

Sago Production and the Population Ecology of the Baroi of Papua New Guinea

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Abstract Palm sago is an efficient source of dietary energy in the otherwise marginal subsistence environment of the Purari delta. This report of sago subsistence and palm management of the Baroi in the context of nutritional and population ecology suggests that the reduction in the number of cultivars and increased palm density which has taken place as part of intensification of sago cultivation since 1947 has not resulted in improved nutritional status. The lack of change in the frequency of consumption of palm sago between 1947 and 1980, together with an increase in population size suggests increased overall production of this staple. However, it is not clear whether a ceiling to sago starch production has been reached. Increased population size has been largely attributed to reduced young child mortality as a consequence of health care provision, rather than dietary change. This study supports that view.

Key words: Papua New Guinea, Purari, Sago, Nutrition, Population

パプアニューギニア・バロイ族におけるサゴ生産と集団としての生存

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要約 人びとの生業適応にとってきびしい環境であるブラリ・デルタではサゴヤシは効率のよいエネルギー源である。本論文は、バロイ族を対象とし、栄養生態学および個体群生態学の視点からサゴヤシの利用と管理に焦点をあてたものである。1947年以降の集約化されたサゴヤシ栽培の結果、栽培品種数の減少とサゴヤシの密度の上昇が起こったが、これらは人びとの栄養状態の改善には結びつかなかった。1947年から1980年にかけてサゴデンプンの摂取頻度は変わらず、人口が増加したことは、サゴヤシの生産量の増加を示唆しているものの、それが限界値に達したか否かについては明かではない。本研究は、バロイ族の人口増加は食生活の変化というよりは、保健サービスの結果もたらされた幼少期の死亡率の低下に強く起因することを示している。

キーワード パプアニューギニア, ブラリ, サゴヤシ, 栄養, 人口

Introduction

Palm sago is the indigenous staple of the peoples of the Purari delta, of which the Baroi are one group. It gives high energy returns per unit of energy expended in its processing (Ulijaszek and Poraituk 1993) making it an efficient source of dietary energy, in an otherwise marginal subsistence environment. Sago may have been used as food in lowlands New Guinea for as long as 20,000 years

(Crosby 1976), although the only clear evidence for sago subsistence near the Purari Delta sets the earliest date at 1,500 years ago (Rhoads 1982).

In 1946 there was an indigenous effort to reorganise the Purari economy on a cooperative tribal basis, through the charismatic leadership of Tommy Kabu (Maher 1958). By attempting to engage in trade on a previously unprecedented scale, the aim was to modernize and gain the same prosperity as the European colonizers. Traditionally,

sago had been traded to Port Moresby, the capital of Papua New Guinea, and an expanded sago trade was the means by which economic growth was to happen. Part of this process involved the relocation and decentralisation of villages, and the planting of new sago grounds. In 1947, the people of three villages united to form a new one, Koravake (Hipsley and Clements 1950). Although Koravake was only 5, 4 and 2 miles away from the old village sites, new sago groves were planted close to the village as part of the Tommy Kabu movement, and to supplement the availability of sago starch from well managed and long-used, but now more distant groves. At this time, the Nutrition Survey Expedition (Hipsley and Clements 1950) carried out studies of diet and nutritional status in this village. In this paper, evidence for the intensification of sago production since 1947 is presented, and related to changes in population size, nutritional status and health.

Materials and Methods

Investigations of sago subsistence and palm management were carried out in Koravake by the author in 1980. These formed part of a larger study of diet and nutritional status (Ulijaszek and Poraituk 1983). It was possible to distinguish sago groves by age, and to assign them into one of three broad categories: 1) pre-1947; 2) established post-1947; and 3) new, created in the previous two years. Grove size and the number of cultivars used were determined for all groves. The names and types of cultivars used by the Baroi, and the methods of sago processing, are described elsewhere (Ulijaszek and Poraituk 1983; Ulijaszek 1991).

Anthropometric measurements of children aged 0 to 5 years were taken as part of a routine maternal and child health care clinical service. Measurements included weight and length of children 0 to 2 years old, whose Z scores of weight for length relative to NCHS growth references (National Center for Health Statistics 1977) were compared with weighted mean Z scores of the same variable for the Koravake 0 to 2 year olds measured in 1947 (Hipsley and Clements 1950). Comparisons were made between measures of height of adult males made in 1980 in Purari delta villages by the author, and the same measurements made between 1898 and 1914 by A.C. Haddon and his colleagues (Ulijaszek 1993). Food frequency questionnaire techniques were used at the household level over a seven day period. At the end of each day adult household members present in the village were asked to recall all food types consumed in the household during that day. This method allowed direct comparison with household food frequency data reported by Hipsley and Clements (1950). Census data for the Baroi was obtained from the Gulf Province Planning Office in Kerema.

Results

Table 1 gives density of palm sago planted, and number of cultivars planted in groves of different age. The one pre-1947 grove visited had a higher palm density than the older post-1947 groves, with 65 palms per 1,000 m², compared with a range of 29 to 45 palms per 1,000 m² in the three older post-1947 groves. The older post-1947 groves were also less than a third of the size of the pre-1947 grove.

Table 1 Density of planting sago palm and number of cultivars planted in gardens of different age

	Area (m ²)	Number of palms planted	Density of palms (per ha)	Number of cultivars
Garden planted pre-1947	1580	102	650	12
Mature gardens planted post-1947	310	14	450	4
	560	16	290	5
	430	19	440	6
Gardens planted within 2 years of the time of present study	1820	36	200	1
	510	11	220	3
	420	9	220	2

The number of cultivars used in the pre-1947 grove was 12, while a maximum of 6 cultivars were used in the older post-1947 groves, and only 3 in the most recently developed groves. The reduction in the number of cultivars used was reported by informants in Koravake to be a function of the superior properties of the ones chosen, including shorter time between planting and maturity, improved storage properties of the palm after harvesting and prior to processing, and greater ease of processing. Unfortunately, none of these claims could be examined at the time of the study. The varieties no longer cultivated included several which had traditionally cultural and symbolic value, but were lacking in the superior physical properties described.

Intensification of sago palm use appears to have had little impact on nutritional state. The evidence is tentative, but in 1947, the mean weighted Z score of weight for height (Hipsley and Clements 1950) of children aged 0 to 2 years was -0.13 , while the mean Z score in 1980 was -0.16 . Mean height of adult males at the turn of the century was 160.7 cm, while in 1980, it was 160.9 cm (Ulijaszek 1993) sug-

gesting a lack of nutritional improvement in young children between 1947 and 1980, and a lack of secular trend in the Purari delta between 1898–1914 and 1980.

The frequency of consumption of most foods recorded in both 1947 and 1980 had changed little

Table 2 Frequency of consumption of different foods (no. of times/week) among Baroi

Food	1947 ^a	1980 ^b
Sago	18	15
Coconut	14	9
Green leaves	7	3
Breadfruit	7	0
Banana	3	4
Fish	3	4
Pumpkin	3	0
Sweet potato	3	0
Cassava	0	3
Rice	0	2
Tinned fish/meat	0	1

a Hipsley and Clements, 1950.

b Ulijaszek: unpublished data.

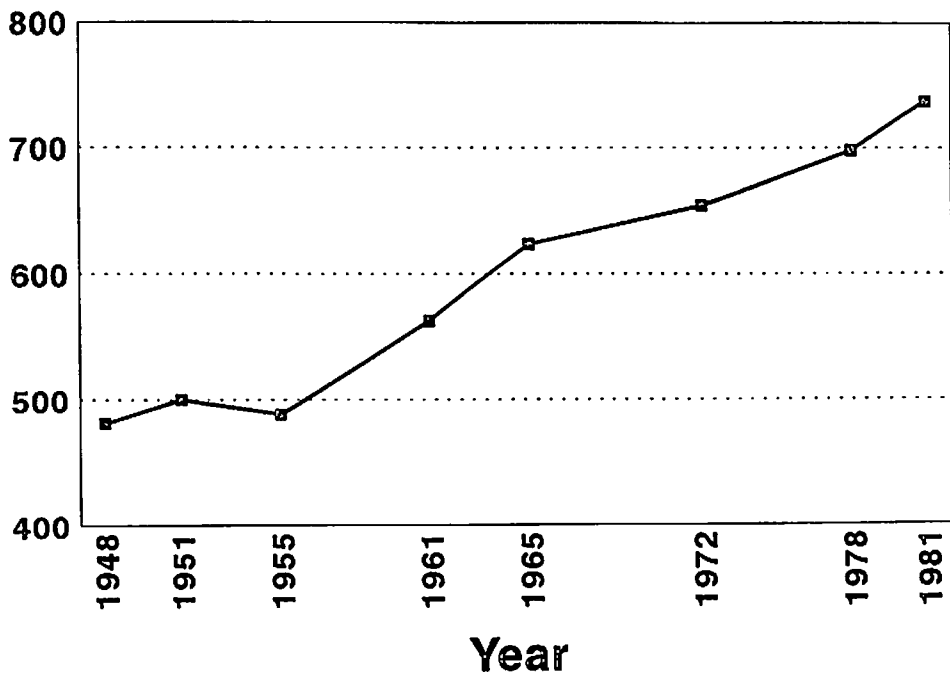


Fig. 1 Total population of Baroi.

(Table 2). The seven day consumption of sago had declined a little, from 18 times per 7 days, to 15, while the consumption of coconut declined from 14 times per 7 days, to 9. This is perhaps not surprising, since the consumption of coconut is usually in the form of coconut sago. In this type of preparation, palm sago is crumbled and mixed with grated coconut, then wrapped and bound in a pandanus leaf and baked in the open fire. There were also decreases in the consumption of green leaves, pumpkin and sweet potato, the latter two food crops being newly introduced in 1947. However, cassava and store foods were dietary items which featured in 1980, but not in 1947. Rice was consumed on average twice per week, and tinned meat or fish once per week, in 1980. Despite the apparent lack of nutritional improvement and very little dietary change, the Baroi population has increased, particularly between 1950 and 1980 (Fig. 1).

What has clearly changed in the Purari delta is the provision of health care, as evidenced by the access to aid post and Kapuna hospital facilities in 1980. While in 1947 there were no health care facilities, in 1980, all Purari delta villages were within two hours travel of either an aid post or Kapuna hospital (Hall 1979). Tuberculosis has been an important cause of

death in the Purari delta. In 1947, 79% of the Koravake population below the age of 29 years had positive tuberculin tests (Hipsley and Clements 1950), while malaria remains holoendemic in the Purari delta (Hall 1983). Malaria control programmes and the active follow-up of tuberculosis cases may have contributed to reduced young child mortality, as may have the availability of primary health care and maternal and child health services which visit the villages, advise mothers and carry out immunisation programmes. A more elderly population pyramid in 1970, compared with that of Koravake in 1947 (Fig. 2), is suggestive of a decline in young child mortality.

Discussion

Although the use of sago from 1947 onward has involved the reduction in the number of cultivars and increased palm density as part of intensification of sago cultivation initially for expanded trading, somewhat surprisingly this has not resulted in nutritional improvement. Since palm sago is considered to be a poor staple because its protein content is virtually zero, it might be reasonable to suggest that this lack of improvement could be due to a general lack of nutrients other than carbohydrates in the

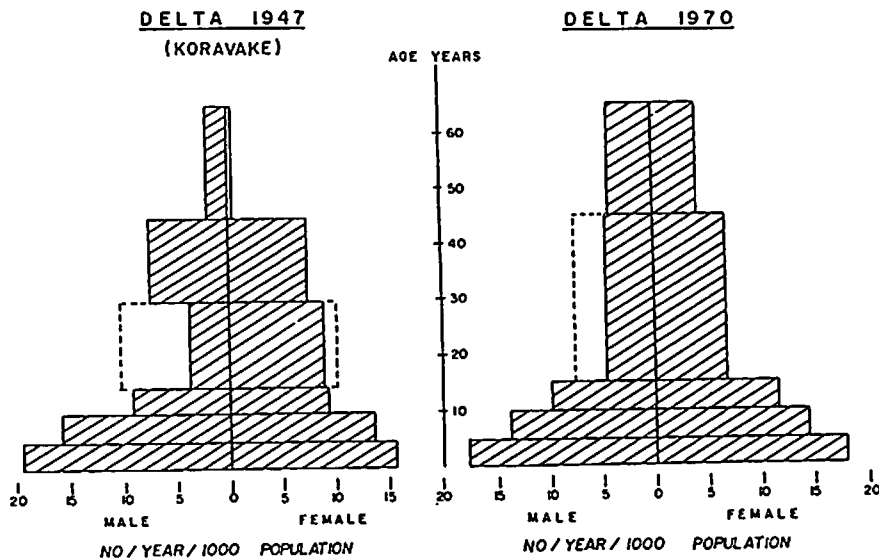


Fig. 2 Age structure of Koravake in 1947 and 1970.

diet. However, sago use in the Purari delta is part of a horticultural complex which allows considerable dietary diversity (Ulijaszek and Poraituk 1983). For any household, sago groves, crab collecting places, fishing grounds and bush gardens are usually several. Bush gardens are made at strategic sites on the river banks on the way to sites of primary subsistence activities, sago, fishing and crab collecting. Thus, small amounts of garden food can be harvested on the journey back to the village from major food-getting expeditions. The hunting of wild pig and gathering of sago grubs are subsidiary activities to crab collection and fishing. Two days of sago making by one adult female usually provides enough of the staple to feed a family for a week, allowing other activities which provide much lower energetic returns for effort invested, but which are rich in other nutrients, protein in particular (Ulijaszek and Poraituk 1983).

That the diet has changed little in terms of frequency of consumption of sago is suggestive of increased overall production of this staple, given that population size has grown by about 50% since 1950. Furthermore, the reduction in the number of cultivars used suggests an intensification of palm sago cultivation, originally as the central component of the process of indigenous modernization instigated by the 'Tommy Kabu movement (Maher 1958), but more recently in relation to the ease of preparation and storage qualities of this staple. However, it is not clear whether a ceiling to production has been reached, although it appears that the subsistence strategies practiced by the Baroi are conservative. The rise in population has been attributed largely to improved health services (Hall 1983), which are likely to have reduced the young child mortality. This is borne out by the differences in population pyramids of Koravake in 1947, and the Purari delta in 1980. Thus the population ecology of the Baroi appears to have been driven by changes in disease management rather than staple food use. However,

changes in population size and density as a result of this process has implications for the ecology of palm sago use in this group.

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