

Time Allocation and Food Consumption among the Kiwai-Speaking Papuan in Papua New Guinea

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Time Allocation and Food Consumption among the Kiwai-Speaking Papuan in Papua New Guinea

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INTRODUCTION

There are a variety of environments, such as the coasts, lowland swamps, inland, highland, highland fringes and islands, in Papua New Guinea. As a result, subsistence patterns among societies in Papua New Guinea shows a great diversity. For example, some lowland groups depend almost entirely on wild sago palm and game and/or fish [TOWNSEND 1974]. In contrast, the central Highlands groups obtain their livelihood from horticulture and domestic pigs [BROWN 1978]. Moreover, some islands groups are devoted largely to fishing, where the catch is exchanged for starchy crops of neighboring horticulturalists [CARRIER and CARRIER 1983].

Many societies in Papua New Guinea have recently undergone rapid social changes caused by the permeation of the cash economy. As a result, their traditional patterns of subsistence and food consumption have been changed drastically [SUDA 1993]. One of the causes of social changes was agricultural development, such as coffee cultivation and cattle raising, recommended by the colonial government in the 1950's and 1960's [HAYANO 1973; SEXTON 1980; GROSSMAN 1983, 1984], and resource development, such as timber, gold, copper and oil, starting around the independence of Papua New Guinea in 1975 [HATANAKA 1985].

In some societies left out large-scale development, some people emigrate to developing areas and big cities, such as Port Moresby or Lae, to work. Following the circulation of people and money, the cash economy permeated into these societies. Taking part in these developments, directly or indirectly, people have gradually grown familiar with cash. This has led people to change their patterns of production and consumption.

This paper presents quantitative data on time allocation and food consumption of a Kiwai-speaking village on the south-western coast of Papua New Guinea. To clarify how villagers allocate their time to various activities and what kind of food they depend on since the permeation of the cash economy, it is not only an illustration of diversified subsistence patterns, but also an important clue to understand social changes in Papua New Guinea.

1. THE SUBJECTS

Ten villages of a dialect group of Kiwai-speaking people, with a population of about 2,000, are located along the coast to the west of the estuary of the Fly River. While other language groups, such as the Bine, Gizra and Gidra, live in the hinterland, only Kiwai-speakers have fishing rights on the coast and reef. Mawata, the subject of the present study, is the second most western village, located at the mouth of the Binaturi River. Mawata is situated about 35 km northwest of Daru, the capital of Western Province and the commercial center of the lower reaches of the Fly River. Mawata consisted of 118 persons of 17 households on first of September 1990.

Some of the Mawata people have worked in other areas of Western Province as assistants in the colonial and national government, or emigrated to Daru or Port Moresby for jobs since about 1960's. There are even some who had worked in the Torres Islands of Australia. Some Mawata people had experienced the cash economy through remittances sent to them or with money they brought back to the village. But, because sources of cash income within the village had been limited, money scarcely flowed into the village periodically until recently, and only families with members working outside the village acquired money. However, after the beginning of trepang-gathering and processing, a novel fishing and cash-earning activity, I found that in July 1990, almost all the villagers were earning money by selling dried trepang to middlemen.

2. SUBSISTENCE AND CASH-EARNING ACTIVITIES

Subsistence or food-getting activities among the Mawata people are divided broadly into three; horticulture, hunting and fishing. Gardens, scattered in surroundings of the residential area, are owned by each family. The main crops are plantain banana and taro, although a small proportion of other crops, such as pitpit, aibika, and some kinds of fruits, are often planted in banana gardens. All garden products are for subsistence and not for sale at the Daru market, in contrast with the horticultural inland peoples. The Mawata people also plant coconut palm along the coast. While some of the coconut harvest is sold at the Daru market, it is not so important as a source of cash income.

Both hunting and animal husbandry play a minor role in the Mawata diet. Only two pigs were reared in my study period. Eventually, one ran away from the pen to the bush during my stay. The Mawata people seldom eat domestic pig. When the pig is grown, they sell it to other villagers.

Game from hunting are either consumed within a household or shared among the related households. A portion may be sold to the other Mawata villagers if the catch is a large animal such as a deer. There are four hunting methods; trapping, bow and arrow with dogs, shotgun and chasing. Two married men and a young man, who are brothers and a brother-in-law, set four traps along the coast with

Table 1. Fishing Activities in Mawata

Fishing ground	Method	Purpose	Main catch species	Canoe
1. river-mouth	line fishing	subsistence	catfish, eel, baramundi	tatak
2. beach	beach net	subsistence	baramundi, catfish, threadfins, mulletts, halfbeaks	—
3. reef	poisoning	subsistence	Sparisomatinae, groupers, grunts	motamota/ motor dinghy
	harpooning	subsistence	dugong, turtle	motamota/ motor dinghy
	diving	commercial	crayfish	motor dinghy
	collecting	commercial	trepang	motamota/ motor dinghy
				motor dinghy

coconut meat as bait to catch wild pigs. Sometimes, groups of young men go hunting with bows and arrows with dogs. They hunt for wild pigs, wallabies, bandicoots and deer. While a few adult men have shotguns, they seldom go hunting because ammunition is difficult to obtain. When some animals, such as wallaby, bandicoot or deer, unexpectedly stray into the village, all the people, including the women, start to chase them with spears or sticks. They sometimes catch animals by shooting or hitting them by chance.

Fishing is the main activity in Mawata and at the core of ethnic identity. Table 1 shows fishing activities in Mawata by fishing ground and the main catch species. Fishing activities in the reef, in comparison with the river-mouth or beach, show greater diversity in methods and purpose. Summaries of each activity by fishing ground are given below.

1) River-Mouth

Only the elderly men and the unmarried young women fish at the river-mouth, although their fishing methods differ depending on the use of canoes. The elderly men use small, single-outrigger canoes (*tatak*) from where they throw fishing lines. The young women throw the lines from the river-banks. Usually, the elderly men go fishing alone, while the young women do so in a group. Catches by both sexes are good, usually enough for the meal of a household.

2) Beach

Except for infants and the elderly, both sexes go beach-net fishing in a group. The method is rather simple. First, two persons hold the opposite sides of the net and pull at the sides parallel to the beach at a few feet's depth. After about half an hour, they narrow the mouth of the net, and another person, usually a small boy or girl, picks up fish from the net. Then they cast the net again. After

several attempts, they walk back to the village with enough catch for a household. The reason why the elderly men prefer line fishing to beach net fishing seems to be that they are unwilling to pull at the heavy net. On the other hand, young and middle-aged men do not go line fishing because it is monotonous.

3) Reef

The Mawata people usually go to the *Otamabu* reef, which is about 15 km south of the village. Although people of the Tureture, the neighboring Kiwai-speaking village, fish in this reef, there is no system to regulate fishing efforts between the two villages. To the *Otamabu* reef, it takes half an hour by motor dinghy and three or more hours by a large sailed double-outrigger canoe (*motamota*), depending on the condition of winds. The four types of reef fishing are usually male activities.

One type of fishing, crayfish diving, is engaged in exclusively by men under 40 years old, because it requires physical strength. Men go diving in a group of two or three by motor dinghy and carry the catch to Daru directly from the reef. The membership of the diving groups is flexible, and profit is shared equally by the members.

Dugong and turtle caught by harpoon have been utilized by the Mawata people as a necessary food item at rituals and as a source of cash income. Harpooning is conducted in a group of 7 or 8 men with a *motamota*. At a reef, a harpooner stands at the bow and a watchman, usually an owner of the *motamota*, keeps a look out at the top of a mast for dugong or turtle to surface. When a watchman finds the prey, crew members row a canoe up to it, and a harpooner dives with a harpoon. While Landtman reported that the harpooner or the owner of a harpoon played a major role in the division of catch [LANDTMAN 1970 (1927)], the elderly men who own the canoes have recently been doing all the decision making on fishing, such as the date of fishing and division of catches. In the interval of harpooning, they often conduct poison fishing in a tide pool for obtaining food for the fishing trip.

Recently, however, the coastal Kiwai-speakers, go harpooning by motor dinghies. Chasing the prey and shooting when it is exhausted, has raised the efficiency of harpooning and is leading to the overexploitation of the resource, especially dugong. As a result, the national government prohibited the use of motor dinghies for commercial harpooning a few years ago. Under these circumstances, trepang-gathering and processing were introduced to the coastal Kiwai village as a cash-earning activity.

Trepang-gathering and processing were first introduced by a Singaporean middleman who expanded his enterprise westward from villages near Daru in the beginning of 1990. A few months later, local middlemen entered into the business as agents of trading companies in Port Moresby. Trepang-gathering and processing were very attractive for the coastal Kiwai-speakers to whom commercial harpooning was prohibited. A trepang boom has spread over the coastal Kiwai

village.

Trepang-gathering and processing were brought to Mawata by a local middleman, relatives in the village in July 1990. The Kiwai-speakers had never exploited trepang (*pirisimai*) as a food before, and so, as a resource, it was abundant. Only men gather trepang, because they must go to the reef by dinghy or canoe. The gathering itself does not require special skill; people gather trepang by hand when they find it in the ankle-deep reef. Processing requires much labor, which consists of peeling off the skin, boiling and drying. Almost all the women and some children participate in trepang-processing on the beach. As the proceeds are divided to all participants, according to age and marital status, this becomes the only cash-earning activity which bring money into almost families, unlike the crayfish diving or remittances.

The prices of processed trepang varies according to quality and middlemen: generally, high grade trepang is 7 kina (1 kina was about 140 yen in 1990), middle grade is 5 kina and low rank is 1 kina per 1 kg. The total proceeds in Mawata from August to September in 1990 was 4,469.5 kina.

3. METHODS

Quantitative data on time allocation and food consumption were collected. As I aimed to understand the time use patterns of the Mawata people as a whole, I chose the "random spot-check" method for the present study, in order to cover all members of the village [SUDA 1994]. However, since research periods were not long enough to conduct a year-round spot-check which Johnson adopted for the Machiguenga [JOHNSON 1975], the "time-saving spot-check" method, which was a revised version of the "random spot-check" by Moji and Koyama, devised to collecting time allocation data within a short term [MOJI and KOYAMA 1985]. This method did not burden the research plan, although it contained a risk of data bias deriving from a short research period.

Data were recorded for 33 men and 34 women, or all village members. A man and a woman whom I lived with were excluded in order to avoid data bias resulting from my presence. Daytime between 6:00 and 19:00, within which productive activities were allocated with very few exceptions, was divided into 13 one-hour time sections to be studied. These 13 time sections were surveyed once each during a successive 6-day period from September 3 to 8, 1990. I visited all the households 13 times each at a randomly selected round by using a random number table in advance, and recorded data by observing what each household member was doing just before my presence. When some members were away from home, I asked other members of the same household or the neighboring household what the absent person was supposed to be doing then. I confirmed data for the absentees by going to the place where they were supposed to be or asking the target persons after they came home. In this schedule, each person's activity was recorded at 13 different time sections of a day. In other words,

recorded person-events amounted to 871 cases (67 persons multiplied by 13 times).

Data on food consumption were collected for two households which consisted of 4 adult, 3 adolescent and 4 juvenile men and 4 adult, 2 adolescent and 3 juvenile women during a continuous 7-day period from September 3 to 9, 1990. The record was obtained using two different methods of estimating the amounts of foods consumed, following Ohtsuka and colleagues [OHTSUKA *et al.* 1985]. In one, all foods stored in each household were weighed twice a day, first in the early morning and again in the late evening. In addition, all food-flow from and into the households during the study period were measured. The other method used was the weighing of all foods just prior to cooking or eating. When some subjects were out of village for overnight fishing, they were excluded from the study during the absent days. When some visitors ate food in a subject household, the amounts of foods consumed were adjusted for by applying man-value coefficients, as described below.

To estimate food intake per day per person, each subject was labeled with a ratio to Thomson's man-value coefficients for adjusting individual differences in age and sex; an adult man was assigned 1.00 consumption unit, an adult woman 0.85 and a pregnant woman as 0.95, and children were assigned from 0.20 to 1.00, according to their age and sex [THOMSON 1954]. The sum of consumption unit figures amounted to 102.6 during the 7-day period. The mean nutrient intake per day per adult male was calculated by dividing the total amount of nutrient intake by the accumulated consumption units.

The nutrients contained in the bulk of the foods (in terms of weight consumed or energy taken) were based on the values measured by Ohtsuka and colleagues who studied the Gidra-speakers in the hinterland of the coastal Kiwai villages [OHTSUKA *et al.* 1985]. When there were a few samples within the same food item, an average value was applied. As pointed out by Ohtsuka and colleagues, the water content of sago flour varied depending on the time elapsed since production. Although I could not identify how long a time sago flour consumed by subjects, had elapsed since production (because they were purchased), the estimated value of 30% water content for 20 days after production was applied [OHTSUKA *et al.* 1984: 165]. For the remaining foods whose samples were not listed in the food composition table by Ohtsuka and colleagues, the value were taken from available food composition tables for Papua New Guinea [FAO/USDHEW 1972; NORGAN *et al.* 1979].

4. RESULTS

1) Time Allocation

Table 2. Activity by Age Class and Sex in Mawata: 6:00 to 19:00

Activity (%)	Male			Female		
	Unmarried	Married	Old	Unmarried	Married	Old
	n=8	n=15	n=10	n=8	n=14	n=12
Horticulture	1.0	6.2	14.6	12.5	9.9	21.2
Coconut harvesting	7.7	0.5	1.5	3.8	0.6	1.9
Fishing	2.9	7.7	13.1	1.9	0.6	1.3
Hunting	1.9	1.5	0.8	0.0	0.0	0.0
Trepang-processing	7.7	10.3	9.2	5.8	8.2	4.5
Tool-making	1.0	0.5	0.8	0.0	1.6	6.4
Household maintenance	6.7	6.2	3.8	8.7	22.0	9.6
Food preparation	1.0	3.1	3.1	9.6	10.4	10.2
Eating	1.9	5.6	3.1	5.8	5.5	2.6
Hygiene	1.0	0.5	4.6	3.8	4.4	2.6
Visiting	6.7	22.0	8.5	14.4	6.0	9.0
Idleness	59.5	35.9	34.6	32.7	30.2	27.5
Other	1.0	0.0	2.3	1.0	0.6	3.2

Table 2 presents time allocation among the Mawata people by age group and sex (the elderly men and women are those with grandchildren). Fishing includes both subsistence and commercial fishing, because the people usually do both types in one fishing trip in the reef. Trepang-processing includes not only processing but also selling products to middlemen. Food preparation is distinguished from household maintenance which consists of drawing water, collecting and cutting firewood, washing and sweeping. Others include ritual, social and religious activities, but exclude visiting other households or villages.

As shown in Table 2, time allocation differed by age group in both sexes. The unmarried young men devoted much time to coconut harvesting and hunting (7.7% and 1.9%), or terrestrial activities outside the village, the most among the three age groups (married: 0.5% and 1.5%, elderly: 1.5% and 0.8%). In contrast, the elderly men spent more time on horticulture and fishing (14.6% and 13.1%) than the younger (unmarried: 1.0% and 2.9%, married: 6.2% and 7.7%). As to non-productive activities, the proportion of idleness of the unmarried young men (59.5%) surpassed those of the married and the elderly men (35.9% and 34.6%, respectively), while the married men spent much time on visiting (35.9%) the most among the three (unmarried: 6.7%, elderly: 8.5%). That is, the elderly men played a major role in food-getting activities and the unmarried young men

Table 3. Percent Time Allocated and Estimated Duration of Each Activity by Sex in Mawata: 6:00 to 19:00

Activity	Male (n=33)		Female (n=34)	
	(%)	(min.)	(%)	(min.)
Horticulture	7.5	59	14.5	113
Coconut harvesting	2.5	20	1.8	14
Fishing	8.2	64	1.2	9
Hunting	1.4	11	0.0	0
Trepang-processing	9.4	73	6.3	49
Tool-making	0.7	5	2.9	23
Household maintenance	5.6	44	14.5	113
Food preparation	2.6	20	10.2	80
Eating	3.9	30	4.5	35
Hygiene	1.9	15	3.6	28
Visiting	14.2	111	9.1	71
Idleness	41.2	321	29.8	233
Other	0.9	7	1.6	12

devoted time to amusement activities, while the married men were situated between the two extremes. It was also noted that the time spent on trepang-processing among the three age groups were almost identical (unmarried: 7.7%, married: 10.3%, elderly: 9.2%).

The tendency found in the time allocation of men was observed in that of: the unmarried young women devoted time on coconut harvesting, the most among the three age groups (unmarried: 3.8%, married: 0.6% and elderly: 1.9%), and the elderly, on horticulture (unmarried: 12.5%, married: 9.9%, elderly: 21.2%). Unlike the time allocation of men, however, the married women were situated not between the two but at extremes: they spent the most time on trepang-processing and household maintenance (unmarried: 5.8% and 8.7%, married: 8.2% and 22.0%, elderly: 4.5% and 10.9%). There was no distinct difference in women's time allocation to non-productive activities among the three age groups, although the unmarried young women spent slightly more time on visiting (the unmarried: 14.4%, the married: 6.0%, the elderly: 9.0%, respectively).

Table 3 presents the percentages of observations and the estimated duration of each activity, which was the product of each percentage multiplied by 13 hours (6:00 to 19:00), by sex. As shown in Table 3, the time allocated to food-getting activities was almost identical between sexes (men: 19.6% and women: 17.5%), while there was a difference in time spent in each food-getting activity: men spent more on fishing and hunting (men: 8.2% and 1.2%, women: 1.4% and 0.0%), and women, on horticulture (men: 7.5% and women: 14.5%). That is, there was a division of roles between the sexes in food-getting activities. On the other hand, men spent slightly more time on trepang-processing than women (9.4%: 6.3%).

The time devoted to tool making, household maintenance and food preparation by women surpassed that of men (27.6%: 8.9%), which led the discrepancy of time spent on productive activities between sexes.

2) Food Consumption

Table 4. Adult Male Nutrient Intake per Day and Contributions to it by Each Food-Getting Activity and Purchased Food (n=102.6)

Activity Food item	Energy (kcal) (%)	Protein (g) (%)	Fat (g) (%)
Horticulture			
Banana	131 (5.8)	1.1 (2.2)	1.1 (3.4)
Taro	101 (4.4)	1.4 (2.9)	0.1 (0.3)
Cassava	14 (0.6)	0.2 (0.4)	0.1 (0.3)
Sweet potato	5 (0.2)		
Subtotal	251 (11.0)	2.7 (5.5)	1.3 (4.0)
Coconut harvesting			
Coconut	294 (12.9)	3.0 (6.2)	26.6 (82.9)
Gathering			
Galip nut	18 (0.8)	0.2 (0.4)	1.1 (3.4)
Hunting			
Wallaby	6 (0.2)	1.3 (2.7)	0.1 (0.3)
Snake	1 (0.1)	0.2 (0.4)	
Subtotal	7 (0.3)	1.5 (3.1)	1.1 (0.3)
Fishing			
Catfish	20 (0.9)	3.5 (7.2)	0.5 (1.6)
Threadfins, etc.	12 (0.5)	2.2 (4.5)	
Crab	5 (0.2)	1.3 (2.7)	0.1 (0.3)
Clam	2 (0.1)		
Subtotal	39 (1.7)	7.0 (14.4)	0.6 (1.9)
Subtotal of food getting activities	609 (26.7)	14.4 (29.6)	29.7 (92.5)

Table 4. (continued)

Activity Food item	Energy (kcal) (%)	Protein (g) (%)	Fat (g) (%)
Purchased plant foods			
Sago flour	583 (25.5)	1.0 (2.1)	0.0 (0.0)
Rice	729 (31.9)	11.9 (24.5)	1.0 (3.1)
Wheat flour	200 (8.8)	6.0 (12.3)	0.6 (1.9)
Sugar	75 (3.3)	0.0 (0.0)	0.0 (0.0)
Biscuit	20 (0.9)	0.5 (1.0)	0.2 (0.6)
Subtotal	1607 (70.4)	19.4 (39.9)	1.8 (5.6)
Purchased animal foods			
Pig	60 (2.6)	13.2 (27.2)	0.5 (1.6)
Wallaby	7 (0.3)	1.6 (3.3)	0.1 (0.3)
Subtotal	67 (2.9)	14.8 (30.5)	0.6 (1.9)
Subtotal of purchased foods	1674 (73.3)	34.2 (70.4)	2.4 (7.5)
Total	2283 (100.0)	48.6 (100.0)	32.1 (100.0)

Table 4 presents the amounts of all food items consumed during the continuous 7-day sample period, from September 3 to 9, 1990, which were adjusted to per-day per-adult-male values, and their relative contributions to energy, protein, and fat intake. Compared with the FAO/WHO recommendations for a moderate active individual [FAO/WHO 1973], the daily amount of energy intake of the Mawata people (2,283 kcal) was slightly lower, *i.e.*, 90%, when we estimated their body weight at 55.0 kg. The mean daily protein intake was higher than the FAO/WHO's safe level (32.0 g), when 70% of net protein utilization (NPU; protein quality of 70% relative to milk or eggs) is applied to the diet. Considering their body weights and the substance of their activities, the nutritional deficit in Mawata, or energy deficiency, is slight, if any.

Food-getting activities composed only less than 30% of energy and protein intake, although coconut containing abundant fat accounted for over 80% of total fat intake. While Mawata is located at a coastal area, fish accounted for only 1.7% of total energy intake and 14.4% of total protein intake. This might indicate that the people attached more importance to trepang-gathering and processing than to subsistence fishing.

On the other hand, the purchased foods, mainly rice and sago flour,

composed over 70% of total energy and protein intake. Sago flour was bought from peddlars from Kiwai Island, and wild pig and wallaby were bought from the Bine-speakers. Imported animal foods, such as tinned fish or corned beef, and flavoring, such as soy sauce or ketchup, were seldom consumed, unlike the food change in Katatai, also one of the coastal Kiwai villages [TAWA 1991].

Table 5. Adult Male Intake of Energy, Protein, and Fat per Day Derived from Two Categories of Foods (n=102.6)

Category	Energy (kcal) (%)	Protein (g) (%)	Fat (g) (%)
Traditional foods	1,214 (53.2)	30.2 (62.1)	30.3 (94.4)
Imported foods	1,069 (46.8)	18.4 (37.9)	1.8 (5.6)
Total	2,283 (100.0)	48.6 (100.0)	32.1 (100.0)

Table 5 presents the breakdown of sources of energy, protein, and fat when the foods are placed in one of the two categories, traditional or imported, without distinction in the ways of acquisition. As shown in Table 5, traditional foods surpassed imported ones in energy and protein intake. That is, the proportion of traditional foods within purchased foods was quite high in Mawata. The people purchased not only imported foods but also traditional ones. This means that in Mawata, the change in food consumption, caused by permeating cash-economy, meant not only a change in food items available but also a change in the way of obtaining foods.

5. DISCUSSION

Ohtsuka and colleagues conducted the time allocation study among four Gidra-speaking villages situated in the hinterland of the coastal Kiwai villages [OHTSUKA and SUZUKI 1990: 15-22]. They kept watch on a number of persons at fixed spots, recorded their times of departure and return, and asked about the places where they had stayed outside the villages. Although micro-environments and social situations among the four villages varied, their subsistence activities were the same; hunting, fishing, gathering, horticulture and sago-making. Out of the four, only the Dorogori people, the nearest village to Daru, engaged in wage labor in Daru in 1981 when they conducted the survey. Kuchikura studied time allocation among two Mountain Ok villages in the Upper Murray Valley, Western Province, adopting the same method as Ohtsuka and colleagues. [KUCHIKURA 1990]. In the two villages, the people raised pig in addition to hunting, fishing, gathering, horticulture and sago-making in 1986 during the surveyed, but they did not engage in any cash-earning activities.

Table 6. Estimated Duration of Productive Activities among the Kiwai, Gidra, and the Mountain Ok (min.)

Ethnic group (village)	Surveyed year	Food-getting		Cash-Earning		Other		Total	
		male	female	male	female	male	female	male	female
Kiwai ¹⁾ (Mawata)	1990	154	136	73	49	49	136	276	321
Kasanmin ²⁾ (Fakobip)	1986	201	317	0	0	158	35	359	352
Seltaman ²⁾ (Woktembip)	1986	257	278	0	0	42	23	299	301
Gidra ³⁾ (Rual)	1981	223	166	—	—	—	—	—	—
Gidra ³⁾ (Wonie)	1971	289	313	—	—	—	—	—	—
Gidra ³⁾ (Wonie)	1981	278	280	—	—	—	—	—	—
Gidra ³⁾ (Ume)	1981	184	288	—	—	—	—	—	—
Gidra ³⁾ (Dorogori)	1981	104	116	91	70	—	—	—	—

1): the present author.

2): Kuchikura (1990).¹

3): Ohtsuka and Suzuki (1990: 15-22).

Table 6 compares the time allocation of the Mawata people to those of four Gidra and two Mountain Ok villagers. Time allocation among Mawata and Dorogori, where cash economy permeated more intensely than the other villages, are quite similar: they spent time on food-getting activities much less than the other villagers. Comparing Mawata to the two Mountain Ok villages, whose data on other productive activities are also presented, the time spent on food-getting and cash-earning activities in Mawata and those in two Mountain Ok villages varied greatly, although the time of total productive activities, including other productive activities among the three such as collecting firewood or making tools, were almost identical. In addition, Fakobip men were involved in house construction to establish a new village, which caused an increase in time spent on other productive activities. Roughly speaking, with money flowing into the village through the cash-economy, time spent on cash-earning activities does not add to the amount of time spent on productive activities, but only affects the distribution of time within productive activities. That is, at the cost of time spent on food-getting activities, people devoted their time on cash-earning activities. Purchased foods may compensate for a decline in time spent on food-getting activities.

Table 7 compares food consumption among 7 villages mentioned above. As shown in Table 7, energy and protein intakes in the four Gidra villagers exceeded that in the other three villagers. Considering body weight and labor substance, Ohtsuka and colleagues pointed out that the nutritional requirement for an adult Gidra man was 3,060 kcal of energy and 32 g of protein [OHTSUKA and SUZUKI

Table 7. Adult Male Nutrient Intake among the Kiwai, the Gidra, and the Mountain Ok

Ethnic group (village)	surveyed year	Self supplied foods			Purchased foods			Total		
		energy (kcal) (%)	protein (g) (%)	fat (g) (%)	energy (kcal) (%)	protein (g) (%)	fat (g) (%)	energy (kcal) (%)	protein (g) (%)	fat (g) (%)
Kiwai ¹⁾ (Mawata)	1990	609 (26.7)	14.4 (29.6)	29.7 (92.5)	1674 (73.3)	34.2 (70.4)	2.4 (7.5)	2283 (100.0)	48.6 (100.0)	32.1 (100.0)
Kasamin ²⁾ (Fakobip)	1986	1936 (100.0)	16.8 (100.0)	6.4 (100.0)	0	0.0	0.0	1936 (100.0)	16.8 (100.0)	6.4 (100.0)
Seltaman ²⁾ (Woktembip)	1986	2400 (100.0)	23.7 (100.0)	7.2 (100.0)	0	0.0	0.0	2400 (100.0)	23.7 (100.0)	7.2 (100.0)
Gidra ³⁾ (Rual)	1981	3342 (94.1)	49.5 (91.2)	18.9 (96.4)	211 (5.9)	4.8 (8.8)	0.7 (3.6)	3553 (100.0)	54.3 (100.0)	19.6 (100.0)
Gidra ³⁾ (Wonie)	1971	3323 (100.0)	48.4 (100.0)	41.4 (100.0)	0	0.0	0.0	3323 (100.0)	48.4 (100.0)	41.1 (100.0)
Gidra ³⁾ (Wonie)	1981	3333 (93.9)	61.8 (90.9)	9.3 (93.0)	216 (6.1)	6.2 (9.1)	0.7 (7.0)	3549 (100.0)	68.0 (100.0)	10.0 (100.0)
Gidra ³⁾ (Ume)	1981	2440 (81.9)	54.6 (80.8)	52.7 (97.4)	539 (18.1)	13.0 (19.2)	1.4 (2.6)	2979 (100.0)	67.6 (100.0)	54.1 (100.0)
Gidra ³⁾ (Dorogori)	1981	1766 (54.8)	44.7 (61.0)	17.5 (70.0)	1456 (45.2)	28.6 (39.0)	7.5 (30.0)	3222 (100.0)	73.3 (100.0)	25.0 (100.0)

1): the present author.

2): Kuchikura (1990).

3): Ohtsuka and Suzuki (1990: 91-100).

1990: 96–97]. Similarly, Kuchikura estimated the nutritional requirement for an adult Fakobip man as 2,072 kcal of energy and 36.7 g of protein, and that for an adult Worktembip man as 2,348 kcal of energy and 41.6 g of protein [KUCHIKURA 1990]. Thus, nutrient intake in four Gidra villages exceeded the FAO/WHO requirement with the exception of energy intake in Ume villagers [OHTSUKA and SUZUKI 1990: 96]. On the other hand, although energy intake among the two Mountain Ok villagers met the requirement, protein intake did not [KUCHIKURA 1990: 132–133].

The proportion of foods among the Mawata and the Dorogori villagers largely differed from those among the other five villagers. In Mawata and Dorogori, people depended heavily on purchased foods, while people acquired their own food in the other five villages, which was consistent with my prediction derived from the analysis of time allocation. Especially, purchased foods accounted for more than 70% of energy and protein intake in Mawata. While purchased foods in Dorogori consisted of only imported foods, such as rice, wheat flour, tinned fish or corned beef, the Mawata purchased not only imported foods but also traditional foods, which increased the proportion of purchased foods in the Mawata nutrient intake.

A large quantity of purchased foods, including traditional foods, in Mawata might be caused by several factors. First, because of the cash-earning trepang-processing, that requires no special skill and is open to all villagers, money flowed into the whole village. Therefore, all households had purchasing ability. Second, the land for subsistence in Mawata was limited, because the Mawata settled later than the inland peoples. As the land for horticulture and hunting were insufficient and no sago palms stood on village site, foods tended to be in short supply. Third, while the coastal Kiwai people had depended on marine foods as sources of protein, they are recently devoting more time to trepang-processing than subsistence fishing.

CONCLUSION

The permeation of the cash economy into Mawata through the introduction of trepang-gathering and processing has affected the villagers' time allocation and food consumption. Comparison of time allocation of the Mawata villagers and the Gidra and Mountain Ok in Western Province of Papua New Guinea, show that the former spent more of their food-getting time to cash-earning activities, without change in the amount of time spent in productive activities. The change of time allocation could be related to the change in food consumption pattern: an increase in the proportion of purchased foods in nutrient intake and the change in how foods are obtained, where villagers purchased imported as well as traditional foods.

In Papua New Guinea, it has been pointed out that food consumption patterns changed largely with the social change [INAOKA 1993]. Some researchers

found a change in food items consumed, from traditional foods, such as sago starch, to imported foods such as rice, tinned fish and corned beef, on the basis of the qualitative data [e.g., MORAES-GORECKI 1983]. On the basis of data on the frequency of food items consumed, Tawa also pointed out that a change in food items was found in Katatai, one of the coastal Kiwai Villages [TAWA 1991]. From quantitative data, I also learned that imported foods, such as rice or wheat flour, were important in Mawata. Moreover, it is worthy of note that the villagers also purchased traditional foods. There are two interpretations of this situation. One is that the villagers were situated in the midway of the change in food items consumed, where imported foods were becoming more and more important. The other is that the villagers may alter how to obtain foods, while retaining traditional foods as staple. In the former case, the villagers would become increasingly dependent on outside food. In the latter, the division of work within the village and the circulation of money would be accelerated, which may result in the change in social structure.

With only the data presented in this paper, it is difficult to conclude which of the above interpretations is more suited for Mawata. Furthermore, as Inaoka pointed out, due to a lack of comparable data on the long term relationship between social change and subsistence activity or food consumption [INAOKA 1993: 230], it is hard to conduct reliable comparative studies. To predict change in time allocation and food consumption, we must compare the data on subsistence activity and food consumption in Mawata to those of other societies more comprehensively, while continuing to study the Mawata people.

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