

Gathering

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Gathering vegetable, insect and small invertebrate foods has probably been important in human history ever since the divergence of the hominins and African apes, and until the advent of effective agriculture. Even today, some subsistence agricultural societies make extensive use of wild plants for essential nutrients not abundant in domestic plants (eg. Ladio and Lozada 2000). Since our closest phylogenetic relatives are chimpanzees who subsist mainly on ripe fruit (Wrangham et al 1998) early Australopithecines probably ate a diet based mainly on ripe fruit, nuts, roots, and insects. Later, when *Homo erectus* began to acquire significant amounts of hunted foods, a division of labor probably arose in which women and children continued to gather sessile resources while men focused on hunting. Most probably women did not hunt because it was incompatible with their main goal of providing effective care for vulnerable infants (Hurtado et al 1992).

Among modern hunting and gathering societies many valuable food resources are collected by women and children. Most vegetable resources that humans exploit are calorically dense reproductive storage organs that can be found in large patches. These mainly include roots, nuts, seeds, fruits, growing shoots, and stored starch in the trunk of palm trees. Surprisingly however, fruits do not contribute more than about 5% of the energy in the diet of most modern hunter-gatherers (Kaplan et al 2000). This is mainly because most fruits are low caloric density (with high water content), and not available during many seasons of the year. Of the commonly collected vegetable foods, only nuts and seeds contain significant amounts of protein and lipids required for optimal human health. Because of these macronutrient requirements women and children also collect insects and invertebrates, or engage in informal trade for meat with men who hunt during the day. The most commonly sought insects are larval forms of beetles and social insects. Aquatic invertebrates are also attractive when they are available, mainly consisting of shellfish and crustaceans. Finally, honey, is an important resource that is collected in many places around the world.

Most important gathered resources require some processing in order to make them edible. This can include removing inedible parts, eliminating toxins, and cooking. Because collecting is often laborious and processing time can be considerable, the overall caloric return rate from gathering is usually not high. For example, mongongo nuts, which are a staple in the Kung bushmen diet during part of the year provide only 670 calories per hour when all travel and processing time is included in the cost of acquisition (Hawkes and O'Connell 1985). More typically return rates from gathering are measured after the collector has arrived at the resource patch. From a database of 91 resource types whose hourly return rate has been measured, the following averages can be calculated (given as mean, s.d.): Fruits 4750, 3900; Roots 1380, 1560; Nuts and tree seeds 1650, 1540; Grass seeds 560, 370; Starch extraction 1450, 740; Growing shoots 1790, 360; Insect larva 2040, 950; Wild honey 17230, 7470; Shellfish 900, 140 (Hill et al 1987; Kelly 1995: 81-

82; Meehan 1982 and unpublished data). These numbers suggest that honey collection is the most profitable resource to collect when it is possible. Not surprisingly this activity is often carried out by men rather than women and children. Fruit collection also gives high average returns but with high variability depending on the species of fruit (large fruits have return rates about twice as high as smaller fruits). Grass seeds are probably the gathered resource with the lowest return rate because of the extensive processing required (winnowing and grinding). Because of substantial travel time to collecting patches and the scarcity of the most calorically dense collected resources women's overall return rate from gathering (counting search time or travel to the collecting patch) is often only about 600 calories per hour.

Women's daily time allocation to gathering resources varies among hunter-gatherer groups and is strongly affected by their reproductive status (Hurtado et al 1992) with new mothers spending very little time gathering compared to older post-reproductive women. The mean number of hours gathering per day from 22 foraging societies is about 3.8 hours. This ranges from less than an hour a day in some Boreal Forest and Arctic groups (Irimoto 1980; Smith 1991) to nearly 8 hours per day among the Hadza (Hawkes et al 1997). The biggest advantage of gathering over hunting is that it is less likely to fail to provide any food on a given day (Kaplan and Hill 1985) and it is an activity that children can engage in to provide some of their own food needs. Sometimes the collecting rates of children can provide a large part of their own food needs whereas in other places children gather very little of their own food (Blurton Jones et al 1989). Children's effectiveness at gathering is mainly dependent on whether gathered foods require complicated extraction techniques or they can simply be collected from the environment. Since most fruits require no complicated extraction, children are nearly as efficient as adults in gathering fruits (Kaplan et al 2000), a finding which appears to have important implications for the divergence in life history between fruit eating apes and early human ancestors.

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