

Objective Evaluation of Hedonic Tone of Food and Drink Using fNIRS

Measuring consumer cerebral function in the food industry

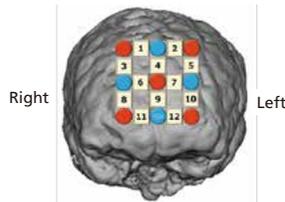
Data provided by Kio University

Key Points

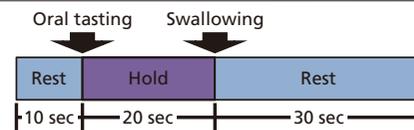
- (1) When subjects tasted sweet and bitter solutions without any instructions, oxygenated hemoglobin (oxyHb) levels in the prefrontal cortex greatly varied among the subjects and no consistent results were obtained.
 - (2) The oxyHb levels decreased and increased in the case of preferred and disliked taste, respectively.
 - (3) When the subjects tasted four different flavors, the oxyHb was negatively correlated with the pleasantness scores.
- The study findings suggest that fNIRS is a useful technique for objectively evaluating hedonic tone of food and drink.

Regions of Measurement

- No. of subjects: 8
- Measured region: Frontal pole 3 x 3 (12-channel)
- Sampling cycle: 12 Hz



Task



The subjects were measured in a block design in which they rested for 10 sec and then placed each of 4 types (no flavor, sucrose, fresh cream, sucrose + fresh cream) of jelly (about 5g) in the mouth for 20 sec, swallowed them, and rested for 30 sec. During the fNIRS measurement, the subjects drew a time-pleasantness curve with a pen on a sheet of paper, allowing them to concentrate on pleasantness evaluation. After each trial, the subjects marked a point on a visual analogue scale as a pleasantness score.

Data

The pleasantness scores range from -10 for the most unpleasant to +10 for the most pleasant. The scores of the 4 types of jellies were sucrose + fresh cream (5.1), sucrose (3.6), fresh cream (-2.5), and no flavor (-4.8). The oxy-Hb decreased in the task of the jellies containing both sucrose and fresh cream and increased in the no flavor (Fig. 1). The correlation coefficients had a strong negative correlation with the mean z-scores for oxyHb for each jelly flavor at 15 sec after swallowing the jelly in 8 subjects, with oxyHb decreasing in response to pleasant taste and increasing to unpleasant (Fig. 2). The correlation coefficients greatly varied among the subjects in channels 1 to 5 on the dorsal side of the frontal pole. The negative correlation was stable in channels 8 to 12 on the ventral side, and the highest negative correlation was obtained in channel 12 (Fig. 3). These results suggest that measurement of the oxyHb in the prefrontal cortex using fNIRS can be useful for objective evaluation of pleasantness of food and drink in addition to subjective evaluation.

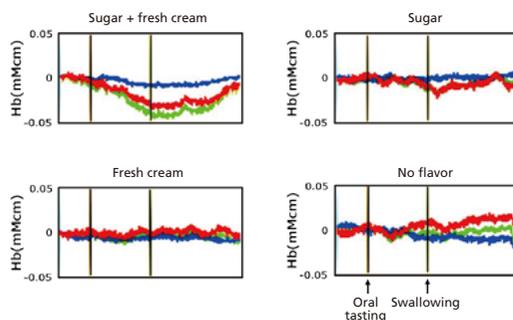


Fig. 1 fNIRS signals for four jelly flavors
Red: oxyHb, Blue: deoxyHb, Green: totalHb

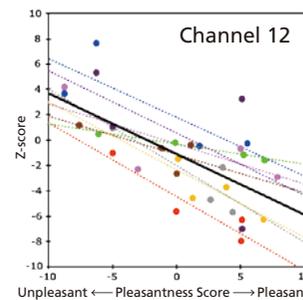


Fig. 2 Correlation between pleasantness scores and z-scores for four differently flavored jellies in eight subjects at channel 12

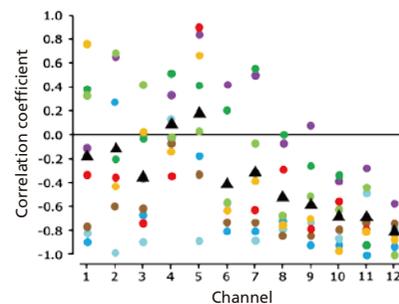
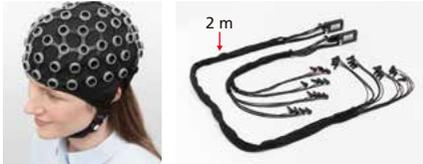


Fig. 3 Correlation coefficients between the pleasantness scores and the mean z-scores for the oxyHb levels (▲ denote mean value of each channel.)

The study data was obtained using the following compact, portable system configuration.

Product name	Product No.	Appearance
LIGHTNIRS™ main unit	S292-34000-41	 <p>LIGHTNIRS 8-set 22 channels</p>
Type A holder 2 m dedicated LIGHTNIRS optic fiber cables (8 sets)	S292-34006-41 S567-11350-02	

LIGHTNIRS >

Scalable system configurations supporting a wide range of research applications are also available. The system configuration can be scaled from 4 up to 40 sets.

Product name	Product No.	Appearance
LABNIRS main unit (4 sets) L-type optic fiber cable (4 sets) 3 modules (+12 sets) L-type optic fiber cable (+12 sets)	S551-08601-01 S567-10288-01 S567-10286-13 S567-10288-13	 <p>LABNIRS 16-set, 52 channels (L-type optic fiber cable)</p>
Forehead holders (3 × 9)	S594 -07600-01	

The following options are recommended:

3D positional measurement system	S567-10401-01	
MRI image overlay software	S567-10391-01	

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