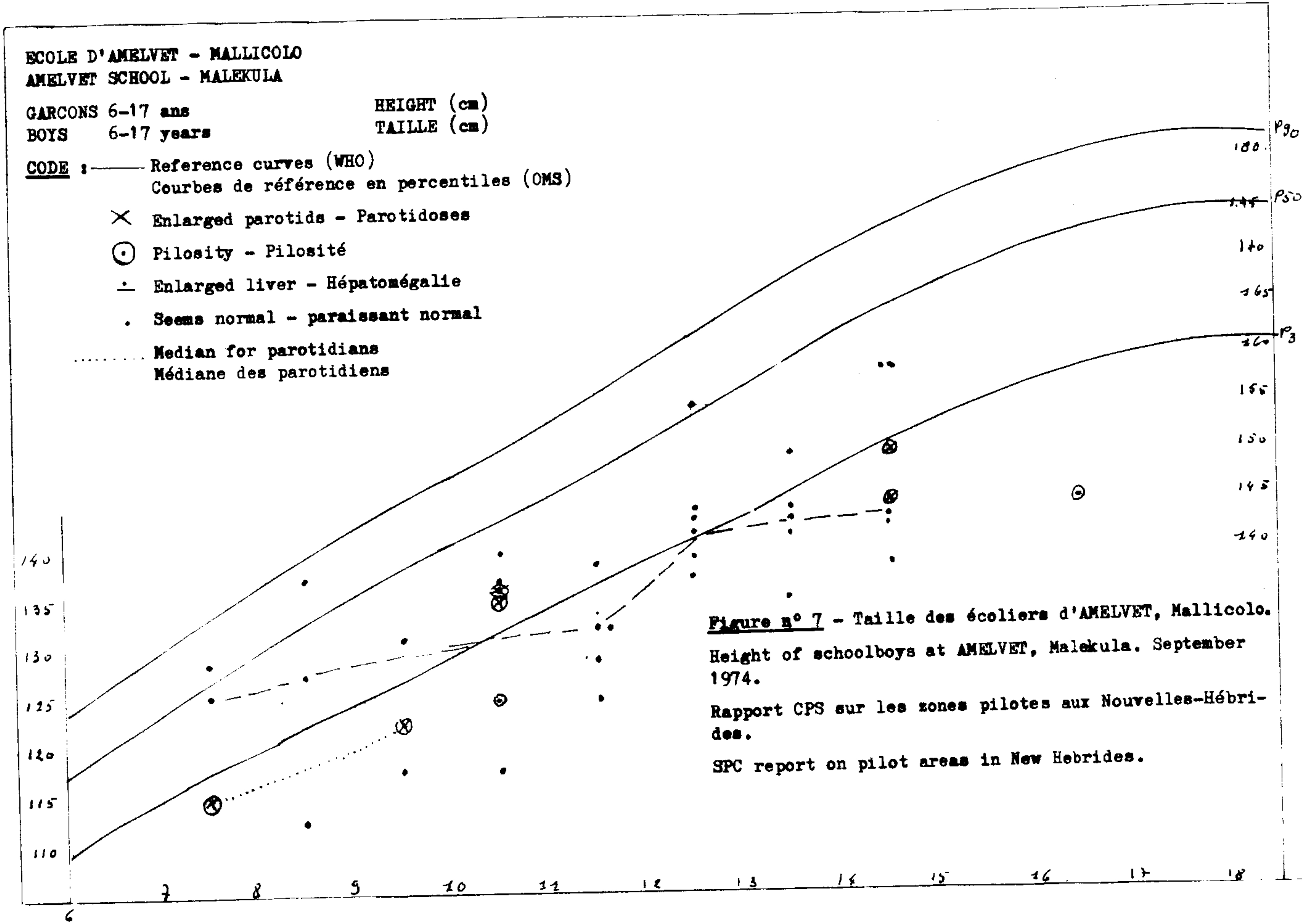


Figure n° 7 - Taille des écoliers d'AMELVET, Mallicolo.

Height of schoolboys at AMELVET, Malekula. September 1974.

Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

SPC report on pilot areas in New Hebrides.

ECOLE D'AMELVET - MALLICOLO
AMELVET SCHOOL - MALEKULA

GIRLS 6-17 years
FILLES 6-17 ans

<u>HEIGHT</u> (cm)
<u>TAILLE</u> (cm)

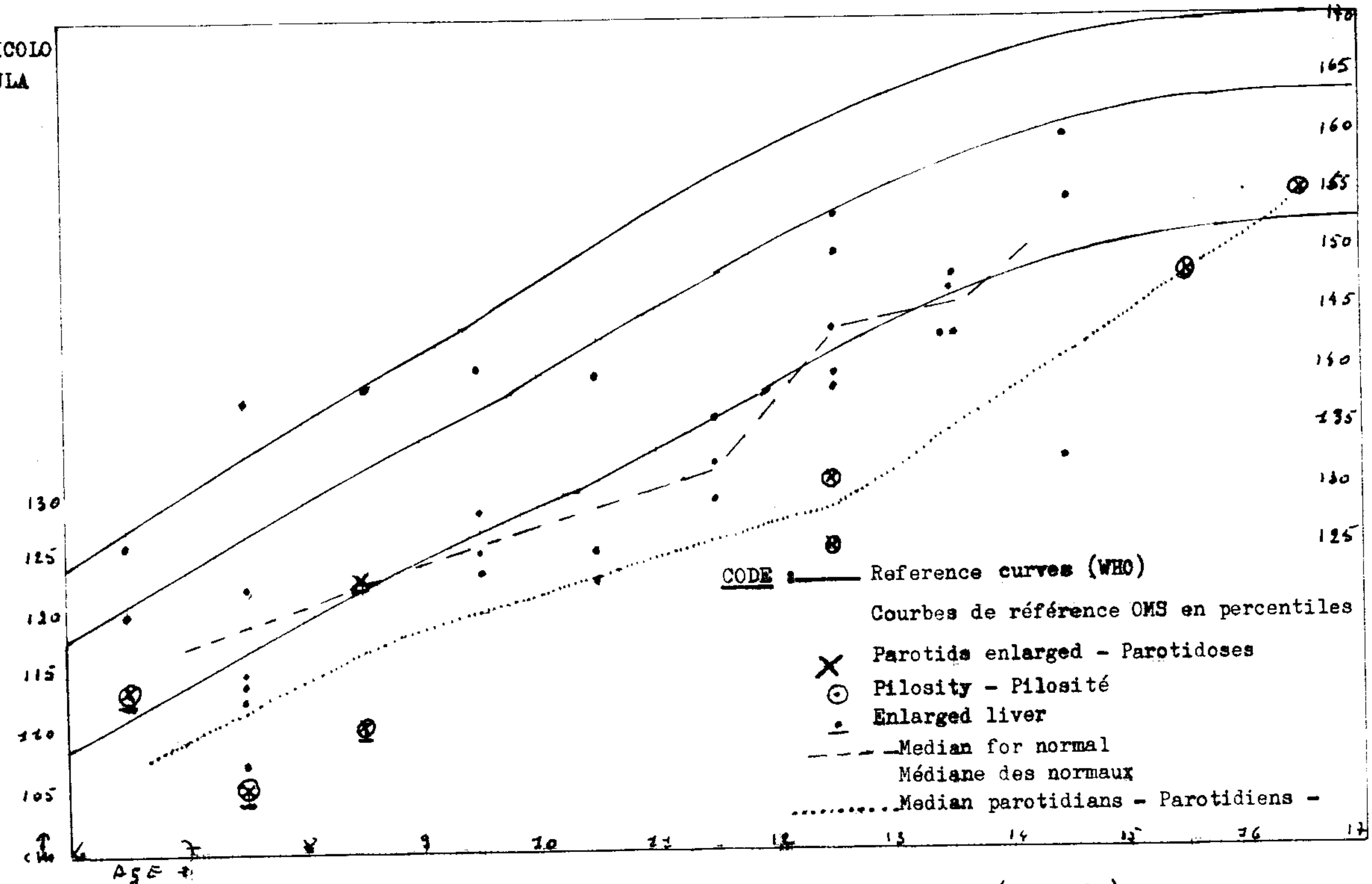


Figure 7 bis - Height of schoolgirls at AMELVET (Malekula).
Taille des filles de l'école d'AMELVET (Malekula).

SPC report on pilot areas in New Hebrides.
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

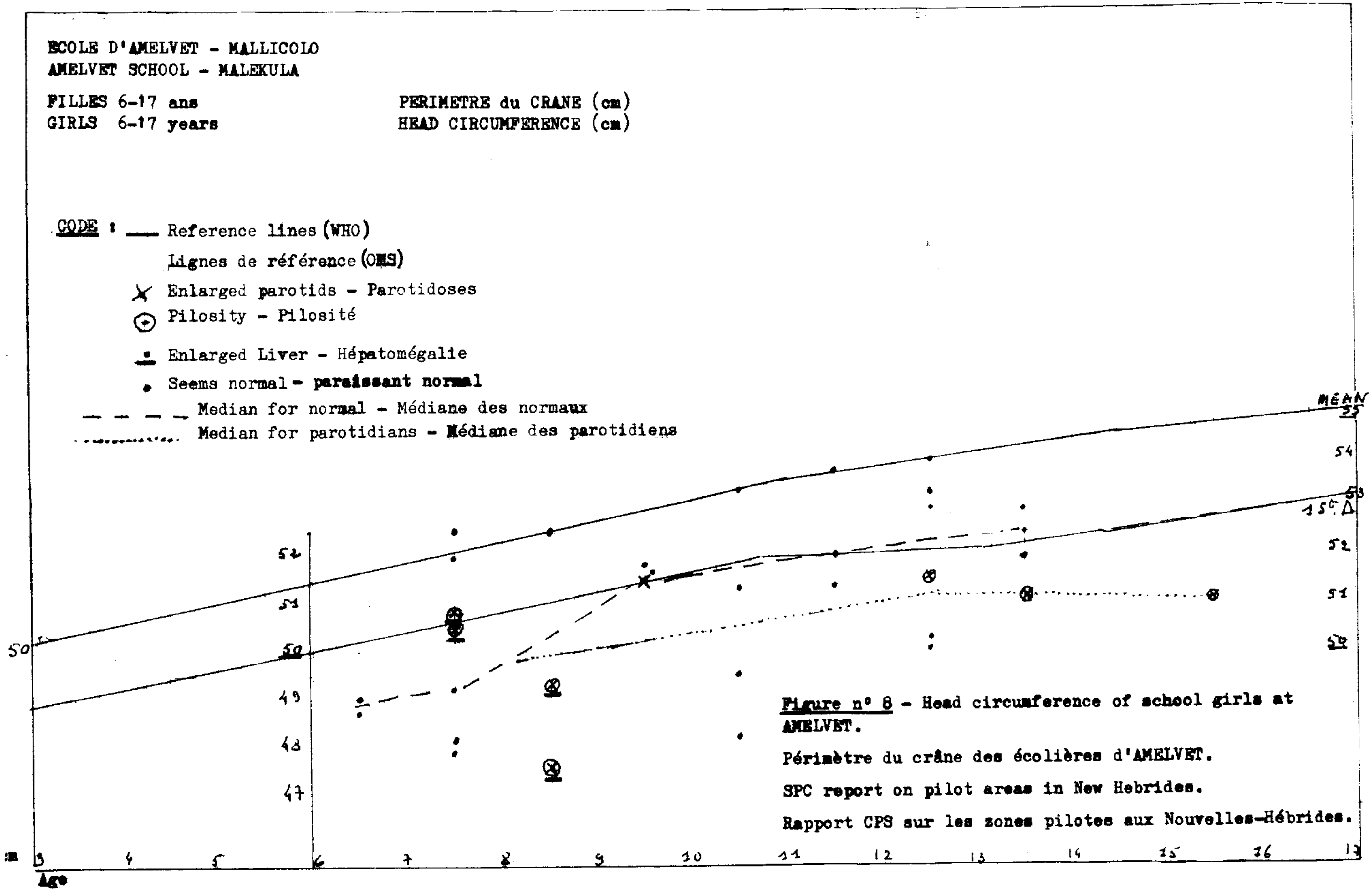


Figure n° 8 - Head circumference of school girls at AMELVET.

Périmètre du crâne des écolières d'AMELVET.

SPC report on pilot areas in New Hebrides.

Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

Although body measurements were not taken and clinical examination was necessarily cursory, our survey of Unmet children revealed a very serious situation.

Prevalence of anaemia and protein-calorie malnutrition in children over 6 months of age was higher at Unmet than anywhere else in Malekula. Figures for malnutrition sequelae, particularly parotid enlargement, were also the highest recorded. The major avitaminosis was riboflavin deficiency, due to a lack of animal-protein in the diet.

The unhealthy environment is largely to blame for this dismal picture. Unmet is in a low-lying, humid area, and both malaria vectors and intestinal helminths thrive under such conditions. General hygiene is, moreover, very poor.

Since even so brief a visit provided interesting information for comparison with Wala-Rano and Tautu, the author is planning to return to the village to conduct further investigations. Individual files prepared during the first examination will enable follow-up of the children.

4. Survey of Ahamb

Ahamb is a small island under British influence, situated near the southern tip of Malekula. It has 389 inhabitants - all Presbyterian - a school, and a dispensary run by a dresser.

Miss Walsh, WHO expert on Maternal and Child Health, was on the island organising MCH services, which were already functioning well at the time of our survey, especially as regards growth surveillance. With her help and that of the dresser, Professor Raoult in 3 hours examined 46 infants and pre-school children and 43 schoolchildren.

Part of the population is of Polynesian extraction, and its seafaring traditions are still very much alive : fishing from sailing canoes is a common practice, and large amounts of fish are eaten.

A summary of our clinical findings is given on the following page.

Ahamb Village

Summary of clinical findings

Number examined (boys + girls) Total : 89	0-5 ms 5	6-11 ms 4	12-35 ms 27	36-59 ms 10	Total 0-5 ys 46	6-9 ys 18	10-13 ys 14	13-18 ys 11
Anaemia (moderate & severe) %		3 75%	8 29.5%	3 30%	14 30.4%	4 22.2%	2 14.3%	2 18.2%
Enlarged spleen %			1 3.7%	1 10%	2 4.3%	1 5.6%	5 35%	2 18.2%
P C M - moderate - severe % severe % total PCM			3 2 7.4% 18.5%					
Dyspigmentation of hair %			5 18.5%	3 30%		8 44%	2 14.3%	
Abnormal hair growth %			1 3.7%	2 20%		3 16%	2 14%	
Enlarged Parotids %			1 3.7%	2 20%	3/37 from 1-5 ys 3.1%			
Enlarged liver %	1 20%	1 25%	9 33%	5 50%		9 50%	7 50%	1 5.6%
Melanodontia %				1	1/37 2.7%			
Caries				1				1
Riboflavin deficiency				1		1		1
Conjunctival thickening							2	3
Bitot's spot							1	
Pigmented tongue (anaemia)						2	3	1

The nutritional status of this community was far better than that of Unmet and Wala-Rano.

Nevertheless, a nutritional crisis did occur after weaning (between 1 and 3 years) in a significant number of cases (18.5%), and anaemia was very common. Some of the anaemia present seems to be due to malaria, which was still prevalent in the pre-puberty period and early adolescence, as shown by the spleen enlargement figures. Intestinal parasites are a probable contributing factor, but their impact could not be evaluated in the short time available. Prevalence of liver enlargement, a symptom suggestive both of malaria and of nutritional disorders, was high up to 13 years of age (50%) and then fell sharply.

Parotid enlargement was significant only in the 3 to 5 year age-group, and then disappeared altogether, which contrasts with our findings for the other areas surveyed.

Riboflavin and other vitamin deficiencies were negligible.

The most striking clinical feature was the excellent condition of teeth and gums. Only 2 cases of caries and 1 case of melanodontia were detected, the latter being the lowest figure recorded in the New Hebrides.

Whether food and water on this little island have a particularly high fluoride content we could not ascertain, but the preponderance of fish in the local diet certainly to a great extent accounts for the remarkable dental state of the children examined.

Ahamb would lend itself to further investigations, based on body measurements. We were most impressed by the fine physique of the school-children, especially the teenage boys, as well as by their vivacity and vitality. Education is beginning to bear fruit in this village, which is tidy and far cleaner than any of the others we saw.

These brief surveys outside the pilot areas highlight the great diversity of conditions that may co-exist within the same island, and show how difficult it is to extrapolate from data collected in one or two places. However, basically, the problems encountered were the same all over Malekula.

The weaning crisis was a matter for grave concern in each of the communities surveyed. Where subsequent food intake is adequate in quality and quantity, sequelae of infant malnutrition are mild and rapidly disappear; where it is not, they tend to be more severe and persistent.

The most notable differences between villages seem to stem from the environment. This is clearly apparent at Unmet, where malaria - the main factor of overall deficiency in this case - remains endemic because of the swampy coastal plain on which the Big Nambas settled when they migrated from their mountainous, incomparably healthier, homelands. Ahamb, on the other hand, illustrates the benefits derived from fishing, which is a Polynesian tradition and thus, unfortunately, not widespread in the New Hebrides.

PART VI

COMMENTS ON SOME CLINICAL SYMPTOMS SUGGESTIVE OF MALNUTRITION

Nutritional imbalance or deficiency, occurring after the weaning crisis or, in later life, during periods of gross malnutrition/under-nutrition, is always accompanied by clinical signs, some of which deserve special consideration.

They are : nutritional parotidosis (parotid enlargement), hepatomegaly (liver enlargement), abnormal hair growth (pilosis) and melanodontia. Though less well known and less spectacular than the symptoms of Kwashiorkor (severe protein malnutrition), these manifestations, when associated in the same child, as they frequently are, constitute a true malnutrition syndrome.

Children showing one or more of these symptoms are nearly always discovered to be retarded in stature and skull development, but not necessarily in weight. A full study of these symptoms and their inter-relationships may be found in our report dealing with the Aitutaki (Cook Islands) pilot area, chapter VII, page 70.

Parotidosis is a painless, bilateral enlargement of the parotid glands. The swelling may vary in size and consistency; generally the glands are quite firm, even sclerous. This condition, which should be looked for systematically during clinical examination, is thought to be due to protein shortage resulting from undernutrition, or to an imbalance between protein and carbohydrate intakes, with the latter being disproportionately high.

Far from being merely a localised lesion, parotidosis was found to be associated with growth retardation (cf.graphs for height and head circumference of Wala-Rano, Norsup and Amelvet children, as well as tables 10, 11, 12, 13 and 14). The action of the parotids, glands that are biologically very similar to the pancreas which is known to be adversely affected by protein malnutrition, calls for further investigation, but the link between growth retardation and protein deficiency is well recognized.

In order to elucidate the relationship between parotidosis and pre-diabetic conditions, as well as the metabolic interaction of the pancreas and the parotids, we are planning to undertake special research on this subject in the SPC pilot areas, with the assistance of University laboratories in New Zealand and France.

Among children recovering from malnutrition, abnormal facial hair growth - over the forehead, on the cheeks and along the jaw bones - was a common feature, and often associated with growth retardation.

Hepatomegaly or liver enlargement also occurred in many children, but cannot be put down to purely nutritional causes in Malekula, because malaria - a common conditioning factor - is endemic.

Melanodontia, a disorder affecting enamel formation of the deciduous teeth, is regarded as a positive sign of PCM of early childhood, but, in Malekula, the number of children displaying this symptom was too small to be useful for statistical purposes.

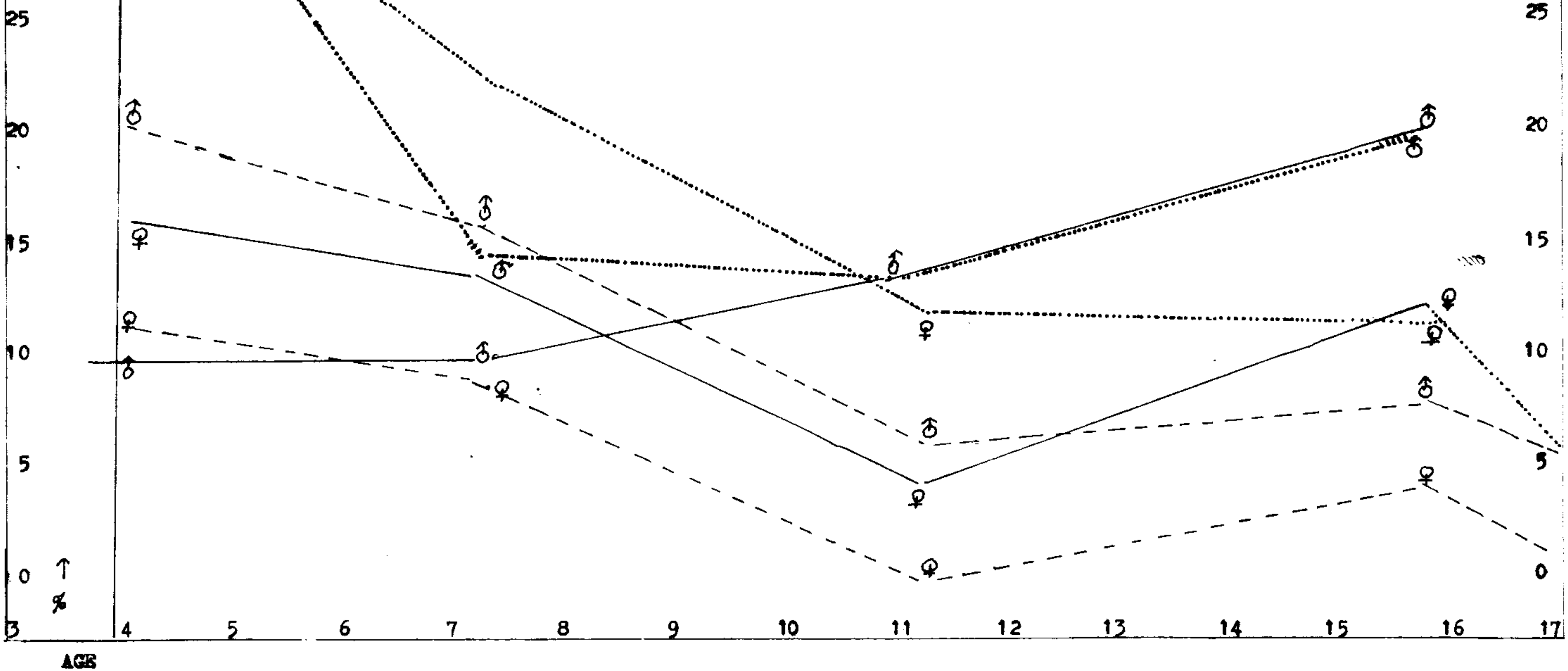
The main value of these four symptoms resides in the fact that they are identifiable by clinical examination. This is no mean advantage in a country like the New Hebrides, where laboratory facilities are not readily available.

Detection of these symptoms is well within the scope of a trained nurse, which would allow remedial measures to be taken early enough - during infancy or, at the latest, on school entrance - to prevent lasting damage.

WALA RANO - New Hebrides
WALA RANO - Nouvelles-Hébrides

Figure n° 9 - Prevalence by age group of clinical symptoms related to malnutrition in a Melanesian population.
Prévalence selon l'âge de signes cliniques en relation avec la malnutrition dans une population mélanésienne.

SPC report on pilot areas in the New Hebrides.
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.



MALLICOLO/MALEKULA - PAROTIDOSES/PAROTIDOSIS

Groupe d'âge/ Age group	WALA-RANO								NORSUP							
	FILLES / GIRLS			GARCONS / BOYS			Total exam.	% Par.	FILLES / GIRLS			GARCONS			Total exam.	% Par.
	Exam.	Par.	%	Exam.	Par.	%			Exam.	Par.	%	Exam.	Par.	%		
2 - 3	-	-	-	-	-	-	14	20,4	-	-	-	-	-	-	-	-
3 - 5	19	3	15,8	30	3	10	49	12,2	-	-	-	-	-	-	-	-
6 - 9	51	7	13,7	60	6	10	111	11,7	19	0	0	21	3	14,2	40	7,5
10 - 13	42	2	4,8	35	5	14,3	77	9,9	22	2	9	40	1	2,5	62	4,8
14 - 18	36	3	8,3	26	5	20	62	12,9	13	1	7,9	27	2	7,4	40	7,5
Ecoliers/ School age	129	12	9,3	121	16	13,2	250	11,2	54	3	5,6	88	6	6,8	142	6,4
Adultes/ Adults	126	11	8,7	99	0	0	225	4,8								
TAUTU Adultes/ Adults	28	0	0	37	0	0	0	0								

Figure n° 10 - Comparison of prevalence of enlarged parotids in school boys of Wala Rano and Norsup and in adults in Wala Rano and Tautu.

Comparaison de la prévalence des parotidoses chez les Ecoliers de Wala Rano et de Norsup et chez les adultes de Wala Rano et Tautu.

WALA-RANO, Nouvelles-Hébrides : PAROTIDOSES - PILOSITE ANORMALE - HEPATOMEGALIE

WALA-RANO, New Hebrides: PAROTIDOSIS - ABNORMAL PILOSITY - LIVER ENLARGEMENT

Filles Girls Groupes d'âge Age groups Ans Years	Examinés Examined	Indemnes Without symptom	Indemnes % Without symptom	PAROTIDOSES PAROTIDOSIS: Isolée Only symptom	+ Pilosité + Pilosity	+ Foie + Liver	Les 3 signes All 3 symptoms	Total parotides Total parotids	Parotides % Parotids %	PILOSITE ANORMALE ABNORMAL PILOSITY: Isolée Only symptom	+ Parotide + Parotid	+ Foie + Liver	Les 3 signes All 3 symptoms	Total pilosité Total pilosity	Pilosité % Pilosity %	HEPATOMEGALIE LIVER ENLARGEMENT: Isolée Only symptom	+ Pilosité + Pilosity	+ Parotide + Parotid	Les 3 signes All 3 symptoms	Total hépatomégalie Total liver enlarg.	Hépatomégalie % Liver enlarg. %
Signe Sign		•	•	x	(x)	x	(x)	X		(•)	(x)	(•)	(x)	( )		-	(•)	x	(x)	—	
3 - 4	6	2	33 %	0	1	0	1	2	33,3 %	2	1	0	1	4	66,6 %	0	0	0	1	1	16 %
4 - 5	13	9	59 %	0	0	0	1	1	7,7 %	2	0	0	1	3	23 %	0	0	0	1	1	7,7 %
3 - 5	19	11	58 %	0	1	0	2	3	15,8 %	4	1	0	2	7	36,8 %	0	0	0	2	2	10,5 %
5 - 6	12	4	33,3 %	1	1	0	1	3	25 %	3	1	0	1	5	41,7 %	0	0	0	1	1	8,3 %
6 - 7	19	16	16 %	0	1	0	1	2	10,5 %	1	1	-	1	3	15,8 %	0	0	0	1	1	5,3 %
7 - 8	10	5	50 %	0	0	0	1	1	10 %	3	-	-	1	4	40 %	0	0	0	1	1	10 %
8 - 9	10	6	60 %	0	0	0	1	1	10 %	3	0	1	1	5	50 %	0	1	0	1	2	20 %
5 - 9	51	31	60 %	1	2	0	4	7	13,7 %	10	2	1	4	17	33,3 %	0	1	0	4	5	9,8 %
9 - 10	12	9	45 %	0	0	0	1	1	8,3 %	2	0	0	1	2	25 %	0	0	0	1	1	8,3 %
10 - 11 11 - 12	19	18	94,7 %	0	1	0	0	1	5,3 %	1	1	0	0	2	10,6 %	0	0	0	0	0	0 %
12 - 13	11	10	90,9 %	0	0	0	0	0	0 %	1	0	0	0	1	9,1 %	0	0	0	0	0	0 %
9 - 13	42	37	88,1 %	0	1	0	1	2	4,8 %	4	1	0	1	6	14,3 %	0	0	0	1	1	2,4 %
13 - 14	12	10	83,3 %	0	0	0	2	2	16,7 %	0	0	0	2	2	16,7 %	0	0	0	2	2	16,7 %
14 - 15	11	10	90 %	0	0	0	0	0	0 %	2	0	0	0	2	18,2 %	0	0	0	2	2	18,2 %
15 - 16	13	12	92,3 %	0	1	0	0	1	7,7 %	0	1	0	0	1	7,7 %	0	0	0	0	0	0 %
13 - 16	36	32	88,9 %	0	1	0	2	3	8,3 %	2	1	0	2	5	13,9 %	0	0	0	4	4	11,1 %

Figure n°11 : Comparative prevalence among GIRLS of a group of clinical symptoms associated with malnutrition in Wala Rano: Parotid enlargement - Pilosity - Hepatomegaly.

Prévalence comparée d'un groupe de symptômes cliniques associés à la malnutrition à Wala Rano : Parotidoses - Pilosité - Hépatomégalie (Filles) - Septembre 1974.

WALA-RANO, Nouvelles-Hébrides : PAROTIDOSES - PILOSITE ANORMALE - HEPATOMEGALIE

WALA-RANO, New Hebrides: PAROTIDOSIS - ABNORMAL PILOSITY - LIVER ENLARGEMENT

Garçons Boys Groupes d'âge Age groups Ans Years	Examinés Examined	Indemnes Without symptom	% Indemnes % Without symptom	PAROTIDOSES PAROTIDOSIS Isolée Only symptom	+ Pilosité + Pilosity	+ Foie + Liver	Les 3 signes All 3 symptoms	Total parotides Total parotids	Parotides % Parotids %	PILOSITE ANORMALE ABNORMAL PILOSITY Isolée Only symptom	+ Parotide + Parotid	+ Foie + Liver	Les 3 signes All 3 symptoms	Total pilosité Total pilosity	Pilosité % Pilosity	HEPATOMEGALIE LIVER ENLARGEMENT Isolée Only symptom	+ Pilosité + Pilosity	+ Parotide + Parotid	Les 3 signes All 3 symptoms	Total hépatomégalie Total liver enlarg.	Hépatomégalie % Liver enlarg. %
Signe Sign		•	•	x	(x)	x	(x)	X		(•)	(x)	(•)	(x)	○		-	(•)	x	(x)	—	
3 - 4	18	9	50 %	0	0	0	1	1	5,6 %	2	0	0	1	3	16,8 %	0	0	0	1	1	5,6 %
4 - 5	12	4	33,3 %	0	0	0	2	2	16,7 %	3	0	3	2	8	66,7 %	0	2	0	3	5	41,7 %
3 - 5	30	13	44,8 %	0	0	0	3	3	10 %	5	0	3	3	11	36,7 %	0	2	0	4	6	20 %
5 - 6	13	8	61,5 %	0	0	0	2	2	15,4 %	0	0	2	2	4	30,8 %	0	2	0	2	4	30,8 %
6 - 7	17	9	52,9 %	0	0	0	0	0	0 %	2	0	1	0	3	17,6 %	0	1	0	0	1	5,9 %
7 - 8	14	8	57,1 %	0	0	1	0	1	6,7 %	1	0	1	0	2	14,3 %	0	1	1	0	2	14,3 %
8 - 9	16	9	56,3 %	0	0	0	3	3	18,8 %	1	0	0	3	4	25 %	0	0	0	3	3	25 %
5 - 9	60	34	56,7 %	0	0	1	5	6	10 %	4	0	4	5	13	15 %	0	4	1	5	10	16,7 %
9 - 10	9	8	89 %	0	0	0	0	0	0 %	1	0	0	0	1	11 %	0	0	0	0	0	0 %
10 - 11	8	8	100 %	0	0	0	0	0	0 %	0	0	0	0	0	0 %	0	0	0	0	0	0 %
11 - 12	8	7	75 %	1	0	0	0	1	12,5 %	0	0	0	0	0	0 %	0	0	0	0	0	0 %
12 - 13	10	5	50 %	1	1	0	2	4	40,4 %	1	1	0	2	4	40 %	0	0	1	2	3	30 %
9 - 13	35	28	80 %	2	1	0	2	5	14,3 %	2	1	0	2	5	14,3 %	0	0	1	2	3	8,6 %
13 - 14	8	6		0	1	1	0	2	25 %	1	1	0	0	2	25 %	0	0	1	0	1	12,5 %
14 - 15	4	4		0	0	0	0	0	0 %	0	0	0	0	0	0 %	0	0	0	0	0	0 %
15 - 16	6	5		0	1	0	0	1	16,7 %	0	1	0	0	1	16,7 %	0	0	0	0	0	0 %
16 - 17	8	6		0	2	0	0	2	25 %	0	2	0	0	2	25 %	0	0	0	0	0	0 %
13 - 17	26	21	80,8 %	0	4	1	0	5	20 %	1	4	0	0	5	20 %	0	0	1	0	1	3,8 %

Figure n° 12 - Comparative prevalence among boys of a group of clinical symptoms associated with malnutrition in Wala Rano: Parotid enlargement, Pilosity - Hepatomegaly - Sept. 1974.

Prévalence comparée chez les garçons d'un groupe de symptômes cliniques associés à la malnutrition - Parotidoses - Hépatomégalie - Pilosité.

WALA-RANO

(Garçons)
(Boys)

RELATIONS ENTRE LA TAILLE ET CERTAINS SYMPTOMES CLINIQUES

RELATIONS BETWEEN HEIGHT AND A NUMBER OF CLINICAL SYMPTOMS

(Parotidoses - Pilosité anormale - Hépatomégalie)
(Parotidosis - Abnormal pilosity - Liver enlargement)

Groupe d'âge	3 - 4 3 ½	4 - 5 4 ½	5 - 6 5 ½	6 - 7 6 ½	7 - 8 7 ½	8 - 9 8 ½	9 - 10 9 ½	10 - 11 10 ½	11 - 12 11 ½	12 - 13 12 ½	13 - 14 13 ½	14 - 15 14 ½	15 - 16 15 ½	16 - 17 16 ½
Taille (en cm) Médiane de référence (IOWA, U.S.) Length (in cm) Reference standard (IOWA, U.S.)	102	107,5	114	121	126	133,5	138	143	148	153	159	165	170	171
Sans signes **Without symptoms**	98	97,5	107,5	114	119	123	130	137,5	132,5	140	142,5	152,5	160	161
Différence/Difference:	- 4	- 10	- 6,5	- 7	- 7	- 9,5	- 8	- 4,5	- 5,5	- 13	- 16,5	- 12,5	- 10	- 10
Avec parotidoses (isolées ou associées) **With parotidosis** (only symptom or in conjunction with other symptoms)	93	96	105	0	118	115	0	0	130	131	137,5	0	147,5	155
Différence/Difference: (avec standard U.S./ (with U.S. standard:	- 9	- 11,5	- 9	-	- 8	- 12,5	-	-	- 18	- 22	- 21,5	-	- 22,5	- 15
(avec standard local/ (with local standard:	- 5	- 1,5	- 2,5	-	- 1	- 3	-	-	- 12,5	- 9	- 5	-	- 12,5	- 5
Avec pilosité (isolée) **With pilosity** (only symptom)	92,5	100	105	111	112,5	117,5	130	0	0	131	0	0	0	non valable chez les garçons
Différence/Difference: (avec standard U.S./ (with U.S. standard:	- 9,5	- 7,5	- 9	- 10	- 15,5	- 16	- 8	0	0	- 22	0	0	0	
(avec standard local/ (with local standard:	- 5,5	+ 2,5	- 2,5	- 3	- 8,5	- 6,5	- 0 -			- 9				
Avec hépatomégalie **With liver enlargement**	93	95	97,5	107,5	111	115	0	0	0	130	135	0	0	0
Différence/Difference: (avec standard U.S./ (with U.S. standard:	- 9	- 12,5	- 18,5	- 13,5	- 15	- 18,5	-	-		- 23	- 24	-	-	-
(avec standard local/ (with local standard:	- 5	- 2,5	- 8	- 6,5	- 8	- 9	-	-		- 10	- 7,5	-	-	-

Figure n° 13 - Retards de taille chez les garçons de Wala Rano présentant des symptômes cliniques en relation avec la malnutrition - Parotidoses - Hépatomégalie - Pilosité -

Height retardation among boys in Wala Rano, showing clinical symptom related to malnutrition - Parotidosis - Hepatomegaly - Pilosity -

WALA-RANO

(Filles)
(Girls)

RELATIONS ENTRE LA TAILLE ET CERTAINS SYMPTOMES CLINIQUES

RELATIONS BETWEEN LENGTH AND A NUMBER OF CLINICAL SYMPTOMS

(Parotidoses - Pilosité anormale - Hépatomégalie)
(Parotidosis - Abnormal pilosity - Liver enlargement)

Groupe d'âge	3 - 4 3 ½	4 - 5 4 ½	5 - 6 5 ½	6 - 7 6 ½	7 - 8 7 ½	8 - 9 8 ½	9 - 10 9 ½	10 - 11 11 - 12 10 ½ 11 ½	12 - 13 12 ½	13 - 14 13 ½	14 - 15 14 ½
Taille (en cm) Médiane de référence (IOWA, U.S.) Length (in cm) Reference standard (IOWA, U.S.)	100	106	112,5	118	125	130	136	145	158	162	163
Sans signes **Without symptoms**	95	100	105	113	116	125	125	138	142,5	145	152,5
Différence : Difference :	- 5	- 6	- 7,5	- 5	- 9	- 5	- 11	- 7	- 15,5	- 17	- 11,5
Avec parotidoses (isolées ou associées) **With parotidosis** (only symptom or in conjunction with other symptoms)	92,5	104	102,5	110	112,5	118	120	130	0	131	0
Différence : Difference :	- 7,5	- 2	- 10	- 8	- 12,5	- 12	- 16	- 15	-	- 31	-
Avec pilosité (isolée) **With pilosity** (only symptom)	-	100	105	105	115	121	125	135	-	-	150
Différence : Difference :		- 6	- 7,5	- 13	- 9	- 9	- 11	- 10	-	-	- 13,5
Avec hépatomégalie **With liver enlargement**	92,5	100	102,5	107,5	112,5	115	120	-	-	131	-
Différence : Difference :	- 7,5	- 6	- 10	- 11,5	- 12,5	- 15	- 16	-	-	- 31	-

Figure n° 14 - Retards de taille chez les Filles de Wala Rano présentant des symptômes cliniques en relations avec la malnutrition : Parotidoses - Pilosité - Hépatomégalie - Septembre 1974.

Growth retardation among GIRLS in Wala Rano, showing clinical symptoms related to malnutrition: Parotidosis - Pilosity - Hepatomegaly.

PART VII

SUMMARY OF NUTRITION PROBLEMS ENCOUNTERED IN MALEKULA

Serious nutritional problems occur at every stage of life, and form a sort of chain, each problem linking up with the following one. They are caused by two sets of inseparable factors:

- internal factors, including diet and assimilation of nutrients;
- external factors, connected with the environment.

The nutritional status of any individual or community is the outcome of the interplay of both these sets of factors, and remedial action, in order to be effective, should be applied to both simultaneously or in close succession.

Priority must be given to the most vulnerable sections of the community: infants, pregnant women, nursing mothers and elderly people, without, of course, neglecting primary-school-age children, who are in a period of slow growth where prevention and correction of deficiencies is comparatively easy, nor adolescents, who are at a stage of rapid development and thus require special protection.

1. Infants and pre-school children

Body measurements and clinical data combine to show that development of Malekula children is satisfactory, in relation to international standards of reference, during the first 8 months of life. During this period infants are usually breast-fed, which means that their state of nutrition reflects their mothers' physical condition. The only noteworthy pathological feature is the high incidence, in this age-group, of iron-deficiency anaemia. The average haemoglobin level for infants between 0 and 11 months was 61% (cf. Dr Ratard's report, Annex I).

These infants could normally be expected to follow standard growth curves in their subsequent development.

<u>The nutritional crisis</u> occurs when breast-milk alone ceases to cover the baby's needs, particularly its calorie requirements. It becomes acute between 18 and 24 months, i.e. after complete weaning, when the infant does not receive anywhere near the amounts of protein and calories necessary for its defence system, while at the same time being increasingly exposed to infection.

The most common diseases in this area are:

(a) malaria,
(b) gastroenteritis and diarrhoea,
(c) communicable diseases of childhood (measles, whooping cough and others),
(d) intestinal parasitism.

All these infections, which may be termed environmental aggressions, were prevalent at the time of our survey. The infant mortality rate (0 to 5 years) for Wala-Rano was estimated at 57/1000 (over a 3-year period), in spite of the existence of an efficient dispensary in the area itself, and of Norsup Hospital not far away.

The nutritional crisis may lead to :

- protein-calorie malnutrition (PCM), but rarely in its severe forms in this area, which explains why it is generally disregarded; or

- overall undernutrition, with often considerable retardation in all growth parameters: weight, skinfold thickness, arm circumference, head circumference and height.

The most vulnerable stage is the period between 16 and 30 months: approximately 30% of the children in this age-bracket were found to suffer from severe undernutrition. In addition to"benign" clinical signs such as hair dyspigmentation, multiple vitamin shortages (particularly riboflavin deficiency) were frequently observed in this group, whereas they were most uncommon in the rest of the population, and the incidence of anaemia was very high. The critical period may extend beyond 3 years and up to 5 years (we found 2 cases of "late" PCM).

Nutritional recovery begins around 30 months, as can be seen from the growth curves, and is quite marked - though far from complete - at 3 years. At this age, signs of physiological disturbance, such as enlarged parotid glands, abnormal hair growth, enlarged liver (partly caused by malaria), and the consequences of faulty maturation of tooth enamel: melanodontia, make their appearance. Recovery is, in many cases, still incomplete by the time children enter school.

The foregoing remarks apply to Tautu and Wala-Rano, but our rapid surveys of Unmet and Ahamb, as well as several brief visits to other places, indicate that the same types of problems exist throughout Malekula.

However, while being similar in nature, in degree the problems vary considerably Wala-Rano and Tautu are privileged in comparison with certain isolated villages where medical care is inadequate or where environmental conditions are particularly trying.

The most serious situation was encountered at Unmet, with severe PCM found in 26% of 1 to 3 year old children, early occurrence of parotid enlargement (15.8% in 4 to 5 year olds) and liver enlargement (34% in 1 to 5 year olds), and a relatively high rate of melanodontia (21% in 4 and 5 year olds). Dietary inadequacies are not solely to blame in this case, for malaria constitutes an important additional factor: spleen enlargement was detected in 46% of 0 to 5 year old children.

The best nutritional status was seen in Ahamb. Though PCM occurred in 18% of the children, it was of shorter duration, after-effects (parotid enlargement in particular) were rare, and melanodontia virtually non-existent. Satisfactory nutritional recovery was achieved before school-age, but anaemia due to malaria and intestinal parasites was common up to adolescence.

2. Schoolchildren

Comparison of body measurements for schoolchildren in Tautu, Wala-Rano, Amelvet and Norsup showed considerable retardation in weight, skinfold thickness, and arm circumference values, together with some stunting of stature and head growth. This can be clearly seen on the relevant graphs. Some recovery takes place just before or during puberty, but most children never reach accepted standards and a significant fraction remains very far below, which could account for the shortish stature of male and female adults.

This comparison further showed that the Norsup School boarders, who receive copious and well-balanced meals, are, in all parameters, far ahead of the Wala-Rano School day-pupils, though there is no ethnic or genetic difference between them. Malnutrition sequelae were fewer in the Norsup group and recovery during the pre-puberty period was satisfactory.

The clinical picture at Amelvet was worse than in Wala-Rano, probably because environmental conditions were less propitious, with dietary patterns being much the same.

Unmet schoolchildren were the most underprivileged of all : 76% of the 6 to 9 year olds were distinctly anaemic, 30.8% showed malarial spleen enlargement and 19% had enlarged parotid glands.

As was the case for infants and pre-school children, nutritional status of schoolchildren was highest at Ahamb where, despite persistent malaria (spleen enlargement still occurred in 35% of 10 to 13 year old children), physical development and general vitality were found to be excellent, and teeth remarkably sound, which is certainly due to consumption of large amounts of fish and other seafoods.

Our surveys of school-age children and adolescents demonstrated that clinical symptoms of chronic malnutrition and its sequelae are usually associated with stunting of stature and head growth. Parotid enlargement, liver enlargement, melanodontia and abnormal hair growth objectify the long-term consequences of malnutrition.

3. Adults

Men were, generally speaking, vigorous and well-developed, but below standard in stature. Obesity and hypertension were very uncommon. Blood levels of cholesterol, triglycerids, albumin, urea and uric acid were normal. Nevertheless, eye examination revealed a tendency to early senility and comparatively few men live beyond the age of 55. Severe anaemia was found in elderly men.

Women were also rather short but of normal weight for height. Overweight was more common than in men (approx. 20%) as were high blood pressure and cholesterol levels. The women's main health problem was anaemia during pregnancy and breast-feeding .

In both sexes, the major vitamin deficiencies (A, D, C, B1 and PP) were rare, with the exception of riboflavin (B2) deficiency, resulting from inadequate intake of foods of animal origin.

Unlike many other Pacific islands, Malekula has virtually no dental problem, presumably because the presence of fluoride in food and water protects teeth against decay; (mild fluorosis occurred in all areas visited). Periodontal diseases with pyorrhoea appeared quite early, on the other hand, frequently leading to complete loss of teeth around 50 years of age.

Skin hygiene was poor and fungus infections (pityriasis versicolor) very prevalent.

4. Remedial action should include:

(1) Health education at village level, and particularly within the schools.

(2) Close growth surveillance (regular weighing and measuring), especially during periods of rapid growth.

(3) Distribution of nutrient supplements (iron - folic acid) systematically to pregnant women and nursing mothers, and selectively (to deficient subjects) in other groups; protein supplements (milk biscuits for instance) for pre-school and schoolchildren.

(4) Regular de-worming of children above 3 years of age, until improved sanitation makes this unnecessary.

(5) Continuation of malaria control through systematic administration of chemical prophylactics.

(6) Carrying out of sanitation programmes: drinking water - excreta disposal - vector control (mosquitoes, other insects, rats) along the lines suggested by Miss Bushra Jabre and Mr Eric Dunn for Tautu and Wala-Rano pilot areas.

(7) Development of cattle and seafood resources, for the benefit of the local people, which is a matter for economic planning.

However, in relation to the New Hebrides as a whole, programmes undertaken in a specific place can be nothing more than scale models. Many communities - whether under Catholic, Protestant or traditional influence - are far more isolated and underdeveloped than those we surveyed in the Norsup area, and their problems are proportionately greater. An all-out effort should be made to communicate information acquired to administrators, technical officers, educators and all field workers

In addition to the curative services provided by dispensaries and hospitals, detection and prevention of nutritional diseases should figure more prominently in Public and Rural Health programmes, alongside malaria and tuberculosis control and vaccinations, which are already being carried out.

Small-scale systematic surveys are an effective and inexpensive way of keeping a check on the nutritional status of communities and nipping problems in the bud, before they come to a head in the form of severe malnutrition cases, comparable to the emerging tip of an under-sea vulcano, and turn up at the local dispensary or hospital in the throes of an acute episode.

ACKNOWLEDGMENTS

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- the Headmaster of Norsup School, and the teachers;
- Mr J. Lecuyer, French District Agent, Norsup, and his staff;

and extend special thanks to Father Soucy, whose generous assistance and intimate knowledge of Wala-Rano greatly facilitated our work. We hereby ask him to convey our gratefulness to the Mission Sisters and schoolteachers, as well as to all the people of Wala-Rano, and the "team-leaders" in particular.

PART VIII

ORGANIZATION OF HEALTH EDUCATION IN WALA-RANO
(under Nutrition Pilot Project)

1. Objectives

The Educational Programme in Wala-Rano had the following objectives:

(a) to sensitize the population about their health problems as detected by the Medical and Environmental Surveys;

(b) to start a community organization movement through the creation of village health committees;

(c) to work with Father Soucy, the Sisters and the teachers on including nutrition and health education in the school curriculum;

(d) to organize women's clubs.

2. Work Programme

(a) Meetings

- Preliminary meetings were held with :

  Father Soucy,
  Sisters,
  Teachers,
  Dresser,
  Women attending clinic,
  Men.

(b) Small Group discussions

- Girls attending Home Economic Course,
  Rano Women,
  Wala Women,
  Men.

(c) Visits were made to :

- Wala mainland,
  Wala island,
  Co-operative store.

3. Activities undertaken

(a) Explanation of the Survey Findings in all meetings and focusing on the following problem areas:

i) Malnutrition among children.
ii) Village hygiene.

(b) Explanation of the forthcoming activities :

i) Intestinal parasite campaign.
ii) Milk programme
iii) Importance of the village committees.

(c) Setting-up of Women's Clubs in the two villages - Wala and Rano. A local Sister, Soeur Bernardine, who has received training in Tonga in women's activities, would be in charge of the Women's Clubs.

Activities of these clubs would include :

- Production of Handicrafts
- Inspection of villages
- Discussions on Health Subjects.

The women were quite eager to join these clubs and they came to all meetings which were held in the villages. The women decided that it would be more convenient to have the meetings at the Mission.

(d) Setting-up a Home Economics Demonstration Unit

The equipment left in Tautu last year was set up as a cooking demonstration unit at the Mission to be used for the benefit of :

i) Women's clubs,
ii) Home economics students,
iii) Terminal classes (who receive special training adapted to village life).

(e) Health Committees

Village Health Committees were started. It was agreed with Father Soucy that the "14 équipes de travail" who used to work for the Mission (mowing lawns, construction, cleaning, etc.) could be transformed into village health committees to provide actual cleaning of the village. The Chiefs and the men agreed that every Thursday morning would be the village clean-up campaign.

Subjects such as refuse disposal, pit latrines, safe water-supply, pests and rat control were discussed and the men showed great interest and willingness to start on problem-solving efforts.

(f) School Health Education

Programmes were reviewed with the teachers and subjects dealing with existing health conditions were introduced into the programme.

Lessons were prepared in writing for the different programmes and discussed with the teacher in charge.

Emphasis was put on the role of the Parent-Teacher Association in the promotion of the health of the students and in the creation of public consciousness and community action.

4. Health Services

It is understood that health education without the provision of health services leads to nowhere. On this basis a series of health services were planned and started :

(a) An intestinal parasites campaign was launched to include all children above the age of 1 year.

(b) A milk programme was started at the school. Due to the fact that Melanesians do not like the taste of milk, Milo and sugar were added.

(c) After the intestinal parasites campaign, iron solution was added to the milk.

(d) Discussions with the Dresser were made on the importance of a Maternal and Child Care programme.

5. Contacts were made with :

(a) Mr John Taaffee (the Public Health Officer at Lakatoro) who came twice to Wala-Rano to discuss the MCH programme with the Dresser. He provided sufficient quantities of iron tablets, iron solution, vitamin A and D, calcium,and Diabetes and Albumin testsfor the Ante-natal Clinic and instructed the Dresser on how to fill out the appropriate forms. A detailed MCH programme was drawn out.

(b) Mr Aisen Obed (Assistant Health Inspector British National Service) agreed to come and carry out demonstrations on the construction of pit privies in the interim period till the water-supply system (which is under study and for which funds have been allocated) is constructed. He then would help in the construction of water-seal latrines.

6. Activities for the Promotion of Nutrition and Health

Activity	Indi-viduals	School	Women's Activi-ties	Agr. Ext.	Chiefs Village health Commit-tees	Mission Church Council
Promotion of Healthy Living						
Personal cleanliness	x	x	x			x
Safe Water-Supply	x	x	x	x	x	x
Waste disposal	x	x	x	x	x	x
Insect pests and vectors control	x	x	x	x	x	x
Improvement of Nutritional Status						
Vulnerable groups	x	x	x	x	x	x
Pregnant Women)						
Nursing Mothers)						
Infants)						
Children						
Family diet	x	x	x	x	x	x
Food Production	x	x	x	x	x	x
Health Services						
- Vaccinations	x	x	x		x	x
- Endemic disease control	x	x	x		x	x
- Maternal and Child:						
Ante-natal care	x	x	x		x	x
Child care	x	x	x		x	x
- Family Planning	x	x	x	y	x	x

7. Health Education Activities on the Village level

A. Family or Individual Activities

(1) A safe water supply

- Protection of rain water recipients through :

  covering drums,
  keeping them clean,
  installing a faucet, etc.

(2) Observation of home hygiene

- Construction of windows to ensure :

  ventilation,
  proper lighting,
  alleviate damp conditions.

- Food hygiene :

  storage of food-stuffs,
  utensils,
  food safe.

(3) Collection and disposal of garbage

  compost making,
  dumping in land fill.

(4) Penning of pigs and hens.

(5) Control of vectors and insects :

  rats,
  mosquitoes,
  houseflies,
  bed bugs,
  lice.

(6) Construction of pit privies

- keeping them clean.

B. Community Activities

(1) Clean-up campaigns :
- to make sure that garbage does not accumulate to attract :

  rats,
  mosquitoes,
  houseflies, etc.

(2) Cutting down grass and clearing bush near houses.

(3) Making sure that sources of drinking water are not polluted.

(4) Finding community solutions for the alcohol problem.

(5) Encouraging women to attend the Ante-natal and Baby Clinics.

C. Role of the Agriculture Extension School

Health Committees :

(1) Encourage people to diversify their crops.

(2) Encourage people to do more fishing.

(3) Encourage people to raise poultry and increase production of eggs.

D. Role of the Dispensary

(1) To set up a maternal and child health programme.

(2) To lead the community in communicable disease control efforts :

- provide prophylaxis;
- carry out preventive measures;
- instruct community members on preventive measures;
- collaborate with school, Health Committee and Women's Clubs.

(3) Provide Health Education for special groups :

- pregnant women;
- nursing mothers.

(4) In collaboration with Home Economics Course and Women's Clubs, provide demonstrations in :

- child care;
- cooking.

E. Role of Women's Clubs

- Create consciousness among the community in relation to their health needs :

  personal hygiene,
  collective hygiene.

- Provide consumers education and work closely with co-operative store to have 'good foods' available for sale (a list of available items and their prices were made and a list of what could be added or replaced and their available prices were given to the Co-operative Agent.)

- Encourage members to cultivate rich crops (maize, groundnuts, green leaves, carrots, tomatoes, etc.).

- Produce handicrafts.

ANNEX I

CONDOMIMIUM OF THE NEW HEBRIDES

RURAL HEALTH SERVICE

REPORT ON A VISIT TO WALA-RANO (MALEKULA) FROM 7 TO 11 OCTOBER 1974

Dr R. RATARD, Medical Officer in charge of Rural Health Service

The aim of the visit was to assist the South Pacific Commission team, composed of Prof. Raoult and Dr Niiranen, who was conducting a Nutrition Survey in the Wala-Rano area.

Schedule

Monday, 7 October: Travel by air Vila/Norsup, then by car to Wala-Rano.
Tuesday 8, Wednesday 9, Thursday 10: in Wala-Rano.
Friday, 11 October: Return to Vila.

Specimens were taken from a population sample selected by Prof. Raoult, for examination in the field or elsewhere. The following operations were performed :

1. Preparation of blood-smear and thick blood film on slide, for detection of malarial parasite and filaria (one hour after injection of diethyl carbamizine at the dose of 2 mg per kg of body weight).

2. Examination of stool samples.

3. Estimation of haemoglobin levels by the Sahli method (acid haematin).

4. Taking of blood serum samples, for despatch to the "Institut Pasteur", Noumea, with a view to biochemical and serological testing (dengue fever, polio).

(1) Malaria investigation

(a) Overall results

	Slides examined	Number positive	Percentage pos. (plas. index)	PF	PV	PM	Mixed
Wala mainland	122	16	13.1	5	10	1	0
Wala island	57	3	5.3	0	3	0	0
Rano mainland	129	19	14.7	0	17	2	0
Rano island	35	3	8.6	1	2	0	0
Total :	343	41	41.7	6	32	3	0

(b) Results by age-group

	Wala mainland			Wala island			Rano mainland			Rano island			T O T A L		
	Slides ex.	Pos.	%	Slides ex.	Pos.	%	Slides ex.	Pos.	%	Slides ex.	Pos.	%	Slides ex.	Pos.	%
0-11 mths.	5	1	20	1	0	0	2	0	0	0	-	-	8	1	12.5
12-23 mths.	3	0	0	1	0	0	1	0	0	0	-	-	5	0	0
2-4 ys.	4	0	0	3	0	0	10	0	0	1	0	0	18	0	0
5-9 ys.	53	11	21	21	2	9	54	13	24	19	2	10	147	28	19
10-14 ys.	41	3	7	15	0	0	38	4	10	11	1	9	105	8	8
15-19 ys.	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
20 + ys.	16	1	6	16	1	6	24	2	8	4	0	0	60	4	7
Total	122	16	13	57	3	5.3	129	19	14.7	35	3	8	343	41	12

Spleen palpation had been done earlier by Prof. Raoult during clinical examination.

Malaria is mesoendemic in the four areas surveyed. Endemicity is distinctly higher on the "mainland" than on the small islands. The plasmodic index (i.e. percentage of slides bearing Plasmodium parasites) was found to be 13.1% and 14.7% on the mainland, as against 5.3% and 8.6% on the islands. This is a fairly common occurrence in the New Hebrides.

One recent transmission was detected during our October investigation : an infant infected with *P. falciparum*. Transmission has been limited: 14,6% of *falciparum* only, no mixed infection. The 5-9 year age-group is more commonly affected than the older groups. The results obtained in the 0-5 year bracket are not very conclusive because the sample was too small: 8 infants, 5 children between 1 and 2 years, 18 between 2 and 4 years. Distribution of cases was irregular : *P. falciparum* is found at Sanwere, Pura, Jupiter, and Wortatsa, villages that lie close together in North Wala. Only in this area is transmission likely to occur at this time of the year. *P. malariae* is found mainly at Worlev. *P. vivax* is present in several places : North Wala, together with *P. falciparum*, at Worlev, with *P. malariae*, but also at Ili and Bethleem.

(2) Filariasis investigation

Filaria was looked for only in the 10 to 14 year bracket. The population sample being comparatively small and consisting of only one age-group, our findings must be regarded as tentative.

Area	Slides exam.	Pos.	Percentage positive
Wala mainland	41	1	2.4
Wala island	15	0	0.0
Rano mainland	38	1	2.7
Rano island	11	0	0.0
TOTAL	105	2	1.9

These results bear out the assumption that filariasis occurs only on the mainland, where malaria is most prevalent : one case was found in the *falciparum* centre (Sanwere), the other in a *vivax* area (Worlev).

(3) Haemoglobin levels

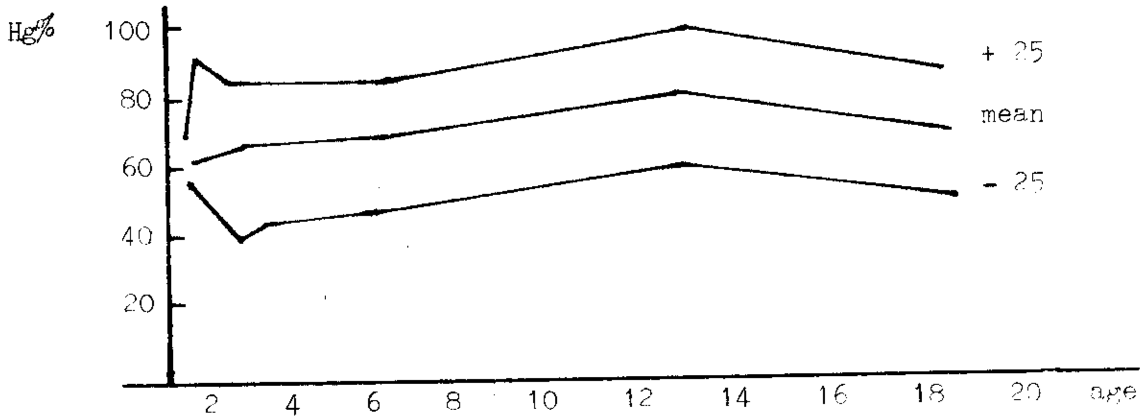
	Wala mainland			Wala island			Rano mainland			Rano island			TOTAL		
	N	M	S	N	M	S	N	M	S	N	M	S	N	M	S
0-11 mths.	5	62	2.8	1	60	-	0	-	-	0	-	-	6	61	2.2
12-23 mths.	4	69	13.4	1	60	-	0	-	-	0	-	-	5	68	12.2
2-4 yrs.	2	64	5.6	2	65	1.4	7.	67	10.8	1	68	-	12	66	8.1
5-9 yrs.	52	70	14.2	20	73	16.0	54	75	14.5	14	66	15.2	139	72	11.5
10-14 yrs.	41	92	7.1	15	91	7.7	35	90	9.8	11	90	8.4	102	91	6.4
15-19 yrs.	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
20 + yrs.	15	74	9.1	15	76	9.1	24	80	12.5	4	82	9.6	57	77	10.1
TOTAL:	119			54			120			30			321		

(N) : number of samples taken

(M) : mean haemoglobin level, expressed as %

(S) : standard deviation.

There was no significant difference between mean haemoglobin levels in each area. On the other hand, mean haemoglobin level varied considerably with age, rising regularly up to adolescence, then dropping at adult age.



(4) Stool examination

198 stool specimens were taken from schoolchildren and examined for intestinal parasites. Results are set out hereunder :

Children 5-9 years	EXAM.	ASC.	ANK.	STR.	TRI.	LAM.	FLA.	MIX.	NEG.
Wala mainland	40	22.5	15.0	2.5	22.5	0.0	7.5	7.5	42.5
Wala island	16	12.5	12.5	0.0	6.2	6.2	0.0	0.0	62.5
Rano mainland	43	18.6	11.6	2.3	2.3	7.0	13.9	2.3	46.5
Rano island	13	30.8	0.0	0.0	23.1	30.8	0.0	7.7	23.1
TOTAL:	112	20.5	11.6	1.8	9.8	7.1	8.0	4.5	44.6
Children 10-14 years	EXAM.	ASC.	ANK.	STR.	TRI.	LAM.	FLA.	MIX.	NEG.
Wala mainland	34	8.8	23.5	2.9	8.8	5.9	5.9	8.8	52.9
Wala island	9	11.1	22.2	0.0	0.0	0.0	0.0	0.0	66.7
Rano mainland	32	15.6	25.0	3.1	9.4	0.0	18.7	6.2	65.6
Rano island	11	45.4	9.1	9.1	9.1	9.1	18.2	9.1	9.0
TOTAL:	86	16.2	22.1	3.5	8.1	3.5	11.6	6.9	41.9
GRAND TOTAL:	198	18.7	16.1	2.5	9.1	5.6	9.6	5.6	43.4

Key to tables

EXAM: total number of stool specimens examined
ASC : % of Ascaris (roundworm) carriers
ANK : % of Ankylostoma (hookworm) carriers
STR : % of Strongyloides carriers
TRI : % of Trichuris (Trichocephalus) carriers
LAM : % of Giardia lamblia carriers

FLA : % of carriers of flagellates other than Giardia lamblia.
MIX : % of specimens containing 2 or more parasite species. These mixed infections were already counted under specific headings.
NEG : % of specimens showing no parasite at all.

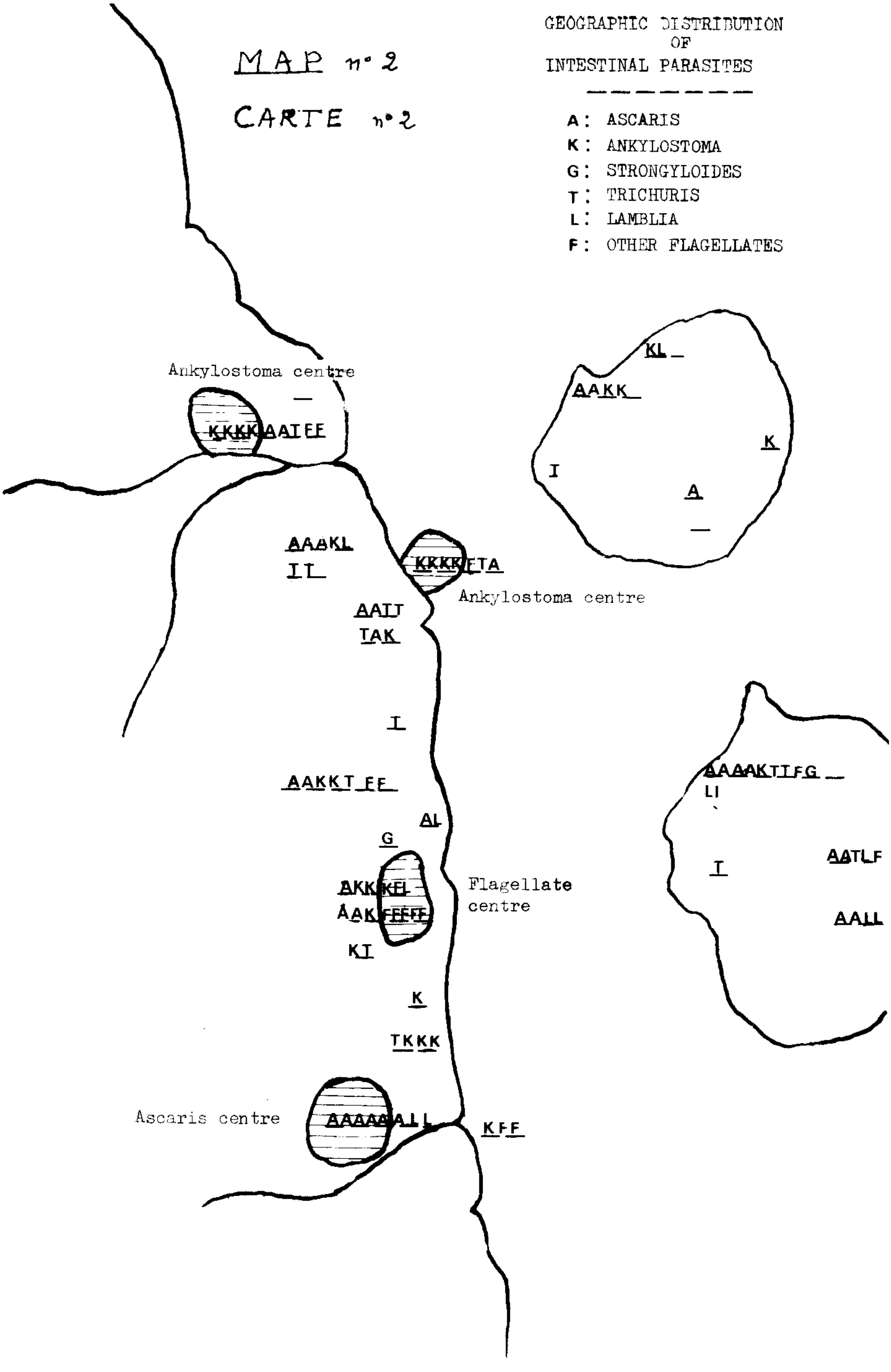
The total ASC + ANK + STR + TRI + LAM + FLA + MIX + NEG is, of course, greater than 100%, since mixed infections were counted several times.

Distribution of intestinal parasites was irregular and there were several centres of infection : at Worlev, prevalence of Ascaris was 50% (average prevalence 20%); at Wormlaki, prevalence of flagellates was 62.5% (average 10%); at Sanwere, prevalence of Ankylostoma was 30.7%, and at Wowute 66.7% (average 16%).

The percentage of parasite carriers was the same for both age-groups, but the distribution of parasites varied with age : more Ascaris and Giardia in the younger children, more Ankylostoma in adolescents.

(5) Blood serum samples

115 blood serum samples were taken and despatched to the "Institut Pasteur" in Noumea.



MAP n° 2
CARTE n° 2
GEOGRAPHIC DISTRIBUTION OF INTESTINAL PARASITES
A : ASCARIS
K : ANKYLOSTOMA
G : STRONGYLOIDES
T : TRICHURIS
L : LAMBLIA
F : OTHER FLAGELLATES
Ankylostoma centre
Ankylostoma centre
Flagellate centre
Ascaris centre

ANNEX II

ADDITIONAL BIOCHEMICAL TESTS FOR WALA-RANO

Blood samples taken during the survey were sent to the Gaston Bourret Hospital, Noumea, where they were analysed, free of charge, by Dr Marc, the Biochemist in charge of the laboratory. Results are shown in Figures A to J2.

Samples were taken at random :

(1) From children in the first two Grades of Wala-Rano School (aged 6 to 9 years).
(2) From male and female adults of all ages.

Results and Comments

(1) Children aged 6 to 9 years

A. Plasma albumin : 60 samples (boys and girls) - Fig. A.

Normal values are those between 45 g and 60 g per 1,000 ml.
The median was 52 g/1,000 ml., i.e. within the normal range.
Extreme values (lowest and highest) : 38 - 68.
6 subjects out of 60, i.e. 10%, had albumin values below 45g/1,000 ml.

The median for subjects with enlarged parotids was 57 g/1,000 ml., which is higher than the overall median and rules out present protein malnutrition.

B. Plasma iron : 40 samples (boys and girls) - Fig. A bis.

Normal values are in the range 30 γ to 100 γ per 1,000 ml.
The median was 35 γ . Extreme values : 10 γ and 88 γ .

15 subjects out of 40, i.e. 37%, had iron values below 30 γ per 1,000 ml., which tallies with the haemoglobin levels estimated by Dr Ratard for the same age-group (139 children : mean hgl level 72%, SD 11.5) and confirms high prevalence of anaemia.

C. Plasma calcium : 26 samples - Fig. C

Normal values are in the range 100 to 120 mg/1,000 ml.
The median was 96 mg/1,000 ml. Extreme values : 90 and 112.

17 out of 26 subjects, i.e. 65.3%, had calcium values below 100 mg/1,000 ml., but none were at an alarmingly low level.

D. Plasma alkaline phosphatase : 52 samples (boys and girls) - Fig.B.

Alkaline phosphatase values are expressed in KAU (King-Armstrong Units).
Values above 25 KAU are regarded as being abnormally high.
The median was 26 KAU. Extreme values : 13 and 43.

The median for subjects with enlarged parotids was the same as for subjects without.

The comparatively high level of alkaline phosphatase is surprising, in view of the complete absence of rickets.

To sum up, the most noteworthy result of the biochemical tests is the low plasma iron level found in 37% of the samples, which confirms haemoglobin estimation data and clinical observation as regards high prevalence of anaemia in children.

(2) Adults

A. Plasma albumin (estimated by electrophoresis)

Men : 26 samples - Fig. D 1.
Normal range : 45 to 60 g/1,000 ml.
Median : 52 g. Extreme values : 45 g and 59 g.

All men were within the normal range.

Women : 25 samples - Fig. D 2.
Median : 48.5 g/1,000 ml. Extreme values : 42 and 57.

8 out of 25 women, i.e. 32% had albumin levels below 45 g.

B. Azotaemia (blood nitrogen level)

Men and Women : 51 samples - Fig. E.
Median : 32 g/1,000 ml. Extreme values : 20 and 75.

The two subjects with enlarged parotids (women), both had a low nitrogen level (20 g.).

C. Cholesterol

Men : 26 samples. Women : 26 samples - Fig F 1 and F 2.
Values above 2.50 g/1,000 ml are regarded as abnormally high.
Median : Men - 1.97 g/1,000 ml. Women : 2.35 g.
Extremes : Men - 1.90 g and 3.02 g. Women : 1.20 g and 3.90 g.

Outside normal range (over 2.50 g/1,000 ml.)

Men : 7/26 = 26.6% Women : 10/26 = 38.5%.

Cholesterol levels were distinctly higher in women.

D. <u>Triglycerides</u> (fasting samples)

Men : 22 samples Women : 26 samples - Fig. H 1 and H 2.
Median - Men : 0.61 g/1,000 ml. Women : 0.53 g/1,000 ml.
Extremes - Men : 0.36 g and 0.90 g. Women : 0.35 g and 1.20 g.

Subjects with enlarged parotids had high levels.

E. <u>Uricaemia</u> (blood uric acid level)

Men : 22 samples Women : 22 samples - Fig. G 1 and G 2.
Median - Men : 49.5 mg/1,000 ml. Women : 44 mg/1,000 ml.
Extremes - Men : 32 mg and 72 mg. Women : 31 mg and 82 mg.

Over 70 mg : Men : 1/22 = 4% Women : 1/22 = 4%

Uric acid levels were low, which bears out our clinical finding that gout was exceedingly rare.

F. <u>Plasma iron</u>

Normal values are those over 50 γ /1,000 ml. for men, and over 40 γ /1,000 ml. for women.

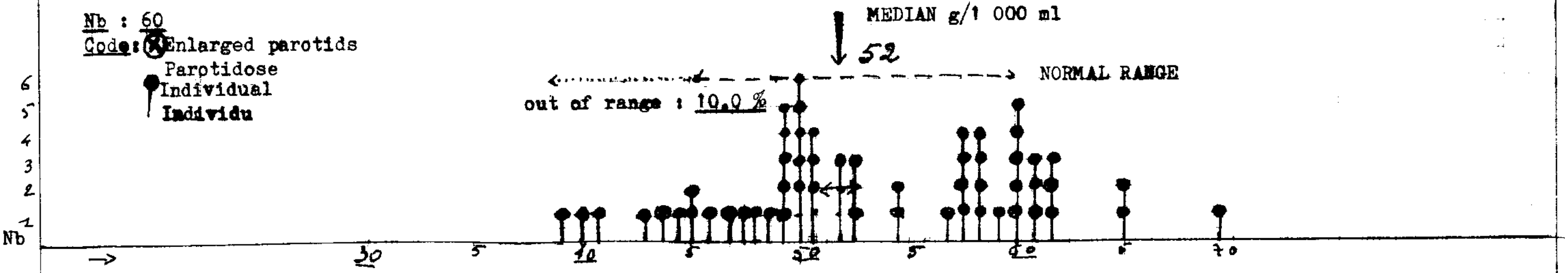
Men : median - 62 γ. Extremes - 43 and 92 γ ; Fig. J 1.
Women : median - 44 γ. Extremes - 10 and 77 γ ; Fig. J 2.
17.7% of men were outside the normal range, i.e. below 50 γ.
42% of women were outside the normal range, i.e. below 40 γ.

Low plasma iron levels indicate high prevalence of anaemia in women, as was the case in children, thus confirming our clinical findings.

<u>N.B.</u> Further interpretation of these results and additional investigations will be undertaken by the author, as part of a special study of metabolic disorders and parotid enlargement, with emphasis on diabetes and associated conditions.

School children - 6-9 years - Boys and girls - SERUM ALBUMIN (Sept.1974).
Ecoliers de 6 à 9 ans - Filles et garçons.

Figure A



School Children 6-9 years - Boys and girls - Plasma Iron -
Ecoliers de 6 à 9 ans - Garçons et filles - Fer sérique -

Figure A bis

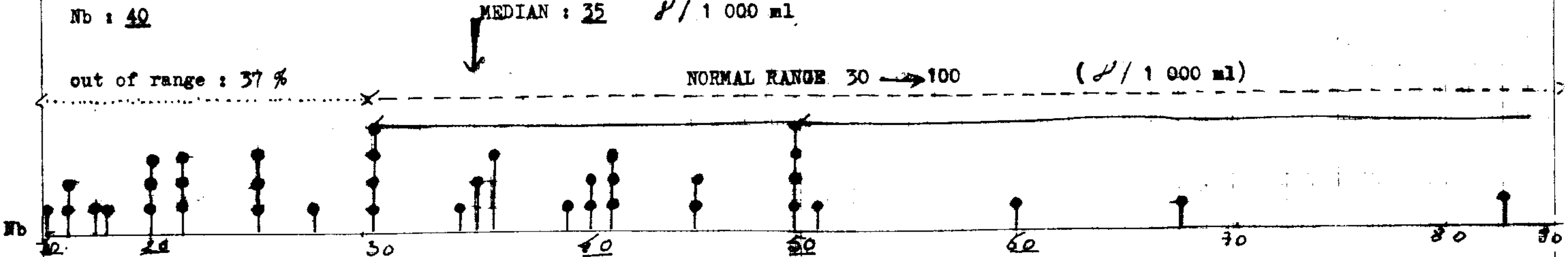
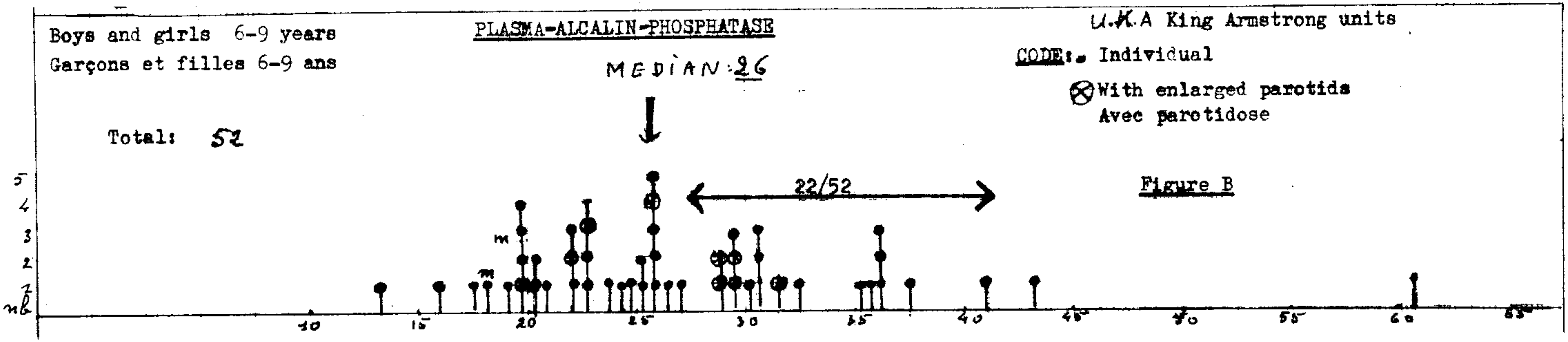
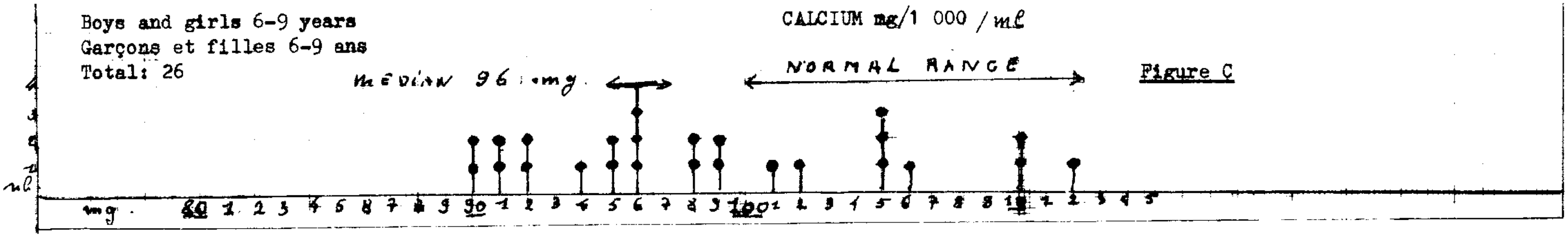


Figure n° A et A-bis - SERUM ALBUMIN and PLASMA IRON in samples of boys and girls 6-9 years in school in Wala Rano (Sept.1974). Melanesian rural population.
Analysis by Dr MARC - Biochemist - Gaston Bourret Hospital - Noumea - SPC Report on pilot areas in New Hebrides.

Albumine sérique et fer sérique dans un échantillon de garçons et filles de 6 à 9 ans à l'Ecole de Wala Rano (sept.1974). Population rurale mélanésienne. Analyses effectuées par le Dr MARC - Biochimiste - Hôpital Gaston Bourret - Nouméa. Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.





Figures n° B + C. Plasma Alkaline Phosphatase / Calcium among schoolboys and girls from Wala Rano - Rural Melanesians population - Sept. 1974.
Plasma - Alcaline - Phosphatase - Calcium : écoliers et écolières de Wala Rano - Mélanésiens ruraux.
Analysis by Dr MARC, Biochemist - Gaston Bourret Hospital - Noumea -
Analyses effectuées par le Dr MARC - Biochimiste - Hôpital Gaston Bourret - Nouméa -
SPC report on pilot areas in New Hebrides -
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

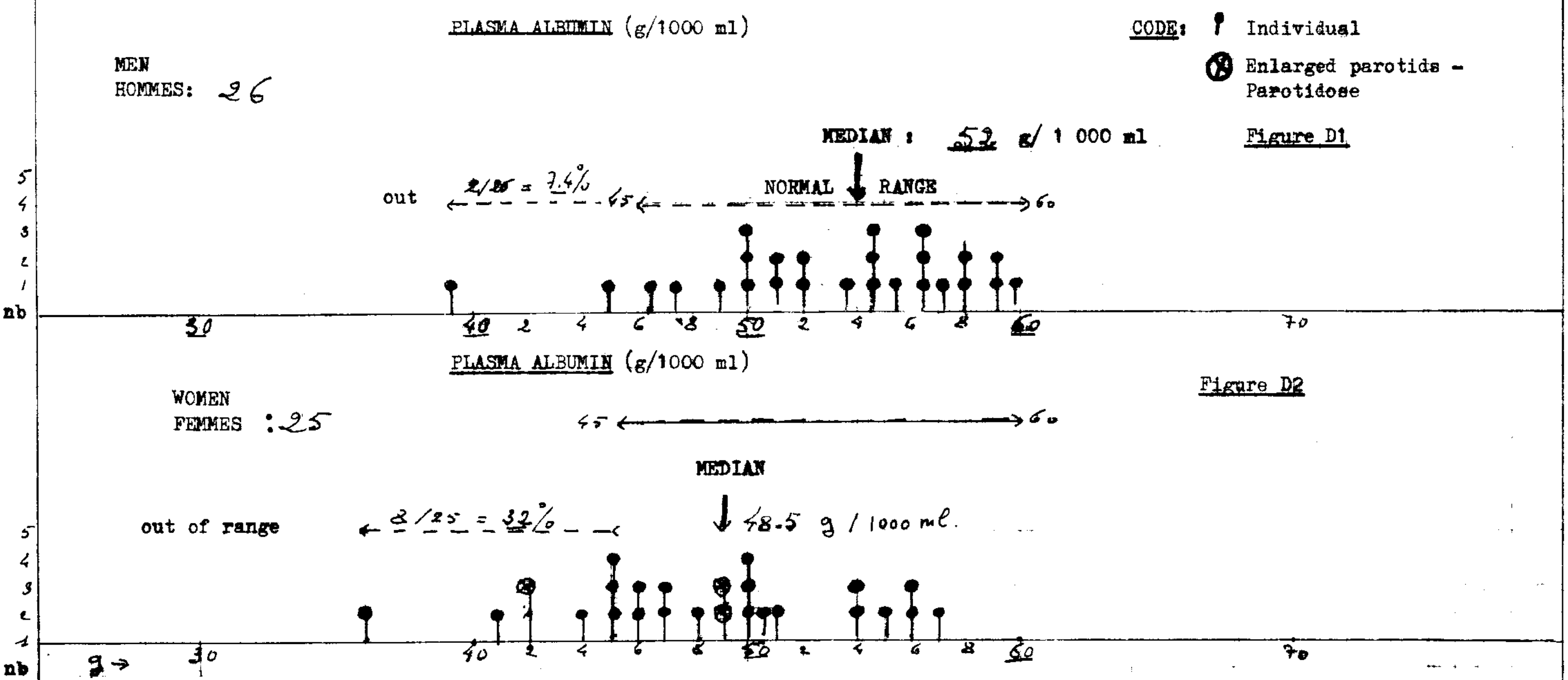


Figure n° D1 - D2 : Plasma albumin in a sample of rural Melanesian population in Wala Rano - Malekula - New Hebrides. (Sept. 1974).
Albumine plasmatique dans un échantillon de population rurale mélanésienne à Wala Rano - Mallicolo - Nouvelles-Hébrides. (Sept. 1974).

Analysis by Dr MARC, biochemist, Gaston Bourret Hospital, Noumea.
Analyses par le Dr MARC, biochimiste, Hôpital Gaston Bourret, Nouméa.

SPC report on pilot areas in New Hebrides.
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

ADULTS : MEN and WOMEN.
ADULTES : HOMMES et FEMMES.

AZOTEMIA (g/1000 ml)

Nb : 51

Figure E

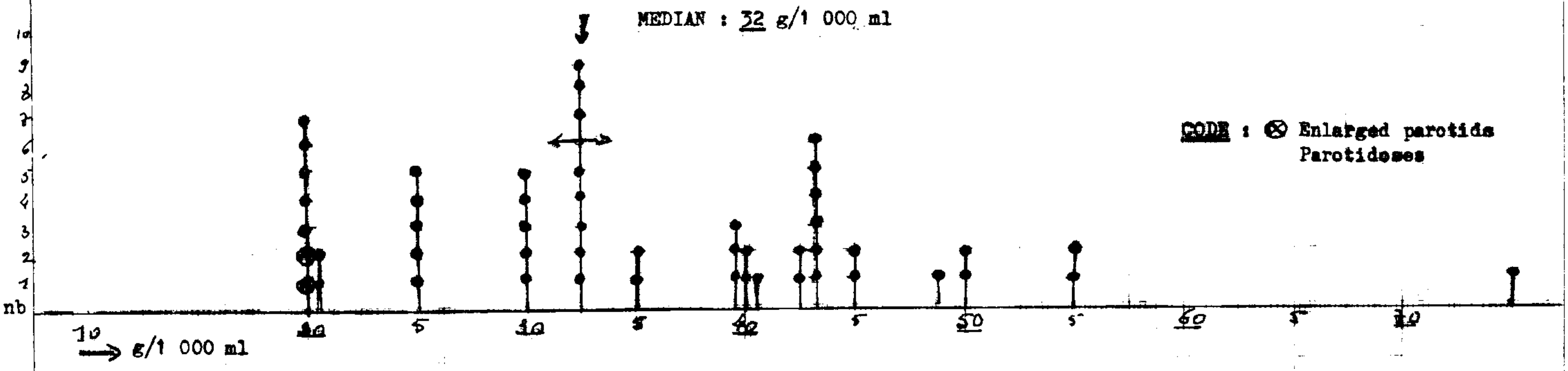
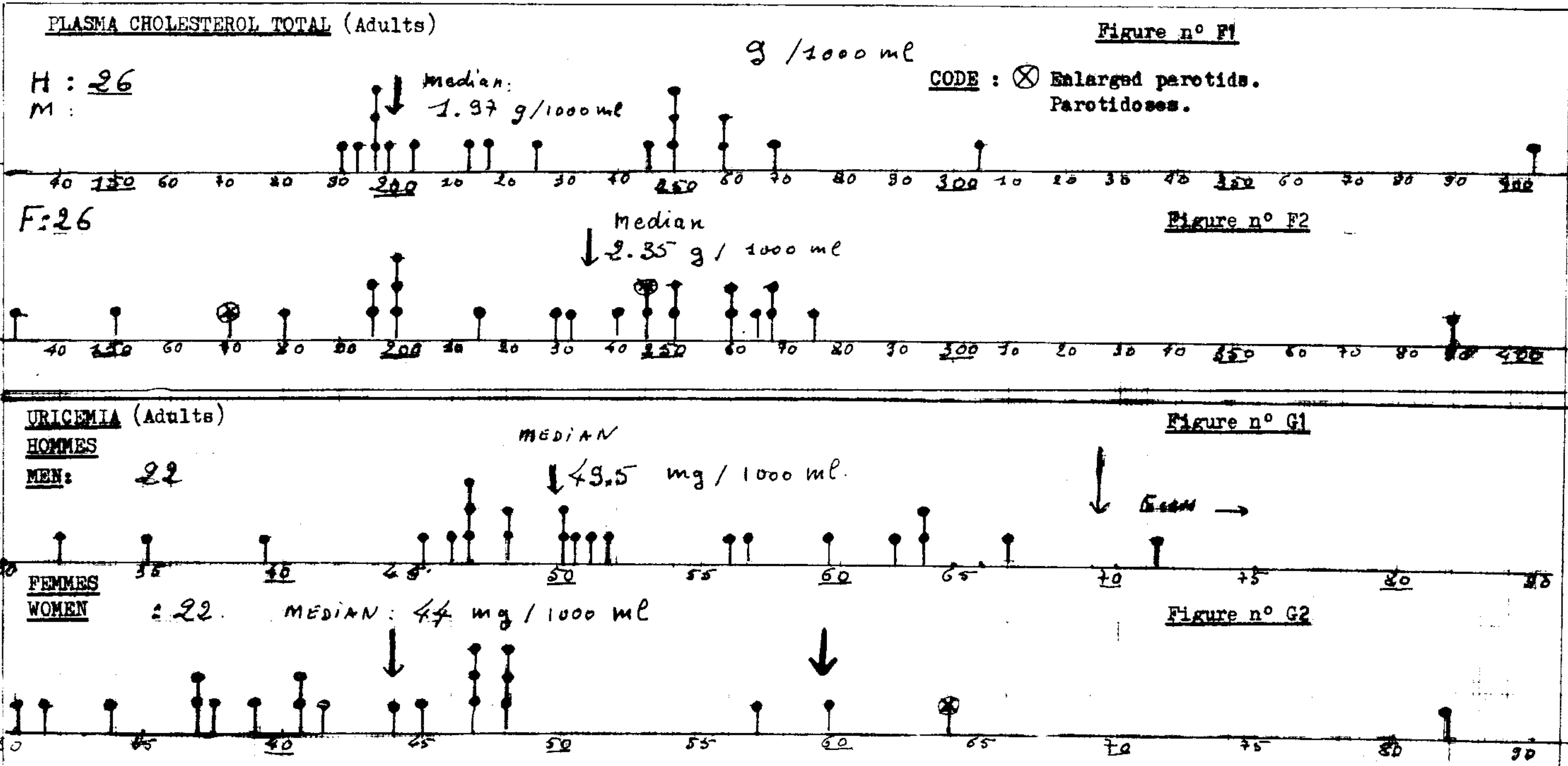


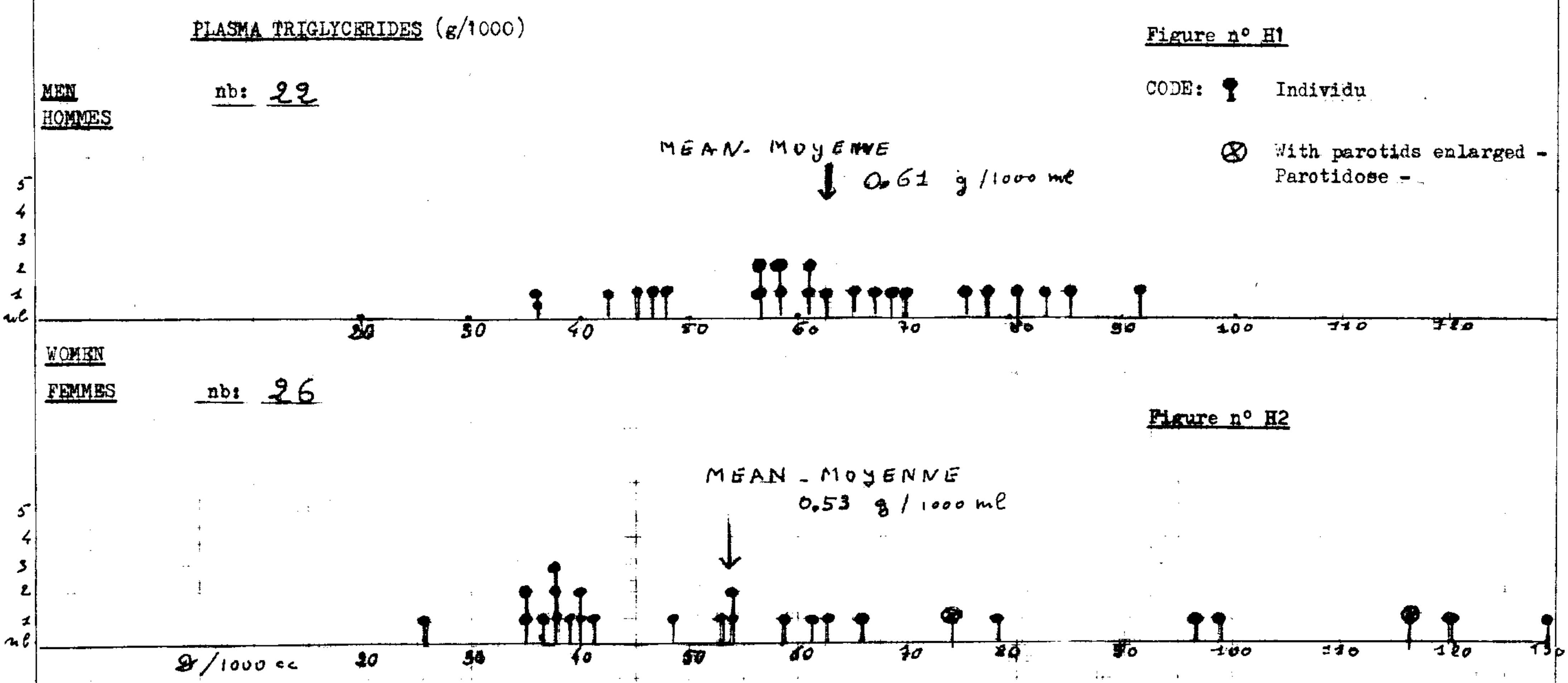
Figure n° E - AZOTEMIA in a sample of men and women of a rural Melanesian population in Wala Rano (New Hebrides). Analysis by Dr MARC - Biochemist — Gaston Bourret Hospital - Noumea - Sept. 1974 - SPC report on pilot areas in New Hebrides.

AZOTEMIE dans un échantillon d'hommes et femmes d'une population mélanésienne rurale - Wala Rano (N.H) - Analyses par le Dr MARC - Biochimiste - Hôpital Gaston Bourret à Nouméa.
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.



Figures n°s F1 - F2 G1 - G2	Plasma cholesterol and uric acid in men and women in a rural Melanesian population, Wala Rano (N.H) Sept. 1974. Analysis by Dr MARC - Biochemist - Gaston Bourret Hospital - Noumea. SPC report on pilot areas in New Hebrides.

Cholestérolémie et uricémie (hommes et femmes) dans une population rurale mélanésienne, Wala Rano (N.H)
Sept. 1974. Analyses du Dr MARC - Biochimiste - Hôpital Gaston Bourret - Nouméa.
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.



Figures n°s H1 et H2 - Plasma Triglycerides in men and women in a rural Melanesian population in Wala Rano (New Hebrides).
Plasma Triglycérides : hommes et femmes dans une population mélanésienne à Wala Rano (Nouvelles-Hébrides).

Plasma examinations by Dr MARC - Biochemist, Gaston Bourret Hospital - Noumea.
Examens de plasma par Dr MARC - Biochimiste à l'Hôpital Gaston Bourret - Nouméa.

SPC report on pilot areas in New Hebrides.
Rapport CPS sur les zones pilotes aux Nouvelles-Hébrides.

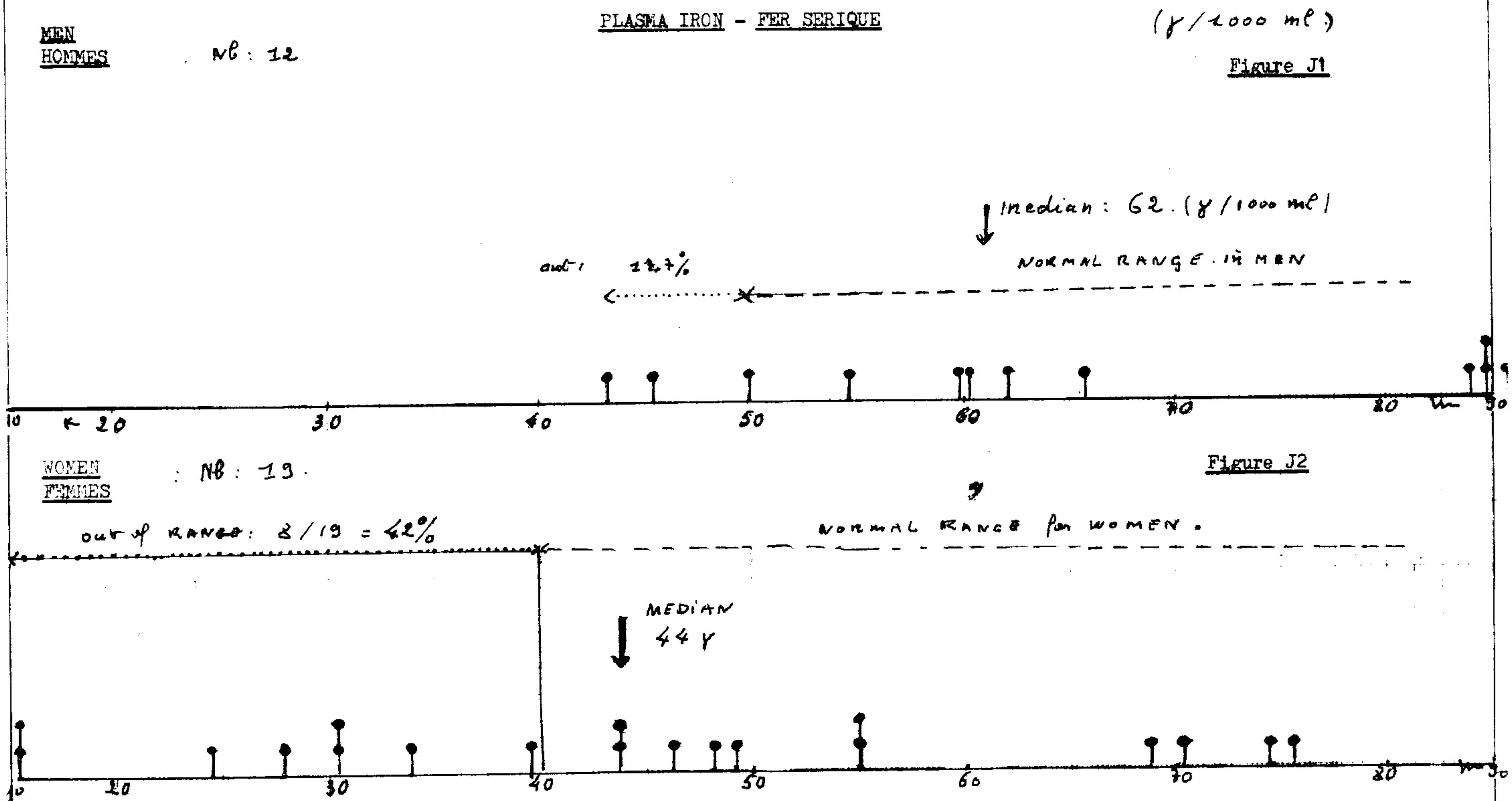


Figure n° J1 - J2 - Plasma iron in a sample of boys and girls in a elanesian rural population - Wala Rano - Malekula - SPC report on pilot **areas in New Hebrides.**

Fer **sérique** dans un échantillon de garçons et filles dans une population rurale mélanésienne - **Mallicolo** - Rapport CPS sur **les zones pilotes aux Nouvelles-Hébrides.**

Analyses du Dr MARC. Biochimiste - Hôpital Gaston Bourret - Nouméa -

ANNEX III

SOUTH PACIFIC COMMISSION

GROWTH STUDY OF PRESCHOOL CHILDREN IN WALA-RANO, MALEKULA

(New Hebrides)

September/October 1974

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South Pacific Commission
Noumea, New Caledonia
July 1975

BACKGROUND

A growth study of preschool children in the Wala-Rano area, Northern Malekula, New Hebrides, was carried out in October 1974 by the South Pacific Commission, as a part of a nutrition pilot project.

The survey was limited to the Catholic, French-speaking, people of the Wala-Rano area since they are well organised around the Catholic Mission.

The village dispensary was used as an examination centre.

The estimated total population of the Wala-Rano area is about 1,200.

The Catholic population living permanently in the village was, according to R.P. Soucy's family records, 817. Half of the population was under 15 years old, and there were 154 children under 5 years old.

There is a dispensary at the Catholic Mission. One local nurse takes care of the sick people and delivers most of the village babies (about 30 a year). The number of patients varies from 20 to 40 a day.

Antimalarial drugs are given weekly to schoolchildren at school and to preschool children at the dispensary. However quite frequently the parents do not bring their children to the dispensary until the baby is sick.

The most frequent cause for bringing a child to the dispensary was fever diagnosed as malaria. Other usual causes were respiratory infections, conjunctivitis, diarrhea and skin infections.

Common infantile diseases observed during the last few years were chicken-pox, parotitis, whooping-cough and measles. A whooping-cough epidemic reached the village at the end of 1973 and a measles epidemic in May-June 1974.

Triple vaccination (pertussis, diphteria, tetanus) was started in early 1974 after the whooping-cough epidemic.

During the 5-year period 1964-1969, 200 children (104 boys and 96 girls) were born at the village. Out of these 14 (7%) died before the age of 5 years.

CHILDREN EXAMINED

144 Melanesian children, 74 boys and 70 girls, from 0 to 5 years, were measured in Wala-Rano Catholic Mission.

Distribution of children in different age groups is shown in Table 1.

METHODS

A. The MOTHERS' INTERVIEW included:

questions about the child's name and age, the birth-rank in the family and the total number of children, the present and previous feeding of the child (breast milk, other milk, solid foods).

B. BIRTH-WEIGHTS were noted from dispensary records as were exact birth-dates.

C. MEASUREMENTS

1. Length/height

Children under 2 years were measured on a locally built measuring table and for children over 2 years standing height was taken with a metallic tape measure attached to the wall. Measurements were recorded to the last complete 0,5 cm.

2. Weight

Babies were weighed naked on a platform baby scale with 0,1 kg precision. Older children were weighed on a bathroom scale and allowed to keep light underpants on and their weights were recorded to the nearest 0,5 kg.

3. Sitting length/sitting height

Before the age of 2 years sitting length (crown-rump length), and after the age of 2 years sitting height was taken.

4. Circumferences (head, thorax, left arm, left calf) were taken with a metallic tape measure and recorded to the last complete mm.

5. Diameters (bi-achromial, bi-iliacal, left wrist) were measured with a spreading caliper GPM and maximal distance between fingertips with a metallic tape measure.

6. Skinfolds (tricipital, subscapular) were measured on the left hand side with a large skinfold caliper and recorded to the nearest 0,5 mm.

D. INSPECTION OF TEETH

The total number of teeth and the presence of enamel hypoplasia were noted.

E. PALPATION OF THE ANTERIOR FONTANEL

The presence of an open anterior fontanel was noted.

F. ANALYSIS OF RECORDED DATA

1. Age

Ages were calculated from birth-dates and recorded to the nearest month.

For calculations children were separated into age groups in the following manner during the first year:

0 month (= 15 days or less),
1-2 months,
3-month intervals up to 1 year.

After 1 year, ages were grouped at 6-month intervals.

2. Measurements

(a) Mean values and standard deviations for different measurements in each age group were calculated with a HP 46 calculator, which uses a small size sample formula for standard deviations.

(b) Comparisons with standard values

Lengths for heights and weights as well as weights for lengths were compared with Harvard Standards (Stuart H.C. and Stevenson S.S., in: Nelson W. Textbook of Paediatrics, Philadelphia, Saunders, 7th ed., 1959, pp. 2-6).

Head circumference mean values were compared with the Nelhaus Standard (Nelhaus G: Practical composite international and interracial graphs. Paediatrics 41: 106, 1968).

Arm circumference mean values were compared with standards given by Wolanski (1964) (in: Jelliffe D.B. The Assessment of the Nutritional Status of the Community. WHO Monograph Series N° 53, 1966).

Tricipital skinfold mean values were compared with English skinfold standards (Tanner J.M.; Whitehouse R.H. Standards for subcutaneous fat in British children. Brit. Med. J. 1: 446, 1962).

Mean values for arm muscular circumferences were calculated from the formula given by Jelliffe and Jelliffe (1960): $C_2 = C_1 - \pi S$, where C_2 = mean arm muscular circumference, C_1 = mean arm circumference and S = mean tricipital skinfold, and compared with the standards given by Jelliffe (in WHO Monograph Series N° 53).

(c) Comparisons between the measurements

Sitting lengths or heights were calculated as percentages of total lengths or heights.

Mean values for arm lengths were compared to mean values of total lengths or heights.

RESULTS

Birth-weights for children born in Wala-Rano were 3,100 g ± 440 (SD) for boys (n= 74) and 3,020 g ± 510 (SD) for girls (n= 58).

Spacing of children in the family was most commonly 2 years. 7% of the children came from families with one child and 62% of them came from families with five children or more. The largest family we met had 12 children. Table 2 shows numbers of younger siblings in the family in different age groups.

Breast-feeding was the rule in Wala-Rano village. During the first year, all but one baby were breast-fed (32/33); between 12 and 17 months 71% of children (12/17) were still breast-fed, and in age group 18-23 months 40% (4/10). During the second year, we met three babies receiving commercial, **usually** sweetened, concentrated milk.

Solid foods were started late. None of the babies under 6 months had anything else but milk in their diet. For older children, their mothers generally told us that they had begun to give solid foods from the age of 3 or 4 months on.

After the weaning period milk was not given to the children.

MEASUREMENTS

Mean values, standard deviations and ranges for various measurements in each age-group are given below.

1. Length

Boys and girls had very similar kinds of growth patterns in length, boys being generally slightly taller for their age than girls (Table 3, fig.1).

Growth rates were about 23 cm/year for the first year, 8,9-9,9 cm for the second year and dropped to 4-5 cm/year for the fifth year (Table 4, fig.2).

Up to 1 year, Wala-Rano children grew very close to Harvard Standards.

During the second year, there was a drop in lengths to the 94% level of the standard (Table 5, fig.3).

2. Weight

Boys and girls again had quite similar growth patterns for weight. Boys were on the average heavier than girls up to 9 months and thereafter their mean weights were sometimes under, sometimes above girls' mean weights (Table 6, fig.4).

Annual weight gains averaged 5,2-5,0 kg for the first year, 1,7-1,8 kg for the second year and dropped to 1,3-1,1 kg for the fifth year (Table 7, fig.5).

In comparison with Harvard Standards, Wala-Rano baby boys up to 5 months were above or on the standard level. At the age of 1 year, their mean weight was 85% of the standard and at the age of 2 years 81% of the standard. The minimum value was reached in age group 18-23 months, when the mean weight of Wala-Rano boys was only 75% of Harvard Standards.

Girls' mean weights were under Harvard Standards in all age groups. Before 1 year, they varied from 74% to 90% of the standard. The minimum value (72% of the standard) was reached in the age group 12-17 months.

After 2 years, the mean weights for age varied from 77% to 85% of the standard (Table 8, fig.6).

Relative weights for length were under Harvard Standards in all age groups in both sexes.

Boys' weights for length were over 90% of Harvard Standards until 9 months and dropped to 81% at the age of 18 to 23 months. After 2 years, mean weights for length in boys varied from 86% to 92% of Harvard Standards.

Girls had their mean weights for length between 81% and 90% of Harvard Standards during the first year. The minimum value of 80% of the standard was reached in age group 12-17 months. After 2 years, girls had their weights for length on the average between 84% and 94% of Harvard Standards (Table 9, fig.7).

3. Sitting length

The growth rate of sitting length was very similar in both sexes. In most age groups, boys on the average had longer sitting lengths than girls (Table 10, fig.8).

The sitting length as a percentage of total length diminished from 65% at the age of 1 to 2 months to about 56% at the age of 5 years (Table 11, fig.9).

4. Head

Boys in most age groups had bigger mean head circumference values than girls (Table 12, fig.10).

Before 6 months, Wala-Rano children had mean head circumference values very close to the Nelhaus Standard (97-100% of the standard), but after 1 year they remained at the 94-96% level of the standard (about 2,5 cm under this standard).

5. Thorax

Mean thorax circumference values exceeded mean head circumference values at the age of 24 to 29 months in boys and 12 to 17 months in girls (Table 13).

In age group 12-17 months, 53% of children had larger chests than heads; in age group 18-29 months, 56%; and in age group 30-35 months, 75%.

6. Arm

Boys had bigger arm circumferences than girls up to 9 months; after that age the mean values were very close to each other in both sexes.

There was a drop in arm circumference mean values around the age of 1 year (Table 14, fig.11).

In comparison with the standard values given by Wolanski, Wala-Rano children had very thin arms.

Boys were near the standard before 6 months, but for baby girls the mean arm circumference was about 1,8 cm under the standard.

After 1 year, the arm circumference mean values for boys were at the 85% level of the standard (2,5 cm under the standard) and for girls 87% of the standard (2,2 cm under the standard).

Arm muscular circumference

On the average boys had bigger arm muscular circumference values than girls, up to 18 months (Table 15, fig.12).

Compared with the standards for arm muscular circumference (Jelliffe), the arm muscular circumferences of these children were at the 90% level of the standard (1,3 cm under standard values).

7. Calf

Boys had bigger calves up to 9 months and thereafter calf circumference mean values were very similar for both sexes.

There was a drop in calf circumference mean values at the age of 1 year (Table 16, fig.13).

8. Bi-achromial diameter

In most age groups, boys on the average had larger shoulders than girls.

Growth rate of shoulder breadth seemed similar in both sexes (Table 17, fig.14).

9. Bi-iliacal diameter

Boys and girls averaged similar hip-widths for age (Table 18, fig.15).

10. Left wrist diameter

Left wrist diameters grew from 2,5 cm at the age of 1 to 2 months to 3,5 cm at the age of 5 years (Table 19).

11. Maximal distance between fingertips

Arm ~~length~~ span with extended arms was always very close to the total length. It averaged 101% of height for boys and 100% of height for girls.

12. Tricipital skinfold

Tricipital skinfolds were very thin, especially during the second year of life (Table 20, fig.16).

Compared to English standards, the tricipital skinfold mean values of Wala-Rano children were at the 70% level of the standard before 1 year and after 2 years. At the age of 18 months, boys' skinfolds were only 51% of the standard (5,0 mm below the standard) and girls' skinfolds at the same age 63% of the standard (3,8 mm below).

13. Subscapular skinfold

Subscapular skinfolds varied less than tricipital skinfolds. Before 9 months, boys had thicker subscapular skinfolds than girls and after 3 years girls had more fat on their back than boys.

In both sexes there was a diminution in subscapular skinfold thickness during the second year of life (Table 21, fig.17).

DISTRIBUTION OF LENGTHS AND WEIGHTS IN % OF HARVARD STANDARDS

1. Length

93% of boys and 91% of girls were above the 90% line of Harvard Standards. All children were above the 80% line (Table 22).

2. Weight

31% of boys and 16% of girls were above the 90% line of Harvard Standards.

For 41% of boys and 54% of girls, the weight for age was less than 80% of Harvard Standards.

For four babies, all in age group 23 months, the weight for age was less than 60% of Harvard Standards.

TEETH

1. Eruption of teeth

33% of children had their first tooth erupted before 6 months, and all children before 9 months.

In age group 24-29 months, 31% (5/16) of children had all 20 teeth of first dentition and all children had gained the full dentition before 3 years (Table 24).

2. Enamel hypoplasia

10% of children between 2 and 5 years had enamel hypoplasia. (Table 25).

CLOSURE OF THE ANTERIOR FONTANEL

All children had an open anterior fontanel up to 9 months and only one child had a closed fontanel before 1 year.

In three children the anterior fontanel remained open after the age of 2 years (Table 26).

COMMENTS

The number of children in each age group was very small and growth curves of different parameters were irregular.

During the clinical examination, four children looked actually malnourished and they were excluded from the calculations of mean values.

One child with a congenital amputation of one leg was also excluded.

All children not appearing to be ill were included in the mean value calculations. We did not leave out children with minor respiratory infections or anemic children. Many had intestinal parasites and skin infections.

Wala-Rano babies were as tall as those of Harvard Standards during the first year of life, but during the second year their growth rate in length was retarded compared with Harvard Standards and after 3 years their heights followed the 94% line of this standard. At the age of 4 years, their heights were on the average 6 cms under Harvard Standards.

Retardation in weight compared with Harvard Standards was more marked than retardation in length. The mean birth-weights of Wala-Rano children were already below Harvard Standards. During the second year of life there was a drop in mean weights for age and also in mean weights for length compared with the standard.

Most of this retardation was due to the diminution of fat, but since arm muscular circumference mean values were also below the standard values, some part of the weight retardation was due to insufficient muscular development.

Head circumference mean values of Wala-Rano children were also under the standard values after the age of 6 months.

It was concluded that protein calorie undernutrition was common among children under 5 years old in Wala-Rano. 41% of boys and 54% of girls had weights for age under 80% of Harvard Standards. There was a poor annual gain in weight and in length during the second year of life, which was the weaning period for Wala-Rano children.

ACKNOWLEDGEMENTS

We are very grateful to all the staff of the Catholic Mission who gave us all possible help in our work, and especially to R.P. Soucy who let us use his family records for the preparation of the survey and gave us verbally all the information we needed; to Judith, our secretary-interpreter; and, of course, to all the people of Wala-Rano who came to our examination.

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WALA RANO :

TABLE 1. NUMBERS OF CHILDREN IN DIFFERENT AGE GROUPS

TABLEAU 1. REPARTITION DES ENFANTS PAR DIFFERENTS GROUPES D'AGE

AGE (MONTHS) (MOIS)	BOYS GARCONS	GIRLS FILLES	TOTAL
0	0	0	0
1-2	5	2	7
3-5	3	6	9
6-8	5	4	9
9-11	5	3	8
12-17	8	9	17
18-23	6	4	10
24-29	9	7	16
30-35	5	8	13
36-41	9	5	14
42-47	3	5	8
48-53	12	6	18
54-59	4	11	15
0-59	74	70	144

WALA RANO :

TABLE 2. NUMBERS OF YOUNGER SIBLINGS IN THE FAMILY IN DIFFERENT AGE GROUPS

TABLEAU 2. NOMBRE DE JEUNES FRERES ET SOEURS PAR FAMILLE ET PAR GROUPES D'AGE

AGE (MONTHS) (MOIS)	TOTAL	NUMBER OF YOUNGER SIBLINGS NOMBRE DE JEUNES ENFANTS 0 n	0 (%)	1 n	1 (%)	2 n	2 (%)	3 n	3 (%)
12-17	15	13	(87)	2	(13)	-		-	
18-23	5	5	(100)	-		-		-	
24-29	13	8	(62)	5	(38)	-		-	
30-35	11	6	(55)	5	(45)	-		-	
36-41	11	3	(27)	7	(67)	1	(9)	-	
42-47	6	-	-	6	(100)	-		-	
48-53	12	4	(33)	7	(58)	1	(8)	-	
54-59	8	-	-	5	(63)	3	(37)	-	

TABLE 3. LENGTH (HEIGHT) IN CENTIMETERS

TABLEAU 3. TAILLE EN CM.

	AGE (MONTHS) (MOIS)	N	MEAN MOYENNE	SD ET	RANGE INTERVALLE
M	1-2	5	57.40	1.19	55.5-58.5
	3-5	3	63.66	2.51	61.0-66.0
	6-8	5	67.20	4.91	59.0-71.0
	9-11	5	70.80	0.75	70.0-72.0
	12-17	7	77.14	3.07	73.0-81.0
	18-23	6	79.33	3.76	74.5-85.0
	24-29	8	84.06	1.97	82.0-87.5
	30-35	5	87.70	2.36	84.5-91.0
	36-41	9	92.88	2.87	88.0-97.5
	42-47	3	94.17	3.06	91.5-97.5
	48-53	12	98.24	3.40	92.5-103.0
	54-59	4	98.12	2.59	95.0-100.5
F	1-2	2	52.25	1.76	51.0-53.5
	3-5	6	61.75	3.43	56.0-65.0
	6-8	4	65.50	3.29	62.0-69.0
	9-11	3	71.66	0.57	71.0-72.0
	12-17	8	73.56	3.11	68.0-76.0
	18-23	3	78.50	1.32	77.0-79.5
	24-29	7	84.14	3.70	79.5-89.0
	30-35	8	86.25	4.75	76.50-92.50
	36-41	4	92.63	6.02	84.0-97.0
	42-47	5	95.50	4.09	92.0-102.0
	48-53	6	100.05	2.22	96.0-102.0
	54-59	11	101.40	2.94	97.5-107.0

TABLE 4. ANNUAL GAIN IN LENGTH IN CENTIMETERS

TABLEAU 4. TAUX DE CROISSANCE PAR AN EN CM.

AGE (MONTHS) (MOIS)	BOYS GARÇONS	GIRLS FILLES
0-1	23.0	23.0
1-2	8.9	9.9
2-3	8.7	7.7
3-4	6.8	8.3
4-5	4.0	5.0

TABLE 5. LENGTH FOR AGE IN % OF HARVARD STANDARD

TABLEAU 5. TAILLE EN FONCTION DE L'AGE EN % DES NORMES DE HARVARD

	AGE (MONTHS) (MOIS)	N	MEAN MOYENNE	SD ET	RANGE INTERVALLE
M	1-2	5	102.40	3.05	100.0-107.0
	3-5	3	102.00	3.61	99.0-106.0
	6-8	5	99.00	7.81	85.0-104.0
	9-11	5	98.60	2.19	95.0-100.0
	12-17	7	99.14	3.93	94.0-105.0
	18-23	6	94.17	3.31	90.0-99.0
	24-29	8	94.38	1.85	92.0-97.0
	30-35	5	92.60	2.70	90.0-97.0
	36-41	9	95.11	3.76	89.0-101.0
	42-47	3	93.00	3.00	90.0-96.0
	48-53	12	93.83	3.16	88.0-98.0
	54-59	4	91.00	3.16	87.0-94.0
F	1-2	2	99.50	9.19	93.0-106.0
	3-5	6	99.50	3.73	93.0-104.0
	6-8	4	97.25	3.77	92.0-100.0
	9-11	3	100.00	2.00	98.0-102.0
	12-17	8	94.25	3.41	89.0-98.0
	18-23	3	93.33	2.31	92.0-96.0
	24-29	7	94.57	3.31	89.0-98.0
	30-35	8	92.00	4.54	83.0-99.0
	36-41	4	94.25	6.60	85.0-99.0
	42-47	5	93.80	4.15	90.0-100.0
	48-53	6	95.17	2.48	91.0-98.0
	54-59	11	93.91	2.91	90.0-100.0

TABLE 6. WEIGHT IN KILOGRAMS

TABLEAU 6. POIDS EN Kg.

	AGE (MONTHS) (MOIS)	N	MEAN MOYENNE	SD ET	RANGE INTERVALLE
M	1-2	5	4.78	0.63	4.0-5.6
	3-5	3	6.50	0.90	5.6-7.4
	6-8	5	7.28	1.14	5.3-8.1
	9-11	5	7.94	0.94	7.0-9.5
	12-17	7	8.83	1.04	7.3-10.0
	18-23	6	8.88	1.30	6.8-10.5
	24-29	8	10.94	0.94	10.0-12.5
	30-35	5	11.10	1.08	10.5-12.0
	36-41	9	12.16	1.34	10.0-13.5
	42-47	3	12.83	1.04	12.0-14.0
	48-53	12	12.87	1.65	10.0-14.5
	54-59	4	13.87	1.88	12.0-16.5
F	1-2	2	3.15	0.35	2.9-3.4
	3-5	6	5.88	1.02	4.2-7.2
	6-8	4	6.07	0.81	5.3-7.0
	9-11	3	8.26	0.20	8.1-8.5
	12-17	8	7.61	0.78	6.5-9.0
	18-23	3	9.66	0.57	9.0-10.0
	24-29	7	9.92	0.88	9.0-11.0
	30-35	8	10.87	1.45	8.5-13.0
	36-41	4	12.90	1.32	11.5-14.0
	42-47	5	12.90	1.24	12.0-15.0
	48-53	6	14.00	0.63	13.0-15.0
	54-59	11	13.90	1.84	12.0-18.0

TABLE 7. ANNUAL WEIGHT GAIN IN KILOGRAMS

TABLEAU 7. CROISSANCE PONDERALE EN Kg.

AGE (YEARS) (ANNEES)	BOYS GARCONS	GIRLS FILLES
0-1	5.2	5.0
1-2	1.7	1.8
2-3	2.0	2.2
3-4	0.9	1.5
4-5	1.3	1.1

TABLE 8. WEIGHT FOR AGE IN % OF HARVARD STANDARD

TABLEAU 8. POIDS EN FONCTION DE L'AGE EN % DES NORMES DE HARVARD

	AGE (MONTHS) (MOIS)	N	MEAN MOYENNE	SD ET	RANGE INTERVALLE
M	1-2	5	104.80	10.66	93-118
	3-5	3	102.67	4.51	98-107
	6-8	5	91.20	16.01	63-101
	9-11	5	86.40	10.78	73-102
	12-17	7	83.71	9.07	72-96
	18-23	6	75.17	10.46	59-86
	24-29	8	85.25	7.44	79-96
	30-35	5	77.20	8.41	66-86
	36-41	9	81.44	9.49	65-92
	42-47	3	80.67	6.43	76-88
	48-53	12	76.83	9.49	61-86
	54-59	4	78.25	10.34	67-92
F	1-2	2	74.50	6.36	70-79
	3-5	6	90.00	15.65	74-114
	6-8	4	76.50	8.35	69-88
	9-11	3	9(.33	5.69	84-95
	12-17	8	72.25	8.88	59-86
	18-23	3	82.00	5.00	77-87
	24-29	7	77.57	6.60	71-89
	30-35	8	77.88	9.49	62-90
	36-41	4	84.50	8.35	75-92
	42.47	5	80.20	7.19	75-92
	48.53	6	82.83	3.76	76-87
	54.59	11	78,18	9.56	67-100

TABLE 9. WEIGHT FOR LENGTH (HEIGHT) IN % OF HARVARD STANDARD

TABLEAU 9. POIDS EN FONCTION DE LA TAILLE EN % DES NORMES DE HARVARD

	AGE (MONTHS) (MOIS)	N	MEAN MOYENNE	SD ET	RANGE INTERVALLE
M	1-2	5	93.60	9.71	80-107
	3-5	3	95.67	10.26	87-107
	6-8	5	92.80	3.27	89-96
	9-11	5	89.40	11.08	80-108
	12-17	7	85.14	5.64	77-93
	18-23	6	81.67	8.04	69-89
	24-29	8	92.63	6.00	86-100
	30-35	5	88.60	8.56	77-97
	36-41	9	88.33	9.08	68-95
	42-47	3	86.00	7.00	79-93
	48-53	12	85.92	9.28	71-97
	54-59	4	92.00	9.27	87-105
F	1-2	2	81.50	14.85	71-92
	3-5	6	88.83	9.56	74-100
	6-8	4	83.00	5.89	77-89
	9-11	3	90.33	2.08	88-92
	12-17	8	79.75	9.57	71-99
	18-23	3	90.67	3.21	87-93
	24-29	6	84.17	4.31	80-92
	30-35	8	88.50	7.07	81-98
	36-41	4	93.75	8.22	82-101
	42-47	5	89.00	2.65	86-93
	48-53	6	89.67	2.42	87-94
	54-59	11	87.00	11.27	72-107

TABLE 10. SITTING LENGTH IN CENTIMETERS

TABLEAU 10. TAILLE EN POSITION ASSISE EN CM

	AGE (MONTHS) (MOIS)	N	MEAN MOYENNE	σ	RANGE INTERVALLE
M	1-2	5	37.20	1.03	36.0-38.5
	3-5	3	41.33	1.52	40.0-43.0
	6-8	5	43.20	2.19	40.0-46.0
	9-11	5	44.90	1.24	43.0-46.0
	12-17	7	47.29	1.82	44.5-49.0
	18-23	6	47.00	1.67	44.0-49.0
	24-29	7	49.29	1.08	48.0-51.0
	30-35	5	50.90	1.14	49.5-52.5
	36-41	9	52.66	2.37	51.0-57.0
	42-47	3	55.17	4.73	51.5-60.5
	48-53	12	54.58	1.88	50.5-57.5
	54-59	3	53.83	1.15	52.5-54.5
F	1-2	2	34.00	2.82	32.0-36.0
	3-5	6	39.50	2.82	34.0-42.0
	6-8	4	41.25	1.50	40.0-43.0
	9-11	3	45.16	2.89	45.0-45.5
	12-17	8	45.19	2.03	42.0-47.5
	18-23	3	48.50	1.32	47.0-49.5
	24-29	6	48.66	1.94	46.5-52.0
	30-35	8	50.18	2.50	46.5-54.5
	36-41	4	52.38	2.06	50.0-55.0
	42-47	5	53.00	2.09	50.5-56.0
	48-53	6	54.58	1.24	53.0-55.5
	54-59	9	55.66	1.60	54.0-58.0

TABLE 11. SITTING LENGTH IN % OF TOTAL LENGTH

TABLEAU 11. TAILLE EN POSITION ASSISE EN % DE LA TAILLE DEBOUT

	AGE (MONTHS) (MOIS)	N	MEAN MOYENNE	SD ET	RANGE INTERVALLE
M	1-2	5	64.76	0.91	63.7-65.8
	3-5	3	64.86	0.77	64.0-65.5
	6-8	5	64.34	2.36	61.2-67.7
	9-11	5	63.36	1.43	61.4-65.2
	12-17	7	61.27	1.28	59.2-62.5
	18-23	6	59.21	1.84	56.4-61.8
	24-29	7	58.40	1.17	56.9-60.6
	30-35	5	57.98	0.71	57.6-58.8
	36-41	9	56.63	1.22	54.7-58.4
	42-47	3	56.53	1.72	55.0-56.2
	48-53	12	55.53	1.17	52.9-56.7
	54-59	3	55.26	0.80	54.5-56.1
F	1-2	2	64.95	3.18	62.7-67.2
	3-5	6	63.88	1.86	60.7-66.3
	6-8	4	62.97	1.06	62.2-64.5
	9-11	3	62.96	0.41	62.5-63.3
	12-17	8	61.40	2.17	60.5-65.2
	18-23	3	61.73	0.80	61.0-62.6
	24-29	7	57.35	1.18	55.0-58.4
	30-35	8	58.17	1.64	56.3-60.7
	36-41	4	56.60	2.25	54.1-59.5
	42-47	5	55.48	1.68	52.8-57.0
	48-53	6	54.53	1.23	52.2-55.7
	54-59	9	54.72	1.32	52.6-56.5

~~TABLE 12. HEAD CIRCUMFERENCE IN CENTIMETERS~~

TABLEAU 12. TOUR DE TETE EN CM

	AGE (MONTHS) (MOIS)	N	MEAN MOYENNE	SD ET	RANGE INTERVALLE
M	1-2	5	38.34	0.72	37.2-39.0
	3-5	3	41.90	1.83	40.3-43.9
	6-8	5	42.54	2.66	38.6-45.8
	9-11	5	43.88	0.69	43.2-45.0
	12-17	7	45.76	0.66	44.8-46.5
	18-23	6	45.90	0.58	45.0-47.4
	24-29	8	47.09	1.80	44.5-49.2
	30-35	5	46.46	3.52	40.5-49.5
	36-41	9	48.32	0.93	47.0-50.1
	42-47	3	47.93	0.15	47.8-48.1
	48-53	11	47.99	1.51	46.2-51.6
	54-59	3	47.77	0.42	47.3-48.1
F	1-2	2	35.70	0.99	35.0-36.4
	3-5	6	40.43	2.12	38.5-44.6
	6-8	4	43.12	1.65	4.16-45.2
	9-11	3	43.13	1.25	41.9-44.4
	12-17	8	43.94	1.30	41.8-46.2
	18-23	3	45.43	1.00	44.5-46.5
	24-29	7	46.25	1.35	44.4-48.0
	30-35	8	46.63	0.92	45.5-48.0
	36-41	4	47.63	1.25	46.0-49.0
	42-47	5	47.68	0.79	46.3-48.2
	48-53	6	47.86	1.05	46.7-49.7
	54-59	11	47.63	1.19	46.2-50.2

TABLE 13. THORAX CIRCUMFERENCE IN CENTIMETERS

TABLEAU 13. TOUR DE POITRINE EN CM

	AGE (MONTHS) (MOIS)	N	MEAN MOYENNE	SD ET	RANGE INTERVALLE
M	1-2	5	36.32	1.57	34.2-37.5
	3-5	3	39.33	1.52	38.0-41.0
	6-8	4	42.10	0.52	41.4-42.5
	9-11	5	43.46	0.97	42.0-44.6
	12-17	7	45.19	2.42	42.1-48.6
	18-23	6	45.61	2.44	41.2-47.5
	24-29	8	48.93	2.14	46.0-52.0
	30-35	5	49.70	3.14	45.8-54.0
	36-41	9	50.75	2.29	48.2-55.3
	42-47	3	50.50	0.50	50.0-51.0
	48-53	12	50.70	2.14	47.0-53.1
	54-59	4	51.15	2.63	49.0-54.5
F	1-2	2	31.55	2.33	29.9-33.2
	3-5	6	37.91	2.14	34.5-41.2
	6-8	3	39.86	2.12	37.5-41.6
	9-11	3	42.90	1.15	41.7-44.0
	12-17	8	44.09	2.08	41.5-48.0
	18-23	3	46.20	1.74	45.0-48.2
	24-29	7	47.82	1.41	46.0-50.0
	30-35	8	49.05	1.89	46.8-52.1
	36-41	4	51.15	2.41	48.5-54.0
	42-47	5	50.36	1.30	49.0-52.0
	48-53	6	51.96	1.41	50.0-53.6
	54-59	11	51.76	1.97	49.6-55.1

TABLE 14. ARM CIRCUMFERENCE IN CENTIMETERS

TABLEAU 14. TOUR DE BRAS EN CM

	AGE (MONTHS) (MOIS)	N	MEAN MOYENNE	SD ET	RANGE INTERVALLE
M	1-2	5	12.12	0.22	11.9-12.5
	3-5	3	13.80	0.30	13.5-14.1
	6-8	5	13.96	1.35	12.1-15.8
	9-11	5	13.72	0.75	12.5-14.5
	12-17	7	13.37	0.99	12.1-14.6
	18-23	6	13.01	0.98	11.3-14.1
	24-29	8	14.21	1.12	12.8-15.6
	30-35	5	14.02	0.56	13.2-14.7
	36-41	9	14.62	0.80	13.2-16.1
	42-47	3	14.63	0.80	13.7-15.1
	48-53	12	14.05	0.99	12.0-15.6
	54-59	4	14.55	0.12	14.4-14.7
F	1-2	2	10.20	0.42	9.9-10.5
	3-5	6	12.30	1.34	10.6-14.5
	6-8	4	12.25	0.62	11.6-13.1
	9-11	3	14.46	0.45	14.0-14.9
	12-17	8	12.35	0.82	10.7-13.2
	18-23	3	13.60	0.65	13.0-14.3
	24-29	6	13.71	0.58	13.0-14.4
	30-35	8	14.17	1.11	12.1-15.3
	36-41	4	14.60	0.69	14.1-15.6
	42-47	5	15.00	0.30	14.5-15.3
	48-53	6	14.85	0.38	14.2-15.3
	54-59	11	14.56	1.16	13.4-17.5

TABLE 15. ARM MUSCULAR CIRCUMFERENCE IN CENTIMETERS

TABLEAU 15. CIRCUMFERENCE DES MUSCLES DU BRAS EN CM

AGE (MONTHS) (MOIS)	BOYS GARÇONS	GIRLS FILLES
1-2	9.76	8.87
3-5	12.81	10.10
6-8	11.73	10.21
9-11	11.60	11.58
12-17	11.49	10.50
18-23	11.49	11.46
24-29	11.93	11.85
30-35	11.57	12.05
36-41	12.28	12.09
42-47	12.54	12.56
48-53	12.12	12.65
54-59	12.58	12.71

TABLE 16. LEFT CALF CIRCUMFERENCE IN CENTIMETERS

TABLEAU 16. TOUR DU MOLLET GAUCHE EN CM

	AGE (MONTHS) (MOIS)	N	MEAN MOYENNE	SD ET	RANGE INTERVALLE
M	1-2	5	13.36	0.75	12.9-14.7
	3-5	3	16.63	0.98	15.5-17.3
	6-8	4	17.95	0.95	16.9-19.2
	9-11	5	16.28	0.69	15.5-17.4
	12-17	7	16.43	1.04	14.5-17.5
	18-23	6	17.21	0.68	16.4-18.1
	24-29	7	18.49	1.44	16.5-20.2
	30-35	5	18.35	0.67	17.4-19.1
	36-41	9	18.97	1.42	16.8-20.6
	42-47	3	19.96	0.73	19.4-20.8
	48-53	12	19.12	1.16	17.1-20.8
	54-59	4	19.90	1.01	18.5-20.9
F	1-2	2	10.55	0.91	9.9-11.2
	3-5	6	14.68	1.85	12.1-17.0
	6-8	3	15.30	0.26	15.0-15.5
	9-11	3	16.70	0.96	16.0-17.8
	12-17	8	15.86	0.79	14.9-17.1
	18-23	3	17.70	1.12	17.0-19.0
	24-29	7	17.57	1.22	15.4-18.9
	30-35	8	18.21	1.89	1.41-20.0
	36-41	4	18.83	0.97	17.6-19.6
	42-47	5	19.94	1.13	19.0-21.5
	48-53	6	20.25	0.45	19.7-20.9
	54-59	11	19.68	1.33	18.3-22.3

TABLE 17. BIACHROMIAL DIAMETER IN CENTIMETERS

TABLEAU 17. DIAMETRE BIACHROMIAL EN CM

	AGE (MONTHS) (MOIS)	N	MEAN MOYENNE	SD ET	RANGE INTERVALLE
M	12-17	5	17.44	0.87	16.2-18.6
	18-23	4	17.57	0.61	17.2-18.5
	24-29	6	18.72	0.86	18.1-20.2
	30-35	5	19.30	0.86	18.1-20.2
	36-41	8	19.46	0.62	18.8-20.4
	42-47	3	20.70	1.05	19.6-21.7
	48-53	12	20.56	0.65	19.0-21.5
	54-59	4	21.70	0.81	20.5-22.3
F	12-17	4	16.65	0.47	16.0-17.0
	18-23	0	-	-	-
	24-29	7	18.52	1.40	16.8-19.7
	30-35	8	18.95	1.37	16.1-20.5
	36-41	4	18.73	1.37	17.0-20.1
	42-47	5	20.68	0.80	20.0-21.7
	48-53	6	22.31	0.82	21.1-23.6
	54-59	11	21.56	1.09	20.1-23.6

TABLE 18. BI-ILIACAL DIAMETER IN CENTIMETERS

TABLEAU 18. DIAMETRE BI-ILIAQUE EN CM

	AGE (MONTHS) (MOIS)	N	MEAN MOYENNE	SD ET	RANGE INTERVALLE
M	1-2	5	9.22	0.26	8.8-9.5
	3-5	3	10.60	0.79	10.0-11.5
	6-8	5	10.74	1.00	10.7-11.6
	9-11	5	11.18	0.21	10.9-11.4
	12-17	7	12.19	0.97	10.2-13.2
	18-23	4	12.32	1.05	11.4-13.8
	24-29	7	13.80	0.76	12.7-14.8
	30-35	5	14.24	0.72	13.1-15.0
	36-41	8	15.00	0.85	14.0-16.3
	42-47	3	15.06	0.25	14.8-15.3
	48-53	12	15.65	0.90	13.7-16.8
	54-59	4	16.15	0.94	15.0-17.3
F	1-2	0	-	-	-
	3-5	5	9.72	0.79	8.7-10.6
	6-8	4	10.67	0.99	9.7-11.8
	9-11	3	11.46	0.56	11.0-12.1
	12-17	8	11.35	0.41	11.0-12.1
	18-23	2	12.90	0.00	12.9-12.9
	24-29	7	13.55	1.04	12.2-14.8
	30-35	8	13.81	1.16	11.3-15.0
	36-41	4	14.85	1.06	13.3-15.7
	42-47	5	15.66	0.76	15.2-17.0
	48-53	6	15.85	0.57	14.8-16.4
	54-59	11	16.13	0.71	14.9-16.9

TABLE 19. LEFT WRIST DIAMETER IN CENTIMETERS

TABLEAU 19. DIAMETRE DU POIGNET GAUCHE EN CM

	AGE (MONTHS) (MOIS)	N	MEAN MOYENNE	SD ET	RANGE INTERVALLE
M	1-2	4	2.47	0.96	2.4-2.6
	3-5	3	2.80	0.00	2.8-2.8
	6-8	4	3.00	1.41	2.8-3.1
	9-11	5	2.92	1.30	2.8-3.1
	12-17	7	3.00	1.30	2.8-3.2
	18-23	6	3.01	1.72	2.7-3.2
	24-29	7	3.13	1.80	2.9-3.4
	30-35	5	3.18	1.30	3.0-3.3
	36-41	7	3.18	1.07	3.0-3.3
	42-47	3	3.33	1.53	3.2-3.5
	48-53	12	3.31	1.70	3.0-3.5
	54-59	4	3.47	2.06	3.2-3.7
F	1-2	0	-	-	-
	3-5	6	2.65	3.02	2.3-3.1
	6-8	4	2.53	0.96	2.4-2.6
	9-11	3	2.73	0.58	2.7-2.8
	12-17	7	2.73	1.89	2.4-3.0
	18-23	1	3.00	-	-
	24-29	7	3.01	1.46	2.7-3.1
	30-35	7	3.08	1.95	2.8-3.3
	36-41	4	3.25	0.13	3.1-3.4
	42-47	5	3.28	0.84	3.2-3.4
	48-53	6	3.43	1.97	3.1-3.7
	54-59	11	3.39	2.63	3.1-3.9

TABLE 20. TRICIPITAL SKINFOLD IN MILLIMETERS

TABLEAU 20. PLI CUTANE TRICIPITAL EN MM

	AGE (MONTHS) (MOIS)	N	$\overline{X}$	^	RANGE INTERVALLE
M	1-2	4	7.50	1.00	6.0-8.0
	3-5	3	7.16	1.60	6.0-9.0
	6-8	5	7.10	2.19	4.5-9.0
	9-11	4	6.75	0.64	6.0-7.5
	12-17	7	6.00	0.76	5.0-7.0
	18-23	6	4.83	1.03	4.0-6.5
	24-29	8	7.25	1.87	5.0-11.0
	30-35	5	7.80	0.57	7.0-8.5
	36-41	9	7.44	1.23	6.0-9.5
	42-47	3	6.66	0.57	4.5-7.0
	48-53	12	6.16	1.35	4.5-8.5
	54-59	4	6.25	0.28	6.0-6.5
F	1-2	2	4.25	1.06	3.5-5.0
	3-5	6	7.00	1.58	4.5-9.0
	6-8	4	6.50	1.29	5.0-8.0
	9-11	3	9.16	2.46	7.5-12.0
	12-17	8	5.88	0.79	5.0-7.5
	18-23	3	6.83	2.46	4.0-8.5
	24-29	7	5.92	0.78	5.0-7.0
	30-35	8	6.75	1.85	4.0-9.5
	36-41	4	8.00	1.47	6.5-10.0
	42-47	5	7.80	0.27	7.5-8.0
	48-53	5	7.00	1.27	5.5-8.5
	54-59	11	5.90	1.24	4.0-8.0

TABLE 21. LEFT SUBSCAPULAR SKINFOLD IN MILLIMETERS

TABLEAU 21. PLI CUTANE SOUS SCAPULAIRE GAUCHE

EN MM

	AGE (MONTHS) (MOIS)	N	$\bar{X}$	σ	RANGE INTERVALLE
M	1-2	4	5.25	1.84	3.0-7.5
	3-5	3	5.16	0.28	5.0-5.5
	6-8	5	5.70	1.48	4.0-8.0
	9-11	4	5.25	0.64	5.5-6.0
	12-17	7	4.29	0.64	3.5-5.5
	18-23	6	3.91	0.73	3.0-5.0
	24-29	8	5.25	1.28	4.0-7.5
	30-35	5	5.10	0.65	4.5-6.0
	36-41	9	4.55	0.68	4.0-6.0
	42-47	3	4.83	0.28	4.5-5.0
	48-53	12	4.00	1.02	2.5-6.5
	54-59	4	4.37	0.47	4.0-5.0
F	1-2	2	4.25	0.35	4.0-4.5
	3-5	6	4.91	1.02	3.5-6.0
	6-8	4	4.50	1.29	3.0-6.0
	9-11	3	6.16	1.60	5.0-8.0
	12-17	8	4.44	0.86	3.5-6.0
	18-23	3	5.00	1.32	4.0-6.5
	24-29	7	4.50	0.57	3.5-5.0
	30-35	8	5.12	1.02	3.5-6.5
	36-41	4	5.75	1.50	4.5-7.5
	42-47	5	5.70	0.90	4.5-6.5
	48-53	5	5.10	0.82	4.0-6.0
	54-59	11	4.59	1.09	3.0-6.5

TABLE 22. DISTRIBUTION OF LENGTHS FOR AGE IN % OF HARVARD STANDARD

TABLEAU 22. REPARTITION DE LA TAILLE EN FONCTION DE L'AGE EN % DES NORMES DE HARVARD

AGE (MONTHS) (MOIS)	BOYS GARÇONS											GIRLS FILLES										
	TOTAL NUMBER NOMBRE	>90		80-89		70-79		60-69		<60		TOTAL NUMBER NOMBRE	>90		80-89		70-79		60-69		<60	
		n	(%)	n	(%)	n	(%)	n	(%)	n	(%)		n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
0-5	8	8	(100)	-		-		-		-		8	8	(100)	-		-		-		-	
6-11	10	9	(90)	1	(10)	-		-		-		7	7	(100)	-		-		-		-	
12-23	14	14	(100)	-		-		-		-		13	11	(85)	2	(15)	-		-		-	
24-35	14	13	(92)	1	(8)	-		-		-		15	13	(87)	2	(13)	-		-		-	
36-59	28	25	(89)	3	(11)	-		-		-		27	25	(93)	2	(7)	-		-		-	
0-59	74	69	(93)	5	(7)	-		-		-		70	64	(91)	6	(9)	-		-		-	

TABLE 23. DISTRIBUTION OF WEIGHTS FOR AGE IN % OF HARVARD STANDARDS

TABLEAU 23. REPARTITION DES POIDS EN FONCTION DE L'AGE EN % DES NORMES DE HARVARD

AGE (MONTHS) (MOIS)	BOYS GARÇONS											GIRLS FILLES										
	TOTAL NUMBER NOMBRE	>90		80-89		70-79		60-69		<60		TOTAL NUMBER NOMBRE	>90		80-89		70-79		60-69		<60	
		n	(%)	n	(%)	n	(%)	n	(%)	n	(%)		n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
0-5	8	8	(100)	-		-		-		-		8	3	(38)	1	(12)	4	(50)	-		-	
6-11	10	6	(60)	2	(20)	1	(10)	1	(10)	-		7	2	(29)	2	(29)	2	(29)	1	(3)	-	
12-23	14	2	(14)	4	(29)	5	(36)	1	(7)	2	(14)	13	-		4	(31)	3	(23)	4	(31)	2	(15)
24-35	14	3	(21)	5	(36)	4	(29)	2	(14)	-		15	1	(7)	5	(33)	7	(47)	2	(13)	-	
36-59	28	2	(7)	12	(43)	8	(29)	6	(21)	-		27	5	(19)	9	(33)	13	(48)	-		-	
0-59	74	21	(28)	23	(31)	18	(24)	10	(14)	2	(3)	70	11	(16)	21	(30)	29	(41)	7	(10)	2	(3)

TABLE 24. ERUPTION OF TEETH

TABLEAU 24. PERCEE DES DENTS

AGE (MONTHS) (MOIS)	NUMBER NOMBRE	NUMBER OF TEETH NOMBRE DE DENTS															
		0		1-2		3-4		5-8		9-12		13-16		17-19		20	
		n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
6-8	9	6	(67)	1	(11)	1	(11)	1	(11)	-		-		-		-	
9-11	8	-		4	(50)	1	(13)	3	(37)	-		-		-		-	
12-17	15	-		-		-		6	(40)	6	(40)	3	(20)	-		-	
18-23	9	-		-		-		-		-		9	(100)	-		-	
24-29	16	-		-		-		-		-		5	(31)	6	(38)	5	(31)
30-35	13	-		-		-		-		-		1	(8)	1	(8)	11	(84)
36-41	14															14	(100)

TABLE 25. ENAMEL HYPOPLASIA

TABLEAU 25. HYPOPLASIE DE L'EMAIL

AGE (MONTHS) (MOIS)	N	n	(%)
24-35	29	2	(7)
36-47	21	1	(5)
48-59	28	5	(18)
24-59	78	8	(10)

TABLE 26. CLOSURE OF ANTERIOR FONTANEL

TABLEAU 26. FERMETURE DE LA FONTANELLE ANTERIEURE

AGE (MONTHS) (MOIS)	N	CLOSED FONTANEL FONTANELLE FERMEE	
		n	(%)
19-11	8	1	(13)
12-17	17	8	(47)
18-23	10	7	(70)
24-29	16	14	(88)
30-35	13	12	(92)
36-41	14	14	(100)

FIG. 1

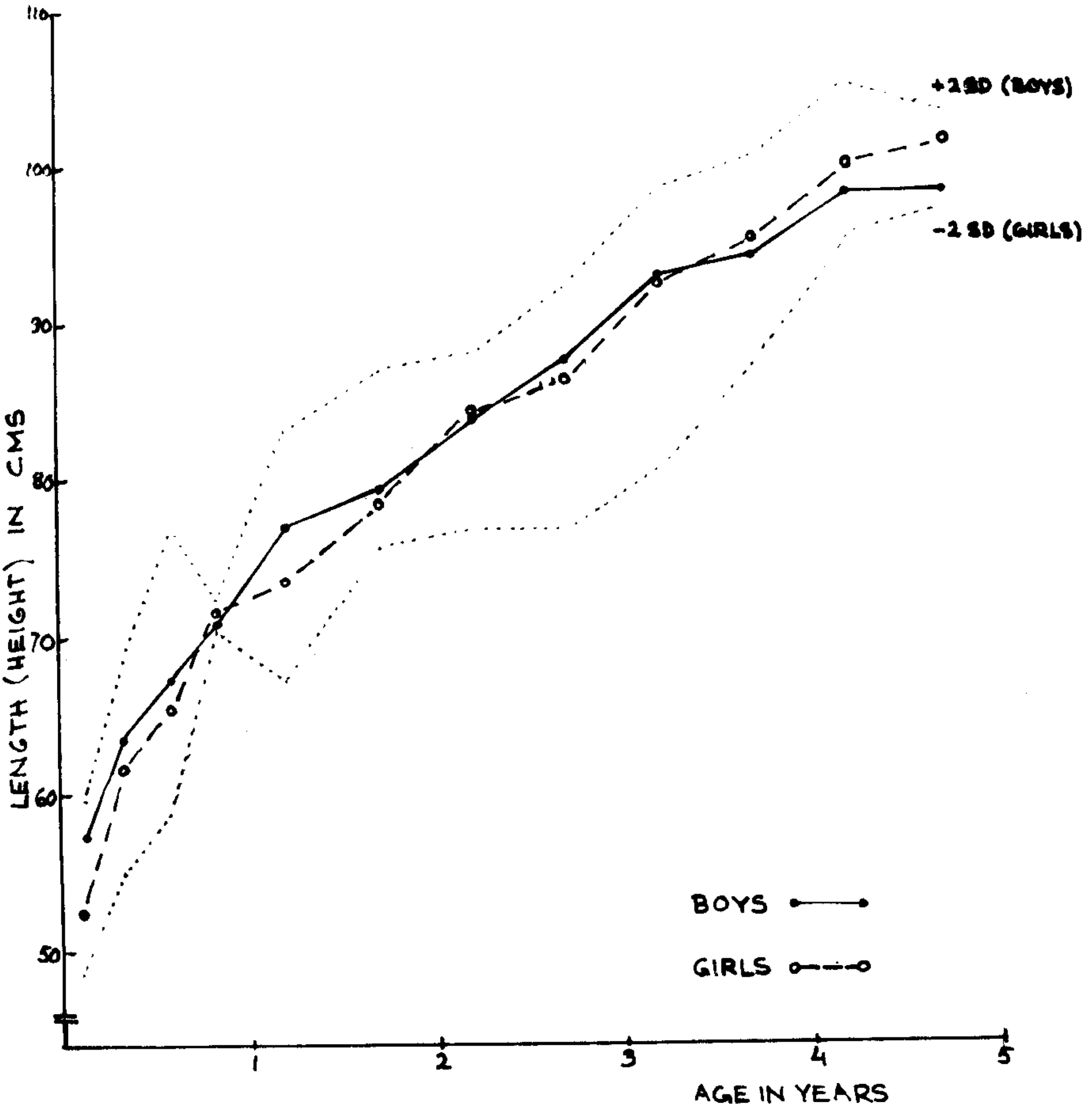

110
100
90
80
70
60
50
LENGTH (HEIGHT) IN CMS
1
2
3
4
5
AGE IN YEARS
+2SD (BOYS)
-2 SD (GIRLS)
BOYS
GIRLS

FIG. 2

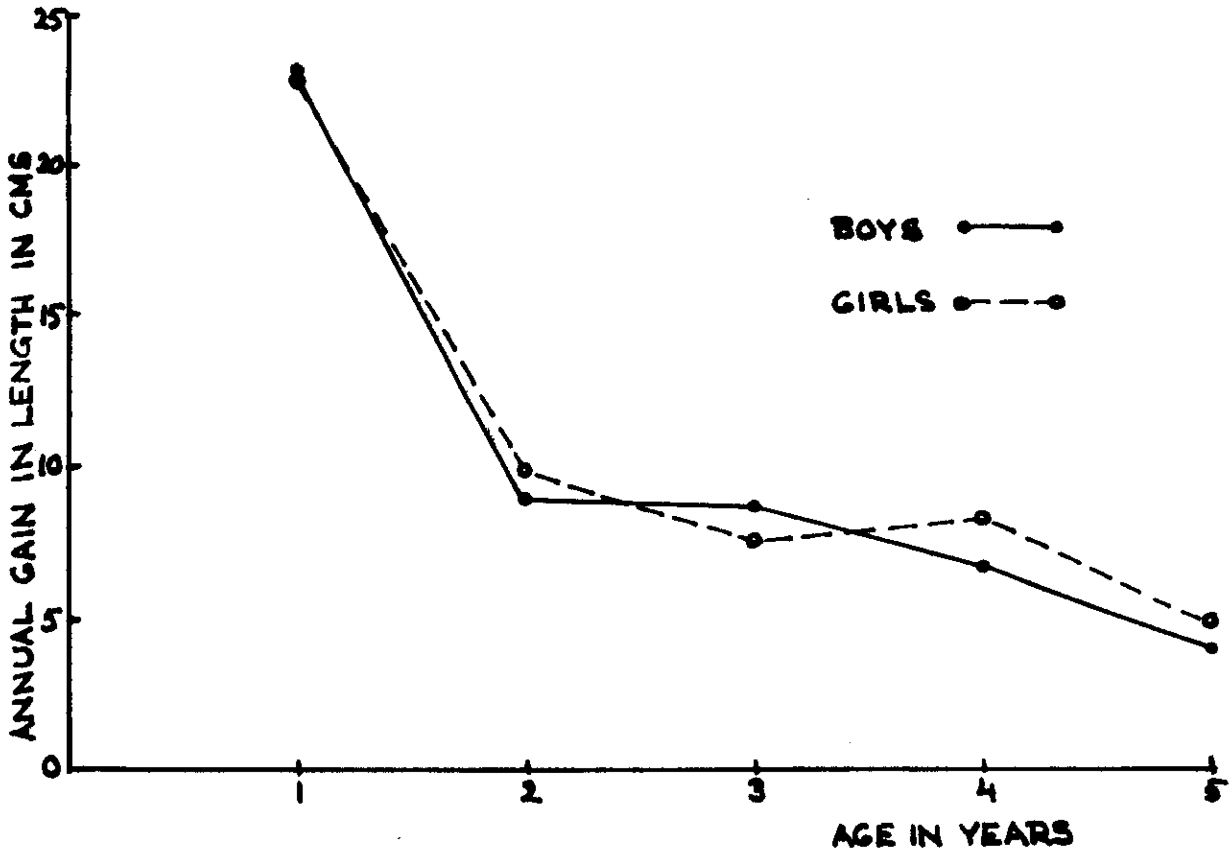
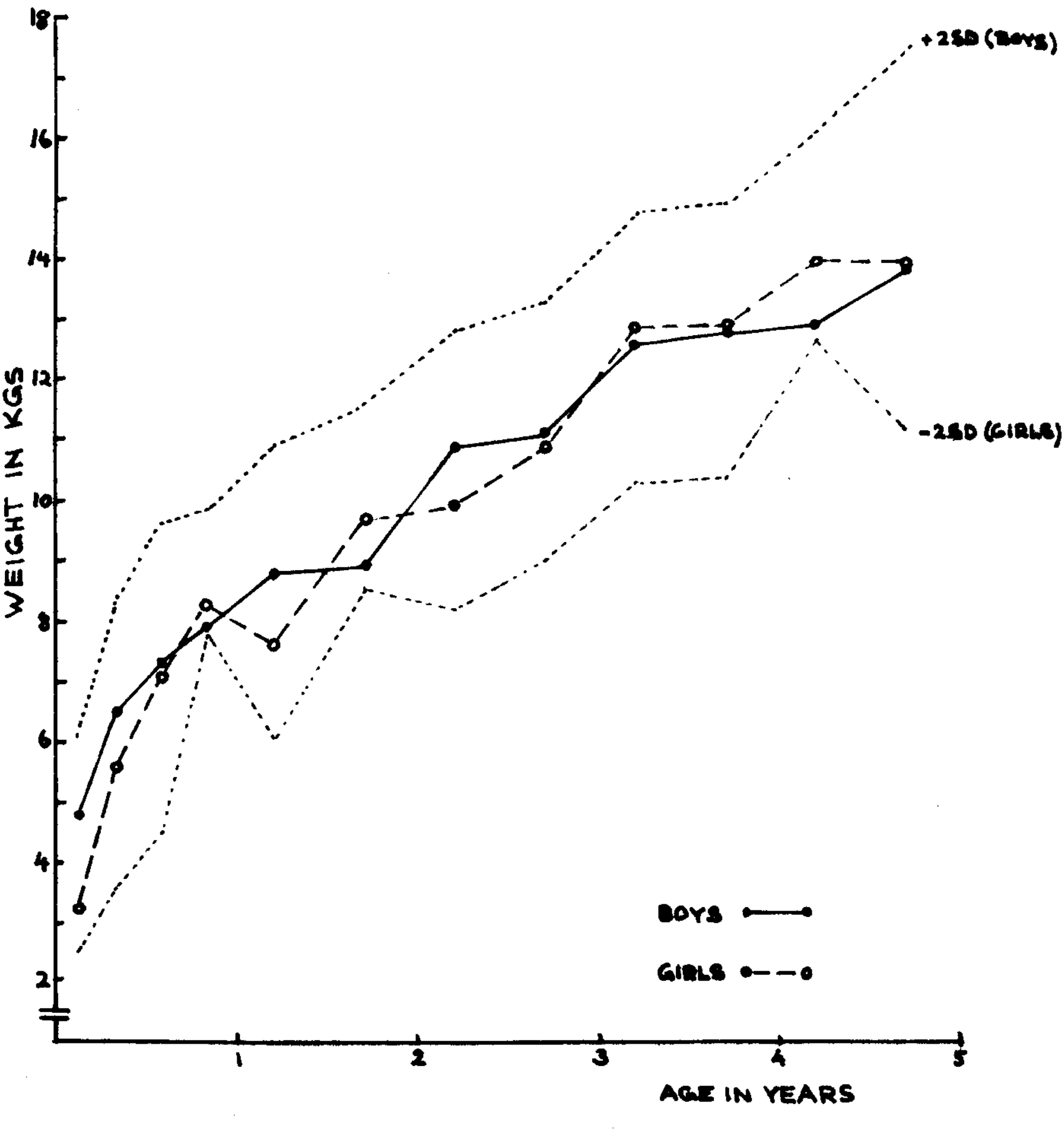

ANNUAL GAIN IN LENGTH IN CMS
25
20
15
10
5
0
BOYS
GIRLS
1
2
3
4
5
AGE IN YEARS

FIG. 3


LENGTH IN % OF HARVARD STANDARD
110
100
90
80
BOYS
GIRLS
1
2
3
4
5
AGE IN YEARS

FIG. 4



+2SD (BOYS)
-2SD (GIRLS)
WEIGHT IN KGS
18
16
14
12
10
8
6
4
2
1
2
3
4
5
AGE IN YEARS
BOYS
GIRLS

FIG 5

FIG. 6

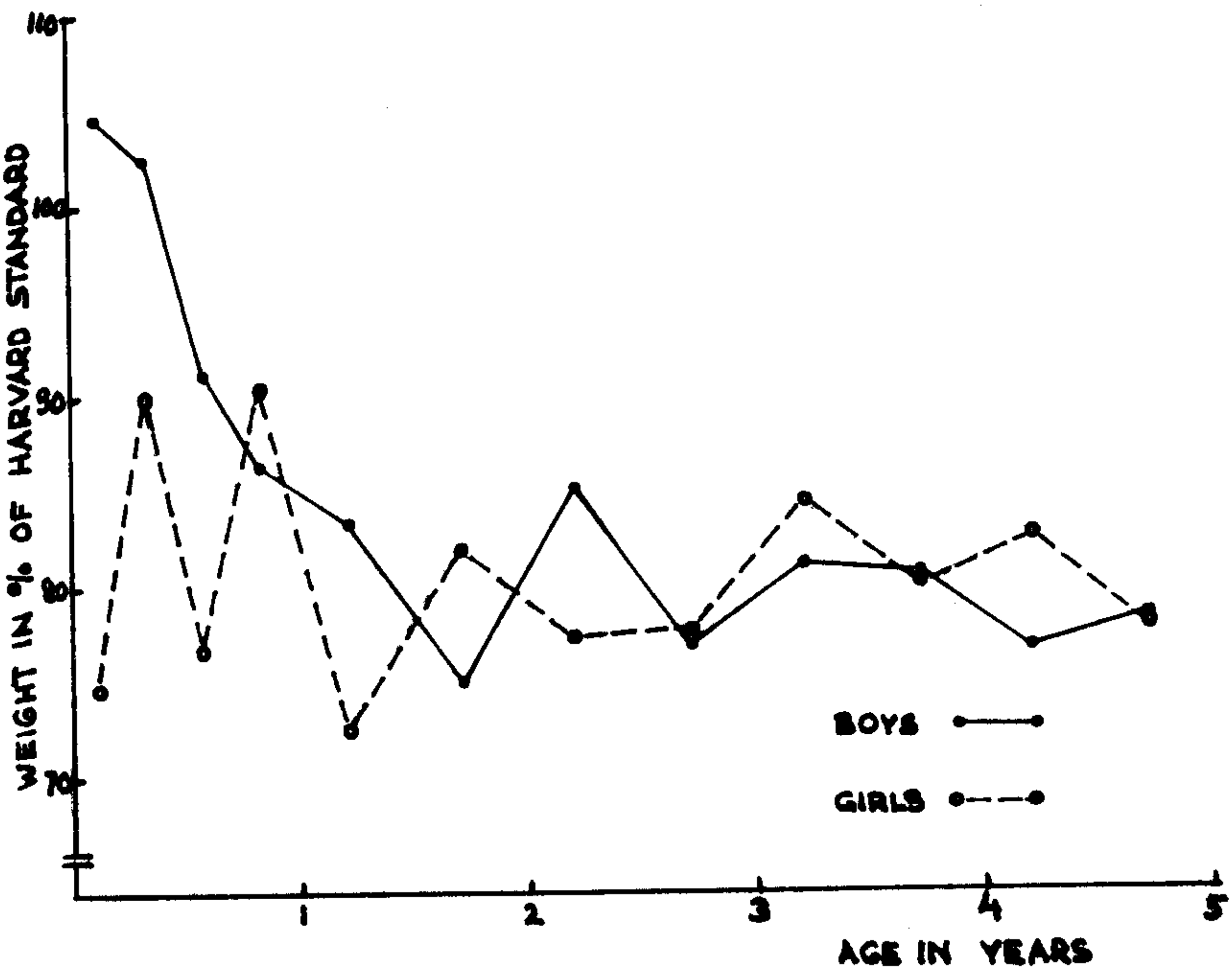

110
100
90
80
70
WEIGHT IN % OF HARVARD STANDARD
1
2
3
4
5
AGE IN YEARS
BOYS
GIRLS

FIG. 7

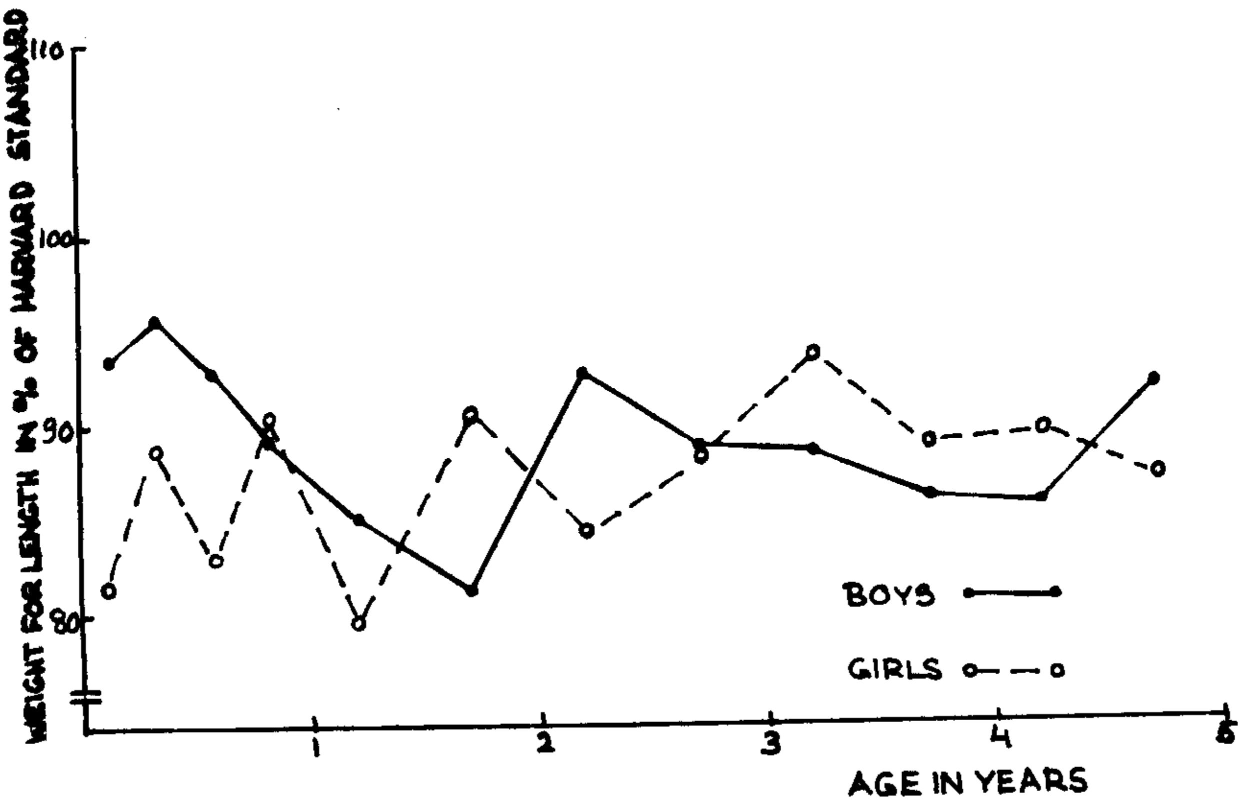

110
100
90
80
WEIGHT FOR LENGTH IN % OF HARVARD STANDARD
1
2
3
4
5
AGE IN YEARS
BOYS
GIRLS

FIG. 8

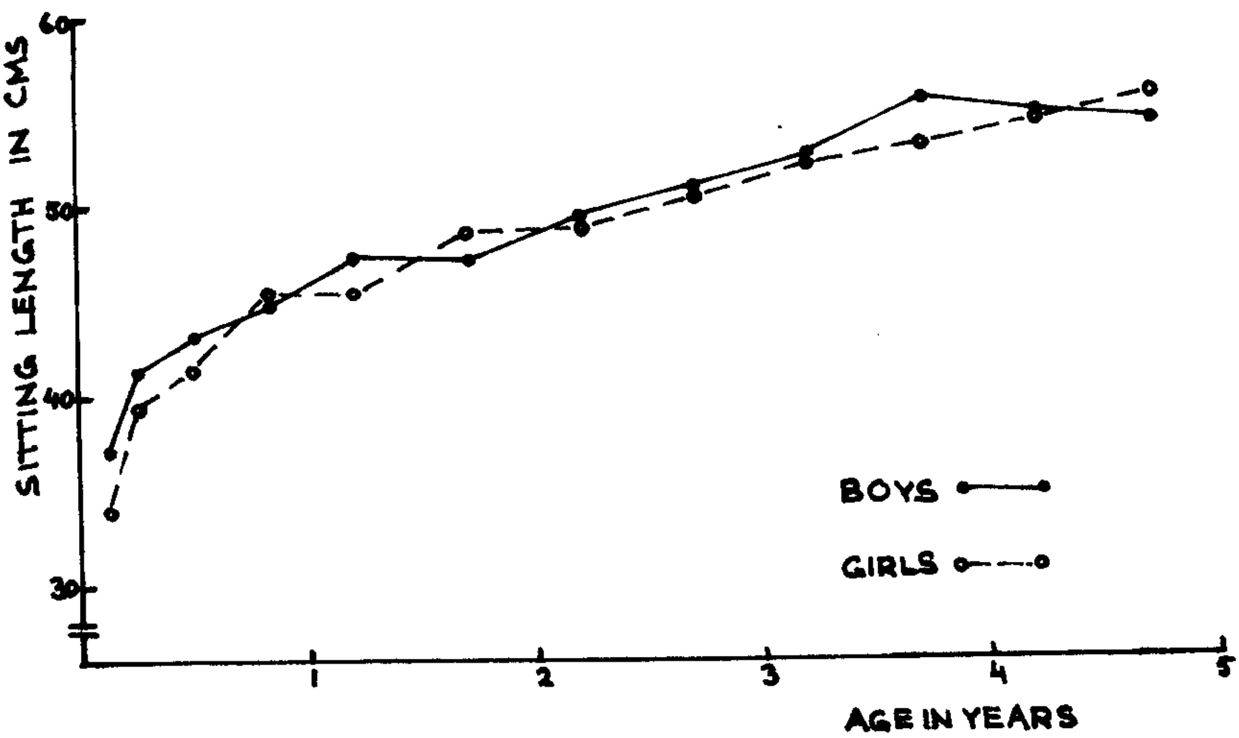

SITTING LENGTH IN CMS
60
50
40
30
BOYS
GIRLS
1
2
3
4
5
AGE IN YEARS

FIG. 9

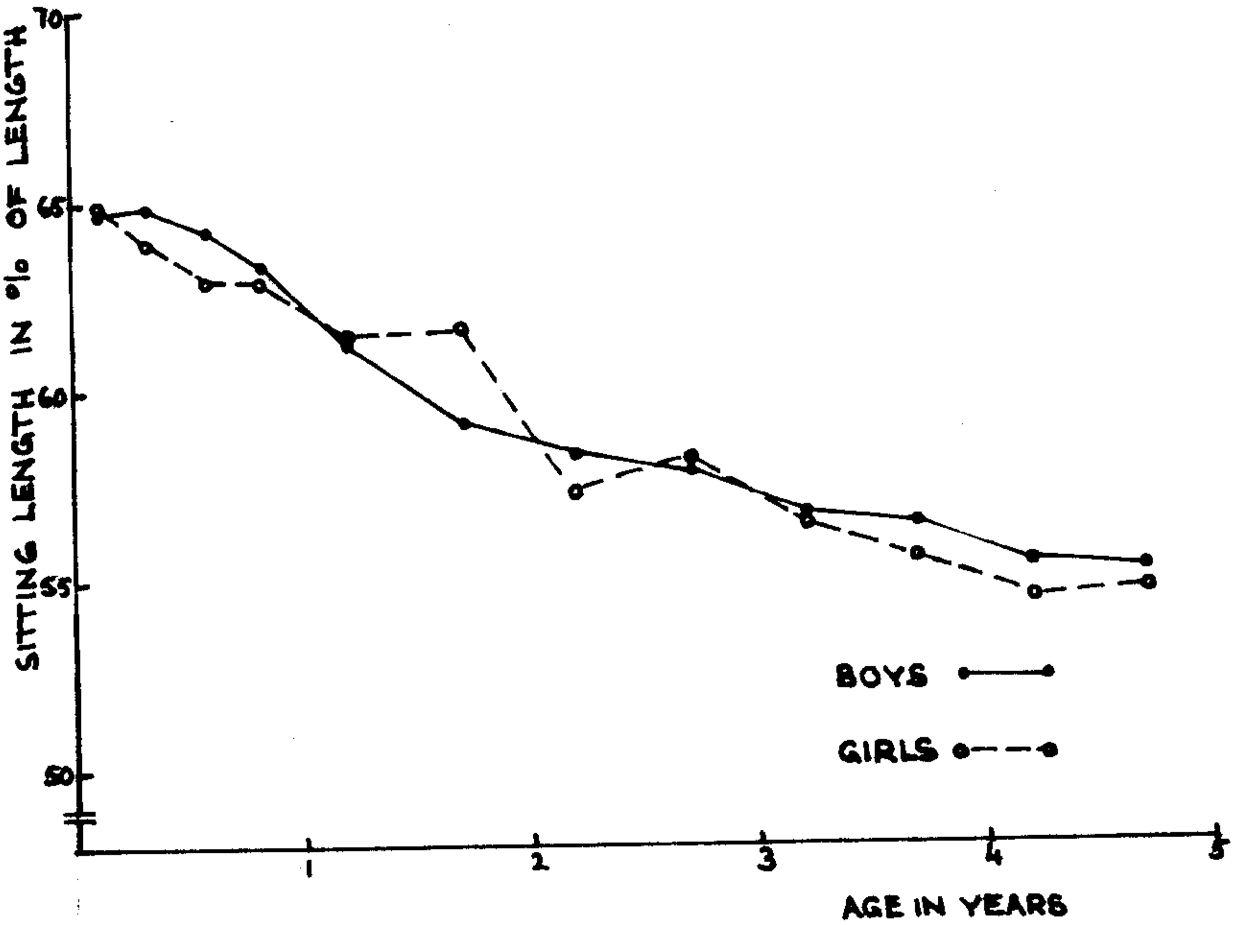

SITTING LENGTH IN % OF LENGTH
70
65
60
55
50
BOYS
GIRLS
1
2
3
4
5
AGE IN YEARS

FIG. 10

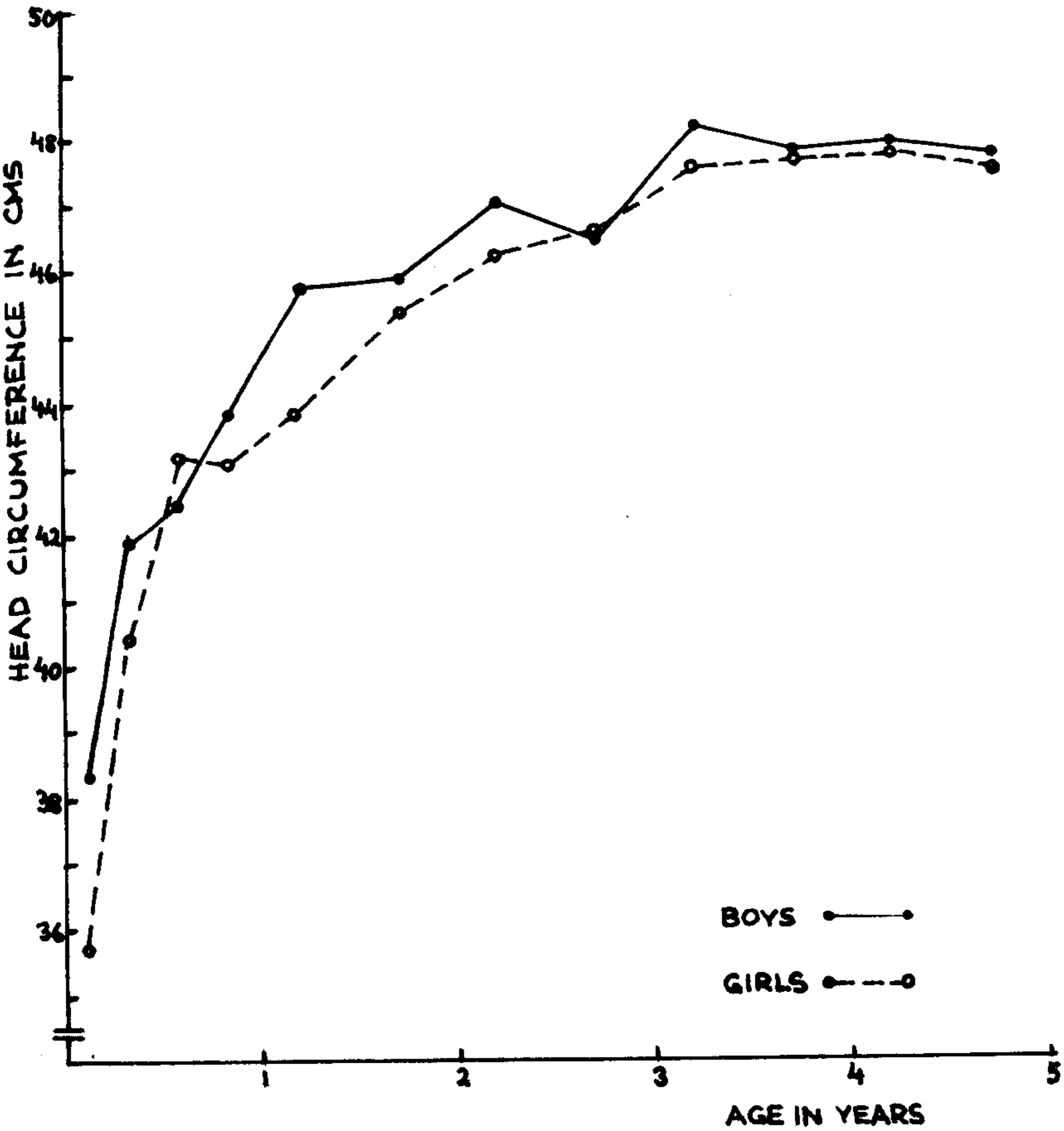

HEAD CIRCUMFERENCE IN CMS
50
48
46
44
42
40
38
36
1
2
3
4
5
AGE IN YEARS
BOYS
GIRLS

FIG. 11

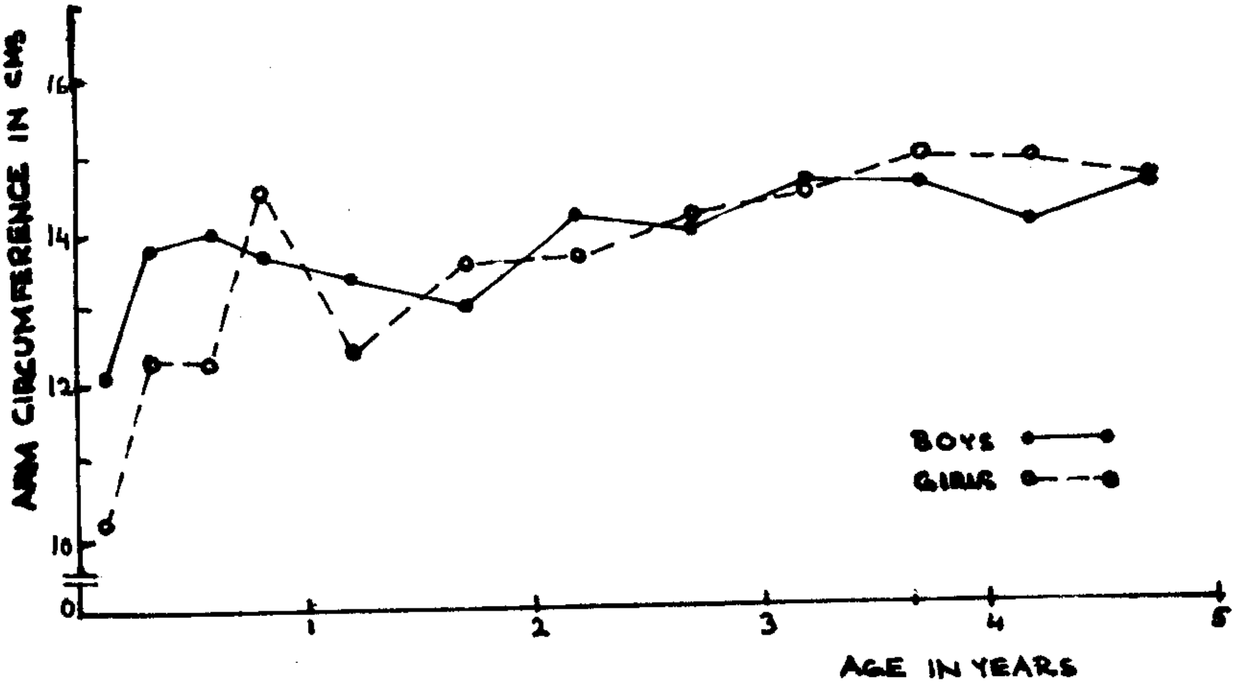

ARM CIRCUMFERENCE IN CMS
16
14
12
10
0
1
2
3
4
5
AGE IN YEARS
BOYS
GIRLS

FIG. 12

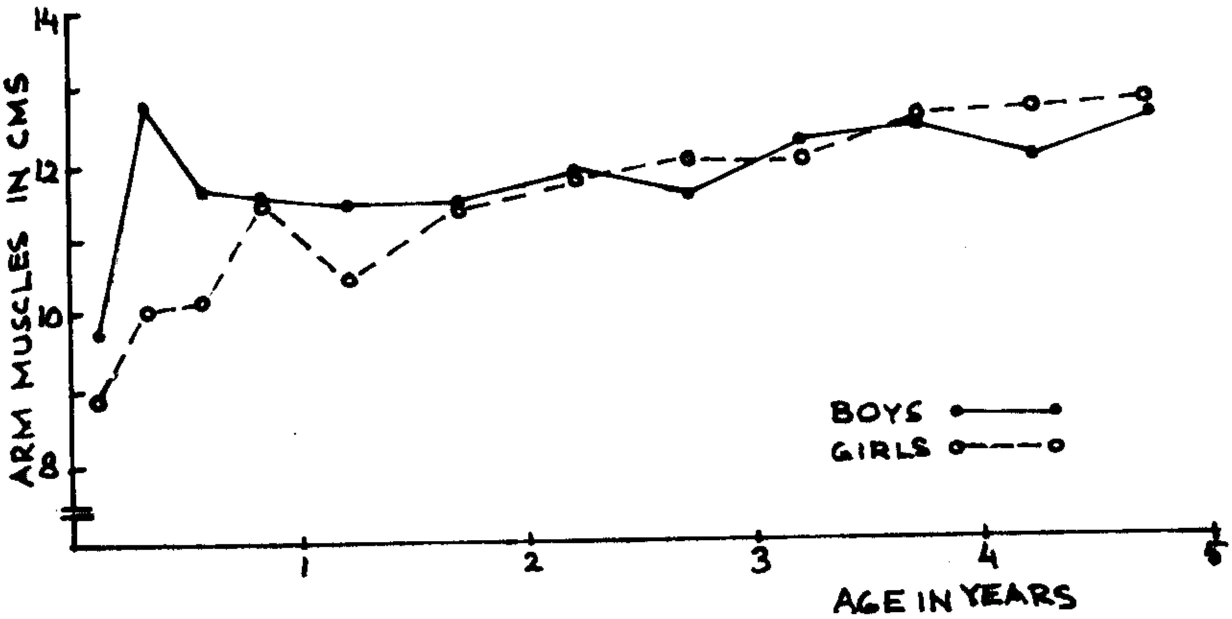

ARM MUSCLES IN CMS
14
12
10
8
1
2
3
4
5
AGE IN YEARS
BOYS
GIRLS

FIG. 13

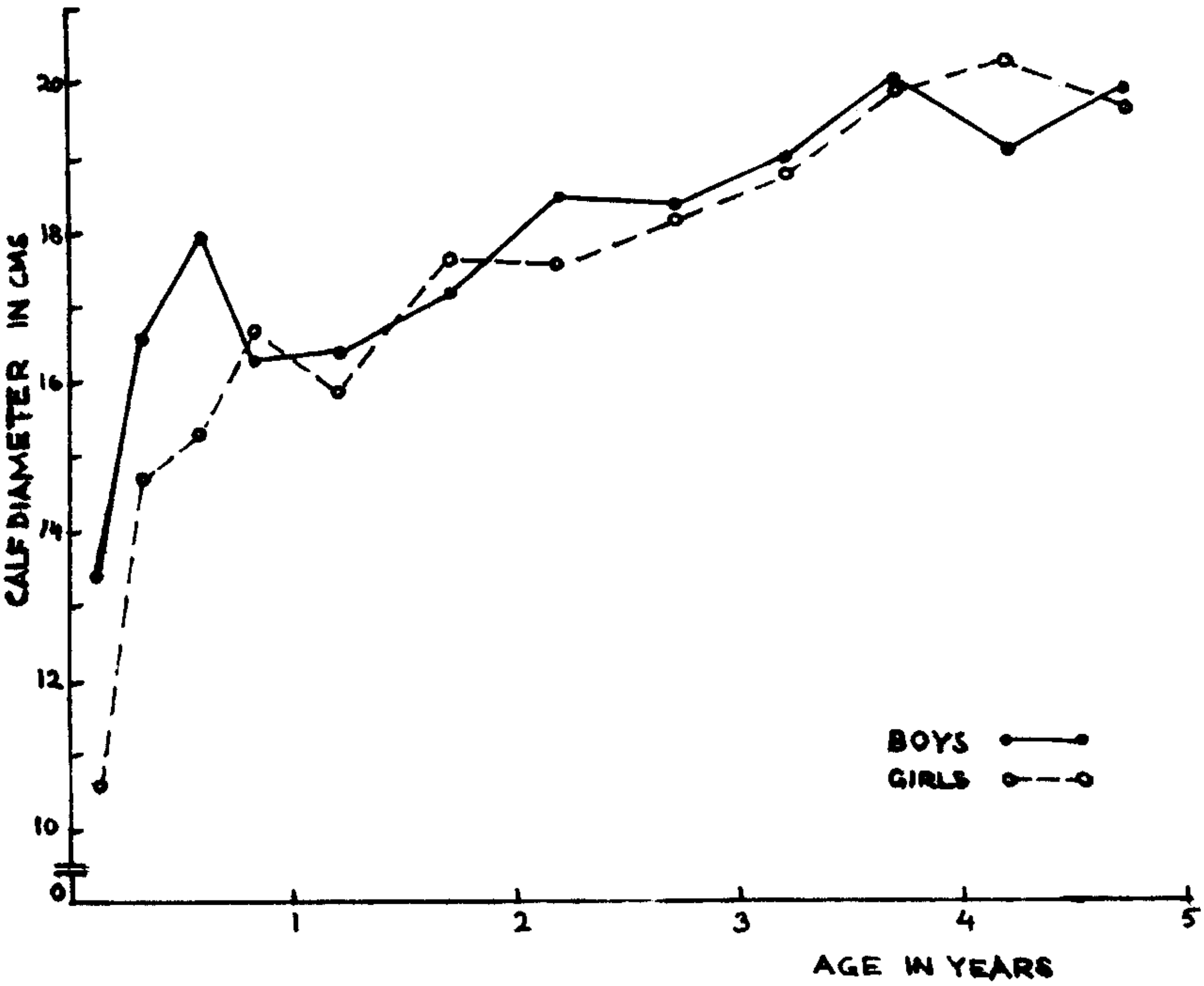

CALF DIAMETER IN CMS
20
18
16
14
12
10
0
1
2
3
4
5
AGE IN YEARS
BOYS
GIRLS

FIG. 14

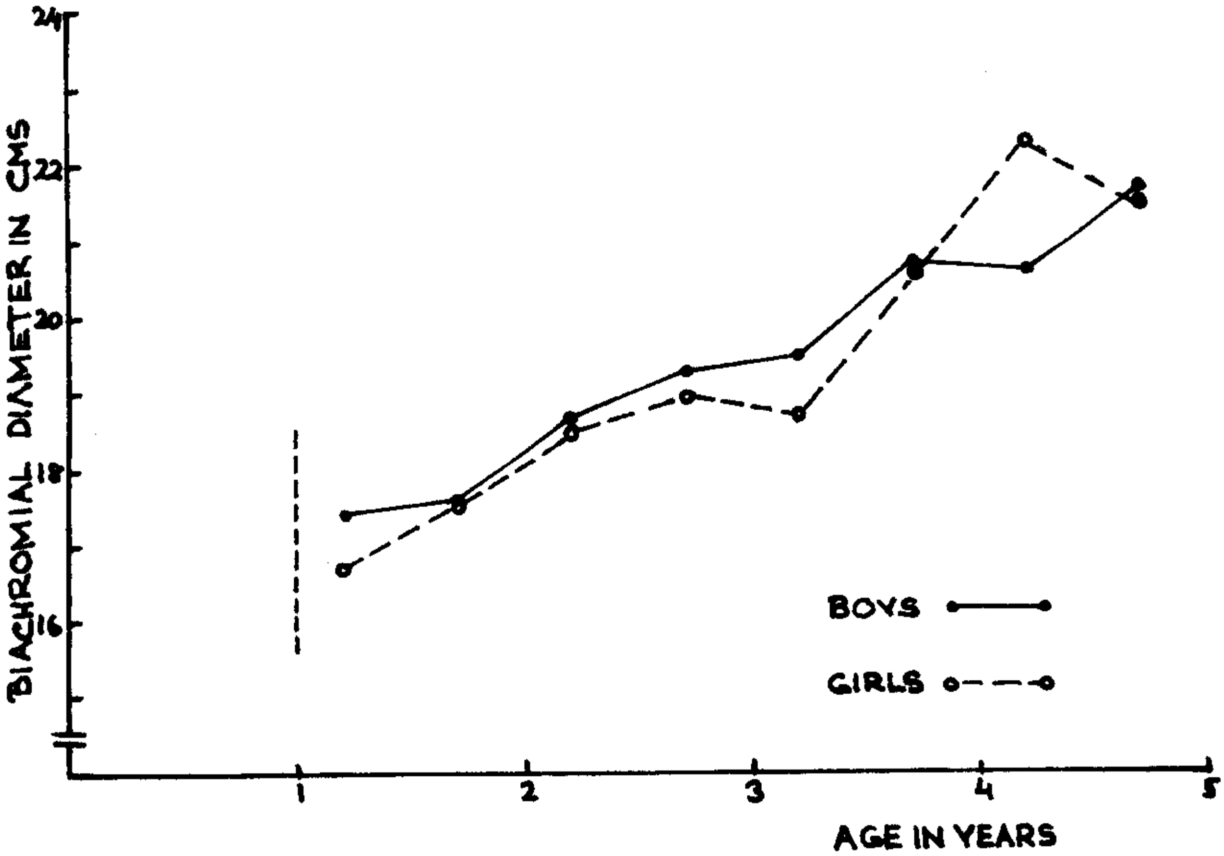

24
22
20
18
16
BIACHROMIAL DIAMETER IN CMS
1
2
3
4
5
AGE IN YEARS
BOYS
GIRLS

FIG. 15

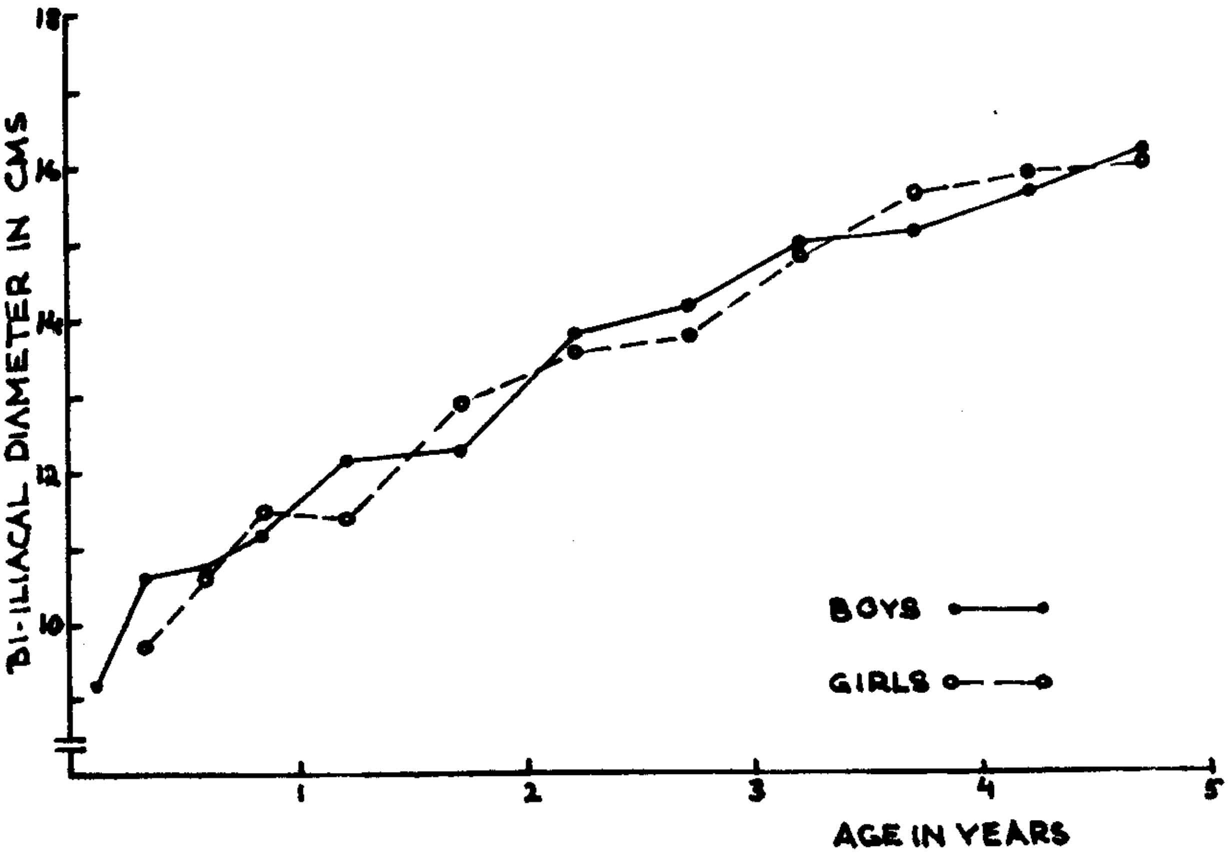

18
16
14
12
10
BI-ILIACAL DIAMETER IN CMS
1
2
3
4
5
AGE IN YEARS
BOYS
GIRLS

FIG. 16

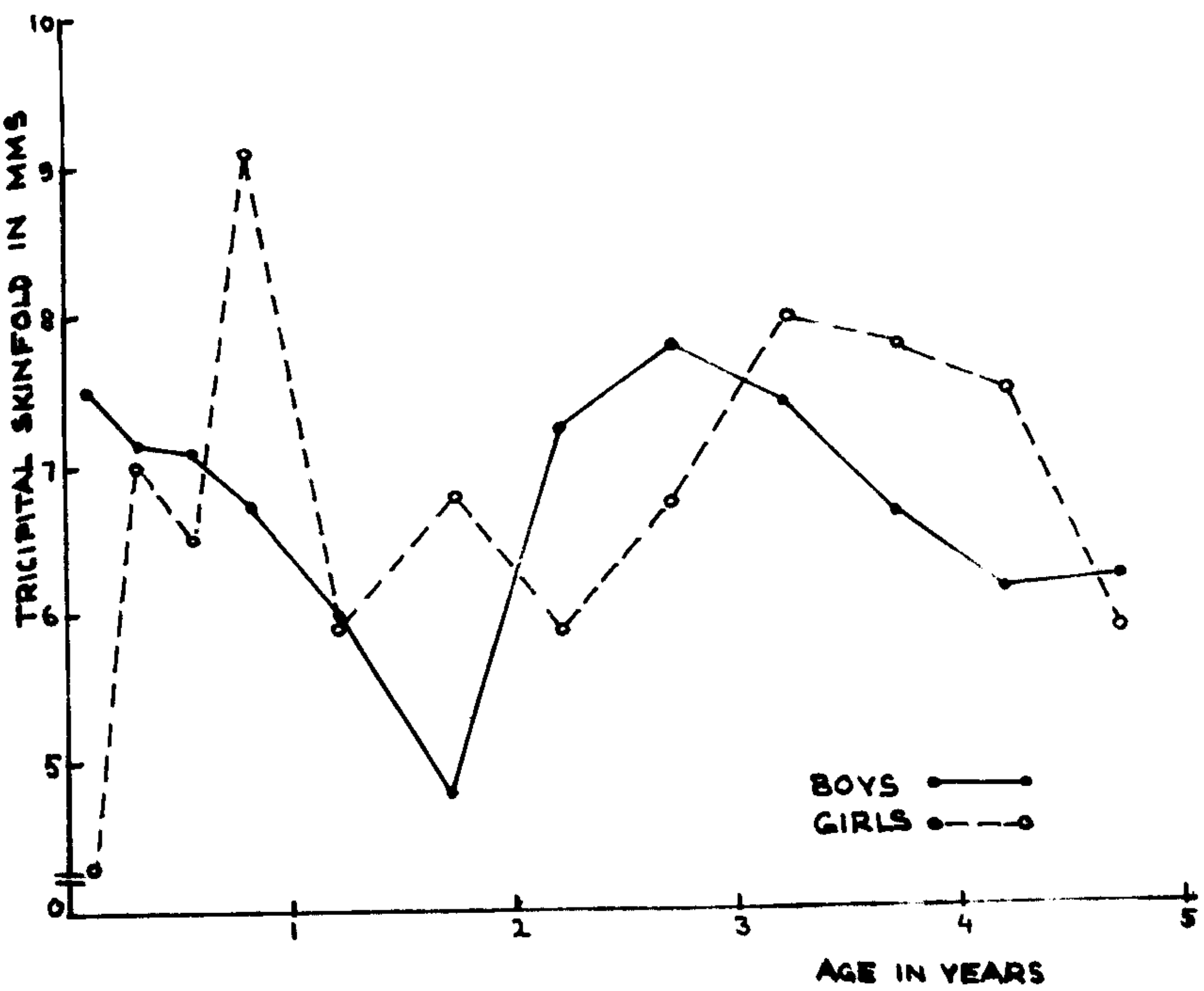

TRICIPITAL SKINFOLD IN MMS
10
9
8
7
6
5
0
1
2
3
4
5
AGE IN YEARS
BOYS
GIRLS

FIG. 17


SUBSCAPULAR SKINFOLD IN MMS
7
6
5
4
0
1
2
3
4
5
AGE IN YEARS
BOYS
GIRLS

ANNEX IV

BACKGROUND AND OBJECTIVES OF HEALTH AND NUTRITION EDUCATION IN THE PILOT AREAS OF MELANESIA : WALA-RANO, TAUTU (MALEKULA).

by
Professor A. Raoult

Reference Documents

Much valuable information that can serve as guide-lines for health and nutrition education is obtainable from the South Pacific Commission in the form of reports on previous surveys and various specialized publications. In addition, results of recent studies of the communities mentioned above can be made available to health educators on request, in particular:

(1) Growth Studies conducted by Dr Anja Niiranen in Wala-Rano and Aitutaki of pre-schoolchildren (0 to 5 years).

(2) Reports on surveys conducted by Professor A. Raoult in SPC Pilot Areas, containing clinical and anthropometric data on :

- pre-schoolchildren (0 to 5 years);
- school-age children, in Wala-Rano, Amelvet, Norsup, Aitutaki and Tautu;
- adolescents and adults.

(3) A study of the psychological and cultural aspects of food patterns by Miss Margaret Mackenzie; (personal communication to the SPC Health Educator, who took part in this study).

(4) A study of environmental conditions at Tautu and in Wala-Rano written by Mr Eric Dunn, SPC Adviser in Environmental Health.

(5) General background data collected at Tautu and in Aitutaki by Miss Bushra Jabre, on dietary patterns, food production and marketing.

Further information on Wala-Rano can be easily obtained from Mr Delion, Chief Agricultural Officer for Norsup district and from the resident missionary, Father Soucy, the Catholic Sisters who assist him, or the Agricultural Extension Officer. The local population will also be found most willing to assist, and information specifically concerning health can be had from the Norsup hospital.

DATA PERTAINING TO HEALTH AND NUTRITION OF MALEKULA COMMUNITIES (WALA-RANO AND TAUTU)

The major nutritional problems are:

Infants and pre-schoolchildren

- Iron deficiency anaemia in infancy;
- protein-calorie malnutrition, i.e. combined undernutrition and protein malnutrition, occurring in early childhood during the weaning period or shortly after.

School-age children

- Mild undernutrition and protein malnutrition;
- after-effects of malnutrition carried over from the previous phase;
- vitamin A and C deficiencies, but especially vitamin B2 (riboflavin) deficiency due to lack of animal proteins in the diet;
- anaemia, due to parasites (hookworm, flagellates, malaria), and nutrient deficiencies (iron, vitamin C, folic acid, protein);
- periodontal diseases.

Pregnant and nursing women

- Anaemia due to parasites (as above);
- anaemia due to multiple nutrient deficiencies: iron, vitamins B and C, proteins;
- periodontal diseases.

ENVIRONMENTAL CONDITIONS

The nutritional status is influenced not only by dietary factors but also by environmental factors.

To be effective, health education must take both sets of factors into account.

Malaria is meso-endemic in the area. An anti-malaria campaign designed by WHO and directed by Dr R. Ratard, is to be launched in March 1975, and will, without any doubt, improve the state of nutrition and lower the incidence of anaemia.

Bacterial intestinal infections arising from contaminated food and water and from lack of personal hygiene, result in numerous cases of gastro-enteritis, severe enough to require admission to Norsup Hospital, that are followed by a long period of diminished resistance conducive to PCM and chronic diarrhoea. There is no organized system of prevention. These bacterial intestinal infections are the main cause of infant mortality, which is highest between 1 and 2 years of age.

Bacterial nose, throat, and ear infections are very common and often lead to pulmonary infections.

Skin infections are also very common and severe, especially in infants : impetigo - ecthyma- craw-craw, aggravated by insect bites and scabies, the latter being very widespread.

Skin fungus infections (pityriasis) are the rule rather than an exception.

Intestinal parasite infestation occurs from an early age. The most common and serious helminth is hookworm, but the ill-effects of Ascaris and the absorption disorders due to flagellate worms are far from negligible.

Of the measures to be taken for the improvement of environmental conditions, some require government assistance or a community effort :

- construction of a piped water supply, or a system of wells protected against pollution;
- drainage of stagnant water around the mouths of rivers and creeks;
- construction of new wells or improvement of existing ones by erecting concrete borders around them, closing them in, and installing a system for drawing water without contaminating the supply;
- building of an adequate number of sanitary latrines, reasonably close to the houses and to the fields where the inhabitants work during the day;
- advice on building better houses : concrete slab or pile foundations.

All these measures have been described in detail by Mr Eric Dunn (cf Part I). If sufficient enthousiasm is kindled within the local population, and this is the specific purpose of health education, many of these improvements can be carried out without much outside assistance by self-help teams made up of villagers.

Others are up to families and individuals,

and constitute, for the time being, the main objective of family education or at least the most easily attainable short-term aim.

- Protection of home supply of drinking water; cleanliness of collection and storage systems, covering of drums.

- Cleanliness of body and hands, particularly when preparing food for meals; home treatment of minor skin infections and injuries.

- Refuse collection and disposal; destruction by fire or composting.

- Penning of pigs; use of pig manure in fields and gardens.

- Control of insect pests in the home; destruction of mosquito breeding sites in and around dwellings; rat control.

- Covering of the ground around houses with a layer of coral or sea-sand to be renewed periodically; construction of play-pens for infants.

FOOD HYGIENE

Storage : food safes to protect foodstuffs from flies.

Cooking utensils : cleanliness, sterilization through boiling.

Early bottle-feeding should be discouraged; but if unavoidable, the following precautions should be taught:

- sterilization of milk and bottle;
- giving boiled salt water as emergency treatment in cases of gastroenteritis, together with a banana diet in the early stages;

or

- use of coconut water.

USEFUL EPIDEMIOLOGICAL DATA

(From Dr Ratard's report on his Wala-Rano survey with Prof. Raoult)

INTESTINAL PARASITES

198 school-age children were examined :

- 5 to 9 years : positive 55% (One or several species of parasites)
- 10 to 14 years : positive 58.1% (- idem -)

The following intestinal parasites were detected: ascaris, ankylostoma, strongyloides, trichuris, lamblia, other flagellates.

Ankylostoma (hookworm) is the predominant intestinal parasite:

5 to 9 years	Wala mainland	15%
	Rano mainland	11%
	Wala island	12%
	Rano island	0%
10 to 14 years	Wala mainland	23.5%
	Wala island	22%
	Rano mainland	25%
	Rano island	9.1%

Prevalence was very high in some of the more densely populated villages:

Sanwere : 30.7%, Wowoute : 66%.

Hookworm infestation is greatly but not solely responsible for anaemia; iron and protein deficiencies are major contributing factors as well; although heavily infested with parasites, adolescents have a low rate of anaemia.

Prevalence of anaemia

Haemoglobin level:

0 to 11 months	61% (due to iron deficiency and malaria)
12 to 23 months	68%
2 to 4 years	66%
5 to 9 years	72%
10 to 14 years	91%
Adults	77%

These findings highlight the need for better home hygiene; health education should stress the following points:

- adequate excreta disposal;
- covering of soil around dwellings with coral or sand;
- sand-pits for infants and toddlers;
- wearing of sandals from an early age.

At community level, and with Government assistance, health education should be reinforced by :

1. Systematic deworming of the entire population at least once, or preferably several times at regular intervals, using a multiple action anthelminthic.

N.B. In Aitutaki, the anti-filariasis campaign organized by WHO considerably lowered the prevalence of intestinal helminths.

2. More specific treatment in villages known to be heavily infested with certain parasites.

Means of financing a small-scale test campaign should be investigated without delay.

DATA CONCERNING NUTRITION

1. Nutritional crisis of infancy

The nutritional crisis begins around 6 months and reaches its peak around 16 months, comparatively late because of prolonged breastfeeding of babies, 16 months being, on an average, the age at which infants are completely weaned.

Recovery is very slow, notably as far as growth in stature and head circumference is concerned, and often incomplete by school entrance. Between 6 months and 3 years no child had height and head measurements above the Stuart and Meredith reference mean, which is the standard recommended by WHO where local standards are unavailable. On the other hand, before the age of 6 months the majority of children (11/15 boys for instance) are well above the reference curve for weight, height and head circumference. Between 6 months and 4 years, 30% had weights below the lowest reference curve, that is below the malnutrition line.

Health workers and everyone responsible for the health and welfare of young children, such as teachers, village leaders, family heads and mothers, should be made aware of this problem and taught how to deal with it.

Simultaneously, preventive MCH services, comprising regular weighing of children and mothers, and charting of individual growth curves on health cards, should be organized. Well-functioning MCH services already exist in many places, Efate (New Hebrides), Cook Islands, Western Samoa, etc., sponsored by WHO.

Mothers generally show concern for the growth and development of their children, but need advice and guidance. A few simple suggestions on dietary improvements will usually suffice in mild cases of malnutrition; more serious cases (second degree) can often be treated without hospitalization of the child, through organization of nutritional rehabilitation with demonstrations and test meals. This can prevent third degree malnutrition necessitating extensive hospital treatment.

2. Schoolchildren

The great majority of Wala-Rano schoolchildren are manifestly undernourished and show clinical sequelae of malnutrition suffered during the pre-school period.

Up to 14 years of age all children were below standard weight.

- 37% were between the standard (P 50) and 80% of the standard.
- 63% were below 80% of the standard.

In this lowest group 20% had enlarged parotid glands, which is regarded as a symptom of chronic malnutrition.

No school-meal service exists and no food supplements are given. Overall food intake of these children is inadequate. After a light breakfast before coming to school (usually consisting of leftovers from the previous day's evening meal) the majority of them eat nothing at all until they return home at night. This is the rule for children living on Wala and Rano islands, and who must take a boat to and from school, but also for many others who live too far from the mission school to have lunch at home.

DATA CONCERNING DIETARY PATTERNS

As at Tautu, diets in Wala-Rano are almost entirely traditional, consisting of starchy tubers (group III - 2) with a very little animal protein (pork, beef) on festive occasions.

Fishing is not a regular, organized activity, and the amount of fish eaten is small. As a result, protein intake does not cover the high requirements of growing children, pregnant women and nursing mothers. Calorie intake of adults is adequate, and for men, protein intake is adequate also. The protein problem can best be solved by increased consumption of animal protein from fowls and small stock raised around the homes. Most local people, especially the high-risk groups, derive no benefit from the large herds of cattle grazing in the area, because slaughtering, processing, preservation and marketing facilities do not exist.

Legumes that yield dry seeds, such as beans, peas and lentils, are not grown locally and never used; villagers know neither how to cook dry vegetables nor how to preserve them. Cooked green leaves could be a useful supplement, but they are not prepared in a way suitable for young children. Fruit is plentiful in some seasons, but never used as juice or dessert for children. As a result, diets are deficient not only in all types of protein, but also in certain amino acids (methionine, tryptophane), in minerals (iron), in Group B vitamins (B6, B12) and in vitamins A and C, which gives rise to anaemia where the need for these body building nutrients is particularly high (pregnant and nursing women, infants).

The general aim of health education is to teach people what an adequate and well balanced diet is, by giving them concrete examples in the field, to encourage early supplementary feeding in infancy, rich in calories if the child is being breastfed, rich in both calories and proteins during weaning. Simple guide-lines and recipes for improved nutrition abound in recent publications, those issued by WHO in particular. The suggestions found in these publications can be easily adapted to the specific needs of these villagers by trained health workers, home economics students, or any competent mother.

There is no substitute for an enthusiastic health worker who is willing to live with the people while training them. The Wala-Rano Mission staff, who is very familiar with the local context and very influential, can provide invaluable assistance in this connection and there is still room for improvement in its already very good work.

At Tautu, political leaders, medical staff and para-medical workers are already doing much to help the people and further activities should build on those already existing, such as the women's clubs directed by Mr Delion. The following outline, prepared by the Nutrition Project Manager, may be found useful in local education programmes, because it classifies foods according to availability.

5 main groups and 2 ancillary groups (VI and VII) list the items that should be encouraged or, on the contrary, advised against.

GROUP I

EGGS : There seems to be no prejudice against eggs. Pregnant women and nursing mothers should be urged to eat them, to include them very early in the baby's diet and to go on giving them regularly throughout the growing period.

POULTRY : Hens and chickens exist in large numbers in all the villages, but they are left to run free and, for this reason, many eggs are simply lost. They are never "raised" in the proper sense of the word and receive no special food, which means that they do not lay as well as they should.
In the present co ntext, eggs would be the most realistic way of adding more protein to the diet, but neither eggs no fowls can be bought as a rule; they are sometimes bartered or given as presents.

MILK AND MILK PRODUCTS : Prolonged breastfeeding is still a widespread custom; complete weaning hardly ever occurs before 14 to 18 months. It is absolutely necessary to encourage this practice, to explain the advantages of breast-milk, especially its protective function, to explain also that the quality of the mother's milk depends to a large extent on her diet, while emphasizing that after the age of about 6 months breastfeeding is no longer sufficient to cover the infant's needs. In special cases : death or illness of the mother, premature birth, accidental weaning, etc., the necessary child-rearing advice is best given by the dispensary staff.

MILK : A large herd of semi-wild cattle grazes under coconut in Wala-Rano. It is owned on a co-operative basis by the people and the Mission. However families derive very little food from this resource: a few animals are slaughtered for celebrations, but, in the absence of refrigeration, the meat cannot be preserved for any length of time and is hardly every given to children. (The same applies to pork.) The herd is reputedly in very good health, but the cows are not milked, through fear and ignorance, and an important potential resource thus goes to waste. Organized milk production would require costly equipment and can only be set up by the Department of Agriculture within the frame- of a long-term economic programme designed mainly for the benefit of the local people rather than for export or quick profit.

The development of goat-milk production appears to offer more promising short-term prospects. Several families own goats. They are known to be disease-free and people would probably feel less apprehensive about milking them. The number of goats kept around the home as part of the family live-stock, could well be increased. There does not seem to be much risk of soils deterioration, since vegetation is abundant and the animals could be penned, tied to a tree, or held while grazing.

<u>All efforts to promote fresh milk production and consumption must be accompanied by advice on the major rules of hygiene, for spoilt milk represents a great health hazard</u>.

PROCESSED MILKS : In spite of some drawbacks, these are, in the present context, far safer than fresh milk. They can be bought from local stores in the form of evaporated milk or sweetened condensed milk. An inventory of what is actually available in the shops should be made before any brand of tinned milk is recommended. Processed milks are all expensive in relation to local earnings. They cannot therefore be recommended except as food supplements, in small quantities, unless an urgent need exists. Dilution of tinned or powdered milk with water from the local sources of supply is to be discouraged, because local water is often polluted. People should be told rather to add powdered milk directly to mashed vegetables or to mix it with coconut milk.

The use of sweetened condensed milk is not to be advocated.

The <u>recommended daily milk intake</u> for a child aged between 1 and 2 years is 30 g of powdered milk (preferably skimmed), that is to say three tablespoons full. Powdered milk, in a well closed tin, can be kept safely for a week under local conditions. The milk intake recommended above may be reduced by half is other group I proteins are given at the same time (combination milk-eggs, etc.).

CHEESE : Cheese should be recommended even more strongly than milk. Dry, Cheddar-type cheeses keep very well, are easy to nibble at odd times through the day, and may be grated and added to any dish. 10 to 30 g of cheese per day constitutes an excellent protein and calcium supplement. Development of the livestock industry will necessarily entail acculturation of the people, a gradual weaning from vegetarian habits to meat-and-dairy patterns of eating. They must be given time to adjust to these new foods, and schools have a very important part to play in this process.

MEAT AND OFFAL : Local cattle being free of disease, minced, grilled or boiled, meat (without fat) can be given to children from an early age, whenever the opportunity arises. The same applies to offal, particularly liver (of cattle or pigs), very rich in iron and vitamins, and brains, both of which should be set aside for women and children.

FISH : The fish caught and eaten in the area are usually properly prepared and can be given to children even earlier than meat (after removing skin and bones). However, fishing in Wala-Rano is not very efficient and regular. Readers will recall that the children living in Ahamb, South Malekula, were found to be nutritionally far better off than Wala-Rano and Tautu children, mainly because Ahamb is a fishing village where large amounts of fish are eaten. The development of small-scale fishing in Wala-Rano would appear one of the easiest and most effective ways of increasing protein production.

TINNED FISH : Until fishing becomes a major activity, tinned fish, bought from the local stores, should be given preference over corned beef, which has become very popular. Corned beef often contains a lot of fibre and fat, which makes it hard to digest for little children, and is also rather expensive. Quite a small quantity of tinned fish considerably enhances the nutritive value of an otherwise largely starchy meal; tuna, skipjack, mackerel are available, but sardines in oil are the most valuable since they are rich, not only in calories, but also in polyunsaturated fatty acids, and indeed constitute one of the most convenient remedies for mild PCM. Children usually like the taste of sardines and a tin of five to six sardines per week makes an excellent supplement from 6 or 8 months onwards.
Health educators should emphasize that the group I foods can be used either singly, or in combination, or alternately, according to price, availability, and individual taste. People should also be taught how to make "pies" and similar dishes that combine starchy staples with one or more of the group I foods.

<u>GROUP II</u> : <u>Vegetable proteins</u>. Most plant foods are poor in protein, particularly in such important nutrients as methionine, cystine, and tryptophane.

LEGUME SEEDS are an important exception. Dry beans, peas, and lentils, as well as many oily seeds, are rich or very rich in protein, but in this area they are hardly ever grown and people do not know how to cook them properly. The Department of Agriculture is doing its best to promote cultivation of edible legumes, in spite of considerable technical difficulties and the poor yields so far obtained.

GROUNDNUTS : Grown successfully in Papua -New Guinee, groundnuts should be introduced to this area; the main impediment would be rats, which are found in profusion and are very fond of groundnuts.
As a snack, roasted groundnuts are far preferable to sweets (which can be bought at Norsup) and children will soon acquire a taste for them. Plants of the cucurbita family (melon, squash, pumpkin) grow very well and their seeds, when roasted and salted, are good to eat.

SOYA BEAN :Soya bean cultivation has never been attempted in the area because of the presence of rats. With adequate rat control it should be possible, and people can be helped to get accustomed to the taste of soya bean if they are taught to use "soy sauce" instead of, or together with, "Maggi" seasoning, the latter being already much appreciated. Tropical varieties of peas could be tested first in family gardens. This is, properly speaking, <u>agricultural extension</u> work, which health education can merely reinforce by making the new foods more <u>acceptable</u> and <u>palatable</u>.

LEAVES : "Fafa" is a traditional dish, combining leaves and starchy tubers. Fresh leaves, thoroughly boiled to eliminate oxalic acid, are a fairly good source of high quality proteins. People should be encouraged to include green leaves in their diet and to give them to children (mashed and strained). The most commonly used are taro and cassava leaves. Among other things, leaves contain carotene, folic acid, iron and magnesium. Generally speaking, not enough use is made of this second group of foods (vegetable proteins) though it is far less costly than the first group. In home gardens, priority should be given to this group, rather than to group V foods (fruits), because many of the latter grow wild and are in plentiful supply.
N.B. : Of the industrial crops cultivated in the New Hebrides, cocoa would be the most useful. Grated, sweetened, and cooked, the cocoa kernel makes a tasty snack and a fairly valuable supplement. The use of commercial chocolate should not be promoted however, because it is too sweet and very expensive.

GROUP III: Energy foods, rich in carbo-hydrates.

CEREALS are not grown and are not part of the traditional diet. However, the use of bread, biscuits, and imported rice has become widespread in recent times. This trend should be firmly checked, because the protein content of white rice is very low and that of wheat flour hardly any higher; what vitamins and minerals they do contain, also exist in the local root crops.
The only cereal to be encouraged is maize, which is well adapted to the local climate and soil, and useful both for human consumption and as livestock fodder. In Tropical Africa, maize is extensively used with very good results, and constitutes the basic ingredient of numerous infant food preparations.

TUBERS, ROOTS AND BANANAS : The local staple foods are taros, of numerous varieties, and yams, which come in an even wider range of varieties, some of which contain up to 7 g/100 of protein. The yam is rightly held in high esteem and an object of worship. Several species of breadfruit exist and are commonly used in season, as are bananas (Musa sapientum) and plantains (Musa balbisiana). These are valuable foods, especially the coloured species, and their nutritive properties are in no way impaired through traditional methods of cooking. People should be strongly urged not to abandon these traditional foods. On the other hand, the introduction of cassava should be discouraged, despite the fact that it grows well under any circumstances, and is easy to digest. Cassava contains very little protein, and its widespread use in Africa is largely to blame for the high prevalence of Kwashiorkor among African children. As there is, at present, no danger of famine occurring in the New Hebrides, introduction of cassava is unnecessary to say the least.

SUGAR, SWEETS : People should be warned against using too much sugar, sweetened condensed milk, sweets, sweet biscuits, chewing gum and soft drinks (cf. Group VI).
Themes for discussion: Dental and oral diseases; obesity; arteriosclerosis; the concept of "empty" calories.
In the rural areas of the New Hebrides, these sugar-associated diseases hardly exist as yet, but could develop rapidly as living standards rise. Prevention being better than cure, spices should be recommended in preference to sugar.
The custom of chewing sugar cane used to entirely satisfy the local peoples' "sweet tooth", and the longer this custom prevails, to the exclusion of commercial sweets, the better it will be for the peoples' health and purse.
As far as this group of foods is concerned, educators should support tradition and help people resist advertising pressure to adopt harmful or useless imported products.

GROUP IV : No special recommendation or prohibition.

The only fatty substances in common use are coconut "milk" and "cream". Some plant oils can now be bought from the store. People should be dissuaded from frying foods, but told that oils are valuable, especially for young children (because of the essential amino acids they contain) when used uncooked in salads or cold dishes, alone or mixed with coconut "milk".

GROUP V : Although many kinds of fruits and vegetables grow virtually wild, only small amounts are eaten. Methods of preparing fruit and vegetable juices should be taught, to counteract the fashion of buying imported, ready-made beverages. Children should be given mashed raw or stewed fruit from 7-8 months on. Every family should be encouraged to have a small home garden and to grow tomatoes, "okra", rich in vitamins and calcium, and, above all, carrots, which, besides being a source of carotene, are excellent for preventing and curing diarrhoea. Bananas are usually classified as a Group III food. Expert advice on how and what to plant can be obtained from Mr Delion, the Agricultural Officer for Norsup, or from his counterpart in Lakatoro.

GROUP VI : Beverages

1. Alcoholism is rare in Wala-Rano, owing to the good influence of the Mission, but somewhat more common at Tautu, among the PRNH workers. Consumption of beverages with high alcohol content (all "strong" drinks, including wines), though the law at present authorizes them, should be opposed in every possible way.

2. Light beer, if drunk in reasonable quantities, may be tolerated, for it is often less harmful than polluted A maximum not be be exceeded under any circumstances, not even during celebrations, should be set (in the vicinity of 60 cc pure alcohol i.e. about 4 tins a day) and "Lager"beers recommended. This tactful approach is advocated because beer is a minor evil and it is always wise to accept what one cannot prevent ("if you can't beat them, join them").

3. Drinking of tea should be encouraged. Besides being a wholesome and stimulating beverage, tea contains fair amounts of niacin and tryptophane. Weak tea is a good drink for children, but should not be excessively sweetened. People should also be taught how to use local plants to make herb-teas.

GROUP VII : Salt and Spices.

Cooking in sea-water is a traditional practice which should not be abandoned, particularly as the fluoride content of sea-water along this coast is very high. Spicy plants such as pimento, capsicum and ginger should be used fresh as seasoning, and soy-sauce should be substituted for artificially flavoured sauces of very little nutritional value.

GUIDELINES FOR ACTION IN WALA-RANO AND TAUTU

What action can be undertaken in these areas will depend largely on how much time the SPC Health Educator, Miss Bushra Jabre, will be able to devote to them. The islands we visited in Polynesia appear to be far more advanced in respect of health and nutrition education than the New Hebrides, which is why we feel that action should primarily focus on Malekula, in spite of the greater number of difficulties involved, and the methods developed there then applied to other parts of the Condominium. Such is, in essence, the meaning of the term "pilot project".

The wide range of problems to be dealt with would necessitate, in the initial stage at least, full-time action aimed at:

- informing those responsible for the welfare of the community: health workers, teachers, village leaders, family heads, educated people of all kinds;

- organizing health education at community level .

The following are high-priority objectives:

1. General health education

(a) Eradication of hookworm.
(b) Provision of wholesome water.

2. Nutrition education

(a) Prevention of the weaning crisis (infant PCM).
(b) Supplementary feeding of schoolchildren.

N.B. The Health Educator should spend at least two months per year in each of the pilot areas, dividing her time between high-level activities, such as training of leaders, and "grass-roots" activities, such as home demonstrations and check-ups.

The recruitment of a Dietician with experience in nutrition education, as Assistant to the Nutrition Project Manager, will enable the Project team to investigate the quantitative aspects of food consumption and to recommend effective remedial measures.