Data Collection Framework on Menus satisfying both Preferences and Nutritional Balance

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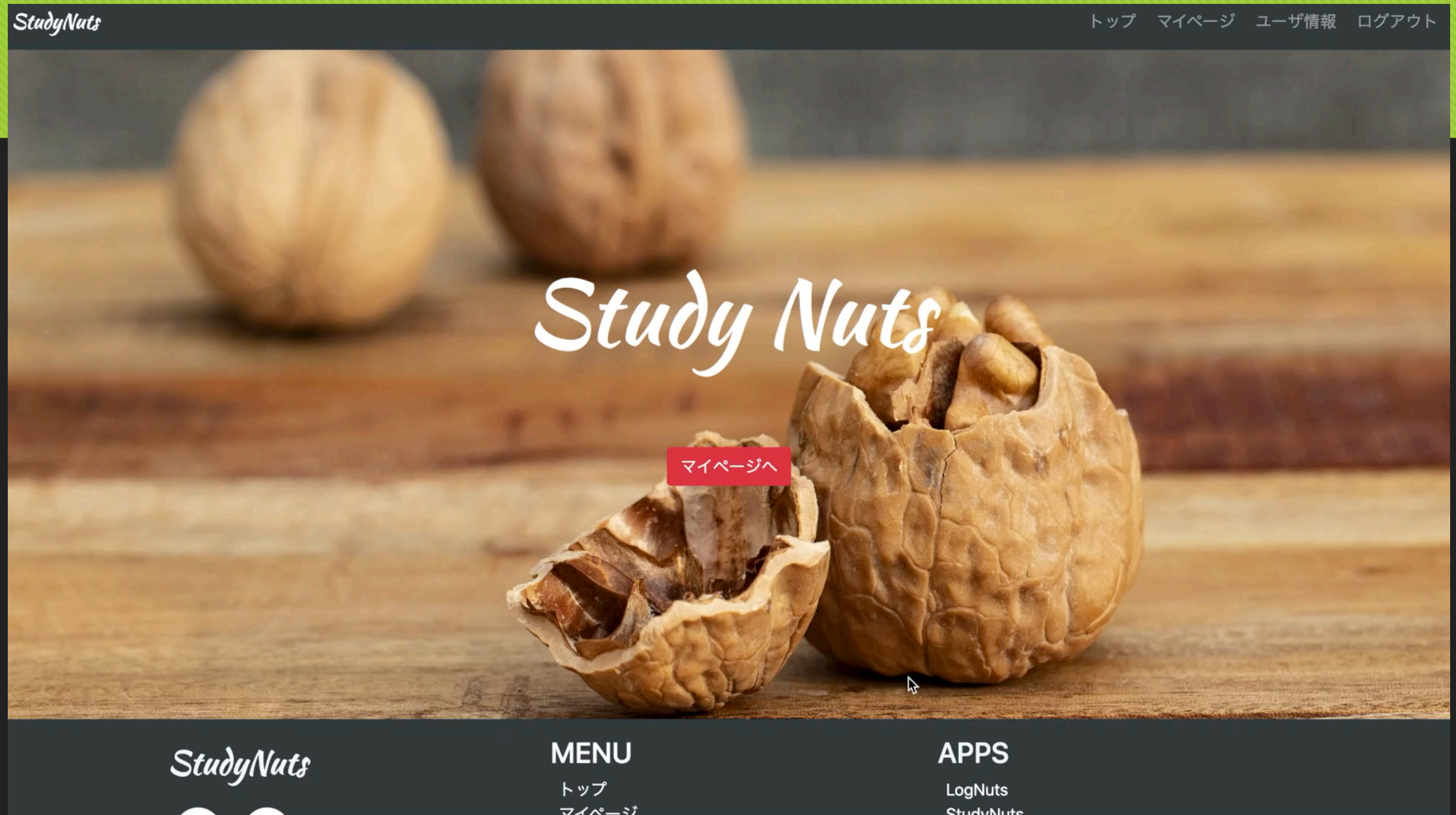
Recommendation on menus is required for healthy life.

- People often utilize meals-out →
- Meals with nutritional balanced should be taken.
- However, **people often refuse menus with nutritional balanced** even if recommended [Ohata et. al. 2019]. Because **their preferences** on food are rarely considered.
- If data on menus is obtained, **which satisfies both preferences and nutritional balance**, menu recommendation will be suitable for them.
- A new framework to collect such data is required.

Objective of this research

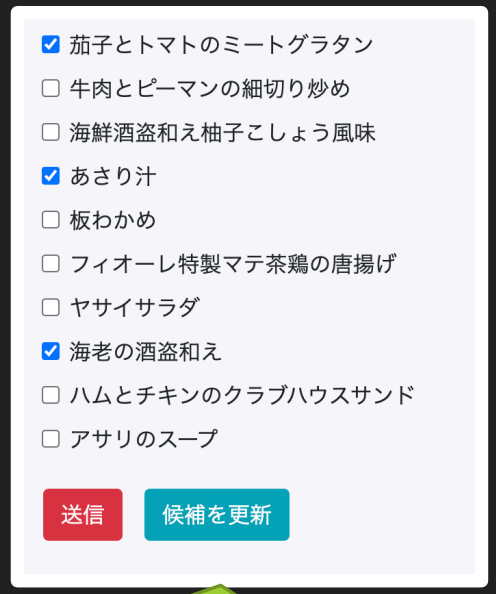
- **We propose a data collection framework on meals out menus that satisfy both preferences and nutritional balance.**
- Most of studies consider people's preferences and recommend recipes of meals. They need to cook them before eating. It is bothering.
- We try to recommend meals out menus satisfying both preferences and nutritional balance.

Demonstration of the proposed framework



Outline of the proposed framework

Menu Input → Nutritional balance evaluation → Menu collection database → Feedback output



choose less than 3 meals to make up a menu considering his preference

if a menu is well-balanced, the menu is stored as that satisfies both preferences and nutritonal balance.

a feedback for the evaluation is given

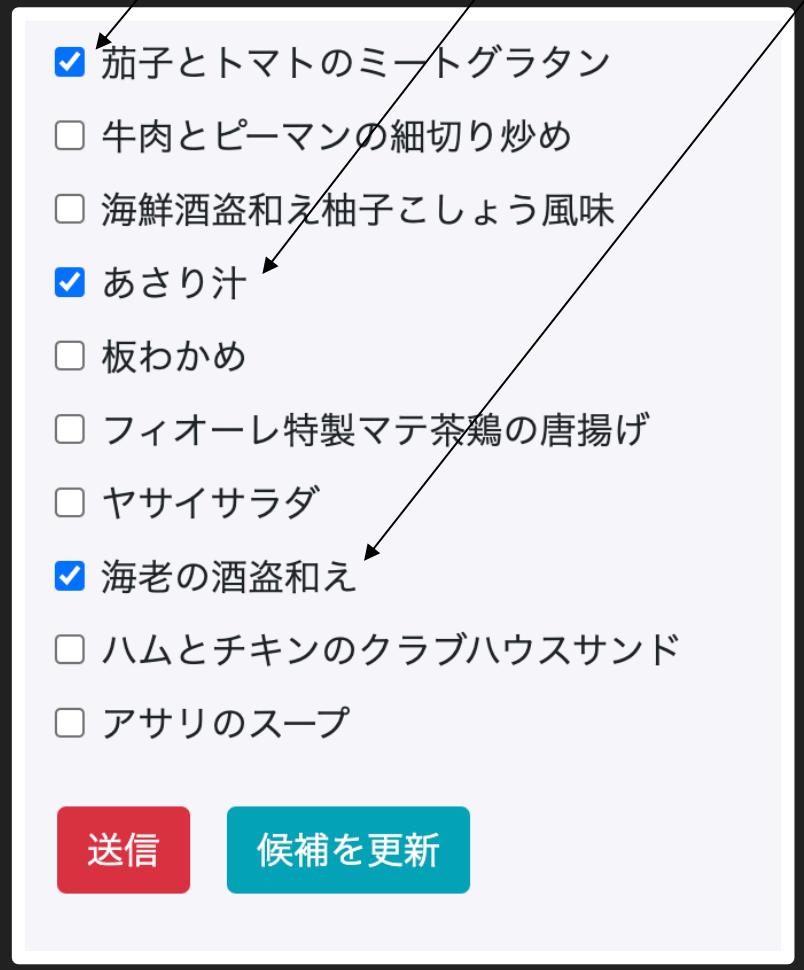
Menu Input by a user

- The framework shows 10 meals chosen randomly from a database.
- A user input a menu by choosing less than three meals.
- The framework asks the user to consider his/her preferences and nutritional balance in making a menu.

(1) Meat Gratin with Eggplant and Tomato

(2) Miso soup with clams

(3) Shrimp with satoimo



(1)

(2)

(3)

Evaluation of the input menu

- The differences of nutritions are evaluated by referring intake ratio targets.
  - Protein, Fat, and Carbohydrate

intake ratio targets
(given by Ministry of Health, Labour, and Welfare)

Nutrition	Lowest limit (%)	Highest limit(%)
Protein	13	20
Fat	20	30
Carbohydrate	50	65

compared

nutritions in the input menu

Nutrition	ratio (%)	difference	
Protein	8	5	P_diff
Fat	39	9	F_diff
Carbohydrate	53	0	C_diff

PFC_diff = P_diff + F_diff + C_diff
PFC_score = normalized(PFC_diff) ← evaluation result

Menu collection database

- The menus with a high PFC_Score are stored in a menu collection database.
- The menus satisfy both preferences and nutritional balance.

Menu	Score
Sashimi of Japanese yam cake Homemade roast beef bowl Low-sugar curry and rice	99
Sarada of homemade half-curdled tofu and whitebait simply scalded Sashimi of avocado Bowl of rice with beef	82
Fried eggplant and chorizo with olive oil Fried pork and Korean pickles Udon noodle on a steaming basket	73
Fried small potato Fried cod ovum Bowl of rice and charcoal-grilled beef	86
Tomato and octopus with garlic Japanese noodle with vegetables Pizza of uncured ham and vegetables	100

Feedback as evaluation result of the menu

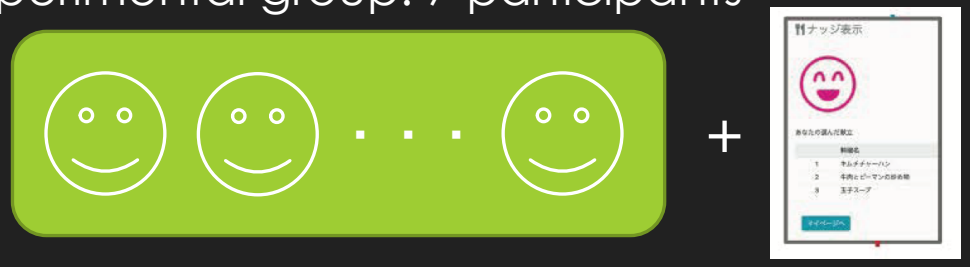
0 <= PFC_score <= 40	40 < PFC_score < 90	90 <= PFC_score <=100
	 PFC_score decreases less than MA. MA is moving average for the last 5 times.	
		
	 PFC_score increases more than MA.	

The proposed framework gives a facemark as a feedback of relative evaluation result.
If a borderline of success or failuer is fixed, users' willingness will be decreased [Tagawa et. al., 2012].

Evaluation experiments

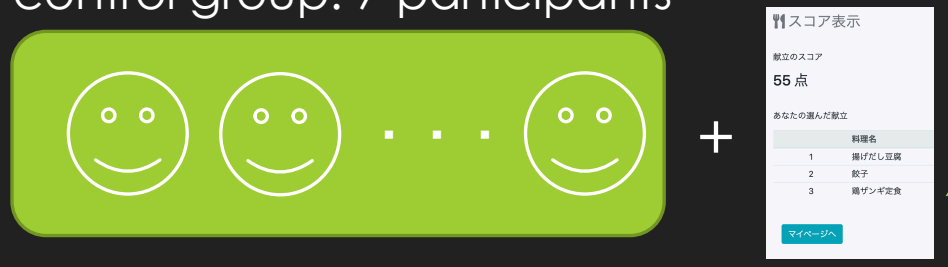
- Procedures:
  - 1. Participants answer questionnaires about awareness of dietary habits.
  - 2. They are divided into two groups based on the questionnaire results.
  - 3. They make menus by using a framework more than 5 times a day.
    - 14 days and more than 70 menus.

experimental group: 7 participants



proposed framework: relative evaluation

control group: 7 participants



comparative framework: absolute evaluation

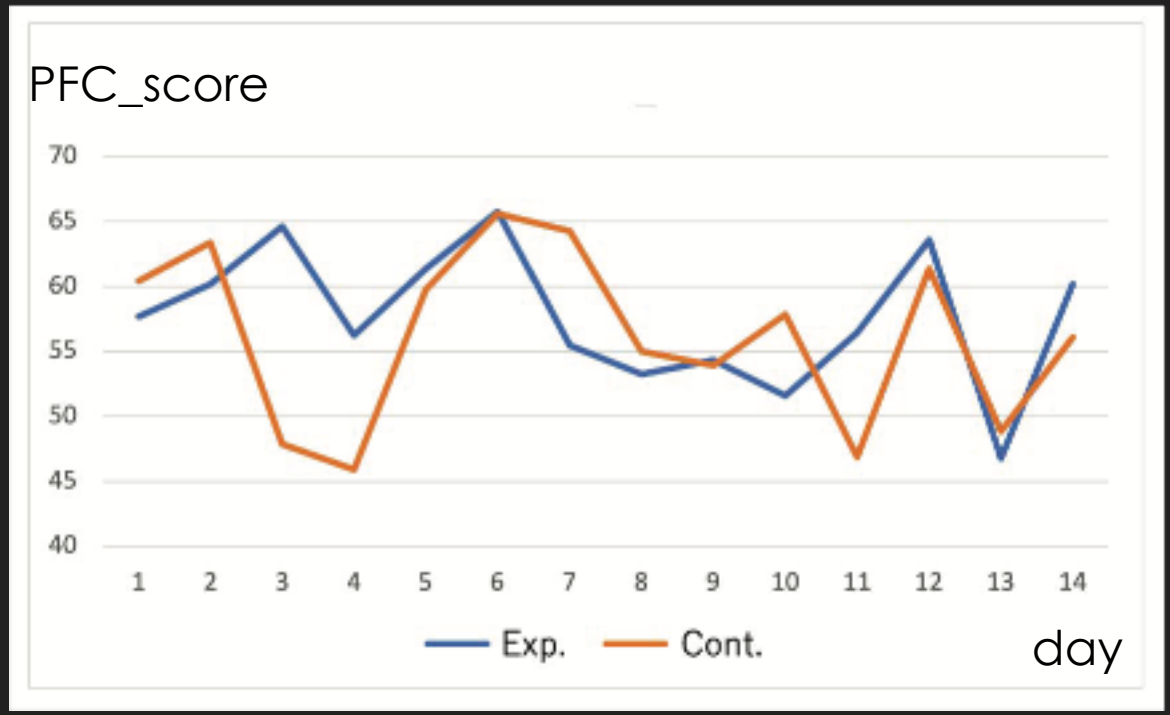
Experimental results

Group	1st day	14th day	increase
Experimental	57.6	60.1	+2.5
Control	60.4	56.1	-4.3

- The increase of PFC_score between 1st day and 14th day was evaluated.
- That of the experimental group was +2.5 while that of the control group was -4.3. (no siginificant difference)
- The results indicated that the proposed framework could not support participants to learn menus with nutritional balanced.

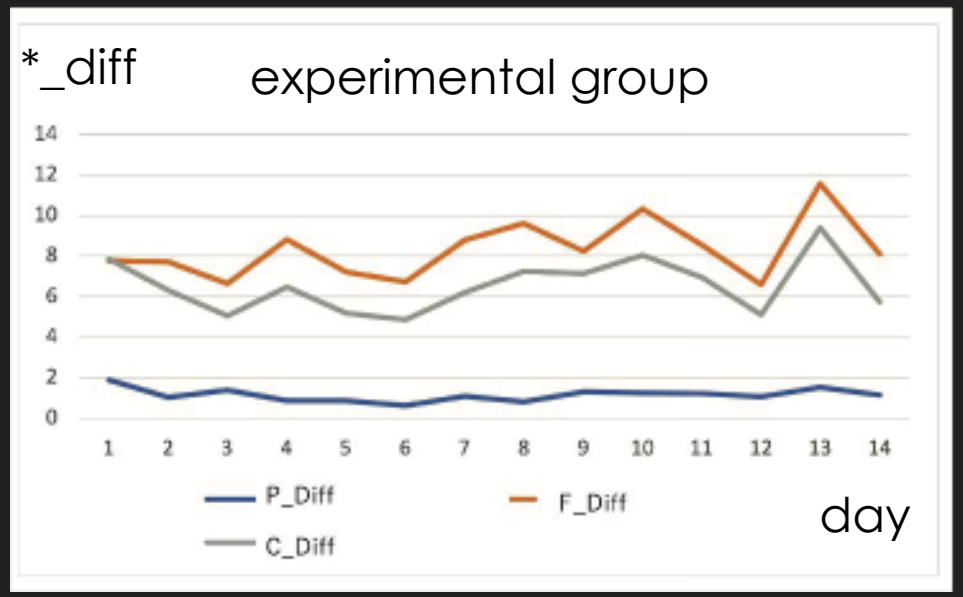
Discussion: Transition of PFC_score

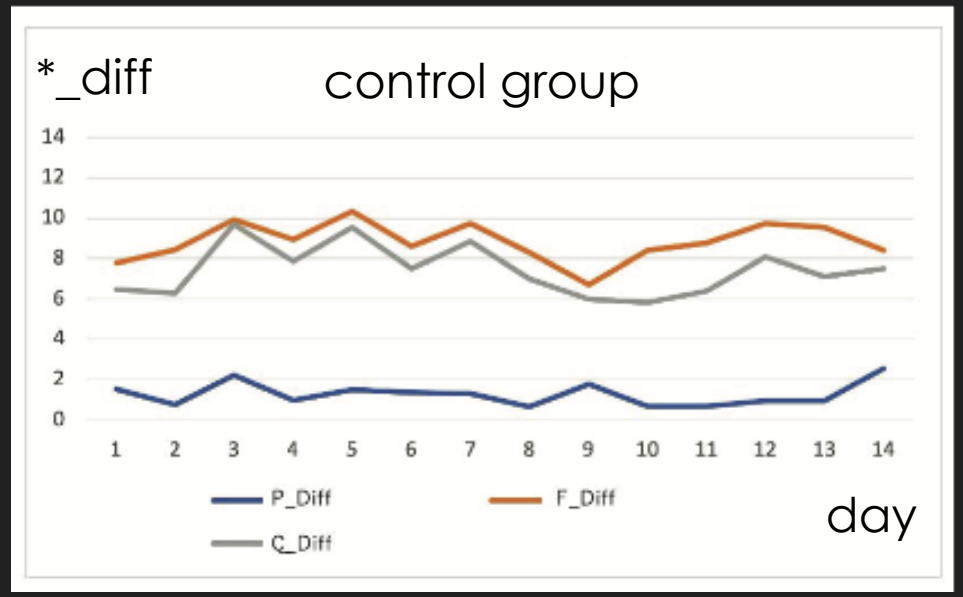
- If they learn well about nutritional balance, they can mark high scores from 1st to the last day.
- However, they did not learn well it because the up-and-down movements of PFC_score were made between the experimental period.



Discussion: transition of nutritional balance

- The differences of Carbohydrate and Fat were more significant than that of Protein.
- They may felt difficulty in adjusting C and F in making menus with nutritional balance. The intake ratio targets may be far from people's eating habits.





Conclusions and future works

- This paper proposed a data collection framework on meals out menus satisfying both preferences and nutritional balance.
- Experimental results showed that:
  - We could collect meals out menus satisfying both.
  - The participants might feel difficulty in adjusing Carbohydrate and Fat in making menus.
- We would extend the time of the experiments to figure out trends on the transitions.
- We would cooperate with restaurants and fast food suppliers to think up menus with both satisfied by using the framework and database.

Database of resutaurant menus

- We collected menu data on the Web to make a database.
  - The menus are restaurants' that located in close to our university campus.
- We filled in the nutritonal information on menus by using data on a Web site ``Calorie Slism."
- The Web site has information on the amount of energy, protein, fat, and carbohydrates of the menus.
  - Energy: kcal, Protein: gram, Fat: gram, Carbohydrate: gram

Example of information in database

Menu title	Energy) (kcal)	P (g)	F (g)	C (g)
Prosciutto and Shibazuke Salad	160.5	5.8	6.2	11.2
Assorted cured ham and salami	204.0	8.1	5.2	14.3
Marinated Hiroshima Oyster with Lemon Cream Sauce	263.5	7.7	4.0	14.0
Marinated mushrooms with toast	231.5	8.9	12.1	23.3
Roast beef salad with shiso leaves	117.0	3.5	7.3	8.2