11. Effects of Adrenal Gland Constituents on the Fitness for High Altitude.

Preliminary report.

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Introduction.

Dr. S. Kawashima and his co-workers studied various Japanese aviation foods for years past and reported that a certain kind of nutritive factors would be specially effective in promoting the fitness for high altitude. The present author has recently become interested in the study of the nutritive significance of adrenal gland constituents.

In 1937 Giragossintz and Sundstroem¹⁾ studied the functional alteration in rats under the low pressure conditions and observed the symptoms very similar to those that in adrenalectomized animals.

In 1938 Armstrong and Heim²⁾ reported the same findings in rabbits exposed to 379 mm pressure (18,000 feet altitude) for 4 hours daily.

Further, concerning the studies on a deficiency of cortico-adrenal secretion, it is also well known that cases suffering from Addison's disease are quite similar to those of cortico-adrenal insufficiency and the typical symptoms of it are asthenia, lassitude, lethargy, headache, debility, fatigue, and nervous irritability. As it is true that chronic altitude sickness may develop the similar symptoms as mentioned above, the following experiment was attempted to use adrenal gland constituents as nutritional factors for aviation food.

Experimental.

The experiment was carried out by feeding animals fed on diets containing some definite amounts of adrenal gland and then testing the time of survival at experimental high altitude. On carrying out this experiment, diets were prepared by mixing 10 g of basal ration in 20 cc of water with 2 g of gland tissue.

Composition of basal diet:

unhulled rice powder	50%
Wheat flour	25 „
Pure casein	15 „
Ebios	2 „
Soy bean oil	4 „
McCollum's salt mixture	2 „
Cod-liver oil	2 „

1), 2). Harry G. Armstrong: Principles and Practice of Aviation Medicine p. 286 (1939).

Diet I was prepared by adding to the basal diet dry gland tissue obtained by treating with methanol and evaporating at low temperature.

Diet II was prepared by adding fresh gland tissue preserved in acetone which was removed at low temperature.

Diet III was prepared by adding air dry gland tissue.

Diet IV—control.

Animal experiment :

Mice previously fed on the basal diet described above were divided into four groups, each consisting of five animals, and then were fed on various experimental diets (I—IV). After a certain period of feeding, animals were exposed to low pressure, and the time of survival at the altitude of 9–10 kilometers was estimated by observing the exposure period necessary to produce death. The results are shown in the following table.

Period treated with the experimental diet	Altitude	Diet No.	Body weight av. of animals	Temperature of room	Time spent in reaching the altitude	The exposure period necessary to produce death	Time of survival at the altitude
1 day	10 kilo-meters	I	14.4 g	28° C	150 sec.	238 sec.	88 sec.
"	"	I	14.2	"	"	225	75
"	"	II	13.4	"	"	238	88
"	"	II	15.0	"	"	330	180
"	"	III	14.4	"	"	236	86
"	"	III	13.6	"	"	346	196
"	"	IV	14.6	"	"	206	56
"	"	IV	13.8	"	"	208	58
5 days	"	I	14.4	26° C	"	262	112
"	"	II	14.8	"	"	568	418
"	"	III	14.6	"	"	260	110
"	"	IV	14.0	"	"	240	90
"	9 kilo-meters	I	16.3	28° C	"	508	358
"	"	I	14.3	"	"	515	365
"	"	II	14.3	"	"	690	540
"	"	II	13.0	"	"	980	830
"	"	III	15.0	"	"	570	420
"	"	III	15.0	"	"	480	330
"	"	IV	12.5	"	"	310	160
"	"	IV	14.0	"	"	380	230

From the experimental data, it has been ascertained that fresh adrenal gland constituents may be effective in promoting the fitness at high altitude.

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