

RESEARCH CONCLUSIONS¹

[The Editor welcomes short statements—normally from 300 to 1,000 words—of research results and conclusions. Such statements should not include detailed supporting data, but should make clear reference to the location of such data (published and unpublished) so that interested readers may refer to the material. Sentences should be specific rather than vague. Abstracts of theses may be included, provided they present conclusions rather than only describe what was done. The date of submission will be included, as well as the address of the contributor, so that colleagues may correspond.—EDITOR]

Food Sharing among Ache Hunter-Gatherers of Eastern Paraguay²

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Empirical research on food sharing among hunter-gatherers should provide critical data for evaluating both the possible role of food sharing in hominid evolution and the question of how such behavior could be selected. First, if we can isolate, through comparative research, the general variables which predict the presence and extent of resource sharing among hunter-gatherers and the specific resources shared, we will then be able to determine the extent to which those conditions held in the Pleistocene. Second, by testing against empirical data the predictions generated by models positing varying modes of selection, we will be able to determine which theoretical framework best explains the existence and range of food sharing in both animals and humans. Quantitative data on food consumption and resource sharing among hunter-gatherers are scarce, although the literature is replete with impressionistic reports (see Feinman 1978 and Woodburn 1982 for reviews).

The present research was conducted with the Northern Ache, who inhabit the lowland subtropical forest of eastern Paraguay and currently number 350–400 persons. Until four to ten years ago, depending upon the band, the Ache were full-time foragers; they now practice a mixed economy of jungle foraging and swidden agriculture in settled mission communities, with most individuals still foraging for up to two weeks a month away from the mission. The data presented here were collected on nine separate foraging trips, 7–15 days in length, between October 1981 and May 1982. The foraging bands included 15–28 persons, with the mean numbers of adult males, adult females, and children being 9.6, 6.6, and 9.0. In all, these data represent 81 days of forest subsistence.

The foraging pattern we observed was almost identical to that reported for precontact times and that observed by Hill in 1978 at Manduvi, where, before the mission's establishment, foraging was virtually the only occupation (Hill n.d.). Ache foraging trips are unlike the special extended hunts of many lowland South American horticulturalists, in which the goal is to return to a settled community with large quantities of game (see, for example, Chagnon 1977). When the Ache forage in mixed-sex groups for extended periods (ranging from several days to several weeks), daily subsistence goals organize behavior. All food brought from the mission settlement is consumed within one or two days of departure. Less than 1% of the total calories acquired during the trip are brought back to the mission, and these are collected on the last day. Game items

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are responsible for 60–80% of the calories Ache foragers consume; honey is calorically the second most important resource, followed by an array of fruits, plant products, and insect larvae (Hawkes et al. 1982, Hill and Hawkes 1983). Foraging bands are highly mobile, remaining at a single camp site for periods ranging from one to four days. Virtually no food storage is practiced; the bulk of all food is consumed within 24 hours of acquisition. Food, once acquired, is shared throughout the band.

Two or three investigators accompanied the Ache on the foraging trips sampled. Virtually all resources acquired were weighed, counted, or measured. The caloric value of these measures was calculated using the *Handbook of Latin American Foods, USDA Handbooks 8 and 456*, and analyses performed by the Ford Chemical Laboratory of Salt Lake City. Four procedures were employed in monitoring food consumption: (1) focal-person sampling, in which all the food-acquisition and consumption activities of a single adult, randomly selected (without replacement), were recorded for an entire day; (2) instantaneous scan sampling, in which the activities of all persons within observation distance were monitored every ten minutes throughout the day (these data cover the entire band in the morning and evening at camp and the largest aggregate assembled at any one place during the remainder of the day); (3) focal-resource sampling, in which all the consumers of a single resource item were recorded; and (4) multiperson focused observation, employed in the morning and in the evening, when most consumption occurs and when most individuals are together at the camp site (for these records, a region of the camp was assigned to each investigator, who recorded all the consumption activities of the individuals located in his zone). An attempt was made to record, for every consumption event observed, the consumer, the resource type (monkey, armadillo, palm fruit, etc.), the acquirer of the resource, and, where possible, the amount by visual estimate. These combined techniques yielded a total of 5,500 entries.

All analyses reported here were performed by calculating relative frequencies of consumption events.³ In order to determine whether relative frequencies accurately reflected relative amounts in calories, we performed three independent tests. First, we calculated the correlation between the total calories acquired from each resource type and the total number of consumption events recorded for that resource. The correlation was quite high (collected resources: Pearson $r = .84, p < 0.00001$; hunted resources: Pearson $r = .92, p < 0.00001$). Second, we calculated the correlation between the total calories acquired by each adult forager and the total number of times he/she was the acquirer of a resource being consumed. This correlation was also quite high (collected resources: Pearson $r = .91, p < 0.00001$; hunted resources: Pearson $r = .92, p < 0.00001$). Third, with the standard *t*-test we compared, where estimates of weight were recorded, the mean amount consumed by women when their spouses were the acquirers with that when men other than their spouses were the acquirers. There was no significant difference (spouse the acquirer: $N = 13, sd = 106, x = 120$ g; man other than spouse the acquirer: $N = 79, sd = 108, x = 140$ g; $t = 0.65, df = 90, p > .5$). Together, these three tests indicate that no resources were selectively over- or underrepresented by our sampling procedure, no acquirers were selectively over- or underrepresented in our sample, and frequencies of consumption events are a valid, unbiased index of quantity in calories.

The results of our analysis are shown in tables 1 and 2.⁴

³ A "consumption event" is a single entry generated by one of the four sampling methods described above. For an entry to qualify as a consumption event, the consumer, the acquirer, and the species of the foodstuff must have been recorded.

⁴ The category "other" in these tables refers to all individuals who are not related to the consumer as parents, children, spouses, or siblings. It includes a mix of affines, more distantly related kin, and unrelated individuals. Data on group composition will be presented elsewhere. Discrepancies in sample sizes between tables 1 and 2 are

Table 1 displays the relative percentages of various food items that come from acquirers with different relationships to the consumer. It is immediately evident that Ache receive a very high percentage of calories from individuals outside their nuclear family and that the four types of resources are shared differentially—meat the most, followed closely by honey and then small collected and mission-brought resources.

Table 2 shows the results of tests designed to determine whether kin biases exist in the pattern of food distribution. Using one-by-two chi-square goodness-of-fit tests for each resource type and consumer class, we compared observed frequencies of consumption with values expected by chance; each acquirer class was tested against the “other” category. For example, if a given hunter acquires 20% of the total game taken by the band, the expectation by a random distribution pattern (that is, with no biases in favor of specific categories of individuals) is that 20% of his, his wife’s, and his children’s consumption events will show him as the acquirer. The test results show that women, children,⁵ and adult siblings of the acquirer receive no more meat from their husbands, fathers, and brothers, respectively, than would be expected by chance, and men eat from their own kills a good deal *less* than would be expected by chance. When the values for honey are examined, the result is slightly different. In this case, while consumers receive no more honey from these close kin than would be expected by chance, both men and women eat *more* from what they themselves acquire than chance predicts. A dramatic shift in the

due to different criteria for inclusion in the data set. For example, individuals with no siblings in the foraging band are not included in the test to determine whether siblings are preferentially shared with (table 2).

⁵ The results for children are borderline significant, but because of the number of interdependent tests run on the data set and because of the overall pattern of results we believe that no bias in fact exists.

sharing pattern can be observed when meat and honey are compared with small collected and mission-brought resources. Not only is each consumer class receiving more food from every category of nuclear-family member than would be expected by chance, but the values are highly significant (particularly for mission-brought resources). While there is still quite a bit of sharing with the latter two resource types, there is substantially less than for meat or honey.

These results raise a number of important questions. Why are resources shared differentially? Under what conditions does genetic relatedness not alter the costs and benefits of food sharing in such a way that close kin are the favored recipients of shared food? What factors condition the variation in the extent to which food is shared across animal taxa and across cultures? Analysis of internal variation across the resources exploited by a single population should provide clues and permit the testing of hypotheses regarding the general principles that govern food sharing.

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TABLE 1
CONSUMPTION EVENTS BY CONSUMER-ACQUIRER RELATIONSHIP (PERCENT)

RESOURCE AND CONSUMER	N	ACQUIRER				
		Self	Spouse	Sibling	Parent	Other
Meat						
Men	928	5.4	0	5.6	0	89.0
Women	805	0	12.9	1.6	0	85.5
Children	636	0	0	0	16.5	83.5
Honey						
Men	373	16.1	0.1	2.7	0	78.8
Women	267	3.4	16.1	1.1	0	79.4
Children	177	0	0	0	14.1	85.9
Collected resources						
Men	636	20.8	14.2	3.1	0	61.9
Women	781	39.1	5.5	1.8	0	53.6
Children	436	0.9	0	4.1	24.1	70.9
Mission-brought resources						
Men	85	0	40	0	0	60.0
Women	93	59.2	0	3.2	0	37.6
Children	94	0	0	0	50.0	50.0
Total						
Men	2,203	11	5.7	4.0	0	79.3
Women	1,946	18.9	9.8	1.7	0	69.6
Children	348	0.3	0	1.3	21.3	77.1
All	5,497	11.2	5.8	2.5	5.2	75.3

TABLE 2
 CONSUMPTION EVENTS BY CONSUMER-ACQUIRER RELATIONSHIP, OBSERVED AND EXPECTED

RESOURCE AND CONSUMER	ACQUIRER														
	Self		Other		<i>p</i>	Spouse		Other		<i>p</i>	Sib/Parent ^a		Other		<i>p</i>
	Obs.	Exp.	Obs.	Exp.		Obs.	Exp.	Obs.	Exp.		Obs.	Exp.	Obs.	Exp.	
Meat															
Men	50	107.7	726	668.3	.00001*	...	...	...	...	...	52	51.2	161	161.8	.9
Women	...	...	...	...	...	104	101.6	609	611.4	.79	12	14.3	59	56.7	.50
Children	...	...	...	...	...	...	...	...	...	...	105	87.4	471	488.6	.04
Honey															
Men	60	35.3	169	193.8	.00001*	2	1.4	45	45.6	.6139	17	12.7	37	41.3	.1721
Women	9	3.1	71	76.9	.00058*	43	33.8	142	151.2	.08	3	2.8	14	14.2	.8746
Children	...	...	...	...	...	...	...	...	...	...	25	19.3	104	109.7	.1611
Collected resources															
Men	132	19.9	301	412.1	.00001*	90	36.1	266	319.9	.00001*	19	15.6	123	126.4	.3554
Women	305	74.5	416	646.5	.00001*	43	18.7	338	362.3	.00001*	14	9.3	110	114.8	.104
Children	...	...	...	...	...	...	...	...	...	...	105	50.8	275	329.2	.00001*
Mission-brought resources															
Men	...	...	...	...	...	34	11.5	18	40.5	.00001*	...	...	...	...	...
Women	55	16.9	19	57.2	.00001*	...	...	...	...	...	3	1.9	5	6.1	.3819
Children	...	...	...	...	...	...	...	...	...	...	46	14.5	17	58.4	.00001*

NOTE: Tests were performed only on those consumer-acquirer relations for which there were enough entries for statistical analysis. Results considered significant are marked with asterisks, $p < .01$ was chosen as the significance level because 23 interdependent tests were performed on the same data set.

^a The Sib/Parent column refers to siblings where the consumer is an adult and parents where the consumer is a child.