Diet Nutrition and Excretion of the Asiatic Races in Singapore.

No. 2. MANUAL WORKERS.

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This is the continuation of the work published in August, 1917, when the diet, nutrition and excretion of the local medical students were dealt with (1). In the present paper, manual workers are under observation.

As might be expected considerable difficulty has been experienced in obtaining material from labourers, but with the faithful co-operation of several of the medical students and of others, a number of analyses were possible. It is hoped that more will be done in the future.

METHODS.

Kidney Excretions.—The same methods were employed for the estimations of nitrogen, ammonia, urea and chloride, as those used in the previous research (1).

In addition, quantitative estimations of the phosphates and uric acid were carried out. Phosphates were estimated by titration with uranium nitrate in a solution of acetic acid, which precipitates all the phosphate. The end reaction is either the brown colour which is produced by an excess of uranium nitrate in the presence of potassium ferrocyanide or the green colour formed by tincture of cochineal with a surplus of uranium nitrate.

The Hopkins-Wörner method was used to estimate the amount of uric acid present.

Diet.—In some cases details, of the kinds and amounts of food allowed to their workers, were obtained from employers.

In other cases it was possible to weigh the food before each meal.

The compositions of the foods and their heat values have been taken from standard books on the subject (2).

VARIOUS WORKERS.

Chinese Bakers.—Two Chinese bakers, employed by the father of one of the students, supplied material for eight observations. The average figures for the kidney excretions will be seen in Table I. The amount was scanty, 807 c.c. This was due to perspiration.

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whilst in the bakery. The total nitrogen was 8.3 grammes. The ammonia, 1.04 grammes, was high and therefore, so was the ammonia co-efficient, 10.3%. The reason for this is not clear. Probably further experiments will elucidate the problem. The amount of chloride was 5.1 grammes and of uric acid 0.48 gramme.

The diet consisted of rice with small quantities of pork, beef and fish.

Tamil Gardeners.—Fourteen observations were made from material furnished by two Tamil gardeners, working at the Medical School Hostel. The average amounts of kidney excretions were nitrogen 7.2 grammes, urea 13.4, uric acid 0.49, ammonia 0.73, chloride 7 and phosphate 1.25 (Table I). Their average weight was 101 lbs. and their average age 23½ years. The average diet consisted of bread 224 grammes, condensed milk 2, sugar 12, butter 13, boiled rice 1376, fish 84, green vegetables 213. This contains 76 grammes of protein, 19 of fat and 468 of carbohydrate. The heat value is 2407 kilocalories. Judging from their nitrogen excretion they metabolised only 45 grammes of protein, so that they did not metabolise all their food (Table II).

Malay Gardener.—This man worked at the school; two observations were made with his kidney excretions. His average figures were nitrogen 7.9 grammes, urea 15, uric acid 0.6, ammonia 0.61, chloride 5 and phosphate 1.5 (Table I). Rice was his chief food, but no details were obtained. He weighed 120 lbs.

Chinese Rickshaw Runner.—This runner was employed privately by the author. One specimen of kidney excretion was obtained when a full day’s running (about 15 miles) was done. His figures were, nitrogen 9.8 grammes, urea 20.4 uric acid 0.54, ammonia 1.06, chloride 2 and phosphate 1.8 (Table I). His diet consisted chiefly of rice with small quantities of beef, pork and fish, but no details were obtained.

Chinese Rubber Estate Coolies.—Five weeder and tappers working on a local rubber estate, owned by a student’s father, supplied material for fifteen observations. On an average they excreted by the kidney 10.4 grammes of nitrogen, which is equivalent to the metabolism of 65 grammes of protein. Their daily allowance of food contained 86 grammes of protein, 17 grammes of fat and 611 grammes of carbohydrate, the diet being rice (weighed uncooked) 728 grammes, pork 14, fat 7, fish 112, dried peas 56, green vegetables 224. This gives a heat value of 3015 kilocalories (Table II). It is evident that they did not metabolise all this allowance, only 65 out of 86 grammes of protein in the food being accounted for in the kidney excretion.

The figures for the other excretion were urea 19.4 grammes, uric acid 0.65, ammonia 1.09, chloride 6.6 and phosphate 1.78 (Table I). The average age was 32 years and the average weight 122 lbs.
**Chinese Prisoners.**—Six first class prisoners at the gaol were next employed, under the supervision of the assistant surgeon. They furnished material for 36 observations. Their daily diet, which is fixed by statute and which is considered to be generous for local labourers, consists of coconunt oil 28 grammes, fresh meat (with bone) 112, rice (weighed uncooked) 448, salt 7, fish (with bone) 84, vegetables 336 and bread 112. This contains 84 grammes of protein, 50 of fat and 432 of carbohydrate, the heat value being 2580 kilocalories.

The average age of the prisoners was 40 years and the average weight 137 lbs. The average length of time on the above diet was 3 years 4 months. The prisoners were all employed in the prison kitchen. Before their confinement they were variously employed—fisherman, rubber estate coolie, tapioca estate coolie, bullock cart driver, shopkeeper and shop coolie.

The average figures for the kidney excretions were nitrogen 11.4 grammes, urea 21, uric acid 0.43, ammonia 0.15, chloride 5.5 and phosphate 1.8 (Table I).

Judging from the nitrogen excretion they metabolised on an average only 71.2 of the 84 grammes of protein of the food. (Table II).

**Commentary.**

Looking at the average figures for the kidney excretions (Table I) it will be seen that there is considerable variation for different occupations, after making allowance for the weight. The amount of nitrogen excreted per kilogram of body weight is shown in one column of Table I. The average figures usually given in text books of Physiology for Europeans in Europe are appended. These figures are the standard figures used for teaching purposes, and the figures for manual labourers in Europe are higher than these. A glance will show that the figures for the nitrogen and urea are much lower in the case of the Asiatic labourer in Singapore. This is due to the fact that he metabolises less protein than the European. He also has less energy. Our local gardeners cannot be regarded as hard workers from a European point of view. The estate coolies and rickshaw runner rank amongst our hardest muscular workers. McCay (3) has shown that a European possesses better physique and greater muscular energy than an Asiatic because the former metabolises a larger quantity of protein. Looking at Table II it will be seen that my figures support this view. The average figure for a European doing moderate labour in Europe is 125 grammes, whereas 71.2 is the highest figure obtained in my experiments with the local labourer. On the other hand the carbohydrate part of the diet is increased in amount, relatively and absolutely, in the case of the Asiatic.

Judging from the amount of protein of the diet, accounted for in the kidney excretion the calorific value of the Asiatic labourer's metabolised food (Table II) is a good deal below that of the European, allowance being made for the difference in weight.
The former does less work. Gentlemen, who have controlled labour both in this city and in Europe, have no doubt that the European labourer has better physique and is capable of heavier work than the tropical Asiatic. Undoubtedly climate plays an important part in this matter. The continuous heat and moisture of the atmosphere in Singapore, do not readily allow escape of heat from the body. Work and food increase body heat, so that the natural remedy is to lessen these. One does occasionally see coolies doing very heavy work but they do not keep this up for any length of time.

Returning to Table 1, it will be observed that the uric acid, phosphate and chloride are also present in smaller quantities in the local labourer's kidney excretion than in that of the European. This is due to the fact that the diet of the former contains smaller quantities of the substances from which these are derived.

In all cases the ammonia co-efficient for the local Asiatic is higher than that of the European. This is due to the fact that the former excretes a smaller amount of nitrogen.

No reference has been made to the nitrogen excreted by the skin. This is not sufficient to interfere greatly with the results obtained.

Conclusions.

I. As far as these experiments go, the figures obtained show that on the whole the amounts of kidney excretions for local labourers differ considerably from the standard amounts given for Europeans in Europe.

II. The total nitrogen varies from 1.2 to 11.4 grammes, the urea from 13.4 to 21, the uric acid from 0.43 to 0.65, the ammonia from 0.61 to 1.09, the chloride from 2 to 7, and the phosphate from 1.25 to 1.8.

III. The local labourer uses less protein and fat, but more carbohydrate than the European. The metabolised food of the former has a smaller calorific value. Two reasons, closely connected with one another may be given for this. They live in a continuously hot and moist climate. They do less work.

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References.


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