# OBSERVATIONS ON BODY WEIGHT, BASAL METABOLIC RATE, URINARY NITROGEN EXCRETION AND DIURESIS OF MEMBERS OF THE FIRST SOUTH AFRICAN NATIONAL ANTARCTIC EXPEDITION (SANAE I) FEBRUARY — DECEMBER 1960

A. LE R. VAN DER MERWE,* *Medical Officer, SANAE I,*

and

K. HOLEMANS, M.D., *Department of Physiology, University of Pretoria*

On each of 9 members of SANAE I, among other investigations, monthly determinations of the basal metabolic rate (BMR) and the body weight were made from February to December 1960. In addition, the 24-hour amounts of urine were measured and a sample of each was analysed in South Africa for total nitrogen and creatinine after 3 - 12 months' storage at low temperatures.

### BODY WEIGHT

Eight members of the group showed an increase in body weight ranging from 0·4 to 4·5 kg. Only one member lost 1·1 kg. during the 10-month observation period. It can immediately and with certainty be inferred from these data that the food intake, from the caloric point of view, was adequate with regard to the special conditions prevailing in the Antarctic.

Daily contact with the members of the expedition also showed that, from the subjective point of view, the quality of the meals, the variety of foods and their preparation quite satisfied the members of the expedition.

We therefore think that the *variety and amount* of food do not need further investigation. Investigations, however, may have to be aimed at possible nutritional imbalances instead.

### NITROGEN CATABOLISM

The ideal level of protein metabolism is still a matter of controversy in normal conditions and even more so in the conditions of Antarctica, the members being continuously exposed to stress of varying causes. Urinary excretion would, of course, measure the intensity of nitrogen turnover.

* At present Principal Research Officer at the National Nutrition Research Institute, Council for Scientific and Industrial Research, Pretoria.

Table I summarizes the results of different determinations performed on each member of the expedition. Fig. I illustrates the overall tendency.

On 5 occasions we see that urinary nitrogen was equal to or less than 2 G. per day. These *low* figures — an apparent physiological impossibility — were obtained once in each of 5 different members (out of 9); this makes the explanation of cheating by the subjects improbable. Low values appeared both in specimens stored for relatively long periods and in those stored for short periods, indicating that period and method of storage are also not an acceptable explanation for these low values.

The *mean* values for the urinary nitrogen of the 9 members showed a continuous decline from February to December, i.e. over a period of 10 months. This decline in nitrogen excretion can by no means be accounted for by the length of the storage period. The regression of the urinary nitrogen on time is statistically very significant ($r = -0{\cdot}88$, $t = 5{\cdot}50$).

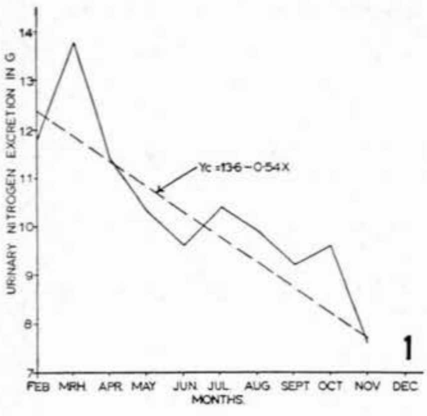
There is no evidence that nitrogen intake was less at the end than at the beginning of the period under consideration. In fact, looking at the protein consumption of the group, i.e. 6 lb. of meat a day, one would rather say that the initial values of urinary nitrogen excretion were on the low side, and were even lower at the end of the expedition.

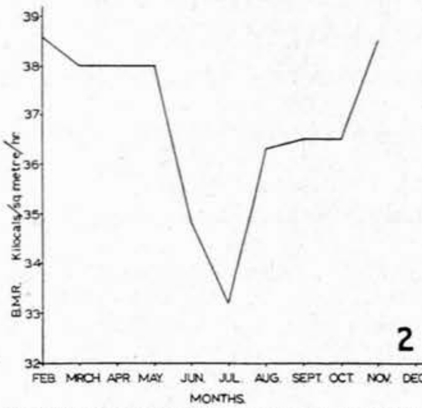
The steady decrease in nitrogen catabolism shows a very different picture from the variations observed in the BMR during the corresponding period (Fig. 2, Table II).

It would indeed be a very striking phenomenon if it were to be confirmed that nitrogen catabolism, of which urinary nitrogen is the expression, decreases during a stay in Antarctica. The first step in establishing this fact beyond doubt would require the total nitrogen excretions in 24-

TABLE I. TOTAL URINARY NITROGEN EXCRETION IN GRAMS

| | Member | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *H* | *G* | *T* | *C* | *M* | *N* | *V* | *D* | *B* | *Mean* |
| Feb. | — | — | — | — | 7·3 | 18·6 | 10·6 | 16·6 | 5·7 | 11·8 |
| March | 20·8 | — | — | 6·8 | — | — | — | — | — | 13·8 |
| April | 10·8 | 7·1 | 6·1 | 17·8 | 9·0 | 10·7 | 12·6 | 9·3 | 17·8 | 11·4 |
| May | 13·1 | *1·5* | 12·6 | 12·0 | 23·8 | 9·8 | *1·1* | 10·5 | 18·4 | 10·3 |
| June | 9·0 | 8·3 | 4·4 | 13·6 | 7·8 | 16·1 | 12·5 | 6·7 | 7·7 | 9·6 |
| July | 8·9 | — | 8·6 | 7·0 | 8·8 | 9·1 | 10·7 | 19·8 | 11·1 | 10·4 |
| August | 7·7 | — | 10·0 | 10·1 | 5·5 | — | 7·0 | 11·7 | 17·8 | 9·9 |
| Sept. | 12·5 | 7·5 | 7·1 | 5·4 | 7·6 | 8·7 | 7·0 | 8·4 | 8·9 | 8·2 |
| Oct. | 11·8 | 21·6 | 5·6 | *0·3* | *0·7* | — | 7·5 | 6·5 | 14·9 | 8·6 |
| Nov. | — | 10·0 | — | 6·3 | 14·1 | — | — | 5·6 | *2·0* | 7·6 |
| Dec. | — | — | — | — | — | — | — | — | — | — |
| Means | 11·8 | 9·5 | 7·8 | 8·8 | 9·4 | 12·2 | 8·6 | 10·6 | 11·6 | |



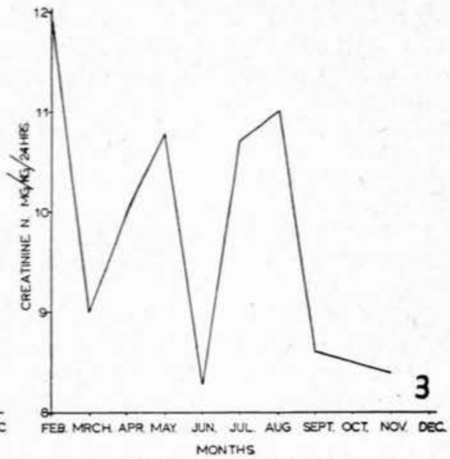




*Fig. 1.* Decrease in total urinary nitrogen excretion of 9 members of SANAE I over a period of 10 months in the Antarctic.
*Fig. 2.* Variations of mean BMR values of 9 members of SANAE I during 10 months' stay in the Antarctic.
*Fig. 3.* Showing that monthly determinations of daily means of creatinine excretion are not significantly dependent on the length of stay of 9 members of SANAE I in the Antarctic.

hour specimens of urine to be determined on the spot for several days a month on every member.

### CREATININE

The results of creatinine estimations are given in Table III and Fig. 3 ($r = -0{\cdot}53$, $t = 1{\cdot}87$).

The mean values (mg. creatinine N/kg./hr.) were within the normal range. They did not show a decline parallel to the total nitrogen decline, and their correlation with time is not statistically significant (Fig. 3).

### DIURESIS

As shown in Table IV, the mean diuresis of most of the subjects was somewhat higher than the 1,500 ml. mean value observed in temperate climates. These slightly higher values (300 - 400 ml. difference) would be easily accounted for by a decreased sweat secretion in a cold environment.

TABLE II. BASAL METABOLIC RATES IN KILOCALS. PER SQ. METRE PER HOUR

| | Member | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *H* | *G* | *T* | *C* | *M* | *N* | *V* | *D* | *B* | *Mean* |
| Feb. .. .. .. | 39·3 | 41·3 | 35·6 | — | 37·1 | 37·0 | 36·3 | 39·8 | 42·6 | 38·6 |
| March .. .. | 36·2 | 41·7 | 35·7 | 39·2 | 38·6 | 36·4 | 36·1 | 36·9 | 41·4 | 38·0 |
| April .. .. .. | 37·5 | 39·5 | 35·7 | 42·2 | 36·6 | 39·9 | 35·7 | 37·5 | 39·8 | 38·1 |
| May .. .. .. | 34·5 | 36·9 | 37·4 | 37·8 | 36·6 | 40·2 | 36·7 | 41·4 | 39·2 | 38·0 |
| June .. .. .. | 35·2 | 33·6 | 35·0 | 36·9 | 32·0 | 40·4 | 31·1 | 33·6 | 35·5 | 34·8 |
| July .. .. .. | 38·0 | 35·5 | 35·2 | 35·9 | 38·1 | 37·5 | 35·9 | 33·8 | 38·0 | 33·2 |
| August .. .. | 34·4 | 38·6 | 36·5 | 39·7 | 36·0 | 37·6 | 37·3 | 37·3 | 40·0 | 36·3 |
| Sept. .. .. .. | 37·6 | 40·4 | 34·7 | 40·0 | 34·6 | 37·5 | 33·9 | 34·8 | 38·4 | 36·5 |
| Oct. .. .. .. | 35·8 | 38·4 | 36·1 | 35·8 | 39·1 | 40·8 | 38·1 | 34·3 | 40·2 | 36·5 |
| Nov. .. .. .. | — | 44·0 | 36·2 | 38·3 | 38·5 | 37·5 | 35·5 | 36·0 | 40·9 | 38·5 |
| Dec. .. .. .. | 36·2 | — | — | — | — | — | — | — | — | — |
| Means .. .. | 35·8 | 39·0 | 35·8 | 38·4 | 36·2 | 38·2 | 35·6 | 36·5 | 39·6 | |
| Pretoria standards for age .. .. | 36·2 | 37·8 | 37·3 | 37·0 | 36·1 | 36·5 | 37·1 | 37·1 | 38·1 | |

TABLE III. N-CREATININE IN MG. PER KG. PER 24 HOURS

| | Member | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *H* | *G* | *T* | *C* | *M* | *N* | *V* | *D* | *B* | *Mean* |
| Feb. .. .. .. | — | — | 11·1 | — | 12·7 | 10·6 | *4·8* | 22·5 | 9·8 | 11·9 |
| March .. .. | 10·8 | — | 11·0 | 5·4 | — | — | — | — | — | 9·0 |
| April .. .. .. | 10·4 | 7·0 | 8·2 | 14·2 | 6·6 | 13·0 | 9·5 | 10·2 | 11·3 | 10·0 |
| May .. .. .. | 10·9 | 8·2 | 9·0 | 10·6 | 13·8 | 10·6 | 7·5 | 10·0 | 16·8 | 10·8 |
| June .. .. .. | 9·0 | 9·1 | 7·2 | 7·4 | 9·6 | 8·9 | 9·2 | 8·4 | 8·4 | 8·4 |
| July .. .. .. | 7·9 | 7·6 | 9·8 | 10·4 | 11·7 | 9·3 | 11·0 | 13·3 | 16·0 | 10·8 |
| August .. .. | 8·1 | — | 8·8 | 6·1 | 7·7 | — | 7·6 | 12·6 | 16·3 | 11·0 |
| Sept. .. .. .. | 9·8 | 9·0 | 9·9 | — | 10·4 | 9·8 | 8·6 | 9·0 | 3·1 | 8·7 |
| Oct. .. .. .. | 8·7 | 8·7 | 9·9 | *0·56* | 11·3 | — | 6·4 | 9·6 | 13·2 | 8·6 |
| Nov. .. .. .. | — | 7·1 | — | 7·2 | 6·8 | — | — | 8·0 | 13·2 | 8·4 |
| Dec. .. .. .. | — | — | — | — | — | — | — | — | — | — |
| Means .. .. | 9·4 | 7·8 | 9·4 | 7·7 | 10·6 | 10·4 | 8·7 | 11·5 | 12·0 | |

TABLE IV. DIURESIS IN ML. PER 24 HOURS ONCE A MONTH

| | Member | | | | | | | | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| | *H* | *G* | *T* | *C* | *M* | *N* | *V* | *D* | *B* | |
| Feb. .. .. .. | 914 | — | 815 | — | 2,287 | 2,757 | 1,721 | 1,850 | 1,100 | 1,634 |
| March .. .. | 1,986 | 1,660 | 750 | 1,745 | 1,630 | 1,050 | — | 1,018 | — | 1,405 |
| April .. .. .. | 1,440 | 1,175 | 1,245 | 2,795 | 2,000 | 2,155 | 2,285 | 2,430 | 2,245 | 1,974 |
| May .. .. .. | 1,860 | 1,030 | 860 | 1,610 | 2,710 | 1,960 | 1,680 | 1,645 | 2,510 | 1,762 |
| June .. .. .. | 1,110 | 1,455 | 740 | 1,176 | 1,250 | 2,280 | 1,795 | 945 | 1,357 | 1,344 |
| July .. .. .. | 1,694 | 1,335 | 990 | 1,336 | 2,080 | 2,225 | 1,883 | 2,613 | 1,885 | 1,782 |
| August .. .. | 1,254 | 3,010 | 1,472 | 944 | 2,040 | — | 1,810 | 2,703 | 2,631 | 1,983 |
| Sept. .. .. .. | 1,789 | 1,695 | 890 | — | 1,778 | 1,935 | 2,060 | 1,148 | 2,440 | 1,716 |
| Oct. .. .. .. | 1,437 | 2,960 | 1,040 | 1,725 | 2,277 | — | 1,560 | 980 | 2,500 | 1,807 |
| Nov. .. .. .. | — | 2,490 | — | 720 | 2,140 | 1,115 | — | 1,445 | 1,560 | 1,578 |
| Dec. .. .. .. | — | — | — | — | — | — | — | — | — | — |
| Means .. .. | 1,498 | 1,867 | 978 | 1,506 | 2,019 | 1,935 | 1,847 | 1,678 | 2,025 | |

CONCLUSIONS

Making the necessary allowances for possible errors from storage or other factors, it seems that nitrogen catabolism decreased with time in the majority of our subjects in the Antarctic. This was shown by total urinary nitrogen as well as by the creatinine nitrogen percentage. Even the earliest values recorded after 2 months away from South Africa were low. But if we accept them as normal, they decreased from 13·6 to 8·3 G. (regression line: $Yc = 13{\cdot}6 - 0{\cdot}54\ X$). This means that nitrogen catabolism decreased by 0·54 G. a month, and after 10 months' stay in Antarctica, was 40% less than its initial value. We believe that this point deserves further investigation, not only for scientific reasons, but even more so from a purely practical point of view.

We wish to acknowledge the assistance and advice in the preparation of this document of Prof. B. J. Meyer, Department of Physiology, University of Pretoria.

# CONSTRICTIVE PERISALPINGITIS

## A PRELIMINARY REPORT ON ANOTHER POSSIBLE CAUSE OF NON-PATENCY OF THE PROXIMAL PORTION OF THE FALLOPIAN TUBE WITH A SHORT NOTE ON A MORE CONSERVATIVE APPROACH TO TUBAL PLASTIC SURGERY*

LOUIS RESNICK, M.D. (CAPE TOWN), F.R.C.O.G., *Senior Lecturer in Obstetrics and Gynaecology, University of Cape Town*

In spite of the fact that non-patency of the proximal ½ - 1 inch of the fallopian tube might be remedied by complicated and often spectacular tuboplastic operations, it is the general experience of gynaecologists that women who have had such operations conceive infrequently, especially when associated obliteration of the fimbriated end of the tube had been present. However, even if pregnancy is not attained, operation is more than justified in many patients for its beneficial effects. These include the relief of debilitating symptoms such as chronic pelvic pain, irregular and often profuse menstruation, and invalidism, and the restoration of morale.

The purpose of this short communication is to draw attention to the possibility, in the light of recent experience, of occasionally being able to overcome proximal-tube non-patency without having to resort to major plastic procedures, where such non-patency was not due to primary endosalpingitic blockage. Alternatively, a less serious diagnostic operation is performed to establish whether such non-patency is due to either (*i*) constriction of the narrowest portion of the tube by peritoneum which is the seat of perisalpingitic inflammatory change, with or without chronic tubal spasm in addition; or (*ii*) primary endosalpingitic blockage.

* From the Somerset Hospital Unit of the Department of Obstetrics and Gynaecology, University of Cape Town.

### CAUSES OF NON-PATENCY OF PROXIMAL THIRD OF THE FALLOPIAN TUBE

These may be divided into 2 main groups, viz: (1) inflammatory, and (2) non-inflammatory.

1. *Inflammatory Changes*

There is no doubt that these are the most important contributory factors in the causation of tubal non-patency, affecting the ampullary end more often than the proximal tube. Inflammatory change manifests most commonly as a perisalpingitis, or infection from without the tube, rather than endosalpingitis or infection primarily from within the tube.

*Perisalpingitis* usually follows postabortal and puerperal infection from the lower genital tract; less often it follows operations such as curettage or cauterization of the cervix. *Pyogenic organisms* are usually responsible, and the common method of spread of infection is by way of the lymphatics and blood vessels of the parametrium and broad ligament, affecting primarily the peritoneum enveloping the fallopian tube. Interstitial involvement may occur with little, if any, encroachment on the tubal