Micronutrient Deficiencies and Supplements in Diabetes

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Diabetes and the Matter of Dietary Supplements

- **Dietary supplements** have gained attention among people with diabetes as an alternative and complementary treatment.
- These supplements, including **vitamins**, **minerals**, **herbal extracts**, and other **functional food ingredients**, are believed to offer benefits
  - ✓Blood glucose regulation
  - ✓Antioxidant properties
  - ✓Anti-inflammatory effects

Nutrients. 2024; 16(23):4021.

Diabetes and the Matter of Dietary Supplements

- Scientific evidence of their **effectiveness** and **safety** remains inconclusive.
- Usage patterns, motivations, and influencing factors among patients are not well understood.
- **More than 60%** of patients with diabetes reported using dietary supplements.
- **Only 45%** of individuals used dietary supplements based on medical advice.
- Common supplements included multivitamins, multimineral supplements, vitamin D, calcium, zinc, vitamin C, and fish oil

Nutrients. 2024; 16(23):4021.

Micronutrient deficiencies in patients with diabetes

Meta-analysis of 132 studies with 52 501 participants:

- Micronutrient deficiencies are common in T2D patients.
- The pooled prevalence of multiple micronutrient deficiency (vitamins, minerals and electrolytes) was **45.30%** (95% CI 40.35% to 50.30%) among T2D patients.
- The pooled prevalence (48.62%, 95% CI 42.55 to 54.70) was higher in women.

Krishan Mangal, et al. BMJ Nutrition, Prevention & Health 2025;:e000950.

Vitamin B Deficiency and supplementation in Diabetes

(B1, B3, B6, B9, B12)

Agenda

1. Essential roles of Vitamin B
2. Vitamin B (B1, B3, B6, B9, B12) deficiencies in patients with diabetes
3. Effects of Vitamin B supplementations in diabetes
4. What do Guidelines say?
5. Conclusion

Essential roles of Vitamin B:

- **Vitamin B1:**

✓ Cofactor for 3 key enzymes of glucose metabolism (Pyruvate dehydrogenase, α-ketoglutarate dehydrogenase, and trans ketolase)

- **Vitamin B3 (Niacin)**

✓ Coenzyme forms (NAD and NADP) are essential for carbohydrate, lipid, and protein metabolism

- **Vitamin B6 (Pyridoxal):**

✓ Transaminase activities and glycogen phosphorylation (gluconeogenesis and glycogenolysis)

Ge Y, et al.Am J Clin Nutr. 2023;117(2):426-435.
Dawood MH, Abdulridha MK, Qasim HS. J Med Life. 2023;16(10):1474-1481.
El-Khodary NM, Dabees H, Werida RH. Nutr Diabetes. 2022;12(1):33.
Didangelos T,et al.Nutrients. 2021;13(2):395.

Essential roles of Vitamin B:

- **Vitamin B9 (Folic acid):**

✓ Regulating plasma Homocysteine (Hcy) concentration

  - Hyperhomocysteinemia in patients with diabetes → insulin resistance, dyslipidemia

✓ Preventing nitric oxide synthase dysfunction→ improving endothelial dysfunction induced by high Homocysteine

- **Vitamin B12:**

✓ Synthesis and regeneration of myelin

✓ Analgesic action

Ge Y, et al.Am J Clin Nutr. 2023;117(2):426-435.
Dawood MH, Abdulridha MK, Qasim HS. J Med Life. 2023;16(10):1474-1481.
El-Khodary NM, Dabees H, Werida RH. Nutr Diabetes. 2022;12(1):33.
Didangelos T,et al.Nutrients. 2021;13(2):395.

Vitamin B Deficiency in Diabetes

- Lower serum levels of vitamin B_1 (thiamine) was observed in patients with diabetes.
- Recommended Dietary Allowances (RDAs) for B1: 1.2 and 1.1 mg/d for adult men and women (1.4 mg/d for pregnancy and lactation)
- Thiamin is available in Multivitamin/mineral supplements with thiamin typically provide about 1.5 mg thiamin.
- The most commonly used forms of thiamin in supplements are thiamin mononitrate and thiamin hydrochloride, which are stable and water soluble

Thiamin. Fact Sheet for Health Professionals (https://ods.od.nih.gov/factsheets/Thiamin-HealthProfessional/)

Contents lists available at ScienceDirect

Metabolism

journal homepage: www.journals.elsevier.com/metabolism

2023

Association between diabetes and thiamine status - A systematic review and meta-analysis

Dan Ziegler [a,*], Karlheinz Reiners [b], Alexander Strom [a], Rima Obeid [c]

Compared to non-diabetic controls, individuals with diabetes

- ↓ **Thiamine** (SMD = -0.97, 95% CI: -1.89 to -0.06)
- ↓ **Thiamine monophosphate** (SMD = -1.16, 95% CI: -1.82 to -0.50)
- ↓ **Total thiamine compounds** (SMD = -1.01, 95% CI: -1.48 to -0.54)

✓ Diabetes is associated with reduced levels of various thiamine markers.

✓ Individuals with diabetes may have higher thiamine requirements.

Vitamin B Deficiency in Diabetes

- Deficiency of pyridoxine is usually found in association with other vitamin B deficiencies, including folate (vitamin B9) and cobalamin (vitamin B12).
- Isolated pyridoxine deficiency is extremely rare.
- Recommended Dietary Allowances (RDAs) for B6: 1.3 mg/d for adults aged 19-50y (1.9 and 2 mg/d for pregnancy and lactation), and 1.7 and 1.5 mg/d for men and women aged over 50y
- Vitamin B6 is available in multivitamins, in supplements containing other B complex vitamins, and as a stand-alone supplement
- The most common vitamin B6 in supplements is pyridoxine (in the form of pyridoxine hydrochloride).

Am J Med Sci. 2021 Jun;361(6):791-794.
Vitamin B6. Fact Sheet for Health Professionals (https://ods.od.nih.gov/factsheets/VitaminB6-HealthProfessional/)

Review > Am J Med Sci. 2021 Jun;361(6):791-794. doi: 10.1016/j.amjms.2020.10.027. Epub 2020 Oct 31.

Isolated Pyridoxine Deficiency Presenting as Muscle Spasms in a Patient With Type 2 Diabetes: A Case Report and Literature Review

- **Age/Sex:** 59-year-old female
- **Medical history:** Type 2 diabetes mellitus
- **Chief complaint:** Painful **muscle spasms** in both feet, spreading to legs and intermittently affecting the left arm
- **Symptoms not responsive to:** Baclofen and Cyclobenzaprine
- ↓ Plasma pyridoxal 5-phosphate: Confirmed pyridoxine deficiency
- Other vitamins (B1, B3, B12, folate): normal
- Standard-dose intramuscular pyridoxine injections for 3 weeks + Oral pyridoxine supplements for 3 months

Consider evaluating vitamin B6 status in patients with T2D with neuromuscular symptoms.

Vitamin B Deficiency in Diabetes

- ↓ Serum folate in T2DM patients with neuropathy
- Recommended Dietary Allowances (RDAs) for Folate: 400μg/d for adults (500 and 600 μg/d for pregnancy and lactation)
- Folic acid is available in multivitamins, supplements containing other B-complex vitamins, and supplements containing only folic acid.
- Common doses ranges 400 to 800 μg folic acid in supplements for adults.

Mol Cell Endocrinol. 2017;443:72-79.
Folate. Fact Sheet for Health Professionals (https://ods.od.nih.gov/factsheets/Folate-HealthProfessional/)

Vitamin B Deficiency in Diabetes

- **B12 deficiency:** 28.7% (95% CI: 21.1% to 36.4%)
- Meta-analysis of 26 studies:
  - ✓ Lower levels of vitamin B_{12} in patients on metformin
  - ✓ Vitamin B12 deficiency is associated with metformin use, likely only in those with longer/greater-dose
- Recommended Dietary Allowances (RDAs) for Vitamin B12 in 2.4 µg/d for adults (2.6 and 2.8 in lactation and pregnancy, respectively)

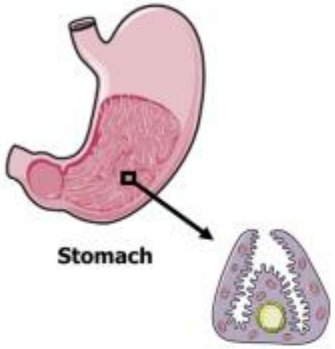
Krishan Mangal, et al. BMJ Nutrition, Prevention & Health 2025;:e000950.

Vitamin B Deficiency in Diabetes

- **Vitamin B12 Deficiency Risk**:
  - Metformin users had a **2.09 times higher risk** of vitamin B12 deficiency vs. non-users (95% CI 1.49-2.93).
- **Serum Vitamin B12 Levels**:
  - Metformin users had **significantly lower** vitamin B12 levels (mean difference **-63.7 pM**, 95% CI -74.35 to -53.05).
  - The decrease was **dose- and duration-dependent**.
- **Percentage Decrease in Vitamin B12**:
  - Metformin use led to a **14.7% greater decline** in vitamin B12 from baseline (95% CI -17.98% to -11.39%).

Diabetes. 2019 Sep;11(9):729-743.

Metformin-induced vitamin B12 deficiency



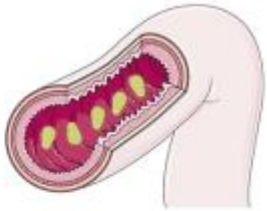
Stomach

Gastric parietal cell

↓ Intrinsic factor secretion

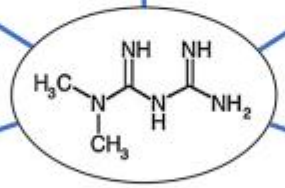
Liver

↑ Liver accumulation of vitamin B12



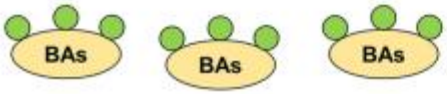
Small intestine

Alteration in small intestine motility
Small intestinal bacterial overgrowth
Inhibition of IF-vitamin B12 complex absorption in the distal ileum

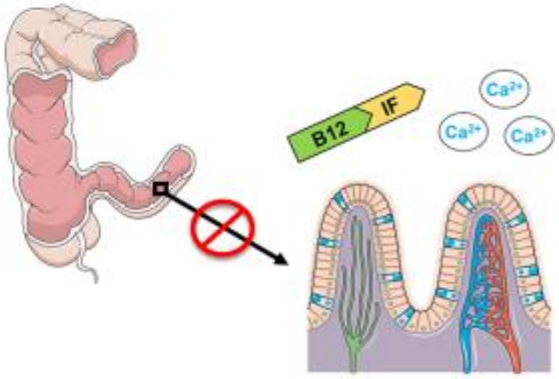


Metformin

Small intestine and enterohepatic circulation of vitamin B12



Altered bile acid metabolism and reabsorption



Intestinal villi and enterocytes (distal ileum)

Interference with the calcium-dependent binding of the IF-vitamin B12 complex to the cubilin receptor

Vitamin B Deficiency in Diabetes

Key Points on Defining Vitamin B12 Deficiency

- **No Consensus Exists**: There is **no universally accepted definition** for vitamin B12 deficiency
- **Debate Over Cut-off Values**:
  - Scientists disagree on the **exact serum B12 thresholds** for deficiency.
  - Different cut-offs can **underestimate or overestimate** deficiency rates
- **Current General Guidelines**:
  - **Sever deficiency**: Serum B12 < **148 pmol/L**.
  - **Marginal/borderline deficiency**: Serum B12 **148–221 pmol/L**
- **Biomarker Challenges**:
  - Uncertainty remains about the **best biomarker (or combination)** to assess B12 status (e.g., serum B12, methylmalonic acid, homocysteine)

World J Diabetes. 2021 Jul 15;12(7):916-931.

Vitamin B Deficiency in Diabetes

Clinical Manifestations of B12 deficiency

- **Hematologic signs:**
  - Megaloblastic anemia (hallmark feature)
  - Low WBC, RBC, and platelet counts
- **Neurological symptoms:**
  - Numbness, tingling in hands and feet
  - Can occur without anemia, risk of irreversible damage if untreated
- **Other symptoms:**
  - Glossitis (inflamed tongue)
  - Fatigue, palpitations, pale skin
  - Dementia, weight loss, infertility

Because the body stores about 1 to 5 mg vitamin B12 (~1000-2000 times as much as the amount typically consumed in a day), the symptoms of vitamin B12 deficiency can take several years to appear.

Effects of Supplementation with Vitamin B

Effects of supplementation

Vitamin B1 (thiamine):

✓ A meta-analysis of 6 trials:

- Supplementation with 100–900 mg/day of thiamine or benfotiamine for up to 3 months:
  - Glycemic outcomes (HbA1c,FBG,Post Prandial Glucose): ↔
  - TG: ↓ (MD*=-1.1)
  - HDL-C: ↑ (MD=0.1)

*MD=Mean Difference

Muley A, et al. BMJ Open. 2022 Aug 25;12(8):e059834.

Effects of supplementation

- **Benfotiamine** is a synthetic **S-acyl derivative of thiamine (vitamin B1)**.
- **Recommended in clinical guidelines**:
  - **Initial dose**: 120–600 mg/day.
  - **Maintenance dose**: 300 mg/day
- Targets both painful and non-painful diabetic peripheral neuropathy (DPN) symptoms.

Diabetes research and clinical practice. 2022;186:109063.
Exp Clin Endocrinol Diabetes. 2001;109(6):330-6.
Diabetes Care. 2010;33(10):2285-93.

Effects of supplementation

- **Benefits of Benfotiamine in DPN prevention:**
  - Improves nerve conduction velocity.
  - Reduces neuropathic pain, especially at higher doses

✓Prevents motor nerve deficits

✓Prevents AGE (advanced glycation end-product) formation

➢ Proposed as a first-line nutritional supplement (along with alpha-lipoic acid, ALA) for preventing DPN progression, given its efficacy and safety.

Diabetes research and clinical practice. 2022;186:109063.
Exp Clin Endocrinol Diabetes. 2001;109(6):330-6.
Diabetes Care. 2010;33(10):2285-93.

Effects of supplementation
Vitamin B3

- Niacin exists in two forms: nicotinic acid and nicotinamide.
- **Pharmacological Uses:** Nicotinic acid (1–3 g/day) effectively treats dyslipidemia but may impair glycemic control in diabetes.
- Nicotinamide is under investigation for diabetes prevention and treatment.
- **RDA:** 14 mg/day (women), 16 mg/day (men).
- **Mechanisms in Diabetes**
  - Protect pancreatic β-cells from autoimmune damage.
  - Maintain intracellular NAD levels.
  - Act as a weak antioxidant.

Systematic Review and Meta-Analysis

Medicine

OPEN

Effectiveness of niacin supplementation for patients with type 2 diabetes

A meta-analysis of randomized controlled trials

Dan Xiang, MM*, Qian Zhang, MM, Yang-Tian Wang, MM

2023

- 8 RCTs including 2,110 patients with T2D
- No significant effects were observed on glucose metabolism:
  - Plasma glucose: WMD = +0.18 mmol/L (95% CI: -0.14-0.50)
  - Hemoglobin A1c (HbA1c): WMD = +0.39% (95% CI: -0.15 to 0.94)

Systematic Review and Meta-Analysis

Medicine®

OPEN

Effectiveness of niacin supplementation for patients with type 2 diabetes

A meta-analysis of randomized controlled trials

Dan Xiang, MM*, Qian Zhang, MM, Yang-Tian Wang, MM

2023

- 8 RCTs including 2,110 patients with T2D
- Niacin supplementation significantly improved lipid parameters:
  - ↓ Total cholesterol: WMD = -0.28 mmol/L (95% CI: -0.44 to -0.12)
  - ↓ Triglycerides: WMD = -0.37 mmol/L (95% CI: -0.52 to -0.21)
  - ↓ LDL cholesterol: WMD = -0.42 mmol/L (95% CI: -0.50 to -0.34)
  - ↑ HDL cholesterol: WMD = +0.33 mmol/L (95% CI: 0.21 to 0.44)

Effects of supplementation

Vitamin B6:

- No meta-analysis
- A randomized clinical trial, 129 Newly diagnosed Type2 Diabetes:
  - ✓ Metformin 500 mg/day+ vitamin B6 300 mg/day+ lifestyle modification
  - **FBS:** ↓36.89%
  - **HbA1c:** ↓ 16.69%
  - **Fasting Insulin:** ↓ 29.98%
  - **HOMA-IR:** ↓ 55.82%

Dawood MH, Abdulridha MK, Qasim HS. J Med Life. 2023;16(10):1474-1481.

Effects of supplementation

Vitamin B9 (Folic acid):

- A double-blind randomized controlled clinical trial:
  1. **Serum Homocysteine:** ↓28.2%
  2. **FBS:** ↓8.7%
  3. **HbA1c:** ↓8.2%
  4. **Serum insulin level:** ↓13.7%
  5. **Insulin resistance:** ↓ 21.7%

Sudchada P, et al. Diabetes Res Clin Pract. 2012 Oct;98(1):151-8.
Zhao JV, et al.Ann Epidemiol. 2018 Apr;28(4):249-257.e1.
El-Khodary NM, Dabees H, Werida RH. Nutr Diabetes. 2022;12(1):33.
Mokgalaboni K, et al. Nutr Diabetes. 2024 Apr 22;14(1):22.

Effects of supplementation

Vitamin B9 (Folic acid):

- Meta-analysis of 18 RCTs: 21,081 participants:
  1. **FBS:** ↓ (MD*=-0.15 mmol/l)
  2. **HOMA-IR:** ↓(MD=-0.83)
  3. **Serum insulin level:** ↓(MD=-1.94μIU/ml)
  4. **HbA1c:** ↔

*MD=Mean Difference

Sudchada P, et al. Diabetes Res Clin Pract. 2012 Oct;98(1):151-8.
Zhao JV, et al.Ann Epidemiol. 2018 Apr;28(4):249-257.e1.
El-Khodary NM, Dabees H, Werida RH. Nutr Diabetes. 2022;12(1):33.
Mokgalaboni K, et al. Nutr Diabetes. 2024 Apr 22;14(1):22.

Effects of supplementation

Vitamin B9 (Folic acid):

- Meta-analysis of 4 RCTs:
  1. **Serum Homocysteine:** ↓(WMD*=- 3.52 μmol/l)
  2. **HbA1c:** ↔

*WMD=Weighted Mean Difference

Sudchada P, et al. Diabetes Res Clin Pract. 2012 Oct;98(1):151-8.
Zhao JV, et al.Ann Epidemiol. 2018 Apr;28(4):249-257.e1.
El-Khodary NM, Dabees H, Werida RH. Nutr Diabetes. 2022;12(1):33.
Mokgalaboni K, et al. Nutr Diabetes. 2024 Apr 22;14(1):22.

Effects of supplementation

Vitamin B12:

- A randomized double-blind placebo-controlled trial, 90 patients with type2 diabetes mellitus, using metformin for at least 4 years, with both peripheral and Autonomic Diabetic Neuropathy & serum B12 level <400 pmol/l:
  - ↑ Plasma vitamin B12 levels
  - Improvement of neurophysiological parameters

Didangelos T,et al.Nutrients. 2021;13(2):395.

Conclusion

Thiamine supplementation:

- No effects on glycemic outcomes, ↓ Triglycerides, ↑ HDL

Niacin supplementation:

- Niacin supplements ranked best in triglyceride reductions and increasing high-density lipoprotein cholesterol levels with low to very low evidence certainty.

Vitamin B6 supplementation:

- Little evidence

Muley A, et al. BMJ Open. 2022 Aug 25;12(8):e059834.
Deng et al. 2023, Page 5201
Dawood MH, Abdulridha MK, Qasim HS. J Med Life. 2023;16(10):1474-1481.
Zhao JV, et al.Ann Epidemiol. 2018 Apr;28(4):249-257.
Mokgalaboni K, et al. Nutr Diabetes. 2024 Apr 22;14(1):22.

Conclusion

Folic acid supplementation:

- Benefits on insulin resistance, glycemic control, mitigating Cardio Vascular Diseases

Vitamin B12 supplementation:

- Monitoring and supplementation of vitamin B12 level are likely beneficial.

Muley A, et al. BMJ Open. 2022 Aug 25;12(8):e059834.
Deng et al. 2023, Page 5201
Dawood MH, Abdulridha MK, Qasim HS. J Med Life. 2023;16(10):1474-1481.
Zhao JV, et al.Ann Epidemiol. 2018 Apr;28(4):249-257.
Mokgalaboni K, et al. Nutr Diabetes. 2024 Apr 22;14(1):22.

Conclusion

- ✓Potential deficiencies of micronutrient must be considered and corrected.
- ✓The most prevalent vitamin B deficiency in T2D: **B12 deficiency:** 28.7% (95% CI: 21.1% to 36.4%)
- ✓More studies must be conducted about the need for supplementation due to the conflicting results of studies to date

Conclusion

The American Diabetes Association:

- People at low risk for nutritional deficiencies meet their nutritional requirements with natural food sources.
- Do not generally support the use of micronutrient supplements for people with diabetes.

Facilitating Positive Health Behaviors and Well-being to Improve Health Outcomes: *Standards of Care in Diabetes - 2024*. Diabetes Care 2024;47(Suppl. 1):S77-S110

Conclusion

The American Diabetes Association:

- ✓Dietary supplementation with vitamins, minerals (such as chromium and vitamin D), herbs, or spices(such as cinnamon or aloe vera) are not recommended for glycemic benefits.
- ✓Health care professionals should inquire about intake of supplements and counsel as needed.

Facilitating Positive Health Behaviors and Well-being to Improve Health Outcomes: *Standards of Care in Diabetes - 2024*. Diabetes Care 2024;47(Suppl. 1):S77-S110

Conclusion

The American Diabetes Association:

- Counsel against β-carotene supplementation, as there is evidence of harm for specific individuals and confers no benefits.

Facilitating Positive Health Behaviors and Well-being to Improve Health Outcomes: *Standards of Care in Diabetes - 2024*. Diabetes Care 2024;47(Suppl. 1):S77-S110

Rich dietary sources of vitamin B

Top 10 Foods Highest in Thiamin (Vitamin B1)

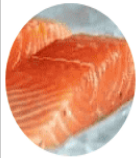
1mg of Thiamin = 100% of the Daily Value (%DV)

1 Lean Pork Chops

96% DV (1.1mg)
in a 6oz chop

332 calories

2 Fish (Salmon)



48% DV (0.6mg)
per 6oz fillet

350 calories

3 Flax Seeds

39% DV (0.5mg)
per oz

152 calories

4 Navy Beans

36% DV (0.4mg)
per cup

255 calories

5 Green Peas

35% DV (0.4mg)
per cup cooked

134 calories

6 Firm Tofu

33% DV (0.4mg)
per cup

363 calories

7 Brown Rice

30% DV (0.4mg)
per cup

248 calories

8 Acorn Squash

29% DV (0.3mg)
per cup cooked

115 calories

9 Asparagus

24% DV (0.3mg)
per cup cooked

40 calories

10 Mussels

21% DV (0.3mg)
per 3oz

146 calories

Top 10 Foods Highest in Vitamin B3 (Niacin)

16mg of Niacin = 100% of the Daily Value (%DV)

1 Tuna (Yellowfin)

234% DV (37.5mg)
in a 6oz fillet

221 calories

2 Lean Chicken Breast

100% DV (16.1mg)
in a 6oz breast

267 calories

3 Lean Pork Chops

85% DV (13.6mg)
in a 6oz chop

332 calories

4 Beef (Skirt Steak)

60% DV (9.5mg)
per 6oz steak

456 calories

5 Portabella Mushrooms

47% DV (7.6mg)
per cup sliced

35 calories

6 Brown Rice

32% DV (5.2mg)
per cup

248 calories

7 Peanuts (Dry Roasted)

25% DV (4.1mg)
per oz

167 calories

8 Avocados

22% DV (3.5mg)
per avocado

322 calories

9 Green Peas

20% DV (3.2mg)
per cup cooked

134 calories

10 Sweet Potatoes

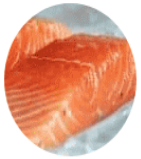
15% DV (2.4mg)
per cup mashed

258 calories

Top 10 Foods Highest in Vitamin B6

2mg of Vitamin B6 = 100% of the Daily Value (%DV)

1 Salmon



94% DV (1.6mg)
per 6oz fillet

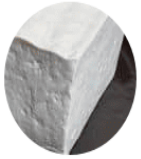
309 calories

2 Lean Chicken Breast

92% DV (1.6mg)
in a 6oz breast

267 calories

3 Fortified Tofu



66% DV (1.1mg)
per cup

208 calories

4 Lean Pork Chops

54% DV (0.9mg)
in a 6oz chop

332 calories

5 Beef (Skirt Steak)

48% DV (0.8mg)
per 6oz steak

456 calories

6 Sweet Potatoes

35% DV (0.6mg)
per cup mashed

258 calories

7 Bananas

32% DV (0.6mg)
per cup sliced

134 calories

8 Potatoes

32% DV (0.5mg)
in a medium potato

161 calories

9 Avocados

30% DV (0.5mg)
per avocado

322 calories

10 Pistachio Nuts

28% DV (0.5mg)
per 1 oz handful

159 calories

Top 10 Foods Highest in Vitamin B9 (Folate)

400µg of Folate = 100% of the Daily Value (%DV)

1 Edamame (Green Soybeans)

121% DV (482µg)
per cup

188 calories

2 Lentils

90% DV (358µg)
per cup

230 calories

3 Asparagus

67% DV (268µg)
per cup cooked

40 calories

4 Spinach

66% DV (263µg)
per cup cooked

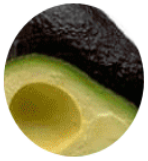
41 calories

5 Broccoli

42% DV (168µg)
per cup cooked

55 calories

6 Avocados



41% DV (163µg)
per avocado

322 calories

7 Mangos

18% DV (71µg)
per cup

99 calories

8 Lettuce

16% DV (64µg)
per cup

8 calories

9 Sweet Corn

15% DV (61µg)
per cup cooked

125 calories

10 Oranges

14% DV (54µg)
per cup

85 calories

Top 10 Foods Highest in Vitamin B12 (Cobalamin)

2µg of Vitamin B12 = 100% of the Daily Value (%DV)

1 Clams

3502% DV (84.1µg)
per 3oz serving

126 calories

2 Tuna

771% DV (18.5µg)
per 6oz fillet

313 calories

3 King Crab

642% DV (15.4µg)
in 1 crab leg

130 calories

4 Beef (Skirt Steak)

533% DV (12.8µg)
per 6oz steak

456 calories

5 Fortified Cereals

254% DV (6.1µg)
per 3/4 cup

95 calories

6 Fortified Soymilk

249% DV (6µg)
per 16oz glass

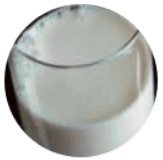
160 calories

7 Fortified Tofu

137% DV (3.3µg)
per cup

208 calories

8 Low-Fat Milk



108% DV (2.6µg)
per 16oz glass

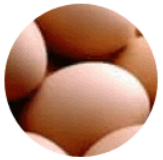
244 calories

9 Swiss Cheese

36% DV (0.9µg)
per oz

112 calories

10 Eggs



23% DV (0.6µg)
in 1 large egg

78 calories


با تشکر از توجه شما