VEGETABLES

Vegetables are herbaceous edible plants cultivated for the consumption of fresh roots, tubers, bulbs, soft stems, immature flowers, leaves or fruit in fresh, conserved, or frozen condition.

Forms of consumption

- Fresh salads
- Cooked salads
- Fruit
- Cooked food
  - Main food
  - Secondary constituents used to improve taste

NUTRITIONAL VALUE

- Protein
- Carbohydrates
- Fat
- Inorganic salts
- Vitamins
- Antioxidant compounds
- Plant fibers

Table 1A: Main nutrient constituents in vegetables (in 100 g of edible part)

Vegetable	Water (%)	Energy (cal)	Protein (g)	Fat (g)	Carbohydrates (g)
Cucumber	95.1	15	0.9	0.1	3.4
Endive	93.1	20	1.7	0.1	4.1
Sweet corn	72.7	96	3.5	1.0	22.1
Kohlrabi	90.3	29	2.0	0.1	6.6
Carrots	88.2	42	1.1	0.2	9.7
Watermelon	92.6	26	0.5	0.2	6.4
Zucchini	94.6	17	1.2	0.1	3.6
Squash	91.6	26	1.0	0.1	6.5
Cauliflower	91.0	27	2.7	0.2	5.2
Fresh onions	89.4	36	1.5	0.2	8.2
Dry onions	89.1	38	1.5	0.1	8.7
Cabbage	92.4	24	1.3	0.2	5.4
Brussel sprouts	85.2	45	4.9	0.4	8.3
Parsley	85.1	44	3.6	0.6	8.5
Fennel	90.0	28	2.8	0.4	5.1
Lettuce	94.0	18	1.3	0.3	3.5
Eggplant	92.4	25	1.2	0.2	5.6
Okra	88.9	36	2.4	0.3	7.6

Table 1B: Main nutrient constituents in vegetables (in 100 g of edible part)

Vegetable	Water (%)	Energy (cal)	Protein (g)	Fat (g)	Carbohydrates (g)
Pea, fresh	78.0	84	6.3	0.4	14.4
Pea, dry	11.7	340	24.1	1.3	60.3
Red beet	87.3	43	1.6	0.1	9.9
Potato	76.0	86	2.1	0	20.8
Melon	90.6	33	0.8	0.3	7.7
Pepper	93.4	22	1.2	0.2	4.8
Leek	85.4	52	2.2	0.3	11.2
Broccoli	89.1	32	3.6	0.3	5.9
Chicory	95.1	15	1.0	0.1	3.2
Radish	94.5	17	1.0	0.1	3.6
Celery	94.1	17	0.9	0.1	3.9
Swiss chard	91.1	25	2.4	0.3	4.6
Garlic	74.0	-	4.5	-	20.0
Spinach	90.7	26	3.2	0.3	4.3
Tomato	93.5	22	1.1	0.2	4.7
Green bean	90.1	32	1.9	0.2	7.1
Dry bean	10.9	340	22.3	1.6	61.3

Table 2A: Composition of vegetables in inorganic salts (mg per 100 g of edible part)

Vegetable	Ca	P	Fe	Na	K
Cucumber	25	27	1.1	6	160
Endive	81	54	1.7	14	294
Sweet corn	41	51	0.5	8	372
Kohlrabi	3	111	0.7		280
Carrots	37	36	0.7	47	341
Watermelon	7	10	0.5	1	100
Zucchini	28	29	0.4	1	202
Squash	21	44	0.8	1	340
Cauliflower	25	56	1.1	13	295
Fresh onions	51	39	1.0	5	231
Dry onions	27	36	0.5	10	157
Cabbage	49	29	0.4	20	233
Brussel sprouts	36	80	1.5	14	390
Parsley	203	63	6.2	45	727
Fennel	100	51	2.7	-	397
Lettuce	68	25	1.4	9	264
Eggplant	12	26	0.7	2	214

Table 2B: Composition of vegetables in inorganic salts (mg per 100 g of edible part)

Vegetable	Ca	P	Fe	Na	K
Pea, fresh	26	116	1.9	2	316
Pea, dry	64	340	5.1	35	1005
Red beet	16	33	0.7	60	335
Potato	8	-	0.5	-	-
Melon	14	16	0.4	12	251
Pepper	10	25	0.7	-	-
Okra	92	51	0.6	3	219
Leek	52	50	1.1	5	347
Broccoli	103	78	1.1	15	382
Chicory	18	21	0.5	7	182
Radish	30	31	1.0	18	322
Celery	39	28	0.3	126	341
Swiss chard	88	39	3.2	147	550
Spinach	93	51	3.1	71	470
Tomato	13	27	0.5	3	244
Green bean	56	44	0.8	7	132
Dry bean	144	425	7.8	19	1,196

Table 3A: Composition of vegetables in main vitamins
(mg per 100 g of edible part)

Vegetable	Βιταμ. A (I.U.)	Θειαμίνη (mg)	Ριβοφαλβίνη (mg)	Νιασίνη (mg)	Βιτ. C (mg)
Cucumber	250	0.03	0.04	0.2	11
Endive	3.300	0.07	0.14	0.5	10
Kohlrabi	20	0.06	0.04	0.3	66
Sweet corn	400	0.15	0.12	1.7	12
Carrots	11.000	0.06	0.05	0.6	0.8
Watermelon	590	0.03	0.03	0.2	7
Zucchini	320	0.05	0.09	1.0	19
Squash	1.600	0.05	0.11	0.6	9
Cauliflower	60	0.11	0.10	0.7	78
Fresh onions	2.000	0.05	0.05	0.4	32
Dry onions	40	0.03	0.04	0.2	10
Cabbage	130	0.05	0.05	0.3	47
Brussel sprouts	550	0.10	0.16	0.9	102
Parsley	8.500	0.12	0.26	1.2	172
Fennel	3.500	-	-	-	31
Lettuce	1.900	0.05	0.08	0.4	18
Eggplant	10	0.05	0.05	0.6	5
Okra	520	0.17	0.21	1.0	31

Table 3B: Composition of vegetables in main vitamins
(mg per 100 g of edible part)

Vegetable	Βιταμ. A (I.U.)	Θειαμίνη (mg)	Ριβοφαλβίνη (mg)	Νιασίνη (mg)	Βιτ. C (mg)
Pea, fresh	640	0.35	0.14	2.9	27
Pea, dry	120	0.74	0.29	3.0	-
Red beet	20	0.03	0.05	0.4	10
Potato	-	0.11	0.04	-	8-30
Melon	40	0.04	0.03	0.6	23
Pepper	770	0.09	0.06	1.7	235
Leek	40	0.11	0.06	0.5	17
Broccoli	2.500	0.10	0.23	0.9	113
Chicory	Traces	-	-	-	-
Radish	10	0.03	0.03	0.3	26
Celery	240	0.03	0.03	0.3	9
Swiss chard	6.500	0.06	0.17	0.5	32
Spinach	8.100	0.10	0.20	0.6	51
Tomato	900	0.06	0.04	0.7	23
Green bean	600	0.08	0.11	0.5	19
Dry bean	-	0.65	0.22	2.4	-

CLASSIFICATION OF VEGETABLES

- Botanical taxonomy
- Edible part
- Requirements in temperature
- Cultivation cycle
- Pollination
- Photoperiod

Botanical classification

- **Plant species**

Examples

- **Pepper: *Capsicum annuum***
- ***spinach: Spinacia oleracea***

Sub-category

- **Botanical variety**
  - **π.χ. *Brassica oleracea*,**
    - **var. *botrytis*: cauliflower**
    - **var. *italica*: broccoli**
    - **Var. *capitata*: cabbage**

- **Cultivated variety:**

  (cv. = cultivated variety)
  - **e.g. τομάτα:**
    - ***Lycopersicon esculentum*, cv. Belladona)**

CLASSIFICATION ACCORDING TO THE EDIBLE PART

CLASSIFICATION ACCORDING TO THE EDIBLE PART

The edible part may be:

1. Underground plant organs
    1. tuber: πατάτα
    2. Root tuber: παντζάρι καρότο
    3. Bulb: κρεμμύδι, σκόρδο
2. Stem: asparagus, kohlrabi
3. Leaves: lettuce, endive
4. Unripe flowers: cauliflower, artichoke
5. Fruit:
    1. Unripe fruit: cucumber, eggplant
    2. Ripe fruit: tomato, watermelon

Table 4: Classification of vegetables according to their temperature requirements

Cold season vegetables		Warm season vegetables	
Cold-resistant Opt. T: 15 - 18 °C , Max >24 °C	Cold tolerant	Moderately cold-sensitive	Strongly cold-sensitive
Kohlrabi	Artichoke	Sweet corn	Cucumber
Onion *	Endive	Green cowpea	Pepper
Cabbage	Carrot	Tomato	Sweet potato
Brussel sprouts	Cauliflower	Green bean	Watermelon
Parsley	Chinese cabbage		Zucchini
Iceberg lettuce	Lettuce (Head)		Squash
Pea	Red beet		Eggplant
Leek *	Potato		Okra
Broccoli	Celery		Melon
Chicory	Swiss chard		
Radish			
Garlic *			
Spinach			
Asparagus *			

Table 5: Vegetables requiring vernalization through exposure to cold temperatures to form reproductive organs

Kohlrabi	Fennel
Carrot	Red beet
Onion	Leek
Cabbage	Radish
Brussel sprouts	Celery
Parsley	Swiss chard

Table 6A: Classification of vegetables according to their pollination needs

Insect-pollinated	Wind-pollinated	Self-pollinated
Artichoke	Sweet corn	Endive
Cucumber	Red beet	Faba bean
Dill	Swiss chard	Lettuce
Sweet potato	Spinach	Eggplant
Kohlrabi		Carrot
Pea		Potato
Watermelon		Pepper
Zucchini squash		Chicory
Onion		Tomato
Cauliflower		Common bean
Cabbage		
Brussels sprouts		
Chinese cabbage		

continues

Table 6A: Classification of vegetables according to their pollination needs

Insect -pollinated	
Parsley	Leek
Fennel	Broccoli
Eggplant	Radish
Okra	Celery
Melon	Asparagus

Classification of vegetables according to the cultivation cycle

- **Perennial**
  - **Asparagus**
  - **Artichoke**

- **Annual**
  - **All other vegetables cultivated in temperate climates**

Current trends in the market of fresh vegetables

- **The percentage of fresh vegetables distributed trough large super markets is increasing**
- **Consumer demand for safe and high quality food has dramatically increased**
- **Quality certification of fresh vegetables and fruits is becoming compulsory**

The importance of quality

- Product quality is a complex characteristic that depends on several factors and includes both objective, measurable quality traits as well as subjective, sensory characteristics.

- Nowadays, most vegetables prescribed for the market are subjected to quality grading based on standards set by EU and other international or national authorities.

The importance of quality

- The application of quality standards to fresh vegetables has increased the uniformity in size, maturity and presentation of produce.
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- However, the vegetable quality characteristics related to flavour and aroma are not affected by such standards.

- Flavour and aroma are important in the market to gain reputation (e.g. a brand name) and get a premium price .

The importance of quality

- Furthermore, the quality characteristics linked with food safe, i.e. the residuals of agrochemicals, are in most cases not taken into consideration when grading into classes according to quality standards.

- Therefore, many state authorities as well as the European Union have established maximum residual limits (MRL) for specific agrochemicals and horticultural products.

The need for certification

The increasing concern of consumers with the safe and quality of fresh vegetables and other food products originating from agriculture forced the large super market chains in Europe to establish a comprehensive system of certification.

- **GLOBALG.A.P. (www.globalgap.org) (formerly EUREPGAP)**
- **Certification is based on a standard protocol of Good Agricultural Practices (GAP)**
  - **GLOBALG.A.P. Fruit and Vegetables Standard**

Certification and Market

The application of good agricultural practices is aimed at minimising detrimental environmental impacts of farming operations, reducing the use of chemical inputs and ensuring a responsible approach to worker health & safety.

Certification and Market

Certification of the production procedure according to the GLOBALGAP standard is a prerequisite for the product to be marketed by the joined retailers.

In Greece and other Mediterranean countries, the introduction of the GLOBALGAP certification system had serious consequences on vegetable production, since it became a prerequisite for growers to export their products to the large fresh vegetable markets of Europe.