

theless, hormone synthesis apparently remained in normal limits, as borne out by the normal serum P.B.I. and the clinical status.

So far we have employed stosstherapy with a rapidly acting thyroid substance only in goitrous cretins—that is, in hypothyroid states resulting from an inability of the gland, despite the presence of sufficient cell mass, to produce the active principles (a form of myxoedema which we should like to term “biochemical,” in contradistinction to the “anatomical” myxoedema resulting from an actual deficiency of glandular tissue). Whether or not this therapeutic procedure will also find a place in other forms of hypothyroidism is still an open question; though again only persons belonging to the younger age groups who show no evidence of circulatory abnormalities other than the classical myxoedema heart would come into account.

Summary

The effects of the short-term administration of large amounts of triiodothyroacetic acid (triac)—that is, 90 mg. within nine days—followed by the complete cessation of substitution therapy, were studied in a 16-year-old girl with familial sporadic cretinism and goitre.

As in the case of her elder brother, in whom the same procedure had on two occasions resulted in the maintenance of a clinically euthyroid state for about seven and six months respectively, triac stosstherapy produced complete euthyroidism, which also lasted about six months. A previous administration of 30 mg. of triac within three days had resulted only in a short-lived remission lasting about three to four weeks.

It was concluded that the effects of triac stosstherapy depend on dosage, and that both patients can be maintained in a euthyroid state by the biannual or triannual administration of stosstherapy in suitable doses.

Although both siblings clinically reacted alike to the triac stoss with 90 mg., the behaviour of the thyroid gland with regard to size and function differed. In the brother the diffuse and nodular goitre was completely suppressed, remaining absent during each remission, and thyroid function became practically normal, as demonstrated by the ^{131}I uptake and serum P.B.I. In the sister only the diffuse goitre disappeared, while the nodules remained palpable, though much reduced in volume. ^{131}I uptake over the thyroid even attained “hyperthyroid” levels; yet the serum P.B.I. was found to be normal (in the brother the thyroid function was studied three and four months after the cessation of stosstherapy and in the sister two months after).

Some theoretical implications of triac stosstherapy are discussed.

We are indebted to Dr. H. M. Walker, Glaxo Laboratories Ltd., Greenford, Middlesex, for a generous supply of triac. Our thanks are also due to Professor A. Hochmann and Dr. A. Holzer, Radioisotope Laboratory, Radium Institute, Rothschild Hadassa University Hospital, Jerusalem, for the tracer studies, and to Dr. A. Fischer, department of biochemistry, Hadassa Municipality Hospital, Tel-Aviv, for the P.B.I. determinations.

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THE ADRENAL CORTEX AND WINTER SPORTS

WITH A NOTE ON OTHER EXERCISE

BY

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Evidence is presented in this paper that a winter sports holiday in the Alps is associated with daily activation of the adrenal cortex. Since most people find such a holiday extremely invigorating, such a course of adrenal stimulation is by no means harmful.

Morning and evening eosinophil counts were performed on a healthy adult over a period of six weeks, which included a three-weeks ski-ing holiday at an Alpine resort situated 3,000 ft. (915 m.) above sea-level. Confirmatory observations were made on two other subjects. The results have been compared with data on other kinds of physical exercise which have accumulated in this laboratory during other investigations. These include observations on swimming, running, and the Harvard step test.

Method

0.02 ml. of capillary blood was diluted with 0.08 ml. of Hinkelman's fluid, which stains the eosinophils black and has the following formula: yellow eosin 0.5 g., formalin (conc.) 0.55 ml., 95% phenol 0.5 ml., made up to 100 ml. with distilled water. The total number of cells in four Fuchs-Rosenthal chambers was counted with a tally, and the result multiplied by 0.78 to give the number of eosinophils per c.mm. The large number of cells counted by this technique greatly reduces the random error in comparison with other methods.

During the winter sports holiday the whole day was spent in activities connected with ski-ing, but the time actually spent in strenuous exercise was limited to one and a half to four hours, and consisted partly in climbing on skis and partly in downhill running on various ski-runs in the district at altitudes ranging from 8,500 ft. down to 3,000 ft. (2,600 to 915 m.).

The morning counts were done after breakfast between 9 and 10 a.m. and the evening counts between 5 and 6 p.m., one to two hours after coming in from ski-ing. During the control periods before and after the holiday the counts were done at 10 a.m. and 5 p.m., and the subject was engaged in ordinary laboratory activities.

Eosinophil counts were performed on several occasions on two companions. Of these, one (R. J.) had been ski-ing regularly for three months and was very fit, the other (E. H.) was a local resident but had not skied much and was relatively unfit. All three subjects were expert skiers.

The eosinophil counts on Channel swimmers were performed either one or two days before the swim and repeated one to three hours after leaving the water.

In the Harvard step test, counts were performed immediately before and three hours after exercise.

Results

Winter Sports.—The results of the daily observations during a winter sports holiday are presented in Fig. 1. A well-marked diurnal rhythm which was independent of physical activity is seen on rest days during the holiday and during the control periods. During the holiday there was a large fall in the eosinophil level each day after ski-ing, except on three days during the third week,

when the change was relatively small. This was associated with improved physical condition.

In general, the eosinopenia was related to the duration of exercise, the largest falls being observed on days when the subject skied for four hours. However, large falls were also observed after relatively light exercise on days when the subject was still tired after severe exercise on the previous day. On returning to England the eosinophil response to an 8-mile (13-km.) run was smaller than it had been on two other occasions before the holiday (Fig. 2).

Duration of Exercise and the Eosinophil Response.—The Table summarizes the findings in different types of strenuous physical exercise varying in duration from five minutes as in the Harvard step test* (ventilation 100 l./min., O₂ consumption 3.5 l./min.) to 12 hours, as in long-distance swimming. Results from the winter sports holiday have been included. Exercise of short duration, even when carried nearly to exhaustion, had little if any effect on the eosinophil count. Swimming, ski-ing, or running, when carried on for one or more hours, produced a large fall in eosinophils in untrained subjects, but had only a minor effect in fit subjects. On the other hand, exercise of four hours' duration caused a fall in eosinophil levels even in well-trained subjects, and very prolonged exercise as in Channel swimming was associated with virtual disappearance of the eosinophils. This was accompanied by an eightfold increase in urinary corticoid output, which has been reported elsewhere (Pace *et al.*, 1956a). The influence of training on the eosinophil response is further illustrated in Fig. 2, showing the response to an eight-mile (13-km.) run.

Discussion

It is beyond the scope of this paper to cite the very extensive literature on the circulating eosinophil cells of the blood and their relation to the functions of the adrenal glands under conditions of stress. The subject has been reviewed in all its aspects by Aschkenasy

*For description see *Metabolic Methods*, by C. F. Consolazio, R. E. Johnson, and E. Marek, 1951, p. 373. Kimpton, London.

(1957). Reference may also be made to Bayliss's (1955) review. The eosinophil count is still the only simple and quick measure of the adrenal response to stress. In a wide variety of stresses both in man and in animals the degree of eosinopenia and its duration have been found to be related to the severity and duration of the

Changes in Eosinophil Count Following Hard Physical Exercise

Subject	No. of Circulating Eosinophil Cells per c.mm.			
	Before Exercise	After Exercise	Percentage Change	
<i>5 minutes' exhausting exercise (Harvard step test)</i>				
R. M.	168	90	-47	Step test score 60
R. M.	119	94	-19	" " " 100
G. P.	402	326	-19	" " " 100
G. P.	276	212	-23	" " " 110
G. P.	328	304	-7	" " " 110
<i>1-2 hours' exercise (unfit subjects)</i>				
G. P.	103	40	-61	Ski-ing
G. P.	136	50	-63	" " "
G. P.	107	53	-53	Swimming
G. P.	116	31	-92	Running
E. H.	90	34	-62	Ski-ing
<i>1-2 hours' exercise (fit subjects)</i>				
G. P.	128	95	-26	Ski-ing
G. P.	300	281	-6	" " "
G. P.	418	311	-26	Running
R. J.	144	111	-23	Ski-ing
J. Z.	510	599	+18	Swimming
<i>4 hours' exercise (unfit subjects)</i>				
G. P.	124	27	-73	Ski-ing, first week of holiday
G. P.	155	56	-63	" " "
E. H.	90	7	-92	Ski-ing
<i>4 hours' exercise (fit subjects)</i>				
G. P.	196	76	-61	Ski-ing, third week of holiday
R. J.	102	24	-77	Ski-ing
<i>7-12 hours' exercise (well-trained subjects)</i>				
J. Z.	357	22	-94	7 hrs' swimming, Windermere
J. G.	322	3	-100	12 hrs' swimming, English Channel
D. B.	90	2	-97	12 hrs' swimming, English Channel
R. G.	685	22	-97	9 hrs. swimming, English Channel
J. G.	309	7	-98	7 hrs' swimming, English Channel
T. P.	100	3	-97	12 hrs' swimming, English Channel

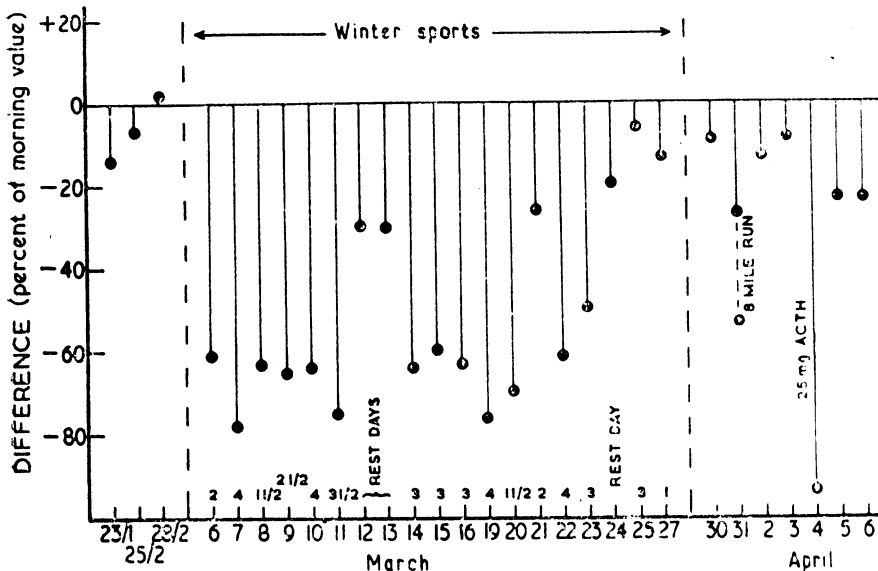


FIG. 1

FIG. 1.—Changes in eosinophil count during a winter sports holiday. Subject G. P. Each plotted point represents the difference between the morning and evening counts expressed as a percentage of the morning value. The figures represent the number of hours spent in ski-ing. FIG. 2.—Effect of training on the changes in eosinophil count following an 8-mile (13-km.) run. Subject G. P. Control without exercise on February 25. Run on February 17 when not fit. Run on February 24 after one week of training. Run on March 31 after winter sports holiday.

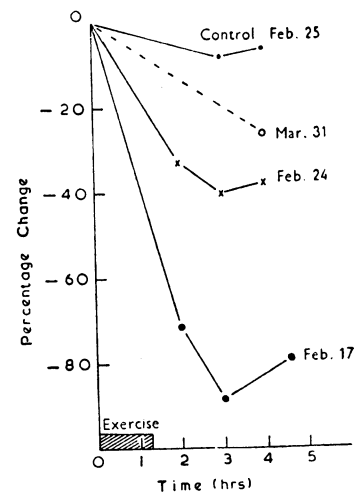


FIG. 2

stress. Stress eosinopenia is known to be caused by adrenal cortical hormones, chiefly hydrocortisone either with or without adrenaline. Noradrenaline has no action on the eosinophil cells.

The question arises whether adrenaline alone may not account for a fall in eosinophils in some stress situations, for it is now known that adrenaline acts directly on the eosinophils in man (Hunter, Bayliss, and Steinbeck, 1955) and not simply through the pituitary-adrenal-cortical system as has been demonstrated in animals. However, the available evidence suggests that conditions associated with increased secretion of adrenaline also cause an increase in the secretion of adrenal cortical hormones (von Euler and Lundberg, 1954; Bayliss, 1955; Elmadjian *et al.*, 1956; Hill *et al.*, 1956; Pace *et al.*, 1956b; Elmadjian *et al.*, 1957; Persky, 1957). Hence for practical purposes the eosinophil count can still be regarded as an index of adrenal cortical stimulation either with or without adrenaline.

The present study affords the first evidence of adrenal cortical stimulation in a holiday situation and is of special interest in view of the obvious benefit which most people seem to derive from this kind of holiday. As in many other life situations, several circumstances may have contributed to the effects observed—in this case the exhilaration of downhill running on skis, moderate changes of altitude, and occasional cold stress. However, the other observations suggest that the most important common factor was prolonged physical exertion, and that the lessened effect towards the end of the holiday was due to improved physical condition.

Studies of physical exercise by other workers have sometimes failed to reveal any major increase in adrenal cortical activity except in competitive sport, when adrenaline may have been implicated, but such studies have dealt with short-term exercise of not more than 20 minutes' duration (Domanski *et al.*, 1951; Renold *et al.*, 1951; Thorn *et al.*, 1953; Hill *et al.*, 1956). The present results, particularly those on Channel swimmers, suggest that the duration of exercise is an important factor in this respect. The results obtained on Channel swimmers, showing virtual disappearance of the blood eosinophils and an eightfold increase in urinary corticoids, were indeed comparable with those obtained in major surgery (Cope *et al.*, 1951; Thorn *et al.*, 1953).

Summary

Morning and evening eosinophil counts performed on a healthy adult over a period of six weeks during a three-weeks winter sports holiday showed a daily fall in circulating eosinophils amounting to 50–80%, according to the amount of exercise. The response diminished in the third week in association with improved physical condition. Confirmation was obtained in two other subjects.

Results are presented concerning other forms of exercise. In Channel swimming virtual disappearance of the eosinophils and an eightfold rise in urinary 17-hydroxysteroids, reported else-

where, suggest an adrenal cortical response comparable with that found in major surgery.

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OBSTRUCTION OF RESPIRATORY TRACT IN THE FLEXED FOETUS

A PRELIMINARY COMMUNICATION

BY

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It was noted in the course of anaesthetizing babies who were undergoing surgery to correct congenital defects, such as oesophageal atresia, oesophago-tracheal fistula, and duodenal atresia, that respiratory obstruction could easily take place. This difficulty occurred in spite of having an endotracheal catheter accurately in place beyond the vocal cords. On occasion this difficulty in inflating the lungs has necessitated the removal of the catheter to check its patency and position. The obstruction was beyond the vocal cords.

It was then found that the position of the baby was the important factor. If the child was flat on the operation table the respiratory obstruction might occur. Flexion of the head alone caused no trouble, but if the thoracic spine was in some degree of flexion, difficulty in inflating

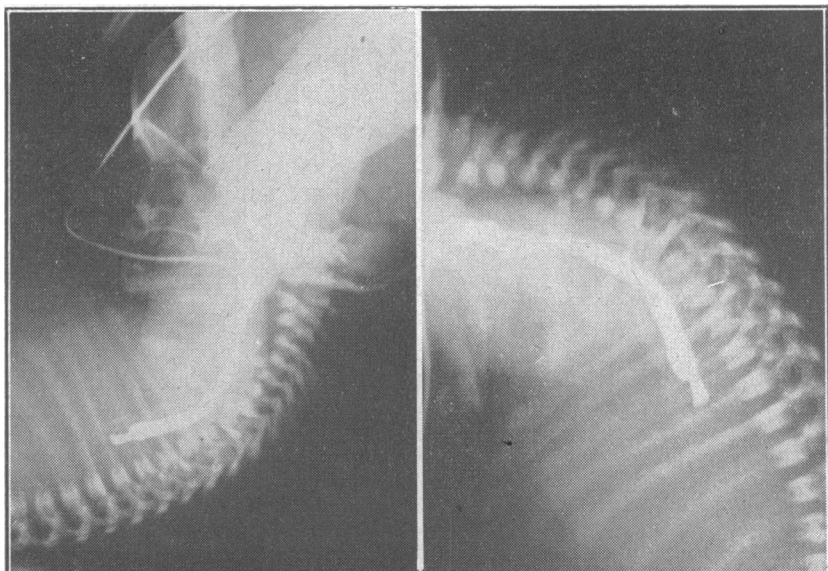


FIG. 1

FIG. 2

FIG. 1.—Radiograph taken in the intrauterine flexed position, showing lipiodol held up just beyond the tracheal bifurcation. FIG. 2.—Showing the kinked-tube appearance.