Enzyme Breaking Protein

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This research is to find out how to eat delicious chicken.Therefore, we conducted a survey about soft meat. We made delicious chicken recipies people may eat more. In measuring the softness of the meat, we created a model of the human mouth and quantified the softness of the meat. There was no big difference between our subjective evaluation and the results of the model. In conclusion, eating chicken is strongly connected with our health. Therefore, delicious chicken helps the earth! We hope our research will be able to contribute to our school society in our future

Background and hypothesis

We want to make meat softer because we eat it everyday. If we do it, elderly people could eat meat easily.

From previous research, we know that vegetables and fruits have proteolytic enzymes which can break protein. Therefore, meat becomes softer. And it also says that pineapple has the most enzymes.

Therefore we make such vegetables and fruits into juice and put it on meat. We expect meat to become softer.

Experiment 1

There are many ways to tenderize meat. However, we use proteolytic enzymes that break down proteins to tenderize the meat. Therefore, it has the ability to break down proteins and is found in some foods. For example, melons, pineapples, kiwis, and maitake mushrooms. First, we researched taste byus and measure the softness.

We prepared five kinds of sources. They are onion, apple, kiwi, pineapple and maitake paste. We use an oven because we want to bake them at an equal temperature.

1）Cut chicken breast into bite-sized pieces with a thickness of 1 cm
2）Food process for each prepared sample
Mix with a sir until liquid
3）Soak 2 pieces of chicken breast for 20 minutes
4）Bake in an oven preheated to 200 degrees for 10 minutes.

Experiments were conducted based on this method.

fig.1 kinds of juice

Result of Experiment 1

After the survey, We made this table. Look at the Table1. The control means the meat which was not marinated in any juice. We felt the taste of maitake mushrooms and onions were very good.

The hardest one was the control. Therefore, we thought that the others were worked by enzymes.

Next, the softness of kiwifruits and pineapples are very good. The kiwi had a crumpled texture, and the pineapple had a soft texture and a melting texture, but they were not delicious.

Table 1:Results of softness and taste in protein breaking enzymes on baked chicken

	the result of Experiment 1		the result of Experiment 2
	taste	softness	(N)
control			19.3
apple	a little sweet	a little soft	14.9
maitake mushroom	good	a little hard	13.4
onion	good	a little soft	13.2
kiwifruit	sweet	soft	11.4
pineapple	sweet	soft	8.5

It was found that when vegetables were used, the taste becomes Japanese-style, and when fruits are used, the taste becomes Western-style.

Experiment 2

The reason why we used this Experiment 2 is because the evaluation method of Experiment 1 causes individual differences, and we could not evaluate the difference in softness of each ingredient, which was our goal. In this experiment, we created a mechanism using a hole punch and a tooth model, and evaluated softness using a microcomputer board called “Arduino nano”. The device measures biting force of the target meat, and uses Newton as the unit. The force is measured through a digital load cell located under the lower jaw, and when the upper jaw tooth presses the switch located on the back left tooth of the lower jaw, it is considered to have been bitten and the result is fixed. We evaluate that number as softness. If it is softer meat, less force is required to bite it

Method

The model of the teeth used in this device was made from actual teeth that were scanned and printed using a 3D printer. The upper jaw is fixed to the top of the hole punch with a screw, and the lower jaw is positioned to fit it. The lower jaw is directly fastened to the digital load cell. Therefore the force is not distributed as much as possible. The switch on the back left tooth of the lower jaw uses a thin-film precision pressure sensor, and when the tooth of the upper jaw touches it, the figure is determined. The measured figures are constantly displayed on a small display, and the fixed figures remain displayed for ten seconds. This makes it easier to collect data.

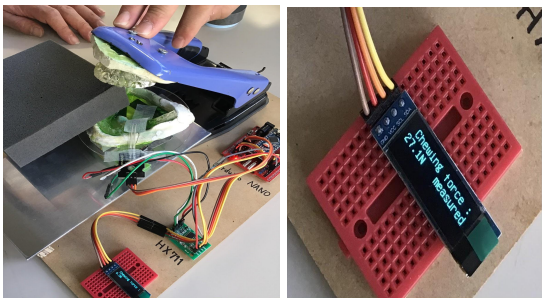

fig.2 Photograph of the bite force
On the left, a sponge is being chewed into the device. On the right is a small display at the bottom right of the device showing the actual figures.

The script of Arduino nano used for this device is shown in fig.3.

```
#include "HX711.h"

#define DOUT  3
 #define CLK   2

HX711 scale;

void setup() {

Serial.begin(57600);
scale.begin (DOUT, CLK);
scale .begin (FOURTH, CLK) +id loop () {

scale.set scale ();
Serial.println(scale.get_units ());

}
```

fig.3 Script
HX711 is the Arduino nano used in this project.

Results and discussion of Experiment 2

The results of the experiment 2 in the table are the average of 25 times data for all the products. This shows that pineapple has the highest amount of proteolytic enzymes, as in the previous study and Experiment 1. However, there are some differences between the results of Experiment 1 and the number of Experiment 2. This can be considered to be related to the dispersion of the figures generated by this device, which will be discussed later. In addition, we did not consider it in this experiment, but there is a probability to change the texture by the type of proteolytic enzyme used.

In order to measure the accuracy of this device, we collect this data. (fig.4)

20.8	23.9	23.4	20.1	28.9
20.2	19.0	22.4	20.9	19.8
21.6	19.9	26.8	17.2	18.6
20.5	18.6	19.4	21.7	19.0
19.3	17.9	25.9	19.2	21.7
		variance		2.63
		standard deviation		1.62

fig.4 Accuracy of the device
Here, we measured the softness of the same sponge 25 times with the same device as in the experiment, and calculated the variance and standard deviation.

The data collected by the device did not have a large variance, but there were several times when the figures became large. Since the number of trials in this experiment was only twenty-five, it is possible that this fluctuation in figures affected the results.

Futurework

We want to remake the machine because there are some points we have to

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