

Pyrrroloquinoline quinone (PQQ) disodium salt

GRAS Notice (GRN) No. 701

<https://www.fda.gov/Food/IngredientsPackagingLabeling/GRAS/NoticeInventory/default.htm>

**GENERALLY RECOGNIZED AS SAFE  
(GRAS) NOTICE OF  
PYRROLOQUINOLINE QUINONE  
DISODIUM SALT  
AS A FOOD INGREDIENT**

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## **GENERALLY RECOGNIZED AS SAFE (GRAS) STATUS OF Pyrroloquinoline quinone (PQQ) AS A FOOD INGREDIENT**

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## PART 1. SIGNED STATEMENTS AND A CERTIFICATION

Pursuant to 21 C.F.R. Part 170, subpart E, Nutraland USA, Inc. submits a Generally Recognized as Safe (GRAS) notice and claims that the use of pyrroloquinoline quinone (PQQ) disodium salt in foods, as described in Parts 2 through 7 of this GRAS notice, is not subject to the premarket approval requirements of the FD&C Act based on its conclusion that the substance is GRAS under the conditions of its intended use.

### 1.A. Name and Address of the Notifier

Contact person: Sanying Xu

Company name: Nutraland USA, Inc. (hereinafter referred to as Nutraland), US Distributor

Address: 212 Technology Drive, Suite X, Irvine, CA 92618

Telephone number: (949) 988-7615

E-mail address: xu.sanying@nutralandusa.com

### 1.B. Common or Trade Name

Common names: Pyrroloquinoline quinone (PQQ) disodium salt; PQQ

Trade Name: LifePQQ™

Manufactured by Shanghai UbaiFu Biotechnology Co., Ltd; distributed by Nutraland USA, Inc.

### 1.C. Applicable Conditions of Use of the Notified Substance

#### 1.C.1. Foods in Which the Substance is to be Used

Intended use and use levels of Nutraland's PQQ disodium salt have been adopted from GRN 625 (page 6) and GRN 641 (page 5). Nutraland proposes to use PQQ disodium salt as a food ingredient in energy, sport, and electrolyte drinks; enhanced, and fortified water beverages; bottled water; and non-milk based meal replacement beverages. Nutraland does not intend to use PQQ disodium salt as a component of infant formula or in foods under the USDA's jurisdiction such as meat, poultry, and egg products.

#### 1.C.2. Levels of Use in Such Foods

The intended use of PQQ disodium salt is in the same food products and at levels proportional to those mentioned in GRN 625 and GRN 641. For each category, the higher level was selected if the different use levels were reported between the two notices for the same intended use.

Table 1. Intended use and maximum use levels of PQQ disodium salt, % (w/w)

Food Category	Food-Uses	Serving Size (RACC) <sup>1</sup>	Proposed Use Level	
			(mg/serving)	(%)
Beverages and Beverage Bases	Energy, Sport, and Electrolyte Drinks	240 mL	8	0.00333
	Enhanced and Fortified Water Beverages	240 mL	20	0.008
	Bottled water	240 mL	8	0.00333
	Non-Milk Based Meal Replacement Beverages	240 mL	8	0.00333

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<sup>1</sup> RACC refers to Reference Amounts Customarily Consumed per eating occasion – 21 CFR §101.12 (U.S. FDA, 2015). When a range of values is reported for a particular food-use, particular foods within that food-use may differ with respect to their RACC.

As shown in Table 1, PQQ disodium salt is intended for use in selected beverages (energy, sport, and electrolyte drinks; bottled, enhanced, and fortified water beverages; and non-milk based meal replacement beverages) at maximum use levels of up to 8 to 20 mg/serving in these product types.

**1.C.3. Purpose for Which the Substance is Used**

The substance will be used as a food ingredient.

**1.C.4. Description of the Population Expected to Consume the Substance**

The population expected to consume the substance consists of members of the general population who consume at least one of the products described above.

**1.D. Basis for the GRAS Determination:** Through scientific procedures.

**1.E. Availability of Information**

The data and information that serve as the basis for this GRAS determination will be sent to the FDA upon request, or are available for the FDA’s review and copying at reasonable times at the office of NutraSource, Inc.

**1.F. Availability of FOIA Exemption**

None of the data and information in Parts 2 through 7 of this GRAS notice are exempt from disclosure under the Freedom of Information Act, 5 U.S.C. §552.

**1.G. Certification**

We certify that, to the best of our knowledge, our GRAS notice is a complete, representative, and balanced submission that includes unfavorable information, as well as favorable information, known to us and pertinent to the evaluation of the safety and GRAS status of the use of the substance.

**Sanying Xu**  
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April 3, 2017

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## **PART 2. INFORMATION ON THE IDENTITY AND MANUFACTURING OF PYRROLOQUINONE QUINONE (PQQ) DISODIUM SALT**

### **2.A. Scientific Information About the Identity of the Notified Substance**

#### **2.A.1. Scientific Information Sufficient to Identify the Biological Source**

##### Background

Pyrroloquinoline quinone (PQQ) is a novel biofactor in plants and animals. Its mechanism of action in animals involves the activation or expression of factors involved with cell signaling pathways and mitochondrial function. It can also serve as an antioxidant. It is water and heat stable, and is capable of catalyzing continuous redox cycling as well as oxidative deamination (Rucker et al. 2009). PQQ can also be found in the form of PQQ disodium salt, while these are technically chemically different compounds, their physiological metabolism and effect are thought to be similar. The importance of PQQ in the health of mammals is shown when it is omitted from chemically defined diets. PQQ deficiency results in a wide variety of systemic responses, including compromised immune function, growth impairment, and abnormal reproductive performance in mice and rats (Steinberg et al. 2003; Steinberg et al. 1994). Varying PQQ quantity also results in modulation of mitochondrial content, changes lipid metabolism, and reverses inhibition by complex I inhibitors (Stites et al. 2006; Hamagishi et al. 1990). Improvements in mitochondrial respiratory function are potentially important to a variety of health issues, including longevity, energy utilization, and protection from reactive oxygen species. Further, mitochondrial DNA depletion and mutations are associated with cardiomyopathy, developmental delays, and impaired mitochondrial function (Debray et al. 2008). PQQ has also been found to attenuate neuronal cell death in stroke and spinal cord injury models and protect against cardiac damage from ischemia. (Tao et al. 2007; Jensen et al. 1994). These factors suggest PQQ plays an important role in human health.

##### Chemistry, Physicochemical Properties, and Structure

Chemical Name: Disodium 4,5-dihydro-4,5-dioxo-1h—pyrrolo(2,3-f) quinolone-2,7,9-tricarboxylate

Common Name: Pyrroloquinoline quinone (PQQ) disodium salt

Common Abbreviation: PQQ

Synonyms: Methoxatin disodium salt, Disodium pyrroloquinolinedione tricarboxylate

Chemical Abstracts Service (CAS) Number: 122628-50-6

Molecular Formula: C<sub>14</sub>H<sub>4</sub>N<sub>2</sub>Na<sub>2</sub>O<sub>8</sub>

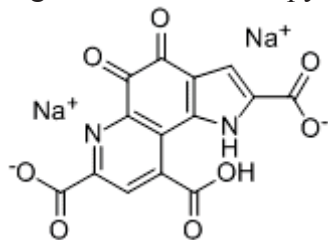
Molecular Weight: 374.17

Melting Point: > 300 °C

Solubility: 3 g/L (25 °C) in water; insoluble in organic solvents

Figure 1 shows structure of PQQ disodium salt.

Figure 1. Structure of pyrroloquinoline quinone (PQQ) disodium salt.



### 2.A.2. Potential Toxicants in the Source of the Notified Substance

Potential toxicants have not been identified.

### 2.A.3. Particle Size

Not less than 90% pass 60 mesh.

## 2.B. Method of Manufacture

*Hyphomicrobium denitrificans* was originally isolated from soil by Fujian Normal University, then strain FJNU-R8 was successfully screened to produce PQQ. Strain FJNY-R8 was identified as a non-pathogenic and non-toxicogenic bacterial species and it is not genetically modified. After serial pure culture of *Hyphomicrobium denitrificans* from single colony plates, slants to bioreactor, the high-yield strain FJNU-R8 was obtained and kept in an ampoule tube, stored at -80°C. For use, take an ampoule seed, refresh it on the plate or slant to amplify them to obtain numerous single colonies. Then pick a single colony grown on plate or slant into a flask containing seed medium for seed culture, followed by a large scale fermentation run in a fermenter. During the fermentation run in a fermenter, nutrients (carbon source, nitrogen source, air like oxygen) supplement, fermentation process (like pH and dissolved oxygen) monitoring and control to biosynthesize PQQ, and the extraction and purification of PQQ from the broth are described below.

1. Slant seed preparation: slant medium is prepared according to medium recipe, then autoclaved at 121 degree. After cooling, a single colony of *H. denitrificans sp.*FJNU-R8 is streaked onto slant, cultured at 30 degrees Celsius for 72 hours.
2. Seed culture:
  - a) Shaking flask culture: seed medium is prepared according to the recipe, and allocated into 5 or more 250 mL flasks containing 25-50 mL seed medium each. After being autoclaved at 121 degrees Celsius for 30 min, seed culture is transferred into each flask with 1-10% inoculum. OR, a single colony grown plate or a loop of lawn from slant is transferred into each flask. All shaking flasks are cultured in an orbited shaker with the agitation speed of 220 rpm and the temperature of 22-30 degrees Celsius for 48-72 hours.
  - b) Seed tank culture: The harvested flask seed culture is inoculated into a 30 or 50 L fermenter. It can be run under the conditions: temperature is controlled at 30 degrees

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- Celsius and dissolved oxygen tension is kept at more than 5% using stirring speed and air-flow rate for 48 hours.
3. Fermentation process: Fermentation medium is prepared according to the recipe. After sterilization, seed culture from the seed tank is transferred into a fermenter, then run at a temperature of 30°C for 120-144 hours.
  4. Centrifugation: After fermentation, the broth is centrifuged to remove the biomass, and retrieve the supernatant.
  5. Filtration: All supernatant is clarified using micro-filtration membrane to remove cell debris and proteins.
  6. Ion exchange chromatography: The harvested filtrate is subjected to ion chromatography to remove peptides, amino acids, and other impurities.
  7. Crystallization:  
 1<sup>st</sup> crystallization: The harvested PQQ solution is adjusted to obtain its isoelectronic point with 10% H<sub>2</sub>SO<sub>4</sub>, and then chilled for crystallization.  
 2<sup>nd</sup> crystallization: The PQQ crystals are dissolved in NaOH solution. After its filtration, it is adjusted at pH of isoelectronic point of PQQ Na<sub>3</sub> to get PQQ Na<sub>3</sub>. Filtration again, dissolved in NaOH; adjust pH to the isoelectric point of PQQ Na<sub>2</sub> to obtain PQQ Na<sub>2</sub> crystals. Finally, all pure PQQ Na<sub>2</sub> salt is polished with ethanol.
  8. Lyophilization of PQQ Na<sub>2</sub> salt: The polished PQQ Na<sub>2</sub> salt is put into a lyophilizer overnight.
  9. Milling and Screening: The dried PQQ Na<sub>2</sub> salt cake is milled and screened by 100 meshes.
  10. Vacuum package: The filtered PQQ Na<sub>2</sub> salt will be packed after its quality is analyzed. Generally, a 1 kg or 5 kg amount is packed in a sealed foil bag.
  11. Storage: keep at 2-8°C, and make sure it is impervious to light and humidity when contained within a sealed inner bag.

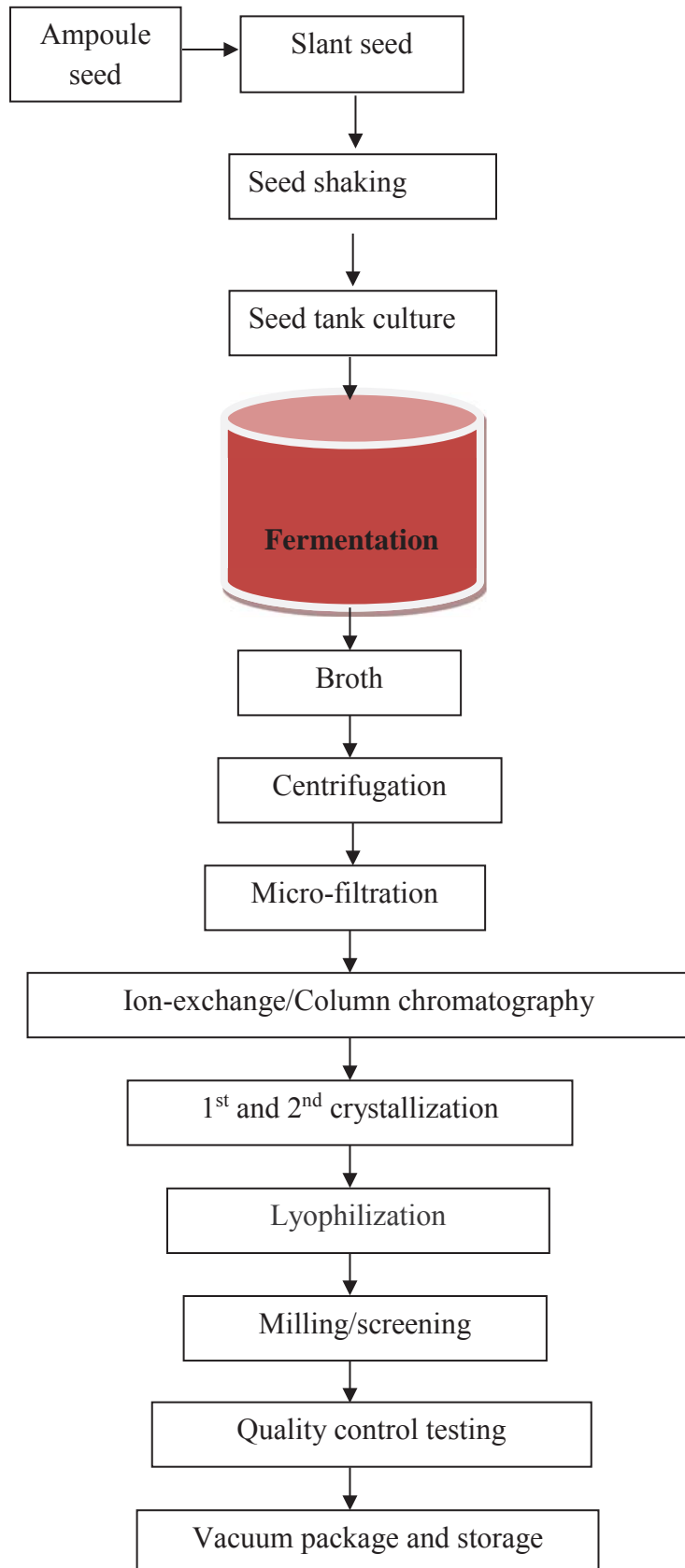
Table 2. Process controls in the production of PQQ

<b>Process</b>	<b>Control</b>
Preparation of Working Cell Bank	Microbiological contamination, appearance, growth characteristics, colony survival number, survival ratio, fermentation potency
Preparation of Slant Culture	Microbiological contamination, appearance
Shaking Culture	Microbiological contamination, morphological characteristics
Seed Tank Fermentation	Microbiological contamination, appearance of seeding liquid, mycelium content, pH
Main Fermentation	Mycelium content, amino-nitrogen, pH, fermentation potency

Nutraland’s PPQ ingredient is manufactured consistent with the principles of Hazard Analysis and Critical Control Points (HACCP). Nutraland rigorously tests its final production batches to verify adherence to quality control specifications. The manufacturing process, which complies with current Good Manufacturing Practice (cGMP), is shown in Figure 2.



Figure 2. Manufacturing process of pyrroloquinoline quinone (PQQ) disodium salt.



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Tables 3 shows the composition of fermentation medium. Chemicals listed in fermentation medium function as nutrients for fermentation. Purchasing specifications and certificate of analysis (COA) of raw materials are included in Appendix A. The ion exchange resins (sulfonated copolymer of styrene and divinylbenzene) and adsorption resins used in the manufacturing process are food grade and comply with 21 CFR 173.25.

Table 3. Composition of fermentation medium

Composite	g/L	Remarks
Methanol	0.15	Sterilized by filtration membrane with diameter of 0.22 um.
Ammonium sulfate; (NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	3.0	Nitrogen source for fermentation
Potassium dihydrogen Phosphate; KH <sub>2</sub> PO <sub>4</sub>	1.4	
Sodium phosphate Na <sub>2</sub> HPO <sub>4</sub>	3.0	
Magnesium sulfate heptahydrate; MgSO <sub>4</sub> .7H <sub>2</sub> O	1.0	
Mineral water	0.7 ml	Its composition is shown in Table 4

Table 4 presents CAS registry numbers and regulatory status of raw materials used in the manufacture of Nutraland's PQQ.

Table 4. CAS registry numbers and regulatory status of raw materials

Raw material	CAS Registry No.	Regulatory Status
Methanol	67-56-1	21 CFR §182.1: Methanol is permitted for use in foods as a GRAS substance
Ammonium sulfate; (NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	7783-20-2	21 CFR §184.1143: Direct food substances affirmed as GRAS; Permitted for use in foods as a dough strengthener, firming agent, and processing aid
Potassium dihydrogen Phosphate; KH <sub>2</sub> PO <sub>4</sub>	7778-77-0	Yeast food-FCC 10th ed.
Disodium phosphate decahydrate; Na <sub>2</sub> HPO <sub>4</sub> .12H <sub>2</sub> O	10039-32-4	21CFR§182.6240; This substance is GRAS when used in accordance with cGMP
Magnesium sulfate heptahydrate; MgSO <sub>4</sub> .7H <sub>2</sub> O	10034-99-8	21 CFR §184.1443: Direct food substances affirmed as GRAS; Permitted for use in foods as a flavor enhancer, nutrient supplement, or processing aid
Sodium hydroxide; NaOH	1310-73-2	21 CFR §184.1763; Direct food substances affirmed as GRAS; can be used in food with no limitation other than cGMP
Ethanol	64-17-5	21 CFR §184.1293: Direct food substances affirmed as GRAS; Permitted for use as an

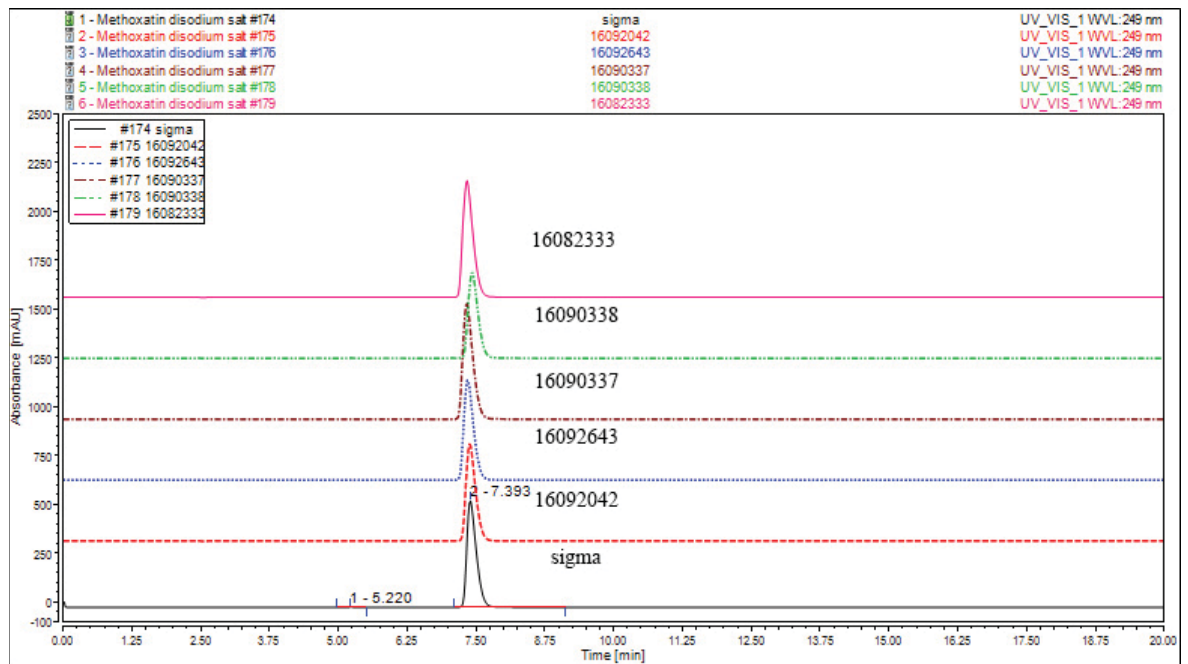
Pyrroloquinoline quinone (PQQ) disodium salt

	antimicrobial agent
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CFR = United States Code of Federal Regulations; cGMP = current Good Manufacturing Processes; FCC = food chemical codex; GRAS = Generally Recognized as Safe.

Figure 3 compares the HPLC chromatograms of Nutraland’s PQQ disodium salt product to that of standard PQQ disodium salt. The HPLC chromatograms also demonstrate that elution times and peak heights are identical for both the reference standard and Nutraland’s PQQ disodium salt. The data suggest that the substance is PQQ disodium salt. The absence of additional peaks demonstrates that byproducts are absent in Nutraland’s PQQ product (analysis shows a 99.9% purity). Details of the HPLC method are described in Appendix B. Other identification methods, such as fourier transform infrared spectroscopy (FT-IR), ultraviolet (UV), nuclear magnetic resonance (NMR), mass spectrometric (MS) analysis, confirmed that the PQQ disodium salt manufactured by Nutraland is chemically and structurally identical to a commercial standard (Sigma). Details are presented in Appendix C.

Figure 3. HPLC chromatograms comparing a commercial PQQ standard and Nutraland’s PQQ disodium salt.



## 2.C. Specifications of Pyrroloquinoline quinone disodium salt

Table 5 presents specifications of PQQ disodium salt.

Table 5. Specifications of PQQ disodium salt

SPECIFICATION	PARAMETERS	METHOD
<b>SENSORY REQUIREMENTS</b>		
Appearance	Crystalline Powder	Visual
Color	Reddish Brown	Visual
Taste	Salty	Taste
<b>PHYSICAL-CHEMICAL REQUIREMENTS</b>		
Identification	Match Standard	FTIR
Assay (dry basis)	Not less than 85.0 %	HPLC†1
Affirmation Test	A233/A259=0.90±0.09 A322/A259=0.56±0.03	CP2000, App. IV A
Water Content Loss on drying	≤12%	USP 731
Ash	Not more than 10.0 %	USP 281
<b>CONTAMINANTS/ADDITIVES</b>		
Arsenic	Not more than 1.0 ppm	USP 233
Lead	Not more than 1.0 ppm	USP 233
Cadmium	Not more than 0.5 ppm	USP 233
Mercury	Not more than 0.1 ppm	USP 233
Residual Solvents		CP 2000, App. V
Ethanol	Not more than 1,000 ppm	USP<467>
Purity	≥98.5%	Internal method
<b>MICROBIOLOGICAL REQUIREMENTS</b>		
Total Aerobic Plate Count	Not more than 10000 cfu/g	USP 38:2015, General Chapter 61 & 62
Yeast & Mold	Not more than 300 cfu/g	USP 38:2015, General Chapter 61 & 62
Enterobacteriaceae	≤100 cfu/g	USP 38:2015, General Chapter 61 & 62
<i>E.coli</i>	Negative in 10 g	USP 38:2015, General Chapter 61 & 62
<i>S.aureus</i>	Negative in 10 g	USP 38:2015, General Chapter 61 & 62
<i>Salmonella</i>	Negative in 10 g	USP 38:2015, General Chapter 61 & 62

CFU = colony forming unit; CP=Chinese Pharmacopia; FTIR = fourier transform infrared spectroscopy; HPLC = high performance liquid chromatography; PQQ = pyrroloquinoline quinone; USP=United State Pharmacopia

## Pyrroloquinoline quinone (PQQ) disodium salt

The certificate of analyses (COA) of finished PQQ disodium salt are included in Appendix D. Mineral composition of PQQ disodium salt is presented in Table 6.

Table 6. Composition of the finished PQQ disodium salt product.

Component	Theoretical value	Batch No.			
		M16092643	M16090337	M16091338	M16092042
Sodium, %	12.3	11.93	12.19	12.05	11.39
Phosphate, %	NA	0.0152	0.0038	0.0102	0.0043
Chloride, mg/kg	NA	ND (<10)	ND (<10)	ND (<10)	ND (<10)
Moisture, %		10.55	10.25	10.45	11.24

NA = not available; ND = not detected.

### Safety of bacteria used in fermentation

The production of Nutraland's PQQ disodium salt is a modification of the production of PQQ disodium salt by bacterial fermentation reported by other investigators (Urakami et al., 1992) and by another company such as Mitsubishi Gas Chemical whose production method for PQQ disodium salt received no objection letter from FDA (FDA, 2007, RPT 417; FDA, 2016a, GRN 641). Specifically, Mitsubishi Gas Chemical Company and Urakami et al. (1992) describe a method wherein *Hyphomicrobium sp.* strain TK0441 was utilized in a fermentation process to produce PQQ. It is noteworthy that the *Hyphomicrobium sp.* strain TK0441 (or ATCC 51888, DSM 1869 or NCIMB11706), available from the American Type Culture Collection (ATCC), is classified as Biosafety Level I (BSL-1) (ATCC, 2016). The Centers for Disease Control and Prevention (CDC) defines BSL-1 organisms as those "not known to consistently cause disease in immunocompetent adult humans, and present minimal potential hazard to laboratory personnel and the environment" (CDC, 2009).

*Hyphomicrobium* are facultatively methylotrophic, non-spore forming, gram-negative, rod-shaped bacteria with a unique Q-9 ubiquinone system (FDA, 2016a [GRN 641]). *Hyphomicrobium denitrificans* utilizes one carbon compounds, such as methanol, as an exclusive source of carbon and energy and is positive for nitrate reduction. *Hyphomicrobium* are found ubiquitously in a variety of environments and are able to utilize single carbon compounds as an exclusive source of energy and carbon in the presence of nitrate under both aerobic and anaerobic conditions (FDA, 2016a [GRN 641]).

Molecular identification *via* 16S and 23S ribosomal DNA (rDNA) sequence analysis demonstrates that the source organism of PQQ has 100% and 99% sequence similarities, respectively, with *Hyphomicrobium denitrificans* American Type Culture Collection (ATCC) 51888 (Details are presented in Appendix E). Further morphological and biochemical analyses demonstrate that *H. denitrificans* is a gram-negative bacterium that forms milky colonies and is positive for nitrate reduction. *Hyphomicrobium denitrificans* is not a genetically modified organism (GMO). Taxonomic Classification of *Hyphomicrobium denitrificans* is presented in Table 7.

Table 7. Taxonomic classification of *Hyphomicrobium denitrificans*

<b>Class</b>	<b>Scientific Classification</b>
Kingdom	<i>Prokaryota</i>
Division	<i>Bacteria</i>
Subdivision	<i>Proteobacteria</i>
Class	<i>Alphaproteobacteria</i>
Order	<i>Rhizobiales</i>
Family	<i>Hyphomicrobiaceae</i>
Genus	<i>Hyphomicrobium</i>
Species	<i>Hyphomicrobium denitrificans</i>

### **Shelf-life and storage conditions**

The New Dietary Ingredient (NDI) notice RPT 417 (FDA, 2007) reported that PQQ disodium salt was stable at 50 degrees Celsius in the dark and at 30 degrees Celsius under light conditions (1575 Ix, LTV 26 $\mu$ W/cm) for more than 12 months. Stability tests are in progress, however, PQQ disodium salt is stable for at least 12 months unaffected by heat (up to 50 degrees Celsius), humidity (RH75%) and light.

### **2.D. Intended Technical Effects**

PQQ disodium salt will be used as a nutritional ingredient in specified foods as described in Table 1 (Part 1).

### PART 3. DIETARY EXPOSURE

#### 3.A. Estimated Daily Intake (EDI) of PQQ Disodium Salt Under the Intended Use

The intended use of PQQ disodium salt is in the same food products and at same levels proportional to those mentioned in GRN 625 and GRN 641. The higher level has been selected if the use levels are different between the two notices for the same intended use food category. The National Health and Examination survey (NHANES) food codes used in the estimated dietary intakes (EDI) calculations are shown in Appendix F. The results of the EDI assessment are summarized in the two tables below (Tables 8-1 and 8-2). The first table presents the results of the mean of the population as well as the 90th percentile in mg/day, and the second in mg/kg bw/day. Since intended use and use levels combined those described in GRN 625 and 641, the EDIs in this GRAS determination are estimated to be slightly higher (by 7.1% in all users aged 2-99 years) than those described in the two GRAS notices. However, EDIs presented in this GRAS notice are within the safe intake levels. These results reveal an average maximum exposure would occur in males greater than 19 years of age, with a 90th percentile value of 76.1 mg/day or 0.85 mg/kg bw/day. On a body weight basis, children aged 2-5 years had shown the highest 90th percentile EDI at 1.54 mg/kg bw/day. Among consumers in the total population, the mean and 90th percentile all-user intakes of PQQ were determined to be 29.9 and 65.8 mg/person/day, respectively. Corresponding EDIs reported in GRN 625 were 26.5 and 61.4 mg/person/day. In GRN 641, mean and 90th percentile all-user intakes of PQQ were 12.8 and 27.8 mg/kg bw/day, respectively.

The no observed effect level (NOAEL) was determined to be 400 mg/kg bw/day in a subchronic toxicity study in rats (details are found in the Section 6.B.3). After applying a safety margin of 100, it can be concluded that doses up to 4 mg/kg bw/day or 240 mg/person/day would be safe in adults weighing 60 kg. The EDIs under the intended use are less than one third of the estimated safe intake levels in humans.

These estimates are highly amplified since it is not likely that PQQ disodium salt will be used at maximum levels for all food categories under the intended uses. Also, food waste should be considered. Overall, intended use will result in EDIs at levels significantly below those associated with any potential side effects.

Table 8-1. Maximum EDIs of PQQ disodium salt under the intended use, mg/day

Population	N-user*	Per User (mg/day)		Per Capita (mg/day)	
		Mean	90 <sup>th</sup> Percentile	Mean	90 <sup>th</sup> Percentile
2-5 y	290	11.28	21.76	5.11	16.81
6-12 y	602	16.26	33.89	8.85	25.99
13-18 y males	249	30.89	77.24	18.12	44.02
13-18 y females	290	25.15	44.39	16.29	41.10
19+ males	1,191	34.37	76.12	17.82	55.00
19+ females	1,419	31.40	66.23	17.18	51.89
2-99 y	4,041	29.87	65.80	16.06	49.38

\*Assuming All the Foods will be Used at the Maximum Use Levels; NHANES 2011-2014

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BW = body weight; EDI = estimated daily intake; PQQ=pyrroloquinoline quinone; y = year

Table 8-2. Maximum EDIs of PQQ disodium salt, mg/kg bw/day

Population	Per User (mg/kg bw/day)		Per Capita (mg/kg bw/day)	
	Mean	90 <sup>th</sup> Percentile	Mean	90 <sup>th</sup> Percentile
2-5 y	0.65	1.54	0.30	1.01
6-12 y	0.37	0.82	0.20	0.58
13-18 y males	0.37	0.78	0.22	0.67
13-18 y females	0.38	0.94	0.25	0.68
19+ males	0.39	0.85	0.18	0.60
19+ females	0.39	0.83	0.20	0.62
2-99 y	0.40	0.87	0.20	0.62

\*Assuming All the Foods will be Used at the Maximum Use Levels; NHANES 2011-2014  
 BW = body weight; EDI = estimated daily intake; PQQ=pyrroloquinoline quinone; y = year

### 3.B. Food Sources of PQQ

PQQ is naturally occurring in small quantities in food products, particularly in vegetables, fruits, fermented soy products and dairy products (Kumazawa et al., 1995; Noji et al., 2007). As shown in Table 9, concentrations of PQQ in foods are low, typically in the parts per billion (ppb) range.

Table 9. Concentrations of PQQ in common foods

Food Item	PQQ Content (ng/g wet weight or ng/mL)	Food Item	PQQ Content (ng/g wet weight or ng/mL)
Broad bean	17.8 ± 6.78	Green soybeans	9.26 ± 3.82
Potato	16.6 ± 7.34	Sweet potato	13.3 ± 3.72
Parsley	34.2 ± 11.6	Cabbage	16.3 ± 3.96
Carrot	16.8 ± 2.81	Celery	6.33 ± 2.41
Green pepper	2.12 ± 0.4 to 28.2 ± 13.7	Spinach	7.0 ± 2.17 to 21.9 ± 6.19
Tomato	ND to 9.24 ± 1.82	Apple	6.09 ± 1.36
Banana	12.6 ± 3.81	Kiwi fruit	27.4 ± 2.64
Orange	6.83 ± 2.20	Papaya	26.7 ± 8.57
Field mustard	5.54 ± 1.50	Broccoli sprout	1.55 ± 0.37
Japanese radish	0.70 ± 0.42	Rape blossom	5.44 ± 0.8
Green tea	0.16 ± 0.05 to 29.6 ± 12.9	Miso (bean paste)	16.7 ± 3.30
Coke	20.1 ± 3.17	Fermented soybeans (natto)	61.0 ± 31.3
Wine	5.79 ± 2.73	Fermented soybeans	1.42 ± 0.32
Oolong (tea)	27.7 ± 1.92	Tofu (bean curd)	24.4 ± 12.5
Whiskey	7.93 ± 1.84	Skim milk (dry wt basis)	2.5 <sup>1</sup> ± 1.4
Sake	3.65 ± 1.39	Milk	3.4 ± 0.4



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Beer	1.66 ± 0.82	Egg yolk <sup>2</sup>	7.0 to 19.3
Bread	9.14 ± 3.64	Egg white <sup>2</sup>	4.1 to 28.8

PQQ = pyrroloquinoline quinone

Adapted from Kumazawa et al. 1995 and Noji et al., 2007.

<sup>1</sup> Units for skim milk lyphosilisate are ng/g dry weight.

<sup>2</sup> Eggs were obtained from domestic fowl (*Gallus gallus*) and duck (*Cairina moschata*)

### 3.C. EDIs of Naturally Occurring PQQ from the Diet

The PQQ concentration in each food is not listed in the USDA food composition tables or the NHANES databases. Using the dietary content of PQQ available from the literature (Table 9), the EDIs from the diet were estimated. NHANES 2011-2012 dietary data for age 2 years and older were used to estimate PQQ exposure from select dietary sources. The dietary sources being analyzed are 36 common foods that contain PQQ as listed in Section 3.A. SAS 9.2 along with strata, PSUs and 2 day dietary weights were used for analyses. Analysis was limited to subjects with reliable dietary intake data on both days. Intake used was the average of the two days intake from subjects with intake over 0 reported on either day (N = 7,100). The NHANES food codes used in the EDI calculation of naturally occurring PQQ in the diet are shown in Appendix G.

The mean and 90<sup>th</sup> percentile EDIs of users are 8.7 and 17.2 ug PQQ/person/day which correspond to 0.13 and 0.26 ug/kg bw/day (Table 10). These levels are insignificant compared to EDIs under the intended use.

Table 10. EDIs of PQQ from the diet, ug/day \*

Population	N	ug/day		ug/kg bw/day	
		Mean	90 <sup>th</sup> Percentile	Mean	90 <sup>th</sup> Percentile
2-5 y	714	4.14	6.72	0.25	0.43
6-12 y	1,156	4.65	10.31	0.16	0.28
13-18 y males	396	8.31	16.47	0.12	0.22
13-18 y females	396	7.48	15.39	0.12	0.21
19+ males	2,156	10.94	21.20	0.13	0.26
19+ females	2,282	8.06	15.83	0.11	0.20
2-99 y	7,100	8.66	17.02	0.13	0.26

\* Based on NHANES 2011-2014. U.S. = United States

BW = body weight; EDI = Estimated daily intake; PQQ = pyrroloquinoline quinone

### 3.D. EDI of Other Components Under the Intended Use

PQQ disodium salt contains sodium. The sodium content of PQQ disodium salt is approximately 12%. Thus, the EDI of sodium under the intended use were calculated based on the EDI of PQQ disodium salt (Tables 8-1 and 8-2) and the sodium content of PQQ disodium salt. For example, the EDI of PQQ disodium salt is 65.8 mg/person/day in all users aged 2-99 years (Table 8-1). Given that the concentration of sodium in PQQ disodium salt is 12%, the 90<sup>th</sup> percentile EDI of sodium under the intended use (7.9 mg/person/day) can then be calculated by multiplying 65.8 by 0.12. As shown in Table 11, the estimated intakes of sodium under the intended use are negligible compared to usual intakes of sodium from the diet, since an average daily sodium intake for Americans is approximately 4,024 mg per person per day (USDA, 2017). In other words, intended use of PQQ disodium salt would likely have no significant impact on sodium intakes in Americans.

Table 11. Maximum EDIs of sodium under the intended use, mg/day

Population	N-user*	Per User (mg/day)		Per Capita (mg/day)	
		Mean	90 <sup>th</sup> Percentile	Mean	90 <sup>th</sup> Percentile
2-5 y	290	1.35	2.61	0.61	2.02
6-12 y	602	1.95	4.07	1.06	3.12
13-18 y males	249	3.71	9.27	2.17	5.28
13-18 y females	290	3.01	5.33	1.95	4.93
19+ males	1,191	4.12	9.13	2.14	6.60
19+ females	1,419	3.77	7.95	2.06	6.23
2-99 y	4,041	3.58	7.90	1.93	5.93

\*Assuming all the foods assessed will be used at the maximum use levels; NHANES 2011-2014 EDI = Estimated daily intake; PQQ = pyrroloquinoline quinone

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**PART 4. SELF LIMITING LEVELS OF USE**

No known self-limiting levels of use are associated with the PQQ disodium salt ingredient.

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**PART 5. HISTORY OF CONSUMPTION**

Not applicable.

## PART 6. BASIS FOR GRAS DETERMINATION

### 6.A. Current Regulatory Status

The FDA has previously issued a ‘no objection’ letter on a GRAS notice and New Dietary Ingredient (NDI) notice related to PQQ disodium salt produced by a fermentation technique (GRN 641 filed by Hisun, FDA 2016a; NDIN RPT 417 filed by Mitsubishi Gas Chemical Co., Inc.). In addition, FDA has issued a no question letter on synthetic PQQ disodium salt (GRN 625 filed by Nascent Health, FDA 2016b). As the PQQ in this GRAS notice is similar in specifications compared to the PQQ in the previous FDA GRAS and NDI notices (Table 12), it is recognized that the information and data in GRNs 641 and 625 and NDIN RPT 417 are pertinent to the safety of the PQQ in this GRAS notice. Therefore, this notice incorporates by reference the safety and metabolism studies discussed in the previous GRAS notices. Additionally, this notice discusses additional animal studies that have been published since the FDA’s last review in 2016. The subject of the present GRAS notice is PQQ disodium salt produced via microbial fermentation (powder form). It is noteworthy that the intended use levels in this notice are adopted from GRN 625 and 641 by combining intended use and use levels described in those notices.

Table 12. Comparison of the PQQ disodium salt preparations

Parameter	Source				
	Nutraland	Hisun	Mitsubishi	Shanghai Med Co	Nascent Health
Regulatory status	Current notice	GRN 641	NDIN 417	NA	GRN 625
Manufacturing Method	Fermentation by <i>Hyphomicrobium denitrificans</i>			Not specified	Synthetic
Appearance	Reddish brown crystalline powder	Henna powder	Reddish brown crystalline powder	Reddish brown crystalline powder	Reddish brown crystalline powder
Purity	>98.5%	>99%	>99%	>98%	>98%

NA = not applicable; PQQ = pyrroloquinoline quinone

### 6.B. Review of Safety Data

#### 6.B.1. Metabolism of PQQ

Since the FDA’s last review of GRNs 625 and 641 in 2016, no metabolism study has been published.

Harris et al. (2013) found PQQ serum concentrations in humans increase directly in response to increase in dietary intake, and daily urinary excretion of PQQ was related to both

serum levels and daily intake ( $r=0.9$ ,  $p<0.05$ ). Human tissue contains 1 to 3 ng of non-derivatized PQQ per gram of tissue or milliliter of fluid. Dietary PQQ (0.1 to 1.0 mg/day) is sufficient to maintain the nanomolar concentrations of PQQ in tissues and that concentration is responsive to changes in the diet (Kumazawa et al. 1992). It appears that limited data from humans are in line with what was found in rats.

In a study by Smidt et al. (1991), 1.5 mg/kg PQQ (radiolabeled with  $^{14}\text{C}$ ) were administered to 10 male mice by oral gavage. Approximately 62% of the PQQ was absorbed through the small intestine and 81% of that absorbed PQQ was excreted within 24 hours via urine. However, only 3.3% of the administered dose was absorbed by the 6 hour time-point. The radioactive PQQ was detected in the kidney (10.7%) and the skin (1.3%) 24 hours after oral administration. This shows PQQ is absorbed effectively, but most of the PQQ absorbed is excreted into the urine. The liver retained only a small percentage of the absorbed PQQ (*i.e.*, 5.4% after 6 hours and 1.5% after 24 hours). Low concentrations were detected in the liver, suggesting that biliary elimination is not a major excretion route in mice. In the blood, nearly all of the PQQ (95 to 97%) was associated with the blood cell fraction at both 6 and 24 hours. At 6 hr, the blood cell fraction constituted about 10% of the absorbed label, which was diminished to 1.2% at 24 hours. An additional 1.3% of the administered dose was detected in the skin 24 hours after dosing. (Smidt et al., 1991).

GRN 641 summarized that no studies were identified on the metabolic fate of exogenously consumed PQQ per se; however, PQQ has been reported to undergo condensation with amino acids to form IPQ derivatives, which have been identified endogenously in human milk.

### **6.B.2. Mutagenicity and Genotoxicity Studies of PQQ**

Mutagenicity and genotoxicity studies of PQQ disodium salt are summarized in Table 13.

#### Studies on Nutraland's PQQ disodium salt (Gao, 2016a)

##### Bacterial mutation assay

Five strains of *Salmonella typhimurium* (TA97, TA98, TA100, TA102 and TA1535) were treated with PQQ disodium salt (dissolved in DMSO) at concentrations of 0 (solvent control), 312.5, 625, 1,250, 2,500, and 5,000  $\mu\text{g}/\text{plate}$  in the presence and absence of an exogenous metabolic activation system (S9) by the pre-incubation method. 4-Nitro-o-phenylenediamine (NPD), daunomycin (DAM), sodium azide ( $\text{NaN}_3$ ) and methyl methanesulfonate (MMS) were used as positive controls in conditions without S9 mix. 2-aminofluorene (2-AF), 1,8-dihydroxyanthraquinone (1,8-DT) and 2-aminoanthracene (2-AA) were used as positive controls in conditions with S9 mix. All plates were incubated at  $37^\circ\text{C}$  for 48 h, and the number of revertant colonies were counted.

There were no increases in revertant frequencies at any of the test article doses in any of the tester strains with or without S<sub>9</sub> compared to those in the vehicle control cultures. The positive control chemicals for each tester strain induced at least a 5-fold increase in the number

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of revertant colonies compared to the vehicle control. The data suggest that PQQ disodium salt is non-mutagenic under the conditions used in this test.

### In vivo mammalian (mouse) micronucleus test (Gao, 2016a)

Male and female Kunming mice, aged 4-5 weeks were acclimated for 5 days prior to administration of the test substance. The mice were housed in cages by sex and provided food and water *ad libitum*. Based on the results of the dose range-finding study, animals were randomly assigned to the following groups: vehicle control, 500 mg/kg body weight (bw)/day (low-dose), 1,000 mg/kg/day (mid-dose), 2,000 mg/kg/day (high-dose), and a positive control (cyclophosphamide, 40 mg/kg). Vehicle control, positive control, or various doses of test substance were administered to the animals by oral gavage for 2 consecutive days. After dosing, animals were examined regularly for clinical signs of toxicity until sacrifice. Mice were sacrificed by dislocation of the cervical vertebrae 24 or 48 h after the last treatment administered (all doses). For the cyclophosphamide group, mice were sacrificed at the 24-h time point only. Both femurs were removed and cleaned of muscle tissue. The proportion of immature erythrocytes (polychromatic erythrocytes, PCE) to total erythrocytes [immature + mature erythrocytes (normochromatic erythrocytes, NCE)] was determined for each animal by analyzing at least 200 erythrocytes. In addition, a minimum of 2,000 PCE were scored for the incidence of micronucleated polychromatic erythrocytes (MNPCE).

No clinical signs of toxicity or mortality were seen at any of the tested dose levels, and no statistically significant changes were noticed in mean body weights between any of the treatment groups and the control. PQQ disodium salt administration did not reveal any significant changes in MNPCE (%) or PCE/NCE in either sex when compared to the control group. Thus, authors concluded that Nutraland's PQQ disodium salt was not genotoxic under the conditions of the study.

### Studies on other sources of PQQ disodium salt

Since the FDA's last review of 2016, no new studies have been published. GRN 641 (FDA, 2016a) and NDIN RPT 417 reported that PQQ disodium salt preparations obtained from microbial fermentation by *Hyphomicrobium denitrificans* were not mutagenic or genotoxic (Table 13). Additionally, synthetically manufactured PQQ disodium salt showed that it lacked mutagenicity and genotoxicity (Table 13; FDA, 2016b, GRN 625). Overall, studies consistently show that all preparations of PQQ disodium salt are not mutagenic or genotoxic.

Table 13. Mutagenicity and genotoxicity studies of PQQ disodium salt

Test system	PQQ concentration	Test	Outcome	Reference
<b>Studies on Nutraland's PQQ disodium salt</b> (produced by microbial fermentation using <i>Hyphomicrobium denitrificans</i> )				
<i>Salmonella typhimurium</i> strains TA97,	0, 312.5, 625, 1,250, 2,500 or 5,000 µg/plate w/ and w/o S9 activation	Ames test (mutagenicity), <i>in vitro</i>	No mutagenic potential	Gao, 2016a

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TA98, TA100, TA102 and TA1535				
ICR mice	0, 500, 1,000, or 2,000 mg/kg bw/day for 2 days	<i>In vivo</i> mouse micronucleus assay	Not genotoxic	Gao, 2016a
<b>Data presented in GRN 641</b> , filed by Hisun (produced by microbial fermentation using <i>Hyphomicrobium denitrificans</i> )				
<i>S. typhimurium</i> strains TA97, TA98 and TA100	0, 1, 6, 8, 40, 200 or 1,000 µg/plate w/ and w/o S9 activation	Ames test (mutagenicity), <i>in vitro</i>	No mutagenic potential	GRN 641 (FDA, 2016a; referenced Hisun's 2012 study; pages 36-38)
<i>S. typhimurium</i> strain TA102	0, 0.16, 0.8, 4, 20 or 100 µg/plate w/ and w/o S9 activation	Ames test (mutagenicity), <i>in vitro</i>	No mutagenic potential	
ICR mice	0, 730, 1,460, or 2,920 mg/kg bw/day for 2 days	<i>In vivo</i> mouse micronucleus assay	Not genotoxic	
ICR mice	M-0, 530, 1,050, or 2,110 mg/kg bw/day for 4 days; F- 0, 730, 1,460, or 2,920 mg/kg bw/day for 4 days	Chromosomal aberration test	Not genotoxic	
<b>Data presented in GRN 625</b> , filed by Nascent Health (synthetically produced)				
<i>S. typhimurium</i> strains TA97, TA98, TA100, and TA102	0, 62, 556, 1,667, and 5,000 µg/plate w/ and w/o S9 activation	Ames test (mutagenicity), <i>in vitro</i>	No mutagenic potential	GRN 625 (FDA, 2016b; pages 35-38)
Kunming mice	M - 630, 1250, and 2,500; F - 460, 920, and 1,840 mg/kg bw for 1 day	<i>In vivo</i> mouse micronucleus assay	Not genotoxic	
<b>Data presented in NDIN RPT 417</b> , filed by Mitsubishi Gas Chemical Co. (produced by microbial fermentation using <i>Hyphomicrobium denitrificans</i> )				
<i>S. typhimurium</i> strains TA98, TA100, TA1535, TA1537, and <i>Escherichia coli</i> strain WP2uvrA	0, 10, 20, 39, 78, 156, 313, 625, 1,250, 2,500, or 5,000 µg/plate w/ S9 activation or 0, 156, 313, 625, 1,250, 2,500, or 5,000 µg/plate w/o S9 activation	Ames test (mutagenicity), <i>in vitro</i>	No mutagenic potential	RPT 417 (FDA, 2007); the data were later published by Nakano et al. (2013)
Chinese hamster lung fibroblasts	0, 117.2, 234.4, 468.8, 937.5, 1875, or 3750 µg/mL w/ S9 activation or 0, 12.5, 25, 50, 100, 200, or 400 µg/mL w/o S9 activation	Chromosomal aberration test, <i>in vitro</i>	Very weak positive results, but repeated testing was negative	
Human peripheral blood lymphocytes	0, 234.4, 468.8, 937.5, 1,875, or 3,750 µg/mL w/activation, or	Chromosomal aberration test, <i>in vitro</i>	Not genotoxic	



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	0, 117.2, 234.4, 468.8, 937.5, 1,875, or 3,750 µg/mL w/o activation			
30 Crlj:CH1 male mice	0, 250, 500, 1,000, or 2,000 mg/kg bw	<i>In vivo</i> mouse micronucleus assay	Not genotoxic	

Abbreviations: bw = body weight; F = female; M = male; PQQ = pyrroloquinoline quinone; w/o = without.

### 6.B.3. Animal Toxicity Studies

#### Studies on Nutraland's PQQ disodium salt

##### Acute Oral Toxicity Study in Rats

An acute oral toxicity study was performed in accordance with the Food and Drug Administration (FDA) Redbook 2000: chapter IV.C.3.a *Short-Term Toxicity Studies with Rodents*. PQQ disodium salt was administered to animals by oral gavage at a single dose of 0, 2.78, 3.33, 4.00, 4.78 or 5.78 g/kg bw (5 males and 5 females per group). Animals were observed for 14 days to monitor changes in body weight, clinical signs, as well as food and water consumption. At the end of the study, all surviving animals were sacrificed and major organs were examined. After PQQ disodium salt administration, a number of the animals died during the follow-up period with dose intake levels of 3.33, 4.00, 4.78 and 5.78 g/kg bw. On day 1, greenish feces and/or diarrhea was observed in the 4.00, 4.78 and 5.78 g/kg bw groups after 1-3 h of administration. Also, a greenish tail was found in the 5.78 g/kg bw group. Although the differences were not significantly statistically different, PQQ disodium salt decreased body weight gain, as well as food and water consumption compared to the control. In addition, necropsy revealed enlarged kidneys in the 4.00 g/kg bw group. No gross abnormalities were noted in the control and other PQQ disodium salt treated groups. Taken together, orally administered PQQ disodium salt caused dose-dependent mortalities with a median lethal dose (LD<sub>50</sub>) of 3.86 g/kg bw and a 95% confidence interval of 3.49~4.25g/kg bw (Table 14).

##### Reproductive Toxicity study (Sperm shape abnormality assay) in Mice

Fifty male mice were randomly divided into five groups of 10 each. PQQ disodium salt (oral 0, 500, 1,000, and 2,000 mg/kg bw) and cyclophosphamide (CP, oral 40 mg/kg bw, as a positive control) were administered for five days with a 24-h interval via oral gavage. 0.5% CMCNa was used as a negative control. The behavioral changes were recorded on a daily basis. Thirty-five days after the first administration, 5 mice per group were sacrificed by cervical dislocation and necropsy was conducted.

The epididymis was isolated, placed into a culture dish containing 2 ml of 0.15 M NaCl and cut vertically by using ophthalmological scissors once or twice. After 3–5 min of static incubation, the suspension was shaken gently and filtered with four layers of the lens-cleaning paper. The filtrate was smeared onto the slide, air-dried and fixed with 95% methanol for 5 min. After being air-dried, the slide was stained with 2% eosin for 1 h, gently washed with distilled

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water and air dried. The fields that appeared with less overlapped sperm under the microscope at low magnification were examined at high magnification. A total of 1000 sperms were recorded for each animal under an optical microscope. Sperm that appeared as hookless, banana-shaped, amorphous, folded tail, double-headed, double-tailed were considered abnormal. The type of abnormal sperm was recorded. The percentage of sperm malformation and abnormality rate were calculated, first as a total, then further classified in relation to the specific anatomical location of each abnormality in the sperm. The results indicated that there was no treatment-related sperm abnormalities at any dose level of PQQ disodium salt (500–2,000 mg/kg bw). The sperm abnormality ratio in all treatment groups and the negative control group was significantly lower than in the positive control group treated with cyclophosphamide, indicating that PQQ disodium salt at the doses studied did not cause abnormal sperm morphology.

Studies on Other Sources of PQQ disodium salt

Since the FDA’s last review of GRNs 625 and 641 in 2016, no new toxicity study has been published. Thus, this GRAS notice has summarized the existing studies pertaining to the toxicity of PQQ in animals which were included in previous GRAS notices and a NDI notice (Table 14; GRNs 625 and 641; NDIN RPT 417; Steinberg et al., 2003). The findings of the published animal studies collectively support the safety of PQQ disodium salt supplementation. Specifically, the results from subchronic toxicity studies by Nakano et al. (2014) and Liang et al. (2015) indicate that PQQ disodium salt was safe up to the highest doses tested, which are 100 mg/kg bw/d and 400 mg/kg bw/d, respectively. For these ‘pivotal’ studies, the dose levels represent the maximum doses administered, rather than absolute safety endpoints. No adverse effects of PQQ disodium salt were noted.

Table 14. Oral toxicity studies of PQQ disodium salt in animals

Animal	Dose, PQQ disodium salt	Duration	Measured Outcome	NOAEL or LD <sub>50</sub>	Reference
<b>Nutraland’s PQQ disodium salt</b>					
50 male and female Sprague-Dawley rats	0, 2.78, 3.33, 4.00, 4.78 or 5.78 g/kg bw	Single day	Oral median lethal dose (LD <sub>50</sub> )	LD <sub>50</sub> : 3.86 g/kg bw	Gao, 2016b
50 male mice	0, 500, 1000, and 2000 mg/kg bw/d	35 days	Sperm abnormalities	NOAEL; 2,000 mg/kg bw	Gao, 2016a
<b>Studies of Other PQQ disodium salt</b>					
Acute toxicity studies					
50 male and female	1, 2.15, 4.64, 10.0,	Single day	LD <sub>50</sub>	LD <sub>50</sub> : M,	GRN 625, FDA 2016b

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Sprague-Dawley rats	or 21.5 g/kg bw			3.69 g/kg bw; F, 5.01 g/kg bw	(synthetic, page 29 )
ICR mice	1-21.5 g/kg bw	Single day	LD <sub>50</sub>	LD <sub>50</sub> : M, 4.22 g/kg bw; F, 5.84 g/kg bw	GRN 641, FDA 2016a; (produced by microbial Fermentation; page 31)
Subchronic toxicity study					
80 male and female Sprague-Dawley rats	0, 100, 200, or 400 mg/kg bw/d	90 days	Hematology, body weight, food consumption, urinalysis, mortality, serum clinical biochemistry, and histopathology	NOAEL: 400 mg/kg bw/d	Liang et al., 2015 (method of manufacture: unknown) & GRN 625 (synthetic; pages 29-34)
Teratogenicity study recently cited in GRN 641					
Wistar rats	0, 78, 310 and 1,250 mg/kg bw/d	7th to the 16th day of gestation	Teratogenicity (embryo survival and development, fetal gross malformations, and fetal bone and organ development)	Not teratogenic	GRN 625, FDA 2016b (synthetic; pages 38-39)
Reproductive toxicity study cited in other GRAS notices					
Kunming mice	460, 920, and 1,840 mg/kg bw	5 d	Sperm malformation Assay	No abnormality	GRN 625, FDA 2016b (synthetic; page 37)
Female BALB/c mice	0 or 6µM/kg diet	8 weeks before breeding	Reproductive performance	6µM/kg diet, the highest level tested	Steinberg et al., 2003
Data included in the FDA's 2007 review (NDIN RPT 417, PQQ disodium salt produced by microbial fermentation)					
80 male and female Sprague-Dawley rats	0, 500, 1,000, or 2,000 mg/kg bw	acute, 14 d follow-up	LD <sub>50</sub>	LD <sub>50</sub> : M, 1- 2 g/kg bw; F, 0.5-1.0 g/kg bw	RPT 417 (FDA, 2007; produced by microbial fermentation); the data were later published
72 male and female Sprague-Dawley rats	0, 3, 12, 48, 192, or 768 mg/kg bw/d	14 d	Hematology, body weight, food consumption, urinalysis,	NOAEL: 192 mg/kg bw/d	

## Pyrroloquinoline quinone (PQQ) disodium salt

36 female Sprague-Dawley rats	0, 200, or 700 mg/kg bw/d	28 d	mortality, serum clinical biochemistry, histopathology	NOAEL: <200 mg/kg bw/d	by Nakano et al. (2014)
80 male and female Sprague-Dawley rats	0, 3, 20, or 100 mg/kg bw/d	91 d (13 wk)		NOAEL: 100 mg/kg bw/d, the highest level tested	

Abbreviations: NOAEL= no-observed-adverse-effect-level; LD<sub>50</sub>= lethal dose 50; bw= body weight; d= day; M= male; F= female; PQQ = pyrroloquinoline quinone; wk= week.

### 6.D.4. Animal Efficacy Studies

The literature was searched for animal studies which examined the effects of orally administered PQQ disodium salt. Since the FDA review of 2016, three animal efficacy studies of PQQ disodium salt were published (Table 15; Huang et al., 2016; Jonscher et al., 2016; Wang et al., 2016). Animal efficacy studies reported in GRN 641 include: Kilgore et al., 1989; Kumar et al., 2015; Wang et al., 2015). Additional animal efficacy studies showed that PQQ at the level of up to 2 mg/kg diet/day (Stites et al. 2006) or 30 mg/kg bw/day (Hamagishi et al. 1990) did not cause any adverse effects on measured outcomes.

Although these studies were designed to investigate the efficacy of PQQ on various health parameters, several safety related endpoints were obtained during the experiments. Therefore, these studies are reviewed below as additional supporting information. These The results are summarized in Table 15. None of these studies reported adverse effects of PQQ disodium salt on measured outcomes.

Table 15. Summary of animal efficacy studies of PQQ disodium salt published since 2016

Animal	Dose	Duration	Measured Outcome	Results	Author
360 53-week-old Hy-Line Gray laying hens	An oxidized sunflower oil diet with 0.08 or 0.12 mg PQQ disodium salt/kg diet	6 weeks	Oxidative stress parameters in the liver and plasma and liver DNA damage	These unfavorable changes induced by the oxidized sunflower oil diet were modulated by dietary vitamin E or PQQ disodium salt supplementation to levels comparable to the fresh oil group	Wang et al., 2016
15 female 8-week-old C57BL/6J mice	Untreated control (no irradiation); 4 gray (Gy) X-ray irradiation; or 4 Gy X-ray irradiation with additional dietary PQQ (4 mg PQQ/kg in normal diet)	4 weeks	Radioprotective effects	PQQ could partially rescue irradiation-induced damage to parotid glands via multiple mechanisms, such as promoting proliferation, inhibiting apoptosis and senescence, upregulating antioxidant ability, scavenging reactive oxygen species and reducing DNA damage.	Huang et al., 2016
Mice, C57BL/6J	Study 1- Pregnant mice-high fat diet w/ or w/o PQQ (7.5 ug/mouse/d); Study 2-A subset of offsprings-Western diet w/ and w/o PQQ (24 ug/mouse/day)	During pregnancy and postnatally (mothers and offsprings)	Nonalcoholic fatty liver disease indices including hepatic ceramide levels, oxidative stress and expression of proinflammatory genes (Nos2, Nlrp3, Il6, and Ptgs2), glucose metabolism, superoxide dismutase activity, and histology	PQQ had no effect on weight gain but increased metabolic flexibility while reducing body fat and liver lipids compared with untreated obese offspring. Indices of nonalcoholic fatty liver disease were decreased in PQQ-fed mice, concomitant with increased expression of fatty acid oxidation genes and decreased Pparg expression. The authors concluded that early PQQ supplementation had protective effects on developmental programming of hepatic lipotoxicity and inflammation in obese mice. No adverse effects on reproductive toxicity were noted.	Jonscher et al., 2016

### 6.B.5. Human Clinical Studies

Since the FDA’s review of 2016, one human clinical study has been published (Nakano et al., 2016). In addition, GRN 625 and GRN 641 reported a few human clinical studies of PQQ disodium salts (Itoh et al., 2016; Nakano et al., 2015a; Nakano et al., 2015b; Nakano et al., 2012; Tsuji et al., 1998, Urakami et al., 1994, cited in Rucker et al., 2009; Nakano et al., 2009; Harris et al., 2013). The results are summarized in Table 16. No adverse effects of PQQ were noted at daily doses of up to 60 mg/person/day, the highest dose tested. Although these studies were designed to investigate the efficacy of PQQ on various health parameters, several safety related endpoints were obtained during the experiments. Therefore, these studies are reviewed below as additional supporting information. For these ‘pivotal’ studies, the dose levels represent the maximum doses administered, rather than absolute safety endpoints.

Table 16. Human clinical studies of PQQ disodium salt

Subjects	Dose	Duration	Measured Outcome	Results	Author
<b>A study published since FDA’s 2016 review</b>					
20 elderly healthy subjects aged 50-70 years	20 mg	12 weeks	Regional cerebral blood flow and oxygen metabolism in prefrontal cortex; Hb concentration and absolute tissue oxygen saturation in the bilateral prefrontal cortex	PQQ causes increased activity in the right prefrontal cortex associated with increases in regional cerebral blood flow and oxygen metabolism, resulting in enhanced cognitive function.	Nakano et al., 2016
<b>Studies reviewed in the GRNs 625 (pages 43-44) and 641 (pages 39-40)</b>					
41 elderly healthy subjects	20 mg	12 weeks	Cognitive function	PQQ increased cerebral blood flow in the prefrontal cortex	Itoh et al., 2016
29 healthy subjects, 40-57 y	20 mg	6 and 12 weeks	Serum lipid profile	PQQ marginally significantly decreased serum LDL-cholesterol concentration.	Nakano et al., 2015a
22 healthy women with mildly dry skin, 20-49 y	20 mg	8 weeks	Skin health	PQQ improved skin conditions.	Nakano et al., 2015b

17 healthy adults	20 mg	8 weeks	Subjective symptoms, body weight, heart rate, blood pressure	No adverse effects related to PQQ disodium salt, as measured by subjective symptoms, objective findings and abnormal changes in the measured values were observed.	Nakano et al., 2012
20 healthy adults	0, 20, or 60 mg/d	4 weeks	Liver toxicity, urinary biomarkers, serum biochemistry, and adverse events	No adverse effects were observed in standard clinical tests (glucose, TG, lipoprotein fractions). Functional tests for liver toxicity were also normal. Urinary N-acetyl- $\beta$ -(D)-glucosaminidase activity was also normal. No adverse effects of PQQ were noted.	Tsuji et al., 1998, Urakami et al., 1994; cited in Rucker et al., 2009
71 healthy adults, 45-65 y	20 mg PQQ+ 300 mg CoQ10	4, 8, and 12 weeks	Memory and attention	PQQ significantly increased word memorization, recall task and attention (no data shown).	Nakano et al., 2009
10 male and female subjects	0.2 mg/kg bw	Single dose	Plasma/urine PQQ levels, antioxidant potential, standard clinical indices	PQQ slightly increased antioxidant potential. Serum TC, LDL-C, HDL-C, TG, creatinine, glucose, uric acid, total protein, and aspartate aminotransferase activity were within normal range. Levels of PQQ peaked in serum in about 2 hours.	Harris et al. 2013
10 male and female subjects	0.3 mg/kg bw/d	3 days	Inflammation indices, standard clinical indices, estimates of urinary metabolites	PQQ decreased levels of CRP, IL-6, and urinary methylated amines. PQQ increased mitochondria-related functions. Serum concentrations of TC, LDL-C, HDL-C, TG,	Harris et al. 2013

				uric acid, creatinine, glucose, total protein, and aspartate aminotransferase activity were within normal range.	
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bw = body weight; CRP = C-reactive protein; HDL-C = high density lipoprotein cholesterol; IL=interleukin; LDL-C = low density lipoprotein cholesterol; PQQ = pyrroloquinoline quinone; TC = total cholesterol; TG = triglycerides.

### 6.C. Safety determination

Numerous human and animal studies have reported health benefits of PQQ with no major adverse effects. Nutraland uses a HACCP-controlled manufacturing process and rigorously tests its final production batches to verify adherence to quality control specifications. There is broad-based and widely disseminated knowledge concerning the chemistry of PQQ disodium salt. This GRAS determination is based on the data and information generally available and consented opinion about the safety of PQQ disodium salt. The literature indicates that PQQ disodium salt offers consumers health benefits without serious adverse effects.

The following safety evaluation fully considers the composition, intake, nutritional, microbiological, and toxicological properties of PQQ disodium salt as well as appropriate corroborative data.

1. Nutraland’s PQQ disodium salt (powder form) is manufactured via microbial fermentation under current Good Manufacturing Practices (cGMP) using common food industry materials and processes.
2. Analytical data from multiple lots indicate that PQQ disodium salt complies reliably with the established specifications and meets all applicable purity standards.
3. In response to GRAS notifications on PQQ (GRN 625 and 641), the FDA did not question the safety of PQQ disodium salt for the specified food uses.
4. The intended use of PQQ disodium salt is in the same food products and at levels proportional to those mentioned in GRN 625 and GRN 641. Nutraland’s PQQ disodium salt will be used as a food ingredient (nutrient) at concentrations of 8-20 mg per serving (reference amounts customarily consumed, 21CFR 101.12) in selected beverages (energy, sport, and electrolyte drinks; enhanced and fortified water beverages; bottled water; and non-milk based meal replacement beverages) at maximum use levels of up to 8 to 20 mg/serving in these product types.



5. Since intended use and use levels combined those described in GRN 625 and 641, the EDIs in this GRAS determination are estimated to be slightly higher (by approximately 7% for all-users) than those described in the two GRAS notices. However, EDIs presented in this GRAS notice are within the safe intake levels. Among consumers in the total population, the mean and 90th percentile all-user intakes of PQQ were determined to be 29.9 and 65.8 mg/person/day, respectively. Corresponding EDIs reported in GRN 625 were 26.5 and 61.4 mg/person/day. In GRN 641, mean and 90th percentile all-user intakes of PQQ were 12.8 and 27.8 mg/kg bw/day, respectively. It is assumed that Nutraland's PQQ disodium salt will replace currently marketed PQQ disodium salt or other PQQ sources. Thus, cumulative exposures are not expected to change.
6. In the previous GRAS notices to the FDA, the safety of PQQ disodium salt has been established in toxicological studies in animals, mutagenicity studies, and is further supported by clinical studies in human. The NOAEL was determined to be 400 mg/kg bw/day in a subchronic toxicity study in rats. After applying a safety margin of 100, it can be concluded that doses up to 4 mg/kg bw/day or 240 mg/person/day would be safe in an average American adult weighing 60 kg. The EDIs under the intended use are less than one thirds of the estimated safe intake levels in humans.
7. Furthermore, historical consumption of PQQ disodium salt supports the safety of PQQ disodium salt. Additional studies published subsequent to the FDA GRAS notices continue to support safety of PQQ disodium salt as a food ingredient.

#### **6.D. Conclusions and General Recognition of the Safety of the Use of PQQ**

The intended uses of PQQ disodium salt have been determined to be safe through scientific procedures as set forth in 21 CFR 170.3(b), thus satisfying the so-called "technical" element of the GRAS determination. In addition, because this safety evaluation was based on generally available and widely accepted data and information, it also satisfies the so-called "common knowledge" element of a GRAS determination.

The PQQ disodium salt, the subject of this GRAS determination, is produced in compliance with cGMP (21 CFR Part 110 and Part 117 Subpart B) and according to HACCP principles by bacterial fermentation using *Hyphomicrobium denitrificans* which is non-toxicogenic and non-pathogenic. The PQQ disodium salt manufacturing process starts with fermentation followed by purification of the crude PQQ disodium salt isolated from the fermentation process. The *Hyphomicrobium* used for the production of PQQ disodium salt is subject to strict quality control for compliance with established internal specifications. The raw materials and processing aids used in the manufacturing process are food grade and/or commonly used in fermentation and food manufacturing processes. The results of batch analyses indicate that the manufacturing method yields a consistent product that reproducibly meets product specifications.

Numerous PQQ disodium salt preparations have been evaluated by the FDA and other global regulatory agencies over the past 10 years for proposed incorporation into food for human consumption. PQQ disodium salt, produced by various methods (synthetic or microbial fermentation), are considered GRAS for use in food for human consumption (GRNs 625 and 641). All of the GRAS notices provided information/clinical study data that supported the safety of the PQQ disodium salt ingredients for use as a food ingredient.

The publicly available scientific literature on the consumption and safety of PQQ disodium salt ingredients, in human clinical studies as well as animal studies, is extensive and sufficient to support the safety and GRAS status of the proposed PQQ disodium salt product. PQQ disodium salt is of low acute oral toxicity. The results from oral subchronic toxicity studies in rats indicate that PQQ disodium salt was safe at the highest doses tested, which were 100-400 mg/kg bw/day. Considering a safety margin of 100, this NOAEL value supports the safe daily intake of PQQ disodium salt up to 70-280 mg for an 80 kg adult. Based on the results of several *in vitro* and *in vivo* genotoxicity studies, there is no evidence to suggest that PQQ presents a mutagenic/genotoxic risk. Human studies have shown that the oral ingestion of PQQ is well-tolerated at intakes ranging from 20 to 60 mg/person/day. For these ‘pivotal’ studies, the dose levels represent the maximum doses administered, rather than absolute safety endpoints.

The proposed uses of PQQ disodium salt are identical to the approved uses for other GRAS products incorporated into foods since intended use and use levels combined those described in GRNs 625 and 641. Among consumers in the total population, the mean and 90th percentile all-user intakes of PQQ disodium salt were determined to be 29.9 and 65.8 mg/person/day, respectively. It is assumed that Nutraland’s PQQ disodium salt will replace currently marketed PQQ disodium salt or other PQQ disodium salt sources. Thus, cumulative exposures are not expected to change.

On the basis of the data and information summarized in this dossier, Nutraland concluded that PQQ disodium salt, produced consistent with cGMP and meeting the specifications described herein, is safe under its intended conditions of use. Nutraland further concluded that these uses of PQQ disodium salt are GRAS based on scientific procedures, and that experts qualified to assess the safety of food and food ingredients would concur with these conclusions. Therefore, it is excluded from the definition of a food additive and may be marketed and sold for its intended purpose in the U.S. without the promulgation of a food additive regulation under Title 21 of the CFR.

Nutraland is not aware of any information that would be inconsistent with a finding that the proposed use of PQQ disodium salt in foods meeting appropriate specifications, and used according to cGMP, is GRAS. Recent reviews of the scientific literature revealed no potential adverse health concerns.

## **PART 7. GENERAL AVAILABILITY OF THE DATA AND INFORMATION**

### **7.A. A List of the Data and Information that are Generally Available, References**

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**7.B. A List of the Data and Information that are Not Generally Available -can be found in Appendix H and I.**

Gao Y. 2016a. Safety evaluation of Pyrroloquinoline Quinone (PQQ) disodium salt: Bacterial reverse mutation, sperm abnormalities, and micronucleus test.

Gao Y. 2016b. Oral acute toxicity study of pyrroloquinoline quinone (PQQ) disodium salt in rats.

## APPENDIX A. Specification and COA of Raw Materials

Name	function	Specification/ standard
Fermentation part		
Methanol (CH <sub>3</sub> OH)	Processing-aid (carbon source for fermentation)	ISO 1338-8:1981
Ammonia water (NH <sub>3</sub> )	Processing-aid  (pH adjustment)	ISO 7105:1985
Ammonium sulfate ((NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> )	Processing-aid (nitrogen source for fermentation)	ISO 3332:1975
Potassium dihydrogen phosphate  (KH <sub>2</sub> PO <sub>4</sub> )	Processing-aid (Fermentation nutrient)	ISO 8157:2015
Disodium hydrogen phosphate dodecahydrate (Na <sub>2</sub> HPO <sub>4</sub> •12H <sub>2</sub> O)	Processing-aid (Fermentation nutrient)	ISO 1970-1:2013
Magnesium sulfate heptahydrate (MgSO <sub>4</sub> •7H <sub>2</sub> O)	Processing-aid (Fermentation nutrient)	ISO 6253-1987
Sodium dihydrogen phosphate (NaH <sub>2</sub> PO <sub>4</sub> •2H <sub>2</sub> O)	Buffer solution	ISO 3360:1976
Hydrochloric acid (HCl)	Crystallization	ISO 2762:1973

**Methanol**

Methanol provide carbon source for fermentation process.

[CAS NO.]:67-56-1

[Molecular Formula]:CH<sub>3</sub>OH

[Molecular Weight]:32.04

[Physical Properties]: Colorless clear liquid

[Specifications]:

Items	Y20151201	Y20151101	Y20141102
Methanol,%	99.5	99.4%	99.6%
Water by KF, %	0.1	0.1%	0.08%
Wt per mL (g)	0.792	0.791	0.793
Acidity (H <sup>+</sup> ), mmol/g	0.0003	0.0004	0.0003

[**Certification**]: ISO9001,ISO14001 &OHASA18001

Producer: West long chemical co., LTD

COA	Methanol			Method of analysis
Manufacturer: West long chemicals co., Ltd	Manufacturer Lot Number: Y20151201 Y20151101 Y20141102			
Item	Test results			
	Y20151201	Y20151101	Y20141102	
Appearance	Colorless clear liquid	Colorless clear liquid	Colorless clear liquid	
Assay, %	99.5%	99.4%	99.6%	USP621
Water by KF, %	0.1%	0.1%	0.08%	USP921
Wt per mL (g)	0.792	0.791	0.793	USP699
Acidity, mmol/g	0.0003	0.0004	0.0003	USP791

Manufacturer Address: P.R.China.



**Ammonia water**

Ammonia water provide nitrogen source and adjust the PH for fermentation process.

[CAS NO.]:1336-21-6

[Molecular Formula]:NH<sub>3</sub>

[Molecular Weight]:17.03

[Physical Properties]:

[Specifications]: Colorless clear liquid

Items	Y20160521	Y20160331	Y20140307
Assay ,%	26	27	25
Chloridum(Cl),%	0.00005	0.00005	0.00005
Sulfide (S),%	0.00002	0.00002	0.00002
Sulfate(SO <sub>4</sub> ),%	0.0002	0.0002	0.0002
Carbonate(NaCO <sub>3</sub> ),%	0.001	0.001	0.001
Phosphate(PO <sub>4</sub> ),%	0.0001	0.0001	0.0001
Sodium (Na),%	0.005	0.005	0.005
Magnesiuml (Mg),%	0.0005	0.0001	0.0001
Potassium (K),%	0.0001	0.0001	0.0001
Calcium (Ca),%	0.0001	0.0001	0.0001
Iron (Fe),%	0.000016	0.000015	0.000018
Copper (Cu),ppm	0.000007	0.000009	0.000008
Plumbum (Pb),ppm	0.48	0.48	0.47

[Standard]: analytical grade

[Certification]: ISO9001,ISO14001 &OHASA18001

Producer: West long chemical co., LT

COA	Ammonia water			Method of analysis
Manufacturer: West long chemicals co., Ltd	Manufacturer Lot Number: Y20160521 Y20160331 Y20140307			
Item	Test results			
	Y20160521	Y20160331	Y20140307	
Appearance	Colorless clear liquid	Colorless clear liquid	Colorless clear liquid	
Assay, %	26%	27%	25%	USP621
Chloride	0.00005%	0.00005%	0.00005%	USP221
Sulfide	0.00002%	0.00002%	0.00002%	USP221
Sulfate	0.0002%	0.0002%	0.0002%	USP221
Carbonate	0.001%	0.001%	0.001%	USP232
Phosphate	0.0001%	0.0001%	0.0001%	USP232
Sodium	0.005%	0.005%	0.005%	USP232
Magnesiuml	0.0001%	0.0001%	0.0001%	USP232

Potassium	0.0001%	0.0001%	0.0001%	USP232
Chloridum	0.0001%	0.0001%	0.0001%	USP221
Iron	0.000016%	0.000015%	0.000018%	USP241
Copper	0.000007%	0.000009%	0.000008%	USP231
Plumbum	0.48ppm	0.48ppm	0.47ppm	USP231

Manufacturer Address: P.R.China.

### Ammonium Sulfate

Ammonium sulfate is used as nitrogen source for fermentation.

[CAS NO.]:7783-20-2

[Molecular Formula]: (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>

[Molecular Weight]:132.14

[Physical Properties]: Colorless crystalline or Translucent powder

[Specifications]:

Items	Y20160319	Y20150422	Y20141007
Ammonium sulfate,%	99.1	99.2	99.0
Ignition residue (sulfate) ,%	0.01	0.01	0.01
Chloride (Cl) ,%	0.005	0.005	0.005
Nitrate (NO <sub>3</sub> ) ,%	0.001	0.001	0.001
Phosphate(PO <sub>4</sub> ) ,%	0.0005	0.0005	0.0005
Potassium (K) ,%	0.005	0.005	0.005
Iron (Fe) ,%	0.00014	0.00017	0.00016
Arsenic (As),ppm	0.18	0.16	0.17
Heavy metals(Zn),ppm	4.6	4.7	4.7

[Certification]: ISO9001,ISO14001 &OHASA18001

Producer: West long chemical co., LTD

### COA

COA	Ammonium sulfate			Method of analysis
Manufacturer: West long chemicals co., Ltd	Manufacturer Lot Number: Y20160319 Y20150422 Y20141007			
Item	Test results			
	Y20160319	Y20150422	Y20141007	
Appearance	Colorless crystalline	Colorless crystalline	Colorless crystalline	
Assay	99.1%	99.0%	99.0%	USP621
Ignition residue	0.01%	0.01%	0.01%	USP733
Chloride	0.005%	0.005%	0.005%	USP221
Nitrate	0.001%	0.001%	0.001%	USP451
Phosphate	0.0005%	0.0005%	0.0005%	USP232
Potassium	0.005%	0.005%	0.005%	USP232
Iron	0.00014%	0.00017%	0.00016%	USP241
Arsenic	0.18 ppm	0.16 ppm	0.17 ppm	USP211
Heavy metals	4.6 ppm	4.7 ppm	4.7 ppm	USP231

Manufacturer Address: P.R.China.

**Potassium dihydrogen phosphate**

Potassium dihydrogen phosphate is used as Fermentation nutrient.

[CAS NO.]:7778-77-0

[Molecular Formula]: KH<sub>2</sub>PO<sub>4</sub>

[Molecular Weight]:136.09

[Physical Properties]: Colorless crystalline

[Specifications]:

Items	Y20160414	Y20151102	Y20150907
Potassium dihydrogen phosphate, %	99.60	99.55	99.55
Loss on drying ,%	0.2	0.2	0.2
Chloride (Cl), %	0.001	0.001	0.001
Sulfate (SO <sub>4</sub> ), %	0.003	0.003	0.003
Total nitrogen (N), %	0.001	0.001	0.001
Sodium (Na), %	0.02	0.02	0.02
Iron (Fe), %	0.001	0.001	0.001
Arsenic (As), ppm	4.5	4.6	4.6
Heavy metals (Pb), ppm	9.5	9.5	9.6

[Certification]: ISO9001,ISO14001 &OHASA18001

Producer: West long chemical co., LTD

COA	Disodium hydrogen phosphate dodecahydrate			Method of analysis
Manufacturer: West long chemicals co., Ltd	Manufacturer Lot Number: Y20160414 Y20151102 Y20150907			
	Test results			
	Y20160414	Y20151102	Y20150907	
Appearance	Colorless crystalline	Colorless crystalline	Colorless crystalline	
Assay	99.60%	99.55%	99.55%	USP621
Ignition residue	0.19%	0.20%	0.21%	USP281
Chloride	0.001%	0.001%	0.001%	USP221
Sulfate	0.003%	0.003%	0.003%	USP221
Total nitrogen	0.001%	0.001%	0.001%	USP421
Sodium	0.02%	0.02%	0.02%	USP232
Iron	0.001%	0.001%	0.001%	USP241
Arsenic	4.5ppm	4.6ppm	4.6ppm	USP211
Heavy metals	9.5ppm	9.5ppm	9.6ppm	USP231

Manufacturer Address: P.R.China.

**Disodium Hydrogen phosphate dodecahydrate**

Disodium hydrogen phosphate dodecahydrate is used as fermentation nutrient elements.

[CAS NO.]:10039-32-4

[Molecular Formula]: Na<sub>2</sub>HPO<sub>4</sub>•12H<sub>2</sub>O

[Molecular Weight]:358.14

[Physical Properties]: Colorless crystalline

[Specifications]:

Items	Y20160304	Y20151101	Y20141101
Disodium hydrogen phosphate dodecahydrate, %	99.1	99.05	99.05
Chloride (Cl),%	0.001	0.001	0.001
Sulfate(SO <sub>4</sub> ),%	0.005	0.005	0.005
Total nitrogen(N),%	0.002	0.002	0.002
Potassium (K),%	0.01	0.01	0.01
Iron(Fe),%	0.00044	0.00045	0.00045
Arsenic (As), ppm	4.6	4.5	4.8
Heavy metals (Pb), ppm	4.8	4.7	4.8

[Standard]: analytical grade

[Certification]: ISO9001,ISO14001 &OHASA18001

Producer: West long chemical co., LT

Chemical Name:	Disodium hydrogen phosphate dodecahydrate			Method of analysis
Manufacturer: West long chemicals co., Ltd	Manufacturer Lot Number: Y20160304 Y20151101 Y20141101			
	Test results			
	Y20160304	Y20151101	Y20141101	
Appearance	Colorless crystalline	Colorless crystalline	Colorless crystalline	
Assay, %	99.1%	99.05%	99.05%	USP621
Chloride, %	0.001%	0.001%	0.001%	USP221
Sulfate, %	0.005%	0.005%	0.005%	USP221
Total nitrogen, %	0.002%	0.002%	0.002%	USP461
potassium, %	0.01%	0.01%	0.01%	USP232
Iron, %	0.00044%	0.00045%	0.00045%	USP241
Arsenic, ppm	4.6 ppm	4.5 ppm	4.8 ppm	USP211
Heavy metals, ppm	4.8 ppm	4.7 ppm	4.8 ppm	USP231

Manufacturer Address: P.R.China.

**Magnesium sulfate heptahydrate**

Magnesium sulfate heptahydrate is used as a nutrient for fermentation.

[CAS NO.]: 7487-88-9

[Molecular Formula]: MgSO<sub>4</sub>•7H<sub>2</sub>O

[Molecular Weight]:246.37

[Physical Properties]: Colorless crystalline

[Specifications]:

Items	Y20160602	Y20150601	Y20141008
Assay ,%	98.15	98.2	98.10
Chloride (Cl), %	0.002	0.002	0.002
Free acid (H <sub>2</sub> SO <sub>4</sub> ), %	0.05	0.05	0.05
Phosphate (PO <sub>4</sub> ), %	0.005	0.005	0.005
Potassium (Ca), %	0.05	0.05	0.05
Iron (Fe), %	0.0008	0.0006	0.0007
Arsenic (As), ppm	1.6	1.7	1.7
Heavy metals (Pb), ppm	9.4	9.4	9.5

[Standard]: analytical grade

[Certification]: ISO9001,ISO14001 &amp;OHASA18001

Producer: West long chemical co., LTD

Chemical Name:	Magnesium sulfate heptahydrate			Method of analysis
Manufacturer: West long chemicals co., Ltd	Manufacturer Lot Number: Y20160602 Y20150601 Y20141008			
	Test results			
	Y20160602	Y20150601	Y20141008	
Appearance	Colorless crystalline	Colorless crystalline	Colorless crystalline	
Assay	98.15%	98.2%	98.10%	USP621
Chloride	0.002%	0.002%	0.002%	USP221
Free acid	0.05%	0.05%	0.05%	USP232
Phosphate	0.005%	0.005%	0.005%	USP232
Potassium	0.05%	0.05%	0.05%	USP232
Iron	0.0008%	0.0006%	0.0007%	USP241
Arsenic	1.6ppm	1.7 ppm	1.7ppm	USP211
Heavy metals	9.4ppm	9.4 ppm	9.5 ppm	USP231

Manufacturer Address: P.R.China.

**Sodium dihydrogen phosphate**

Sodium dihydrogen phosphate is used as buffer solution for purification process.

[CAS NO.]:13472-35-0

[Molecular Formula]: NaH<sub>2</sub>PO<sub>4</sub>•2H<sub>2</sub>O

[Molecular Weight]:

[Physical Properties]: Colorless crystalline

[Specifications]:

Items	20160321	Y20151023	Y20150501
Assay ,%	99.15	99.05	99.10
Chloridum(Cl),%	0.005	0.005	0.005
Sulfate(SO <sub>4</sub> ),%	0.005	0.005	0.005
Nitrate (NO <sub>3</sub> ),%	0.001	0.001	0.001
Ammonium (NH <sub>3</sub> ),%	0.002	0.002	0.002
Iron, (Fe)%	0.0007	0.0008	0.0007
potassium(K),%	0.02	0.02	0.02
Arsenic (As),ppm	1.6	1.5	1.5
Heavy metals(Pb),ppm	9.5	9.4	9.5

[**Standard**]: analytical grade

[**Certification**]: ISO9001,ISO14001 &OHASA18001

Producer: West long chemical co., LTD

Manufacturer Address: P.R.China.

<b>Chemical Name:</b>	Sodium dihydrogen phosphate			Method of analysis
Manufacturer: West long chemicals co., Ltd	Manufacturer Lot Number: Y20160321 Y20151023 Y20150501			
Item	Test results			
	Y20160321	Y20151023	Y20150501	
Appearance	Colorless crystalline	Colorless crystalline	Colorless crystalline	
Assay	99.15%	99.05%	99.10%	USP621
Chloridum	0.005%	0.005%	0.005%	USP221
Sulfate	0.005%	0.005%	0.005%	USP221
Nitrate	0.001%	0.001%	0.001%	USP451
Ammonium	0.002%	0.002%	0.002%	USP232
Iron	0.0007%	0.0008%	0.0007%	USP241
potassium	0.02%	0.02%	0.02%	USP232
Arsenic	1.6ppm	1.5ppm	1.5ppm	USP211
Heavy metals	9.5ppm	9.4ppm	9.5ppm	USP231

**Hydrochloric acid**

Hydrochloric acid is used for Crystallization

[CAS NO.]:7647-01-0

[Molecular Formula]: HCl

[Molecular Weight]: 36.46

[Physical Properties]: Colorless clear liquid

[Specifications]:

Items	Y20160311	Y20151103	Y20150123
Assay, %	38.0	37.5	37.0
Ignition residue( sulfate),%	≤0.0005	≤0.0005	≤0.0005
Free chlorine (Cl),%	≤0.0001	≤0.0001	≤0.0001
Sulfate(SO4),%	≤0.0002	≤0.0002	≤0.0002
Sulfite(SO3),%	≤0.0002	≤0.0002	≤0.0002
Iron(Fe),%	≤0.00005	≤0.00005	≤0.00005
Copper (Cu),%	≤0.000008	≤0.000009	≤0.000008
Tin(Sn),%	≤0.00016	≤0.00018	≤0.00017
Arsenic (As), ppm	≤0.46	≤0.47	≤0.47
Plumbum(Pb),ppm	≤0.45	≤0.45	≤0.46

[Standard]: analytical grade

[Certification]: ISO9001,ISO14001 &amp;OHASA18001

Producer: West long chemical co., LTD

Chemical Name:	Hydrochloric acid			Method of analysis
Manufacturer: West long chemicals co., Ltd	Manufacturer Lot Number: Y20160311 Y20151103 Y20150123			
Item	Test results			
	Y20160311	Y20151103	Y20150123	
Appearance	Colorless clear liquid	Colorless clear liquid	Colorless clear liquid	
Assay	38%	37.5%	37%	USP621
Ignition residue	0.0005%	0.0005%	0.0005%	USP281
Free chlorine	0.0001%	0.0001%	0.0001%	USP232
Sulfate	0.0002%	0.0002%	0.0002%	USP211
Iron	0.00005%	0.00005%	0.00005%	USP241
Tin	0.00016%	0.00018%	0.00017%	USP232
Copper	0.000008%	0.000009%	0.000008%	USP232
Arsenic	0.46ppm	0.47ppm	0.47ppm	USP211
Plumbum	0.45ppm	0.45ppm	0.46ppm	USP231

Manufacturer Address: P.R.China.



## Ethanol

Ethanol is used for Crystallization.

[CAS NO.]:64-17-5

[Molecular Formula]: $\text{CH}_3\text{CH}_2\text{OH}$

[Molecular Weight]:46.07

[Physical Properties]: Clear,colorless liquid

[Specifications]:

Items	20160716	20151103	20150924
Assay, %	99.80	99.75	99.75
Density (20°C),g/mL	0.791	0.790	0.790
Moisture (H <sub>2</sub> O),%	0.26	0.25	0.26
Acidity (H <sup>+</sup> ), mmol/100g	0.039	0.038	0.038
Methanol( $\text{CH}_3\text{OH}$ ), %	0.0041	0.0042	0.0040
Isopropyl alcohol ( $(\text{CH}_3)_2\text{CHOH}$ ), %	0.007	0.008	0.008

[Standard]: analytical grade

[Certification]: ISO9001,ISO14001 &OHASA18001

Producer: West long chemical co., LTD

## **Appendix B. HPLC Conditions**

### **Procedure of Validation**

HPLC parameters

HPLC column: Waters spherisorb (250\*4.6mm, 5 $\mu$ m)

Column temperature: 45°C

Mobile phase A: Mobile phase B=60:40

Flow rate: 1.0 mL/min

Injector volume: 10  $\mu$ L

Wavelength: 249 nm

Detector: UV

Run time: 10 minutes

### **The preparation of solutions**

Diluent

Water, 16% acetone and 0.1M sodium carbonate buffer (pH 9.2)

16% acetone

Take 16mL acetone into a 100-mL volumetric flask, dilute to volume with water, and mix well.

0.1 M sodium carbonate buffer (pH 9.2)

Prepare by weighing 1.2 g of sodium carbonate and transfer to 100-mL volumetric flask, add 30 ml water and stir to dissolve. Cautiously pipette in 0.6 ml of concentrated nitric acid using micropipette. QS to volume with water, check pH and adjust to 9.2 with diluted nitric acid or 0.1N NaOH. Do not keep more than a week, check pH before use.

Mobile phase A

Weigh 2.7g monopotassium and 6.5g tetrabutylammonium bromide into 1000-mL volumetric flask, and mix well. Ultrasonic degassing.

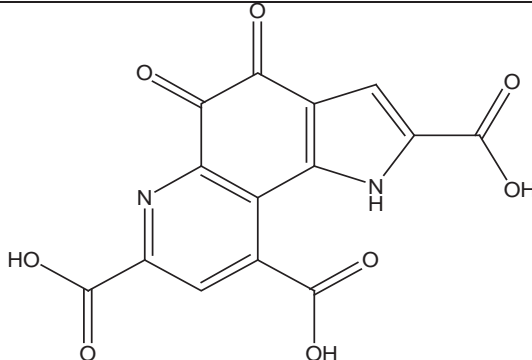
Mobile phase B

Acetonitrile. Ultrasonic degassing.

## Appendix C. Other Identification Methods

Public Lab of Shanghai Pharma Engine Co., Ltd.

### 1. Sample Information

Client	Ubaifu	 <p style="text-align: center;"> <math>C_{14}H_6N_2O_8</math>            Exact Mass: 330.01            Mol. Wt.: 330.21         </p>
Sample Name	Pyrroloquinoline quinone	
Formula	$C_{14}H_6N_2O_8$	
M.W.	330.21	
CAS No.	72909-34-3	

### 2. Structure Elucidation

#### 2.1 FT-IR

Instrument: PE Spectrum Two

Test conditions: Temperature 23°C , Humidity 54%.

Test result: The assignments of main absorption are listed in Table 1. The spectrum of the Nutraland's sample is shown in Figure A1, the spectrum of the Sigma standard is shown in Figure A2.

Table 1. Major absorption peaks list and assignment

Wavelength (cm <sup>-1</sup> )		Vibration Type	Group	Strength	Assignment
NL	SIGMA				
3444	3439	ν	COOH	s	O-H stretching vibration of carboxyl

1716	1716	v	COOH	s	C=O stretching vibration of carboxyl
1682	1673	v	C=O	s	C=O stretching vibration of keto group
1595	1594	v	COO-	s	C=O asymmetry stretching vibration of carboxylic ion
1552	1551	v	C=C	m	Stretching vibration of benzene ring
1497	1494	v	C=C	m	Stretching vibration of benzene ring
1350	1348	v	COO-	s	C=O symmetry stretching vibration of carboxylic ion
1241	1241	v	C-O	s	C-O stretching vibration

## 2.2 UV Absorption

Instrument: PE Lambda 25

Test method: UV scan range: 190nm to 900nm. Water, 0.1N HCl and 0.1N NaOH as solvent

Test Result: The assignments of absorption is listed in Table A2. the spectra of the Nutraland's sample and Sigma standard are shown in Figures A4-A6 and Figures A6-A8, respectively.

Table A2. Absorption peaks list and assignment

Solvent	$\lambda_{max}$ (nm)		Assignment
	NL	SIGMA	
Water	248.8	248.7	K absorption band of conjugated system
	327.1	327.1	K absorption band of conjugated system
0.1N HCl	206.2	205.5	E absorption band of conjugated system
	254.1	254.0	K absorption band of conjugated system
	361.0	361.1	K absorption band of conjugated system
0.1N NaOH	247.6	247.4	K absorption band of conjugated system
	355.0	355.1	K absorption band of conjugated system

### 2.3 Nuclear Magnetic Resonance (NMR) Spectrum

Instrument: Bruker AVANCE III 600MHz UltraShield-Plus TM

Solvent: D<sub>2</sub>O-d<sub>2</sub>. Spectra of the Nutraland's sample and Sigma standard are shown in Figures A9-A10 and Figures A11-A12, respectively.

Test results: The NMR assignments of the Nutraland's sample and the Sigma standard are tabulated in Table A3.

**Table A3. Summary of the NMR Data of PPQ**

Summary of the Analytical Data of the CNMR, DEPT135, HMBC and HSQC Analysis of PPQ						
Chemical Shift(ppm)		DEPT	HSQC Relative H		HMBC Relative H	
NL	SIGMA		NL	SIGMA	NL	SIGMA
110.54	110.54	CH	7.02	7.01		
117.59	117.48	C			7.02	7.01
118.08	118.12	C			7.59	7.56
118.36	118.12	CH	7.59	7.56		
139.64	140.07	C			7.02	7.01
140.32	140.27	C				
141.76	142.14	C			7.02	7.01
147.15	147.01	C				
158.02	158.25	C				
170.32	170.53	C				
170.50	170.53	C			7.59	7.56
175.51	175.51	C			7.59	7.56
190.71	190.90	C				

## 2.4 Mass spectrometry (MS)

Instrument: Waters ZQ2000

Test result: The observed MS signal of the sample under ESI negative ion mode can be assigned as:  $329.01[M-H]^+$  which is consistent with the parent PQQ compound ( molecular weight of 330.01g/mol) (Figure A13). The observed MS signal of the Sigma standard under ESI negative ion mode can be assigned as:  $329.06[M-H]^+$  which is somewhat different from the parent PQQ compound, but it is acceptable (Figure A14).

## 3. Conclusion

The spectral data (FT-IR, UV, NMR, and MS) of the Nutraland's sample and the Sigma standard confirm that Nutraland's sample is PQQ disodium salt.

Figure A1. FT-IR spectrum of the Nutraland's sample

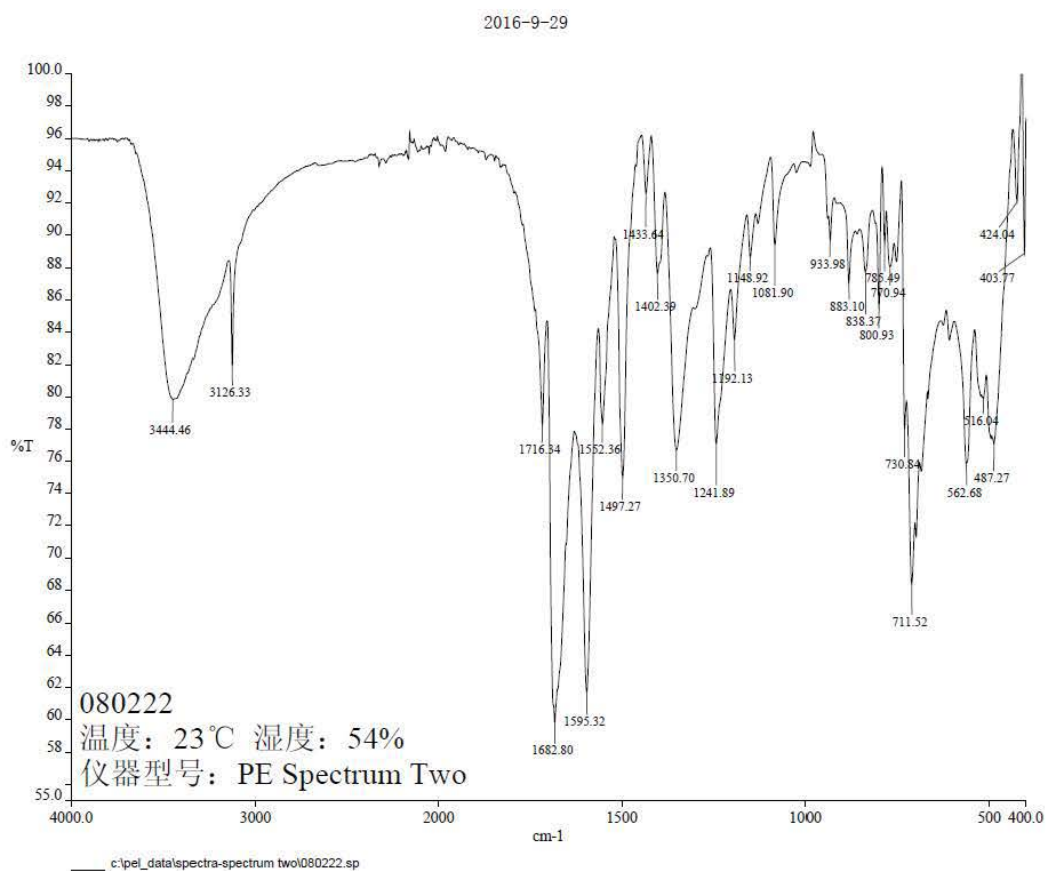


Figure A2. FT-IR spectrum of the Sigma standard

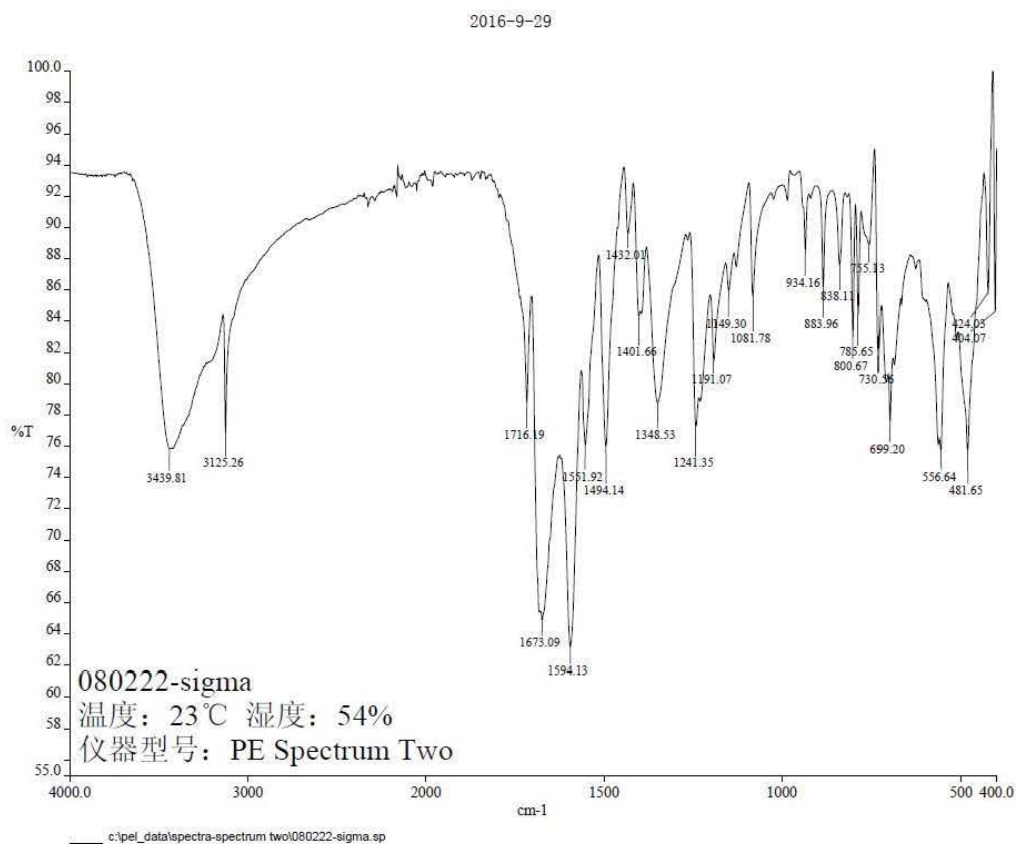
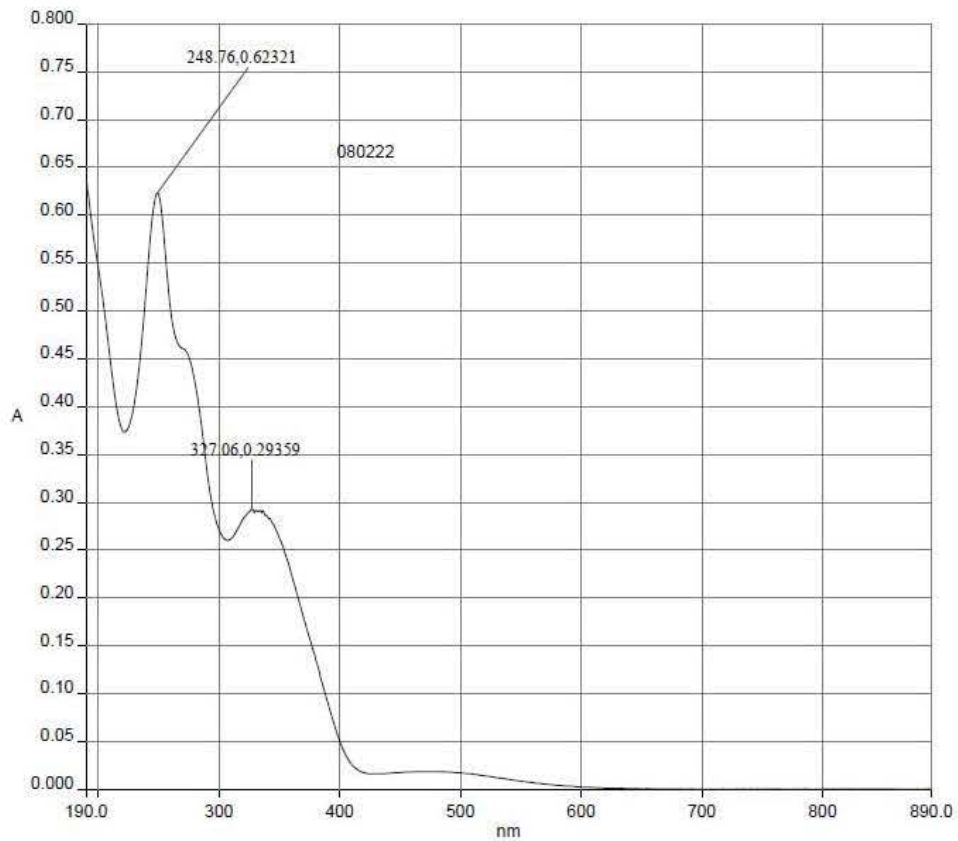




Figure A3. UV spectrum of the Nutraland's sample

Date: 9/29/2016 Time: 9:28:07 AM



Description:

Spectrum Name: C:\UVWINLAB\DATA\16092902.SP Scan Speed: 480.00 nm/min

Date Created: Thu Sep 29 10:10:17 2016

Slit Width: 1.0000 nm

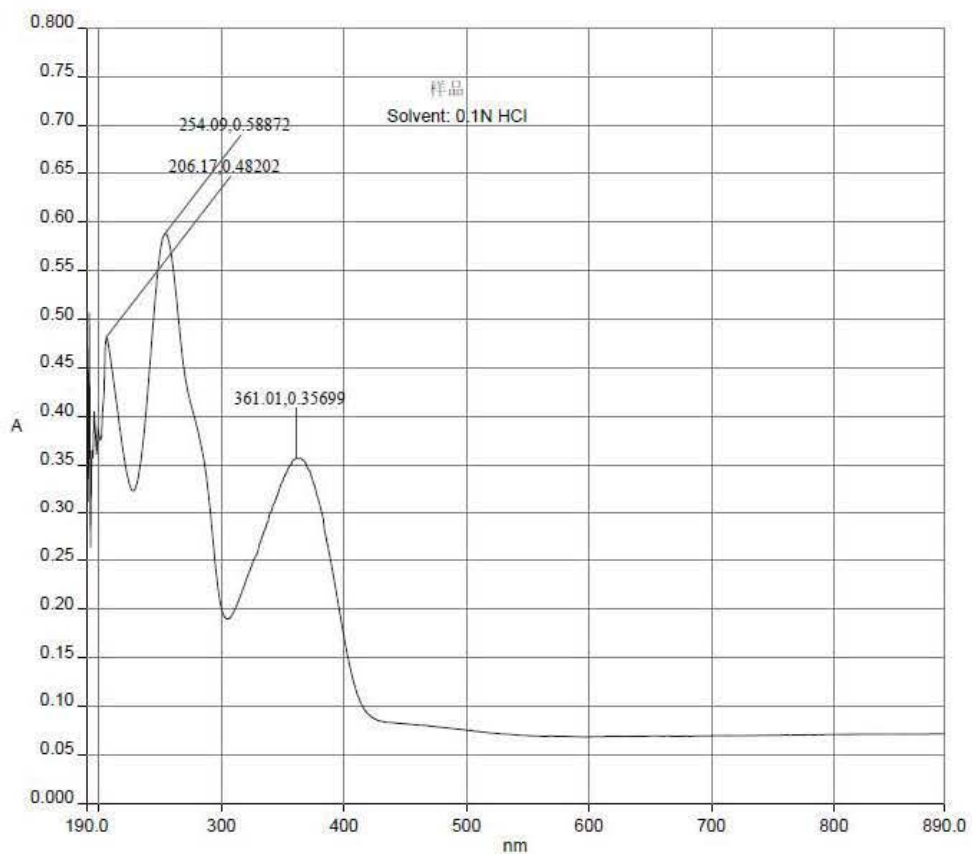
Instrument Model: Lambda 25

Smooth Bandwidth: 0.00 nm

Data Interval: 1.0000 nm

Figure A4. UV spectrum of the Nutraland's sample

Date: 10/12/2016 Time: 3:44:24 PM



Description:

Spectrum Name: C:\UVWINLAB\DATA\16101215.SP Scan Speed: 480.00 nm/min

Date Created: Wed Oct 12 15:03:30 2016

Slit Width: 1.0000 nm

Instrument Model: Lambda 25

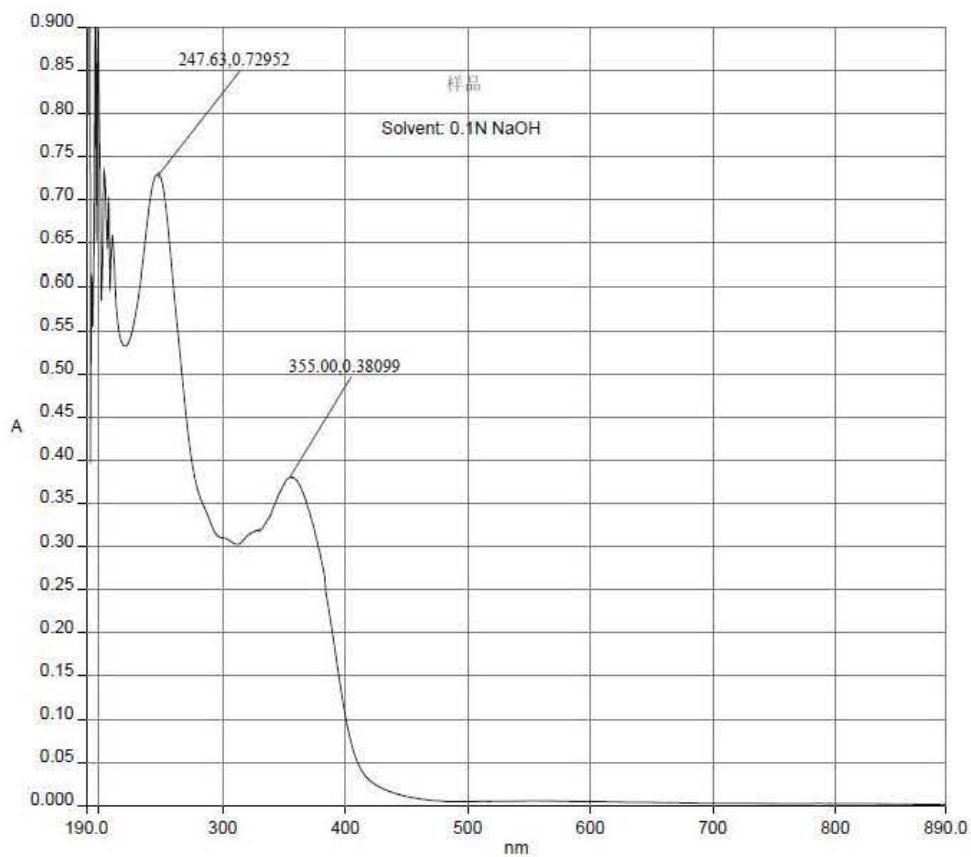
Smooth Bandwidth: 0.00 nm

Data Interval: 1.0000 nm

Figure A5. UV spectrum of the Nutraland's sample

Date: 10/12/2016

Time: 3:46:34 PM



Description:

Spectrum Name: C:\UVWINLAB\DATA\16101206.SP Scan Speed: 480.00 nm/min

Date Created: Wed Oct 12 14:33:04 2016

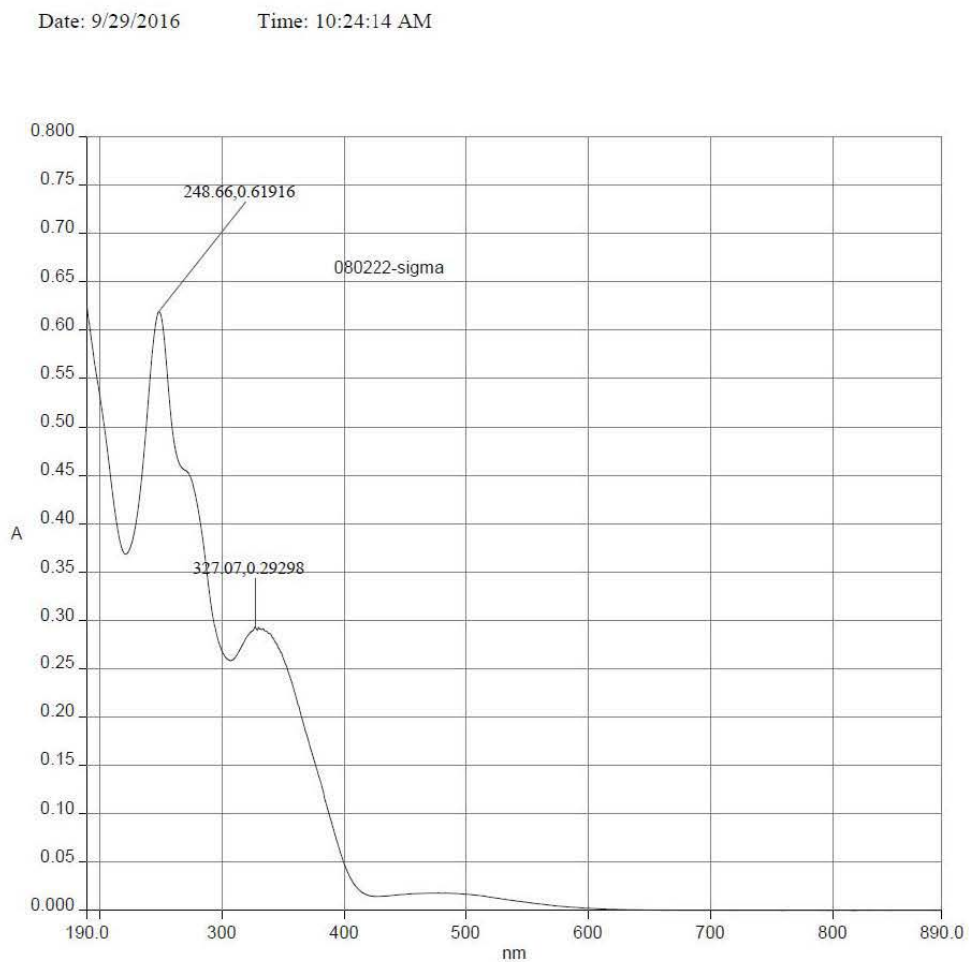
Slit Width: 1.0000 nm

Instrument Model: Lambda 25

Smooth Bandwidth: 0.00 nm

Data Interval: 1.0000 nm

Figure A6. UV spectrum of the Sigma standard



Description:

Spectrum Name: C:\UVWINLAB\DATA\16092904.SP Scan Speed: 480.00 nm/min

Date Created: Thu Sep 29 10:19:50 2016

Slit Width: 1.0000 nm

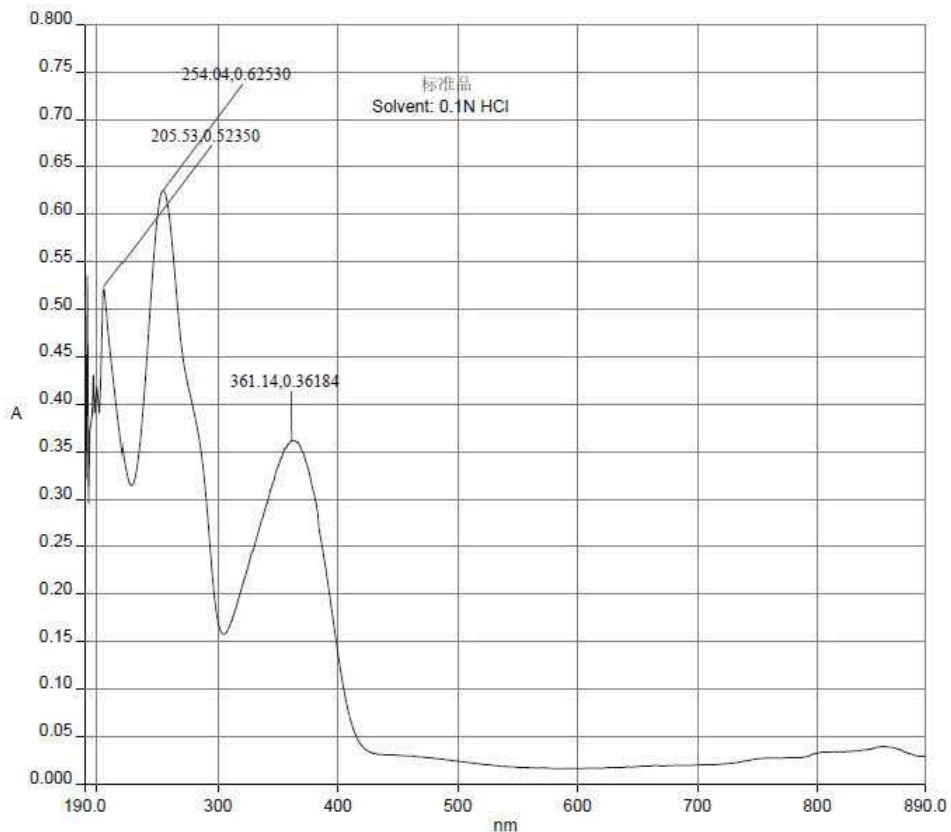
Instrument Model: Lambda 25

Smooth Bandwidth: 0.00 nm

Data Interval: 1.0000 nm

Figure A7. UV spectrum of the Sigma standard

Date: 10/12/2016 Time: 3:43:25 PM



Description:

Spectrum Name: C:\UVWINLAB\DATA\16101218.SP Scan Speed: 480.00 nm/min

Date Created: Wed Oct 12 15:34:38 2016

Slit Width: 1.0000 nm

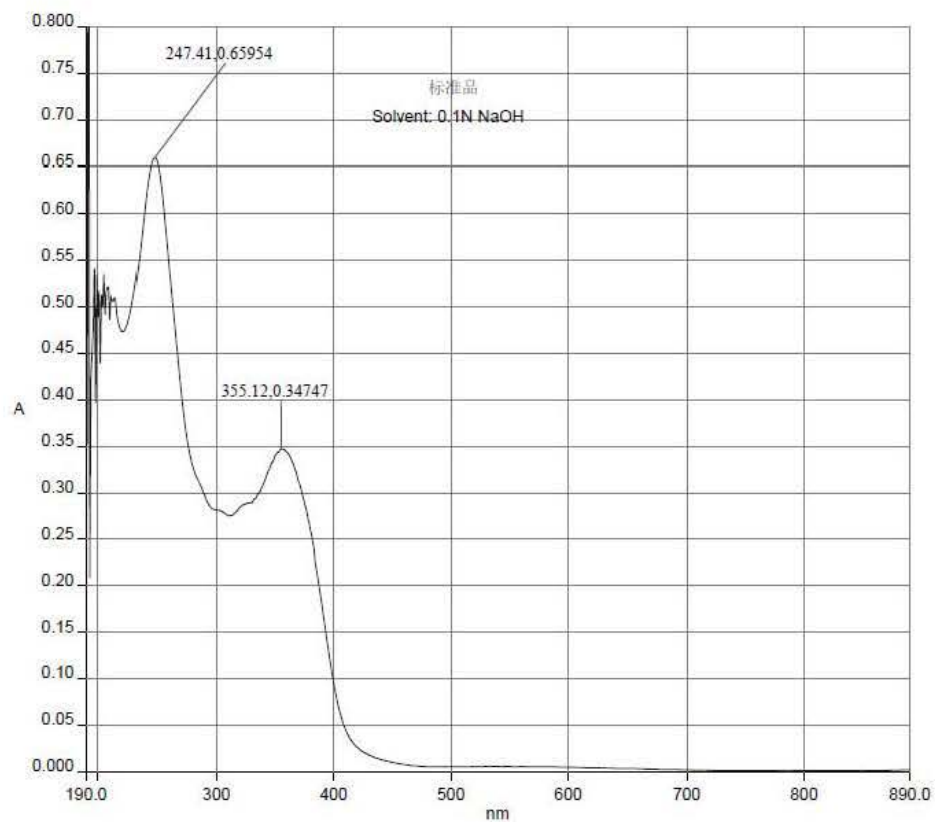
Instrument Model: Lambda 25

Smooth Bandwidth: 0.00 nm

Data Interval: 1.0000 nm

Figure A8. UV spectrum of the Sigma standard

Date: 10/12/2016 Time: 3:45:35 PM



Description:

Spectrum Name: C:\UVWINLAB\DATA\16101210.SP Scan Speed: 480.00 nm/min

Date Created: Wed Oct 12 14:45:32 2016 Slit Width: 1.0000 nm

Instrument Model: Lambda 25 Smooth Bandwidth: 0.00 nm

Data Interval: 1.0000 nm

Figure A9.  $^1\text{H}$ NMR of the Nutraland's sample

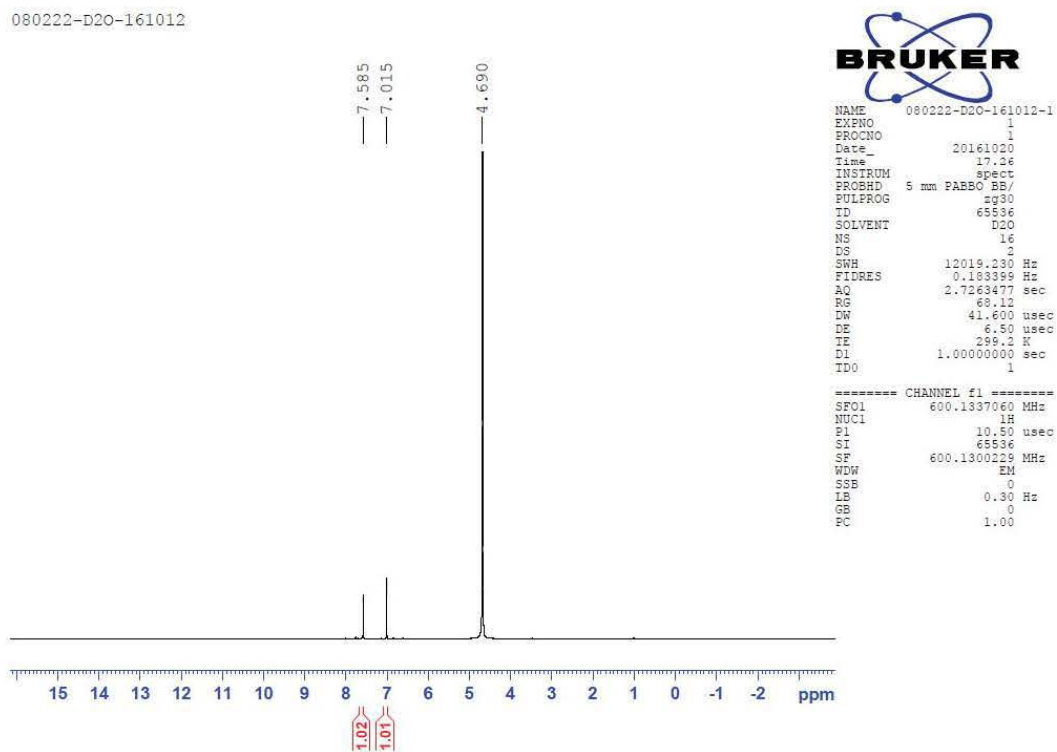


Figure A10. <sup>13</sup>C NMR of the Nutraland's sample

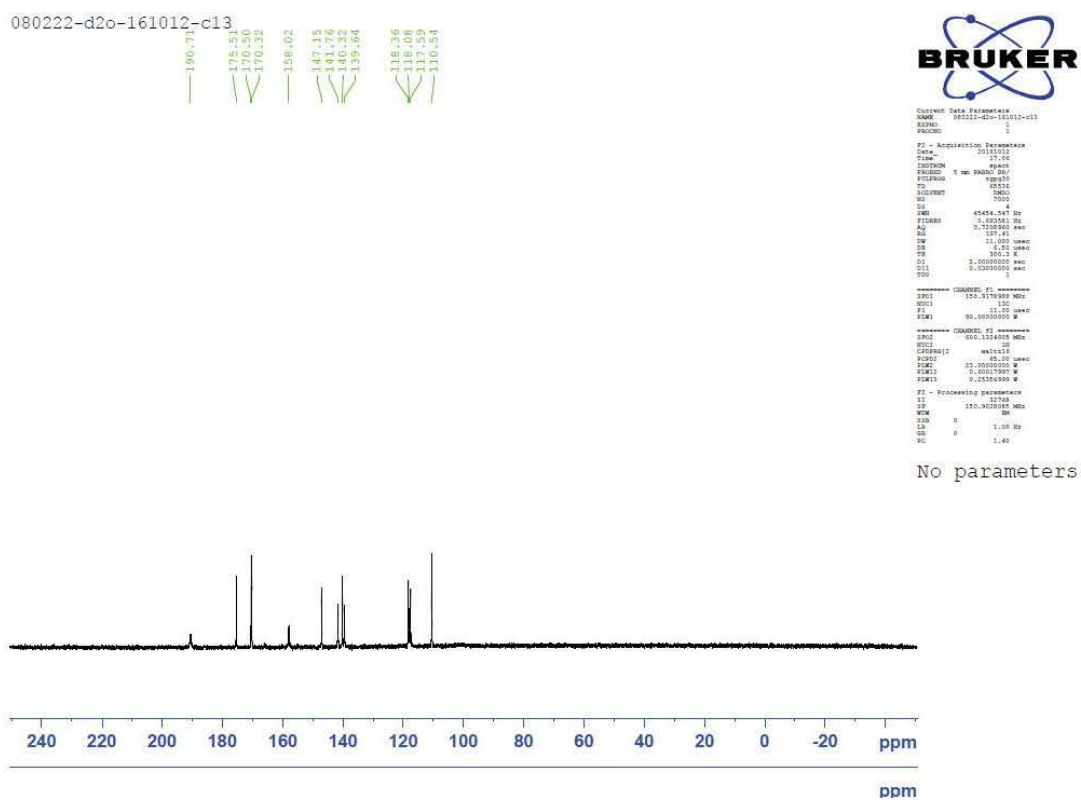




Figure A11. <sup>1</sup>H NMR of the Sigma standard

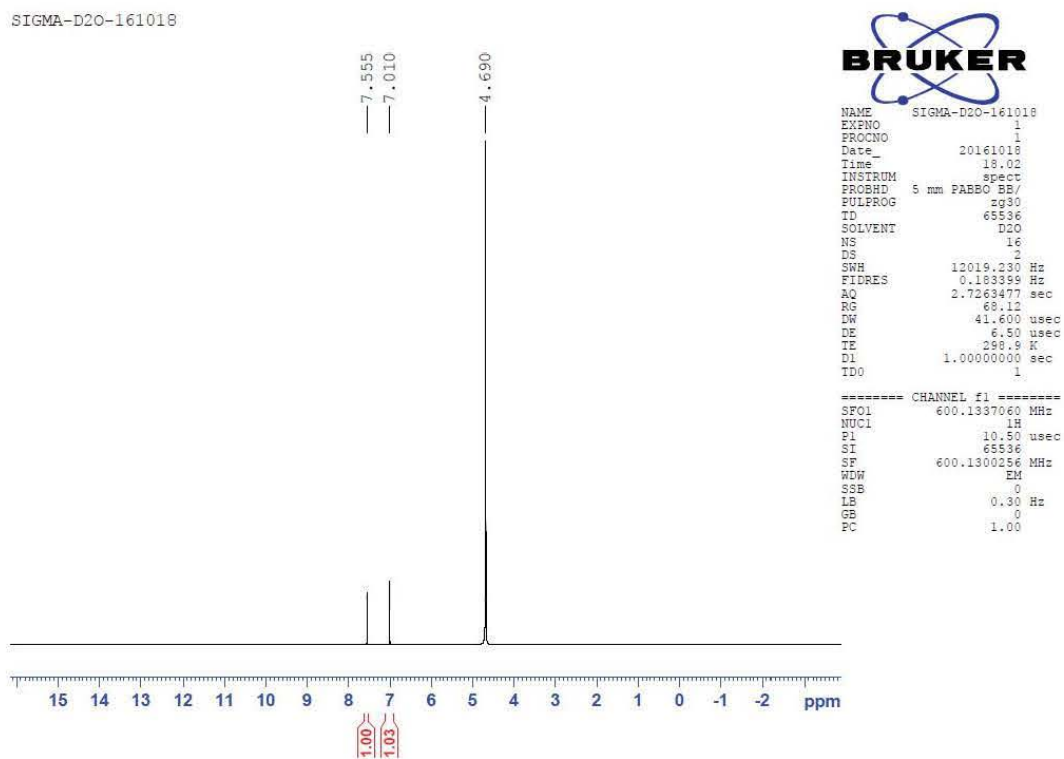


Figure A12. <sup>13</sup>C NMR of the Sigma standard

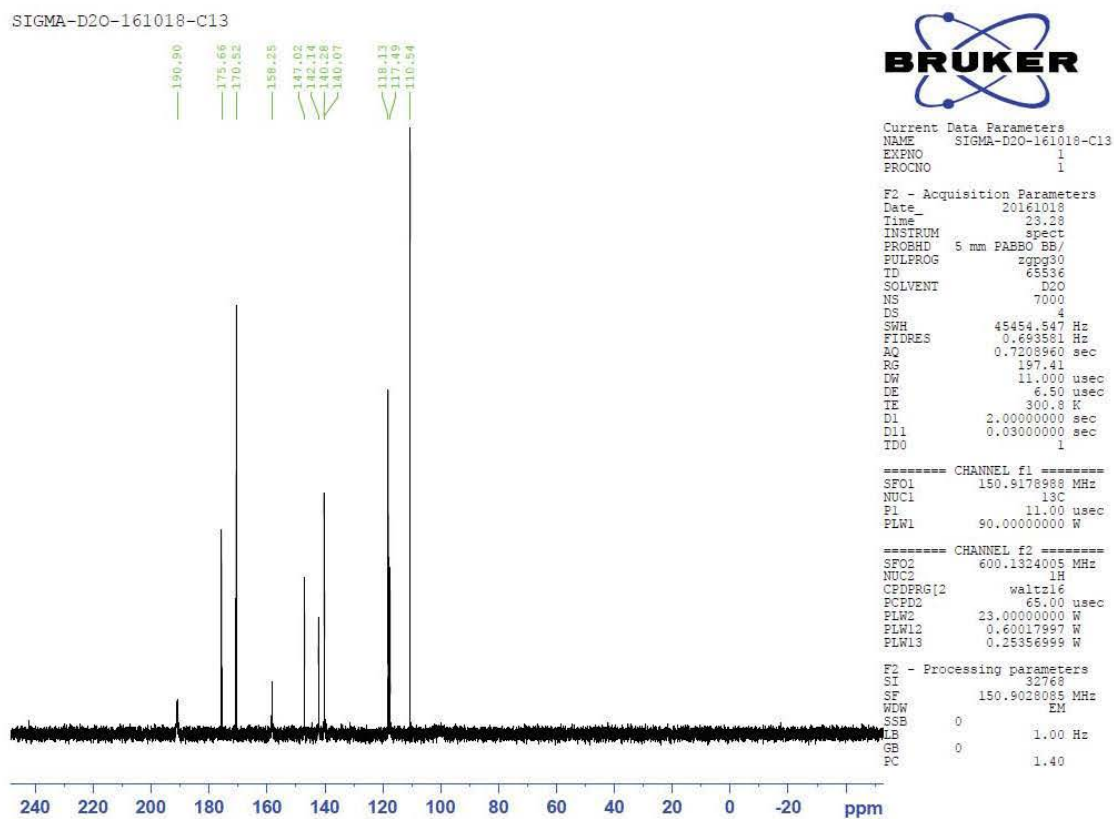


Figure A13. MS spectrum of the Nutraland's sample

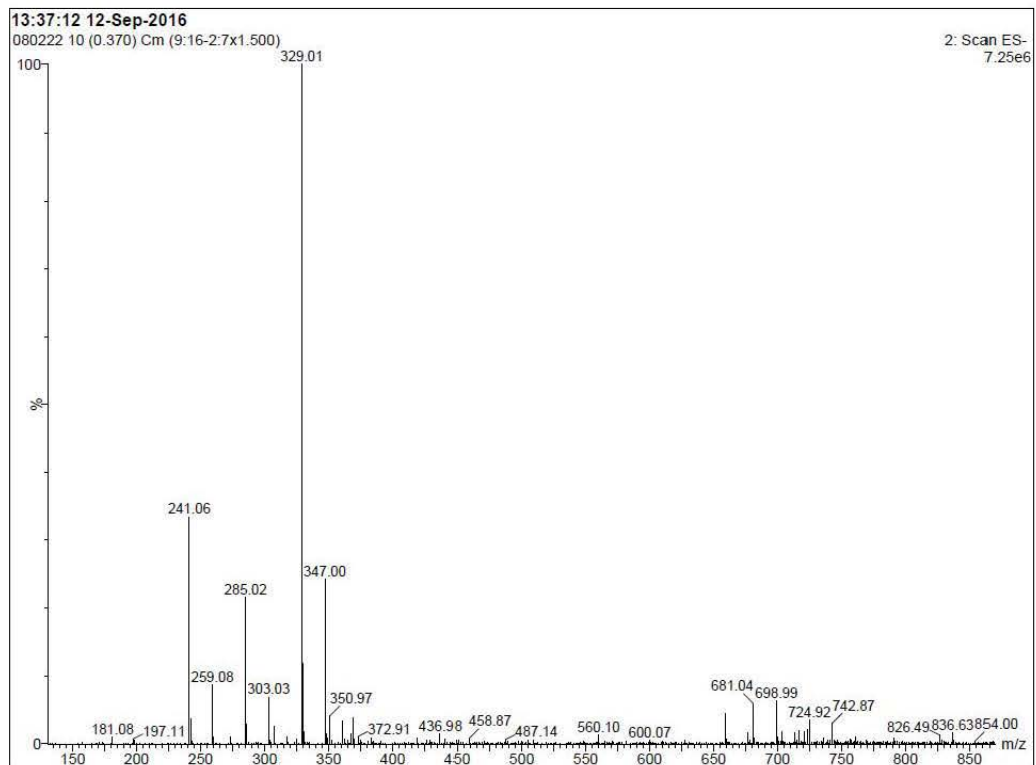
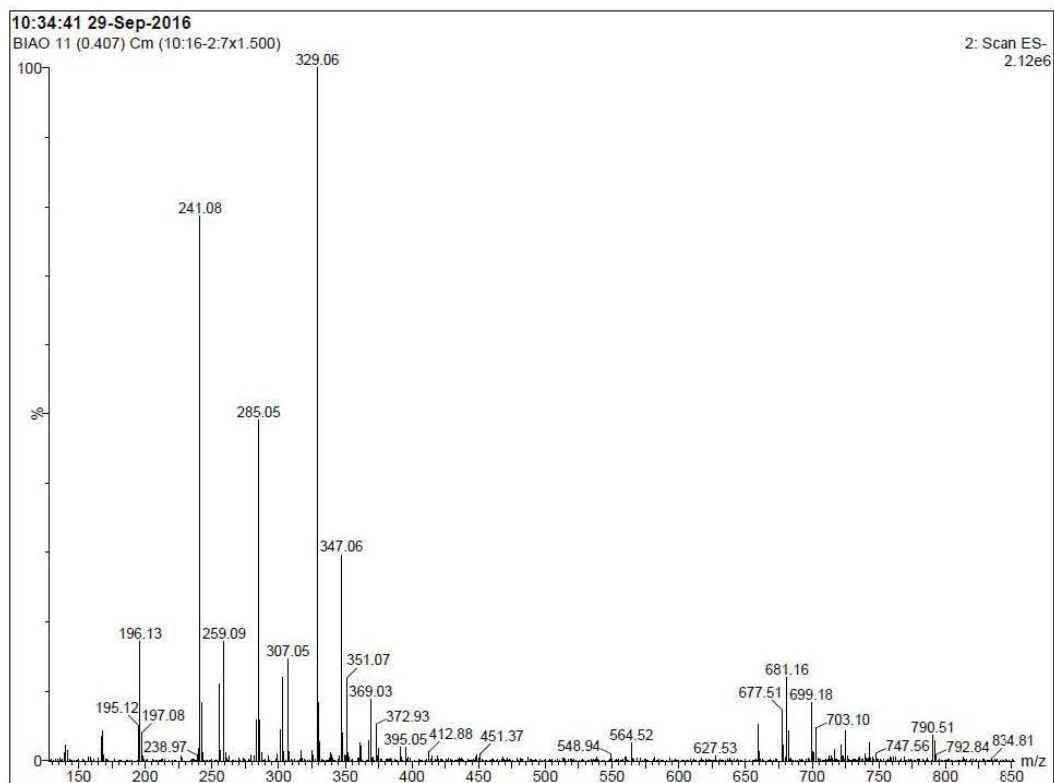


Figure A14. MS spectrum of the Sigma standard



## Appendix D. COA of PQQ Disodium Salt

PARAMETER	SPECIFICATION	Batch Number				
		M16090 338	M16092 643	M16092 042	M16091 337	M160830 35
Identity						
Appearance	Crystalline Powder	Confirms	Confirms	Confirms	Confirms	Confirms
Colour	Reddish Brown	Confirms	Confirms	Confirms	Confirms	Confirms
Taste	Salty	Confirms	Confirms	Confirms	Confirms	Confirms
PHYSICAL-CHEMICAL REQUIREMENTS						
Assay (dry basis)	Not less than 85.0 %	94.9%	95.1%	96.7%	97.8%	96.7%
Water Content Loss on drying	≤12%	11.1	10.9	13.2	11.1	12.0
Ethanol	Not more than 1,000 ppm	24	192	78	24	140
CONTAMINANTS/ADDITIVES						
Arsenic	<1.0 ppm	<0.1	<0.1	<0.1	<0.1	<0.1
Lead	< 1.0 ppm	<0.3	<0.3	<0.3	<0.3	<0.3
Cadmium	< 0.5 ppm	<0.3	<0.3	<0.3	<0.3	<0.3
Mercury	< 0.1 ppm	<0.1	<0.1	<0.1	<0.1	<0.1
Residual Solvents (ethanol mg/kg)	CP2000, App. V	24	192	78	ND	214
Purity	≥98.5%	99.6%	100.0%	99.9%	99.9%	99.8%
MICROBIOLOGICAL ANALYSIS						
Total Aerobic Plate Count	< 10,000 cfu/g	<10	<10	<10	<10	10
Yeast & Mold	< 300 cfu/g	<10	<10	<10	<10	100
Enterobacteriaceae	≤100 cfu/g	ND	ND	ND	ND	ND
<i>E.coli</i>	Negative in 10 g	ND	ND	ND	ND	ND
<i>S.aureus</i>	Negative in 10 g	ND	ND	ND	ND	ND
<i>Salmonella</i>	Negative in 10 g	ND	ND	ND	ND	ND

## Appendix E. *Hyphomicrobium denitrificans* Strain Identification

According to the results of the morphological, physiological properties, sequences of 16S rRNA gene, 23S rRNA gene and moxF gene, the strain FJNU-R82 belongs to :

*Hyphomicrobium denitrificans*

### 1、 Morphological and Physiological properties :

Test	Result	Test	Result	Test	Result
Cell morphology	rod	Gram staining	-	Oxidase	+
Arginine dihydrolase	+	VP test	-	Nitrate reduction	+
Gelatin hydrolysis	-	Urease	-	Catalase	+
Ornithine decarboxylase	-	Indole production	-	H <sub>2</sub> S production	-
Lysine decarboxylase	-	$\beta$ -galactosidase	-	Starch hydrolysis	-
Biolog GEN III (Carbon and nitrogen source utilization)					
Negative Control	-	$\alpha$ -D-Glucose	-	Gelatin	-
Dextrin	-	D-Mannose	-	Glycyl-L-Proline	-
D-Maltose	-	D-Fructose	-	L-Alanine	-
D-Trehalose	-	D-Galactose	-	L-Arginine	-
3-Methyl-D-Glucose	-	D-Cellobiose	-	L-Aspartic Acid	-
Gentiobiose	-	D-Fucose	-	L-Glutamic Acid	-
$\alpha$ -Hydroxy- Butyric Acid	-	L-Fucose	-	L-Histidine	-
L-Pyroglutamic Acid	-	L-Rhamnose	-	Turanose	-
Stachyose	-	Inosine	-	L-Serine	-
p-Hydroxy- Phenylacetic Acid	-	D-Malic Acid	-	Tween 40	+
Methyl Pyruvate	-	L-Malic Acid	-	$\gamma$ -Amino-Butyric Acid	-
D-Lactic Acid Methyl Ester	-	Bromosuccinic Acid	-	Sucrose	-
D-Raffinose	-	D-Sorbitol	-	Pectin	-
$\alpha$ -D-Lactose	-	D-Mannitol	-	D-Galacturonic Acid	-
L-Galactonic Acid Lactone	-	D-Arabitol	-	D-Melibiose	-
$\beta$ -Methyl-D-Glucoside	-	Myo-Inositol	-	D-Gluconic Acid	-
D-Salicin	-	Glycerol	-	D-Glucuronic Acid	-
N-Acetyl-D-Glucosamine	-	D-Glucose-6-PO <sub>4</sub>	-	L-Lactic Acid	-
N-Acetyl- $\beta$ -D-Mannosamine	-	D-Fructose-6-PO <sub>4</sub>	-	Mucic Acid	-

N-Acetyl-D-Galactosamine	-	D-Aspartic Acid	-	Quinic Acid	-
N-Acetyl Neuralminic acid	-	D-Serine	-	D-Saccharic Acid	-
$\beta$ -Hydroxy-D,L-Butyric Acid	+	Acetoacetic Acid	+	Acetic Acid	+
$\alpha$ -Keto-Butyric Acid	+	Propionic Acid	+	Formic Acid	+
Biolog GEN III (Chemical sensitivity)					
Positive Control	+	Nalidixic Acid	+	Lincomycin	+
pH 6.0	+	Fusidic Acid	+	Potassium Tellurite	+
pH 5.0	-	D-Serine	+	Aztreonam	+
1% NaCl	+	Troleandomycin	+	Sodium Butyrate	+
8% NaCl	-	Rifamycin SV	+	Tetrazolium Violet	+
Sodium Bromate	+	Minocycline	+	Tetrazolium Blue	+

## The sequence of 23S rRNA gene

GCACCCATGCGATGGGTTTCGGATTTTCAGGGTGTCATCAGAAGGTATTTAGCCCTGA  
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## Reference sequence



>gb|CP002083.1|:3627028-3629326 *Hyphomicrobium denitrificans* ATCC 51888,  
complete genome

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GGCATAAGCCCGCCTG  
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### **Sequence alignment**

**Sequence identity and similarity: 2297/2299 (99%)**

Hyphomicrobium denitrificans ATCC 51888, complete genome

Sequence ID: [CP002083.1](#) Length: 3638969 Number of Matches: 1

Range 1: 3627028 to 3629326 [GenBank](#) [Graphics](#) [▼ Next Match](#) [▲ Previous Match](#)

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Sbjct 3627088		CATAGGGGTTAAAAGCAAACCCAGGGAACCTGAAACATCTCAGTACCTGGAGGAAAGGACA		3627147
Query 120		TCAACCGAGACTCCCGGAGTAGTGGCGAGCGAAAGCGGACTAGGCCAGTGATAAAGCAAT		179
Sbjct 3627148		TCAACCGAGACTCCCGGAGTAGTGGCGAGCGAAAGCGGACTAGGCCAGTGATAAAGCAAT		3627207
Query 180		GACAACTCGAACCATCTCGAAAGTTGGCCCTACCGGCTGACACCCCGGTACAGCTAATC		239
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Query 240		CAGAGCTTTATCCTCGAGTAGAAGGGACACGTGCAATCCTGTTGAACATGGGGGATC		299
Sbjct 3627268		CAGAGCTTTATCCTCGAGTAGAAGGGACACGTGCAATCCTGTTGAACATGGGGGATC		3627327
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Sbjct 3627328		ACCTTCCAAGCCTAAGTACTCCTTACCAGCCGATAGCGCACCAGTACCCTGAGGAAAGG		3627387
Query 360		TGAAAAGCACCCCGACGAGGGGAGTGAAATAGTACCTGAAACCGGATGCCTACAACAGT		419
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Query 420		CGGAGCCCACAAGGGTGACGACGTACCTTTTGTATAATGGGTTGCGACTTAGTCTGACG		479
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Sbjct 3627508		AGCAAGCTTAAGGCGATAGCTGTAGGCGTAGCGAAAGCGAGTCTGAACAGGGCGTTCAGT		3627567
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Query 660		GTGAAAGGCTAATCAAGGCAGGAAATAGCTGGTTCCTCCGAAATCTATTTAGGTAGAGC		719
Sbjct 3627688		GTGAAAGGCTAATCAAGGCAGGAAATAGCTGGTTCCTCCGAAATCTATTTAGGTAGAGC		3627747
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Sbjct 3627748		CTCAGATGAATACTCCAGGGGTAGAGCACTACATGGGCTAGGGGCCCTACAGGGTTAC		3627807
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Query	840	AACGTCCTCGTGAAGAGGGAACACCTGATCGCCGTCTAAGTCCCTAAATCACTGC 	899
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Query	900	TAAGTGTGAAAGGATGTGGGAATCCCATACAGCCAGGATGTTGGCTTAGAAGCAGCCAT 	959
Sbjct	3627928	TAAGTGTGAAAGGATGTGGGAATCCCATACAGCCAGGATGTTGGCTTAGAAGCAGCCAT 	3627987
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Sbjct	3627988	CATTTAAAGAAAGCGTAACAGCTCACTGGTCTAAACAAGGGTTTCTGCGCCGAAAATGTA 	3628047
Query	1020	ACGGGGCTAAAGCAGTGTACCAGAGACGCGGGTGTACAGCAATGTACGCGGTAGCGGAGC 	1079
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Sbjct	3628108	CTTCCCTAACCTCTGAAGCCAGACCCGTGAGCCCTCTCCAGCTATCCCAACTCCGAAT 	3628167
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Sbjct	3628348	GAGGCTTATCGGATTGCCAGGCAGCGAATGTCTCCCTGAAATAGCCCCACGTAGACC 	3628407
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Sbjct	3628768	CCACTGTCTCCAGCACACTCAGTAAAATTGAATCCCGTGAAGATCGGGGTTCCCTG 	3628827
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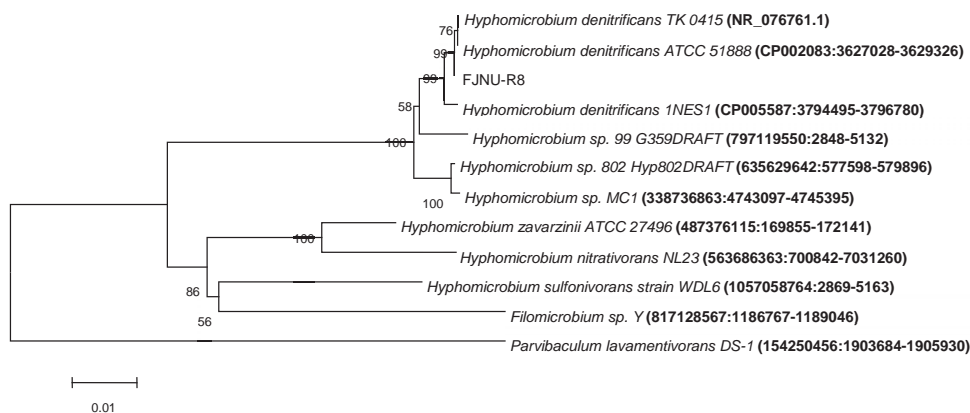
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Sbjct 3629308 GCTGGAGCAGGTCCCAAGG 3629326

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## 23s rRNA gene Phylogenetic tree analysis



## The sequence of 16S rRNA gene and Phylogenetic analysis

ACACATGCAAGTCGAACGCCCGCAAGGGGAGTGGCAGACGGGTGAGTAACACGT  
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## Reference sequence

>gi|300021538:3624641-3626033 *Hyphomicrobium denitrificans* ATCC 51888, complete genome

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### Sequence alignment

**Sequence identity and similarity: 1393/1393 (100%)**

Hyphomicrobium denitrificans ATCC 51888, complete genome

Sequence ID: [NC\\_014313.1](#) Length: 3638969 Number of Matches: 1

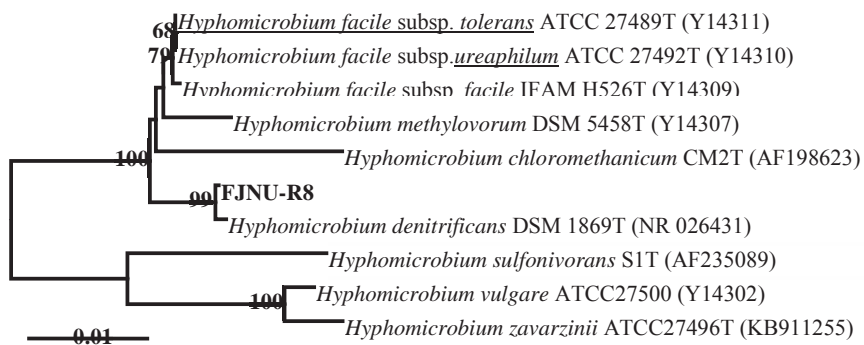
Range 1: 3624641 to 3626033 [GenBank](#) [Graphics](#) ▼ Next Match ▲ Previous Match

Score	Expect	Identities	Gaps	Strand
2573 bits(1393)	0.0	1393/1393(100%)	0/1393(0%)	Plus/Plus
Query 1	ACACATGCAAGTCGAACGCCCGCAAGGGGAGTGGCAGACGGGTGAGTAACACGTGGGAA			60
Sbjct 3624641	ACACATGCAAGTCGAACGCCCGCAAGGGGAGTGGCAGACGGGTGAGTAACACGTGGGAA			3624700
Query 61	CCTTCCTATAGTADGGAATAGCCAGGAAACTTGGAGTAATACCGTATACGCCGAAA			120
Sbjct 3624701	CCTTCCTATAGTADGGAATAGCCAGGAAACTTGGAGTAATACCGTATACGCCGAAA			3624760
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Sbjct 3624821	GCTCACC AAGCGACGATCCTTAGCTGGTTGAGAGAACGACAGCCACACTGGGACTGA			3624880
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Sbjct 3624881	GACACGCCAGACTCCTACGGGAGCAGCAGTGGGGAATATTGGACAATGGCGCAAGC			3624940
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Sbjct 3624941	CTGATCCAGCCATGCCGCGTGAAGGCTTAAAGCTCTTTGGCGG			3625000
Query 361	GGACGATAATGACGGTACCCGCAAGTAAGTCCCGGCTAACTTCGTCCAGCAGCCGCGG			420
Sbjct 3625001	GGACGATAATGACGGTACCCGCAAGTAAGTCCCGGCTAACTTCGTCCAGCAGCCGCGG			3625060
Query 421	TAATACGAAGGGGACTAGCGTTGTTCCGGAATCACTGGGCGTAAAGCGCACGTAGGCGGAT			480
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Query 541	CTTGAGTCCGATAGAGGTGGGTGGAATTCCTAGTGTAGAGGTGAAATTCGTAGATATTAG			600
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Sbjct 3625301	GTGGGGAGCAAAACAGGATTAGATACCCCTGGTAGTCCACGCCGTAACGATGGATGCTAGC			3625360
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Sbjct 3625361	CGTCGGATAGCTTGCTATTCCGTGGCGCAGCTAACGCATTAAAGCATCCCGCTGGGGAGT			3625420
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Sbjct 3625421	ACGGCCGCAAGGTTAAAACCTCAAAGGAATTGACGGGGGCCGCACAAGCGGTGGAGCATG			3625480



Query	841	TGGTTTAATTCGACGCAACGCGAAGAACCTTACCAGCTCTTGACATTACTGATTGCCGG	900
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Sbjet	3625541	TAGAGATGCCGGAGTTCCAGCAATGGACAGTGGGACAGGTGCTGCATGGCTGTCGTCAGC	3625600
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Sbjet	3625601	TCGTGTCGTGAGATGTTGGGTTAAGTCCCACAACGAGCGCAACCCCTCGCCATTAGTTGCC	3625660
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Sbjet	3625661	ATCATTACAGTTGGGCACTCTAGTGGGACTGCCGGTGATAAGCCGGAGGAAGTGGGGATG	3625720
Query	1081	ACGTC AAGTCATCATGGCCCTTACGGGCTGGGCTACACACGTGCTACAATGGCGGTGACA	1140
Sbjet	3625721	ACGTC AAGTCATCATGGCCCTTACGGGCTGGGCTACACACGTGCTACAATGGCGGTGACA	3625780
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Query	1201	GTCTGCAACTCGACCTCATGAAGTCGGAATCGCTAGTAATCGGCATCAGCATGGCGCGG	1260
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Sbjet	3625901	TGAATACGTTCCCGGGCCTTGTACACACCCGCCGTCACACCATGGGAGTTGGTCTTACCC	3625960
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Sbjet	3625961	TAAAACGGTGCCTAACC GCAAGGAGGCAGCCGGCCACGGTAAGGTCAGCGACTGGGGTG	3626020
Query	1381	AAGTCGTAACAAG	1393
Sbjet	3626021	AAGTCGTAACAAG	3626033

## 16s rRNA gene Phylogenetic tree analysis



## Appendix F. NHANES Food Codes for EDI Calculation under the Intended Use

Food code	Food description
95310200	Full Throttle Energy Drink
95310400	Monster Energy Drink
95310500	Mountain Dew AMP Energy Drink
95310550	No Fear Energy Drink
95310555	No Fear Motherload Energy Drink
95310560	NOS Energy Drink
95310600	Red Bull Energy Drink
95310700	Rockstar Energy Drink
95310750	SoBe Energize Energy Juice Drink
95310800	Vault Energy Drink
95311000	Energy Drink
95312400	Monster Energy Drink, Lo Carb
95312500	Mountain Dew AMP Energy Drink, sugar-free
95312550	No Fear Energy Drink, sugar-free
95312555	NOS Energy Drink, sugar-free
95312560	Ocean Spray Cran-Energy Cranberry Energy Juice Drink
95312600	Red Bull Energy Drink, sugar-free
95312700	Rockstar Energy Drink, sugar-free
95312800	Vault Zero Energy Drink
95312900	XS Energy Drink
95312905	XS Gold Plus Energy Drink
95320200	Gatorade G sports drink
95320500	Powerade sports drink
95321000	Sports drink, NFS
95322200	Gatorade G2 sports drink, low calorie
95322500	Powerade Zero sports drink, low calorie
95323000	Sports drink, low calorie
95330100	Fluid replacement, electrolyte solution
95330500	Fluid replacement, 5% glucose in water
92900300	Sports drink, dry concentrate, not reconstituted
95101000	Boost, nutritional drink, ready-to-drink
95101010	Boost Plus, nutritional drink, ready-to-drink
95104000	Glucerna, nutritional shake, ready-to-drink
95105000	Kellogg's Special K Protein Shake
95110000	Slim Fast Shake, meal replacement, regular, ready-to-drink
95110010	Slim Fast Shake, meal replacement, sugar free, ready-to-drink
95110020	Slim Fast Shake, meal replacement, high protein, ready-to-drink
95120000	Nutritional drink or meal replacement, ready-to-drink, NFS
95120010	Nutritional drink or meal replacement, high protein, ready-to-drink, NFS
95120020	Nutritional drink or meal replacement, high protein, light, ready-to-drink, NFS
95120050	Nutritional drink or meal replacement, liquid, soy-based
95201300	EAS Soy Protein Powder
95201500	Herbalife, nutritional shake mix, high protein, powder
95201600	Isopure protein powder

95201700 Kellogg's Special K20 Protein Water Mix  
95210000 Slim Fast Shake Mix, powder  
95210010 Slim Fast Shake Mix, sugar free, powder  
95210020 Slim Fast Shake Mix, high protein, powder  
95220000 Nutritional drink mix or meal replacement, powder, NFS  
95220010 Nutritional drink mix or meal replacement, high protein, powder, NFS  
95230010 Protein powder, soy based, NFS  
95230020 Protein powder, light, NFS  
95230030 Protein powder, NFS  
94100200 Water, bottled, sweetened, with low calorie sweetener  
94100300 Capri Sun Roarin' Waters  
94210100 Propel Water  
94210200 Glaceau Vitamin Water  
94210300 SoBe Life Water  
94220200 Glaceau Water, low calorie  
94100100 Water, bottled, unsweetened

## Appendix G. NHANES Food Codes for EDI Calculation from the Diet Source

NHANES 2011-2012 dietary data for age 2+ was used to estimate PQQ disodium salt exposure from select dietary sources. The dietary sources being analyzed are 36 common foods that contain PQQ. SAS 9.2 along with strata, psus and day 2 dietary weights were used for analyses. Analysis was limited to subjects with reliable dietary intake data on both days. Intake used was average of two days intake from subjects with intake > 0 reported on either days data (N = 7,100).

FNDDS 6, SR26, FPED and FPID were used to calculate the amount of the select foods that were in each foodcode. When the pqq content for a food was reported as a range, the mean of the range was used.

### Foodcodes Table

Displays all usda foodcodes in fndds6 along with ppq ug/100g from the common foods sources being analyzed. Counts of consumers and consumptions are given for age 2+.

Food code	Description	PQQ ug/100 g
11100000	Milk, NFS	0.340
11111000	Milk, cow's, fluid, whole	0.340
11111160	Milk, calcium fortified, cow's, fluid, 1% fat	0.340
11111170	Milk, calcium fortified, cow's, fluid, skim or nonfat	0.340
11112110	Milk, cow's, fluid, 2% fat	0.340
11112130	Milk, cow's, fluid, acidophilus, 2% fat	0.340
11112210	Milk, cow's, fluid, 1% fat	0.340
11113000	Milk, cow's, fluid, skim or nonfat, 0.5% or less butterfat	0.340
11114300	Milk, cow's, fluid, lactose reduced, 1% fat	0.340
11114320	Milk, cow's, fluid, lactose reduced, nonfat	0.340
11114330	Milk, cow's, fluid, lactose reduced, 2% fat	0.340
11114350	Milk, cow's, fluid, lactose reduced, whole	0.340
11115000	Buttermilk, fluid, nonfat	0.340
11115200	Buttermilk, fluid, 2% fat	0.340
11115300	Buttermilk, fluid, whole	0.340
11116000	Milk, goat's, fluid, whole	0.340
11121210	Milk, dry, reconstituted, lowfat	0.275
11121300	Milk, dry, reconstituted, nonfat	0.308
11210050	Milk, evaporated, NS as to fat content (formerly NS as to dilution, used in coffee or tea, assume undiluted)	0.663
11211050	Milk, evaporated, whole (formerly NS as to dilution, used in coffee or tea)	0.663
11211400	Milk, evaporated, 2% fat (formerly NS as to dilution)	0.652
11212050	Milk, evaporated, skim (formerly NS as to dilution, used in coffee or tea)	0.663
11220000	Milk, condensed, sweetened (formerly NS as to dilution)	0.332
11320000	Milk, soy, ready-to-drink, not baby's	0.323
11320100	Milk, soy, light, ready-to-drink, not baby's	0.340
11320200	Milk, soy, nonfat, ready-to-drink, not baby's	0.340
11321000	Milk, soy, ready-to-drink, not baby's, chocolate	0.323

11321100	Milk, soy, light, ready-to-drink, not baby's, chocolate	0.340
11460300	Yogurt, frozen, flavors other than chocolate, nonfat milk	0.249
11511000	Milk, chocolate, NFS	0.340
11511100	Milk, chocolate, whole milk-based	0.340
11511200	Milk, chocolate, reduced fat milk-based, 2% (formerly "lowfat")	0.340
11511300	Milk, chocolate, skim milk-based	0.316
11511400	Milk, chocolate, lowfat milk-based	0.340
11512000	Cocoa, hot chocolate, not from dry mix, made with whole milk	0.310
11512500	Hot chocolate, Puerto Rican style, made with whole milk	0.317
11512510	Hot chocolate, Puerto Rican style, made with low fat milk	0.315
11513000	Cocoa and sugar mixture, milk added, NS as to type of milk	0.312
11513100	Cocoa and sugar mixture, whole milk added	0.312
11513150	Cocoa and sugar mixture, reduced fat milk added	0.312
11513200	Cocoa and sugar mixture, lowfat milk added	0.312
11513300	Cocoa and sugar mixture, skim milk added	0.312
11513355	Cocoa and sugar mixture, reduced sugar, whole milk added	0.322
11513365	Cocoa and sugar mixture, reduced sugar, lowfat milk added	0.322
11513400	Chocolate syrup, milk added, NS as to type of milk	0.295
11513500	Chocolate syrup, whole milk added	0.295
11513550	Chocolate syrup, reduced fat milk added	0.295
11513600	Chocolate syrup, lowfat milk added	0.295
11514100	Cocoa, sugar, and dry milk mixture, water added	0.009
11514300	Cocoa with nonfat dry milk and low calorie sweetener, mixture, water added	0.089
11516000	Cocoa, whey, and low-calorie sweetener mixture, lowfat milk added	0.384
11519000	Milk beverage, made with whole milk, flavors other than chocolate	0.312
11519040	Milk, flavors other than chocolate, NFS	0.340
11519050	Milk, flavors other than chocolate, whole milk-based	0.312
11519105	Milk, flavors other than chocolate, reduced fat milk-based	0.340
11519200	Milk, flavors other than chocolate, lowfat milk-based	0.312
11519205	Milk, flavors other than chocolate, skim-milk based	0.312
11521000	Milk, malted, unfortified, chocolate, made with milk	0.334
11522000	Milk, malted, unfortified, natural flavor, made with milk	0.431
11526000	Milk, malted, fortified, chocolate, made with milk	0.334
11531000	Eggnog, made with whole milk	0.394
11541110	Milk shake, homemade or fountain-type, chocolate	0.228
11541120	Milk shake, homemade or fountain-type, flavors other than chocolate	0.236
11542100	Carry-out milk shake, chocolate	0.290
11542200	Carry-out milk shake, flavors other than chocolate	0.348
11551050	Milk fruit drink	0.437
11553000	Fruit smoothie drink, made with fruit or fruit juice and dairy products	0.332
11553100	Fruit smoothie drink, NFS	0.332
11560000	Chocolate-flavored drink, whey- and milk-based	0.025
11561000	Cafe con leche	0.173
11561010	Cafe con leche prepared with sugar	0.161
11810000	Milk, dry, not reconstituted, NS as to whole, lowfat, or nonfat	3.317
11811000	Milk, dry, whole, not reconstituted	3.317
11813000	Milk, dry, nonfat, not reconstituted	3.317
11830100	Cocoa (or chocolate) with dry milk and sugar, dry mix, not reconstituted	0.066
11830110	Cocoa powder with nonfat dry milk and low calorie sweetener, dry mix, not reconstituted	1.144

11830120	Cocoa, whey, and low calorie sweetener, fortified, dry mix, not reconstituted	1.451
11830140	Chocolate, instant, dry mix, fortified with vitamins and minerals, not reconstituted, Puerto Rican style	0.265
11830170	Cocoa (or chocolate) flavored beverage powder with low-calorie sweetener, dry mix, not reconstituted	1.144
11830260	Milk, malted, dry mix, fortified, not reconstituted, chocolate	0.265
12100100	Cream, NS as to light, heavy, or half and half	0.166
12120100	Cream, half and half	0.166
12120105	Cream, half and half, low fat	0.245
12120110	Cream, half and half, fat free	0.323
12140100	Cream, whipped, pressurized container	0.100
12140105	Cream, whipped, pressurized container, light	0.100
12310300	Sour cream, reduced fat	0.166
12310350	Sour cream, light	0.166
12310370	Sour cream, fat free	0.307
12350000	Dip, sour cream base	0.029
12350100	Spinach dip	0.240
12350110	Spinach and artichoke dip	0.209
13110000	Ice cream, NFS	0.191
13110100	Ice cream, regular, flavors other than chocolate	0.191
13110110	Ice cream, regular, chocolate	0.141
13110120	Ice cream, rich, flavors other than chocolate	0.160
13110130	Ice cream, rich, chocolate	0.235
13110200	Ice cream, soft serve, flavors other than chocolate	0.191
13110210	Ice cream, soft serve, chocolate	0.182
13110310	Ice cream, no sugar added, NS as to flavor	0.174
13110320	Ice cream, no sugar added, flavors other than chocolate	0.174
13120050	Ice cream bar or stick, not chocolate covered or cake covered	0.191
13120100	Ice cream bar or stick, chocolate covered	0.158
13120110	Ice cream bar or stick, chocolate or caramel covered, with nuts	0.207
13120120	Ice cream bar or stick, rich chocolate ice cream, thick chocolate covering	0.148
13120121	Ice cream bar or stick, rich ice cream, thick chocolate covering	0.344
13120130	Ice cream bar or stick, rich ice cream, chocolate covered, with nuts	0.268
13120140	Ice cream bar or stick, chocolate ice cream, chocolate covered	0.276
13120300	Ice cream bar, cake covered	0.263
13120310	Ice cream bar, stick or nugget, with crunch coating	0.083
13120500	Ice cream sandwich	0.141
13120550	Ice cream cookie sandwich	0.116
13120700	Ice cream cone with nuts, flavors other than chocolate	0.158
13120710	Ice cream cone, chocolate covered, with nuts, flavors other than chocolate	0.174
13120720	Ice cream cone, chocolate covered or dipped, flavors other than chocolate	0.161
13120730	Ice cream cone, no topping, flavors other than chocolate	0.180
13120750	Ice cream cone with nuts, chocolate ice cream	0.247
13120760	Ice cream cone, chocolate covered or dipped, chocolate ice cream	0.257
13120770	Ice cream cone, no topping, chocolate ice cream	0.281
13120780	Ice cream cone, chocolate covered, with nuts, chocolate ice cream	0.229
13120790	Ice cream sundae cone	0.145
13120800	Ice cream soda, flavors other than chocolate	0.050
13120810	Ice cream soda, chocolate	0.037
13121100	Ice cream sundae, fruit topping, with whipped cream	0.102
13130300	Light ice cream, flavors other than chocolate (formerly ice milk)	0.199

13130310	Light ice cream, chocolate (formerly ice milk)	0.182
13130330	Light ice cream, no sugar added, flavors other than chocolate	0.207
13130340	Light ice cream, no sugar added, chocolate	0.232
13130600	Light ice cream, soft serve, flavors other than chocolate (formerly ice milk)	0.232
13130610	Light ice cream, soft serve, chocolate (formerly ice milk)	0.249
13130620	Light ice cream, soft serve cone, flavors other than chocolate (formerly ice milk)	0.224
13130630	Light ice cream, soft serve cone, chocolate (formerly ice milk)	0.210
13130700	Light ice cream, soft serve, blended with candy or cookies	0.240
13135000	Ice cream sandwich, made with light ice cream, flavors other than chocolate	0.133
13135010	Ice cream sandwich, made with light chocolate ice cream	0.139
13136000	Ice cream sandwich, made with light, no sugar added ice cream	0.166
13140100	Light ice cream, bar or stick, chocolate-coated (formerly ice milk)	0.157
13140110	Light ice cream, bar or stick, chocolate covered, with nuts (formerly ice milk)	0.137
13140500	Light ice cream, cone, flavors other than chocolate (formerly ice milk)	0.214
13140580	Light ice cream, no sugar added, cone, chocolate	0.186
13140660	Light ice cream, sundae, soft serve, chocolate or fudge topping (without whipped cream) (formerly ice milk)	0.183
13140700	Light ice cream, creamsicle or dreamsicle (formerly ice milk)	0.143
13140900	Light ice cream, fudgesicle (formerly ice milk)	0.191
13142000	Milk dessert bar or stick, frozen, with coconut	0.449
13150000	Sherbet, all flavors	0.092
13160400	Fat free ice cream, flavors other than chocolate	0.398
13161000	Milk dessert bar, frozen, made from lowfat milk	0.199
13161500	Milk dessert sandwich bar, frozen, made from lowfat milk	0.177
13161600	Milk dessert bar, frozen, made from lowfat milk and low calorie sweetener	0.257
13161630	Light ice cream, bar or stick, with low-calorie sweetener, chocolate-coated (formerly ice milk)	0.191
13210110	Pudding, bread	0.501
13210180	Pudding, Mexican bread (Capirotada)	0.258
13210220	Pudding, chocolate, NS as to from dry mix or ready-to-eat	0.133
13210250	Pudding, chocolate, low calorie, containing artificial sweetener, NS as to from dry mix or ready-to-eat	0.133
13210280	Pudding, flavors other than chocolate, NS as to from dry mix or ready-to-eat	0.182
13210300	Custard	0.501
13210350	Flan	0.515
13210410	Pudding, rice	0.301
13210500	Pudding, tapioca, made from home recipe, made with milk	0.465
13210520	Pudding, tapioca, made from dry mix, made with milk	0.288
13220110	Pudding, flavors other than chocolate, prepared from dry mix, milk added	0.285
13220120	Pudding, chocolate, prepared from dry mix, milk added	0.283
13220210	Pudding, flavors other than chocolate, prepared from dry mix, low calorie, containing artificial sweetener, milk added	0.320
13220220	Pudding, chocolate, prepared from dry mix, low calorie, containing artificial sweetener, milk added	0.314
13220230	Pudding, ready-to-eat, chocolate, reduced fat	0.133
13220235	Pudding, ready-to-eat, chocolate, fat free	0.133
13230110	Pudding, ready-to-eat, flavors other than chocolate	0.182
13230120	Pudding, ready-to-eat, low calorie, containing artificial sweetener, flavors other than chocolate	0.182
13230130	Pudding, ready-to-eat, chocolate	0.133
13230140	Pudding, ready-to-eat, low calorie, containing artificial sweetener, chocolate	0.133
13230200	Pudding, ready-to-eat, chocolate and non-chocolate flavors combined	0.158

13230500	Pudding, ready-to-eat, tapioca	0.182
13241000	Pudding, with fruit and vanilla wafers	0.608
13250000	Mousse, chocolate	0.294
13250100	Mousse, not chocolate	0.168
13252200	Milk dessert or milk candy, Puerto Rican style (Dulce de leche)	0.249
13252500	Barfi or Burfi, Indian dessert, made from milk and/or cream and/or Ricotta cheese	0.057
13252600	Tiramisu	0.221
13411000	White sauce, milk sauce	0.287
13412000	Milk gravy, quick gravy	0.298
14610520	Cheese with nuts	0.018
14620100	Dip, cream cheese base	0.024
14620120	Shrimp dip, cream cheese base	0.008
14620150	Dip, cheese with chili pepper (chili con queso)	0.147
14620200	Dip, cheese base other than cream cheese	0.147
14620300	Topping from cheese pizza	0.294
14620320	Topping from meat pizza	0.186
14620330	Topping from meat and vegetable pizza	0.310
14630200	Cheese souffle	0.558
14640000	Cheese sandwich	0.580
14650100	Cheese sauce	0.207
14650150	Cheese sauce made with lowfat cheese	0.243
14710100	Cheddar cheese soup, home recipe, canned or ready-to-serve	0.185
14710200	Beer cheese soup, made with milk	0.119
21103110	Beef steak, breaded or floured, baked or fried, NS as to fat eaten	0.135
21103120	Beef steak, breaded or floured, baked or fried, lean and fat eaten	0.135
21103130	Beef steak, breaded or floured, baked or fried, lean only eaten	0.135
21104110	Beef steak, battered, fried, NS as to fat eaten	0.073
21104120	Beef steak, battered, fried, lean and fat eaten	0.081
21304200	Beef, shortribs, barbecued, with sauce, NS as to fat eaten	0.061
21304210	Beef, shortribs, barbecued, with sauce, lean and fat eaten	0.061
21500200	Ground beef or patty, breaded, cooked	0.218
22002100	Pork, ground or patty, breaded, cooked	0.154
22101140	Pork chop, breaded or floured, broiled or baked, lean and fat eaten	0.084
22101150	Pork chop, breaded or floured, broiled or baked, lean only eaten	0.084
22101300	Pork chop, breaded or floured, fried, NS as to fat eaten	0.269
22101310	Pork chop, breaded or floured, fried, lean and fat eaten	0.269
22101320	Pork chop, breaded or floured, fried, lean only eaten	0.269
22101410	Pork chop, battered, fried, lean and fat eaten	0.047
22101420	Pork chop, battered, fried, lean only eaten	0.047
22201060	Pork steak or cutlet, battered, fried, lean and fat eaten	0.052
22201320	Pork steak or cutlet, breaded or floured, broiled or baked, lean only eaten	0.042
22201410	Pork steak or cutlet, breaded or floured, fried, lean and fat eaten	0.269
22210310	Pork, tenderloin, breaded, fried	0.252
22300160	Ham, breaded or floured, fried, lean and fat eaten	0.124
22300170	Ham, breaded or floured, fried, lean only eaten	0.143
22701030	Pork, spareribs, barbecued, with sauce, NS as to fat eaten	0.061
22701040	Pork, spareribs, barbecued, with sauce, lean and fat eaten	0.061
22701050	Pork, spareribs, barbecued, with sauce, lean only eaten	0.061
23220030	Veal patty, breaded, cooked	0.159



23321250	Venison/deer steak, breaded or floured, cooked, NS as to cooking method	0.271
24107010	Chicken, NS as to part, coated, baked or fried, prepared with skin, skin/coating eaten	0.020
24107040	Chicken, NS as to part, coated, baked or fried, prepared skinless, NS as to coating eaten	0.020
24107050	Chicken, NS as to part, coated, baked or fried, prepared skinless, coating eaten	0.020
24127100	Chicken, breast, coated, baked or fried, prepared with skin, NS as to skin/coating eaten	0.023
24127110	Chicken, breast, coated, baked or fried, prepared with skin, skin/coating eaten	0.023
24127125	Chicken, breast, from fast food, coated, baked or fried, prepared with skin, NS as to skin/coating eaten	0.023
24127130	Chicken, breast, from fast food, coated, baked or fried, prepared with skin, skin/coating eaten	0.023
24127140	Chicken, breast, coated, baked or fried, prepared skinless, NS as to coating eaten	0.024
24127150	Chicken, breast, coated, baked or fried, prepared skinless, coating eaten	0.024
24137210	Chicken, leg (drumstick and thigh), coated, baked or fried, prepared with skin, skin/coating eaten	0.022
24137250	Chicken, leg (drumstick and thigh), coated, baked or fried, prepared skinless, coating eaten	0.022
24147210	Chicken, drumstick, coated, baked or fried, prepared with skin, skin/coating eaten	0.017
24147230	Chicken, drumstick, from fast food, coated, baked or fried, prepared with skin, skin/coating eaten	0.023
24147240	Chicken, drumstick, coated, baked or fried, prepared skinless, NS as to coating eaten	0.017
24147250	Chicken, drumstick, coated, baked or fried, prepared skinless, coating eaten	0.017
24157210	Chicken, thigh, coated, baked or fried, prepared with skin, skin/coating eaten	0.019
24157230	Chicken, thigh, from fast food, coated, baked or fried, prepared with skin, skin/coating eaten	0.023
24157250	Chicken, thigh, coated, baked or fried, prepared skinless, coating eaten	0.020
24167110	Chicken, wing, coated, baked or fried, prepared with skin, skin/coating eaten	0.028
24167130	Chicken, wing, from fast food, coated, baked or fried, prepared with skin, skin/coating eaten	0.023
24201060	Turkey, light meat, breaded, baked or fried, skin not eaten	0.082
24201350	Turkey, light or dark meat, battered, fried, NS as to skin eaten	0.021
25112200	Liver paste or pate, chicken	0.355
25210150	Frankfurter or hot dog, cheese-filled	0.050
25240110	Chicken salad spread	0.015
26100130	Fish, NS as to type, coated, baked or broiled, made with oil	0.086
26100133	Fish, NS as to type, coated, baked or broiled, made without fat	0.090
26100140	Fish, NS as to type, coated, fried, made with oil	0.242
26100200	Fish, NS as to type, from fast food	0.044
26100260	Fish stick, patty or nugget from fast food	0.194
26100270	Fish stick, patty or nugget from restaurant, home, or other place	0.194
26105140	Carp, coated, fried	0.242
26107110	Catfish, cooked, NS as to cooking method	0.242
26107130	Catfish, coated, baked or broiled, made with oil	0.086
26107140	Catfish, coated, fried, made with oil	0.242
26109130	Cod, coated, baked or broiled, made with oil	0.086
26109140	Cod, coated, fried, made with oil	0.242
26111140	Croaker, coated, fried	0.242
26115110	Flounder, cooked, NS as to cooking method	0.242
26115140	Flounder, coated, fried, made with oil	0.242

26117130	Haddock, coated, baked or broiled, fat added in cooking	0.086
26117140	Haddock, coated, fried	0.242
26121140	Mackerel, coated, fried	0.241
26123140	Mullet, coated, fried	0.242
26125130	Ocean perch, coated, baked or broiled, fat added in cooking	0.086
26125140	Ocean perch, coated, fried	0.242
26127133	Perch, coated, baked or broiled, made without fat	0.090
26127140	Perch, coated, fried, made with oil	0.242
26131140	Pompano, coated, fried	0.242
26133130	Porgy, coated, baked or broiled, fat added in cooking	0.086
26133140	Porgy, coated, fried	0.242
26137130	Salmon, coated, baked or broiled, made with oil	0.086
26137131	Salmon, coated, baked or broiled, made with butter	0.086
26137133	Salmon, coated, baked or broiled, made without fat	0.090
26137140	Salmon, coated, fried, made with oil	0.242
26141140	Sea bass, coated, fried	0.242
26151140	Trout, coated, fried, made with oil	0.242
26151143	Trout, coated, fried, made without fat	0.242
26157110	Whiting, cooked, NS as to cooking method	0.242
26157130	Whiting, coated, baked or broiled, made with oil	0.086
26157133	Whiting, coated, baked or broiled, made without fat	0.090
26157140	Whiting, coated, fried, made with oil	0.242
26158020	Tilapia, coated, baked or broiled, made with oil	0.086
26158023	Tilapia, coated, baked or broiled, made without fat	0.090
26158030	Tilapia, coated, fried, made with oil	0.242
26203110	Frog legs, NS as to cooking method	0.242
26205110	Octopus, cooked, NS as to cooking method	0.242
26213140	Squid, coated, fried	0.242
26303140	Clams, coated, fried	0.242
26305130	Crab, coated, baked or broiled, fat added in cooking	0.086
26307140	Crab, soft shell, coated, fried	0.242
26309140	Crayfish, coated, fried	0.242
26315140	Oysters, coated, fried	0.242
26317140	Scallops, coated, fried	0.242
26317160	Scallops, coated, baked or broiled, fat added in cooking	0.086
26319110	Shrimp, cooked, NS as to cooking method	0.242
26319140	Shrimp, coated, fried, made with oil	0.242
26319142	Shrimp, coated, fried, made with margarine	0.242
26319145	Shrimp, coated, fried, from fast food / restaurant	0.074
26319160	Shrimp, coated, baked or broiled, made with oil	0.086
26319163	Shrimp, coated, baked or broiled, made without fat	0.090
27111000	Beef with tomato-based sauce (mixture)	0.305
27111050	Spaghetti sauce with beef or meat other than lamb or mutton, homemade-style	0.520
27111100	Beef goulash	0.102
27111200	Beef burgundy (beef bourguignonne)	0.125
27111300	Mexican style beef stew, no potatoes, tomato-based sauce (mixture) (Carne guisada sin papas)	0.096
27111310	Mexican style beef stew, no potatoes, with chili peppers, tomato-based sauce (mixture) (Carne guisada con chile)	0.454
27111410	Chili con carne with beans	0.180
27111420	Chili con carne without beans	0.204

27111440	Chili con carne with beans and cheese	0.179
27111500	Beef sloppy joe (no bun)	0.363
27112010	Salisbury steak with gravy (mixture)	0.074
27116100	Beef curry	0.460
27116200	Beef with barbecue sauce (mixture)	0.061
27116300	Beef with sweet and sour sauce (mixture)	0.231
27116350	Stewed, seasoned, ground beef, Mexican style (Picadillo de carne de rez)	0.102
27118120	Stewed seasoned ground beef, Puerto Rican style (Picadillo guisado, picadillo de carne)	0.474
27118130	Stewed dried beef, Puerto Rican style (Tasajo guisado, carne cecina guisada)	0.372
27118180	Puerto Rican style beef stew, meat with gravy (potatoes reported separately)	0.258
27120020	Ham or pork with gravy (mixture)	0.009
27120030	Ham or pork with barbecue sauce (mixture)	0.061
27120060	Sweet and sour pork	0.278
27120090	Ham or pork with (mushroom) soup (mixture)	0.034
27120100	Ham or pork with tomato-based sauce (mixture)	0.328
27120110	Sausage with tomato-based sauce (mixture)	0.457
27120120	Sausage gravy	0.253
27120130	Mexican style pork stew, no potatoes, tomato-based sauce (mixture) (cerdo guisado sin papas)	0.096
27120160	Pork curry	0.458
27120250	Frankfurters or hot dogs with tomato-based sauce (mixture)	0.345
27121000	Pork with chili and tomatoes (mixture) (Puerco con chile)	0.471
27121410	Chili con carne with beans, made with pork	0.292
27130040	Spaghetti sauce with lamb or mutton, homemade-style	0.526
27130100	Lamb or mutton curry	0.474
27136100	Chili con carne with venison/deer and beans	0.297
27141000	Chicken or turkey cacciatore	0.367
27141030	Spaghetti sauce with poultry, home-made style	0.518
27141050	Stewed chicken with tomato-based sauce, Mexican style (mixture) (Pollo guisado con tomate)	0.141
27141500	Chili con carne with chicken or turkey and beans	0.287
27143000	Chicken or turkey with cream sauce (mixture)	0.195
27144000	Chicken or turkey with (mushroom) soup (mixture)	0.027
27146000	Chicken or turkey with barbecue sauce, skin eaten	0.047
27146010	Chicken or turkey with barbecue sauce, skin not eaten	0.061
27146100	Sweet and sour chicken or turkey	0.023
27146110	Sweet and sour chicken or turkey, without vegetables	0.023
27146150	Chicken curry	0.461
27146160	Chicken with mole sauce	0.249
27146200	Chicken or turkey with cheese sauce (mixture)	0.098
27146250	Chicken or turkey cordon bleu	0.100
27146300	Chicken or turkey parmigiana	0.319
27146360	Sesame chicken	0.030
27146400	Chicken kiev	0.076
27148010	Stuffed chicken, drumstick or breast, Puerto Rican style (Muslo de pollo o pechuga rellena)	0.206
27150060	Lobster newburg	0.048
27150100	Shrimp curry	0.463
27150110	Shrimp cocktail (shrimp with cocktail sauce)	0.108
27150160	Shrimp with lobster sauce (mixture)	0.095

27150170	Sweet and sour shrimp	0.257
27150190	Lobster sauce (broth-based)	0.180
27150200	Oyster sauce (white sauce-based)	0.154
27150230	Shrimp scampi	0.049
27150310	Fish with tomato-based sauce (mixture)	0.210
27150320	Fish curry	0.459
27150350	Sardines with tomato-based sauce (mixture)	0.141
27151030	Marinated fish (Ceviche)	0.122
27151070	Stewed codfish, Puerto Rican style, no potatoes (potatoes reported separately)	0.519
27162010	Meat with tomato-based sauce (mixture)	0.367
27162060	Spaghetti sauce with meat and vegetables, homemade-style	0.562
27211000	Beef and potatoes, no sauce (mixture)	0.954
27211100	Beef stew with potatoes, tomato-based sauce (mixture)	0.647
27211200	Beef stew with potatoes, gravy	0.524
27211400	Corned beef hash	0.619
27211500	Beef and potatoes with cheese sauce (mixture)	0.487
27211550	Stewed, seasoned, ground beef with potatoes, Mexican style (Picadillo de carne de rez con papas)	0.570
27212000	Beef and noodles, no sauce (mixture)	0.062
27212050	Beef and macaroni with cheese sauce (mixture)	0.073
27212100	Beef and noodles with tomato-based sauce (mixture)	0.029
27212120	Chili con carne with beans and macaroni	0.177
27212150	Beef goulash with noodles	0.063
27212200	Beef and noodles with gravy (mixture)	0.026
27212300	Beef and noodles with cream or white sauce (mixture)	0.175
27212350	Beef stroganoff with noodles	0.017
27213010	Biryani with meat	0.399
27213100	Beef and rice with tomato-based sauce (mixture)	0.274
27213120	Porcupine balls with tomato-based sauce (mixture)	0.139
27213600	Beef and rice with cheese sauce (mixture)	0.001
27214100	Meat loaf made with beef	0.189
27214110	Meat loaf made with beef, with tomato-based sauce	0.271
27220010	Meat loaf made with ham (not luncheon meat)	0.205
27220080	Ham croquette	0.206
27220110	Pork and rice with tomato-based sauce (mixture)	0.153
27220120	Sausage and rice with tomato-based sauce (mixture)	0.121
27220190	Sausage and noodles with cream or white sauce (mixture)	0.127
27220520	Ham or pork and potatoes with cheese sauce (mixture)	0.443
27221100	Stewed pig's feet, Puerto Rican style (Patitas de cerdo guisadas)	0.175
27241010	Chicken or turkey and potatoes with gravy (mixture)	0.566
27242000	Chicken or turkey and noodles, no sauce (mixture)	0.060
27242200	Chicken or turkey and noodles with gravy (mixture)	0.034
27242300	Chicken or turkey and noodles with cream or white sauce (mixture)	0.160
27242310	Chicken or turkey and noodles with cheese sauce (mixture)	0.116
27242350	Chicken or turkey tetrazzini	0.018
27242400	Chicken or turkey and noodles, tomato-based sauce (mixture)	0.284
27243100	Biryani with chicken	0.444
27243300	Chicken or turkey and rice with cream sauce (mixture)	0.110
27243400	Chicken or turkey and rice with (mushroom) soup (mixture)	0.009
27243500	Chicken or turkey and rice with tomato-based sauce (mixture)	0.293

27246100	Chicken or turkey with dumplings (mixture)	0.029
27246200	Chicken or turkey with stuffing (mixture)	0.141
27246300	Chicken or turkey cake, patty, or croquette	0.207
27246500	Meat loaf made with chicken or turkey	0.245
27246505	Meat loaf made with chicken or turkey, with tomato-based sauce	0.321
27250030	Codfish ball or cake	0.094
27250040	Crab cake	0.197
27250050	Fish cake or patty, NS as to fish	0.731
27250070	Salmon cake or patty	0.686
27250120	Shrimp and noodles, no sauce (mixture)	0.061
27250122	Shrimp and noodles with gravy (mixture)	0.035
27250126	Shrimp and noodles with cream or white sauce (mixture)	0.164
27250130	Shrimp and noodles with cheese sauce (mixture)	0.162
27250132	Shrimp and noodles with tomato sauce (mixture)	0.203
27250160	Tuna cake or patty	0.669
27250250	Flounder with crab stuffing	0.154
27250410	Shrimp with crab stuffing	0.176
27250520	Seafood restructured	0.074
27250610	Tuna noodle casserole with cream or white sauce	0.179
27250630	Tuna noodle casserole with (mushroom) soup	0.106
27250710	Tuna and rice with (mushroom) soup (mixture)	0.062
27250810	Fish and rice with tomato-based sauce	0.236
27250830	Fish and rice with (mushroom) soup	0.063
27250950	Shellfish mixture and noodles, tomato-based sauce (mixture)	0.168
27260010	Meat loaf, NS as to type of meat	0.189
27260050	Meatballs, with breading, NS as to type of meat, with gravy	0.129
27260100	Meat loaf made with beef and pork, with tomato-based sauce	0.271
27260510	Liver dumpling	0.393
27311110	Beef, potatoes, and vegetables (including carrots, broccoli, and/or dark-green leafy), no sauce (mixture)	0.668
27311120	Beef, potatoes, and vegetables (excluding carrots, broccoli, and dark-green leafy), no sauce (mixture)	0.542
27311310	Beef stew with potatoes and vegetables (including carrots, broccoli, and/or dark-green leafy), tomato-based sauce	0.400
27311320	Beef stew with potatoes and vegetables (excluding carrots, broccoli, and dark-green leafy), tomato-based sauce	0.481
27311410	Beef stew with potatoes and vegetables (including carrots, broccoli, and/or dark-green leafy), gravy	0.547
27311420	Beef stew with potatoes and vegetables (excluding carrots, broccoli, and dark-green leafy), gravy	0.452
27311510	Shepherd's pie with beef	1.000
27311600	Beef, potatoes, and vegetables (including carrots, broccoli, and/or dark-green leafy), gravy (mixture)	0.465
27311610	Beef, potatoes, and vegetables (including carrots, broccoli, and/or dark-green leafy), cream sauce, white sauce, or mushroom soup-based sauce (mixture)	0.639
27311620	Beef, potatoes, and vegetables (excluding carrots, broccoli, and dark-green leafy), cream sauce, white sauce, or mushroom soup-based sauce (mixture)	0.581
27311625	Beef, potatoes, and vegetables (including carrots, broccoli, and/or dark-green leafy), tomato-based sauce (mixture)	0.586
27311630	Beef, potatoes, and vegetables (excluding carrots, broccoli, and dark-green leafy), tomato-based sauce (mixture)	0.545
27311640	Beef, potatoes, and vegetables (excluding carrots, broccoli, and dark-green leafy), cheese sauce (mixture)	0.490

27313020	Beef, noodles, and vegetables (excluding carrots, broccoli, and dark-green leafy), no sauce (mixture)	0.168
27313150	Beef, noodles, and vegetables (including carrots, broccoli, and/or dark-green leafy), soy-based sauce (mixture)	0.181
27313210	Beef, noodles, and vegetables (including carrots, broccoli, and/or dark-green leafy), tomato-based sauce (mixture)	0.281
27313220	Beef, noodles, and vegetables (excluding carrots, broccoli, and dark-green leafy), tomato-based sauce (mixture)	0.177
27313420	Beef, noodles, and vegetables (excluding carrots, broccoli, and dark-green leafy), gravy (mixture)	0.018
27315010	Beef, rice, and vegetables (including carrots, broccoli, and/or dark-green leafy), no sauce (mixture)	0.210
27315220	Beef, rice, and vegetables (excluding carrots, broccoli, and/or dark-green leafy), tomato-based sauce (mixture)	0.152
27315250	Stuffed cabbage rolls with beef and rice	0.745
27315340	Beef, rice, and vegetables (excluding carrots, broccoli, and dark-green leafy), cheese sauce (mixture)	0.149
27315510	Beef, rice, and vegetables (including carrots, broccoli, and/or dark-green leafy), soy-based sauce (mixture)	0.183
27317010	Beef pot pie	0.194
27320025	Ham or pork, noodles and vegetables (excluding carrots, broccoli, and dark-green leafy), no sauce (mixture)	0.166
27320027	Ham or pork, noodles, and vegetables (including carrots, broccoli, and/or dark-green leafy), no sauce (mixture)	0.253
27320040	Pork, potatoes, and vegetables (including carrots, broccoli, and/or dark-green leafy), no sauce (mixture)	0.771
27320070	Ham or pork, noodles, and vegetables (including carrots, broccoli, and/or dark-green leafy), tomato-based sauce (mixture)	0.461
27320080	Sausage, noodles, and vegetables (excluding carrots, broccoli, and dark-green leafy), tomato-based sauce	0.288
27320100	Pork, potatoes, and vegetables (including carrots, broccoli, and/or dark-green leafy), tomato-based sauce (mixture)	0.968
27320130	Sausage, potatoes, and vegetables (excluding carrots, broccoli, and dark-green leafy), gravy (mixture)	0.588
27320210	Pork, potatoes, and vegetables (excluding carrots, broccoli, and dark-green leafy), no sauce (mixture)	0.774
27320330	Pork, rice, and vegetables (excluding carrots, broccoli, and dark-green leafy), soy-based sauce (mixture)	0.176
27320350	Pork, rice, and vegetables (excluding carrots, broccoli, and dark-green leafy), tomato-based sauce (mixture)	0.267
27320450	Ham, potatoes, and vegetables (including carrots, broccoli, and/or dark-green leafy), no sauce (mixture)	0.492
27330110	Lamb or mutton stew with potatoes and vegetables (excluding carrots, broccoli, and dark-green leafy), gravy	0.646
27330210	Lamb or mutton stew with potatoes and vegetables (including carrots, broccoli, and/or dark-green leafy), tomato-based sauce	0.754
27341000	Chicken or turkey, potatoes, corn, and cheese, with gravy	0.463
27341010	Chicken or turkey, potatoes, and vegetables (including carrots, broccoli, and/or dark-green leafy), no sauce (mixture)	0.688
27341020	Chicken or turkey, potatoes, and vegetables (excluding carrots, broccoli, and dark-green leafy), no sauce (mixture)	0.472
27341040	Chicken or turkey, potatoes, and vegetables (excluding carrots, broccoli, and dark-green leafy), cream sauce, white sauce, or mushroom soup-based sauce (mixture)	0.426
27341050	Chicken or turkey, potatoes, and vegetables (excluding carrots, broccoli, and dark-green leafy), cheese sauce (mixture)	0.490
27341060	Chicken or turkey, potatoes, and vegetables (excluding carrots, broccoli, and dark-green leafy), tomato-based sauce (mixture)	0.594

27341310	Chicken or turkey stew with potatoes and vegetables (including carrots, broccoli, and/or dark-green leafy), gravy	0.533
27341510	Chicken or turkey stew with potatoes and vegetables (including carrots, broccoli, and/or dark-green leafy), tomato-based sauce	0.729
27341520	Chicken or turkey stew with potatoes and vegetables (excluding carrots, broccoli, and dark-green leafy), tomato-based sauce	0.536
27343010	Chicken or turkey, noodles, and vegetables (including carrots, broccoli, and/or dark-green leafy), no sauce (mixture)	0.180
27343020	Chicken or turkey, noodles, and vegetables (excluding carrots, broccoli, and dark-green leafy), no sauce (mixture)	0.039
27343410	Chicken or turkey, noodles, and vegetables (including carrots, broccoli, and/or dark-green leafy), gravy (mixture)	0.348
27343470	Chicken or turkey, noodles, and vegetables (including carrots, broccoli, and/or dark-green leafy), cream sauce, white sauce, or mushroom soup-based sauce (mixture)	0.384
27343480	Chicken or turkey, noodles, and vegetables (excluding carrots, broccoli, and/or dark-green leafy), cream sauce, white sauce, or mushroom soup-based sauce (mixture)	0.052
27343510	Chicken or turkey, noodles, and vegetables (including carrots, broccoli, and/or dark-green leafy), tomato-based sauce (mixture)	0.445
27343520	Chicken or turkey, noodles, and vegetables (excluding carrots, broccoli, and dark-green leafy), tomato-based sauce (mixture)	0.233
27343950	Chicken or turkey, noodles, and vegetables (including carrots, broccoli, and/or dark-green leafy), cheese sauce (mixture)	0.118
27345010	Chicken or turkey, rice, and vegetables (including carrots, broccoli, and/or dark-green leafy), no sauce (mixture)	0.141
27345210	Chicken or turkey, rice, and vegetables (including carrots, broccoli, and/or dark-green leafy), gravy (mixture)	0.018
27345220	Chicken or turkey, rice, and vegetables (excluding carrots, broccoli, and dark-green leafy), gravy (mixture)	0.019
27345410	Chicken or turkey, rice, and vegetables (including carrots, broccoli, and/or dark-green leafy), cream sauce, white sauce, or mushroom soup-based sauce (mixture)	0.017
27345440	Chicken or turkey, rice, and vegetables (including carrots, broccoli, and/or dark-green leafy), cheese sauce (mixture)	0.057
27345450	Chicken or turkey, rice, and vegetables (excluding carrots, broccoli, and dark-green leafy), cheese sauce (mixture)	0.077
27345510	Chicken or turkey, rice, and vegetables (including carrots, broccoli, and/or dark-green leafy), tomato-based sauce (mixture)	0.446
27345520	Chicken or turkey, rice, and vegetables (excluding carrots, broccoli, and dark-green leafy), tomato-based sauce (mixture)	0.218
27347100	Chicken or turkey pot pie	0.074
27347250	Chicken or turkey, dumplings, and vegetables (excluding carrots, broccoli, and dark green leafy), gravy (mixture)	0.074
27350060	Shrimp creole, with rice	0.198
27350080	Tuna noodle casserole with vegetables, cream or white sauce	0.159
27350100	Fish, noodles, and vegetables (excluding carrots, broccoli, and dark-green leafy), cheese sauce (mixture)	0.097
27350110	Bouillabaisse	0.125
27350410	Tuna noodle casserole with vegetables and (mushroom) soup	0.099
27361010	Stewed variety meats, Puerto Rican style (mostly liver) (Gandinga)	0.344
27362000	Stewed tripe, Puerto Rican style, with potatoes (Mondongo)	0.244
27363000	Gumbo with rice (New Orleans type with shellfish, pork, and/or poultry, tomatoes, okra, rice)	0.137
27363100	Jambalaya with meat and rice	0.184
27410210	Beef and vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), no sauce (mixture)	0.452

27410220	Beef and vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), no sauce (mixture)	0.329
27410250	Beef shish kabob with vegetables, excluding potatoes	0.117
27411100	Beef with vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), tomato-based sauce (mixture)	0.347
27411120	Swiss steak	0.268
27411150	Beef rolls, stuffed with vegetables or meat mixture, tomato-based sauce	0.231
27411200	Beef with vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), tomato-based sauce (mixture)	0.607
27415100	Beef and vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), soy-based sauce (mixture)	0.211
27415200	Beef and vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), soy-based sauce (mixture)	0.203
27415220	Beef, tofu, and vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), soy-based sauce (mixture)	0.722
27416150	Pepper steak	0.406
27416300	Beef taco filling: beef, cheese, tomato, taco sauce	0.300
27416450	Beef and vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), gravy (mixture)	0.204
27416500	Beef and vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), gravy (mixture)	0.053
27420020	Ham or pork salad	0.166
27420060	Pork and vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), no sauce (mixture)	0.246
27420250	Ham and vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), no sauce (mixture)	0.354
27420270	Ham and vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), no sauce (mixture)	0.243
27420350	Pork and vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), no sauce (mixture)	0.239
27420370	Pork, tofu, and vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), soy-based sauce (mixture)	0.722
27420400	Pork and vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), tomato-based sauce (mixture)	0.431
27420410	Pork and vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), tomato-based sauce (mixture)	0.385
27420450	Sausage and vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), tomato-based sauce (mixture)	0.496
27420460	Sausage and vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), tomato-based sauce (mixture)	0.425
27420470	Sausage and peppers, no sauce (mixture)	0.369
27420500	Pork and vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), soy-based sauce (mixture)	0.211
27420510	Pork and vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), soy-based sauce (mixture)	0.203
27430610	Lamb shish kabob with vegetables, excluding potatoes	0.117
27440110	Chicken or turkey and vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), no sauce (mixture)	0.291
27440120	Chicken or turkey and vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), no sauce (mixture)	0.192
27442110	Chicken or turkey and vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), gravy (mixture)	0.206
27443110	Chicken or turkey a la king with vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), cream, white, or soup-based sauce	0.295
27443120	Chicken or turkey a la king with vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), cream, white, or soup-based sauce	0.108



27445120	Chicken or turkey and vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), soy-based sauce (mixture)	0.203
27445125	Chicken or turkey and vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), tomato-based sauce (mixture)	0.266
27445130	Chicken or turkey and vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), tomato-based sauce (mixture)	0.191
27445150	General Tso chicken	0.030
27445180	Moo Goo Gai Pan	0.005
27446200	Chicken or turkey salad, made with mayonnaise	0.169
27446205	Chicken or turkey salad with nuts and/or fruits	0.136
27446220	Chicken or turkey salad with egg	0.281
27446225	Chicken or turkey salad, made with light mayonnaise	0.161
27446230	Chicken or turkey salad, made with mayonnaise-type salad dressing	0.162
27446235	Chicken or turkey salad, made with light mayonnaise-type salad dressing	0.161
27446240	Chicken or turkey salad, made with creamy dressing	0.148
27446245	Chicken or turkey salad, made with light creamy dressing	0.148
27446260	Chicken or turkey salad, made with any type of fat free dressing	0.138
27446315	Chicken or turkey garden salad with bacon and cheese (chicken and/or turkey, bacon, cheese, lettuce and/or greens, tomato and/or carrots, other vegetables), no dressing	0.270
27446320	Chicken or turkey (breaded, fried) garden salad with bacon and cheese (chicken and/or turkey, bacon, cheese, lettuce and/or greens, tomato and/or carrots, other vegetables), no dressing	0.299
27446360	Chicken or turkey caesar garden salad (chicken and/or turkey, lettuce, tomato, cheese), no dressing	0.317
27446400	Chicken or turkey and vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), cheese sauce (mixture)	0.223
27446410	Chicken or turkey and vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), cheese sauce (mixture)	0.194
27450010	Crab salad	0.169
27450030	Salmon salad	0.160
27450060	Tuna salad, made with mayonnaise	0.167
27450061	Tuna salad, made with light mayonnaise	0.160
27450062	Tuna salad, made with mayonnaise-type salad dressing	0.160
27450063	Tuna salad, made with light mayonnaise-type salad dressing	0.160
27450066	Tuna salad, made with Italian dressing	0.139
27450068	Tuna salad, made with any type of fat free dressing	0.137
27450070	Shrimp salad	0.173
27450100	Tuna salad with egg	0.279
27450130	Crab salad made with imitation crab	0.211
27450400	Shrimp and vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), no sauce (mixture)	0.334
27450405	Shrimp and vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), no sauce (mixture)	0.075
27450410	Shrimp and vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), soy-based sauce (mixture)	0.210
27450420	Shrimp and vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), soy-based sauce (mixture)	0.203
27450450	Shrimp creole, no rice	0.277
27450600	Shellfish mixture and vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), soy-based sauce	0.210
27450610	Shellfish mixture and vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), soy-based sauce	0.203
27450650	Shellfish mixture and vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), (mushroom) soup (mixture)	0.141

27450700	Fish and vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), tomato-based sauce (mixture)	0.408
27450710	Fish and vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), tomato-based sauce (mixture)	0.306
27450740	Fish and vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes)), soy-based sauce (mixture)	0.210
27450750	Fish and vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes)), soy-based sauce (mixture)	0.203
27451070	Codfish salad, Puerto Rican style (Serenata)	0.287
27460510	Antipasto with ham, fish, cheese, vegetables	0.390
27464000	Gumbo, no rice (New Orleans type with shellfish, pork, and/or poultry, tomatoes, okra)	0.149
27500200	Wrap sandwich, filled with meat, poultry, or fish, vegetables, and cheese	0.177
27500300	Wrap sandwich, filled with meat, poultry, or fish, and vegetables	0.216
27510110	Beef barbecue sandwich or Sloppy Joe, on bun	0.372
27510230	Cheeseburger, with mayonnaise or salad dressing, and tomato and/or catsup, on bun	0.473
27510250	Cheeseburger, 1/4 lb meat, with mayonnaise or salad dressing, on bun	0.309
27510280	Double cheeseburger (2 patties), with mayonnaise or salad dressing, on bun	0.309
27510310	Cheeseburger with tomato and/or catsup, on bun	0.063
27510311	Cheeseburger, 1 oz meat, plain, on miniature bun	0.465
27510320	Cheeseburger, 1/4 lb meat, with tomato and/or catsup, on bun	0.047
27510330	Double cheeseburger (2 patties), with tomato and/or catsup, on bun	0.047
27510340	Double cheeseburger (2 patties), with mayonnaise or salad dressing and tomatoes and/or catsup, on bun	0.364
27510350	Cheeseburger, 1/4 lb meat, with mayonnaise or salad dressing, and tomato and/or catsup, on bun	0.110
27510355	Cheeseburger, 1/3 lb meat, with mayonnaise or salad dressing, tomato and/or catsup on bun	0.360
27510360	Bacon cheeseburger, with mayonnaise or salad dressing, tomato and/or catsup, on bun	0.030
27510370	Double cheeseburger (2 patties, 1/4 lb meat each), with mayonnaise or salad dressing, on bun	0.006
27510380	Triple cheeseburger (3 patties, 1/4 lb meat each), with mayonnaise or salad dressing and tomatoes and/or catsup, on bun	0.218
27510385	Double bacon cheeseburger (2 patties), with tomato and/or catsup, on bun	0.338
27510425	Double bacon cheeseburger (2 patties, 1/4 lb meat each), with mayonnaise or salad dressing, on bun	0.006
27510430	Double bacon cheeseburger (2 patties, 1/4 lb meat each), with mayonnaise or salad dressing, and tomato and/or catsup, on bun	0.086
27510440	Bacon cheeseburger, 1/4 lb meat, with mayonnaise or salad dressing, and tomato and/or catsup, on bun	0.149
27510445	Bacon cheeseburger, 1/3 lb meat, with tomato and/or catsup, on bun	0.353
27510510	Hamburger, with tomato and/or catsup, on bun	0.047
27510520	Hamburger, with mayonnaise or salad dressing, and tomato and/or catsup, on bun	0.168
27510540	Double hamburger (2 patties), with tomato and/or catsup, on bun	0.409
27510560	Hamburger, 1/4 lb meat, with mayonnaise or salad dressing, and tomato and/or catsup, on bun	0.172
27510570	Hamburger, 2-1/2 oz meat, with mayonnaise or salad dressing and tomatoes, on bun	0.440
27510600	Hamburger, 1 oz meat, plain, on miniature bun	0.544
27510620	Hamburger, 1/4 lb meat, with tomato and/or catsup, on bun	0.031
27510680	Double hamburger (2 patties, 1/4 lb meat each), with tomato and/or catsup, on bun	0.288

27510690	Double hamburger (2 patties, 1/4 lb meat each), with mayonnaise or salad dressing and tomatoes and/or catsup, on double-decker bun	0.078
27510700	Meatball and spaghetti sauce submarine sandwich	0.401
27510950	Reuben sandwich (corned beef sandwich with sauerkraut and cheese), with spread	0.340
27511010	Pastrami sandwich	0.359
27513010	Roast beef sandwich	0.362
27513041	Roast beef submarine sandwich, with cheese, lettuce, tomato and spread	0.006
27513050	Roast beef sandwich with cheese	0.315
27513070	Roast beef submarine sandwich, on roll, au jus	0.320
27515020	Steak and cheese submarine sandwich, with lettuce and tomato	0.407
27515070	Steak and cheese submarine sandwich, with fried peppers and onions, on roll	0.436
27515080	Steak sandwich, plain, on biscuit	0.622
27516010	Gyro sandwich (pita bread, beef, lamb, onion, condiments), with tomato and spread	0.416
27517000	Wrap sandwich filled with beef patty, cheese and spread and/or sauce	0.322
27520130	Bacon, chicken, and tomato club sandwich, with lettuce and spread	0.402
27520135	Bacon, chicken, and tomato club sandwich, with cheese, lettuce and spread	0.094
27520140	Bacon and egg sandwich	0.898
27520150	Bacon, lettuce, and tomato sandwich with spread	0.730
27520165	Bacon, chicken fillet (breaded, fried), and tomato club with lettuce and spread	0.410
27520166	Bacon, chicken fillet (breaded, fried), and tomato club sandwich with cheese, lettuce and spread	0.078
27520170	Bacon on biscuit	0.816
27520250	Ham on biscuit	0.025
27520370	Hot ham and cheese sandwich, on bun	0.345
27520380	Ham and cheese on English muffin	0.366
27520390	Ham and cheese submarine sandwich, with lettuce, tomato and spread	0.392
27520510	Pork barbecue sandwich or Sloppy Joe, on bun	0.320
27540110	Chicken sandwich, with spread	0.441
27540111	Chicken sandwich, with cheese and spread	0.374
27540120	Chicken salad or chicken spread sandwich	0.469
27540130	Chicken barbecue sandwich	0.429
27540140	Chicken fillet (breaded, fried) sandwich	0.435
27540145	Chicken fillet (breaded, fried) sandwich on biscuit	0.486
27540150	Chicken fillet (breaded, fried) sandwich with lettuce, tomato and spread	0.078
27540170	Chicken patty sandwich, miniature, with spread	0.396
27540180	Chicken patty sandwich or biscuit	0.508
27540190	Chicken patty sandwich, with lettuce and spread	0.078
27540210	Wrap sandwich filled with chicken strips (breaded, fried), cheese, lettuce, and spread	0.002
27540230	Chicken patty sandwich with cheese, on wheat bun, with lettuce, tomato and spread	0.394
27540235	Chicken fillet, broiled, sandwich with lettuce, tomato, and spread	0.125
27540240	Chicken fillet, (broiled), sandwich, on whole wheat roll, with lettuce, tomato and spread	0.448
27540250	Chicken fillet, broiled, sandwich with cheese, on whole wheat roll, with lettuce, tomato and non-mayonnaise type spread	0.396
27540270	Chicken fillet, broiled, sandwich, with lettuce, tomato, and non-mayonnaise type spread	0.451
27540280	Chicken fillet, broiled, sandwich with cheese, on bun, with lettuce, tomato and spread	0.113
27540290	Chicken submarine sandwich, with lettuce, tomato, and spread	0.360

27540291	Chicken submarine sandwich, with cheese, lettuce, tomato, and spread	0.335
27540300	Wrap sandwich filled with chicken strips (broiled), cheese, lettuce, and spread	0.002
27540310	Turkey sandwich, with spread	0.351
27540350	Turkey submarine sandwich, with cheese, lettuce, tomato and spread	0.392
27541000	Turkey, ham, and roast beef club sandwich, with lettuce, tomato and spread	0.433
27541001	Turkey, ham, and roast beef club sandwich with cheese, lettuce, tomato, and spread	0.400
27550000	Fish sandwich, on bun, with spread	0.030
27550100	Fish sandwich, on bun, with cheese and spread	0.022
27550750	Tuna salad submarine sandwich, with lettuce and tomato	0.133
27550751	Tuna salad submarine sandwich, with cheese, lettuce and tomato	0.258
27560350	Pig in a blanket (frankfurter or hot dog wrapped in dough)	0.304
	Pepperoni and salami submarine sandwich, with lettuce, tomato, and spread	
27560500		0.532
27560650	Sausage on biscuit	0.025
27560660	Sausage griddle cake sandwich	0.033
27560910	Cold cut submarine sandwich, with cheese, lettuce, tomato, and spread	0.094
27564000	Frankfurter or hot dog sandwich, NFS, plain, on bun	0.388
27564010	Frankfurter or hot dog sandwich, NFS, plain, on white bread	0.301
27564020	Frankfurter or hot dog sandwich, NFS, plain, on wheat bread	0.301
27564060	Frankfurter or hot dog sandwich, beef, plain, on bun	0.388
27564070	Frankfurter or hot dog sandwich, beef, plain, on white bread	0.301
27564080	Frankfurter or hot dog sandwich, beef, plain, on wheat bread	0.301
27564090	Frankfurter or hot dog sandwich, beef, plain, on whole wheat bread, NS as to 100%	0.354
27564100	Frankfurter or hot dog sandwich, beef, plain, on whole grain white bread	0.354
27564120	Frankfurter or hot dog sandwich, beef and pork, plain, on bun	0.388
27564130	Frankfurter or hot dog sandwich, beef and pork, plain, on white bread	0.301
27564140	Frankfurter or hot dog sandwich, beef and pork, plain, on wheat bread	0.301
27564150	Frankfurter or hot dog sandwich, beef and pork, plain, on whole wheat bread, NS as to 100%	0.354
27564180	Frankfurter or hot dog sandwich, meat and poultry, plain, on bun	0.388
27564190	Frankfurter or hot dog sandwich, meat and poultry, plain, on white bread	0.301
27564200	Frankfurter or hot dog sandwich, meat and poultry, plain, on wheat bread	0.301
27564210	Frankfurter or hot dog sandwich, meat and poultry, plain, on whole wheat bread, NS as to 100%	0.354
27564240	Frankfurter or hot dog sandwich, chicken and/or turkey, plain, on bun	0.388
27564250	Frankfurter or hot dog sandwich, chicken and/or turkey, plain, on white bread	0.301
27564260	Frankfurter or hot dog sandwich, chicken and/or turkey, plain, on wheat bread	0.301
27564270	Frankfurter or hot dog sandwich, chicken and/or turkey, plain, on whole wheat bread, NS as to 100%	0.354
27564300	Frankfurter or hot dog sandwich, reduced fat or light, plain, on bun	0.388
27564310	Frankfurter or hot dog sandwich, reduced fat or light, plain, on white bread	0.301
27564420	Frankfurter or hot dog sandwich, meatless, plain, on bun	0.384
27564440	Frankfurter or hot dog sandwich, with chili, on bun	0.236
27564460	Frankfurter or hot dog sandwich, with chili, on wheat bread	0.172
27564500	Frankfurter or hot dog sandwich, with vegetarian chili, on bun	0.620
27564510	Frankfurter or hot dog sandwich, with vegetarian chili, on white bread	0.616
27570310	Hors d'oeuvres, with spread	0.628
27640810	Chicken, noodles, and vegetables, baby food, toddler	0.022

27642130	Turkey, rice, and vegetables, baby food, toddler	0.047
28110300	Salisbury steak dinner, NFS (frozen meal)	0.414
28110310	Salisbury steak with gravy, potatoes, vegetable (frozen meal)	0.414
28110350	Salisbury steak with gravy, potatoes, vegetable, dessert (frozen meal, large meat portion)	0.296
28110380	Salisbury steak with gravy, macaroni and cheese (frozen meal)	0.238
28110510	Beef, sliced, with gravy, potatoes, vegetable (frozen meal)	0.459
28110640	Meatballs, Swedish, in sauce, with noodles (frozen meal)	0.131
28110660	Meatballs, Swedish, in gravy, with noodles (diet frozen meal)	0.014
28113140	Beef with spaetzle or rice, vegetable (frozen meal)	0.312
28140100	Chicken dinner, NFS (frozen meal)	0.134
28140150	Chicken divan (frozen meal)	0.196
28140710	Chicken, fried, with potatoes, vegetable (frozen meal)	0.499
28140720	Chicken patty, or nuggets, boneless, breaded, potatoes, vegetable (frozen meal)	0.466
28140730	Chicken patty, breaded, with tomato sauce and cheese, fettuccine alfredo, vegetable (frozen meal)	0.107
28140740	Chicken patty, or nuggets, boneless, breaded, with pasta and tomato sauce, fruit, dessert (frozen meal)	0.249
28140810	Chicken, fried, with potatoes, vegetable, dessert (frozen meal)	0.359
28141010	Chicken, fried, with potatoes, vegetable, dessert (frozen meal, large meat portion)	0.364
28141610	Chicken and vegetables in cream or white sauce (diet frozen meal)	0.144
28143020	Chicken and vegetable entree with rice, Asian (diet frozen meal)	0.030
28143110	Chicken cacciatore with noodles (diet frozen meal)	0.210
28143130	Chicken and vegetable entree with noodles (frozen meal)	0.242
28143150	Chicken and vegetable entree with noodles (diet frozen meal)	0.206
28143170	Chicken in cream sauce with noodles and vegetable (frozen meal)	0.134
28143180	Chicken in butter sauce with potatoes and vegetable (diet frozen meal)	0.323
28143220	Chicken in barbecue sauce, with rice, vegetable and dessert, reduced fat and sodium (diet frozen meal)	0.139
28145110	Turkey with vegetable, stuffing (diet frozen meal)	0.245
28145210	Turkey with gravy, dressing, potatoes, vegetable (frozen meal)	0.223
28145610	Turkey with gravy, dressing, potatoes, vegetable, dessert (frozen meal, large meat portion)	0.323
28150650	Fish, breaded, or fish sticks, with pasta, vegetable and dessert (frozen meal)	0.091
28154010	Shrimp and vegetables in sauce with noodles (diet frozen meal)	0.234
28160310	Meat loaf with potatoes, vegetable (frozen meal)	0.464
28160650	Stuffed green pepper (frozen meal)	0.454
28310230	Meatball soup, Mexican style, home recipe (Sopa de Albondigas)	0.460
28310320	Beef noodle soup, Puerto Rican style (Sopa de carne y fideos)	0.433
28311010	Pepperpot (tripe) soup	0.081
28315050	Beef vegetable soup with potato, pasta, or rice, chunky style, canned, or ready-to-serve	0.196
28315140	Beef vegetable soup, Mexican style, home recipe, (Sopa / Caldo de Res)	0.534
28320140	Ham, noodle, and vegetable soup, Puerto Rican style	0.417
28320160	Pork vegetable soup with potato, pasta, or rice, stew type, chunky style	0.238
28320300	Pork with vegetable (excluding carrots, broccoli and/or dark-green leafy) soup, Asian Style	0.109
28331110	Lamb, pasta, and vegetable soup, Puerto Rican style	0.497
28340130	Chicken or turkey broth, with tomato, home recipe	0.273
28340150	Mexican style chicken broth soup stock	0.633
28340220	Chicken soup with noodles and potatoes, Puerto Rican style	0.412

28340310	Chicken or turkey gumbo soup, home recipe, canned or ready-to-serve	0.031
28340580	Chicken or turkey soup with vegetables (broccoli, carrots, celery, potatoes and onions), Asian style	0.149
28340600	Chicken or turkey vegetable soup, canned, prepared with water or ready-to-serve	0.149
28340610	Chicken or turkey vegetable soup, stew type	0.263
28340640	Chicken or turkey vegetable soup with noodles, stew type, chunky style, canned or ready-to-serve	0.263
28340660	Chicken or turkey vegetable soup, home recipe	0.239
28340670	Chicken or turkey vegetable soup with rice, Mexican style, home recipe (Sopa / Caldo de Pollo)	0.506
28340750	Hot and sour soup	0.096
28340800	Chicken or turkey soup with vegetables and fruit, Asian Style	0.122
28345160	Chicken or turkey mushroom soup, cream of, prepared with milk	0.170
28350050	Fish chowder	0.430
28350110	Crab soup, NS as to tomato-base or cream style	0.124
28350120	Crab soup, tomato-base	0.247
28350220	Clam chowder, Manhattan	0.323
28351110	Fish and vegetable soup, no potatoes (Sopa de pescado y mariscos)	0.124
28351120	Fish soup, with potatoes (Sopa de Pescado y Mariscos)	0.122
28355110	Clam chowder, New England, NS as to prepared with water or milk	0.414
28355120	Clam chowder, New England, prepared with milk	0.405
28355130	Clam chowder, New England, prepared with water	0.248
28355250	Lobster bisque	0.124
28355440	Shrimp gumbo	0.222
28355450	Seafood soup with potatoes and vegetables (including carrots, broccoli, and/or dark-green leafy)	0.236
28355460	Seafood soup with potatoes and vegetables (excluding carrots, broccoli, and dark-green leafy)	0.201
28355470	Seafood soup with vegetables (including carrots, broccoli, and/or dark-green leafy (no potatoes))	0.146
28355480	Seafood soup with vegetables (excluding carrots, broccoli, and dark-green leafy (no potatoes))	0.106
28522000	Mole poblano (sauce)	0.277
31101010	Egg, whole, raw	1.480
31102000	Egg, whole, cooked, NS as to cooking method	1.312
31103010	Egg, whole, boiled or poached	1.469
31105010	Egg, whole, fried without fat	1.469
31105020	Egg, whole, fried with margarine	1.372
31105030	Egg, whole, fried with oil	1.376
31105040	Egg, whole, fried with butter	1.372
31105060	Egg, whole, fried with animal fat or meat drippings	1.381
31105080	Egg, whole, fried with cooking spray	1.460
31105090	Egg, whole, fried, from fast food / restaurant	1.391
31106000	Egg, whole, baked, NS as to fat added in cooking	1.145
31107000	Egg, whole, pickled	1.469
31111000	Egg, yolk only, cooked, NS as to fat added in cooking	1.223
31111010	Egg, yolk only, cooked, fat not added in cooking	1.305
31111020	Egg, yolk only, cooked, fat added in cooking	1.223
32101500	Egg, Benedict	0.606
32101530	Egg curry	0.673
32102000	Egg, deviled	1.357

32103000	Egg salad, made with mayonnaise	1.209
32103015	Egg salad, made with light mayonnaise	1.184
32103020	Egg salad, made with mayonnaise-type salad dressing	1.189
32103025	Egg salad, made with light mayonnaise-type salad dressing	1.184
32103050	Egg Salad, made with any type of fat free dressing	1.148
32105190	Egg casserole with bread, cheese, milk and meat	0.386
32105210	Chicken egg foo yung (young)	0.563
32105220	Pork egg foo yung (young)	0.563
32105230	Shrimp egg foo yung (young)	0.565
32105310	Ripe plantain omelet, Puerto Rican style (Tortilla de amarillo)	0.609
32130000	Egg omelet or scrambled egg, made with margarine	1.145
32130010	Egg omelet or scrambled egg, made with oil	1.147
32130020	Egg omelet or scrambled egg, made with butter	1.145
32130040	Egg omelet or scrambled egg, made with animal fat or meat drippings	1.150
32130060	Egg omelet or scrambled egg, made with cooking spray	1.201
32130070	Egg omelet or scrambled egg, made without fat	1.207
32130080	Egg omelet or scrambled egg, from fast food / restaurant	1.185
32130100	Egg omelet or scrambled egg, with cheese, made with margarine	1.015
32130110	Egg omelet or scrambled egg, with cheese, made with oil	1.017
32130120	Egg omelet or scrambled egg, with cheese, made with butter	1.015
32130160	Egg omelet or scrambled egg, with cheese, made with cooking spray	1.059
32130170	Egg omelet or scrambled egg, with cheese, made without fat	1.064
32130200	Egg omelet or scrambled egg, with meat, made with margarine	0.787
32130210	Egg omelet or scrambled egg, with meat, made with oil	0.788
32130220	Egg omelet or scrambled egg, with meat, made with butter	0.787
32130240	Egg omelet or scrambled egg, with meat, made with animal fat or meat drippings	0.790
32130260	Egg omelet or scrambled egg, with meat, made with cooking spray	0.813
32130270	Egg omelet or scrambled egg, with meat, made without fat	0.816
32130300	Egg omelet or scrambled egg, with cheese and meat, made with margarine	0.724
32130310	Egg omelet or scrambled egg, with cheese and meat, made with oil	0.724
32130320	Egg omelet or scrambled egg, with cheese and meat, made with butter	0.724
32130360	Egg omelet or scrambled egg, with cheese and meat, made with cooking spray	0.746
32130370	Egg omelet or scrambled egg, with cheese and meat, made without fat	0.748
32130400	Egg omelet or scrambled egg, with tomatoes, fat added in cooking	1.059
32130410	Egg omelet or scrambled egg, with tomatoes, fat not added in cooking	1.092
32130420	Egg omelet or scrambled egg, with tomatoes, NS as to fat added in cooking	1.059
32130430	Egg omelet or scrambled egg, with dark-green vegetables, fat added in cooking	1.010
32130450	Egg omelet or scrambled egg, with dark-green vegetables, NS as to fat added in cooking	1.010
32130480	Egg omelet or scrambled egg, with tomatoes and dark-green vegetables, NS as to fat added in cooking	1.030
32130490	Egg omelet or scrambled egg, with vegetables other than dark green and/or tomatoes, fat added in cooking	0.960
32130500	Egg omelet or scrambled egg, with vegetables other than dark green and/or tomatoes, fat not added in cooking	1.017
32130510	Egg omelet or scrambled egg, with vegetables other than dark green and/or tomatoes, NS as to fat added in cooking	0.960
32130600	Egg omelet or scrambled egg, with cheese and tomatoes, fat added in cooking	0.983
32130610	Egg omelet or scrambled egg, with cheese and tomatoes, fat not added in cooking	1.011

32130620	Egg omelet or scrambled egg, with cheese and tomatoes, NS as to fat added in cooking	0.983
32130630	Egg omelet or scrambled egg, with cheese and dark-green vegetables, fat added in cooking	0.914
32130650	Egg omelet or scrambled egg, with cheese and dark-green vegetables, NS as to fat added in cooking	0.914
32130660	Egg omelet or scrambled egg, with cheese, tomatoes, and dark-green vegetables, fat added in cooking	0.941
32130690	Egg omelet or scrambled egg, with cheese and vegetables other than dark green and/or tomatoes, fat added in cooking	0.882
32130700	Egg omelet or scrambled egg, with cheese and vegetables other than dark green and/or tomatoes, fat not added in cooking	0.931
32130710	Egg omelet or scrambled egg, with cheese and vegetables other than dark green and/or tomatoes, NS as to fat added in cooking	0.882
32130800	Egg omelet or scrambled egg, with meat and tomatoes, fat added in cooking	0.897
32130820	Egg omelet or scrambled egg, with meat and tomatoes, NS as to fat added in cooking	0.897
32130830	Egg omelet or scrambled egg, with meat and dark-green vegetables, fat added in cooking	0.875
32130890	Egg omelet or scrambled egg, with meat and vegetables other than dark-green and/or tomatoes, fat added in cooking	0.835
32130900	Egg omelet or scrambled egg, with meat and vegetables other than dark-green and/or tomatoes, fat not added in cooking	0.884
32131000	Egg omelet or scrambled egg, with cheese, meat, and tomatoes, fat added in cooking	0.835
32131010	Egg omelet or scrambled egg, with cheese, meat, and tomatoes, fat not added in cooking	0.858
32131020	Egg omelet or scrambled egg, with cheese, meat, and tomatoes, NS as to fat added in cooking	0.835
32131030	Egg omelet or scrambled egg, with cheese, meat, and dark-green vegetables, fat added in cooking	0.792
32131090	Egg omelet or scrambled egg, with cheese, meat, and vegetables other than dark-green and/or tomatoes, fat added in cooking	0.769
32131100	Egg omelet or scrambled egg, with cheese, meat, and vegetables other than dark-green and/or tomatoes, fat not added in cooking	0.810
32131110	Egg omelet or scrambled egg, with cheese, meat, and vegetables other than dark-green and/or tomatoes, NS as to fat added in cooking	0.769
32131200	Egg omelet or scrambled egg, with potatoes and/or onions, fat added in cooking	1.142
32131210	Egg omelet or scrambled egg, with potatoes and/or onions, fat not added in cooking	1.204
32131220	Egg omelet or scrambled egg, with potatoes and/or onions, NS as to fat added in cooking	1.142
32202000	Egg, cheese, ham, and bacon on bun	0.701
32202010	Egg, cheese, and ham on English muffin	0.548
32202025	Egg, cheese and ham on bagel	0.444
32202030	Egg, cheese, and sausage on English muffin	0.422
32202035	Egg, extra cheese (2 slices), and extra sausage (2 patties) on bun	0.458
32202040	Egg, cheese, and beef on English Muffin	0.636
32202045	Egg, cheese, and steak on bagel	0.407
32202050	Egg, cheese, and sausage on biscuit	0.395
32202055	Egg, cheese, and sausage griddle cake sandwich	0.253
32202060	Egg and sausage on biscuit	0.446
32202070	Egg, cheese, and bacon on biscuit	0.400
32202075	Egg, cheese, and bacon griddle cake sandwich	0.272
32202080	Egg, cheese, and bacon on English muffin	0.548
32202085	Egg, cheese and bacon on bagel	0.797



32202130	Egg and steak on biscuit	0.756
32202200	Egg and cheese on biscuit	0.820
32300100	Egg drop soup	0.155
32400060	Egg white omelet, scrambled, or fried, made with margarine	1.525
32400065	Egg white omelet, scrambled, or fried, made with oil	1.529
32400070	Egg white omelet, scrambled, or fried, made with butter	1.525
32400075	Egg white omelet, scrambled, or fried, made with cooking spray	1.623
32400080	Egg white omelet, scrambled, or fried, made without fat	1.633
32400120	Egg white, omelet, scrambled, or fried, with cheese, NS as to fat added in cooking	1.314
32400200	Egg white, omelet, scrambled, or fried, with meat, fat added in cooking	0.965
32400300	Egg white, omelet, scrambled, or fried, with vegetables, fat added in cooking	1.166
32400310	Egg white, omelet, scrambled, or fried, with vegetables, fat not added in cooking	1.249
32400320	Egg white, omelet, scrambled, or fried, with vegetables, NS as to fat added in cooking	1.166
32400420	Egg white, omelet, scrambled, or fried, with cheese and meat, NS as to fat added in cooking	0.875
32400500	Egg white, omelet, scrambled, or fried, with cheese and vegetables, fat added in cooking	1.057
32400510	Egg white, omelet, scrambled, or fried, with cheese and vegetables, fat not added in cooking	1.125
32400600	Egg white, omelet, scrambled, or fried, with meat and vegetables, fat added in cooking	1.015
32400700	Egg white, omelet, scrambled, or fried, with cheese, meat, and vegetables, fat added in cooking	0.922
32400720	Egg white, omelet, scrambled, or fried, with cheese, meat, and vegetables, NS as to fat added in cooking	0.922
33001010	Egg substitute, omelet, scrambled, or fried, made with oil	1.376
33001020	Egg substitute, omelet, scrambled, or fried, made with butter	1.372
33001040	Egg substitute, omelet, scrambled, or fried, made with cooking spray	1.460
33001050	Egg substitute, omelet, scrambled, or fried, made without fat	1.469
33401100	Egg substitute, omelet, scrambled, or fried, with meat, fat added in cooking	0.868
33401400	Egg substitute, omelet, scrambled, or fried, with cheese and vegetables, fat added in cooking	0.970
41102220	Fava beans, cooked, fat not added in cooking	1.769
41201010	Baked beans, NFS	0.110
41201020	Baked beans, vegetarian	0.157
41202020	Chili beans, barbecue beans, ranch style beans or Mexican- style beans	0.016
41202500	Beans and tomatoes, NS as to fat added in cooking	0.207
41202505	Beans and tomatoes, fat not added in cooking	0.211
41202510	Beans and tomatoes, fat added in cooking	0.207
41205050	Bean dip, made with refried beans	0.039
41205100	Black bean sauce	0.046
41206030	Beans and franks	0.141
41207030	Beans, dry, cooked with ground beef	0.125
41208030	Pork and beans	0.110
41208100	Beans, dry, cooked with pork	0.121
41209000	Falafel	0.609
41221010	Baked beans, low sodium	0.110
41221020	Chili with beans, without meat	0.369
41310150	Stewed chickpeas, Puerto Rican style	0.149
41420010	Soybean curd	2.440
41420050	Soybean curd cheese	2.440

41420100	Miso sauce	0.753
41420110	Miso (fermented soybean paste)	1.670
41420380	Soy yogurt	2.440
41421010	Soybean curd, deep fried	2.440
41421020	Soybean curd, breaded, fried	2.209
41480000	Tofu, frozen dessert, flavors other than chocolate	0.197
41601010	Bean soup, NFS	0.148
41601020	Bean with bacon or ham soup, canned or ready-to-serve	0.148
41601030	Black bean soup, home recipe, canned or ready-to-serve	0.047
41601040	Lima bean soup, home recipe, canned or ready-to-serve	0.055
41601070	Soybean soup, miso broth	0.219
41601090	Bean soup, with macaroni, home recipe, canned, or ready-to-serve	0.050
41601100	Portuguese bean soup, home recipe, canned or ready-to-serve	0.493
41601110	Bean and ham soup, chunky style, canned or ready-to-serve	0.347
41601130	Bean soup, mixed beans, home recipe, canned or ready-to-serve	0.056
41601140	Bean soup, home recipe	0.057
41601180	Bean and ham soup, home recipe	0.048
41602010	Pea and ham soup, chunky style, canned or ready-to-serve	0.347
41602020	Garbanzo bean or chickpea soup, home recipe, canned or ready-to-serve	0.058
41602030	Split pea and ham soup	0.347
41603010	Lentil soup, home recipe, canned, or ready-to-serve	0.057
41810200	Bacon strip, meatless	0.807
41810250	Bacon bits, meatless	0.044
41810400	Breakfast link, pattie, or slice, meatless	0.104
41810600	Chicken, meatless, NFS	0.866
41810610	Chicken, meatless, breaded, fried	0.059
41811400	Frankfurter or hot dog, meatless	0.067
41811800	Meatball, meatless	0.118
41812400	Vegetarian pot pie	0.316
41812450	Vegetarian chili (made with meat substitute)	0.648
41812500	Tofu and vegetables (including carrots, broccoli, and/or dark-green leafy vegetables (no potatoes)), with soy-based sauce (mixture)	1.139
41812510	Tofu and vegetables (excluding carrots, broccoli, and dark-green leafy vegetables (no potatoes)), with soy-based sauce (mixture)	1.165
41812800	Vegetarian stew	0.245
41812900	Vegetarian meat loaf or patties (meat loaf made with meat substitute)	0.895
42301010	Peanut butter sandwich	0.640
42302010	Peanut butter and jelly sandwich	0.543
44201000	Carob chips	0.199
51000100	Bread, NS as to major flour	0.914
51000110	Bread, NS as to major flour, toasted	0.914
51000180	Bread, made from home recipe or purchased at a bakery, NS as to major flour	0.914
51000190	Bread, made from home recipe or purchased at a bakery, toasted, NS as to major flour	0.914
51000200	Roll, NS as to major flour	0.914
51000400	Roll, bran, NS as to type of bran	0.914
51101000	Bread, white	0.914
51101010	Bread, white, toasted	0.914
51101050	Bread, white, made from home recipe or purchased at a bakery	0.914
51101060	Bread, white, made from home recipe or purchased at a bakery, toasted	0.914
51102010	Bread, white with whole wheat swirl	0.914

51105010	Bread, Cuban	0.914
51107010	Bread, French or Vienna	0.914
51107040	Bread, French or Vienna, toasted	0.914
51108010	Focaccia, Italian flatbread, plain	0.914
51108100	Naan, Indian flatbread	0.914
51109010	Bread, Italian, Grecian, Armenian	0.914
51109040	Bread, Italian, Grecian, Armenian, toasted	0.914
51109100	Bread, pita	0.914
51111010	Bread, cheese	0.914
51111040	Bread, cheese, toasted	0.914
51113010	Bread, cinnamon	0.914
51113100	Bread, cinnamon, toasted	0.914
51119010	Bread, egg, Challah	0.914
51121010	Bread, garlic	0.914
51127010	Bread, potato	0.914
51127020	Bread, potato, toasted	0.914
51129010	Bread, raisin	0.914
51129020	Bread, raisin, toasted	0.914
51133010	Bread, sour dough	0.914
51133020	Bread, sour dough, toasted	0.914
51135000	Bread, vegetable	0.914
51136000	Bruschetta	0.914
51140100	Bread, dough, fried	0.914
51150000	Roll, white, soft	0.914
51150100	Roll, white, soft, toasted	0.914
51151060	Roll, white, soft, made from home recipe or purchased at a bakery	0.914
51153000	Roll, white, hard	0.914
51154550	Roll, egg bread	0.914
51154600	Roll, cheese	0.914
51155000	Roll, French or Vienna	0.914
51156500	Roll, garlic	0.914
51157000	Roll, hoagie, submarine	0.914
51158100	Roll, Mexican, bolillo	0.914
51159000	Roll, sour dough	0.914
51160000	Roll, sweet, no frosting	0.914
51160100	Roll, sweet, cinnamon bun, no frosting	0.914
51160110	Roll, sweet, cinnamon bun, frosted	0.914
51161000	Roll, sweet, with fruit, no frosting	0.914
51161020	Roll, sweet, with fruit, frosted	0.914
51161050	Roll, sweet, frosted	0.914
51161250	Roll, sweet, no topping, Mexican (Pan Dulce)	0.914
51161270	Roll, sweet, sugar topping, Mexican (Pan Dulce)	0.914
51161280	Roll, sweet, with raisins and icing, Mexican (Pan Dulce)	0.914
51165000	Coffee cake, yeast type	0.914
51166000	Croissant	0.914
51166100	Croissant, cheese	0.914
51166200	Croissant, chocolate	0.914
51166500	Croissant, fruit	0.914
51167000	Brioche	0.914
51180010	Bagel	0.914

51180020	Bagel, toasted	0.914
51180030	Bagel, with raisins	0.914
51180080	Bagel, with fruit other than raisins	0.914
51182010	Bread stuffing	0.914
51182020	Bread stuffing made with egg	0.914
51184000	Bread sticks, hard	0.914
51184010	Bread stick, soft	0.914
51184020	Bread stick, NS as to hard or soft	0.914
51184030	Bread stick, soft, prepared with garlic and parmesan cheese	0.914
51185000	Croutons	0.914
51186010	Muffin, English	0.914
51186020	Muffin, English, toasted	0.914
51187000	Melba toast	0.914
51188500	Zwieback toast	0.914
51201010	Bread, whole wheat, 100%	0.914
51201020	Bread, whole wheat, 100%, toasted	0.914
51201060	Bread, whole wheat, 100%, made from home recipe or purchased at bakery	0.914
51201070	Bread, whole wheat, 100%, made from home recipe or purchased at bakery, toasted	0.914
51202000	Muffin, English, whole wheat, 100%	0.914
51207010	Bread, sprouted wheat	0.914
51207020	Bread, sprouted wheat, toasted	0.914
51208100	Bagel, whole wheat, 100%, with raisins	0.914
51300050	Bread, whole grain white	0.914
51300060	Bread, whole grain white, toasted	0.914
51300100	Bagel, whole grain white	0.914
51300110	Bread, whole wheat, NS as to 100%	0.914
51300120	Bread, whole wheat, NS as to 100%, toasted	0.914
51300140	Bread, whole wheat, NS as to 100%, made from home recipe or purchased at bakery	0.914
51300150	Bread, whole wheat, NS as to 100%, made from home recipe or purchased at bakery, toasted	0.914
51300175	Bread, chappatti or roti (Indian bread), wheat	0.914
51300180	Bread, puri or poori (Indian puffed bread), wheat	0.914
51300185	Bread, paratha, (Indian flat bread), wheat	0.914
51300210	Bread, whole wheat, with raisins	0.914
51300220	Bread, whole wheat, with raisins, toasted	0.914
51301010	Bread, wheat or cracked wheat	0.914
51301020	Bread, wheat or cracked wheat, toasted	0.914
51301040	Bread, wheat or cracked wheat, made from home recipe or purchased at bakery	0.914
51301050	Bread, wheat or cracked wheat, made from home recipe or purchased at bakery, toasted	0.914
51301120	Bread, wheat or cracked wheat, with raisins	0.914
51301510	Bread, wheat or cracked wheat, reduced calorie and/or high fiber	0.914
51301540	Bread, French or Vienna, whole wheat, NS as to 100%	0.914
51301600	Bread, pita, whole wheat, NS as to 100%	0.914
51301620	Bread, pita, wheat or cracked wheat	0.914
51301630	Bread, pita, wheat or cracked wheat, toasted	0.914
51301700	Bagel, wheat	0.914
51301750	Bagel, whole wheat, NS as to 100%	0.914
51301800	Bagel, wheat, with raisins	0.914

51301900	Bagel, wheat bran	0.914
51303010	Muffin, English, wheat or cracked wheat	0.914
51303030	Muffin, English, whole wheat, NS as to 100%	0.914
51303050	Muffin, English, wheat or cracked wheat, with raisins	0.914
51303070	Muffin, English, whole wheat, NS as to 100%, with raisins	0.914
51320010	Roll, wheat or cracked wheat	0.914
51320040	Roll, wheat or cracked wheat, made from home recipe or purchased at bakery	0.914
51320500	Roll, whole wheat, NS as to 100%	0.914
51401010	Bread, rye	0.914
51401020	Bread, rye, toasted	0.914
51401030	Bread, marble rye and pumpernickel	0.914
51404010	Bread, pumpernickel	0.914
51404020	Bread, pumpernickel, toasted	0.914
51404500	Bagel, pumpernickel	0.914
51407010	Bread, black	0.914
51420000	Roll, rye	0.914
51421000	Roll, pumpernickel	0.914
51501010	Bread, oatmeal	0.914
51501020	Bread, oatmeal, toasted	0.914
51501050	Bread, oat bran, toasted	0.914
51502010	Roll, oatmeal	0.914
51601010	Bread, multigrain, toasted	0.914
51601020	Bread, multigrain	0.914
51601210	Bread, multigrain, with raisins	0.914
51602010	Bread, multigrain, reduced calorie and/or high fiber	0.914
51620000	Roll, multigrain	0.914
51630000	Bagel, multigrain	0.914
51630100	Bagel, multigrain, with raisins	0.914
51630200	Muffin, English, multigrain	0.914
51805010	Bread, sunflower meal	0.914
51806010	Bread, rice	0.914
51807000	Injera (American-style Ethiopian bread)	0.914
51808000	Bread, low gluten	0.914
52101000	Biscuit, baking powder or buttermilk type, NS as to made from mix, refrigerated dough, or home recipe	0.914
52101100	Biscuit, baking powder or buttermilk type, made from mix	0.914
52102040	Biscuit, baking powder or buttermilk type, made from refrigerated dough	0.914
52103000	Biscuit, baking powder or buttermilk type, commercially baked	0.914
52104010	Biscuit, baking powder or buttermilk type, made from home recipe	0.914
52104040	Biscuit, whole wheat	0.914
52104100	Biscuit, cheese	0.914
52104200	Biscuit, cinnamon-raisin	0.914
52105100	Scone	0.914
52105200	Scone, with fruit	0.914
52201000	Cornbread, prepared from mix	0.914
52202060	Cornbread, made from home recipe	0.914
52204000	Cornbread stuffing	0.914
52206010	Cornbread muffin, stick, round	0.914
52206060	Cornbread muffin, stick, round, made from home recipe	0.914
52208010	Corn pone, baked	0.914

52208760	Gordita/sope shell, plain, no filling	0.914
52209010	Hush puppy	0.914
52215000	Tortilla, NFS	0.914
52215100	Tortilla, corn	0.914
52215200	Tortilla, flour (wheat)	0.914
52215260	Tortilla, whole wheat	0.914
52215300	Taco shell, corn	0.914
52215350	Taco shell, flour	0.914
52220110	Cornmeal bread, Dominican style (Arepa Dominicana)	0.914
52301000	Muffin, NFS	0.914
52302010	Muffin, fruit	0.914
52302020	Muffin, fruit, low fat	0.914
52302500	Muffin, chocolate chip	0.914
52302600	Muffin, chocolate	0.914
52303010	Muffin, whole wheat	0.914
52304000	Muffin, whole grain	0.914
52304010	Muffin, wheat bran	0.914
52304150	Muffin, oat bran	0.914
52306010	Muffin, plain	0.914
52306500	Muffin, pumpkin	0.914
52306550	Muffin, zucchini	0.914
52306700	Muffin, carrot	0.914
52311010	Popover	0.914
52404060	Bread, pumpkin	0.914
52405010	Bread, fruit	0.914
52407000	Bread, zucchini	0.914
53100100	Cake or cupcake, NS as to type	0.084
53101100	Cake, angel food, without icing or filling	0.252
53101200	Cake, angel food, with icing or filling	0.154
53101250	Cake, angel food, with fruit and icing or filling	0.155
53102100	Cake or cupcake, applesauce, without icing or filling	0.227
53102200	Cake or cupcake, applesauce, with icing or filling	0.148
53102600	Cake or cupcake, banana, without icing or filling	0.465
53102700	Cake or cupcake, banana, with icing or filling	0.300
53104100	Cake or cupcake, carrot, without icing or filling	0.556
53104260	Cake or cupcake, carrot, with icing or filling	0.358
53104400	Cake or cupcake, coconut, with icing or filling	0.311
53104500	Cheesecake	0.277
53104550	Cheesecake with fruit	0.170
53104600	Cheesecake, chocolate	0.250
53105270	Cake or cupcake, chocolate, devil's food or fudge, with icing or filling	0.084
53105275	Cake or cupcake, chocolate, devil's food or fudge, without icing or filling	0.269
53105300	Cake or cupcake, German chocolate, with icing or filling	0.077
53108200	Snack cake, chocolate, with icing or filling	0.097
53109200	Snack cake, not chocolate, with icing or filling	0.201
53109220	Snack cake, not chocolate, with icing or filling, reduced fat and calories	0.052
53110000	Cake, fruit cake, light or dark, holiday type cake	0.052
53111000	Cake or cupcake, gingerbread	0.098
53112000	Cake, ice cream and cake roll, chocolate	0.128
53112100	Cake, ice cream and cake roll, not chocolate	0.079

53114000	Cake or cupcake, lemon, without icing or filling	0.294
53114100	Cake or cupcake, lemon, with icing or filling	0.280
53115100	Cake or cupcake, marble, without icing or filling	0.281
53115200	Cake or cupcake, marble, with icing or filling	0.042
53115320	Cake or cupcake, nut, with icing or filling	0.276
53115410	Cake or cupcake, oatmeal	0.067
53116000	Cake, pound, without icing or filling	0.355
53116500	Cake or cupcake, pumpkin, without icing or filling	0.150
53116510	Cake or cupcake, pumpkin, with icing or filling	0.099
53116600	Cake, rice flour, without icing or filling	0.172
53117100	Cake or cupcake, spice, without icing or filling	0.227
53117200	Cake or cupcake, spice, with icing or filling	0.148
53118100	Cake, sponge, without icing or filling	0.333
53118200	Cake, sponge, with icing or filling	0.212
53118410	Rum cake, without icing (Sopa Borracha)	0.355
53118500	Cake, torte	0.279
53118550	Cake, tres leche	0.408
53119000	Cake, upside down (all fruits)	0.176
53120270	Cake or cupcake, white, with icing or filling	0.030
53120275	Cake or cupcake, white, without icing or filling	0.289
53121270	Cake or cupcake, yellow, with icing or filling	0.030
53121275	Cake or cupcake, yellow, without icing or filling	0.294
53122080	Cake, shortcake, biscuit type, with fruit	0.076
53123070	Cake, shortcake, sponge type, with whipped cream and fruit	0.222
53123500	Cake, shortcake, with whipped topping and fruit, diet	0.181
53200100	Cookie, batter or dough, raw	0.169
53203500	Cookie, biscotti (Italian sugar cookie)	0.275
53204000	Cookie, brownie, NS as to icing	0.118
53204010	Cookie, brownie, without icing	0.118
53204100	Cookie, brownie, with icing or filling	0.059
53204840	Cookie, brownie, reduced fat, NS as to icing	0.089
53205250	Cookie, butterscotch, brownie	0.118
53206020	Cookie, chocolate chip, made from home recipe or purchased at a bakery	0.095
53206100	Cookie, chocolate chip sandwich	0.031
53210900	Cookie, graham cracker with chocolate and marshmallow	0.393
53215500	Cookie, coconut	0.318
53222010	Cookie, fortune	0.007
53224000	Cookie, ladyfinger	0.747
53224250	Cookie, lemon bar	0.238
53225000	Cookie, macaroon	0.318
53233050	Cookie, oatmeal sandwich, with creme filling	0.031
53233080	Cookie, oatmeal sandwich, with peanut butter and jelly filling	0.031
53234000	Cookie, peanut butter	0.052
53234100	Cookie, peanut butter, with chocolate	0.040
53235000	Cookie, peanut butter sandwich	0.052
53237000	Cookie, raisin	0.148
53237010	Cookie, raisin sandwich, cream-filled	0.031
53241500	Cookie, butter or sugar	0.222
53241600	Cookie, butter or sugar, with fruit and/or nuts	0.105
53244010	Cookie, butter or sugar, with chocolate icing or filling	0.053

53244020	Cookie, butter or sugar, with icing or filling other than chocolate	0.080
53246000	Cookie, tea, Japanese	0.007
53247500	Cookie, vanilla with caramel, coconut, and chocolate coating	0.017
53300100	Pie, NFS	0.234
53300170	Pie, individual size or tart, NFS	0.174
53301000	Pie, apple, two crust	0.234
53301070	Pie, apple, individual size or tart	0.328
53301080	Pie, apple, fried pie	0.328
53301500	Pie, apple, one crust	0.251
53301750	Pie, apple, diet	0.306
53305700	Pie, lemon (not cream or meringue)	0.236
53341000	Pie, banana cream	0.174
53341500	Pie, buttermilk	0.266
53342000	Pie, chocolate cream	0.108
53342070	Pie, chocolate cream, individual size or tart	0.189
53343000	Pie, coconut cream	0.133
53343070	Pie, coconut cream, individual size or tart	0.348
53344070	Pie, custard, individual size or tart	0.376
53344300	Dessert pizza	0.405
53346000	Pie, peanut butter cream	0.276
53347000	Pie, pumpkin	0.105
53347600	Pie, squash	0.235
53360000	Pie, sweet potato	0.480
53381000	Pie, lemon meringue	0.074
53381070	Pie, lemon meringue, individual size or tart	0.074
53385000	Pie, pecan	0.148
53386250	Pie, pudding, chocolate, with chocolate coating, individual size	0.049
53386500	Pie, pudding, flavors other than chocolate, with chocolate coating, individual size	0.068
53410100	Cobbler, apple	0.280
53410300	Cobbler, berry	0.040
53410500	Cobbler, cherry	0.031
53410800	Cobbler, peach	0.032
53415100	Crisp, apple, apple dessert	0.545
53415120	Fritter, apple	0.513
53415200	Fritter, banana	0.866
53415400	Crisp, cherry	0.056
53420100	Cream puff, eclair, custard or cream filled, not iced	0.200
53420200	Cream puff, eclair, custard or cream filled, iced	0.320
53420300	Air filled fritter or fried puff, without syrup, Puerto Rican style (Bunuelos de viento)	0.325
53430100	Crepe, dessert type, chocolate-filled	0.428
53430200	Crepe, dessert type, fruit-filled	0.316
53440000	Strudel, apple	0.160
53440500	Strudel, cherry	0.097
53441210	Basbousa (semolina dessert dish)	0.019
53450000	Turnover or dumpling, apple	0.160
53452100	Pastry, fruit-filled	0.064
53452120	Pastry, Asian, made with bean or lotus seed paste filling (baked)	0.158
53452200	Pastry, Italian, with cheese	0.009
53452420	Pastry, puff, custard or cream filled, iced or not iced	0.277



53453150	Empanada, Mexican turnover, fruit-filled	0.108
53510000	Danish pastry, plain or spice	0.193
53510100	Danish pastry, with fruit	0.209
53511000	Danish pastry, with cheese	0.160
53520000	Doughnut, NS as to cake or yeast	0.038
53520110	Doughnut, cake type	0.038
53520120	Doughnut, chocolate, cake type	0.071
53520140	Doughnut, cake type, chocolate covered	0.111
53520160	Doughnut, chocolate, cake type, with chocolate icing	0.111
53520500	Doughnut, Asian	0.038
53521100	Doughnut, chocolate, raised or yeast, with chocolate icing	0.067
53521110	Doughnut, raised or yeast	0.079
53521120	Doughnut, chocolate, raised or yeast	0.076
53521130	Doughnut, raised or yeast, chocolate covered	0.088
53521140	Doughnut, jelly	0.096
53521210	Doughnut, custard-filled	0.097
53521230	Doughnut, custard-filled, with icing	0.097
53610100	Coffee cake, crumb or quick-bread type	0.174
53610170	Coffee cake, crumb or quick-bread type, with fruit	0.254
53610200	Coffee cake, crumb or quick-bread type, cheese-filled	0.150
53710504	Kellogg's Nutri-Grain Fruit and Nut Bar	0.066
53710600	Milk 'n Cereal bar	0.406
53710800	Kashi GOLEAN Chewy Bars	0.116
53710902	Nature Valley Chewy Granola Bar with Yogurt Coating	0.017
53710904	Nature Valley Sweet and Salty Granola Bar	0.116
53711000	Quaker Chewy Granola Bar	0.041
53711002	Quaker Chewy 90 Calorie Granola Bar	0.124
53711006	Quaker Chewy Dipp's Granola Bar	0.017
53712000	Snack bar, oatmeal	0.111
53712200	Granola bar, lowfat, NFS	0.124
53712210	Granola bar, nonfat	0.108
53714200	Granola bar, chocolate-coated, NFS	0.017
53714220	Granola bar with nuts, chocolate-coated	0.124
53714230	Granola bar, oats, nuts, coated with non-chocolate coating	0.083
53714250	Granola bar, coated with non-chocolate coating	0.124
53714500	Breakfast bar, NFS	0.216
53714520	Breakfast bar, cereal crust with fruit filling, lowfat	0.216
53720300	PowerBar	0.033
53720500	Snickers Marathon Protein bar	0.158
53720610	South Beach Living High Protein Bar	0.158
53720700	Tiger's Milk bar	0.066
54308000	Crackers, milk	0.205
54336000	Crackers, water biscuits	0.058
54401120	Salty snacks, corn or cornmeal base, tortilla chips, fat free, made with Olean	0.017
54402610	Salty snacks, multigrain and potato chips (made with rice flour, dried potatoes, corn flour, and wheat starch)	1.809
54406200	Shrimp chips (tapioca base)	1.809
54408200	Pretzel, hard, chocolate-coated	0.332
54408250	Pretzel, yogurt-covered	0.088
54420200	Multigrain mixture, bread sticks, sesame nuggets, pretzels, rye chips	0.312

55101000	Pancakes, plain	0.133
55101015	Pancakes, plain, reduced fat	0.137
55101020	Pancakes, plain, fat free	0.085
55103000	Pancakes, with fruit	0.349
55103100	Pancakes, with chocolate chips	0.342
55105000	Pancakes, buckwheat	0.366
55105100	Pancakes, cornmeal	0.174
55105200	Pancakes, whole wheat	0.338
55105205	Pancakes, whole wheat, reduced fat	0.352
55105210	Pancakes, whole wheat, fat free	0.364
55201000	Waffle, plain	0.266
55202000	Waffle, wheat, bran, or multigrain	0.325
55203000	Waffle, fruit	0.213
55203600	Waffle, chocolate chip	0.067
55205000	Waffle, 100% whole wheat or 100% whole grain	0.416
55211000	Waffle, plain, fat free	0.601
55211050	Waffle, plain, lowfat	0.397
55212000	Waffle, whole wheat, lowfat	0.059
55301000	French toast, plain	0.908
55301050	French toast sticks, plain	0.348
55401000	Crepe, plain	0.584
55610300	Dumpling, plain	0.081
55801000	Funnel cake with sugar	0.336
56112000	Noodles, cooked, NS as to fat added in cooking	0.096
56112010	Noodles, cooked, fat not added in cooking	0.096
56112030	Noodles, cooked, fat added in cooking	0.093
56113990	Noodles, cooked, spinach, NS as to fat added in cooking	0.096
56201071	Grits, cooked, corn or hominy, with cheese, regular, fat not added in cooking	0.104
56201072	Grits, cooked, corn or hominy, with cheese, regular, fat added in cooking	0.102
56201082	Grits, cooked, corn or hominy, with cheese, quick, fat added in cooking	0.102
56201530	Cornmeal mush, made with milk	0.297
56201540	Cornmeal, made with milk and sugar, Puerto Rican Style (Harina de maiz)	0.242
56201700	Cornstarch with milk, eaten as a cereal (2 tbsp cornstarch in 2-1/2 cups milk)	0.331
56203210	Oatmeal, NS as to regular, quick, or instant, made with milk, fat not added in cooking	0.291
56203211	Oatmeal, cooked, regular, made with milk, fat not added in cooking	0.291
56203212	Oatmeal, cooked, quick (1 or 3 minutes), made with milk, fat not added in cooking	0.291
56203213	Oatmeal, cooked, instant, made with milk, fat not added in cooking	0.261
56203220	Oatmeal, NS as to regular, quick, or instant, made with milk, fat added in cooking	0.281
56203221	Oatmeal, cooked, regular, made with milk, fat added in cooking	0.281
56203222	Oatmeal, cooked, quick (1 or 3 minutes), made with milk, fat added in cooking	0.281
56203223	Oatmeal, cooked, instant, made with milk, fat added in cooking	0.250
56203230	Oatmeal, NS as to regular, quick, or instant, made with milk, NS as to fat added in cooking	0.291
56203231	Oatmeal, cooked, regular, made with milk, NS as to fat added in cooking	0.291
56203232	Oatmeal, cooked, quick (1 or 3 minutes), made with milk, NS as to fat added in cooking	0.291
56203540	Oatmeal, made with milk and sugar, Puerto Rican style	0.256
56205080	Rice, creamed, made with milk and sugar, Puerto Rican style	0.143
57104000	Apple Jacks	0.080

57106050	Banana Nut Crunch Cereal (Post)	0.150
57106060	Banana Nut Cheerios	0.019
57227000	Granola, NFS	0.010
57229500	Granola with Raisins, lowfat, Kellogg's	0.100
57319500	Sun Country 100% Natural Granola, with Almonds	0.033
57342010	Smorz, Kellogg's	0.091
57344005	Special K Chocolatey Delight	0.124
57344015	Special K Fruit & Yogurt	0.017
57419000	Yogurt Burst Cheerios	0.008
58100000	Burrito, taco, or quesadilla with egg	0.665
58100005	Burrito, taco, or quesadilla with egg and potato	1.023
58100010	Burrito, taco, or quesadilla with egg and breakfast meat	0.587
58100013	Burrito, taco, or quesadilla with egg and breakfast meat, from fast food	0.256
58100015	Burrito, taco, or quesadilla with egg, potato, and breakfast meat	0.966
58100020	Burrito, taco, or quesadilla with egg, beans, and breakfast meat	0.215
58100100	Burrito with meat	0.099
58100120	Burrito with meat and beans	0.058
58100135	Burrito with meat and sour cream	0.097
58100140	Burrito with meat, beans, and sour cream	0.057
58100145	Burrito with meat, beans, and sour cream, from fast food	0.027
58100160	Burrito with meat, beans, and rice	0.058
58100165	Burrito with meat, beans, rice, and sour cream	0.056
58100200	Burrito with chicken	0.054
58100220	Burrito with chicken and beans	0.015
58100235	Burrito with chicken and sour cream	0.045
58100245	Burrito with chicken, beans, and sour cream	0.015
58100255	Burrito with chicken, beans, and rice	0.015
58100260	Burrito with chicken, beans, rice, and sour cream	0.014
58100300	Burrito with beans and rice, meatless	0.009
58100320	Burrito with beans, meatless	0.009
58100325	Burrito with beans, meatless, from fast food	0.031
58100330	Burrito with beans, rice, and sour cream, meatless	0.009
58100360	Chilaquiles, tortilla casserole with salsa, cheese, and egg	0.416
58100370	Chilaquiles, tortilla casserole with salsa and cheese, no egg	0.231
58100520	Enchilada with meat and beans, red-chile or enchilada sauce	0.145
58100525	Enchilada with meat and beans, green-chile or enchilada sauce	0.044
58100530	Enchilada with meat, red-chile or enchilada sauce	0.352
58100535	Enchilada with meat, green-chile or enchilada sauce	0.112
58100620	Enchilada with chicken and beans, red-chile or enchilada sauce	0.145
58100625	Enchilada with chicken and beans, green-chile or enchilada sauce	0.044
58100630	Enchilada with chicken, red-chile or enchilada sauce	0.352
58100635	Enchilada with chicken, green-chile or enchilada sauce	0.112
58100720	Enchilada with beans, meatless, red-chile or enchilada sauce	0.091
58100725	Enchilada with beans, green-chile or enchilada sauce	0.027
58100800	Enchilada, just cheese, meatless, no beans, red-chile or enchilada sauce	0.362
58100805	Enchilada, just cheese, meatless, no beans, green-chile or enchilada sauce	0.116
58101320	Taco or tostada with meat	0.166
58101325	Taco or tostada with meat and sour cream	0.145
58101345	Soft taco with meat	0.147
58101350	Soft taco with meat and sour cream	0.131

58101450	Soft taco with chicken	0.068
58101460	Soft taco with chicken and sour cream	0.059
58101520	Taco or tostada with chicken	0.080
58101555	Soft taco with fish	0.068
58101610	Soft taco with beans	0.009
58101615	Soft taco with beans and sour cream	0.009
58101620	Soft taco with meat and beans	0.029
58101630	Soft taco with meat, beans, and sour cream	0.028
58101720	Taco or tostada with beans	0.009
58101725	Taco or tostada with beans and sour cream	0.009
58101730	Taco or tostada with meat and beans	0.030
58101745	Taco or tostada with meat, beans, and sour cream	0.029
58101820	Mexican casserole made with ground beef, beans, tomato sauce, cheese, taco seasonings, and corn chips	0.086
58101830	Mexican casserole made with ground beef, tomato sauce, cheese, taco seasonings, and corn chips	0.117
58101930	Taco or tostada salad with meat	0.099
58101935	Taco or tostada salad with chicken	0.098
58101940	Taco or tostada salad, meatless	0.100
58101945	Taco or tostada salad with meat and sour cream	0.087
58101950	Taco or tostada salad with chicken and sour cream	0.086
58101955	Taco or tostada salad, meatless with sour cream	0.088
58103250	Tamale, plain, meatless, no sauce, Mexican style	0.044
58104090	Nachos with cheese and sour cream	0.099
58104120	Nachos with cheese	0.041
58104130	Nachos with meat and cheese	0.083
58104150	Nachos with chicken and cheese	0.081
58104160	Nachos with chili	0.035
58104180	Nachos with meat, cheese, and sour cream	0.015
58104260	Gordita, sope, or chalupa with beans	0.009
58104270	Gordita, sope, or chalupa with beans and sour cream	0.009
58104280	Gordita, sope, or chalupa with meat and sour cream	0.110
58104290	Gordita, sope, or chalupa with meat	0.122
58104320	Gordita, sope, or chalupa with chicken and sour cream	0.048
58104340	Gordita, sope, or chalupa with chicken	0.054
58104500	Chimichanga with meat	0.028
58104520	Chimichanga, meatless	0.009
58104530	Chimichanga with chicken	0.016
58104550	Chimichanga with chicken and sour cream	0.015
58104710	Quesadilla, just cheese, meatless	0.030
58104720	Quesadilla, just cheese, from fast food	0.045
58104730	Quesadilla with meat	0.027
58104740	Quesadilla with chicken	0.027
58104750	Quesadilla with vegetables	0.027
58104760	Quesadilla with vegetables and meat	0.027
58104770	Quesadilla with vegetables and chicken	0.027
58104820	Taquito or flauta with meat	0.047
58104825	Taquito or flauta with meat and cheese	0.047
58104830	Taquito or flauta with chicken	0.047
58104835	Taquito or flauta with chicken and cheese	0.047
58104905	Taquito or flauta with egg and breakfast meat	0.332

58105000	Fajita with chicken and vegetables	0.158
58105050	Fajita with meat and vegetables	0.158
58105110	Pupusa, meat-filled	0.031
58106200	Pizza, cheese, prepared from frozen, thin crust	0.157
58106205	Pizza, cheese, prepared from frozen, thick crust	0.141
58106210	Pizza, cheese, from restaurant or fast food, NS as to type of crust	0.188
58106220	Pizza, cheese, from restaurant or fast food, thin crust	0.188
58106225	Pizza, cheese, from restaurant or fast food, regular crust	0.188
58106230	Pizza, cheese, from restaurant or fast food, thick crust	0.188
58106233	Pizza, cheese, stuffed crust	0.188
58106235	Pizza, cheese, from school lunch, thin crust	0.097
58106236	Pizza, cheese, from school lunch, thick crust	0.085
58106255	Pizza, extra cheese, regular crust	0.175
58106300	Pizza, cheese, with vegetables, prepared from frozen, thin crust	0.230
58106305	Pizza, cheese with vegetables, prepared from frozen, thick crust	0.181
58106310	Pizza, cheese, with vegetables, NS as to type of crust	0.248
58106320	Pizza, cheese, with vegetables, thin crust	0.267
58106325	Pizza, cheese, with vegetables, regular crust	0.248
58106330	Pizza, cheese, with vegetables, thick crust	0.251
58106345	Pizza with cheese and extra vegetables, thin crust	0.241
58106347	Pizza with cheese and extra vegetables, regular crust	0.229
58106350	Pizza with cheese and extra vegetables, thick crust	0.215
58106358	Pizza, cheese, with fruit, thin crust	0.156
58106359	Pizza, cheese, with fruit, regular crust	0.163
58106360	Pizza, cheese, with fruit, thick crust	0.165
58106500	Pizza with meat, prepared from frozen, thin crust	0.148
58106505	Pizza with meat, prepared from frozen, thick crust	0.130
58106540	Pizza with pepperoni, from restaurant or fast food, NS as to type of crust	0.141
58106550	Pizza with pepperoni, from restaurant or fast food, thin crust	0.141
58106555	Pizza with pepperoni, from restaurant or fast food, regular crust	0.141
58106560	Pizza with pepperoni, from restaurant or fast food, thick crust	0.078
58106570	Pizza with pepperoni, from school lunch, thin crust	0.079
58106580	Pizza with pepperoni, from school lunch, thick crust	0.085
58106620	Pizza with meat other than pepperoni, from restaurant or fast food, thin crust	0.125
58106625	Pizza with meat other than pepperoni, from restaurant or fast food, regular crust	0.157
58106630	Pizza with meat other than pepperoni, from restaurant or fast food, thick crust	0.157
58106635	Pizza, with meat other than pepperoni, from school lunch, thin crust	0.086
58106636	Pizza, with meat other than pepperoni, from school lunch, thick crust	0.090
58106640	Pizza with extra meat, NS as to type of crust	0.149
58106650	Pizza with extra meat, thin crust	0.135
58106655	Pizza with extra meat, regular crust	0.149
58106660	Pizza with extra meat, thick crust	0.150
58106700	Pizza with meat and vegetables, prepared from frozen, thin crust	0.078
58106705	Pizza with meat and vegetables, prepared from frozen, thick crust	0.110
58106720	Pizza with meat and vegetables, thin crust	0.233
58106725	Pizza with meat and vegetables, regular crust	0.078
58106730	Pizza with meat and vegetables, thick crust	0.209
58106735	Pizza with extra meat and extra vegetables, NS as to type of crust	0.195
58106736	Pizza with extra meat and extra vegetables, thin crust	0.197
58106737	Pizza with extra meat and extra vegetables, thick crust	0.195

58106738	Pizza with extra meat and extra vegetables, regular crust	0.195
58106750	Pizza with meat and fruit, thin crust	0.141
58106755	Pizza with meat and fruit, regular crust	0.150
58106760	Pizza with meat and fruit, thick crust	0.158
58107050	Pizza, no cheese, thin crust	0.214
58107100	Pizza, no cheese, thick crust	0.157
58108000	Calzone, with cheese, meatless	0.039
58108010	Calzone, with meat and cheese	0.044
58108050	Pizza rolls	0.282
58110200	Roll with meat and/or shrimp, vegetables and rice paper (not fried)	0.435
58111200	Puffs, fried, crab meat and cream cheese filled	0.100
58116115	Empanada, Mexican turnover, filled with cheese and vegetables	0.358
58116120	Empanada, Mexican turnover, filled with meat and vegetables	0.292
58116130	Empanada, Mexican turnover, filled with chicken and vegetables	0.349
58117510	Hayacas, Puerto Rican style (hominy, pork or ham, vegetables)	0.221
58120110	Crepes, filled with meat, fish, or poultry, with sauce	0.193
58121610	Dumpling, potato- or cheese-filled	0.256
58121620	Dumpling, vegetable	0.212
58122220	Gnocchi, potato	0.880
58122320	Knish, cheese (pastry filled with cheese)	0.277
58122330	Knish, meat (pastry filled with meat)	0.252
58124210	Pastry, cheese-filled	0.240
58124250	Spanakopitta	0.702
58124500	Pastry, filled with potatoes and peas, fried	0.508
58125110	Quiche with meat, poultry or fish	0.268
58125120	Spinach quiche, meatless	0.384
58126130	Turnover, meat- and cheese-filled, no gravy	0.066
58126150	Turnover, meat- and cheese-filled, tomato-based sauce	0.124
58126160	Turnover, cheese-filled, tomato-based sauce	0.047
58126280	Turnover, chicken- or turkey-, and vegetable-filled, lower in fat	0.094
58126290	Turnover, meat- and cheese-filled, lower in fat	0.104
58126300	Turnover, meat- and cheese-filled, tomato-based sauce, lower in fat	0.160
58126400	Turnover, filled with egg, meat and cheese	0.085
58127150	Vegetables and cheese in pastry	0.053
58127210	Croissant sandwich, filled with ham and cheese	0.104
58127270	Croissant sandwich with sausage and egg	0.467
58127310	Croissant sandwich with ham, egg, and cheese	0.512
58127330	Croissant sandwich with sausage, egg, and cheese	0.407
58127350	Croissant sandwich with bacon, egg, and cheese	0.578
58127500	Vegetable submarine sandwich, with fat free spread	0.561
58128000	Biscuit with gravy	0.448
58128120	Cornmeal dressing with chicken or turkey and vegetables	0.220
58128220	Dressing with chicken or turkey and vegetables	0.422
58128250	Dressing with meat and vegetables	0.386
58130011	Lasagna with meat	0.439
58130013	Lasagna with meat, canned	0.470
58130020	Lasagna with meat and spinach	0.305
58130140	Lasagna with chicken or turkey	0.207
58130150	Lasagna, with chicken or turkey, and spinach	0.305

58130310	Lasagna, meatless	0.282
58130320	Lasagna, meatless, with vegetables	0.316
58131100	Ravioli, NS as to filling, no sauce	0.303
58131110	Ravioli, NS as to filling, with tomato sauce	0.368
58131310	Ravioli, meat-filled, no sauce	0.344
58131320	Ravioli, meat-filled, with tomato sauce or meat sauce	0.584
58131323	Ravioli, meat-filled, with tomato sauce or meat sauce, canned	0.470
58131330	Ravioli, meat-filled, with cream sauce	0.322
58131510	Ravioli, cheese-filled, no sauce	0.248
58131520	Ravioli, cheese-filled, with tomato sauce	0.303
58131523	Ravioli, cheese-filled, with tomato sauce, canned	0.219
58131530	Ravioli, cheese-filled, with meat sauce	0.313
58131590	Ravioli, cheese and spinach-filled, no sauce	0.399
58131600	Ravioli, cheese and spinach-filled, with cream sauce	0.360
58131610	Ravioli, cheese and spinach filled, with tomato sauce	0.488
58132110	Spaghetti with tomato sauce, meatless	0.306
58132113	Pasta with tomato sauce and cheese, canned	0.548
58132310	Spaghetti with tomato sauce and meatballs or spaghetti with meat sauce or spaghetti with meat sauce and meatballs	0.275
58132313	Pasta with tomato sauce and meat or meatballs, canned	0.485
58132340	Spaghetti with tomato sauce and vegetables	0.420
58132350	Spaghetti with tomato sauce, meatless, whole wheat noodles	0.306
58132360	Spaghetti with tomato sauce and meatballs, whole wheat noodles or spaghetti with meat sauce, whole wheat noodles or spaghetti with meat sauce and meatballs, whole wheat noodles	0.275
58132450	Spaghetti with tomato sauce, meatless, made with spinach noodles	0.134
58132460	Spaghetti with tomato sauce and meatballs made with spinach noodles, or spaghetti with meat sauce made with spinach noodles, or spaghetti with meat sauce and meatballs made with spinach noodles	0.128
58132710	Spaghetti with tomato sauce and frankfurters or hot dogs	0.254
58132910	Spaghetti with tomato sauce and poultry	0.274
58133120	Manicotti, cheese-filled, with tomato sauce, meatless	0.309
58134130	Stuffed shells, cheese-filled, with meat sauce	0.486
58134210	Stuffed shells, with chicken, with tomato sauce	0.540
58134610	Tortellini, meat-filled, with tomato sauce	0.234
58134620	Tortellini, cheese-filled, meatless, with tomato sauce	0.360
58134640	Tortellini, cheese-filled, meatless, with vinaigrette dressing	0.182
58134660	Tortellini, cheese-filled, with cream sauce	0.233
58134680	Tortellini, cheese-filled, no sauce	0.111
58134720	Tortellini, spinach-filled, no sauce	0.633
58137220	Pad Thai, meatless	0.360
58137230	Pad Thai with chicken	0.089
58137240	Pad Thai with seafood	0.092
58145110	Macaroni or noodles with cheese	0.164
58145112	Macaroni or noodles with cheese, made from packaged mix	0.031
58145119	Macaroni or noodles with cheese, made from reduced fat packaged mix	0.032
58145120	Macaroni or noodles with cheese and tuna	0.030
58145135	Macaroni or noodles with cheese and meat	0.028
58145136	Macaroni or noodles with cheese and meat, prepared from Hamburger Helper mix	0.118
58145140	Macaroni or noodles with cheese and tomato	0.064
58145160	Macaroni or noodles with cheese and frankfurters or hot dogs	0.029

58145170	Macaroni or noodles with cheese and egg	0.072
58145190	Macaroni or noodles with cheese and chicken or turkey	0.028
58146100	Pasta with tomato sauce, meatless	0.306
58146110	Pasta with meat sauce	0.204
58146120	Pasta with cheese and meat sauce	0.292
58146130	Pasta with carbonara sauce	0.159
58146150	Pasta with cheese and tomato sauce, meatless	0.296
58146160	Pasta with vegetables, no sauce or dressing	0.129
58147110	Macaroni or noodles with beans or lentils and tomato sauce	0.287
58147310	Macaroni, creamed	0.133
58148110	Macaroni or pasta salad, made with mayonnaise	0.035
58148111	Macaroni or pasta salad, made with light mayonnaise	0.031
58148112	Macaroni or pasta salad, made with mayonnaise-type salad dressing	0.031
58148114	Macaroni or pasta salad, made with Italian dressing	0.249
58148116	Macaroni or pasta salad, made with creamy dressing	0.253
58148120	Macaroni or pasta salad with egg	0.164
58148130	Macaroni or pasta salad with tuna	0.029
58148150	Macaroni or pasta salad with shrimp	0.030
58148160	Macaroni or pasta salad with tuna and egg	0.141
58148170	Macaroni or pasta salad with chicken	0.030
58148180	Macaroni or pasta salad with cheese	0.030
58148550	Macaroni or pasta salad with meat	0.029
58150100	Bibimbap (Korean)	0.161
58150110	Rice, fried, meatless	0.096
58150310	Rice, fried, NFS	0.096
58150320	Rice, fried, with chicken	0.082
58150330	Rice, fried, with pork	0.082
58150340	Rice, fried, with beef	0.082
58150510	Rice, fried, with shrimp	0.082
58151100	Sushi, NFS	0.005
58151130	Sushi, with vegetables and seafood	0.005
58151140	Sushi, with vegetables, rolled in seaweed	0.101
58155310	Paella, Valenciana style, with meat (Paella Valenciana)	0.034
58155320	Seafood paella, Puerto Rican style	0.089
58156610	Pigeon pea asopao (Asopao de gandules)	0.209
58160120	Rice with beans and tomatoes	0.148
58160150	Red beans and rice	0.069
58160460	Rice, white, with carrots, NS as to fat added in cooking	0.344
58160470	Rice, white, with carrots, fat not added in cooking	0.351
58160480	Rice, white, with carrots, fat added in cooking	0.344
58160490	Rice, white, with peas and carrots, NS as to fat added in cooking	0.163
58160500	Rice, white, with peas and carrots, fat not added in cooking	0.167
58160520	Rice, white, with tomatoes (and/or tomato based sauce), NS as to fat added in cooking	0.211
58160530	Rice, white, with tomatoes (and/or tomato based sauce), fat not added in cooking	0.215
58160540	Rice, white, with tomatoes (and/or tomato based sauce), fat added in cooking	0.211
58160580	Rice, white, with carrots and tomatoes (and/or tomato-based sauce), NS as to fat added in cooking	0.274
58160610	Rice, white, with dark green vegetables and tomatoes (and/or tomato-based sauce), NS as to fat added in cooking	0.112



58160630	Rice, white, with dark green vegetables and tomatoes (and/or tomato-based sauce), fat added in cooking	0.112
58160640	Rice, white, with carrots and dark green vegetables, NS as to fat added in cooking	0.173
58160650	Rice, white, with carrots and dark green vegetables, fat not added in cooking	0.176
58160660	Rice, white, with carrots and dark green vegetables, fat added in cooking	0.173
58160700	Rice, white, with other vegetables, NS as to fat added in cooking	0.106
58160710	Rice, white, with other vegetables, fat not added in cooking	0.108
58160720	Rice, white, with other vegetables, fat added in cooking	0.106
58161325	Rice, brown, with beans and tomatoes	0.138
58161435	Rice, brown, with carrots, NS as to fat added in cooking	0.295
58161440	Rice, brown, with peas and carrots, NS as to fat added in cooking	0.139
58161462	Rice, brown, with tomatoes (and/or tomato based sauce), fat not added in cooking	0.186
58161464	Rice, brown, with tomatoes (and/or tomato based sauce), fat added in cooking	0.183
58161500	Rice, brown, with carrots and dark green vegetables, NS as to fat added in cooking	0.147
58161504	Rice, brown, with carrots and dark green vegetables, fat added in cooking	0.147
58161530	Rice, brown, with other vegetables, NS as to fat added in cooking	0.091
58161534	Rice, brown, with other vegetables, fat added in cooking	0.091
58162090	Stuffed pepper, with meat	0.854
58162110	Stuffed pepper, with rice and meat	0.706
58162120	Stuffed pepper, with rice, meatless	0.805
58162130	Stuffed tomato, with rice and meat	0.570
58163130	Dirty rice	0.059
58163410	Spanish rice, fat added in cooking	0.258
58163420	Spanish rice, fat not added in cooking	0.262
58163430	Spanish rice, NS as to fat added in cooking	0.258
58163450	Spanish rice with ground beef	0.194
58163510	Rice dressing	0.080
58164500	Rice, white, with cheese and/or cream based sauce, NS as to fat added in cooking	0.069
58164510	Rice, white, with cheese and/or cream based sauce, fat not added in cooking	0.070
58164520	Rice, white, with cheese and/or cream based sauce, fat added in cooking	0.069
58165000	Rice, white, with vegetables, cheese and/or cream based sauce, NS as to fat added in cooking	0.055
58165010	Rice, white, with vegetables, cheese and/or cream based sauce, fat not added in cooking	0.056
58165020	Rice, white, with vegetables, cheese and/or cream based sauce, fat added in cooking	0.055
58165410	Rice, brown, with vegetables, cheese and/or cream based sauce, fat not added in cooking	0.050
58174000	Upma (Indian breakfast dish)	0.293
58175110	Tabbouleh (bulgar with tomatoes and parsley)	0.386
58301050	Lasagna with cheese and meat sauce (diet frozen meal)	0.455
58301110	Vegetable lasagna (frozen meal)	0.144
58301150	Zucchini lasagna (diet frozen meal)	0.255
58302050	Beef and noodles with meat sauce and cheese (diet frozen meal)	0.414
58304010	Spaghetti and meatballs dinner, NFS (frozen meal)	0.275
58304050	Spaghetti with meat and mushroom sauce (diet frozen meal)	0.224
58304200	Ravioli, cheese-filled, with tomato sauce (diet frozen meal)	0.462
58304230	Ravioli, cheese-filled, with vegetable and fruit (frozen meal)	0.363
58306100	Chicken enchilada (diet frozen meal)	0.315

58310310	Pancakes and sausage (frozen meal)	0.212
58402010	Beef noodle soup, canned or ready-to-serve	0.091
58402030	Beef rice soup, home recipe, canned or ready-to-serve	0.177
58402100	Beef noodle soup, home recipe	0.099
58403010	Chicken or turkey noodle soup, canned or ready-to-serve	0.026
58403040	Chicken or turkey noodle soup, home recipe	0.099
58403050	Chicken or turkey noodle soup, cream of, home recipe, canned, or ready-to-serve	0.196
58403060	Chicken or turkey noodle soup, reduced sodium, canned or ready-to-serve	0.015
58403100	Noodle and potato soup, Puerto Rican style	0.490
58404030	Chicken or turkey rice soup, home recipe	0.087
58404500	Matzo ball soup	0.196
58404510	Chicken or turkey soup with dumplings and potatoes, home recipe, canned, or ready-to-serve	0.034
58404520	Chicken or turkey soup with dumplings, home recipe, canned or ready-to-serve	0.033
58407010	Instant soup, noodle	0.008
58408500	Noodle soup with vegetables, Asian style	0.169
58409000	Noodle soup, with fish ball, shrimp, and dark green leafy vegetable	0.020
58421010	Sopa Seca de Fideo, Mexican style, made with dry noodles, home recipe	0.218
58421020	Sopa de Fideo Aguada, Mexican style noodle soup, home recipe	0.143
58421060	Sopa seca de arroz (dry rice soup), Mexican style, home recipe	0.206
58421080	Sopa de tortilla, Mexican style tortilla soup, home recipe	0.038
61119010	Orange, raw	0.683
61122300	Orange, mandarin, canned or frozen, NS as to sweetened or unsweetened; sweetened, NS as to type of sweetener	0.329
61122320	Orange, mandarin, canned or frozen, juice pack	0.519
61122330	Orange, mandarin, canned or frozen, in light syrup	0.329
61122350	Orange, mandarin, canned or frozen, drained	0.670
61125010	Tangerine, raw	0.683
61210000	Orange juice, NFS	0.506
61210010	Orange juice, freshly squeezed	0.506
61210220	Orange juice, canned, bottled or in a carton	0.506
61210250	Orange juice, with calcium added, canned, bottled or in a carton	0.506
61210620	Orange juice, frozen (reconstituted with water)	0.516
61210820	Orange juice, frozen, with calcium added (reconstituted with water)	0.506
61213800	Fruit juice blend, including citrus, 100% juice	0.253
61213900	Fruit juice blend, including citrus, 100% juice, with calcium added	0.506
62101050	Fruit mixture, dried (mixture includes three or more of the following: apples, apricots, dates, papaya, peaches, pears, pineapples, prunes, raisins)	0.223
62101100	Apple, dried, uncooked	1.486
62101200	Apple, dried, cooked, NS as to sweetened or unsweetened; sweetened, NS as to type of sweetener	0.268
62101300	Apple chips	1.171
62107200	Banana chips	3.291
63100100	Fruit, NS as to type	0.688
63101000	Apple, raw	0.609
63101110	Applesauce, stewed apples, NS as to sweetened or unsweetened; sweetened, NS as to type of sweetener	0.274
63101120	Applesauce, stewed apples, unsweetened	0.274
63101140	Applesauce, stewed apples, sweetened with low calorie sweetener	0.274
63101150	Applesauce with other fruits	0.247
63101210	Apple, cooked or canned, with syrup	0.335

63101320	Apple, baked, unsweetened	0.609
63101330	Apple, baked, with sugar	0.544
63101420	Apple, pickled	0.382
63101500	Apple, fried	0.508
63107010	Banana, raw	1.260
63107210	Banana, ripe, fried	1.191
63107310	Banana, ripe, boiled	1.260
63126500	Kiwi fruit, raw	2.740
63133010	Papaya, raw	2.670
63133050	Papaya, green, cooked	1.867
63301010	Ambrosia	0.591
63311000	Fruit salad, fresh or raw, (excluding citrus fruits), no dressing	0.394
63311050	Fruit salad, fresh or raw, (including citrus fruits), no dressing	0.455
63311145	Tropical fruit cocktail, cooked or canned, in light syrup	1.025
63320100	Fruit salad, Puerto Rican style (Mixture includes bananas, papayas, oranges, etc.) (Ensalada de frutas tropicales)	0.780
63401010	Apple salad with dressing	0.404
63401060	Apple, candied	0.536
63401070	Fruit, chocolate covered	0.006
63402950	Fruit salad (excluding citrus fruits) with salad dressing or mayonnaise	0.384
63402960	Fruit salad (excluding citrus fruits) with whipped cream	0.395
63402970	Fruit salad (excluding citrus fruits) with nondairy whipped topping	0.413
63402980	Fruit salad (excluding citrus fruits) with marshmallows	0.361
63403000	Fruit salad (excluding citrus fruits) with pudding	0.388
63403010	Fruit salad (including citrus fruits) with salad dressing or mayonnaise	0.539
63403020	Fruit salad (including citrus fruit) with whipped cream	0.565
63403040	Fruit salad (including citrus fruits) with marshmallows	0.508
63409020	Chutney	0.596
64100100	Fruit juice, NFS	0.366
64100110	Fruit juice blend, 100% juice	0.134
64100200	Fruit juice blend, with cranberry, 100% juice	0.134
64101010	Apple cider	0.268
64104010	Apple juice	0.268
64120010	Papaya juice	0.602
64134000	Fruit smoothie drink, made with fruit or fruit juice only (no dairy products)	0.412
67102010	Applesauce, baby food, strained	0.274
67105030	Bananas, baby food, strained	0.771
67106010	Bananas with apples and pears, baby food, strained	0.348
67309030	Bananas and strawberry, baby food, junior	0.329
71000100	White potato, NFS	1.554
71101000	White potato, baked, peel not eaten	2.041
71101100	White potato, baked, peel eaten, NS as to fat added in cooking	1.991
71101110	White potato, baked, peel eaten, fat not added in cooking	2.042
71101120	White potato, baked, peel eaten, fat added in cooking	1.991
71103000	White potato, boiled, without peel, NS as to fat added in cooking	1.557
71103010	White potato, boiled, without peel, fat not added in cooking	1.601
71103020	White potato, boiled, without peel, fat added in cooking	1.554
71103100	White potato, boiled with peel, peel not eaten, NS as to fat added in cooking	1.554
71104000	White potato, roasted, NS as to fat added in cooking	1.558
71104010	White potato, roasted, fat not added in cooking	1.656

71104020	White potato, roasted, fat added in cooking	1.558
71201015	White potato chips, regular cut	4.336
71201020	White potato chips, ruffled, rippled, or crinkle cut	4.336
71201050	White potato, chips, reduced fat	4.336
71201080	White potato, chips, fat free	4.336
71201090	White potato, chips, fat free, made with Olean	4.336
71201100	White potato, chips, restructured	4.336
71201200	White potato, chips, restructured, reduced fat and reduced sodium	4.336
71201210	White potato, chips, restructured, fat free, made with Olean	4.336
71201250	White potato, chips, restructured, baked	4.336
71202000	White potato, chips, unsalted	4.336
71202100	White potato, chips, unsalted, reduced fat	4.336
71202500	White potato chips, lightly salted	4.336
71205000	White potato, sticks	4.336
71211000	White potato skins, chips	4.336
71220000	Vegetable chips	5.650
71301020	White potato, cooked, with cheese	1.169
71301120	White potato, cooked, with ham and cheese	1.076
71305010	White potato, scalloped	1.180
71305110	White potato, scalloped, with ham	1.066
71401000	White potato, french fries, NS as to from fresh or frozen	1.610
71401010	White potato, french fries, from fresh, deep fried	1.655
71401015	White potato, french fries, from fresh, oven baked	1.556
71401020	White potato, french fries, from frozen, oven baked	1.610
71401030	White potato, french fries, from frozen, deep fried, from fast food / restaurant	1.610
71401035	White potato, french fries, from frozen, NS as to deep fried or oven baked	1.610
71402500	White potato, french fries, with cheese	0.723
71402505	White potato, french fries, with cheese and bacon	0.695
71402510	White potato, french fries, with chili and cheese	0.620
71402520	White potato, french fries, with chili con carne	0.759
71403000	White potato, home fries	1.317
71403500	White potato, home fries, with green or red peppers and onions	1.389
71405000	White potato, hash brown, NS as to from fresh, frozen, or dry mix	1.610
71405010	White potato, hash brown, from fresh	1.601
71405020	White potato, hash brown, from frozen	1.610
71405100	White potato, hash brown, with cheese	1.433
71411000	White potato skins, with adhering flesh, fried, with cheese and bacon	1.608
71501000	White potato, mashed, NFS	1.181
71501010	White potato, from fresh, mashed, made with milk	1.449
71501015	White potato, from fresh, mashed, made with milk, and sour cream and/or cream cheese	1.234
71501020	White potato, from fresh, mashed, made with milk and fat	1.397
71501025	White potato, from fresh, mashed, made with milk, and sour cream and/or cream cheese and fat	1.173
71501030	White potato, from fresh, mashed, made with fat	1.535
71501040	White potato, from dry, mashed, made with milk and fat	1.016
71501050	White potato, from fresh, mashed, made with milk, fat and cheese	1.304
71501055	White potato, from fresh, mashed, made with sour cream and/or cream cheese and fat	1.196
71501070	White potato, from dry, mashed, made with milk, fat, egg and cheese	1.047
71501080	White potato, from fresh, mashed, not made with milk or fat	1.601

71501090	White potato, from dry, mashed, made with milk, no fat	1.074
71501200	White potato, from complete dry mix, mashed, made with water	1.183
71501300	White potato, from dry, mashed, NS as to milk or fat	1.014
71501310	White potato, from fresh, mashed, NS as to milk or fat	1.397
71503010	White potato, patty	1.113
71505000	White potato, puffs	1.313
71507005	White potato, stuffed, baked, peel not eaten, stuffed with butter or margarine	1.680
71507010	White potato, stuffed, baked, peel not eaten, stuffed with sour cream	1.387
71507020	White potato, stuffed, baked, peel not eaten, stuffed with cheese	1.503
71507040	White potato, stuffed, baked, peel not eaten, stuffed with broccoli and cheese sauce	1.008
71507050	White potato, stuffed, baked, peel not eaten, stuffed with meat in cream sauce	0.285
71508005	White potato, stuffed, baked, peel eaten, stuffed with butter or margarine	1.758
71508010	White potato, stuffed, baked, peel eaten, stuffed with sour cream	1.506
71508020	White potato, stuffed, baked, peel eaten, stuffed with cheese	1.608
71508060	White potato, stuffed, baked, peel eaten, stuffed with bacon and cheese	1.552
71508070	White potato, stuffed, baked, peel not eaten, stuffed with bacon and cheese	1.439
71601010	Potato salad with egg, made with mayonnaise	1.203
71601015	Potato salad with egg, made with light mayonnaise	1.250
71601020	Potato salad with egg, made with mayonnaise-type salad dressing	1.253
71603010	Potato salad, made with mayonnaise	1.239
71603015	Potato salad, made with light mayonnaise	1.220
71603025	Potato salad, made with light mayonnaise-type salad dressing	1.220
71603040	Potato salad, made with Italian dressing	1.277
71603050	Potato salad, made with any type of fat free dressing	1.192
71701000	Potato pancake	1.388
71703000	Stewed potatoes, Mexican style (Papas guisadas)	1.214
71703040	Stewed potatoes with tomatoes, Mexican style (Papas guisadas con tomate)	1.135
71704000	Stewed potatoes with tomatoes	1.063
71801000	Potato soup, NS as to made with milk or water	0.385
71801010	Potato soup, cream of, prepared with milk	0.467
71801020	Potato soup, prepared with water	0.302
71801100	Potato and cheese soup	0.617
71803010	Potato chowder	0.528
71910110	Green banana, cooked (in salt water)	1.252
71910210	Green banana, fried	1.191
71931010	Cassava with creole sauce, Puerto Rican style (Yuca al mojo)	0.071
72118305	Chamnamul (Korean leaf vegetable), cooked, fat not added in cooking	1.212
72121210	Mustard cabbage, cooked, fat not added in cooking	0.862
72125100	Spinach, raw	1.445
72125200	Spinach, cooked, NS as to form, NS as to fat added in cooking	0.656
72125201	Spinach, cooked, from fresh, NS as to fat added in cooking	0.656
72125202	Spinach, cooked, from frozen, NS as to fat added in cooking	0.579
72125210	Spinach, cooked, NS as to form, fat not added in cooking	0.673
72125211	Spinach, cooked, from fresh, fat not added in cooking	0.673
72125212	Spinach, cooked, from frozen, fat not added in cooking	0.593
72125213	Spinach, cooked, from canned, fat not added in cooking	0.596
72125220	Spinach, cooked, NS as to form, fat added in cooking	0.656
72125221	Spinach, cooked, from fresh, fat added in cooking	0.656
72125222	Spinach, cooked, from frozen, fat added in cooking	0.579

72125231	Spinach, from fresh, creamed	0.515
72125232	Spinach, from frozen, creamed	0.471
72125240	Spinach souffle	0.614
72125250	Spinach, cooked, NS as to form, with cheese sauce	0.515
72125260	Spinach and cheese casserole	0.652
72125310	Palak Paneer or Saag Paneer (Indian)	0.627
72201230	Broccoli, cooked, NS as to form, with cheese sauce	0.071
72201231	Broccoli, cooked, from fresh, with cheese sauce	0.071
72201232	Broccoli, cooked, from frozen, with cheese sauce	0.064
72202010	Broccoli casserole (broccoli, noodles, and cream sauce)	0.044
72202020	Broccoli casserole (broccoli, rice, cheese, and mushroom sauce)	0.105
72202030	Broccoli, batter-dipped and fried	0.085
72302000	Broccoli soup, prepared with milk, home recipe, canned or ready-to-serve	0.195
72302020	Broccoli soup, prepared with water, home recipe, canned, or ready-to-serve	0.025
72302100	Broccoli cheese soup, prepared with milk, home recipe, canned, or ready-to-serve	0.195
72307000	Spinach soup	0.564
72308000	Dark-green leafy vegetable soup with meat, Asian style	0.117
72308500	Dark-green leafy vegetable soup, meatless, Asian style	0.138
73101010	Carrots, raw	1.660
73101110	Carrots, raw, salad	1.056
73102200	Carrots, cooked, NS as to form, NS as to fat added in cooking	1.381
73102201	Carrots, cooked, from fresh, NS as to fat added in cooking	1.381
73102202	Carrots, cooked, from frozen, NS as to fat added in cooking	1.377
73102203	Carrots, cooked, from canned, NS as to fat added in cooking	1.386
73102210	Carrots, cooked, NS as to form, fat not added in cooking	1.423
73102211	Carrots, cooked, from fresh, fat not added in cooking	1.423
73102212	Carrots, cooked, from frozen, fat not added in cooking	1.422
73102213	Carrots, cooked, from canned, fat not added in cooking	1.432
73102220	Carrots, cooked, NS as to form, fat added in cooking	1.381
73102221	Carrots, cooked, from fresh, fat added in cooking	1.381
73102222	Carrots, cooked, from frozen, fat added in cooking	1.377
73102223	Carrots, cooked, from canned, fat added in cooking	1.386
73102230	Carrots, cooked, NS as to form, creamed	0.919
73102241	Carrots, cooked, from fresh, glazed	1.189
73105010	Carrot juice	0.851
73111200	Peas and carrots, cooked, NS as to form, NS as to fat added in cooking	0.641
73111202	Peas and carrots, cooked, from frozen, NS as to fat added in cooking	0.641
73111211	Peas and carrots, cooked, from fresh, fat not added in cooking	0.561
73111213	Peas and carrots, cooked, from canned, fat not added in cooking	0.521
73111221	Peas and carrots, cooked, from fresh, fat added in cooking	0.544
73111222	Peas and carrots, cooked, from frozen, fat added in cooking	0.641
73111223	Peas and carrots, cooked, from canned, fat added in cooking	0.506
73111400	Carrots in tomato sauce	0.461
73304010	Squash fritter or cake	0.212
73305020	Squash, winter, souffle	0.275
73401000	Sweet potato, NFS	0.822
73402010	Sweet potato, baked, peel eaten, fat not added in cooking	0.856
73402020	Sweet potato, baked, peel eaten, fat added in cooking	0.822
73403000	Sweet potato, baked, peel not eaten, NS as to fat added in cooking	0.822

73403010	Sweet potato, baked, peel not eaten, fat not added in cooking	0.860
73403020	Sweet potato, baked, peel not eaten, fat added in cooking	0.822
73405000	Sweet potato, boiled, without peel, NS as to fat added in cooking	0.832
73405010	Sweet potato, boiled, without peel, fat not added in cooking	0.858
73405020	Sweet potato, boiled, without peel, fat added in cooking	0.832
73405110	Sweet potato, boiled with peel, peel not eaten, fat not added in cooking	0.858
73406000	Sweet potato, candied	0.708
73407000	Sweet potato, canned, NS as to syrup	0.449
73409000	Sweet potato, casserole or mashed	0.752
73410110	Sweet potato, fried	1.326
73410210	Sweet potato, chips	3.023
73410300	Sweet potato, french fries	0.822
73421000	Sweet potato, yellow, Puerto Rican, cooked	0.858
73501000	Carrot soup, cream of, prepared with milk, home recipe, canned or ready-to-serve	0.633
74101000	Tomatoes, raw	0.924
74201000	Tomatoes, cooked, NS as to form, NS as to method	0.642
74201001	Tomatoes, cooked, from fresh, NS as to method	0.655
74201003	Tomatoes, cooked, from canned, NS as to method	0.642
74204010	Tomatoes, NS as to form, stewed	0.658
74204500	Tomatoes, canned, low sodium	0.642
74205010	Tomatoes, green, cooked, NS as to form	0.654
74206000	Tomatoes, red, dried	6.264
74301100	Tomato juice	0.642
74303000	Tomato and vegetable juice, mostly tomato	0.642
74303100	Tomato and vegetable juice, mostly tomato, low sodium	0.642
74304000	Tomato juice with clam or beef juice	0.482
74401010	Tomato catsup	0.908
74401110	Tomato catsup, reduced sodium	0.908
74402010	Tomato chili sauce (catsup-type)	0.579
74402100	Salsa, NFS	0.392
74402110	Salsa, pico de gallo	0.429
74402150	Salsa, red, commercially-prepared	0.392
74402200	Salsa, red, homemade	0.389
74402250	Enchilada sauce, red	0.739
74402260	Enchilada sauce, green	0.227
74404010	Spaghetti sauce, meatless	0.642
74404020	Spaghetti sauce with vegetables, homemade-style	0.559
74404030	Spaghetti sauce with meat, canned, no extra meat added	0.604
74404050	Spaghetti sauce, meatless, reduced sodium	0.642
74404090	Vodka flavored pasta sauce made with tomatoes and cream	0.468
74406010	Barbecue sauce	0.204
74406100	Steak sauce, tomato-base	0.517
74406500	Cocktail sauce	0.313
74410110	Puerto Rican seasoning with ham	0.576
74420110	Puerto Rican seasoning without ham and tomato sauce	0.661
74504000	Tomato and okra, cooked, NS as to fat added in cooking	0.375
74504010	Tomato and okra, cooked, fat not added in cooking	0.384
74504100	Tomato and onion, cooked, NS as to fat added in cooking	0.497
74504110	Tomato and onion, cooked, fat not added in cooking	0.507

74504120	Tomato and onion, cooked, fat added in cooking	0.497
74506000	Tomato and cucumber salad made with tomato, cucumber, oil, and vinegar	0.256
74601000	Tomato soup, NFS	0.246
74601010	Tomato soup, cream of, prepared with milk	0.413
74602010	Tomato soup, prepared with water, or ready-to-serve	0.246
74602200	Tomato soup, canned, reduced sodium, prepared with water, or ready-to-serve	0.238
74602300	Tomato soup, canned, reduced sodium, prepared with milk	0.405
74603010	Tomato beef soup, prepared with water	0.116
74604010	Tomato beef noodle soup, prepared with water	0.116
74604100	Tomato beef rice soup, prepared with water	0.116
74604500	Tomato noodle soup, canned, prepared with water or ready-to-serve	0.201
74605010	Tomato rice soup, prepared with water	0.204
74606010	Tomato vegetable soup, prepared with water	0.246
74606020	Tomato vegetable soup with noodles, prepared with water	0.175
75100250	Raw vegetable, NFS	1.660
75103000	Cabbage, green, raw	1.630
75105000	Cabbage, red, raw	1.630
75109000	Celery, raw	0.633
75114000	Mixed salad greens, raw	0.289
75119000	Parsley, raw	3.420
75121000	Pepper, hot chili, raw	0.758
75122000	Pepper, raw, NFS	0.985
75122100	Pepper, sweet, green, raw	1.516
75132000	Mixed vegetable juice (vegetables other than tomato)	0.837
75132100	Celery juice	0.511
75140500	Broccoli salad with cauliflower, cheese, bacon bits, and dressing	0.032
75140510	Broccoli slaw salad	0.155
75140990	Cabbage salad or coleslaw, from fast food / restaurant	0.007
75141000	Cabbage salad or coleslaw, made with coleslaw dressing	1.203
75141005	Cabbage salad or coleslaw, made with light coleslaw dressing	1.173
75141020	Cabbage salad or coleslaw, made with Italian dressing	1.209
75141030	Cabbage salad or coleslaw, made with creamy dressing	1.212
75141035	Cabbage salad or coleslaw, made with light creamy dressing	1.184
75141040	Cabbage salad or coleslaw, made with any type of fat free dressing	1.186
75141100	Cabbage salad or coleslaw with apples and/or raisins, with dressing	1.058
75143000	Lettuce, salad with assorted vegetables including tomatoes and/or carrots, no dressing	0.438
75143050	Lettuce, salad with assorted vegetables excluding tomatoes and carrots, no dressing	0.333
75143200	Lettuce, salad with cheese, tomato and/or carrots, with or without other vegetables, no dressing	0.377
75143300	Lettuce, salad with egg, tomato, and/or carrots, with or without other vegetables, no dressing	0.608
75210000	Cabbage, Chinese, cooked, NS as to fat added in cooking	0.838
75210010	Cabbage, Chinese, cooked, fat not added in cooking	0.862
75210020	Cabbage, Chinese, cooked, fat added in cooking	0.838
75211010	Cabbage, green, cooked, NS as to fat added in cooking	0.947
75211020	Cabbage, green, cooked, fat not added in cooking	0.978
75211030	Cabbage, green, cooked, fat added in cooking	0.947
75212020	Cabbage, red, cooked, fat added in cooking	0.948
75215000	Celery, cooked, NS as to fat added in cooking	0.493



75215010	Celery, cooked, fat not added in cooking	0.508
75215020	Celery, cooked, fat added in cooking	0.493
75215120	Fennel bulb, cooked, fat added in cooking	0.493
75226000	Peppers, green, cooked, NS as to fat added in cooking	1.456
75226010	Peppers, green, cooked, fat not added in cooking	1.507
75226020	Peppers, green, cooked, fat added in cooking	1.456
75226090	Peppers, hot, cooked, NS as to form, NS as to fat added in cooking	1.516
75226100	Peppers, hot, cooked, NS as to form, fat not added in cooking	1.516
75226101	Peppers, hot, cooked, from fresh, fat not added in cooking	1.516
75226102	Peppers, hot, cooked, from frozen, fat not added in cooking	1.516
75226103	Peppers, hot, cooked, from canned, fat not added in cooking	1.516
75226110	Peppers, hot, cooked, NS as to form, fat added in cooking	1.471
75226111	Peppers, hot, cooked, from fresh, fat added in cooking	1.469
75227100	Radish, Japanese (daikon), cooked, fat not added in cooking	0.070
75227110	Radish, Japanese (daikon), cooked, fat added in cooking	0.067
75302050	Beans, string, green, and potatoes, cooked, fat not added in cooking	0.774
75302510	Beans, string, green, and potatoes, cooked, fat added in cooking	0.748
75303020	Corn with peppers, red or green, cooked, fat added in cooking	0.138
75306010	Eggplant in tomato sauce, cooked, fat not added in cooking	0.366
75307000	Green peppers and onions, cooked, fat added in cooking	0.577
75311110	Mixed vegetables (corn, lima beans, peas, green beans, and carrots), canned, low sodium, fat not added in cooking	0.498
75315305	Peas and potatoes, cooked, NS as to fat added in cooking	0.767
75315310	Peas and potatoes, cooked, fat added in cooking	0.767
75316010	Zucchini with tomato sauce, cooked, fat not added in cooking	0.267
75316050	Ratatouille	0.218
75317000	Vegetables, stew type (including potatoes, carrots, onions, celery) cooked, NS as to fat added in cooking	1.108
75317010	Vegetables, stew type (including potatoes, carrots, onions, celery) cooked, fat added in cooking	1.108
75317020	Vegetables, stew type (including potatoes, carrots, onions, celery) cooked, fat not added in cooking	1.153
75330100	Vegetable combination (including carrots, broccoli, and/or dark-green leafy), cooked, no sauce, NS as to fat added in cooking	0.364
75330110	Vegetable combination (including carrots, broccoli, and/or dark-green leafy), cooked, no sauce, fat not added in cooking	0.377
75330120	Vegetable combination (including carrots, broccoli, and/or dark-green leafy), cooked, no sauce, fat added in cooking	0.364
75330130	Vegetable combination (excluding carrots, broccoli, and dark-green leafy), cooked, no sauce, NS as to fat added in cooking	0.170
75330140	Vegetable combination (excluding carrots, broccoli, and dark-green leafy), cooked, no sauce, fat not added in cooking	0.176
75330150	Vegetable combination (excluding carrots, broccoli, and dark-green leafy), cooked, no sauce, fat added in cooking	0.170
75340000	Vegetable combinations, Asian style, (broccoli, green pepper, water chestnut, etc) cooked, NS as to fat added in cooking	0.073
75340010	Vegetable combinations, Asian style, (broccoli, green pepper, water chestnuts, etc), cooked, fat not added in cooking	0.075
75340020	Vegetable combinations, Asian style, (broccoli, green pepper, water chestnuts, etc), cooked, fat added in cooking	0.073
75340160	Vegetable and pasta combinations with cream or cheese sauce (broccoli, pasta, carrots, corn, zucchini, peppers, cauliflower, peas, etc.), cooked	0.277
75365000	Vegetable mixture, dried	0.618
75401011	Asparagus, from fresh, creamed or with cheese sauce	0.065

75402012	Beans, lima, immature, from frozen, creamed or with cheese sauce	0.072
75403012	Beans, string, green, from frozen, creamed or with cheese sauce	0.078
75403013	Beans, string, green, from canned, creamed or with cheese sauce	0.072
75403020	Beans, string, green, cooked, NS as to form, with mushroom sauce	0.036
75403023	Beans, string, green, cooked, from canned, with mushroom sauce	0.034
75407010	Cabbage, creamed	0.662
75409010	Cauliflower, NS as to form, creamed	0.082
75409011	Cauliflower, from fresh, creamed	0.082
75409012	Cauliflower, from frozen, creamed	0.065
75410500	Chiles rellenos, cheese-filled (stuffed chili peppers)	0.952
75410530	Chiles rellenos, filled with meat and cheese (stuffed chili peppers)	1.019
75410550	Jalapeno pepper, stuffed with cheese, breaded or battered, fried	0.501
75411010	Corn, scalloped or pudding	0.300
75411020	Corn fritter	0.232
75411030	Corn, cooked, NS as to form, with cream sauce, made with milk	0.142
75412010	Eggplant, batter-dipped, fried	0.065
75412030	Eggplant dip	0.043
75412060	Eggplant parmesan casserole, regular	0.198
75414010	Mushrooms, NS as to form, creamed	0.125
75414020	Mushrooms, stuffed	0.189
75414030	Mushrooms, batter-dipped, fried	0.020
75414500	Okra, batter-dipped, fried	0.180
75416600	Pea salad with cheese	0.097
75417010	Peas, NS as to form, creamed	0.124
75417030	Peas, cooked, NS as to form, with tomato sauce	0.286
75418010	Squash, summer, yellow or green, breaded or battered, fried	0.085
75418040	Squash, summer, casserole, with cheese sauce	0.111
75418101	Turnips, from fresh, creamed	0.125
75439010	Vegetable stew without meat	0.629
75440100	Vegetable combination (including carrots, broccoli, and/or dark-green leafy), cooked, with soy-based sauce	0.311
75440110	Vegetable combination (excluding carrots, broccoli, and dark-green leafy), cooked, with soy-based sauce	0.306
75440200	Vegetable tempura	0.214
75440300	Vegetable combinations (including carrots, broccoli, and/or dark-green leafy), cooked, with tomato sauce	0.485
75440310	Vegetable combinations (excluding carrots, broccoli, and dark-green leafy), cooked, with tomato sauce	0.277
75440400	Vegetables, dipped in chick-pea flour batter, (pakora), fried	0.080
75440500	Vegetable combinations (including carrots, broccoli, and/or dark-green leafy), cooked, with cheese sauce	0.347
75440510	Vegetable combinations (excluding carrots, broccoli, and dark-green leafy), cooked, with cheese sauce	0.178
75440600	Vegetable curry	0.526
75450510	Vegetable combination (excluding carrots, broccoli, and dark-green leafy), cooked, with cream sauce	0.122
75450600	Vegetable combination (including carrots, broccoli, and/or dark-green leafy), cooked, with butter sauce	0.631
75460700	Vegetable combinations (including carrots, broccoli, and/or dark-green leafy), cooked, with pasta	0.251
75460710	Vegetable combinations (excluding carrots, broccoli, and dark-green leafy), cooked, with pasta	0.111
75500510	Celery, pickled	0.556

75501010	Corn relish	0.178
75502500	Cabbage, fresh, pickled, Japanese style	0.984
75502510	Cabbage, red, pickled	0.545
75502520	Cabbage, Kimchi (Kim Chee) style	0.550
75506100	Mustard sauce	0.062
75511020	Peppers, pickled	0.557
75511040	Pepper, hot, pickled	0.548
75515100	Vegetables, pickled	0.628
75600150	Soup, cream of, NFS	0.413
75601100	Beet soup (borscht)	0.186
75601200	Cabbage soup, home recipe, canned or ready-to-serve	0.398
75601210	Cabbage with meat soup, home recipe, canned or ready-to-serve	0.276
75604600	Gazpacho	0.063
75607010	Mushroom soup, cream of, prepared with milk	0.171
75607040	Mushroom soup, with meat broth, prepared with water	0.064
75607060	Mushroom soup, cream of, NS as to made with milk or water	0.171
75608010	Onion soup, cream of, prepared with milk	0.170
75608100	Onion soup, French	0.201
75611010	Vegetable soup, cream of, prepared with milk	0.310
75612010	Zucchini soup, cream of, prepared with milk	0.105
75649010	Vegetable soup, canned, prepared with water or ready-to-serve	0.193
75649050	Vegetable soup, made from dry mix	0.149
75649110	Vegetable soup, home recipe	0.367
75649150	Vegetable noodle soup, home recipe	0.268
75651000	Minestrone soup, home recipe	0.147
75651010	Minestrone soup, canned, prepared with water, or ready-to-serve	0.081
75651020	Vegetable beef soup, canned, prepared with water, or ready-to-serve	0.163
75651030	Vegetable beef noodle soup, prepared with water	0.163
75651040	Vegetable noodle soup, canned, prepared with water, or ready-to-serve	0.183
75651070	Vegetable rice soup, canned, prepared with water or ready-to-serve	0.258
75651140	Vegetable soup with chicken broth, Mexican style, home recipe (Sopa Ranchera)	0.217
75651150	Vegetable noodle soup, reduced sodium, canned, prepared with water or ready-to-serve	0.249
75652010	Vegetable beef soup, home recipe	0.239
75652040	Vegetable beef soup with noodles or pasta, home recipe	0.152
75652050	Vegetable beef soup with rice, home recipe	0.142
75654010	Vegetarian vegetable soup, prepared with water	0.183
75656020	Vegetable soup, chunky style	0.193
75656060	Vegetable beef soup, chunky style	0.177
77121010	Fried stuffed potatoes, Puerto Rican style (Rellenos de papas)	1.047
77121110	Potato and ham fritters, Puerto Rican style (Frituras de papa y jamon)	1.199
77230210	Cassava Pasteles, Puerto Rican style (Pasteles de yuca)	0.120
77250710	Tannier fritters, Puerto Rican style (Frituras de yautia)	0.185
77316600	Eggplant and meat casserole	0.201
77513010	Spanish stew, Puerto Rican style (Cocido Espanol)	0.415
77563010	Puerto Rican stew (Salcocho / Sancocho)	0.202
78101000	Vegetable and fruit juice blend, 100% juice, with high vitamin C plus added vitamin E and vitamin A	0.282
81301020	Lemon-butter sauce	0.195
81302010	Hollandaise sauce	0.344

81302040	Sandwich spread	0.052
81302050	Tartar sauce	0.030
81330210	Adobo fresco	0.078
83100100	Salad dressing, NFS, for salads	0.021
83100200	Salad dressing, NFS, for sandwiches	0.120
83101000	Blue or roquefort cheese dressing	0.037
83102000	Caesar dressing	0.030
83103000	Coleslaw dressing	0.044
83104000	French or Catalina dressing	0.047
83105500	Honey mustard dressing	0.037
83107000	Mayonnaise, regular	0.126
83108000	Mayonnaise, imitation	0.015
83109000	Russian dressing	0.157
83110000	Mayonnaise-type salad dressing	0.096
83112500	Creamy dressing	0.037
83112950	Poppy seed dressing	0.008
83114000	Thousand Island dressing	0.184
83200100	Salad dressing, light, NFS	0.040
83202020	French or Catalina dressing, light	0.235
83204000	Mayonnaise, light	0.096
83204030	Mayonnaise, reduced fat, with olive oil	0.037
83204050	Mayonnaise-type salad dressing, light	0.096
83207000	Thousand Island dressing, light	0.140
83210100	Creamy dressing, light	0.040
83300300	Creamy dressing, fat free	0.025
83300400	French or Catalina dressing, fat free	0.078
83300900	Salad dressing, fat free, NFS	0.025
83301000	Thousand Island dressing, fat free	0.125
91304010	Topping, butterscotch or caramel	0.017
91304020	Topping, chocolate, thick, fudge type	0.033
91304090	Topping, chocolate flavored hazelnut spread	0.365
91361020	Fruit sauce	0.182
91403000	Fruit butter, all flavors	0.462
91404000	Marmalade, all flavors	0.240
91406500	Jams, preserves, marmalades, sweetened with fruit juice concentrates, all flavors	0.479
91501020	Gelatin dessert with fruit	0.220
91501040	Gelatin dessert with fruit and whipped cream	0.163
91501100	Gelatin salad with vegetables	0.176
91501110	Gelatin dessert with fruit and whipped topping	0.196
91501120	Gelatin dessert with fruit and vegetables	0.124
91511020	Gelatin dessert, dietetic, with fruit, sweetened with low calorie sweetener	0.246
91611050	Ice pop filled with ice cream, all flavor varieties	0.063
91700500	M&M's Almond Chocolate Candies	0.274
91701010	Almonds, chocolate covered	0.231
91703010	Caramel, chocolate-flavored roll	0.158
91703020	Caramel, flavor other than chocolate	0.299
91703030	Caramel, with nuts	0.266
91703040	Caramel candy, chocolate covered	0.407
91703060	Caramel with nuts, chocolate covered	0.116

91703070	Rolo	0.498
91703150	Toblerone, milk chocolate with honey and almond nougat	0.656
91703200	TWIX Caramel Cookie Bars (formerly TWIX Cookie Bars)	0.398
91703250	TWIX Chocolate Fudge Cookie Bars	0.589
91703300	TWIX Peanut Butter Cookie Bars	0.199
91703400	Whatchamacallit	0.440
91703500	Nuts, carob-coated	0.100
91703600	Espresso coffee beans, chocolate-covered	0.688
91705010	Milk chocolate candy, plain	0.771
91705020	Milk chocolate candy, with cereal	0.672
91705030	Kit Kat	0.033
91705040	Chocolate, milk, with nuts, not almond or peanuts	0.632
91705050	Milk chocolate candy, with fruit and nuts	0.493
91705060	Milk chocolate candy, with almonds	0.688
91705070	Chocolate, milk, with peanuts	0.066
91705400	Chocolate, white	0.456
91705420	Chocolate, white, with cereal	0.672
91709000	Gumdrops, chocolate covered	0.216
91713030	Fudge, chocolate	0.033
91713040	Fudge, chocolate, with nuts	0.041
91713050	Fudge, peanut butter	0.031
91715000	Fudge, caramel and nut, chocolate-coated candy	0.307
91715100	SNICKERS Bar	0.299
91715200	Baby Ruth	0.017
91715300	100 GRAND Bar	0.514
91718100	Butterfinger	0.017
91718110	Butterfinger Crisp	0.008
91723050	Marshmallow, coconut-coated	0.082
91726110	Nougat, with caramel, chocolate covered	0.390
91726130	MILKY WAY Bar	0.390
91726140	MILKY WAY MIDNIGHT Bar (formerly MILKY WAY DARK Bar)	0.075
91726150	MARS Almond Bar (formerly MARS bar)	0.240
91726410	Nougat, chocolate covered	0.216
91726420	3 MUSKETEERS Bar	0.299
91726425	3 Musketeers Truffle Crisp Bar	0.124
91727010	Nuts, chocolate covered, not almonds or peanuts	0.386
91728000	Nut roll, fudge or nougat, caramel and nuts	0.064
91731000	Peanuts, chocolate covered	0.539
91731010	M&M's Peanut Chocolate Candies	0.249
91731060	M&M's Peanut Butter Chocolate Candies	0.282
91731100	Peanuts, sugar-coated	0.473
91733200	Peanut Bar, chocolate covered candy	0.565
91734000	Peanut butter, chocolate covered	0.270
91734100	Reese's Peanut Butter Cup	0.282
91734300	Reese's Sticks	0.315
91734400	Reese's Fast Break	0.207
91735000	Pralines	0.080
91739010	Raisins, chocolate covered	0.373
91739600	Raisins, yogurt covered	0.070
91746100	M&M's Milk Chocolate Candies (formerly M&M's Plain Chocolate Candies)	0.531

91746200	M&M's Pretzel Chocolate Candies	0.149
91750000	Taffy	0.041
91760000	Toffee, plain	0.299
91760100	Toffee, chocolate covered	0.425
91760200	Toffee, chocolate-coated, with nuts	0.396
91760500	Truffles	0.558
91770030	Dietetic or low calorie candy, chocolate covered	0.070
92101900	Coffee, Latte	0.255
92101910	Coffee, Latte, decaffeinated	0.219
92101920	Blended coffee beverage, made with regular coffee, milk, and ice, sweetened	0.198
92101925	Blended coffee beverage, made with regular coffee, milk, and ice, sweetened, with whipped cream	0.201
92101950	Coffee, mocha	0.228
92101960	Coffee, mocha, made with soy milk	0.186
92161000	Cappuccino	0.172
92161005	Cappuccino, sweetened	0.203
92162000	Cappuccino, decaffeinated	0.172
92301000	Tea, NS as to type, unsweetened	0.283
92301060	Tea, NS as to type, presweetened with sugar	0.260
92301080	Tea, NS as to type, presweetened with low calorie sweetener	0.282
92301100	Tea, NS as to type, decaffeinated, unsweetened	0.283
92301130	Tea, NS as to type, presweetened, NS as to sweetener	0.263
92301160	Tea, NS as to type, decaffeinated, presweetened with sugar	0.260
92301180	Tea, NS as to type, decaffeinated, presweetened with low calorie sweetener	0.282
92301190	Tea, NS as to type, decaffeinated, presweetened, NS as to sweetener	0.270
92302000	Tea, leaf, unsweetened	0.283
92302200	Tea, leaf, presweetened with sugar	0.260
92302300	Tea, leaf, presweetened with low calorie sweetener	0.282
92302400	Tea, leaf, presweetened, NS as to sweetener	0.260
92302500	Tea, leaf, decaffeinated, unsweetened	0.283
92302600	Tea, leaf, decaffeinated, presweetened with sugar	0.269
92302700	Tea, leaf, decaffeinated, presweetened with low calorie sweetener	0.282
92302800	Tea, leaf, decaffeinated, presweetened, NS as to sweetener	0.272
92305000	Tea, made from powdered instant, presweetened, NS as to sweetener	0.021
92305010	Tea, made from powdered instant, unsweetened	0.001
92305040	Tea, made from powdered instant, presweetened with sugar	0.021
92305050	Tea, made from powdered instant, decaffeinated, presweetened with sugar	0.001
92305090	Tea, made from powdered instant, presweetened with low calorie sweetener	0.283
92305110	Tea, made from powdered instant, decaffeinated, presweetened with low calorie sweetener	0.002
92305180	Tea, made from powdered instant, decaffeinated, unsweetened	0.001
92305800	Tea, made from powdered instant, decaffeinated, presweetened, NS as to sweetener	0.002
92306000	Tea, herbal	0.283
92306020	Tea, herbal, presweetened with sugar	0.269
92306030	Tea, herbal, presweetened with low calorie sweetener	0.282
92306040	Tea, herbal, presweetened, NS as to sweetener	0.269
92307500	Half and Half beverage, half iced tea and half fruit juice drink (lemonade)	0.128
92307510	Half and Half beverage, half iced tea and half fruit juice drink (lemonade), low calorie	0.134
92400000	Soft drink, NFS	2.010

92400100	Soft drink, NFS, sugar-free	2.010
92410310	Soft drink, cola-type	2.010
92410315	Soft drink, cola type, reduced sugar	2.010
92410320	Soft drink, cola-type, sugar-free	2.010
92410330	Soft drink, cola-type, with higher caffeine	2.010
92410340	Soft drink, cola-type, decaffeinated	2.010
92410350	Soft drink, cola-type, decaffeinated, sugar-free	2.010
92410360	Soft drink, pepper-type	2.010
92410370	Soft drink, pepper-type, sugar-free	2.010
92410390	Soft drink, pepper-type, decaffeinated	2.010
92410400	Soft drink, pepper-type, decaffeinated, sugar-free	2.010
92410550	Soft drink, fruit flavored, caffeine containing	2.010
92411510	Cola with fruit or vanilla flavor	2.010
92411610	Cola with fruit or vanilla flavor, sugar-free	2.010
92431000	Carbonated juice drink, NS as to type of juice	0.134
92432000	Carbonated citrus juice drink	0.187
92433000	Carbonated noncitrus juice drink	0.094
92510730	Fruit punch, made with soda, fruit juice, and sherbet or ice cream	0.154
92550030	Fruit juice drink, low calorie, with high vitamin C	0.020
92550110	Cranberry juice drink or cocktail, low calorie, with high vitamin C	0.020
92550350	Light orange juice beverage, 40-50% juice, lower sugar and calories, with artificial sweetener	0.202
92550400	Vegetable and fruit juice drink, low calorie, with high vitamin C	0.063
92550405	Vegetable and fruit juice drink, low calorie, with high vitamin C plus added vitamin E and vitamin A	0.063
92582110	Fruit juice drink, with thiamin (vitamin B1) and high vitamin C plus calcium	0.076
92611100	Oatmeal beverage with milk (Atole de avena)	0.148
92613010	Atole (corn meal beverage)	0.146
92613510	Corn beverage with chocolate and milk (Champurrado, Atole de Chocolate)	0.139
92801000	Wine, nonalcoholic	0.579
92804000	Shirley Temple	0.071
93101000	Beer	0.166
93102000	Beer, lite	0.166
93301000	Cocktail, NFS	1.330
93301030	Bloody Mary	0.397
93301031	Canadian Club and soda	0.190
93301090	Manhattan	0.737
93301110	Martini	0.121
93301115	Mimosa	0.267
93301140	Screwdriver	0.406
93301142	Seven and Seven	0.184
93301160	Whiskey sour	0.368
93301190	Rum and cola	1.317
93301220	Coquito, Puerto Rican (coconut, rum)	0.243
93301250	White Russian	0.017
93301270	Fruit punch, alcoholic	0.290
93301320	Tequila Sunrise	0.276
93301360	Long Island iced tea	1.239
93401010	Wine, table, red	0.579
93401020	Wine, table, white	0.579
93401100	Wine, rice	0.365

93402000	Wine, dessert, sweet	0.579
93404000	Wine cooler	0.242
93404500	Sangria	0.327
93405000	Wine spritzer	0.347
93502000	Whiskey	0.793
93504100	Rum cooler	0.013
95102000	Carnation Instant Breakfast, nutritional drink, regular, ready-to-drink	0.431
95105000	Kellogg's Special K Protein Shake	0.066
95110000	Slim Fast Shake, meal replacement, regular, ready-to-drink	0.100
95110020	Slim Fast Shake, meal replacement, high protein, ready-to-drink	0.100
95120010	Nutritional drink or meal replacement, high protein, ready-to-drink, NFS	0.100
95201000	Carnation Instant Breakfast, nutritional drink mix, regular, powder	1.028
95201010	Carnation Instant Breakfast, nutritional drink mix, sugar free, powder	2.604
95210000	Slim Fast Shake Mix, powder	0.199
95210020	Slim Fast Shake Mix, high protein, powder	0.199
95220000	Nutritional drink mix or meal replacement, powder, NFS	1.028



**APPENDIX H. MUTAGENICITY, GENOTOXICITY, AND SPERM HEALTH  
STUDIES OF PQQ DISODIUM SALT**

**Reference: Gao 2016 a**

<b>Title of Study</b>	<u>Safety evaluation of Pyrroloquinoline Quinone (PQQ) Disodium Salt by assessing bacterial reverse mutation, sperm abnormalities, and micronucleus test</u>
<b>Study Number</b>	<u>A2016-T015</u>
<b>Entrustment Company</b>	<u>Shanghai Ubaiifu Biotechnology Co.,Ltd.</u>
<b>Address of Entrustment Company</b>	<u>Room 3322, Building 2, No.1077, Zuchongzhi Road, China(Shanghai) Pilot Free Trade Zone, Shanghai, China</u>
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<b>Primary Test Facility</b>	<u>School of Life Sciences, Yantai University</u>
<b>Address of Research Institute</b>	<u>32, Qingquan RD, Laishan District, Yantai, China</u> <span style="color: red;">(b) (6)</span> <u>Yonglin Gao</u>
<b>Contact Tel. and E-mail</b>	<u>86-15854569558; gylbill@163.com(gaoyonglin@ytu.edu.cn)</u>
<b>Study Director</b>	<u>Yonglin Gao</u>
<b>Study Participants</b>	<u>YonglinGao</u> <i>Operator</i> <u>Xiaochen Fan</u> <i>Test products management</i> <u>Yunzhi Wang</u> <i>Animal management</i>
<b>Study Start And End Dates</b>	<u>October 2016 –November 2016</u>

**Safety evaluation of Pyrroloquinoline Quinone (PQQ) Disodium Salt by assessing bacterial reverse mutation, sperm abnormalities, micronucleus and chromosomal aberration**

**ABSTRACT**

**1. Bacterial mutation assay**

Five strains of *Salmonella typhimurium* (TA97, TA98, TA100, TA102 and TA1535) were treated with a pre-incubation method. Shanghai Bioplus Biotech Co., Ltd., Shanghai, China, provided all bacterial strains. We selected concentrations for the test based on a preliminary study. The results indicated that PQQ disodium salt did not show any antibacterial activity up to 5000 µg/plate. TA97, TA98, TA100, TA102 and TA1535 were treated with PQQ disodium salt (dissolved in DMSO) at concentrations of 0 (solvent control), 312.5, 625, 1250, 2500, and 5000 µg/plate in the presence and absence of an exogenous metabolic activation system (S<sub>9</sub>) by the pre-incubation method. We prepared triplicate plates for each concentration. 4-Nitro-o-phenylenediamine (NPD), daunomycin (DAM), sodium azide (NaN<sub>3</sub>) and methyl methanesulfonate (MMS) were used as positive controls in conditions without S<sub>9</sub> mix, and 2-aminofluorene (2-AF), 1,8-Dihydroxyanthraquinone (1,8-DT) and 2-aminoanthracene (2-AA) were used as positive controls in conditions with S<sub>9</sub> mix. All plates were incubated at 37°C for 48 h, and the number of revertant colonies were counted.

We declared the test substance mutagenic if the number of revertant colonies in the test dose levels was more than twofold that in the control, or the number of revertant colonies increased in a dose-dependent manner compared to control in at least one strain with or without the metabolic activation system. The validity of the study was confirmed by more than twofold increases in the number of revertant colonies in positive control plates compared to the control.

The mutagenicity of PQQ disodium salt in bacteria was evaluated up to a maximum dose of 5000 µg/plate using pre-incubation methods. Findings indicated no increases in revertant frequencies at any test article doses in any of the tester strains with or without S<sub>9</sub> compared to those in the vehicle control cultures. The positive control chemicals for each tester strain induced at least a 5-fold increase in the number of revertant colonies compared to the vehicle

control. The data suggested that PQQ disodium salt was non-mutagenic under the conditions used in this test.

## **2. *In vivo* mammalian (mouse) micronucleus test**

Male and female Kunming mice, aged 4-5 weeks, were used from the Experimental Animal Center of Shandong Luye Pharmaceutical Co. Ltd. (SPF grade). Upon receipt, a veterinarian checked their health. They were acclimated for 5 days prior to administration of the test substance. The mice were housed in cages by sex (5 animals per cage) and provided food and water *ad libitum*. The housing facility was designed to maintain temperature and relative humidity at 22±3°C and 50-60%, respectively.

Based on the results of the dose range-finding study, animals were randomly assigned to the following groups: vehicle control; 500 mg/kg/day (low-dose); 1000 mg/kg/day (mid-dose); 2000 mg/kg/day (high-dose); and a positive control (cyclophosphamide, 40 mg/kg). We administered vehicle control or various doses of test substance to the animals by oral gavage for 2 consecutive days. A similar group was treated once with the positive control. After dosing, we examined animals regularly for clinical signs of toxicity until sacrifice. Mice were sacrificed by dislocation of the cervical vertebrae 24 or 48 h after the last treatment administered (all doses). For the cyclophosphamide group, mice were sacrificed at the 24 h time point only.

We removed both femurs and cleaned the bones of the muscle tissue. The proximal ends of the femurs were opened and the bone marrow was flushed into a 5 ml centrifuge tube containing 3 ml fetal bovine serum. We centrifuged the mixture for 5 min at 1000 rpm and discarded the resulting supernatant. Following thorough mixing, one drop of the sediment was smeared onto a clean slide and air-dried. Slides were briefly flamed, then fixed by immersion in methanol for 10 min and stained in ordinary staining jars with Giemsa Working Solution for 15 min.

All slides were coded to ensure that the evaluation was blinded. We determined the proportion of immature erythrocytes (polychromatic erythrocytes, PCE) to total erythrocytes [immature + mature erythrocytes (normochromatic erythrocytes, NCE)] for each animal by analyzing at least 200 erythrocytes. In addition, a minimum of 2000 PCE was scored for the incidence of micronucleated polychromatic erythrocytes (MNPCE). Both biological and

statistical significance were considered for evaluation of a positive response. If there was a statistically significant, dose-related increase in the number of micronucleated PCEs for at least one of the time points compared to the concurrent vehicle control group, the test substance was considered positive for a mutagenic response.

The results indicated a statistically significant increase in the ratios of MNPCE (%) and PCE/NCE in either sex compared to the control group following administration of the positive control cyclophosphamide. This indicated the correct functioning of the test system. However, no clinical signs of toxicity and mortality were seen at any of the tested dose levels, and no statistically significant changes were noticed in mean body weights between any of the treatment groups and the control. PQQ disodium salt administration did not reveal any significant changes in MNPCE (%) and PCE/NCE in either sex as compared to the control group.

### **3. Sperm shape abnormality assay**

Fifty mice were randomly divided into five groups of 10 each (5 males and 5 females per group). PQQ disodium salt (oral; 500, 1000, and 2000 mg/kg bw) and cyclophosphamide (CP, oral; 40 mg/kg bw), as a positive control were administered for five days with a 24-h interval at a dose level of 0.5% CMCNa via oral gavage, which was used as a negative control. The behavioral changes were recorded on a daily basis. Thirty-five days after the first administration, 5 mice per group were sacrificed by cervical dislocation and necropsy was conducted.

The epididymis was isolated, placed into a culture dish containing 2 ml of 0.15 M NaCl and cut vertically by using ophthalmological scissors once or twice. After 3–5 min of static incubation, the suspension was shaken gently and filtered with four layers of the lens-cleaning paper. The filtrate was smeared onto the slide, air-dried and fixed with 95% methanol for 5 min. After being air-dried, the slide was stained with 2% eosin for 1 h, gently washed with distilled water and air dried. Fields with less overlapped sperm under microscope at low magnification were examined at high magnification. A total of 1000 sperm were recorded for each animal under an optical microscope. Sperm appeared as hookless, banana-shaped, amorphous, folded tail, double-headed, double-tailed were considered as abnormal. The type

of abnormal sperm was recorded. The percentage of sperm malformation and abnormality rate were calculated, first as a total, then further classified in relation to the specific anatomical location of each abnormality in the sperm.

The results indicated that the sperm abnormality of the PQQ disodium salt treatment groups at all dose levels (PQQ disodium salt, 500–2000 mg/kg) showed no significant differences compared with the control group. The sperm abnormality ratio in all treatment groups and the negative control group was significantly lower than in the positive control group treated with cyclophosphamide, indicating that PQQ disodium salt at the doses studied did not cause abnormal sperm morphology.

**Keywords:** PQQ disodium salt; Genotoxicity; Bacterial reverse mutation assay; Mouse micronucleus assays; Sperm shape abnormality assay.

## **1. Study design**

As part of a safety evaluation, we evaluated the potential mutagenicity and genotoxicity of Pyrroloquinoline quinone (PQQ) disodium salt using bacterial reverse mutation assay, mouse micronucleus assay and sperm shape abnormality assay.

## **2. Materials and methods**

### **2.1 Bacterial mutation assay**

#### **2.1.1 Tester strains**

Five strains of *Salmonella typhimurium* (TA97, TA98, TA100, TA102 and TA1535) were treated with a pre-incubation method. Shanghai Bioplus Biotech Co., Ltd., Shanghai, China, provided all bacterial strains.

#### **2.1.2 Preparation of doses**

We selected concentrations for the test based on a preliminary study. The results indicated that PQQ disodium salt did not show any antibacterial activity up to 5000 µg/plate. TA97, TA98, TA100, TA102 and TA1535 were treated with PQQ disodium salt (dissolved in DMSO) at concentrations of 0 (solvent control), 312.5, 625, 1250, 2500, and 5000 µg/plate in the presence and absence of an exogenous metabolic activation system (S<sub>9</sub>) by the pre-incubation method. We prepared triplicate plates for each concentration.

4-Nitro-o-phenylenediamine (NPD), daunomycin (DAM), sodium azide (NaN<sub>3</sub>) and methyl methanesulfonate (MMS) were used as positive controls in conditions without S<sub>9</sub> mix, and 2-aminofluorene (2-AF), 1,8-Dihydroxyanthraquinone (1,8-DT) and 2-aminoanthracene (2-AA) were used as positive controls in conditions with S<sub>9</sub> mix. All plates were incubated at 37°C for 48 h, and the number of revertant colonies were counted.

We declared the test substance mutagenic if the number of revertant colonies in the test dose levels was more than twofold that in the control, or the number of revertant colonies increased in a dose-dependent manner compared to control in at least one strain with or without the metabolic activation system. The validity of the study was confirmed by more than twofold increases in the number of revertant colonies in positive control plates compared to the control.

### **2.2 In vivo mammalian (mouse) micronucleus test**

#### **2.2.1 Animals**

Male and female Kunming mice, aged 4-5 weeks, were used from the Experimental Animal Center of Shandong Luye Pharmaceutical Co. Ltd. (SPF grade). Upon receipt, a veterinarian checked their health. They were acclimated for 5 days prior to administration of the test substance. The mice were housed in cages by sex (5 animals per cage) and provided food and water *ad libitum*. The housing facility was designed to maintain temperature and relative humidity at 22±3°C and 50-60%, respectively.

### **2.2.2 Treatment procedures**

In this dose range-finding study, animals were randomly assigned to the following groups: vehicle control; 500 mg/kg/day (low-dose); 1000 mg/kg/day (mid-dose); 2000 mg/kg/day (high-dose); and a positive control (cyclophosphamide, 40 mg/kg). Group assignments are shown in **Table 1**. We administered a vehicle control or various doses of the test substance to the animals by oral gavage for 2 consecutive days. A similar group was treated once with the positive control. After dosing, we examined animals regularly for clinical signs of toxicity until sacrifice. Mice were sacrificed by dislocation of the cervical vertebrae 24 or 48 h after the last treatment administered (all doses). For the cyclophosphamide group, mice were sacrificed at the 24-h time point only (**Table 1**).

We removed both femurs and cleaned the bones of muscle tissue. The proximal ends of the femora were opened and the bone marrow was flushed into a 5 ml centrifuge tube containing 3 ml fetal bovine serum. We centrifuged the mixture for 5 min at 1000 rpm and discarded the resulting supernatant. Following thorough mixing, one drop of the sediment was smeared onto a clean slide and air-dried. Slides were briefly flamed, then fixed by immersion in methanol for 10 min and stained in ordinary staining jars with Giemsa Working Solution for 15 min.

All slides were coded to ensure that the evaluation was blinded. We determined the proportion of immature erythrocytes (polychromatic erythrocytes, PCE) to total erythrocytes [immature + mature erythrocytes (normochromatic erythrocytes, NCE)] for each animal by analyzing at least 200 erythrocytes. In addition, a minimum of 2000 PCE was scored for the incidence of micronucleated polychromatic erythrocytes (MNPCE).

Both biological and statistical significance were considered for the evaluation of a positive response. If there was a statistically significant, dose-related increase in the number of

micronucleated PCEs for at least one of the time points compared to the concurrent vehicle control group, the test substance was considered positive for a mutagenic response.

**Table 1. Animal group assignments *in vivo* mammalian micronucleus test**

<b>Group</b>	<b>Dose level</b>	<b>Number of animals</b>	<b>Sampling time (h post-administration)</b>
<b>1</b>	Vehicle control	♀:5, ♂:5	24
<b>2</b>	PQQ Disodium Salt (500 mg/kg)	♀:5, ♂:5	24
<b>3</b>	PQQ Disodium Salt (1000 mg/kg)	♀:5, ♂:5	24
<b>4</b>	PQQ Disodium Salt (2000 mg/kg)	♀:5, ♂:5	24
<b>5</b>	Cyclophosphamide (40 mg/kg)	♀:5, ♂:5	24
<b>6</b>	Vehicle control	♀:5, ♂:5	48
<b>7</b>	PQQ Disodium Salt (2000 mg/kg)	♀:5, ♂:5	48

### 2.3 Sperm shape abnormality assay

Fifty mice were randomly divided into five groups of 10 each. PQQ disodium salt (oral, 500, 1000, and 2000 mg/kg bw) and cyclophosphamide (CP, oral, 40 mg/kg bw), as a positive control were administered for five days with a 24-h interval at a dose level of through oral gavage. 0.5% CMCNa was used as a negative control. The behavioral changes were recorded on the daily basis. Thirty-five days after the first administration, 5 mice per group were sacrificed by cervical dislocation and necropsy was conducted.

The epididymis was isolated, placed into a culture dish containing 2 ml of 0.15 M NaCl and cut vertically by using ophthalmological scissors once or twice. After 3–5 min of static incubation, the suspension was shaken gently and filtered with four layers of the lens-cleaning



paper. The filtrate was smeared onto the slide, air-dried and fixed with 95% methanol for 5 min. After being air-dried, the slide was stained with 2% eosin for 1 h, gently washed with distilled water and air dried. Fields with less overlapped sperm under microscope at low magnification were examined at high magnification. A total of 1000 sperm were recorded for each animal under an optical microscope. Sperm which appeared as hookless, banana-shaped, amorphous, folded tail, double-headed, double-tailed were considered as abnormal. The type of abnormal sperm was recorded. The percentage of sperm malformation and abnormality rate were calculated, first as a total, then further classified in relation to the specific anatomical location of each abnormality in the sperm.

## **2.4 Statistical analysis**

We used SPSS 11.5 software for Windows to perform all analyses. One-way ANOVA with Dunnet's post-hoc test was used to compare treatment and control group data. A p-value less than 0.05 was considered statistically significant.

## **3. Results**

### **3.1 Bacterial mutation assay**

The mutagenicity of PQQ disodium salt in bacteria was evaluated up to a maximum dose of 5000 µg/plate using pre-incubation methods (**Tables 2, 3**). We found no increase in revertant frequencies at any test article doses in any of the tester strains with or without S<sub>9</sub> compared to those in the vehicle control cultures. The positive control chemicals for each tester strain induced at least a 5-fold increase in the number of revertant colonies compared to the vehicle control. The data indicated that PQQ disodium salt was non-mutagenic under the conditions used in this test.

**Table 2. Bacterial mutation assay results (- S9) <sup>a</sup>**

Group	Dose (µg/plate)	Mean revertant colony counts per plate				
		TA97	TA98	TA100	TA102	TA1535
Vehicle control	—	128.7±15.6	34.7±5.7	135.0±21.5	247.3±10.5	13.7±2.9
PQQ Disodium Salt	5000	125.0±19.1	35.0±6.1	131.3±14.4	251.0±19.7	13.3±2.5
	2500	126.3±12.7	39.0±3.6	133.7±15.9	247.7±42.7	15.0±2.6
	1250	132.3±6.8	36.3±7.6	143.0±21.9	242.0±21.7	13.3±3.2
	625	129.3±19.9	34.0±3.5	131.0±13.1	251.0±36.9	15.3±3.2
	312.5	126.7±7.8	36.0±4.4	141.7±7.6	255.3±37.5	13.3±1.2
NPD	20	668.0±46.9**	—	—	—	—
DAM	10	—	377.0±87.5**	—	—	—
NaN <sub>3</sub>	1.5	—	—	997.0±43.5**	—	117.0±9.6**
MMS	2µL/plate	—	—	—	2079.3±434.9**	—

Abbreviations: NPD, 4-Nitro-o-phenylenediamine; DAM; daunomycin; NaN<sub>3</sub>, sodium azide; MMS, methyl methanesulfonate; PQQ, pyrroloquinoline quinone. <sup>a</sup> Values are the mean of triplicate plates. \*\* P<0.01, compared with vehicle control.

**Table 3. Bacterial mutation assay results (+ S<sub>9</sub>)<sup>a</sup>**

Group	Dose (µg /Plate)	Mean revertant colony counts per plate				
		TA97	TA98	TA100	TA102	TA1535
Vehicle control	—	155.0±15.6	37.3±8.1	181.7±23.7	307.0±40.0	16.3±3.8
PQQ Disodium Salt	5000	162.0±14.2	37.7±6.4	184.7±39.8	294.0±18.0	19.0±2.0
	2500	151.0±15.4	41.0±1.0	189.0±17.4	306.7±9.0	18.7±2.1
	1250	163.0±5.0	37.0±8.9	173.7±21.1	298.0±14.7	15.7±6.4
	625	155.3±10.6	39.7±4.5	179.3±16.7	300.7±24.7	16.7±2.5
	312.5	161.0±15.1	35.0±4.0	180.0±12.1	299.0±22.9	18.7±2.1
2-AF	20	803.0±152.9**	608.0±19.0**	1201.0±310.2**	—	—
1,8-DT	50	—	—	—	3251.0±233.2**	—
2-AA	5	—	—	—	—	242.7±31.2**

Abbreviations: 2-AF, 2-aminofluorene; 1,8-DT, 1,8-Dihydroxyanthraquinone; 2-AA, 2-aminoanthracene; PQQ, pyrroloquinoline quinone.

<sup>a</sup> Values are the mean of triplicate plates. \*\* P<0.01, compared with vehicle control.

### **3.2 *In vivo* mammalian micronucleus test**

No clinical signs of toxicity or mortality were seen at any of the tested dose levels, and no statistically significant changes were noticed in mean body weights between any of the treatment groups and the control. The results of microscopic observations in the micronucleus assay for male and female mice groups are summarized in **Table 4** and **5**. PQQ disodium salt administration did not reveal any significant changes in MNPCE (%) and PCE/NCE in either sex as compared to the control group. We observed a statistically significant increase in the ratios of MNPCE (%) and PCE/NCE in either sex compared to the control group following administration of the positive control cyclophosphamide. This indicated the correct functioning of the test system.

**Table 4. Bone marrow micronucleus assay results of female mice**

Group	Dose (mg/kg)	Sampling time (h post-administration)	Number of animals	Body weights (g)		MNPCE(%) <sup>a</sup>	PCE/NCE
				First treatment	Sacrifice		
Vehicle control	—	24	5	26.33±1.08	28.58±2.09	0.09±0.04	1.00±0.06
PQQ Disodium Salt	500	24	5	26.15±1.16	28.75±1.80	0.09±0.04	1.02±0.07
	1000	24	5	26.27±1.08	29.22±2.31	0.08±0.04	1.04±0.14
	2000	24	5	26.36±1.28	28.62±1.78	0.10±0.04	1.06±0.15
Cyclophosphamide	40	24	5	26.54±1.19	28.42±1.94	5.95±0.93 **	0.83±0.13*
Vehicle control	—	48	5	26.20±1.09	28.87±2.03	0.10±0.04	1.06±0.10
PQQ Disodium Salt	2000	48	5	26.29±1.17	29.35±2.04	0.09±0.04	1.02±0.15

Abbreviations: PCE, polychromatic erythrocytes; NCE, normochromatic erythrocytes; MNPCE, micronucleated polychromatic erythrocytes; PQQ, pyrroloquinoline quinone. <sup>a</sup>2000 Polychromatic erythrocytes per mouse were scored for the presence of micronuclei. \*\* P<0.01, compared with vehicle control. The control animals were received with the same volume of 0.5% CMCNa.

**Table 5. Bone marrow micronucleus assay results of male mice**

Group	Dose (mg/kg)	Sampling time (h post-administration)	Number of animals	Body weights (g)		MNPCE(%) <sup>a</sup>	PCE/NCE
				First treatment	Sacrifice		
Vehicle control	—	24	5	28.31±1.51	30.57±2.00	0.10±0.06	1.03±0.15
PQQ Disodium Salt	500	24	5	29.07±1.02	31.55±1.73	0.10±0.04	1.04±0.07
	1000	24	5	28.88±1.00	31.01±2.09	0.10±0.04	1.02±0.07
	2000	24	5	29.00±1.26	30.91±2.02	0.09±0.04	1.00±0.10
Cyclophosphamide	40	24	5	28.67±1.15	30.81±1.85	5.19±0.46**	0.87±0.09
Vehicle control	—	48	5	28.92±1.74	31.19±1.94	0.08±0.04	1.01±0.07
PQQ Disodium Salt	2000	48	5	28.87±1.46	30.56±2.01	0.08±0.04	1.05±0.19

Abbreviations: PCE, polychromatic erythrocytes; NCE, normochromatic erythrocytes; MNPCE, micronucleated polychromatic erythrocytes; PQQ, pyrroloquinoline quinone. <sup>a</sup>2000 Polychromatic erythrocytes per mouse were scored for the presence of micronuclei. \*\* P<0.01, compared with vehicle control. The control animals were received with the same volume of 0.5% CMCNa.

### 3.3 Sperm shape abnormality assay

**Table 6** shows the rate of sperm abnormal morphology and proportion of malformation type. The sperm abnormality of the PQQ disodium salt treatment groups at all dose levels (PQQ disodium salt, 500–2000 mg/kg) showed no significant differences compared with the control group. The sperm abnormality ratio in all treatment groups and the negative control group was significantly lower than in the positive control group treated with cyclophosphamide, indicating that PQQ disodium salt at the doses studied did not cause abnormal sperm morphology.

**Table 6. Sperm abnormality test in mice**

Parameters	Groups				
	Control	500	1000	2000	CP
Number of mice	5	5	5	5	5
Number of sperms	5 × 1000	5 × 1000	5 × 1000	5 × 1000	5 × 1000
Total abnormalities	89	91	86	87	267
<i>Hookless</i>	21	24	23	24	67
<i>Banana shape</i>	13	12	11	10	31
<i>Amorphous</i>	47	47	47	48	139
<i>Folded</i>	4	3	2	2	10
<i>Double-headed</i>	2	2	2	2	9
<i>Double-tailed</i>	2	3	1	1	11
Abnormal ratio (%)	1.78 ± 0.13	1.82 ± 0.47	1.72 ± 0.26	1.74 ± 0.24	5.34 ± 0.29**

The control animals were received with the same volume of 0.5% CMCNa.  
Abbreviations: CP, Cyclophosphamide.

#### 4. Conclusion

Under our test conditions, a reverse mutation assay using five strains of *Salmonella typhimurium* (TA97, TA98, TA100, TA102 and TA1535), PQQ disodium salt (312.5, 625, 1250, 2500, and 5000 µg/plate) did not increase the number of revertant colonies in any tester strain regardless of metabolic activation by S9 mix. An *in vivo* bone marrow micronucleus test in Kunming mice dosed by oral gavage PQQ disodium salt at up to 2000 mg/kg bw showed no significant or dose-dependent increases in the frequency of micronucleated polychromatic erythrocytes. The sperm abnormality of the PQQ disodium salt treatment groups at all dose levels (PQQ disodium salt, 500, 1000, 2000 mg/kg bw) showed no significant differences compared with the control group, indicating that PQQ disodium salt at the doses studied did not cause abnormal sperm morphology. These data indicate a low risk of genotoxic activity in PQQ disodium salt.



## APPENDIX I. ACUTE ORAL TOXICOLOGY STUDY REPORT

Reference: Gao 2016 b

**Title of Study** Acute Oral Toxicity Study of pyrroloquinoline quinone (PQQ) disodium salt in Rats

**Study Number** A2016-T014

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**Study Director** Yonglin Gao

**Study Participants** YonglinGao *Operator*

Xiaochen Fan *Test products management*

Yunzhi Wang *Animal management*

**Study Start And End Dates** August 2016 – September 2016

**TITLE:**

Oral Acute Toxicity Study of pyrroloquinoline quinone (PQQ) disodium salt in Rats

**ABSTRACT**

The study was performed in accordance with the Food and Drug Administration (FDA) Redbook 2000: chapter IV.C.3.a Short-Term Toxicity Studies with Rodents. The aim of this study was to evaluate the acute toxicity of pyrroloquinoline quinone (PQQ) disodium salt after a single oral administration in rats. Sprague-Dawley rats, 6 weeks of age, were housed in cages under hygienic conditions and placed in a controlled environment with a 12-h light/dark cycle at  $23\pm 3^{\circ}\text{C}$  and 40-60% humidity. Animals were allowed a commercial standard rat cube diet and water *ad libitum*. All procedures involving the use of laboratory animals were in accordance with the Guidelines of Animal Care. PQQ disodium salt was administered to animals by oral gavage at a single dose of 0, 2.78, 3.33, 4.00, 4.78 or 5.78 g/kg body weight (bw) (5 males and 5 females per group). Animals were observed for 14 days to monitor changes in body weight, clinical signs, as well as food and water consumption. At the end of the study, all surviving animals were sacrificed and major organs were examined. After PQQ disodium salt administration, a number of animals died on the following days at 3.33, 4.00, 4.78 and 5.78 g/kg BW. On day 1, the greenish feces and/or diarrhea was observed in 4.00, 4.78 and 5.78 g/kg BW groups after 1-3 h of administration. Also, the symptom of a greenish tail was found in the 5.78 g/kg BW group. Although these differences were not statistically significant, PQQ disodium salt decreased body weight gain, as well as food and water consumption. In addition, necropsy revealed enlarged kidneys in 4.00 g/kg bw group, and the coefficient of kidney size was increased in this group. No gross abnormalities were noted in the control and other PQQ disodium salt treated groups. Taken together, orally administered PQQ disodium salt caused dose-dependent mortalities with the median lethal dose ( $\text{LD}_{50}$ ) of 3.86g/kg bw and the 95% confidence interval was 3.49~4.25g/kg bw. The no observed adverse effect level (NOAEL) and the lowest observed adverse effect level (LOAEL) were 2.78 g/kg BW and 3.33 g/kg BW, respectively. In addition, previous study also indicated that the  $\text{LD}_{50}$  of PQQ disodium salt was considered to be 5100 mg/kg bw (3440 to 7300 mg/kg bw) in female rats and 3690 mg/kg bw (2710 to 5010 mg/kg bw) in male rats. According to acute toxicity classification (World Health Organization), PQQ disodium salt demonstrates low toxicity in rats.

### 3. Study design

The study was performed in accordance with the Food and Drug Administration (FDA) Redbook 2000: chapter IV.C.3.a Short-Term Toxicity Studies with Rodents. PQQ disodium salt was administered by oral gavage to 60 rats (0, 2.5, 3.0, 3.6, 4.3 or 5.2 g/kg body weight (bw); 5 males and 5 females for each group) and observed for 2 weeks. Clinical signs, body weight, food and water consumption and death rates were observed. On day 15, all surviving animals were sacrificed and organs in the control and the highest dose group were weighed, including: brain, heart, kidney, liver, and spleen. **LD<sub>50</sub> and its 95% confidence intervals analyses were conducted by the Bliss method.**

### 2. Animals

Sprague-Dawley rats, 6 weeks of age, were housed in cages under hygienic conditions and placed in a controlled environment with a 12-h light/dark cycle at 23±3°C and 40-60% humidity. Animals were allowed a commercial standard rat cube diet and water *ad libitum*. All procedures involving the use of laboratory animals were in accordance with the Guidelines of Animal Care.

### 3. Treatment

Rats were divided into five groups (each group of 10 rats consisted of 5 male and 5 female rats) based on stratified randomization using body weights taken before treatment: control (0.5% CMCNa) or PQQ disodium salt at doses of 2.5, 3.0, 3.6, 4.3 or 5.2 g/kg bw (a single orally administered dose by gavage). Group assignments are outlined in **Table 1**.

**Table 1. Experimental design of a 14-day rat acute toxicity study.**

<b>Groups</b>	<b>PQQ disodium salt dose levels (g/kg bw)</b>	<b>Number of animals</b>
<b>1</b>	0 (Control)	<b>10 ( ♀:5+♂:5 )</b>
<b>2</b>	2.5	<b>10 ( ♀:5+♂:5 )</b>
<b>3</b>	3.0	<b>10 ( ♀:5+♂:5 )</b>
<b>4</b>	3.6	<b>10 ( ♀:5+♂:5 )</b>
<b>5</b>	4.3	<b>10 ( ♀:5+♂:5 )</b>
<b>6</b>	5.2	<b>10 ( ♀:5+♂:5 )</b>

The control animals were received with the same volume of 0.5% CMCNa.  
Abbreviations: PQQ = pyrroloquinoline quinone; bw =body weight.

## **5. Observations and clinical tests**

All animals were observed once daily for clinical signs of toxicity and twice daily for mortality and morbidity. The body weight of each rat was measured pre-test, weekly thereafter, and at sacrifice. Food and water consumption also were noted.

## **6. Organ weights, and gross necropsy**

At the end of treatment, all surviving animals were fasted overnight. The body weight and the main organ weights (includes liver, kidneys, spleen, heart and lung) were measured. Moreover, the coefficient was reported as the organ weight/the body weight.

## **7. Statistical analysis**

We used SPSS 11.5 software for Windows to perform all analyses. One-way ANOVA with Dunnet' s post-hoc test was used to compare treatment and control group data. A p-value less than 0.05 was considered statistically significant. LD<sub>50</sub> and its 95% confidence intervals analyses were conducted by the Bliss method.

## **8. Results**

After PQQ disodium salt administration, a number of animals died on the following days at the 3.0, 3.6, 4.3 and 5.2 g/kg bw (**Table 2**). Orally administered PQQ disodium salt caused dose-dependent mortalities with LD<sub>50</sub> of 3.474 g/kg BW and the 95% confidence interval was 3.145~3.820 g/kg BW. The no observed adverse effect level (NOAEL) and the lowest observed adverse effect level (LOAEL) were 2.5 g/kg bw and 3.0 g/kg bw, respectively.

**Table 2. Oral acute toxicity study of PQQ disodium salt in rats**

Groups (g/kg BW)	Dead animals					
	0	2.5	3.0	3.6	4.3	5.2
0 day	0	0	0	0	0	0
1 day	0	0	0	2	3	3
2 day	0	0	1	2	2	2
3 day	0	0	1	2	1	3
4 day	0	0	1	0	1	2
5 day	0	0	0	0	1	0

Abbreviations: PQQ = pyrroloquinoline quinone; bw =body weight.

On day 1, the greenish feces and/or diarrhea were observed in the 3.6, 4.3 and 5.2 g/kg bw groups after 1-3 h of administration (**Figure 1**). Also, the animals' tails appeared greenish in the 5.2 g/kg bw group (**Figure 2**). Although these differences were not statistically significant, PQQ disodium salt decreased body weight gain, as well as food consumption and water intake (**Tables 3,4,5; Figures 3,4,5**). In addition, necropsy revealed enlarged kidneys in the 3.6 g/kg bw group, and the coefficient of kidney size was also increased in this group (**Table 6; Figure 6**). No gross abnormalities were noted in the control and other PQQ disodium salt treated groups.



Normal feces



Greenish feces



Diarrhea

**Figure 1.** The greenish feces and/or diarrhea were observed after PQQ disodium salt administration



Control group



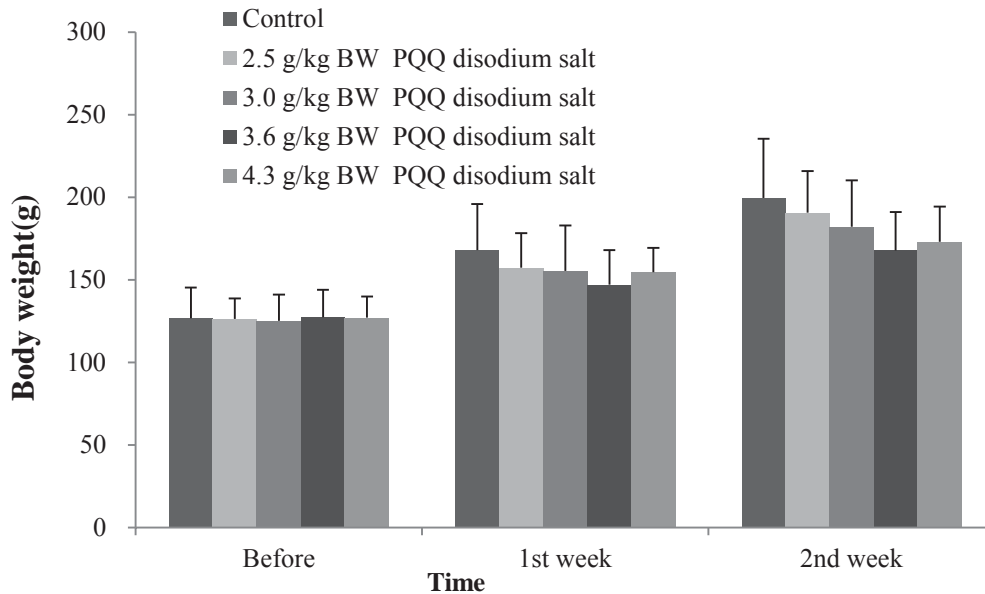
5.2 g/kg bw group

**Figure 2.** The animal's tail was appeared greenish in 5.2 g/kg bw group

**Table 3. Body weight change of rats during a 14-day study (g)**

Groups	PQQ disodium salt (g/kg bw)	Before	1 <sup>st</sup> week	2 <sup>nd</sup> week
1	0	126.70±18.64 ( n=10 )	168.00±27.76 ( n=10 )	199.50±35.80 ( n=10 )
2	2.5	126.30±12.35 ( n=10 )	157.20±21.06 ( n=10 )	190.70±25.06 ( n=10 )
3	3.0	125.20±15.77 ( n=10 )	155.29±27.54 ( n=7 )	182.14±28.12 ( n=7 )
4	3.6	127.30±16.69 ( n=10 )	147.00±20.94 ( n=4 )	167.75±23.19 ( n=4 )
5	4.3	127.00±12.85 ( n=10 )	154.50±14.85 ( n=2 )	173.00±21.21 ( n=2 )
6	5.2	128.00±18.12 ( n=10 )	-	-

Abbreviations: PQQ = pyrroloquinoline quinone; bw =body weight.



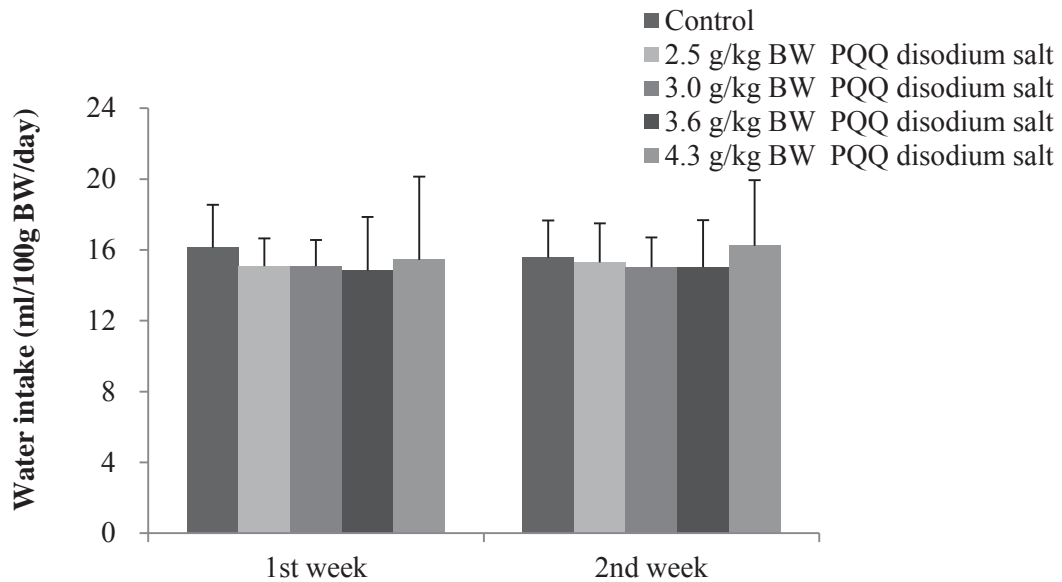
**Figure 3. Body weight change of rats during a 14-day study.**

Abbreviations: PQQ = pyrroloquinoline quinone; bw =body weight.

**Table 4. Water intake of rats during a 14-day study (ml/100g bw/day)**

Groups	PQQ disodium salt (g/kg bw)	1 <sup>st</sup> week	2 <sup>nd</sup> week
1	0 ( n=10 )	16.13±2.42	15.56±2.10
2	2.5 ( n=10 )	15.09±1.57	15.29±2.20
3	3.0 ( n=7 )	15.08±1.48	15.03±1.68
4	3.6 ( n=4 )	14.84±3.02	15.02±2.66
5	4.3 ( n=2 )	15.45±4.68	16.24±3.70
6	5.2 ( n=0 )	-	-

Abbreviations: PQQ = pyrroloquinoline quinone; bw =body weight.



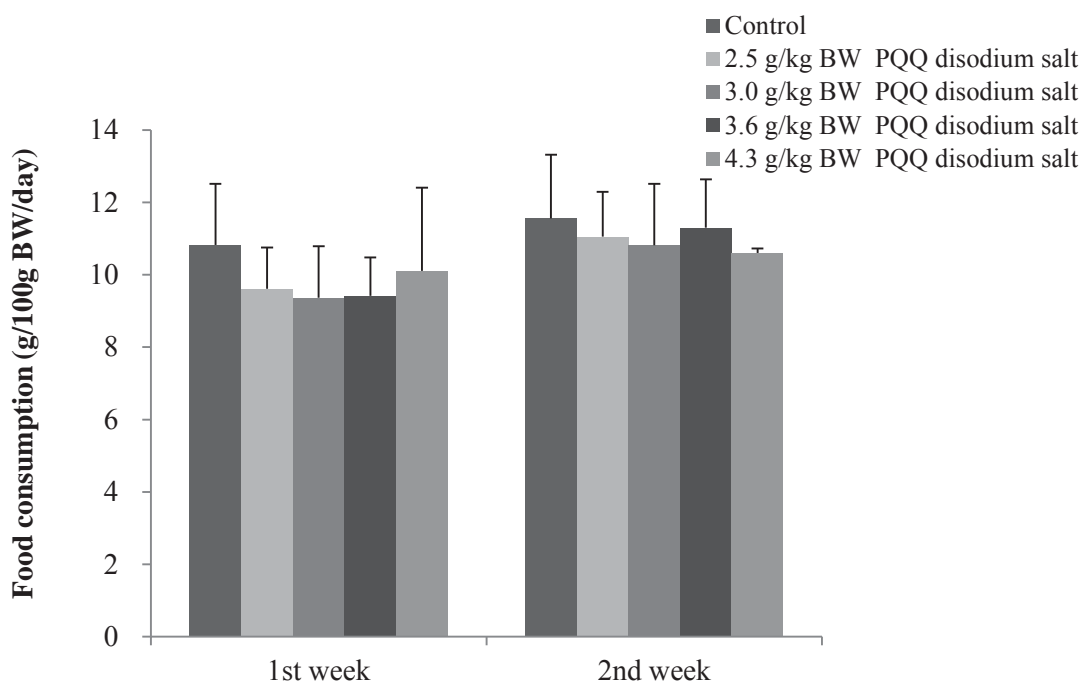
**Figure 4. Water intake of rats during a 14-day study.**  
Abbreviations: PQQ = pyrroloquinoline quinone; bw =body weight.



**Table 5. Food consumption of rats during a 14-day study (g/100g bw/day)**

Groups	PQQ disodium salt (g/kg bw)	1 <sup>st</sup> week	2 <sup>nd</sup> week
1	0 ( n=10 )	10.83±1.69	11.56±1.76
2	2.5 ( n=10 )	9.62±1.14	11.06±1.24
3	3.0 ( n=7 )	9.37±1.42	10.81±1.70
4	3.6 ( n=4 )	9.42±1.06	11.30±1.34
5	4.3 ( n=2 )	10.11±2.30	10.61±0.12
6	5.2 ( n=0 )	-	-

Abbreviations: PQQ = pyrroloquinoline quinone; bw =body weight.



**Figure 5. Food consumption of rats during a 14-day study.**

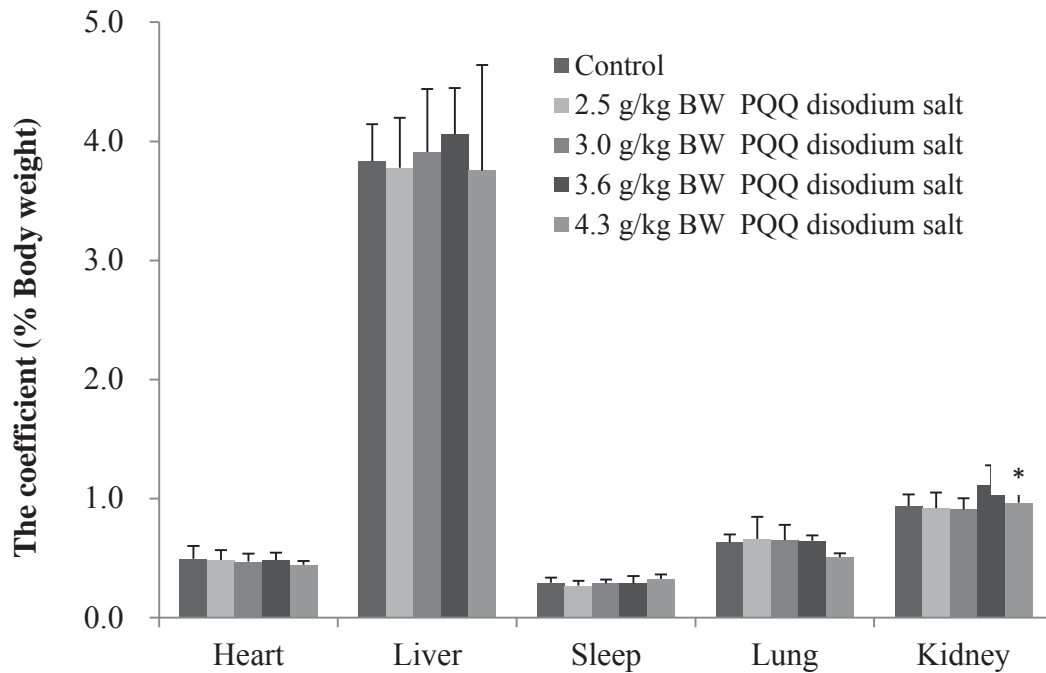
Abbreviations: PQQ = pyrroloquinoline quinone; bw =body weight.

**Table 6. The organ coefficient of rats after a 14-day study (% bw).**

<b>PQQ disodium salt Dose Groups</b>	<b>Heart</b>	<b>Liver</b>	<b>Spleen</b>	<b>Lung</b>	<b>Kidney</b>
0 (n=10)	0.50±0.11	3.83±0.31	0.29±0.04	0.63±0.07	0.94±0.10
2.5 (n=10)	0.48±0.08	3.78±0.42	0.27±0.04	0.66±0.19	0.92±0.13
3.0 (n=7)	0.47±0.07	3.91±0.53	0.29±0.03	0.65±0.13	0.91±0.09
3.6 (n=4)	0.48±0.06	4.06±0.39	0.29±0.06	0.64±0.05	1.11±0.17*
4.3 (n=2)	0.44±0.03	3.75±0.89	0.33±0.04	0.51±0.03	0.97±0.11
5.2 (n=0)	-	-	-	-	-

Abbreviations: PQQ = pyrroloquinoline quinone; bw =body weight.

\*, P<0.05 vs. Control group.



**Figure 6. The organ coefficient of rats after a 14-day study.**

Abbreviations: PQQ = pyrroloquinoline quinone; bw =body weight.

\*, P<0.05 vs. Control group.