

Assignment #2

INFO 6540 Data Management

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Kimchi Ontology

Introduction

Kimchi is a fermented vegetable food. As more people are becoming interested in kimchi internationally including Canada, it is useful to know what kimchi contains and provides in terms of health.

This ontology focuses on introducing some of the popular kimchi, its health benefits, nutritional values, microorganisms, and its basic ingredients.

1. Concepts

- Kimchi
- Kimchi Health Benefits
- Kimchi Nutritional Values
- Kimchi Microorganisms
- Kimchi Seasoning
- Kimchi Vegetables
- Kimchi Origin Country

2. Object Properties

- **hasCountryOfOrigin**

This property describes the relations of kimchi and Korea: kimchi is from Korea.

Inverse Property: isOriginCountryOf

Characteristic of Property: Functional, Inverse Functional

Domain: Kimchi

Range: Country

Triples: Kimchi hasCountryOfOrigin Korea.

Inverse: Korea isOriginCountryOf kimchi.

- **hasHealthBenefit**

This property relates kimchi to the health benefits it provides.

Inverse Property: isHealthBenefitOf
Characteristic of Property: Anti-symmetric
Domain: Kimchi
Range: HealthBenefit

Triples: Kimchi has some health benefits.

Kimchi hasHealthBenefit anticancer.

Kimchi hasHealthBenefit antiaging effect.

Kimchi hasHealthBenefit immune-stimulatory effect.

Kimchi hasHealthBenefit antioxidative effect.

Kimchi hasHealthBenefit antidiabetic effect.

Kimchi hasHealthBenefit antiobesity effect.

Inverse triples

Anticancer isHealthBenefitOf kimchi.

Antiaging effect isHealthBenefit of kimchi.

Immune-stimulatory effect isHealthBenefitOf kimchi.

Antioxidative effect isHealthBenefitOf kimchi.

Antidiabetic effect isHealthBenefitOf kimchi.

Antiobesity effect isHealthBenefitOf kimchi.

- **hasNutritionalValue**

This property relates kimchi to the nutritional values it contains.

Inverse Property: isNutritionalValueOf

Characteristic of Property: Anti-symmetric

Domain: Kimchi

Range: NutritionalValue

Triples: Kimchi has some nutritional values.

Kimchi hasNutritionalValue vitamins

Kimchi hasNutritionalValue dietary mineral.

Inverse: Vitamin isNutritionalValueOf kimchi.

Dietary mineral isNutritionalValueOf kimchi.

- **hasMicroorganism**

This property relates kimchi to the microorganisms it has.

Inverse Property: isMicroorganismOf

Characteristic of Property: Anti-symmetric

Domain: Kimchi

Range: Microorganism

Triples: Kimchi has some microorganisms.

Kimchi hasMicroorganism Lactic Acid Bacteria.

Kimchi hasMicroorganism Lactobacillus Plantarum.

Kimchi hasMicroorganism Leuconostoc Citrum.

Kimchi hasMicroorganism Leuconostoc Inhae.

Kimchi hasMicroorganism Leuconostoc Gasicomitatum.

Kimchi hasMicroorganism Weissella Koreensis.

Kimchi hasMicroorganism Lactobacillus Sakei.

Inverse:

Lactic Acid Bacteria isMicroorganismOf kimchi.

Lactobacillus Plantarum isMicroorganismOf kimchi.

Leuconostoc Citrum. isMicroorganismOf kimchi.

Leuconostoc Inhae isMicroorganismOf kimchi.

Leuconostoc Gasicomitatum isMicroorganismOf kimchi.

Weissella Koreensis isMicroorganismOf kimchi.

Lactobacillus Sakei isMicroorganismOf kimchi.

- **hasIngredient**

This property relates kimchi to the ingredients it contains.

Inverse Property: isIngredientOf

Characteristic of Property: Transitive

Sub-Property: hasVegetable, hasKimchiSeasoning

Triple: FermentedVegetableFood hasIngredient kimchi seasoning.

Kimchi seasoning hasIngredient spice.

- **hasVegetable**

This property relates kimchi to the vegetables that are used for it.

Inverse Property: isVegetableOf

Characteristic of Property: Anti-symmetric

Domain: Kimchi

Range: Vegetable

Triple: Kimchi has some vegetables.

Kimchi hasVegetable chinese cabbage.

Kimchi hasVegetable korean radish.

Kimchi hasVegetable mustard greens.

Kimchi hasVegetable cucumber.

Kimchi hasVegetable green onion.

Kimchi hasVegetable onion.

Inverse: Chinese cabbage isVegetableOf kimchi.

Korean radish isVegetableOf kimchi.

Mustard green isVegetableOf kimchi.

Cucumber isVegetableOf kimchi.

Green onion isVegetableOf kimchi.

Onion isVegetableOf kimchi.

- **hasSeasoning**

This property relates kimchi to the seasoning used for it.

Inverse Property: isSeasoningOf

Characteristic of Property: Anti-symmetric

Domain: Kimchi

Range: KimchiSeasoning

Triple: Kimchi has some kimchi seasoning.

Kimchi hasSeasoning spice.

Kimchi hasSeasoning garlic.

Kimchi hasSeasoning ginger.

Kimchi hasSeasoning seafood.

Kimchi hasSeasoning anchovy.

Kimchi hasSeasoning salted baby shrimp.

Inverse: Garlic isSeasoningOf kimchi.

Ginger isSeasoningOf kimchi.

Anchovy isSeasoningOf kimchi.

Salted baby shrimp isSeasoningOf kimchi.

- **hasFermentationFood**

This property relates FermentedVegetableFood to kimchi,
and kimchi has baechu kimchi as fermentation food.

Inverse Property: isFermentedFoodOf

Characteristic of Property: Transitive, inverse transitive

Domain: FermentedVegetableFood

Range: Kimchi

Triple: Fermented vegetable food hasFermentationFood kimchi.

Kimchi hasFermentationFood baechu kimchi.

Inverse: Kimchi isFermentedFoodOf fermented vegetable food.

Baechu Kimchi isFermentedFoodOf Kimchi.

3. Property Hierarchy

hasIngredient

hasSeasoning

hasVegetable

4. Property Restrictions

Restriction----Anonymous Class

As anonymous class, kimchi class has relationships, based on several “object properties”, to some individuals such as health benefits, nutritional value, microorganism, kimchi seasoning, and country. Those are restricted to kimchi’s subclasses such as baechu kimchi, cucumber kimchi, dongchimi kimchi, etc.

Restrictions –Existential, Universal

Class: Kimchi

Property: hasVegetable

- Baechu Kimchi: used “Existential Restriction”
Baechu kimchi has some vegetables of Chinese cabbage, green onion, and onion.
- Kkakdugi: used “Existential Restriction”
Kkakdugi kimchi has some vegetables of chosunmoo and green onion.
- Nabak Kimchi: used “Existential Restriction” and “Universal Restriction”
Nabak Kimchi has some vegetables of chosunmoo and Chinese cabbage. It only has vegetables of chosunmoo and Chinese cabbage.
- Yeolmu Kimchi: used “Existential Restriction”
Yeolmu Kimchi has some vegetables of yeolmu and green onion.
- Oisobagi Kimchi: used “Existential Restriction” and “Universal Restriction”
Oisobagi kimchi has some vegetables such as cucumber and green onion. This kimchi only has vegetables of cucumber and green onion.
- Gat Kimchi: used “Existential Restriction” and “Universal Restriction”
Gat kimchi has vegetables of mustard green and onion. It only has vegetables of mustard green and onion.
- Chonggak Kimchi: used “Existential Restriction”
Chonggak Kimchi has some vegetables of chonggakmoo and green onion.
- Dongchimi Kimchi: used “Existential Restrictions”

Dongchimi Kimchi has some vegetables of chosunmoo and green onion.

Restriction-hasValue

Class: Country

Property: hasCountryofOrigin

Created an individual "Korea" of class "Country" to restrict the hasCountryOfOrigin property to specific individual Korea. In OWL, Kimchi hasCountryofOrigin value Korea (see class kimchi description).

Classes (for more subclasses, see OWL file)

Thing

Fermented vegetable

"Fermented vegetables are believed to have a positive impact on health. Kimchi and sauerkraut are probably the most popular fermented vegetable when these come to purported health beneficial properties."

Kimchi

"Kimchi is Korea's representative ethnic food and unique food, without anything similar in other countries. Kimchi is made by fermenting Chinese cabbage or radish with lactic acid bacteria and there are about 200 types of kimchi in Korea."

- Baechu Kimchi
Baechu kimchi is made of Chinese cabbage, green onion, and onion.
- Kkakdugi Kimchi
Kkakdugi kimchi is made of chosunmoo and green onion. To make this kimchi, dice chosunmoo.
- Nabak_Kimchi
Nabak Kimchi is made of sliced chosunmoo and cabbage. It only has vegetables of chosunmoo and cabbage.
- Yeolmu Kimchi
Yeolmu Kimchi is made of Korean yeolmoo and green onion.
- Oisobagi Kimchi
Oisobagi kimchi is made of cucumber and green onion. This kimchi only has vegetables of cucumber and green onion.

- Gat Kimchi
Mustard kimchi is made of mustard green and onion. It only has vegetables of mustard green and onion.
- ChongGak Kimchi
Chonggak Kimchi is made of chonggakmoo and green onion. Its whole daikon including leaves is used.
- Dongchimi Kimchi
Donchimi is a water kimchi made of chosunmoo and green onion.

Health Benefit

Health Benefit is "a helpful or good effect, or something intended to help the condition of the body and the degree to which it is free from illness, or the state of being well."

- Antiaging Effect
"The effect of kimchi intake on antiaging characteristics, free radical production, and antioxidative enzyme activities in the brains of senescence-accelerated mice has also been evaluated. Kimchi consumption moderated the increase in free radical production due to aging."
- Anticancer
"Kimchi exhibited antimutagenicity against aflatoxin B1 and N-methyl-Nnitro-N-nitrosoguanidine (MNNG) in the Ames test and in the SOS chromotest in vitro. b-sitosterol and a linoleic acid derivative were the main active compounds that showed anticancer activity in kimchi."
- Immune-stimulatory Effect
"The cell wall fraction of *Lab. plantarum* from kimchi activated the phagocytic activity of macrophages in mice. Administration of a culture broth of *Lab. plantarum* from kimchi to mice increased immune function. This compound can stimulate macrophages and produce superoxide anion and H₂O₂ and kill tumor cells."
- Antioxidative Effect
"Antioxidative and anticancer effects are very important probiotic functionalities of microorganisms in human health. The antioxidative activity of *Lab. plantarum* KCTC 3099 from kimchi was evaluated by measuring the resistance to active

oxygen species. Intact cell and cell-free extracts of *Lab. plantarum* exhibited potent antioxidative activity in inhibiting lipid oxidation."

- Antidiabetic Effect

"Kimchi has blood glucose lowering and antidiabetic effects."

- Antiobesity effect

"Capsaicin in red pepper can cause body fat loss in the body by stimulating spinal nerves and thus activating the release of catecholamines in the adrenal glands."

Nutritional Value

Nutritional value is "relating to nutrition, or containing a food substance your body can use."

- Vitamin

Vitamin is "any of a group of natural substances that are necessary in small amounts for growth and good health and that are obtained from food."

- Dietary Mineral

"Minerals are important for your body to stay healthy. You need larger amounts of macrominerals. They include calcium, phosphorus, magnesium, sodium, potassium, chloride and sulfur. You only need small amounts of trace minerals. They include iron, manganese, copper, iodine, zinc, cobalt, fluoride and selenium."

Microorganism

"A microorganism is a living thing that is too small to be seen with the naked eye. Examples of microorganisms include bacteria, archaea, algae, protozoa, and microscopic animals such as the dust mite."

"Among LAB found in kimchi includes *Lactobacillus plantarum*, *Lactobacillus sake*, *Leuconostoc mesenteroides*, *Leuconostoc lactis*, *Leuconostoc citreum*, *Pediococcus pentosaceus*, *Weissella cibaria*, *Weissella confusa*, *Weissella koreensis*, etc.

- *Lactobacillus Plantarum*

Good bacteria is called probiotics, "from the Latin and Greek words meaning "for life." *Lactobacillus Plantarum* is one of probiotics bacteria and belongs to *Lactobacillus* which is part of Lactic Acid Bacteria group.

- *Leuconostoc Citreum*

Leuconostoc Citreum is one of Leuconostoc species. "Leuconostoc is a genus of Gram-positive bacteria, heterofermentative, and are able to produce dextran from sucrose."

- Leuconostoc Inhae

Leuconostoc Inhae is one of Leuconostoc species. "Leuconostoc is a genus of Gram-positive bacteria, heterofermentative, and are able to produce dextran from sucrose."

- Leuconostoc Gasicomitatum

Leuconostoc gasicomitatum is one of Leuconostoc species. "Leuconostoc spp. are widespread in the environment, and have been isolated from plant matter, human clinical sources, and foods, such as chill-stored and fermented meats, fermented vegetables (e.g., sauerkraut, kimchi), and fermented dairy products (e.g., cheese, kefir, yogurt)."

- Weissella Koreensis

Weissella Koreensis is part of "lactic acid bacteria (LAB), the major group of bacteria that grows on kimchi. W. koreensis is a psychrophilic bacterium and is the dominating species in kimchi produced at -1°C ."

- Lactobacillus Sakei

Lactobacillus Sakei is "an important food-associated lactic acid bacterium (LAB). An important property of the bacterium is the production of lactic acid that acidifies the product and both inhibits growth of spoilage bacteria and food pathogens, and confers taste and texture to the fermented products."

Kimchi Seasoning

Seasoning is "an ingredient added to food primarily for the savor that it imparts" such as a condiment, spice, or herb.

- Spice
Spice is "a substance made from a plant, used to give a special flavor to food."
- Seafood
Seafood is "animals from the sea that can be eaten, especially fish or sea creatures with shells."
- Mineral

Vegetable

Vegetable is "a usually herbaceous plant (such as the cabbage, bean, or potato) grown for an edible part that is usually eaten as part of a meal."

- Chinese cabbage
- Korean radish
- Mustard green
- Green onion
- Cucumber
- Onion

Country

Country means "an area of land that has its own government, army, etc."

- Korea (individual)

Kimchi Ontology Graph (main classes)

