

cepts these communal barracks as evidence of a former stage of promiscuity, and the universality of their tabu to the married woman as proof that "marriage" arose by capture; but the evidence all along the line (which is barely outlined here) seems to be irresistible. After all, perhaps, when we recollect that our ideas of incest, chastity, and modesty were pretty certainly as unknown to our remote ancestors as they are to some races even in our own day, it does not very much matter whether the primary "unit" was the family or the horde; if anything the horde is preferable.

A feature of the races having these barracks is (as a rule), that there are no juvenile marriages. At 18 or 20 the young women and at 20 or 25 the men settle down as fairly staid couples while yet in the prime of life, and divorces are rare. There are, as a rule, no old maids, and until civilized races appeared upon the scene, there were probably no prostitutes. Possibly a more extended research may reveal traces of the communal barrack system and its accompanying tabu in other countries; but enough has been stated to show that the subject is worthy the attention of all those interested in the question of the origin of marriage and social development.

Rajmal P.O., Sibsagar, Asam, Sept. 4.

THE UTILITY OF VEGETABLE ACIDS IN FOOD.

BY H. J. PATTERSON.

TECHNICALLY speaking, a food is generally described as a substance supplying material for maintaining the vital processes, renewing the waste and forming additional tissues in the animal system. It is a question whether it would not be well to broaden this definition so as to include those substances which serve the purpose of increasing digestibility and assimilation, and of preventing destructive metabolism. If these substances are not worthy of being classed as true foods, it may be well to class them as auxiliary foods. Whether the vegetable acids fall in the first class or in the second is still an open question; but they most probably belong to that of auxiliary foods.

The study of the definite character, quantity, and functions of the vegetable acids which exist in our foods has received but little attention, and consequently their true utility is but little understood or imperfectly defined. In the dietary of man acid foods have generally been considered to simply serve to gratify the senses of sight, taste, and smell, promote the appetite, and contribute to pleasure. It is well recognized that organic acids occur in small quantities in most feeding stuffs, but in the natural state they are generally in combination with bases. In the proximate analyses of foods the organic acids fall into that general dumping-ground of nitrogen-free extractive matter, and, with the rest of the members of that class, have until very recently received little or no attention.

It is a common practice in medicine to use vegetable acids to cause a decrease in the amount of flesh and to retard or stop flesh formation. Again, we know that in some cases these acids are used to facilitate digestion and to give a general toning up of the whole animal system. Some investigators have suggested that these acids have certain fuel values closely related to the carbohydrates, and that their combustion will save the consumption of other materials; this would class the acids as a true food. With the now almost universal use of silage and brewers' grains in our feeding economy with animals, and the considerable quantity of acids in the free state which are formed in the fermentation which these feeds undergo, it is a matter of considerable importance to know the true effect which these acids exert in the animal system, and whether they themselves are foods; whether they exert a beneficial influence on other foods; whether they aid or retard digestion, assimilation, and tissue and albuminoid consumption.

The investigations which have been conducted bearing upon this question have been very few and have not taken up the question as much in detail as it is desirable or as the matter deserves. The first experiment¹ in this line, and the one that brought this subject prominently before the author, was where a dog had been fed considerable organic acids in addition to his other food, exact

¹ Reference lost.

records of the amount and composition of the food eaten and matter voided kept, with the result that there was produced a greatly increased consumption of the albuminoids. H. Weiske and E. Flechsig² performed experiments with a rabbit and sheep, feeding in addition to ordinary food the calcium and sodium salts of lactic and acetic acids; their results varied, but generally large quantities of the acids increased the albuminoid consumption, while small quantities had the opposite effect. A. Stulzer³ compared the different organic acids found in feeding-stuffs and in the stomach in the artificial digestion of albuminoids, with the result that most of them have a high value. Acetic acid was found to be surprisingly low. We know from the investigations of Woehler and Lehmann that organic salts are changed in the animal organisms into carbonates and pass off as such in the urine. Charles, in "Physiological and Pathological Chemistry," states that oxalic acid, with animals in normal condition and when active oxidation is going on, rarely appears as such in the system, but is burnt into carbonic acid and water.

During the winter of 1891, experiments were made at this station by the author to test the effects of silage in connection with other foods on the digestibility of the different constituents and on the albuminoid metabolism. The foods used were corn-meal, wheat-bran, cotton-seed meal, germ feed, and gluten meal, in connection with corn-silage *versus* the same foods in connection with corn-fodder (stover). The animals used in the experiment were two one-year-old, and two two-year old steers. The silage contained on the average 1.86 per cent free acid,⁴ and as the two-year-old steers ate on the average from 20 to 25 pounds of silage per day, and the one-year-old steers ate on the average about 15 pounds of silage per day, this would make about 180 grams and 100 grams of free acid taken by the steers, respectively, per day. The two-year-old steers averaged about 950 pounds, and the one-year-old steers about 550 pounds. These quantities of acid are only from $\frac{1}{4}$ to $\frac{1}{2}$ as much as were fed in the experiments of Weiske and Flechsig; with the smaller quantities they concluded that the acid served to conserve the albuminoids, and with the larger quantities to increase albuminoid consumption.

The average results of my experiments showed that with the rations containing the corn-fodder 33.7 per cent of the nitrogen fed was stored in the body, while with the rations containing the corn-silage there was only 26.6 per cent of the nitrogen fed stored in the body. From this we gather that even with small quantities of acid in the free state, they do not serve to conserve the albuminoids, but rather to increase nitrogen metabolism. The acid of the silage had a tendency to increase the digestibility of all the food constituents except that of the protein; this was slightly less digestible in the acid ration.

The experiments performed and the data at hand will justify the following summary: 1. Large quantities of vegetable acids, either in the free state or combined with bases, will produce an increased consumption of albuminoids. 2. Small quantities of vegetable acids in the combined state and very small quantities in the free state have a tendency to increase the digestibility of foods and to decrease nitrogen metabolism or conserve the albuminoids. 3. The vegetable acids may, in some cases and to a slight degree, serve as conservatives of carbohydrates through their own oxidation. 4. That exclusive or excessive feeding of very acid foods, such as silage or brewer's grains, is detrimental to the animal, and causes a waste of the nitrogen or albuminoids of the food and of the animal body.

College Park, Md., Oct 8.

ON Tuesday, Oct. 18, there was opened a telephone line between New York and Chicago. The length of the line is 950 miles, which makes it nearly twice the length of any previously in regular operation. Professor A. Graham Bell was present and easily conversed with one of his early associates in telephonic work, who happened to be in Chicago. The formal opening of the line was made by Mayor Grant of New York, who conversed with the Mayor of Chicago at the other end.

² Journal f. Landw, 37, pp. 199-234.

³ Landw Versuchs., 38, pp. 257-279.

⁴ Principally acetic and lactic acids.