THE EFFECT OF STIMULATION OF THE MECHANO-AND CHEMORECEPTORS
OF THE ORAL CAVITY ON CARBOHYDRATE METABOLISM

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In previous communications devoted to the study of the effect of stimulation of the receptors of the oral
cavity on metabolism, the effect of the duration of stimulation on the taste receptors of the mucosa of the oral
cavity on the regulation of carbohydrate metabolism was established. It was shown that prolonged sucking (for
one hour) of 15 g of candy drops causes an intensive increase in the blood sugar and in the oxygen demand, which
continues for many hours. If the same quantity of candy drops were eaten quickly, only a transient rise in the
carbohydrate metabolism was produced [1, 2].

It is well known that in the higher animals and in man the mucous membrane of the oral cavity not only
possesses taste receptors but also contains a very complex arrangement of mechanical, chemical and temperature
receptors.

The present investigation was devoted to the further study of the influence of stimulation of the receptors
of the oral cavity on the level of the blood sugar and on the gas exchange. It appeared necessary, in the first
place, to study the influence of sucking substances of no food value on the regulation of carbohydrate metabolism
and thereby to ascertain the role of the mechanoreceptors of the oral cavity in metabolism, and in the second
place to define the conditions in which subthreshold concentrations of chemical (taste) stimuli become threshold
stimuli, perceptible to the taste and having an effect on the regulation of carbohydrate metabolism.

EXPERIMENTAL METHOD

Observations were made on 6 healthy human subjects, ages from 18 to 49 years. As a chemical (taste)
stimulus glucose was used, a 4% solution having hardly any sweet taste. The mechanical stimulus was sucking
a round glass disk, which resembled a candy drop, being 3 mm in thickness and 2 cm in diameter. The disk was
kept in the subject's mouth for 1 hour without causing any sensation of taste. For greater convenience the glucose
was poured into a burette, from which it passed through a rubber tube and a mouthpiece, to emerge into the
subject's mouth in drops, where it was gradually swallowed.

We performed several series of experiments in order to study:
1) the effect of sucking the glass disk for 1 hour on the level of the blood sugar and the gas exchange;
2) the effect of introducing 100 ml of 4% glucose solution, in drops in the course of 1 hour, into the
subject's mouth, on the level of carbohydrate metabolism;
3) the effect of administration of 100 ml of 4% glucose solution in the course of 1 hour to the subject by
mouth, with simultaneous sucking of the glass disk, on the blood sugar level and the gas exchange.
We also carried out preliminary control experiments for a period of 3 hours to investigate the blood sugar level and the gas exchange. Altogether 24 experiments were performed, and the results of each series were in agreement. All experiments were carried out in the morning, on fasting subjects, within a period of 3 hours.

The blood sugar concentration was estimated by the Hagedorn-Jensen method, before the application of any form of stimulus, and then every 15 minutes during the hour that the stimuli were in action, and subsequently after 30, 60 and 120 minutes. The gas exchange was measured by the Zuntz-Haldane method, before application of the stimuli, and then over periods of 10 minutes every 30 minutes throughout the period of the observations.

EXPERIMENTAL RESULTS

The results of the control experiments, carried out in the absence of any form of stimulus, showed (see Figure) that both the blood sugar and the gas exchange remained practically unchanged during the 3 hours of the experiment.

The study of the effect of sucking the glass disk on the blood sugar level and the gas exchange showed that if the disk was sucked for a long time it caused a gradual fall in the blood sugar level, which varied only very slightly from the fluctuations of the blood sugar level in the control experiments (see Figure, a). At the same