Kawal, Meat Substitute from Fermented Cassia obtusifolia Leaves

HAMD A. DIRAR

The green leaves of Cassia obtusifolia are fermented to produce a food product, kawal, used by certain tribes of Sudan as a meat substitute. Following fermentation for 2 wk the product is sundried and used when needed. Protein content of kawal is about 20% on dry matter basis. Two microorganisms are most commonly recovered from fermenting as well as dried kawal: the bacterium Bacillus subtilis and a species of the fungus Rhizopus. Other uses of the plant are discussed.

Recent years have witnessed an increased interest in leaf protein as a possible source to help alleviate the world shortage in protein. Research work has shown beyond doubt that leaves of various plants contain appreciable levels of protein (Martin and Ruberté, 1979). Man has made use of this protein source throughout his history. Leaves are consumed as salads, stews, relishes or boiled vegetables. However, to the author's knowledge, there is no report of a meat substitute obtained by fermentation of leaves. This paper reports on such a food.

MATERIALS AND METHODS

Kawal (the dry fermented food) and kawal plant seed were collected from different places in the Sudan, mostly from the western regions of Kordofan and Darfur.

Identification of the kawal plant was carried out using Andrews (1952). Tentative identification of bacteria was done according to Buchanan and Gibbons (1974). Isolation and routine cultivation of microorganisms was carried out on nutrient agar (Difco). Anaerobic incubation in an anaerobic jar was done under hydrogen gas.

Chemical analyses were conducted according to the routine procedures described by the Association of Official Analytical Chemists (1975). Protein was determined by multiplying the nitrogen content by a factor of 6.25. Hydrogen ion concentration was measured with a Pye, model 79, pH meter.

Kawal fermentation was carried out by the usual procedure used by the Fur people of western Sudan. A woman, experienced in kawal making, supervised the process. Leaves were collected at the flowering and fruiting stage. They were then cleaned of all impurities, such as flower petals and leaves of other plants. All worms, insects, or insect-damaged leaves were removed. The leaves were then pounded in a wooden mortar until they formed a paste, without loss of juice. The leaf paste was packed tightly, with the hands, in an earthenware jug (capacity 30 l) previously buried in a pit in the ground in a cool, shaded place. Only the neck of the jug was above ground level. The surface of the packed leaf paste was covered.

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1 Received 19 April 1983; accepted 30 January 1984.
2 Department of Agricultural Botany, Faculty of Agriculture, University of Khartoum, Khartoum, Sudan.

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with a pile of twisted green sorghum leaves, weighted down with clean stones. The jug (called *zeer*) was then covered with a suitable lid and sealed with mud. Every 3 days the *zeer* was opened, the now dried sorghum leaves removed and the fermenting paste hand-mixed, crushing the material between the fingers. The leaf paste was then repacked, fresh green sorghum leaves used to replace the old yellow ones and the *zeer* resealed. Samples for pH determination were taken at the time of mixing. After an incubation period of 15 days, the kawal matured and was taken out, cut into small irregular balls and was sundried on a raised shelf or platform for 5 days. The dried kawal balls (Fig. 1) were then ready for consumption as food in the form of stew.

**RESULTS AND DISCUSSION**

Until a few years ago kawal was poorly known to most Sudanese, for it was a product confined to the western regions of the Sudan. It is depreciated by the elite who consider it not fit for social life because of its repugnant, putrid odor that lingers on the fingers for hours and hours. Traditional kawal eaters have described kawal as the food that “when you eat it with your right hand, you smell it on your left.” Yet, unlike most traditional foods, which tend to disappear in time, kawal has spread in recent years across the Sudan from west to east and up and down the Nile.