days of treatment, and finally 18 days after the neomycin had been withdrawn. In the other two subjects biopsies were obtained on the fifth to tenth day while they were receiving the antibiotic.

Biopsies were obtained from the proximal jejunum. The changes obtained on histological examination varied in magnitude, but mucosal samples from all subjects treated with neomycin showed the characteristic patterns. Such changes were not found in the untreated subjects. Following neomycin therapy, the mucosal villi showed edema and increased cellular infiltration and changed their form becoming polypoid, plateaued, or sometimes mushroom shaped. All the villi did not undergo changes since there were normal villi adjacent to those showing marked abnormality. The authors also suggest that the severity of the changes could not be correlated with the duration of the administration of the antibiotic.

The histological changes noted in the intestinal mucosa were qualitatively similar, although much less pronounced than those found in patients with idiopathic steatorrhea. These changes indicate that neomycin produces a definite histological alteration in the normal jejunal mucosa. It should also be noted that in the one subject who was biopsied again 18 days after cessation of the treatment the intestinal mucosa had returned to normal.

While these investigations indicate that neomycin produces a definite change in intestinal mucosa, they neither indicate the mechanism by which the alteration is produced nor prove that the malabsorption is definitely dependent upon the changes noted. The authors believe that it is highly probable that these intestinal changes, because of their similarity to those occurring in other malabsorption syndromes, are responsible for the defects in absorption, rather than the drug decreasing intestinal absorption of nutrients by merely increasing intestinal transit time.

PEMMICAN

An emergency ration of pemmican provides 1000 calories a day; adaptation to resulting starvation persists for at least a week and reduces physiological disturbances during a second starvation period.

The North American Indian prepared pemmican by drying thin slices of buffalo meat or venison in the sun. The dried meat was then pounded into small particles, mixed with melted fat, and packed in sacks of hide. Some of the early explorers used a similar preparation made of dried beef, suet, raisins, and sugar. The high caloric density and its preservative qualities are the primary reasons why pemmican has been proposed as an emergency ration for a variety of military personnel. This suggestion has elicited much discussion, but has produced relatively little experimental data on the physiological effects of eating pemmican.

The United States military forces have recently added pemmican to one of their emergency survival rations, hence, a number of reports have appeared on the reactions of military personnel to pemmican.

E. P. Torrance and R. Mason (*Am. J. Clin. Nutr.* **5**, *176* (*1957*)) of the Survival Research Field Unit at Stead Air Force Base in Nevada provided each of 543 airmen with a double issue of the emergency survival ration (containing pemmican) plus two pounds of beef and a small quantity of vegetables. The food was to last for a nine-day simulated survival exercise, four days of which were spent in rest and the last five in travelling over difficult terrain.

At the end of the field test each man's reaction to the pemmican was secured by a questionnaire. The 27 per cent of the subjects showing the greatest aversion to the pemmican were studied further to determine the basis for their aversion. The men who found pemmican unacceptable had been exposed to unfavorable comments about it either prior to or during the test. In a few cases the men had been too hungry or too tired when they first ate pemmican, and these conditions appeared responsible for their dislike.

A more extensive evaluation of pemmican as an emergency ration was made in Alaska by H. F. Drury, D. A. Vaughan, and J. P. Hannon (*Arctic Survival Rations, III. The Evaluation of Pemmican Under Winter Field Conditions, Arctic Aeromedical Laboratory, January (1959)*). Ten young men were restricted to a remote part of Ladd Air Force Base. They were provided with standard air force arctic clothing and double sleeping bags. During the day the men were physically active for at least six hours. They slept in unheated snow shelters.

The temperatures recorded at the camp in the morning decreased from +14°F on the first day of the test to −55° on the fifth day. From the fifth day to the ninth day the temperature gradually increased to +13°. In spite of the severity, the men did not suffer from the cold.

Each man received 1000 calories per day consisting of 5 ounces of pemmican and a number of opaque gelatin capsules. The capsules for half of the men contained pemmican; capsules for the other men contained sucrose to provide 40 g. per day. Both groups were instructed to take the capsules at regular intervals throughout the day.

Most men ate the pemmican at regular mealtimes, often with distaste, especially from the third to the fifth day. Uneaten pemmican was weighed.

Difficulty in eating pemmican was usually associated with nausea. The nausea, however, disappeared after the fifth day, then all the pemmican was eaten. The investigators suggested that the nausea was probably due to the starvation of the men as a result of the 1000 calorie allowance per day.

During the nine days of the study the men became weaker and tired easily when doing any physical activity. Resting however, produced prompt recovery, and the men could work for another short time.

The men lost an average of 10.5 pounds during the nine-day trial. There was no difference in the weight lost by the group receiving the sugar supplement and the group receiving only pemmican. The sucrose supplement increased the fasting blood sugar to only an insignificant extent (68 mg. per 100 ml. versus 64 mg.). The two groups also showed no difference in nitrogen balance as measured by nitrogen intake and urinary excretion. The sugar had no subjective response that could be detected by the observers.

The urinary excretion of acetone provided no definitive evidence for any beneficial effect of the sucrose supplement. One of the subjects receiving the sugar excreted 31 g. of acetone equivalents during the nine days, whereas the other four members of this group averaged 7.7 g. Disregarding the subject showing the highest acetone excretion, the group receiving the sugar would then show a slightly lower acetone excretion than the five men receiving nothing but pemmican (7.7 g. versus 12.4 g.).

The average daily excretion of acetone by both groups showed a peak on the third day of the study, after which the excretion values gradually returned close to normal. The nitrogen balance data also showed that the maximum loss occurred on the third or fourth day followed by a gradual return to equilibrium. There is no explanation for the apparent adaptation that occurs after the third day of starvation. Drury and co-workers observed a similar indication of an adaptive process in sedentary subjects given a 1000 calorie diet while living in a heated laboratory.

In an extension of these studies, D. A. Vaughan and co-workers (*Arctic Survival Rations, VI. The Physiological Effects of Restricted Diets During Successive Winter Field Trials, Arctic Aeromedical Laboratory,* *August* (*1959*)) subjected 12 young men to two test periods of five days each, separated by one week, during which the men ate at home on an ad libitum basis. In both trials each man received 1000 calories per day. All subjects were given gelatin capsules as in the previous study. Four of the men had pemmican in their capsules, another four received 40 g. of sucrose per day, and the last four received 80 g. of sucrose per day.

The results of the first five-day trial were essentially the same as those noted in the previous study. The 80 g. sucrose supplement had no greater effect than the 40 g. on fasting blood sugar levels, nitrogen balance or urinary acetone excretion.

In the second trial, all subjects showed evidence of an adaptation to starvation in so far as the above parameters are concerned. All three groups showed a less precipitous drop in fasting blood sugar values during the second trial than during the first trial. Actually, the group receiving 80 g. of sucrose showed no change in blood sugar levels when compared to the pre-test control values. A similar trend appeared in the nitrogen balance values. During the first trial, the men showed a sharp increase in the nitrogen lost from the body with a peak value of 7 g. per day being reached on the second or third day. In the second trial, the nitrogen loss never exceeded 4 g. per day.

The acetone excreted in the first five-day period was inversely related to the sucrose supplement, and all values were approximately twice those observed in the second trial.

The difference in the results of the first and second trials was not attributable to either the external temperature or the physical condition of the men. The latter was evaluated by R. E. Johnson, L. Brouha, and R. C. Darling (*Rev. canad. de biol.* **1,** *491* (*1942*)).

It was suggested by Vaughan and coworkers that "a metabolic adjustment or adaptation to restricted caloric intake" was developed during the first trial which persisted during the one week of rehabilitation. This concept agrees with the observation of H. L. Taylor *et al.* (*Am. J. Physiol.* **143,** *148* (*1945*)) who found that men without food for a period of four days carried over an adaptation to starvation. When the men were subjected to a subsequent starvation as long as six weeks after the first starvation, they showed a reduced excretion of nitrogen and ketone bodies in the second test.

These studies suggest that the acceptance of a survival ration, which of necessity must be an unusual diet, can be enhanced by prior consumption of the ration. The work re-emphasizes the fact that metabolic and physiological adaptations to semistarvation can occur. Whether this adaptation is also associated with psychological adjustments which permit the individual to withstand the rigors of a reduced food intake is not apparent from these reports. Additional work in the latter area would certainly be desirable and might offer suggestions as to how an obese individual might best adapt himself to the rigors of a reducing diet.

TOXICITY OF VITAMIN K SUBSTITUTES IN PREMATURE INFANTS

Another article pointing out the potential hazards from the use of large doses of certain water-soluble vitamin K substitutes in young infants.

During recent years a number of authors have reported untoward effects from large doses of certain vitamin K substitutes given to prematurely born infants (a large dose is 10 mg. or more, about 1000 times that required as prophylaxis for the newborn).

These effects of hyperbilirubinemia, mild hemolytic anemia, increased frequency of Heinz-bodies in erythrocytes, and an increased incidence of kernicterus (*Nutrition Reviews* **15,** *331* (*1957*)) are largely limited