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FINAL REPORT

ON

AN ANALYSIS OF DATA ON THE NUTRITION OF AMERICAN OFFICER PRISONERS OF WAR AT THE ZENTSUJI PRISONER OF WAR CAMP AT SHIKOKU, JAPAN

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DEPARTMENT OF FOOD TECHNOLOGY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
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MAY 1948

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Abstract

The amounts of various nutrients on a monthly per man per day basis obtained from foods supplied by the Japanese to, and foods received in Red Cross parcels by American officer Prisoners of War in Zentsuji, Japan, 1942-1945, have been calculated. The amount of each nutrient received has been compared with that recommended in the daily allowances of the National Research Council. These have been correlated with certain clinical observations that were made during the period of internment.

The report includes a description of the Zentsuji Camp, the prisoners, their treatment and a literature review.

The report includes 43 tables, 12 figures and an appendix consisting of a brief account of nutrition conditions of Philippine Prisoner of War camps from whence the majority of the American Officer P.O.W's at Zentsuji came.

Preliminary Statement and Outline of Report

During the incarceration of one of us (Samuel A. Goldblith) in a Japanese P. O. W. camp, data on food supplied by the Japanese was collected and calculated for proximate analysis from tables available in the camp in order that we might have a better means of bargaining for increased supply of foods. These data were brought up to date daily during the period from December 1942 to June 1945. They were brought back on liberation.

To our knowledge these data on food intake are the most complete on a large group of human beings. As these data may be of interest to the armed forces, the Office of Naval Research was contacted and this office sponsored the preparation of the present report.

Outline of Report

This report is subdivided into 5 sections, viz:

1. An introduction describing the concentration camp and the treatment received by the P.O.W's. This may be of importance especially to a physician, for malnutrition may certainly be aggrevated by psychological factors, threats, beatings, living conditions, etc. In addition, this section also contains a description of the prisoners when captured.

2. A literature review on previous recent data on the effects of malnutrition on humans.

3. Data.

4. Discussion of the data.

5. A description of malnutrition in the Philippines after the capture of Bataan and Corrigidor. This was felt to be an asset to the present report since a large number of the officers who were involved in the period from December 1942 to June 1945 were captured on Bataan and Corrigidor.

Part 1

Introduction

The data used in this investigation were collected by one of us during the period for December 1942-June 1945. It involves as subjects: Officer Prisoners-of-War of American, English, Dutch and Australian nationalities.

The prison camp was located at Zentsuji on the Island of Shikoku, Japan. The climate at this camp is approximately the same as at Washington, D. C. At no time during the period covered in this report was any auxiliary heat provided by Japanese.

The camp was located at the side of the German concentration camp of the First World War, in the midst of an Army cantonment. There were two large barracks in the camp, two outside-covered latrines, a cook house, a rabbitry, a chicken house, a small hall and a small playground. These buildings were surrounded by a fence patrolled by regular Army Japanese guards.

Each of the barracks was subdivided into large rooms with raised platforms on each side on which were laid thin straw mats on which the P. O. W's slept. Each officer P.O.W. had an allowance of sleeping space 25-30 inches wide. The latrines were outdoors, buildings set up over large holes into which the excreta fell and which were emptied more or less regularly by the neighboring Japanese farmer, who used the excreta as fertilizer. The washstands were outdoors also and were not enclosed, and this often necessitated the breaking of the ice in the winter in order to wash. As a result, chilblains were quite common.

In the cookhouse all cooking was done primitively in large cast-iron pots over a coal fire. Here the food (rice and soup) was weighed

out in buckets proportionately and carried to each room.

The medical care was supposedly in the hands of the camp physician (Japanese) who, however, delegated this to the competent American surgeons among the prisoners. The American medical officers, naval officers captured on Guam, Dr. E. J. Van Peenan, and Dr. T. I. Coe, had a daily sick call, dispensed the available drugs and performed operations including successful appendectomies under poor conditions. A sick-bay, or hospital, was maintained for non-ambulatory patients and convalescents. However, this was certainly inadequate for the size of the camp.

The drugs were under the control of the Japanese medical officer and although there were sufficient medical supplies in camp, including vitamin supplements (through the kindness of the American Red Cross) these were not always available.

The camp was opened in January 1942 with P. O. W.'s captured on Guam and Wake Islands. In July 1942, there were transferred to the Australian Officer P. O. W.'s from Rabaul, New Britain. In January 1943 most of the enlisted men captured on Guam and Wake Islands were transferred out of the camp, and these were replaced by 150 malnourished officer P. O. W.'s captured on Bataan and Corrigidor. In addition, some of the officers captured after sinking of the U. S. S. Houston, H. M. S. Perth, and a few of the allied submarines, also arrived at the Camp. In August 1943 approximately two hundred odd American officer P. O. W.'s captured in the Philippines plus some British officers captured at Java, Singapore and Malaya and Dutch officers captured in Java arrived at the camp. By January 1943, over 90% of the complement of the Zentsuji camp were officer personnel of mixed nationalities. The

complement increased from December 1942 when there were 250 officers, until August 1943 when there were approximately 700 officer prisoners.

During the period of time covered by this report, there were only two deaths at the camp. One of them was due to a volvulus condition and the second can be attributed definitely to starvation.

Infractions of the Japanese rules were punishable usually by incarceration in the "brig", a separate small building used for storage by the Japanese. In the "brig" no mosquito nets were allowed in the summer (mosquitos were very prevalent in warm weather) and no blankets allowed in the winter. Neither shoes nor washing facilities were available there. In addition, the prisoner was on half-rations while in the "brig".

Minor infractions resulted in slaps on the face and standing at attention for periods of time varying from 1 hour to 5 or 6 hours. Actually the punishments were not nearly as severe as reported at other camps.

There were certain Japanese officers and enlisted men who were sadistic and enjoyed bullying the prisoners. The Japanese had different officers and non-commissioned officers of the day, and when these sadistic individuals were on duty they delighted in making life as unpleasant as possible. This contributed materially to the morale of the camp.

Officer P.O.W.'s were officially not supposed to work. However due to enforced exercise, shorter rations, punishment for the least offense, theoriseners at Tentsuji worked most of the day. This work consisted of gardening from the breaking of the ground to harvesting, caring for and foraging for the rabbitry, care of the grounds, etc.

The work was for 4 hours per day and might be classed as semi-hard labor.

Another factor contributing to morale was the herding of the P. O. W's into one small room when air-raid sirens blew. Shades were drawn and no smoking allowed. The Japanese allowed one hour's entertainment every Sunday evening, always a play or skit was staged by the P. O. W's after censoring by the Japanese.

Cigarettes were issued in varying amounts up to as high as 5 per day, depending on the desires of the Japanese officials in charge of the camp.

Part 2

Literature Survey

From time immemorial civilization has known hunger and starvation. However, it is only in recent years that science has advanced sufficiently to study the effects upon the human mechanism. The first study of this type was performed during the war by Ancel Keys and co-workers (1) at the University of Minnesota on a group of conscientious objectors. Various observations on malnutrition have been reported as a result of this war. Butler and co-workers (2) reported on the "nutritional status of Civilians Rescued in Philippine Concentration Camps", stressing mainly the lack of literature on the subject.

A complete review on "Nutritive Deficiency and Susceptibility to Poliomyletis and other Infections in Experimental Animals" (3) has been reported. These experiments have been concerned with induced rather than spontaneous infections. In regard to their application to man, the difference in species reaction to infection must be kept in mind. Adequate nutrition for the host may also be optimal and conducive to producing conditions for invading microorganisms.

Fasal (4) reported on the results of a nutritional survey performed in Malay in 1939 and 1940. The author observed Vitamin A deficiency, Bitot spots and angular dermatitis. The author attempted to correlate the symptoms of the various dietary deficiency diseases with the different diets of the various groups of peoples. However, the occupation of Malaya by the Japanese brought t is study to an end.

1-Human Starvation and its Consequences", A.Keys,J.Amer.Diet.Assoc., 22,562 (1946). Science, 103:369-370 (1946).
2-"The Nutritional Status of Civilians Rescued from Japanese Prison Camps", A.M.Butler,et al., N.E.J. Med., 233:639-52 (1945)
3-"Nutrition Reviews", 3:69-72 (1946).
4-Arch. Dermat. Syph., 50:160 (1944).

Among the more recent studies on larger groups have been those in Holland immediately following its liberation (5). Dietary histories taken in "street clinics" in several of the larger cities are given. The results of these "spearhead surveys" and nutritional studies made by Dutch scientists throughout the war are to be published soon. It seems that on the basis of clinical findings that deficiencies in calories, (particularly fat), protein, iron, Vitamin A, riboflavin, and, in infants calcium, seemed the most serious.

French & Stare (5[1]) presented biochemical and dietary data obtained in two nutritional surveys of Rotterdam, Holland in 1945. The average weight losses of the various age groups and symptoms are presented. The dietary consumption data were obtained by questioning and the authors state that they are subject to considerable error.

A preliminary statement has been published by Burger, Sandstead, and Drummond (6) describing the clinical features and the treatment of the mass starvation in western Holland. Among the symptoms observed on a daily caloric intake of 1000 calories per person per day were physical and mental exhaustion, dizziness, a tendency to collapse after standing, headache, nocturia, emaciation, numbness in the extremities, slow heart-rate and low systolic blood pressure were characteristic. Body temperature was often low with a tendency to a loss of the thermoregulation of normal persons. A nonbacillary diarrhea was present. Many were anemic. When the final paper is written many of the clinical vagaries of dietary

5-F.J.Stare, Nutr. Rev., 3:225-227 (1946) "Nutritional Conditions in Holland".
5[1] French, C.E. and Stare, F.J. J.Nutr. 33:649-660, 1947
6- Lancet II, 282 (1945)

deficiency diseases will become clear.

Pollack (7) in a letter to the editor of Nutrition Reviews gave a complete picture of the total starvation syndrome from a macroscopic point of view. Minimal laboratory data are available, however.

Jonxis (8) described the nutritional status of "Dutch Children in Wartime" after September 1944, when the food supply began to drop markedly. The total protein for children over one year of age dropped to 10 to 15 grams per day; fat 2.5 gms. per day; carbohydrate 100 gms. per day. About 70 I.U. of Vitamin A, 0.22 mg of thiamine per day and 4 mgs of niacin was the daily estimated dietary intake. The quantity of Vitamin C was also very low due to the lack of potatoes. Children all lost weight and towards the end of the war, they even stopped growing in height. Most of the children had a moderate anemia due to the lack of iron in the food. The only vitamin deficiency observed in a great number of cases was avitaminosis A. Many children showed no Vitamin A in their blood at all. Nutritional edema was seldom seen in children. Bed rest and unsalted food were sufficient to cause the edema to disappear. Decalcification of the bones was prevalent and the susceptibility of the children to infection increased.

Besancon (9) reported on the selective starvation employed by the Germans in France. Lassitude, weakness, hypersusceptibility to cold, chilblains, dispepsia, atrophy of gastric mucosa, and pronounced diarrhea were among the symptoms noted. One of the peculiar signs was "an abnormally

7-Nutr. Rev., 4:63-64 (1946). Letters to the Editor.
8-Jonxix. J.H.P., Nutr. Rev., 4:97-99 (1946)
9-L.J. Besancon, War Med. 8:283 (1945)
10-C. S. Davidson, Nutr. Rev. 4:161-163 (1946)

abundant diuresis", beginning with nocturia, but later becoming diurnal and reaching 3.4 or 5.0 liters.

Davidson (10) reported on "Nutrition and Food Supply in Germany and Austria". Although these people averaged above the weight for Americans before the war, they lost weight during war rationing, but did not reach the degree of starvation nor showed as many nutritional deficiencies as the people in Holland. Some nutritional edema and hypoproteinemia was present in the cities, but few signs of avitaminosis were found.

Musselman (11a) described the severe nutritional deficiencies among American prisoners captured in Bataan and described the beri-beri, pelagra and hypoproteinemia. Lewis Musselman (11b) described some observations they had made of pellagra in American Prisoners of War in the Philippines and the onset of the disease corresponds to that observed by the author in Part of this report.

Griffith (12), who was chief of the nutritional branch of the U. N. R. R. A., states that the specific effects of malnutrition in the P.D.P. camps and in political camps, were due to caloric and protein deficiencies and that the resulting low metabolic level tended to protect against avitaminosis.

French and Stare (13) conducted nutritional surveys in Holland and discussed malnutrition in Rotterdam. Pollack (14) described the syndrome of total emaciation which clinically can be differentiated from acute starvation and malnutrition. Specific vitamin syndromes were not

11a- [illegible] Musselman, War Med., 8:320 (1945)
11b- Lewis, C. F. & Musselman, [illegible] J.Nutr. 32:549-558,1946
12- [illegible] H. Griffith, "Food and Nutrition in War-torn Europe", A.C.S. Abstracts, 12A, September,1946
13- C.E.French, F.J.Stare, "Nutritional Conditions in Western Holland with Particular Reference to Rotterdam", A.C.S. 12A,1946(Sept.)
14- Pollack, H., "Observations on Total Emaciation States", 13A.

as common as might be anticipated.

Ashe (15) surveyed in occupied Germany and discussed the relationship if the minimal calorie requirements of various categories of peoples compatible with a policy of maintenance of minimal satisfactory health standards. The data also included the various deficiency states among the German people.

Johnson & Kark (16) have shown that environment has an effect on voluntary food intake in man. It would seem to the author that it would have an effect on assimilation and utilization of the food also.

Metcoff & McQueeney (17) summarized the result of 35 survey studies performed in Italy in 1945 on approximately 4000 persons. These authors found that with rare exceptions, no deficiencies were encountered that could not have been prevented or successfully treated with cod liver oil or dry skim milk.

The effect of reduced thiamine and riboflavin intake on the biochemical, clinical, neurological and psychological aspects of nutrition were studied by Horwitt et al. (18). The self-restriction of activity, dullness of ambition, drying of lips and loss of skin elasticity was especially marked.

McDaniel, White & Thompson (19) examined 1520 repatriated P.O.W.'s aboard the Navy Hospital ship "Benevolence". Clinical evidence of multiple dietary deficiency was observed in most of the prisoners but none of the symptoms indicated classic beriberi, pellagra, scurvy or sprue. There was little indication of deficiency of Vitamins A,C,D,E or K of essential minerals.

15-A. F. Ashe,"Nutritional Surveys in Germany, May,1945-May,1946", 15A.
16-Johnson,R.E. and Kark, S.L. Science 105:378-9,1947
17-Metcoff, J. and McQueeney, A.J. N.E. J. of Med. 235:451-460,1946
18-Horwitt, L.K., Liebert, E., Kreisler, O. & Kittman,P. Science 104:407-8,1946
19-McDaniel, F.L., White,B.V. and Thompson,C.M. U.S.Nav.Med.Bull.46: 743-810 (1946)

Burgess (20) described rather completely the state of nutrition of troops captured in Singapore, calculated their dietary intake, and attempted to correlate those data with the various clinical observations made.

Walters et al. (21) conducted a survey on 2000 Indian P.O.W's in Japanese prison camps. The clinical features and treatment were discussed.

Glusman (22) described the syndrome of "burning feet". This manifestation has been noted previously in the British-Burmese war (1822-1824) etc. and it has been estimated that 1/3 of the P.O.W's of the Japanese during World War I were affected by this condition. Treatment with niacin relieved the associated sign of pellagra but had no effect on the symptoms of the burning feet. Thiamine was not effective either.

Gopalan (23) has presented some evidence which indicates that burning feet may be caused by pantothenic acid deficiency. It will be difficult to prove this important point for human subjects will be needed.

20- Burgess, R. C. Lancet, Sept. 21,1946, pp 411-418
21- Walters, J.H., Rossiter, K. J. and Lehmann, H. Lancet, 251:205-10,1947
22- Glusman, M. The Amer. J. of Med. 3:211-223, 1947
23- Gopalan, Ind. Med. Gaz. 81:22-5, 1946

Part 3

Data

The food data presented in this section represent the quantities of all foods issued by the Japanese to officer P.o.w.'s at Fentsuji, Japan, calculated on a gram/man/day/month basis. These figures were calculated from the weights of foods supplied by the Japanese. These weights were recorded by the chief petty officer in charge of the galley and transmitted to the author.

The gram/man/day of each food item was obtained by adding the total issue for the month and applying the following formula:

$$\text{total issued (kgs)} \times \frac{1000 \text{ gms}}{1 \text{ kg}} \times \frac{1}{\text{no. of officers}} \times \frac{1}{\text{no. of days in mo.}}$$

$$= \text{gms/man/day for the month}$$

These data are presented in Tables 1 - 21, inclusive.

As may be seen from those tables, the dietary was mainly vegetarian with an occasional portion of meat and fish. Rice, barley and millet were the chief staples and these were mixed together, often with dry beans or soybeans. This part of the ration was served separately. The different vegetables issued to the galley were cut up and cooked either alone or mixed in a soup. Usually these consisted in some type of green such as spinach, Chinese cabbage, pickled greens, etc. Each day for breakfast small quantities of "miso", a fermented soybean mash was issued. This was cooked up in the soup.

From these data the composition of the diet for the month was calculated using as a basis the following: "Tables of Food Composition"- U. S. Department of Agriculture. Misc. Pub. No. 572, and Chinese Food

Composition tables of Dr. R. S. Harris et al (unpublished).

The total protein, fat, carbohydrate, calcium, phosphorus, iron, thiamine, riboflavin, niacin, ascorbic acid, vitamin A and calories were then calculated for all foods on a "per man per day" basis for the monthly periods.

These data are summarized on a monthly basis for the period of December 1942 to June 1945, inclusive, and appear in Table 32.

During the period of incarceration, the officer P.O.W.'s at Zentsuji Camp were fortunate enough to receive some Red Cross parcels. The dates of issue and types of parcel are listed in Table 33. The types of parcels received and the contents thereof are listed in Table 34 The composition of the respective parcels is presented in Table 35 These data are included in this report because any correlation between diet and clinical data certainly requires that all of the food be included.

Using the data in Tables 33 and 35 the nutrients obtained /officer/day from Red Cross sources have been calculated over a monthly basis (Table 36).

To compare the effects of the diet, the average weights of the officers of the camp during the period studied are presented in Table 37 and graphically in Figure 12.

Part 4

Discussion of Data

To assist in a study of the data contained in this report, graphs have been made, showing the monthly variation of each nutrient (Figures 1-12 inclusive). The dietary allowances recommended by the Food and Nutrition Board of the National Research Council have been represented on each graph for comparison. The figures used are presented in Table 39 and are those of a man weighing 70 kilograms and moderately active. Figures 1-12 also contain the nutrients obtained from the Red Cross parcels. The individual nutrients are discussed separately below.

1. Fat:

According to National Research Council Standards, the calories obtained from fat in the diet should represent about 25% of the total calorie intake. The calories obtained from the fat in the diet (Table 22) and 25% of the total calories in the allowance per month have been calculated. From these, the ratio of the fat calories actually received to the fat calories desirable have been calculated (Table 40). It can be seen that in no period was there sufficient fat in the diet. During certain months the dietary fat fell as low as 15% of that desired. This may have bearing on the fact that all officers were suffering from dry scaly skin at all times. There is a good possibility that there was a deficient intake of the essential fatty acids such as arachidonic and linoleic acids.

2. Proteins:

The National Research Council allowance for protein is 70 gms /day. However, this allowance is based on diet containing considerable animal protein, which contains a good balance of essential amino acids. Most of the protein received at Zentsuji was vegetable protein which was rather incomplete nutritionally. An allowance of 100 to 120 grams of vegetable proteins would be more satisfactory. It is evident that the protein intake at Zentsuji was inadequate. This conclusion is supported by evidence that hypoproteinemia began to show quite markedly in October and November 1944. It will be seen that the average weights of the officers did not go down, but even increased (Table 37), further indication of the lack of a complete protein. The gains of weight after November 1944 may be attributed to the improvement in nutrition resulting from the Red Cross parcels. This is even more obvious if we realize (Table 36) that the addition of only 16 gms of protein (animal) per officer per day was followed by a cure of the edema and gain in weight in November, 1944. This is further evidence of the poor quality of vegetable protein.

3. Calories:

In no month was sufficient food issued by the Japanese to provide sufficient energy for an average man doing moderate work, i.e. 3000 calories. It is very interesting to note the downward trends of the weight curve (Fig. 12) and followed by an upward trend in the month following issuance of the Red Cross parcels. The calories received via the Red Cross parcels were just sufficient to supply approximately 3000 calories per day and with this energy input the weight

curves rose (Fig. 12).

4. Calcium:

The National Research Council allowance for calcium is 800 mgs/day. In no month was this level reached in the foodstuffs issued by the Japanese. During the months when Red Cross parcels were issued, the calcium intake was sufficient. However, since the bone trabeculae serve as a depot for excess calcium and since the blood and soft tissues can draw from the bone for calcium needed when sufficient is not supplied in the food, it is believed that there was no serious lack of calcium. In 14 of the 31 months covered by this study, more than sufficient calcium was provided via the Red Cross parcels.

5. Phosphorous:

In every month the phosphorous supplied by the foods was sufficient. The Ca:P ratio was usually 1:3.

6. Iron:

The diet issued by the Japanese was more than sufficient in iron content, using 12 mgs/day as a standard. The National Research Council has remarked that the male adult needs little or no iron.

7. Vitamin A:

In very few cases, September 1944 and June 1945, did the vitamin A intake go below that prescribed by the National Research Council allowance. This was because of the large quantity of green vegetables supplied, which although high in vitamin A content are very low in energy. Only a few officer prisoners were nyctalopia observed. It is suspected that the condition in these officers is attributable to (1) failure of conversion of carotene to vitamin A in the body or (2) impaired utilization due to

lack of fat in the diet.

8. Thiamine:

There was sufficient thiamine in the diet until July, 1944. Four months later the Red Cross parcels were issued and the thiamine intake became adequate again. It is questionable whether any beri-beri was observed, for oedema which was observed in October of 1944 might well have been due to lack of protein rather than deficient intake of thiamine (wet beri-beri).

9. Riboflavin:

The riboflavin intake was deficient throughout the entire period. This dietary lack of riboflavin was confirmed by frequent outbreaks of cheiliosos, by dermatitis around the folds of the nose and by complaints of sore mouth.

10. Niacin:

In July 1944, the niacin intake fell below the National Research Council allowance of 15 mg/day, and stayed below throughout the remainder of the period. The Red Cross issues were not sufficient to make up the niacin deficiency. Pellagra was evident in the late summer of 1944, when sore, raw mouths were observed, brown splotches on the skin which turned red on exposure to the sun, and a chronic diarrhea developed in many of the prisoners.

11. Ascorbic Acid:

Very few cases of scurvy were observed in the entire period represented in this report. This is not unexpected in view of the rather high ascorbic acid content of the green foods supplied throughout most of the period. Actually, there were only 5 months in the period where the ascorbic acid fell below 75 mg/day (Table 32).

Summary and Conclusions

An analysis of total food intake of Officer Prisoners of War at Zentsuji, Japan have been made. These calculations are based upon the composition of the raw foods. The actual intake of the various nutrients was undoubtedly less than these calculations indicate, because vitamins are destroyed during cooking and vitamins and minerals are extracted into the cooking water and discarded. The data presented here therefore reflect a condition which is quite optimistic.

The diet consisted almost entirely of vegetable foods with rice, barley, and to a lesser extent, soybeans as the staple foods.

Due to the large amount of green vegetables in the diet there was no lack of vitamin A, ascorbic acid or iron. There were clinical evidences of hypoproteinemia which may be ascribed to the fact that there was very little animal protein in the dietary.

The monthly average weights of the officers correlate quite well with the calories received. The National Research Council's recommended daily allowances for a moderately active, 70 kilogram man are 3000 calories/day. It was observed that body weight was maintained when the calorie intake was approximately 3000 calories.

Fat intake was below a desirable level. It is suspected that the dry scaly skin observed in all of the prisoners is a manifestation of a deficient intake of essential fatty acids.

The calcium intake was sufficient for only 7 months of the 31 months studied.

There was sufficient thiamine in the diet until the last 12 months of the period studied. Suspected cases of beri-beri were observed during this period of low thiamine intake.

The riboflavin was not accequate during the entire period of the study. The clinical manifestations of riboflavin deficiency were apparent.

Pellagra was observed intermittently during the 31 months of incarceration between December 1942 and June 1945. Since the exact niacin intake is not known it is difficult to determine whether the development of pellagra in subjects on a diet which calculates to contain approximately 16 mgs. is proof that the National Research Council's allowance of 15 mg. per day is inacequate.

APPENDIX

Malnutrition Studies in Philippine Prisoner of War Camps - 1942

This part of the report covers the period from March to October 1942 when troops were imprisoned in Camps O'Donnell and Cabanatuan.

After the battle of Bataan in World War II, over ten thousand American and sixty thousand Filipino prisoners-of-war were maintained by the Japanese on diets that were far below the accepted standards in the United States. One of these captives (the author), believing that these conditions afforded opportunity for a study of the effects of malnutrition, collected data on the diet of these prisoners of war. He also made some macroscopic observations of deficiency diseases. The results of his observations are presented in this report.

After the Bataan "death march" in April 1942, a former training camp of the Philippine Army at Capas, Tarlac, was established by the Japanese as a camp for American and Filipino captives. When Corregidor surrendered in May of 1942, the surviving Americans at this camp (Camp O'Donnell) plus Americans captured on Corregidor, were taken to Cabanatuan, Nueva Ejica, where two camps were established (Camp 1 and Camp 3).

Of a total of some 14,000 to 16,000 American prisoners and 60,000 Filipino prisoners, over 1,800 Americans and 27,000 Filipinos died during the 60 days they were at Camp O'Donnell, and over 2,100 Americans died in Cabanatuan in as short a period. The exertions of the "death march", as well as malaria, dysentery, improper sanitation, and lack of medical supplies, were important causes of these deaths.

Malnutrition and actual starvation were perhaps the most important causes. Although death certificates listed heart-failure as the cause of many deaths, the actual cause was beri-beri or pellagra.

At Camp O'Donnell, the daily diet per individual consisted of approximately 12 ounces of dry rice of very poor quality, 2 to 4 ounces of native sweet potatoes, and 3 ounces of sweet potato tops, all boiled in a soup. Once each week a 1/4 ounce of meat was issued to each prisoner. This was the never-varying diet for the captives at this camp. At Cabanatuan, the daily ration was somewhat better. Here about 16 ounces of rice and 4 ounces of a vegetable (sweet potato or corn, or usually, sweet potato tops) were issued. Once each week one ounce of caribao meat was issued and, while in season, one thin slice of cucumber per day was given to each captive. At 2-week intervals, 2 ounces of coconut or banana were issued. These were cooked with cornstarch and sugar in the form of a pudding. For the soups, 1/10 pound of hydrogenated coconut oil (Purico) was issued per week per man. A mere inspection of these figures shows that these diets were deficient in many nutrients. This may account for the high incidence of nutritional deficiency diseases and subsequent high death rate among the captives.

The troops on Bataan went on quarter-rations early in January 1942. Beri-beri was observed by March 1942 and increased to a marked degree by September 1942, many men dying from a "beri-beri heart". Pellagra became marked toward the end of September 1942 (Table 3), although a few cases were reported before then. Scurvy, until October 1942, was questionable. Ariboflavinosis, as demonstrated by cheiloses, began

to be observed in September 1942. By the end of October 1942, the majority of the prisoners of war were suffering from malnutrition in some form or other.

Daily sick calls were held by prisoner physicians, who, as a rule, did not have much more to dispense than sympathy. However, the dispensary kept a careful record of the diagnosis and treatment, if any, of each patient. From these records and from personal observation, the data in Tables 1 to 4 on American prisoners-of-war were compiled by the author.

Comparing the figures in Table 2 (Group 3, Camp I) and in Table 3 (Camp III), we may observe the following:

The percentage values for patients having beri-beri in Group 3 of Camp I and in Camp III coincide almost exactly over the same period.

A greater percentage of patients with pellagra and a lower percentage of patients with scurvy were reported in Camp III than in Group 3 of Camp I. In checking over the physicians' diagnoses and dispensary reports for Group 3, Camp I, the author concluded that the clinical symptoms of pellagra had probably been mistaken for scurvy, the erythemia and vesicles, etc.). No capillary fragility test was performed. The author performed such tests on some men in Group 3, Camp I, who were reported to have scurvy and found them to have pellagra. The conclusion may be drawn that few cases of scurvy existed by September 1942. A limited quantity of niacin was available and was given to some of the patients suspected to have scurvy. All these patients, who received 5 mg. of niacin per day for 10 days, responded to this treatment. Their skin and mouth lesions were completely healed, a definite proof that the disorder was not scurvy.

The percentage of the men in Group 3, Camp I, having pellagra increased markedly during September 1942. This was likewise true of those in this group having bori-bori.

Xerophthalmia began to be noticeable in September 1942 and by the end of October (Table 4) was showing a marked increase.

The percentage of the men having any protein or vitamin deficiency disease at all increased markedly during captivity, in the case of Group 3, Camp I, from 5.9% as of September 10, 1942, to 14.2% as of September 30, 1942, and in the case of Group 1, Camp 1, to 62.8% as of October 25, 1942.

It must be realized that clinically, without any type of biophotometer, xerophthalmia and nyctalopia are difficult to diagnose. Physicians in Camp III believed that by October 1942 many men were beginning to suffer from lack of vitamin A, developing nyctalopia (nightblindness) to even xerophthalmia.

In November 1942, 1,500 of the prisoners were moved to Japan, and there they were given a somewhat better diet. Nevertheless many of the men developed nyctalopia and an optic neuritis and, in some cases, total blindness. However, massive doses of vitamin A and thiamine given, those disease symptoms disappeared. It seemed that these two diseases reached a maximum during the winter of 1942-1943, about January and February, when the sore mouths of pellagra were also very noticeable. During this winter many men died from "bori-bori heart", pellagra, and protein edema, and most of the men developed aching feet and legs which were sore to the touch. We called this condition "electric feet" because of the type of "shock" that ran up their legs

periodically. The pain was extreme, but was relieved somewhat by constant massage or soaking in ice water and sleeping with the feet outside the blankets. However, gangrene soon set in, which necessitated the amputation of the toes and fore part of the foot. With the advent of warmer weather in the spring of 1943, the pains subsided. It since has been shown that this may be due to pantothenic acid deficiency. However, in most cases the pains were so severe that sleep was possible only with opiates. Those patients who received intraspinal or intramuscular injections of thiamine (50 mg.) responded quickly. Only a small amount of thiamine was available, however, and many deaths resulting from beri-beri were recorded in the winter of 1942-1943. The gangrene developed was entirely local and apparently limited to the capillaries in the toes. It did appear very high in the legs, but 329 of the 1,500 prisoners transferred to Japan died during the winter of 1942-1943, almost every one had some form of dietary deficiency disease (beri-beri, pellagra, protein edema,etc.) and often a subject would show clear evidence of several deficiency diseases present concurrently.

Conclusions

1. Starvation and malnutrition were the lot of American prisoners of war in the Philippines in 1942. It is likely that these were the direct cause of death in the great majority of cases.

2. Among these prisoners, whose diet changed from a balanced one at the beginning of the war to a nutritionally unbalanced one after capture, beri-beri was the first nutritional disease observed; it occurred 3 months after capture. Pellagra and ariboflavinosis were observed after 9 months. Scurvy was still questionable after 9 months, but began to appear definitely in 10 months. Xerophthalmia and nyctalopia, although difficult to diagnose microscopically, were unquestionably present in 10 months and rather severe thereafter. This condition increased in intensity until complete blindness developed in many cases, and was cured by massive doses of vitamin A.

3. Severe and sharp "shooting" pains in the feet and legs developed during the winter months of 1942-1943. This developed into gangrene of the toes and caused many deaths. In test cases this deficiency disease was definitely cured by massive doses of thiamine, administered intraspinally and intramuscularly.

4. The efficiency and fighting capacity of the Filipino-American troops in Bataan was markedly lowered by a nutritionally deficient diet, which adversely affected military capabilities, morale, and fighting ability.

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

DECEMBER, 1942.

NAME OF FOOD	GRAMS/MAN/DAY
Bread	300.0
Rice	180.0
Barley	120.0
Beans	26.3
Tofu	6.8
Aburages	35.7
Doughnuts	9.2
Flour	7.6
Fish	17.3
Beef	8.5
Rabbit	4.0
Sugar	4.0
Oil	4.6
Greens	206.5
Daikons	164.3
Sweet Potatoes	52.7
Irish Potatoes	25.7
Onions	7.0
Taro	3.5
Carrots	12.7
Tangerines	1.8

TABLE I

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

JANUARY, 1943.

Name of Food	Grams/Man/Day
Bread	300.0
Rice	180.0
Barley	120.0
Beans	24.4
Tofu	15.4
Aburagee	41.8
Doughnuts	5.5
Flour	36.9
Fish	16.6
Beets	4.0
Eggs	1.5
Rabbit	5.7
Sugar	6.4
Oil	2.7
Greens	218.2
Daikons	204.0
Carrots	87.8
Taro	2.9
Tangerines	4.6

TABLE 2

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

FEBRUARY, 1943.

Name of Food	Grams/Man/Day
Bread	300.0
Rice	180.0
Barley	120.0
Beans	28.4
Tofu	23.1
Aburagee	52.3
Flour	27.1
Clams	1.9
Beef	4.5
Eggs	1.0
Pork	3.1
Sugar	2.8
Oil	1.0
Greens	221.0
Daikons	223.0
Carrots	70.5
Onions	1.5
Taro	1.9
Sweet Potatoes	89.9

TABLE 3

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

March, 1943.

Name of Food	Grams/Man/Day
Bread	300.0
Rice	180.0
Barley	120.0
Beans	32.0
Tofu	23.2
Aburagoc	65.6
Flour	23.0
Fish	8.4
Beef	5.4
Rabbit	0.1
Pork	6.9
Doughnuts	7.3
Sugar	4.3
Oil	1.6
Eggs	3.1
Greens	125.6
Daikons	114.2
Spinach	31.7
Cabbage	83.0
Onions	67.3
Carrots	80.0
Irish Potatoes	18.8
Sweet Potatoes	43.3

TABLE 4

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

APRIL, 1943.

Name of Food	Grams/Man/Day
Bread	300.0
Rice	180.0
Barley	120.0
Beans	15.8
Tofu	23.2
Aburages	56.0
Flour	28.0
Fish	10.6
Beef	5.1
Rabbit	4.5
Eggs	0.5
Doughnuts	8.1
Sugar	3.9
Oils	1.4
Greens	114.3
Daikons	92.0
Cabbage	3.6
Onions	115.0
Spinach	137.4
Carrots	9.9
Irish Potatoes	60.8
Sweet Potatoes	3.1
Peas	10.7
Bamboo Shoots	25.2
Burdock	2.7

TABLE 5

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

MAY, 1943.

Name of Food	Grams/Man/Day
Bread	300.0
Rice	208.0
Barley	117.0
Beans	30.4
Tofu	29.8
Aburagee	65.2
Flour	16.3
Fish	11.9
Beef	3.5
Pork	10.5
Eggs	2.1
Doughnuts	12.6
Sugar	6.0
Oil	1.5
Greens	152.1
Daikons	105.3
Onions	138.9
Spinach	45.2
Cabbage	63.9
Bamboo Shoots	37.4
Peas	3.3
Irish Potatoes	6.1

TABLE 6

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZAMTSUJI CAMP, ZAMTSUJI, JAPAN.

JUNE, 1943.

Name of Food	Grams/ Man/Day
Bread	300.0
Rice	208.0
Barley	118.0
Beans	27.8
Tofu	27.3
Aburageo	47.6
Flour	21.8
Fish	9.4
Pork	8.3
Rabbit	6.5
Eggs	1.2
Doughnuts	6.6
Sugar	10.5
Oil	0.2
Greens	87.0
Daikons	133.8
Cabbage	130.0
Spinach	5.9
Onions	102.9
Cucumbers	23.7
String Beans	7.2
Carrots	9.2
Potatoes	65.5
Konniku	11.6
Seaweed	0.7

TABLE 7

SUMMARY OF FOOD BOUGHT BY THE JAPANESE TO OFFICIAL PRISONER CAMP
ZENSUJI CAMP, ZENSUJI, JAPAN.

JULY, 1943.

Name of Food	Grams/Man/Day
Bread	281.0
Rice	212.0
Barley	125.0
Beans	38.3
Tofu	28.6
Aburagoo	46.3
Flour	33.7
Fish	4.1
Beef	3.3
Pork	4.1
Rabbit	9.3
Eggs	1.0
Soy	8.0
Oil	7.3
Greens	1.6
Cucumber	18.6
Eggplant	114.1
Cabbage	80.6
Onions	120.0
Squash	26.5
String Beans	34.7
Irish Potatoes	71.0
Konjaku	1.6
Cornwood	1.3

TABLE 8

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

AUGUST, 1943.

Name of Food	Grams/Man/Day
Bread	77.0
Rice	206.0
Barley	134.0
Beans	51.3
Tofu	27.7
Aburagoo	18.9
Flour	50.3
Fish	16.5
Pork	5.3
Rabbit	1.4
Eggs	0.5
Sugar	9.1
Oils	14.0
Greens	39.9
String Beans	14.7
Cucumbers	10.8
Cabbage	38.4
Onions	32.3
Eggplant	117.6
Squash	77.6
Fuki	57.6
Pot toos	55.8
Miso	1.5
Cornstarch	0.7
Green Melon	2.[illegible]
Koniaku	1.4

TABLE 9

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

SEPTEMBER, 1943.

Name of Food	Grams/Man/Day
Bread	30.0
Rice	188.0
Barley	171.0
Beans	110.0
Tofu	12.0
Aburagee	41.9
Flour	39.8
Fish	14.1
Rabbit	1.6
Eggs	0.5
Sugar	9.1
Oil	7.8
Fresh Greens	66.5
Cucumber	12.2
Onions	62.3
Squash	150.5
Eg.plant	159.6
Cabbage	36.2
Daikons	35.9
Cobo / Burdock	6.6
Irish Potatoes	115.0
Koniaku	1.9

TABLE 10

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

OCTOBER, 1943.

Name of Food	Grams/Man/Day
Bread	-
Rice	230.0
Barley	161.0
Beans	119.7
Tofu	14.7
Aburagee	38.5
Flour	43.8
Fish	17.1
Beef	5.0
Eggs	0.7
Sugar	6.9
Oil	9.9
Greens	212.0
Onions	33.2
Eggplant	4.7
String Beans	34.6
Squash	8.0
Daikons	47.5
Taro	28.0
Sweet Potatoes	74.0
Irish Potatoes	174.5
Miso	17.1
Koniaku	18.2
Fish Puree	1.6
Cornstarch	0.8

TABLE 11

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

NOVEMBER, 1943.

Name of Food	Grams/Man/Day
Rice	224.0
Barley	170.0
Beans	128.5
Tofu	11.1
Abura-age	31.6
Flour	56.6
Fish	17.9
Beef	2.9
Sugar	7.2
Oil	10.7
Greens	187.3
Onions	15.5
Daikons	164.2
Gobo	2.0
Squash	27.7
Miso	25.7
Irish Potatoes	112.2
Sweet Potatoes	89.4
Taro	55.7
Koniaku	12.6
Salt	9.8

TABLE 12

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

DECEMBER, 1943.

Name of Food	Grams/Man/Day
Bread	127.0
Rice	204.0
Barley	133.0
Beans	119.0
Tofu	10.4
Aburage	12.5
Flour	41.6
Fish	12.0
Lima Beans	12.4
Beef	3.2
Rabbit	-
Sugar	8.9
Oil	10.5
Fresh Greens	157.0
Daikons	276.0
Onions	63.6
Carrots	58.0
Squash	21.6
Taro	77.3
Irish Potatoes	88.1
Sweet Potatoes	97.8
Miso	22.1
Koniku	7.7

TABLE 13

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

JANUARY, 1944.

Name of Food	Grams/Man/Day
Bread	27.0
Rice	207.5
Barley	154.0
Beans	121.5
Tofu	8.6
Flour	36.8
Fish	5.8
Clams	2.0
Pork	3.8
Lima Beans	14.9
Sugar	7.6
Oil	9.1
Fresh Greens	222.0
Daikons	238.0
Mungo Beans	3.0
Carrots	107.0
Irish Potatoes	80.7
Sweet Potatoes	77.5
Taro	65.3
Miso	24.6
Koniaku	6.3
Cornstarch	0.5
Onions	4.5
Powdered Fish	0.9

TABLE 14

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZUNTSUJI CAMP, ZUNTSUJI, JAPAN.

FEBRUARY, 1944.

Name of Food	Grams/Man/Day
Bread	37.8
Rice	165.0
Barley	127.0
Beans	161.0
Tofu	9.0
Flour	15.1
Fish	8.4
Eggs	1.2
Sugar	2.9
Oil	6.7
Miso	22.6
Red Beans	1.5
Cornstarch	0.3
Fresh Greens	163.0
Daikons	256.0
Carrots	50.0
Irish Potatoes	42.3
Onions	19.3
Konisku	2.8
Taro	84.7
Squash	0.6
Turnip	35.4
Aburagee	9.6
Rabbit	4.5

TABLE 15

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

MARCH, 1944

Name of Food	Grams/Man/Day
Bread	40.5
Rice	74.1
Barley	141.6
Millet	2.6
Soy Beans	184.0
Red Beans	11.2
Tofu	23.7
Aburagee	1.9
Fish	20.5
Pork	7.3
Flour	3.1
Oil	1.9
Sugar	3.9
Eggs	0.6
Greens	198.0
Daikons	213.5
Onions	162.8
Turnips	32.2
Konjaku	8.1
Miso	25.8
Irish Potatoes	4.7

TABLE 16

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

APRIL, 1944.

Name of Food	Grams/Man/Day
Bread	-
Rice	217.4
Barley	152.2
Tofu	32.1
Aburagee	26.2
Soy Beans	14.5
Red Beans	12.8
Fish	19.3
Rabbit	1.5
Seaweed	4.6
Oil	0.6
Onions	15.0
Beef	2.7
Fresh Greens	351.2
Irish Potatoes	21.0
Koniaku	12.3
Miso	28.5
Sugar	4.2
Millet	12.6
Bamboo Shoots	11.8
Eggs	0.9

TABLE 17

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

MAY, 1944.

Name of Food	Grams/Man/Day
Beans	250.0
Rice	281.0
Barley	112.5
Aburagee	50.3
Onions	86.7
Tofu	15.0
Fresh Greens	273.0
Koniaku	14.5
Miso	33.5
Oil	1.9
Fish	21.0
Seaweed	6.0
Bamboo Shoots	106.0
Red Beans	11.4
Sugar	2.6
Gobo	54.7
Meat	7.5
Daikon	41.2
Soy Beans	37.1

TABLE 18

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

JUNE, 1944.

Name of Food	Grams/Man/Day
Beans	225.0
Rice	257.0
Barley	99.3
Millet	51.0
Miso	31.2
Daikons	15.6
Onions	7.4
Red Bean Soup	27.7
Koniaku	8.0
Oil	0.2
Sugar	2.8
Seaweed	3.9
Fish	24.1
Meat	2.8
Curry	1.9
Cucumber	244.0
Fresh Greens	80.2
Irish Potatoes	199.0
Aburagee	20.0
Bread	1.8
Tofu	3.5
Tomato	5.3
Bamboo Shoots	5.9
Soy Bean Soup	29.3
Gobo	73.2

TABLE 19

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

JULY, 1944.

Name of Food	Grams/Man/Day
Beans	84.4
Rice	223.0
Barley	109.9
Millet	136.0
Miso	40.8
Cucumber	97.5
Bean Soup	55.3
Fresh Greens	23.4
Fish	11.9
Tofu	3.4
Age	43.4
Eggplant	62.7
Irish Potatoes	77.2
Meat	5.6
Curry	0.5
Gobo	40.0
Seaweed	7.4
Sugar	6.8
Apples	37.3

TABLE 20

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

AUGUST, 1944.

Name of Food	Grams/Man/Day
Soy Beans	71.3
Rice	188.2
Barley	94.1
Millet	116.5
Miso	39.1
Melon Cucumber	91.8
Soup Beans	7.9
Fresh Greens	16.1
Fish	8.8
Tofu	14.2
Aburagee	27.6
Eggplant	30.6
Irish Potatoes	5.8
Gobo	243.0
Seaweed	3.6
Sugar	1.5
Cornstarch	1.0
Oil	0.3
Bamboo Shoots	20.8
Chocolate	0.2

TABLE 21

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

SEPTEMBER, 1944.

Name of Food	Grams/Man/Day
Red Beans	129.0
Rice	180.0
Wheat	93.4
Millet	49.6
Miso	42.9
Melon Cucumber	2.6
Soup Beans	3.1
Gobo	248.5
Tofu	18.4
Aburagee	12.3
Sugar	2.7
Eggplant	86.0
Seaweed	3.1
Cornstarch	5.1
Irish Potatoes	35.7
Fish	15.8
Oil	1.0
Meat	4.5
Squash	4.1
String Beans	7.5

TABLE 22

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICIAL P.O.W.'S AT
ZENTSUJI CAMP, ZENTSUJI, JAPAN.

OCTOBER, 1944

Name of Food	Grams/Man/Day
Red Beans	119.5
Rice	202.0
Wheat	97.9
Millet	74.7
Salt	10.5
Soy Beans	12.4
Miso	51.8
Daikon Tops	328.0
String Beans	81.9
Oil	2.1
Daikon Salad	79.7
Squash	21.1
Seaweed	2.8
Tofu	15.4
Meat	2.9
Fish	15.4
Sugar	3.9
Taro	12.1
Cornstarch	2.2
Soup Beans	8.0
Leeks	3.2
Gobo	11.7
Irish Potatoes	4.8
Cabbage	6.4

TABLE 23

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER B.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

NOVEMBER, 1944.

Name of Food	Grams/Man/Day
Rice	194.6
Barley	91.3
Millet	30.9
Maize	34.5
Soy Beans	41.6
Mungo Beans	47.9
Red Beans	25.0
Sweet Potatoes	21.6
Daikons	209.0
Miso	27.5
Tofu	15.0
String Beans	79.8
Daikon Salad	26.0
Pork	1.0
Sweet Potatoes	254.3
Onions	11.5
Squash	12.8
Daikon Greens	194.0
Clams	4.6
Cornstarch	2.1
Sugar	1.0
Chinese Cabbage	221.5
Octopus	5.1
Bamboo Shoots	5.8
Oil	0.9

TABLE 24

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

DECEMBER, 1944.

Name of Food	Grams/Man/Day
Rice	200.0
Barley	104.5
Millet	63.5
Maize	35.2
Soy Beans	1.8
Mungo Beans	0.1
Red Beans	25.4
Sweet Potato Cereal	175.8
Sweet Potato Soup	30.4
Miso	42.1
Daikon	366.7
Chinese Cabbage	306.9
Daikon Salad	6.3
String Beans	3.8
Oil	2.8
Eggs	3.0
Taro	30.5
Daikon Greens	103.0
Tofu	9.6
Clams	4.1
Leeks	21.3
Irish Potatoes	11.2
Chicken	3.6
Squash	3.8
Rabbit	2.7
Sugar	5.5
Flour	2.0

TABLE 25

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S. AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

JANUARY, 1945.

Name of Food	Grams/Man/Day
Rice	221.0
Barley	112.5
Millet	212.0
Sweet Potatoes	6.6
Greens	240.0
Pickled Greens	15.2
Sweet Potato Soup	23.0
Taro	91.7
Chinese Cabbage	73.4
Daikon	264.0
Red Beans	3.0
Carrots	4.8
Leeks	17.6
Turnip	23.5
Konjaku	0.3
Seaweed	3.5
Cornstarch	0.5
Sugar	1.1

TABLE 26

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

FEBRUARY, 1945.

Name of Food	Grams/Man/Day
Rice	221.3
Barley	110.2
Millet	217.3
Soy Beans	2.0
Taro	47.8
Sweet Potatoes	14.0
Fresh Greens	43.0
Pickled Greens	271.0
Cornstarch	1.3
Sugar	2.4
Seaweed	0.4
Millet	0.8
Tofu	7.4
Beef	4.4
Rabbits	2.0
Daikon	15.5
Pork	1.4
Fish	0.2
Oil	0.2

TABLE 27

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

MARCH, 1945.

Name of Food	Grams/Man/Day
Rice	182.4
Barley	8918
Millet	182.2
Bread	28.5
Fresh Greens	34.4
Pickled Greens	175.2
Seaweed	2.8
Oil	0.4
Fish	0.6
Sugar	0.8
Konjaku	8.7
Leeks	78.3
Beef	5.3
Daikon	24.0
Beans	4.2
Sweet Potatoes	13.5
Irish Potatoes	4.0
Dried Taro Tops & Dried Daikons	6.6

TABLE 28

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

APRIL, 1945.

Name of Food	Grams/Man/Day
Rice	185.4
Barley	91.7
Millet	185.4
Bread	37.1
Rice (Extra Work)	2.1
Fresh Greens	552.0
Irish Potatoes	18.1
Daikons	4.8
Dried Taro & Dried Daikon	3.2
Seaweed	0.4
Eggs	0.4
Pork	1.8
Tofu	5.5
Leeks	57.5
Miso	0.6
Bamboo Shoots	136.2

TABLE 29

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

MAY, 1945.

Name of Food	Grams/Man/Day
Rice	174.7
Barley	72.2
Millet	197.5
Bread	34.3
Rice (Extra Work)	12.3
Soy Beans	28.5
Fresh Greens	162.7
Bamboo Shoots	88.0
Daikons	24.6
Gobo	33.0
Leeks	19.7
Cabbage	187.5
Dried Daikons	51.2
Dried Fish	0.3
Flour	0.5
Pork	3.6

TABLE 30

QUANTITY OF FOOD ISSUED BY THE JAPANESE TO OFFICER P.O.W.'S AT ZENTSUJI CAMP, ZENTSUJI, JAPAN.

JUNE, 1945.

Name of Food	Grams/Man/Day
Rice	181.0
Barley	14.4
Millet	235.5
Navy Beans	54.8
Cabbage	477.0
Dried Daikons	25.9
Dried Fish	0.4
Dried Sweet Potatoes	2.6
Oil	0.7

TABLE 31

TABLE 32

DAILY RATIONS OF NUTRIENTS IN FOODS SUPPLIED DAILY TO OFFICER PRISONERS OF WAR AT CENTSUJI, JAPAN ON A MONTHLY BASIS

Date of Issue	Fat grams	Carbo-hydrate grams	Protein grams	Calories	Calcium mgs.	Phosphorous mgs.	Iron mgs.	Vit. A I. U.	Thiamine mgs.	Riboflavin mgs.	Niacin mgs	Ascorbic Acid mgs.
Dec.'42	22	471	77	2400	480	1120	19	25,000	1.7	1.4	17.2	191
Jan.'43	10	480	76	2300	490	1090	19	31,100	1.7	1.3	16.6	187
Feb.'43	18	471	74	2300	510	1100	20	36,200	1.3	1.4	16.4	210
Mar.'43	22	472	87	2400	530	1130	20	26,300	1.9	1.3	17.1	180
Apr.'43	13	485	74	2300	510	1120	20	25,300	1.7	1.4	17.1	199
May '43	34	478	80	2400	530	1190	20	18,800	1.8	1.3	16.8	190
June '43	20	498	78	2500	470	1140	17	10,200	1.8	1.2	17.0	161
July '43	20	498	77	2500	400	1140	15	1,800	1.7	1.0	17.3	82
Aug.'43	59	400	69	2100	320	1070	14	7,000	1.5	0.8	13.8	73
Sept.'43	33	411	87	2300	450	1330	19	14,000	2.2	1.1	16.3	113
Oct.'43	30	445	97	2500	590	1610	24	23,500	2.3	1.3	16.5	194
Nov.'43	19	522	79	2600	470	1470	27	20,000	1.8	1.1	16.2	196
Dec.'43	21	512	78	2700	770	1430	28	23,500	2.0	1.2	16.6	172
Jan.'44	10	492	77	2400	540	1250	28	27,000	1.7	1.3	16.4	224
Feb.'44	15	419	72	2100	270	1410	29	15,500	1.5	1.1	13.8	146
Mar.'44	43	270	106	1900	710	1700	27	16,800	3.2	1.3	11.8	142
Apr.'44	50	368	129	2300	770	1920	32	33,300	2.9	1.6	14.7	212
May '44	10	587	114	2700	770	2150	43	25,800	2.3	1.6	17.5	185
June '44	10	556	100	2600	580	2130	38	7,700	2.2	1.3	17.4	114
July '44	11	504	79	2400	330	1520	28	2,300	1.2	0.7	12.5	44
Aug.'44	10	424	53	2000	210	1110	19	1,400	0.9	0.6	8.4	34
Sept.'44	13	411	85	2100	170	540	15	300	0.7	0.3	5.7	28
Oct.'44	14	415	84	2100	230	1030	17	1,600	0.7	0.3	5.5	127
Nov.'44	10	447	78	2200	420	1240	18	22,300	1.5	0.7	9.3	303
Dec.'44	14	447	84	2300	540	1000	18	31,700	0.9	0.9	10.0	193
Jan.'45	9	430	59	2200	390	1230	25	27,000	0.8	0.9	9.0	231
Feb.'45	11	434	56	2100	330	1250	26	30,600	0.7	1.0	9.2	32
Mar.'45	9	394	50	1800	300	1050	21	20,800	0.6	0.7	8.0	37
Apr.'45	11	414	61	2000	590	1310	32	52,000	1.0	1.6	10.4	335
May '45	15	420	67	2000	400	1260	23	15,500	1.0	0.8	8.0	203
June '45	9	300	56	1900	380	1240	23	400	0.7	0.5	6.7	249

TABLE 33

DATES OF ISSUE AND TYPES OF RED CROSS PARCELS
RECEIVED BY OFFICER PRISONERS OF WAR AT ZENTSUJI, JAPAN

DECEMBER, 1942 - JUNE, 1945

Date of Issue	Type of Parcel
December, 1942	One American Parcel (old type) per officer
March, 1943	One American Parcel (old type) per officer
April, 1943	One American Parcel (old type) per officer
August, 1943	One American Parcel (old type) per officer
October, 1943	One Canadian Parcel per officer
November, 1943	One Canadian Parcel per officer
December, 1943	1/3 American Parcel (old type) per officer 1/6 Canadian Parcel per officer 1/6 British Parcel per officer
March, 1944	One American Parcel (new type) per officer
November, 1944	One Standard Red Cross Box #10 per officer (via Vladivostok)
December, 1944	Two Standard Red Cross Box #10 per officer (via Vladivostok)
January, 1945	Two Standard Red Cross Box #10 per officer (via Vladivostok)
February, 1945	Two Standard Red Cross Box #10 per officer (via Vladivostok)
March, 1945	Two Standard Red Cross Box #10 per officer (via Vladivostok)
May, 1945	Two Standard Red Cross Box #10 per officer (via Vladivostok)

TABLE 34

FOOD CONTENTS OF RED CROSS PARCELS ISSUED TO OFFICER PRISONERS OF WAR AT SENTSUJI, JAPAN, DECEMBER 1942 - JUNE 1945

	Old Type American	Canadian Parcel	British Parcel	New Type American	10 Box American
Evap. milk	14.50 oz.	-	-	-	-
Hard tack	8.00 oz.	16.00 oz.	8.00 oz.	-	-
Cheese	8.00 oz.	-	2.00 oz.	8.00 oz.	8.00 oz.
Cocoa	8.00 oz.	-	-	-	-
Oleomargarine	16.00 oz.	-	8.00 oz.	-	-
Chocolate candy	11.00 oz.	5.00 oz.	4.00 oz.	8.00 oz.	12.00 oz.
Sugar	2.00 oz.	8.00 oz.	2.00 oz.	8.00 oz.	8.00 oz.
Orange conc.	7.00 oz.	-	-	-	-
Dehydrated soup	15.00 oz.	--	-	-	-
Prunes	16.00 oz.	-	-	-	-
Dry milk	-	16.00 oz.	-	16.00 oz.	16.00 oz.
Salmon	7.75 oz.	7.75 oz.	-	7.75 oz.	7.75 oz.
Sardines	15.00 oz.	3.50 oz.	-	-	-
Butter	-	16.00 oz.	-	15.00 oz.	15.00 oz.
Jam	-	16.00 oz.	8.00 oz.	6.00 oz.	6.00 oz.
Luncheon meat	-	10.00 oz.	10.00 oz.	36.00 oz.	24.00 oz.
Tomatoes	-	-	10.00 oz.	-	-
Sweet Condens. milk	-	-	10.00 oz.	-	-
Pudding	-	-	12.00 oz.	-	-
Bacon	-	-	8.00 oz.	-	-
Meat Stew	-	-	16.00 oz.	-	-
Creamed rice	-	-	8.00 oz.	-	-
Candy toffee	-	-	2.00 oz.	-	-
Raisins	-	-	-	15.00 oz.	15.00 oz.
Liver Pate	-	-	-	6.00 oz.	6.00 oz.
Corned beef	12.00 oz.	12.00 oz.	-	12.00 oz.	12.00 oz.

TABLE 35

ANALYSIS OF FOOD COMPONENTS OF RED CROSS PARCELS ISSUED TO AMERICAN OFFICER PRISONERS OF WAR AT ZENTSUJI, 1942-1945

	Old Type American	Canadian Parcel	British	New Type American	Box #10 American
Fat gms	839.	749.	618.	872.	855.
Carbohydrate gms	1145.	1128.	802.	964.	979.
Protein gms	251.	374.	191.	518.	472.
Calories	14220.	12740.	9530.	13780.	13510.
Calcium (mg)	3830.	4870.	2690.	8170.	8090.
Phosphorus (mg)	10310.	6495.	3250.	9820.	9630.
Iron (mg)	88.8	37.9	41.5	57.4	55.5
Vitamin A (I.U.)	26100.	22300.	12200.	23000.	23000.
Thiamine (mg)	3.9	2.8	2.3	5.4	4.4
Riboflavin (mg)	7.3	8.9	4.0	12.7	12.3
Niacin (mg)	74.1	44.1	34.9	58.1	50.1
Ascorbic acid (mg)	1838.	55.	39.	39.	39.

TABLE 36

Nutrients Received from Red Cross Parcels at Zentsuji, Japan
Calculated per Officer per Day on a Monthly Basis
December 1942 - May 1945

Date of Issue	Fat /m/day (gm)	Carb. (gm)	Protein (gm)	Calories	Calcium (mg)	Phosphorus (mg)	Iron (mg)	Vit.A (I.U.)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic Acid (mg)
Dec.'42	27.	37.	8.	459.	120.	330.	2.9	840.	0.1	0.2	2.4	60.
Mar.'43	27.	37.	8.	459.	120.	330.	2.9	840.	0.1	0.2	2.4	60.
Apr.'43	28.	38.	8.	474.	130.	340.	3.0	900.	0.1	0.2	2.5	62.
Aug.'43	27.	37.	8.	459.	120.	330.	2.9	800.	0.1	0.2	2.4	60.
Oct.'43	24.	36.	12.	412.	160.	210.	1.2	720.	0.1	0.3	1.4	2.
Nov.'43	25.	33.	12.	425.	160.	220.	1.5	740.	0.1	0.3	1.5	2.
Dec.'43	15.	20.	6.	273.	80.	60.	1.4	500.	0.1	0.2	1.2	21.
Mar.'44	23.	31.	17.	444.	260.	320.	1.9	700.	0.2	0.4	1.9	13.
Nov.'44	29.	33.	16.	450.	270.	320.	1.9	870.	0.2	0.4	1.7	13.
Dec.'44	55.	33.	31.	674.	520.	620.	3.6	1500.	0.3	0.8	3.2	26.
Jan.'45	55.	63.	31.	674.	520.	620.	3.6	1500.	0.3	0.8	3.2	26.
Feb.'45	51.	70.	34.	933.	580.	630.	4.0	1000.	0.3	0.9	3.6	28.
Mar.'45	55.	63.	31.	674.	520.	620.	3.6	1500.	0.3	0.8	3.2	26.
May '45	55.	63.	31.	674.	520.	620.	3.6	1500.	0.3	0.8	3.2	26.

Table 37

Average Weight of Officers in Zentsuji Prisoner of War Camp
December 1942 to August 1945

1942		1943	1944	1945
Dec. 69.932 kg	Jan.	66.807 kg.	66.764 kg.	62.832 kg.
	Feb.	64.467	67.337	65.162
	Mar.	66.183	66.403	65.062
	Apr.	66.404	64.555	
	May	67.020	63.909	
	June	66.570	62.384	
	July	66.215	59.594	
	Aug.	66.452	60.043	
	Sept.	64.534	59.299	
	Oct.	69.034	58.538	
	Nov.	70.941	59.063	
	Dec.	69.135	60.738	

Table 33

Recommended Dietary Allowances
Food & Nutrition Board, National Research Council*

(For man, 70 kg - moderately active)

Component	Quantity
Calories	3000
Protein	70 mg
Calcium	800 mg
Iron	12 mg
Vitamin A	5000 I.U.
Thiamine	1.5 mg
Riboflavin	2.0 mg
Niacin	15.0 mg
Ascorbic acid	75.0 mg

* - Recommended Dietary Allowances Revised 1945, Food & Nutrition Board, National Research Council, Reprint and Circular Series, No.122 August, 1945.

TABLE 39

The Calories Obtained Daily from Fat in the Diet of Officer P.O.W's at Tentsuji Calculated on a Monthly Basis and Comparison with Recommended Standards

Year	Month	Calories from Fat in the Diet	25% of Total Calories* From Jap. Issue	Percent of Calories Received** / Calories Required from Fat
1942	December	194	586	33.1
1943	January	169	598	28.2
	February	166	584	28.4
	March	202	598	33.7
	April	145	578	25.1
	May	309	608	50.7
	June	182	621	29.3
	July	228	628	36.3
	August	259	528	49.0
	September	299	572	52.3
	October	348	628	55.2
	November	175	643	27.2
	December	187	672	27.8
1944	January	166	593	27.9
	February	132	522	25.3
	March			
	April	448	572	78.5
	May	172	683	25.2
	June	139	696	20.0
	July	103	598	17.2
	August	86	502	17.2
	September	115	518	22.3
	October	130	528	24.6
	ovember	161	559	28.8
	December	123	543	
1945	January	82	549	14.9
	February	99	525	16.8
	March	81	455	17.8
	April	96	489	19.7
	May	139	511	27.2
	June	85	464	18.3

* - This was calculated since the N.R.C. standards recommend that 25% of the total calories should come from fat.

**- This column represents the ratio of calories received from fat to the 25% of total calories, i.e.: $\frac{\text{column 1}}{\text{column 2}} \times 100\%$.

(Appendix)

TABLE I.

Number of Cases of Malnutrition Classified by Cause in Group 3

Cabanatuan P. O. W. Camp No. 1, N. L., P. I. for the Period

September 1, to September 30, 1942

Period (1)	Mean Population of Group 3 (2)	Total No. of Dispensary Patients (3)	Total No. of Malnutrition Patients (4)	Total No. of Malnutrition Cases (5)	No. of Cases lack of Vit. A (6)	No. of Beri-beri Cases (7)	No. of Aribofla-vinosis Cases (8)	No. of Pellagra Cases (9)	No. of Scurvy Cases (10)	No. of Mixed Dietary Deficiency Patients (11)*
Sept.1-10	1352	792	80	83	0	52	1	4	26	3
Sept.11-20	1426	843	150	169	0	92	1	11	65	0
Sept.21-30	1412	889	201	362	1	87	17	55	102	39

* - Some of the patients (as expected) developed general nutritional deficiency diseases.

(Appendix)

TABLE 2.

Percentages of Cases of Malnutrition, Classified by Causes, in Group 3

P.O.W. Camp No. 1, Cabanatuan, P. I., for the Period
September 1, to September 30, 1942 Inclusive by 10 Day Intervals

Period (1)	% Group 3 Having Beri-beri (2)	% Group 3 Having Pellagra (3)	% Group 3 Having Ariboflavinosis (4)	% Group 3 Having Scurvy (5)	% Group 3 Malnutrition Cases vs. Total Dispensary Cases (6)	% Group 3 Having Mixed Dietary Deficiency Diseases (7)	% Group 3 Suffering from Dietary Deficiency Diseases (8)
1942							
Sept. 1-10	3.8%	0.20%	0.074	1.93%	10.2%	0.264%	5.9%
Sept. 11-20	6.5%	0.73%	0.70%	4.55%	19.9%	0.672%	10.3%
Sept. 21-30	6.2%	3.9%	1.2 %	7.39%	40.8%	2.77%	14.2%

(Appendix)

TABLE 3.

Percentages of Cases of alnutrition Classified by Cause in P.C.T. Camp III, Cabanatuan P. I., for Period June to Sept. 1942, Inclusive

Month	% Camp III Having Beri-Beri	% Camp III Having Pellagra	% Camp III Having Scurvy
June	0.4%	0	0
July	1.2%	0	0
August	3.0%	0.4%	0.01%
September	6.5%	24.4%	0.4 %

(Appendix)

TABLE 4.

Number of men in Group 1, P.O.W. Camp No. 1, Cabanatuan, P. I., Suffering from malnutrition, classified by disease on October 28, 1942 when survey was performed

	Number of men	% of Group 1
Beri-beri	340	21.6%
Scurvy	38	2.4%
Pellagra	24	1.5%
Xerophthalmia	55	3.5%
Mixed Diet. Defic. Disease	475	27.5%
Protein Edema	81	5.2%
Total Number of men suffering from Diet Deficiency Disease (Protein and Vitamin Diseases)	1094	62.4%
Total Number of men comparatively well*	654	37.2%
Total strength of camp	1752	100.0%

* as regards malnutrition

Fig. 1 Average Daily FAT Intake of American Officer POWs
Zentsuji Japan, 1942-1945

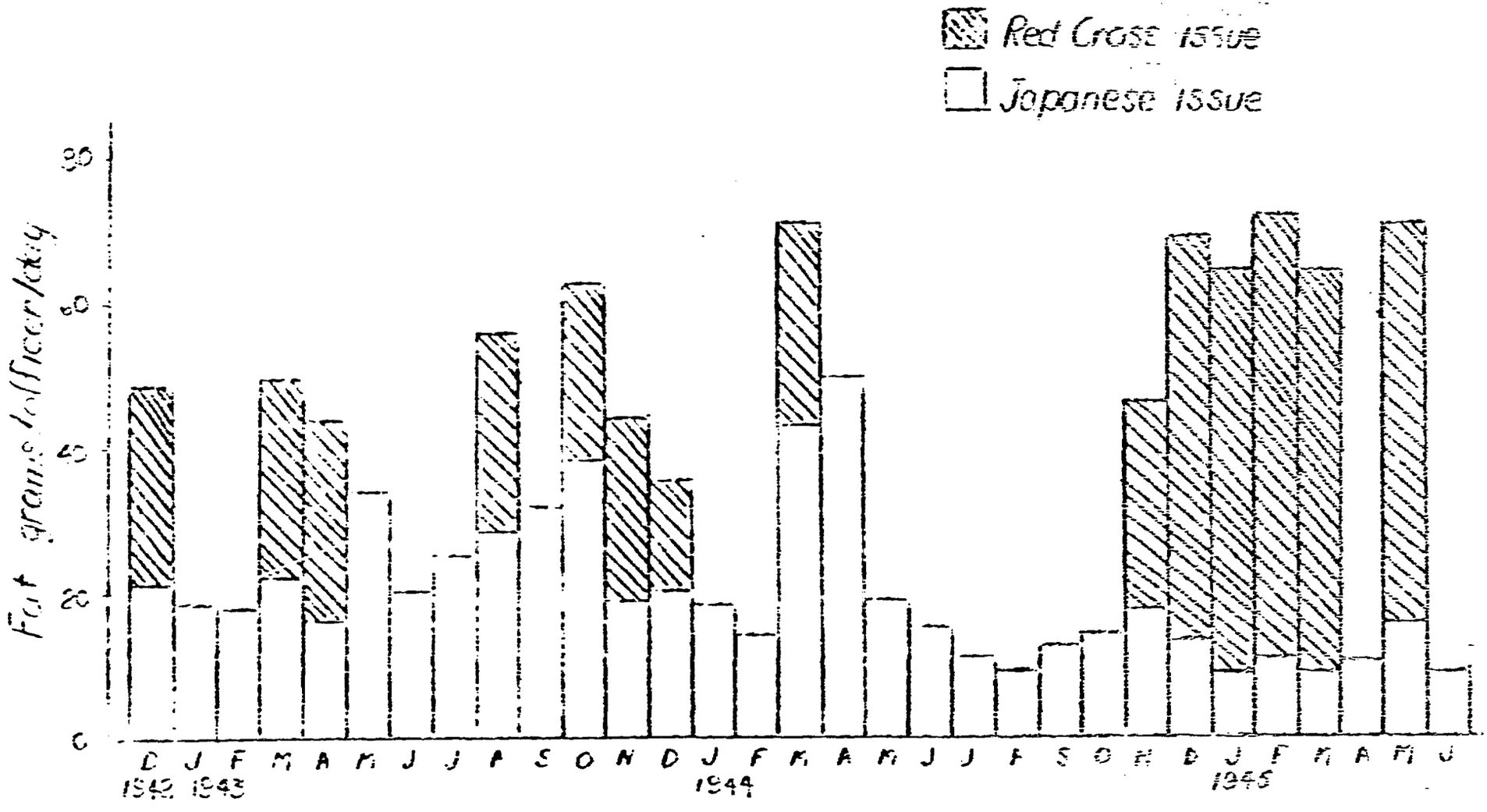


Fig 2 Average Daily PROTEIN Intake of American Officer P.O.W.'s
Zentsuji Japan 1942-1945

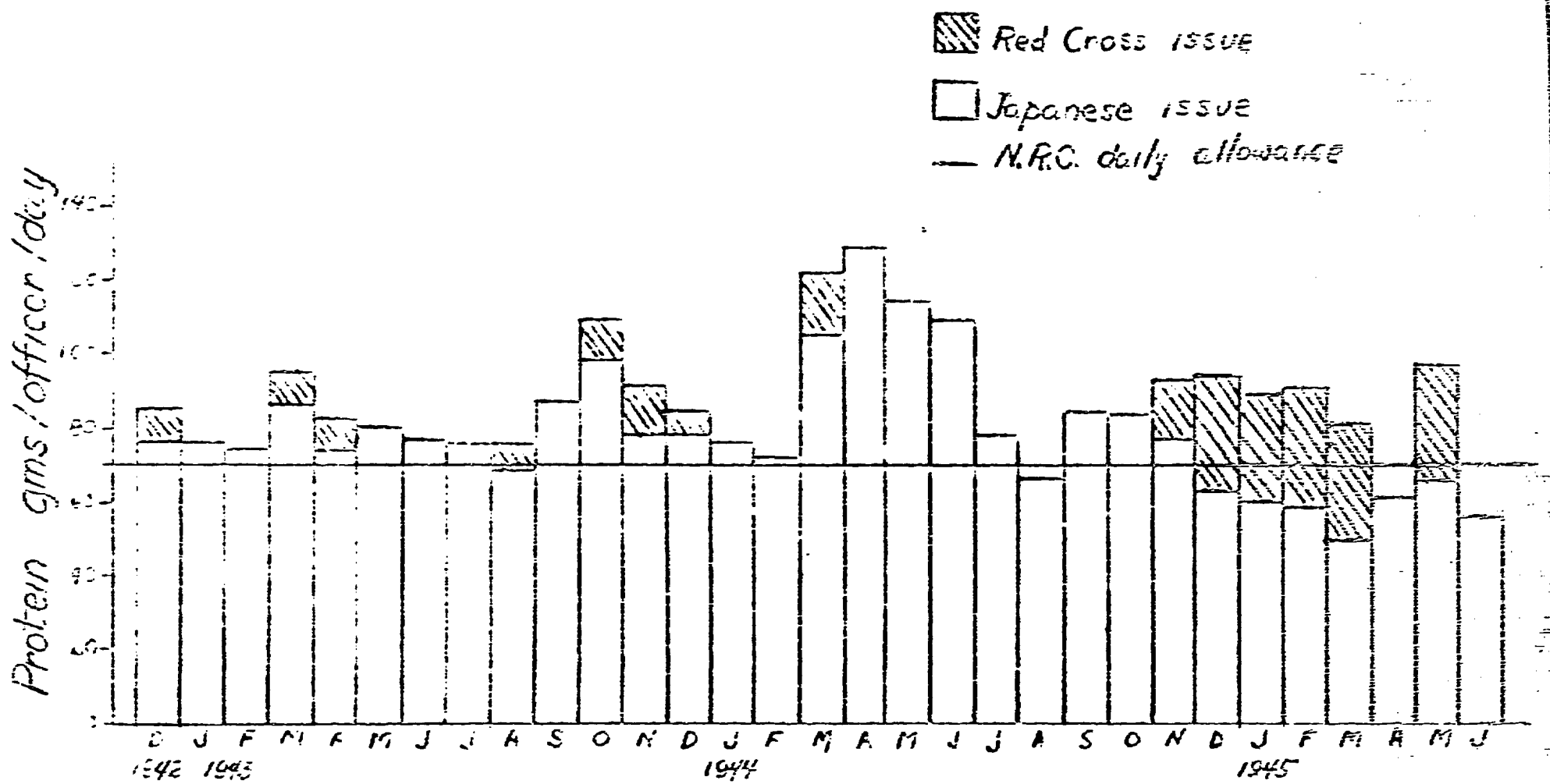


Fig. 3. Average Daily CARBOHYDRATE Intake of American Officer P.O.W.'s Zentsuji Japan 1942–1945

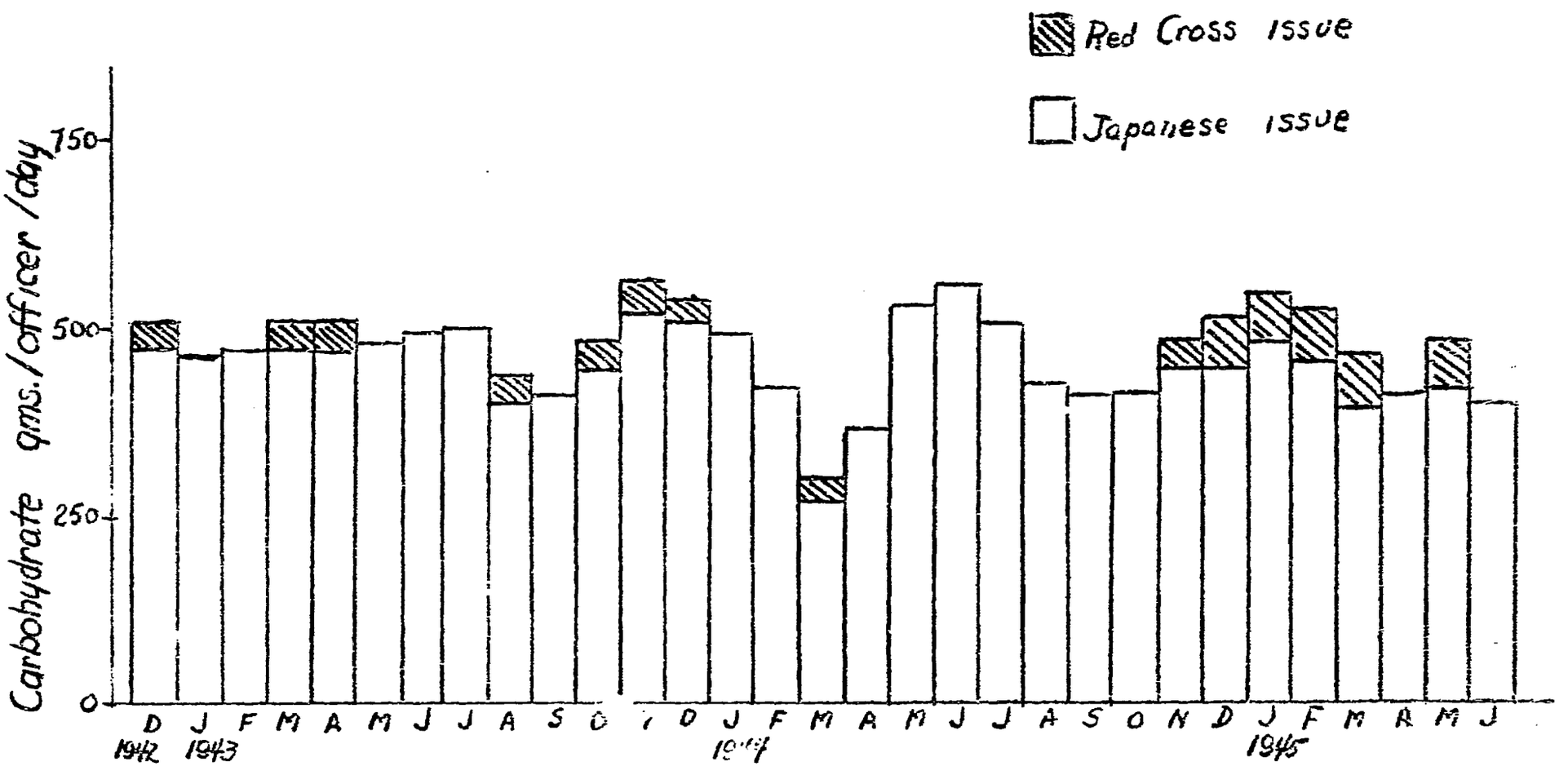


Fig. 4. Average Daily CALCIUM Intake of American Officer P.O.W.'s Zentsuji Japan 1942-1945

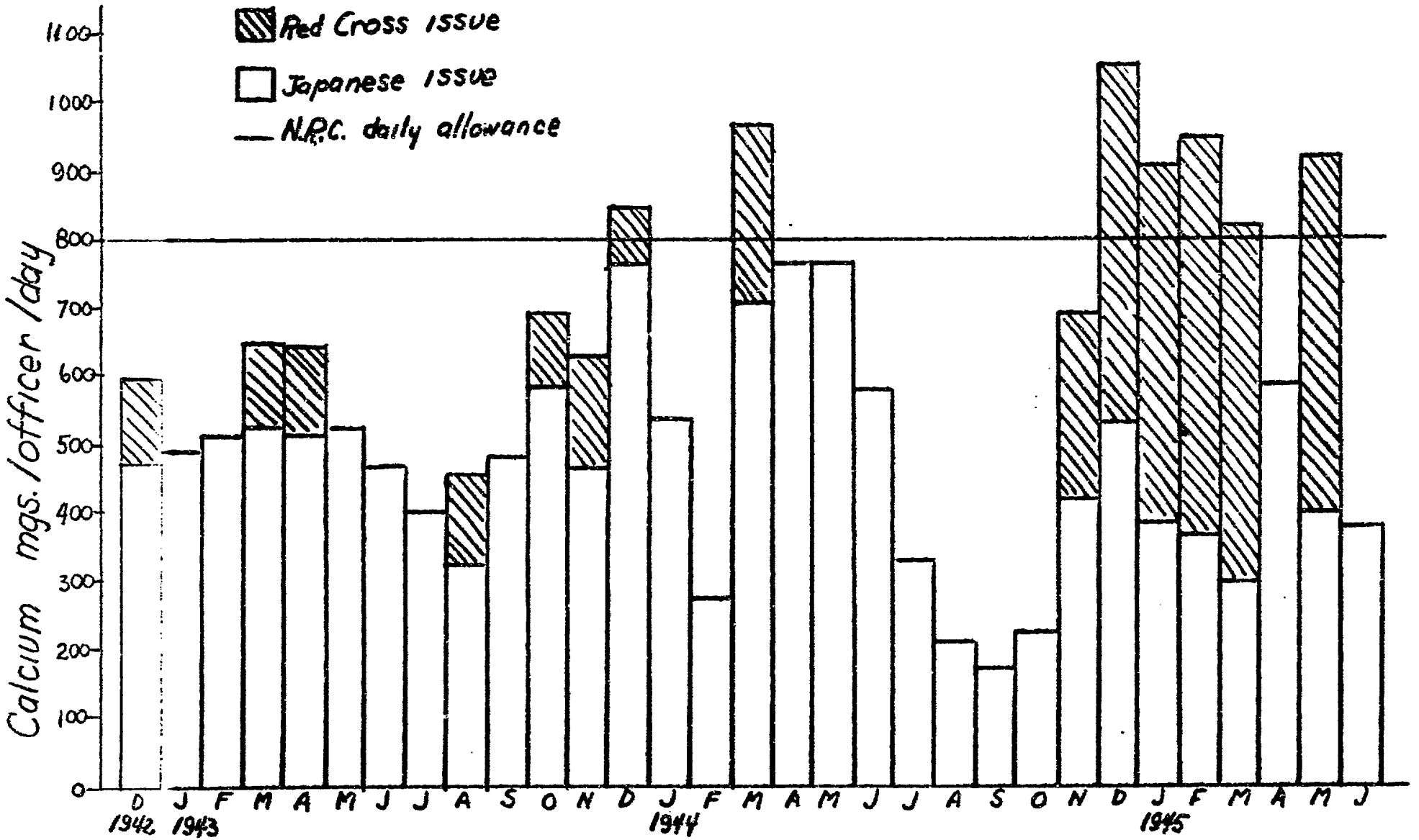


Fig.5 Average Daily PHOSPHOROUS Intake of American Officer P.O.W.'s Zentsuji Japan 1942-1945

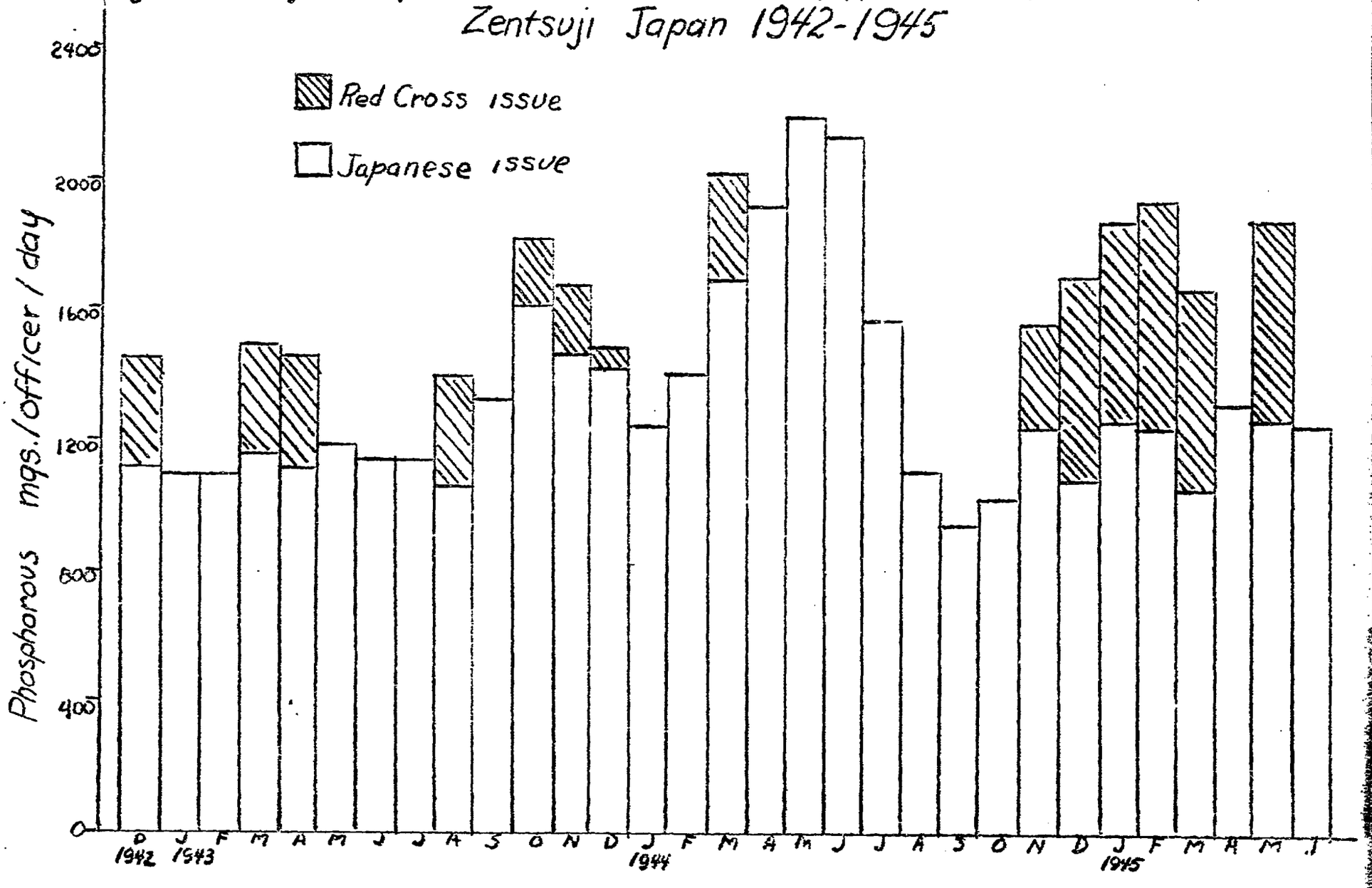


Fig. 6 Average Daily IRON Intake of American Officer P.O.W.'s
Zentsuji, Japan, 1942-1945

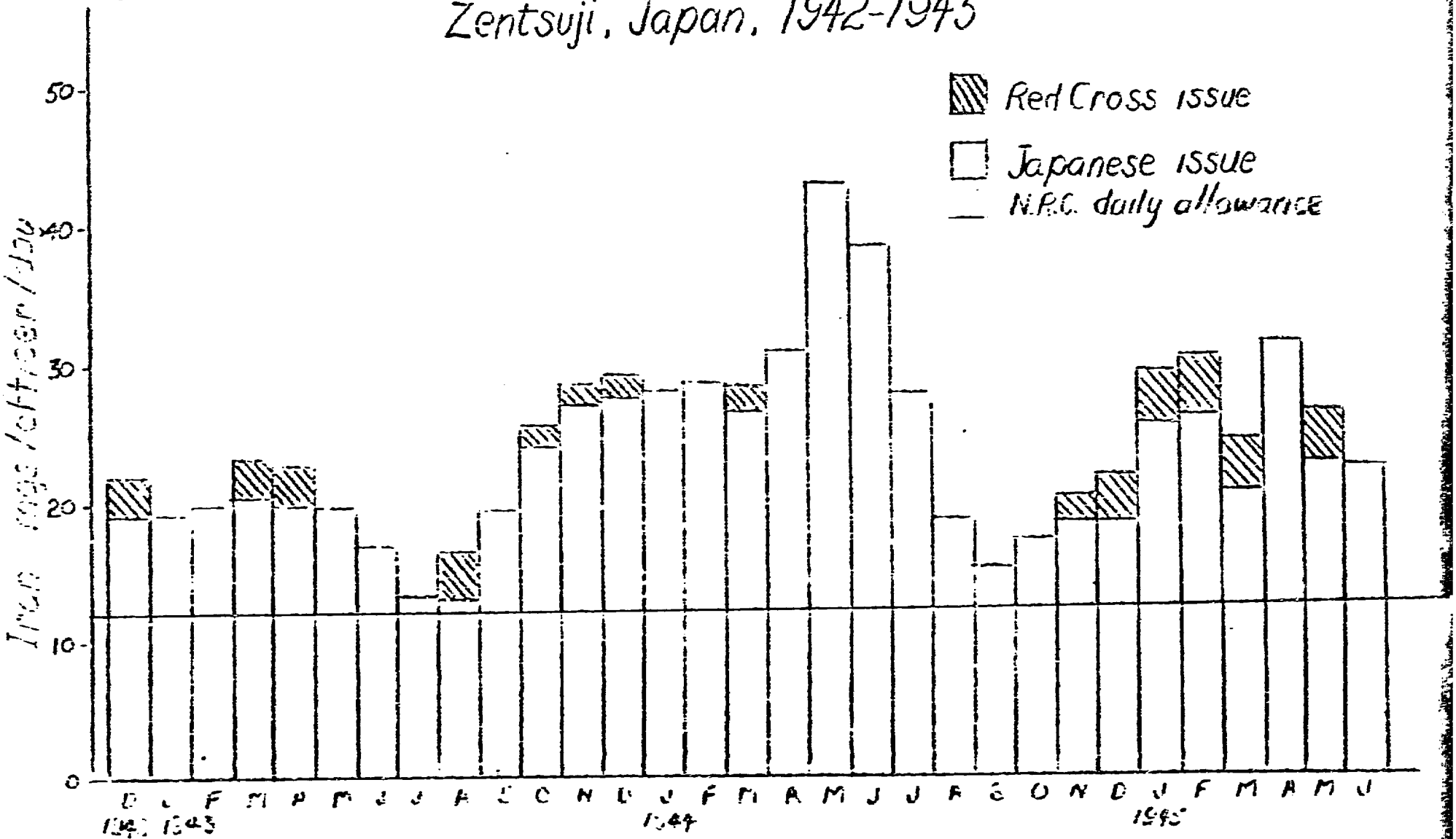


Fig. 7 Average Daily THIAMINE Intake of American Officer P.O.W.'s Zentsuji Japan 1942-1945

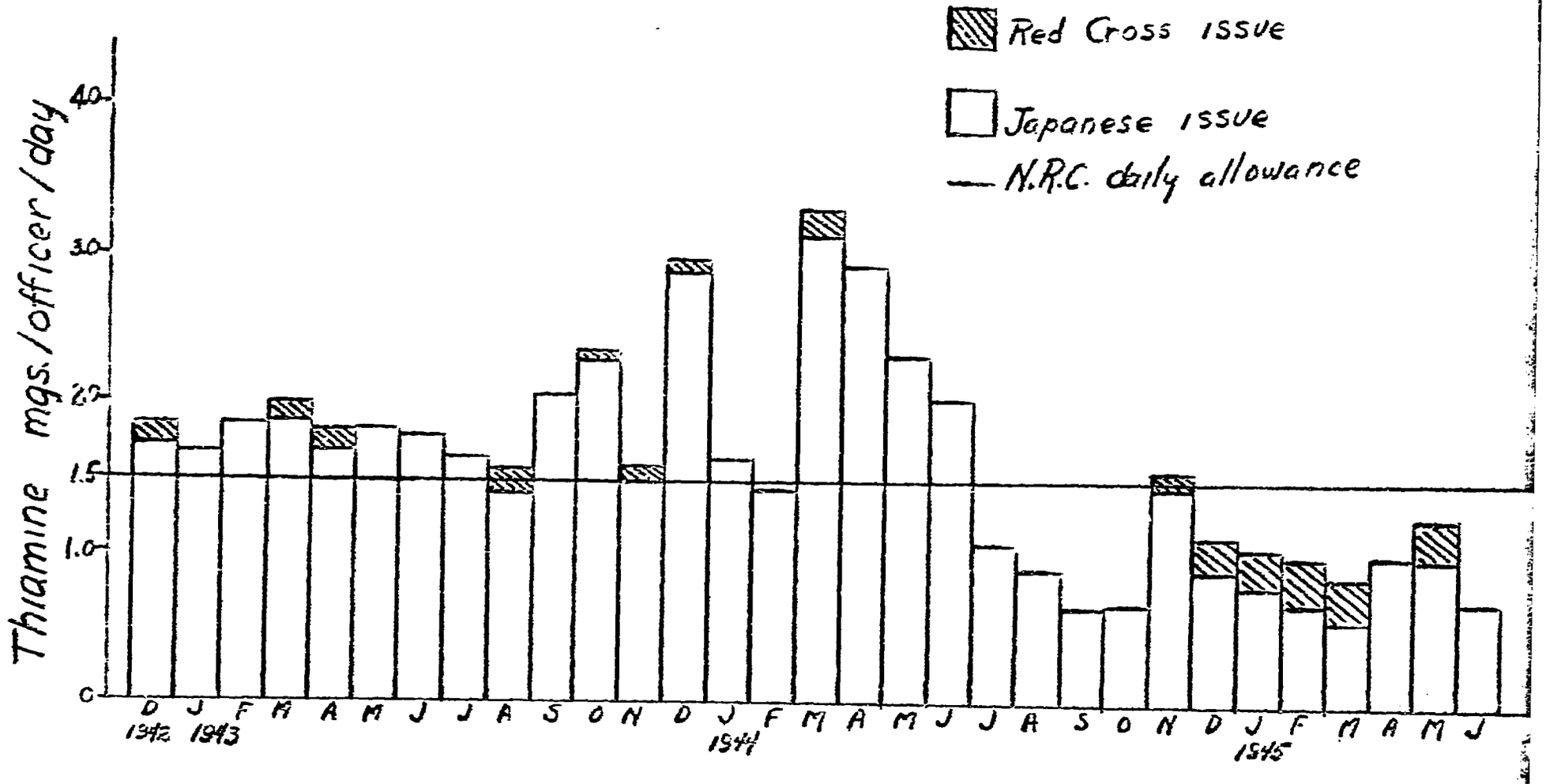


Fig.8. Average Daily RIBOFLAVIN Intake of American Officer P.O.W.'s Zentsuji Japan 1942-1945

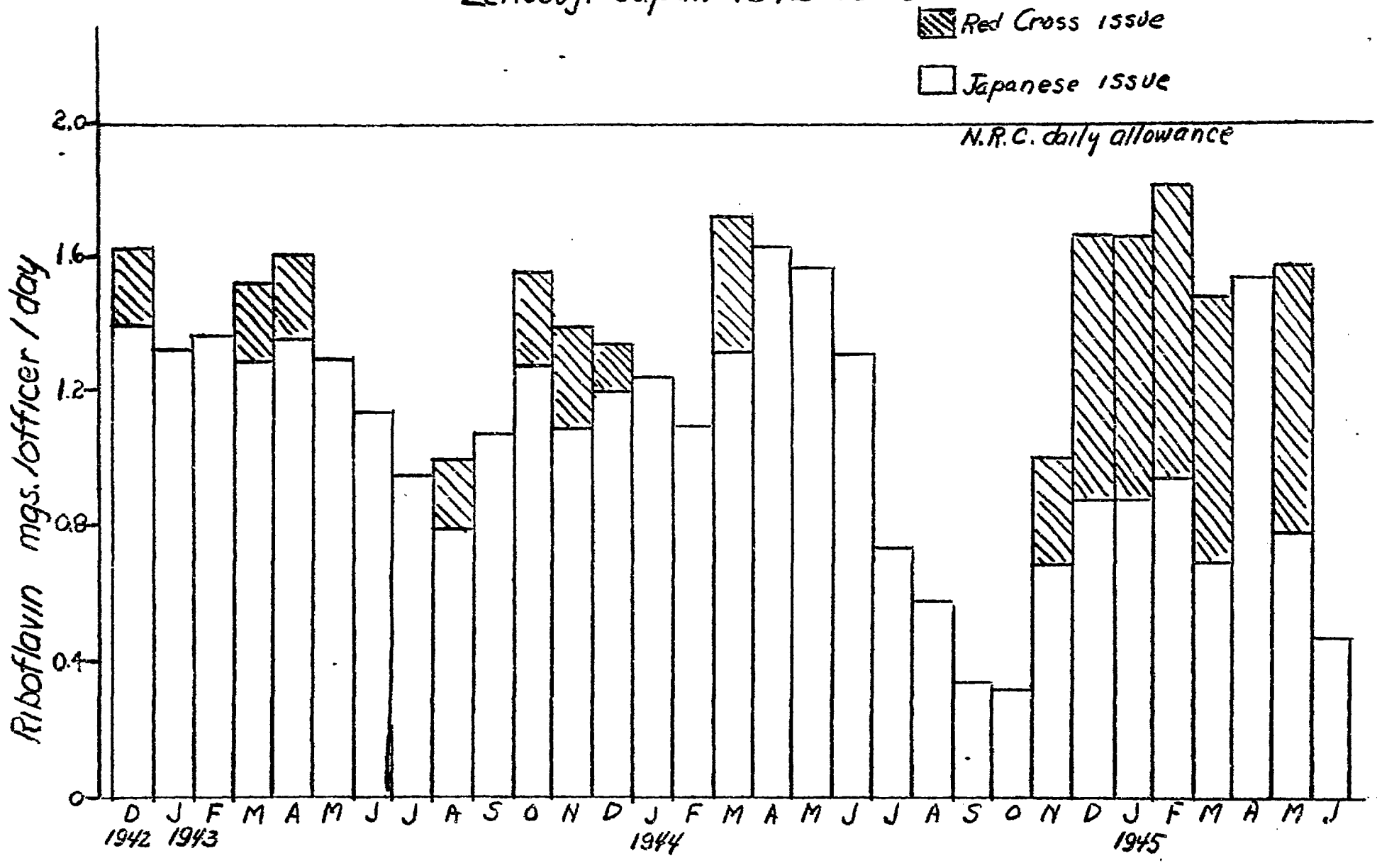
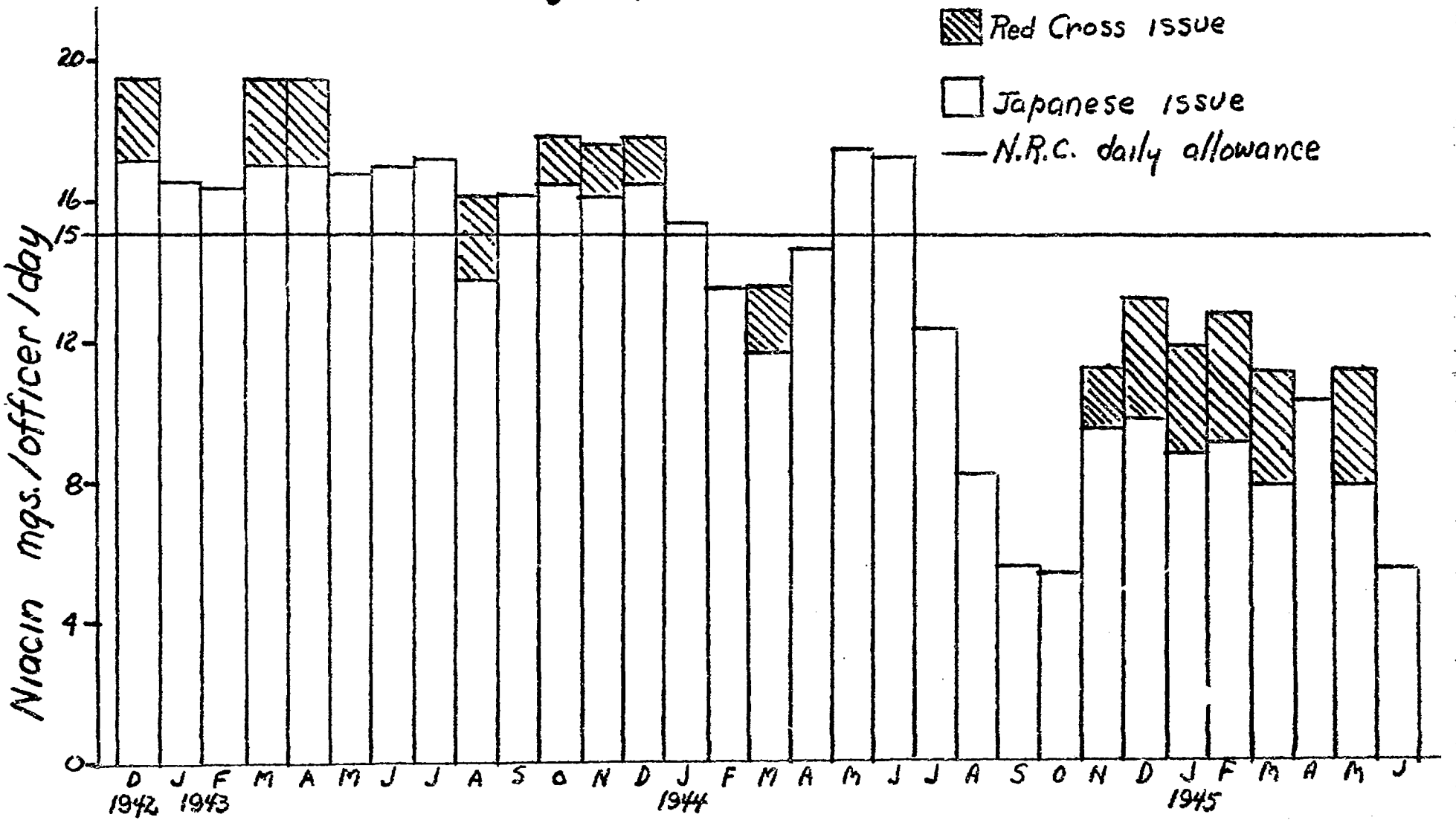


Fig. 9 Average Daily NIACIN Intake of American Officer P.O.W.'s
Zentsuji Japan 1942-1945



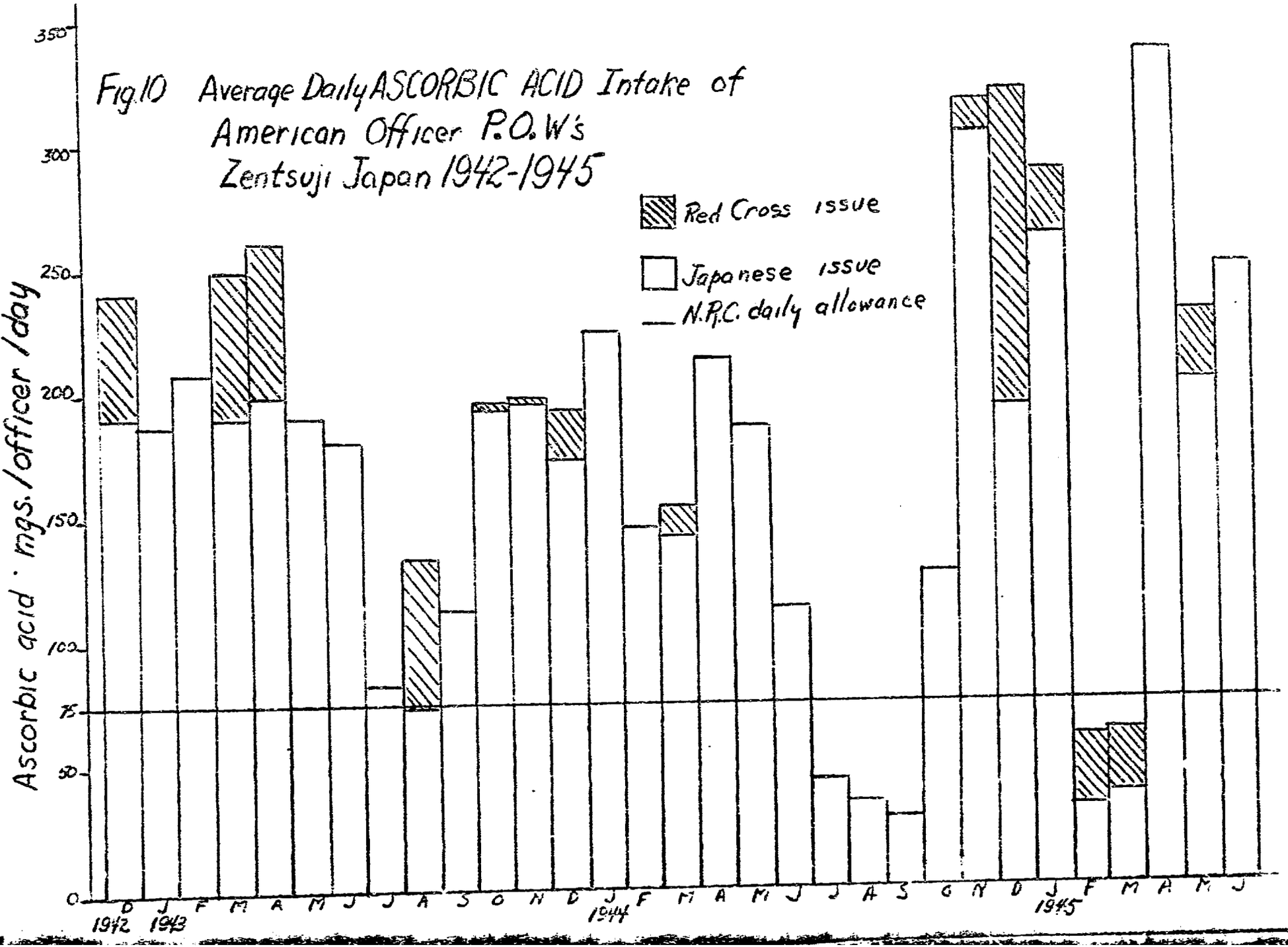


Fig.10 Average Daily ASCORBIC ACID Intake of American Officer P.O.W's Zentsuji Japan 1942-1945
Red Cross issue
Japanese issue
N.R.C. daily allowance
Ascorbic acid · mgs./officer/day
350
300
250
200
150
100
75
50
0
D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
1942 1943 1944 1945

Fig. 11 Average Daily VITAMIN A Intake of American Officer P.O.W.'s
Zentsuji, Japan 1942-1945

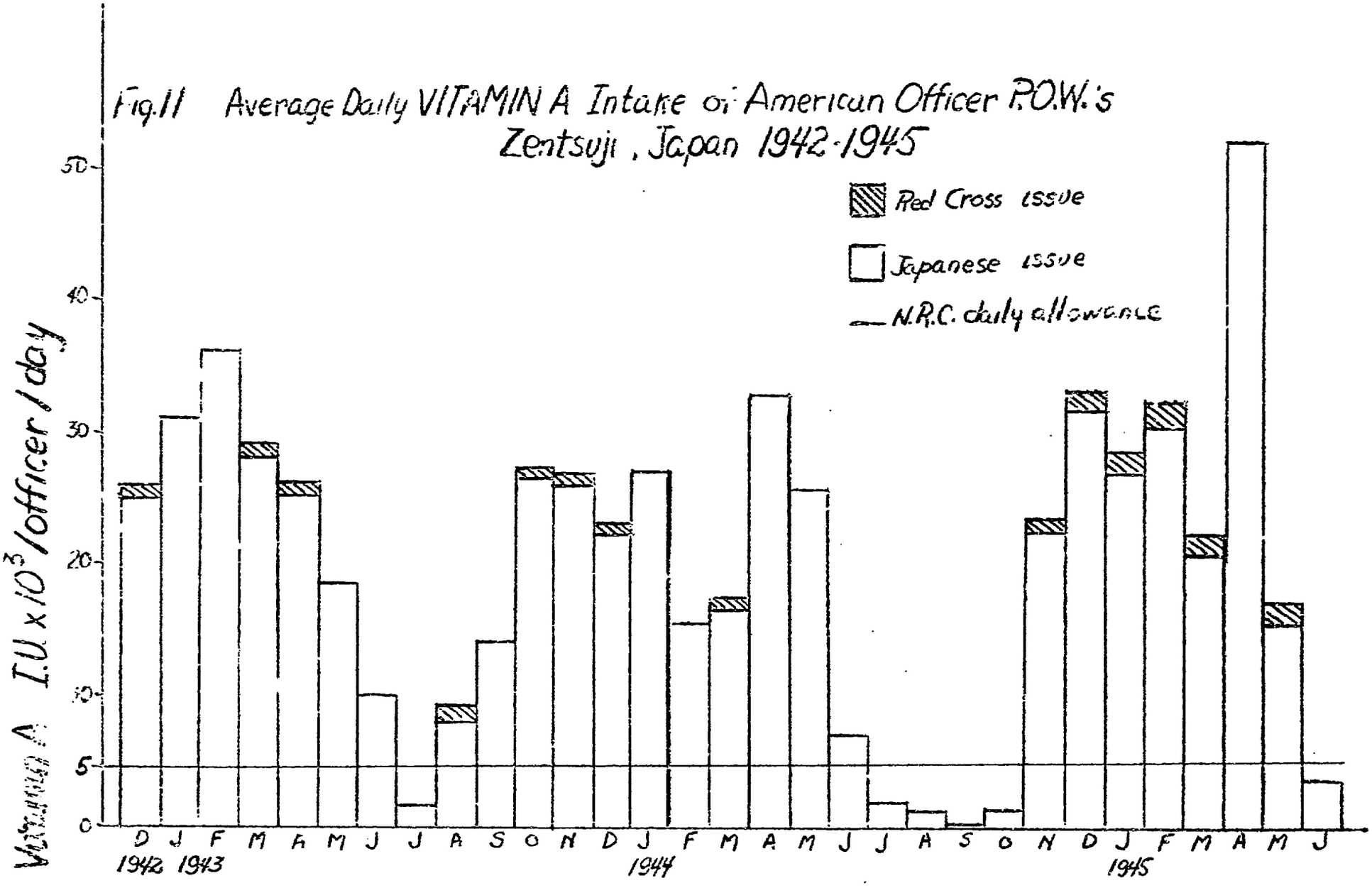
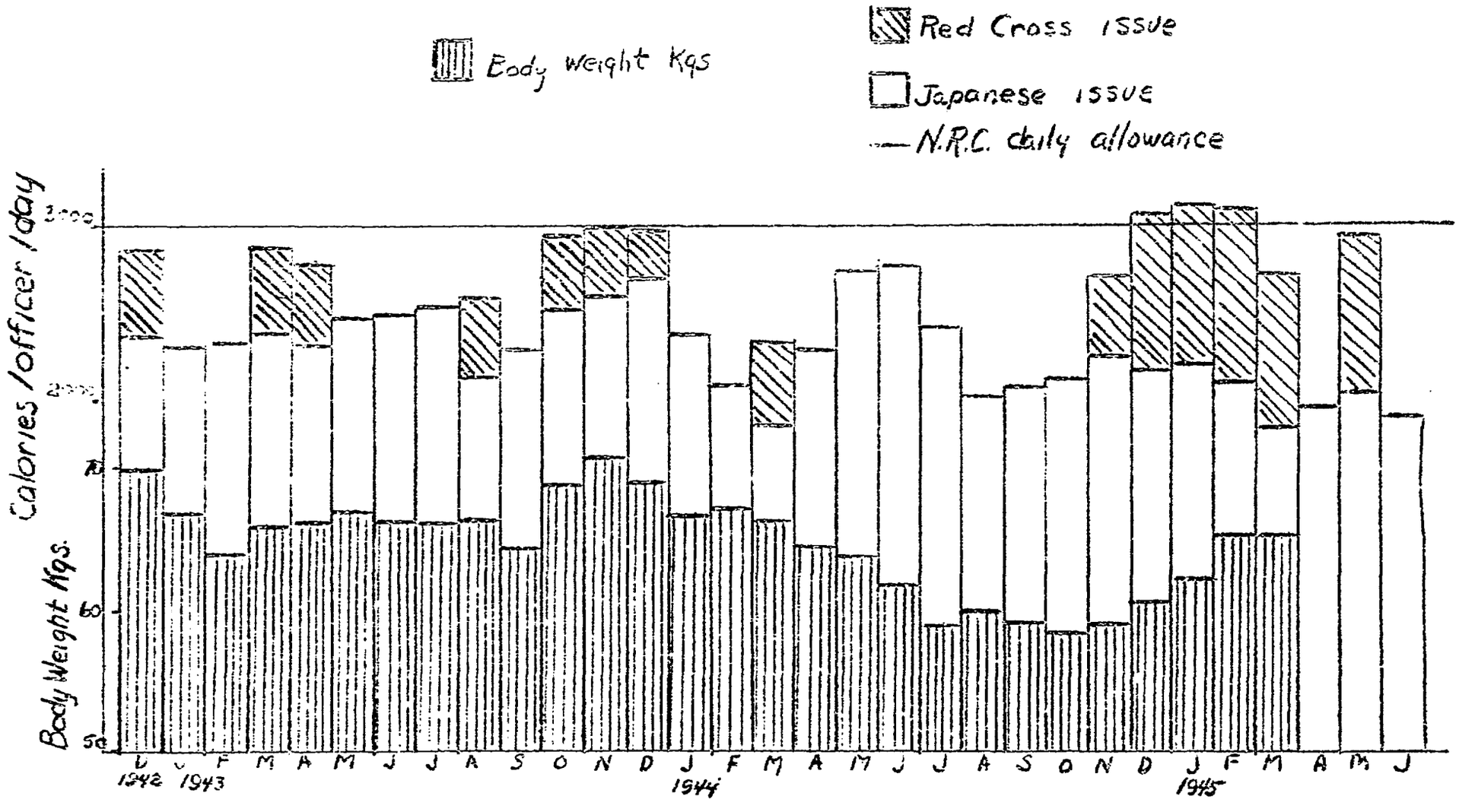


Fig. 12 Average Daily CALORIE Intake and Average Monthly BODY WEIGHT of American Officer P.O.W.'s Zentsuji Japan 1942-1945



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