NIH NATIONAL CANCER INSTITUTE

Laetrile/Amygdalin (PDQ®)–Health Professional Version

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Overview

This cancer information summary provides an overview of the use of laetrile as a treatment for people with cancer. The summary includes a history of laetrile research, a review of laboratory studies, the results of clinical trials, and possible side effects of laetrile use.

This summary contains the following key information:

- Laetrile is another name for the natural product amygdalin, which is a chemical constituent found in the pits of many fruits and in numerous plants.
- Hydrogen cyanide is thought to be the main anticancer compound formed from laetrile via *in situ* release.
- Laetrile was first used as a cancer treatment in Russia in 1845, and in the United States in the 1920s.
- Laetrile has shown little anticancer activity in animal studies and no anticancer activity in human clinical trials.
- The side effects associated with laetrile toxicity mirror the symptoms of cyanide poisoning, including liver damage, difficulty walking (caused by damaged nerves), fever, coma, and death.
- Laetrile is not approved for use in the United States.
- Inappropriate advertisement of laetrile as a cancer treatment resulted in a U.S. Food and Drug Administration investigation that culminated in charges and conviction of one distributor.

Many of the medical and scientific terms used in this summary are hypertext linked (at first use in each section) to the NCI Dictionary of Cancer Terms, which is oriented toward nonexperts. When a linked term is clicked, a definition will appear in a separate window.

Reference citations in some PDQ cancer information summaries may include links to external websites that are operated by individuals or organizations for the purpose of marketing or advocating the use of specific treatments or products. These reference citations are included for informational purposes only. Their inclusion should not be viewed as an endorsement of the content of the websites, or of any treatment or product, by the PDQ Integrative, Alternative, and Complementary Therapies Editorial Board or the National Cancer Institute.

General Information

The term *laetrile* is derived from the terms laevorotatory and mandelonitrile and is used to describe a purified

form of the chemical amygdalin, a cyanogenic glucoside found in the pits of many fruits and raw nuts and in other plants, such as lima beans, clover, and sorghum.[1-6] In body fluids and at physiological pH, hydrogen cyanide dissolves to form the cyanide anion. The term *vitamin B-17* was given to laetrile by E.T. Krebs Jr, but it is not an approved designation by the Committee on Nomenclature of the American Institute of Nutrition Vitamins. In the 1970s, laetrile gained popularity as an anticancer agent. By 1978, more than 70,000 individuals in the United States were reported to have been treated with it.[2,7,8]

Laetrile has been used for cancer treatment both as a single agent and in combination with a metabolic therapy program that consists of a specialized diet, high-dose vitamin supplements, and pancreatic enzymes.[9,10]

In the United States, researchers must file an Investigational New Drug (IND) application with the U.S. Food and Drug Administration (FDA) to conduct drug research in human subjects. In 1970, an IND application to study laetrile was filed by the McNaughton Foundation (San Ysidro, California). This request was initially approved but later rejected because preclinical evidence in animals showed that laetrile was not likely to be effective as an anticancer agent,[3,11,12] and because there were questions about how the proposed study was to be conducted.[13] Laetrile supporters viewed this reversal as an attempt by the U.S. government to block access to new and promising cancer therapies, and pressure mounted to make laetrile available to the public. Court cases in Oklahoma, Massachusetts, New Jersey, and California challenged the FDA's role in determining which drugs should be available to cancer patients. Consequently, laetrile was legalized in more than 20 states during the 1970s. In 1980, the U.S. Supreme Court acted to uphold a federal ban on interstate shipment of laetrile.[2,14] As a result, the use of laetrile has greatly diminished, but the compound continues to be manufactured and administered as an anticancer therapy, primarily in Mexico, and in some clinics in the United States.

Although the names laetrile, Laetrile, vitamin B-17, and amygdalin are often used interchangeably, they are not the same product. The chemical composition of U.S.-patented Laetrile (mandelonitrile-beta-glucuronide), a semisynthetic derivative of amygdalin, is different from the laetrile/amygdalin produced in Mexico (mandelonitrile beta-D-gentiobioside), which is made from crushed apricot pits.[15,16] Mandelonitrile, which contains a cyanide group, is a structural component of both products.[15] It has been proposed that released (hydrogen) cyanide is the active cancer-killing ingredient in laetrile, but two other breakdown products of amygdalin—prunasin (which is similar in structure to Laetrile) and benzaldehyde—may also be cancer cell inhibitors.[17-20] The studies discussed in this summary used either Mexican laetrile/amygdalin or the patented form. In most instances, the generic term *laetrile* will be used in this summary; however, a distinction will be made between the products when necessary.

Laetrile can be administered orally as a pill, or it can be given by injection (intravenous or intramuscular). It is commonly given intravenously for a period of time followed by oral maintenance therapy. The incidence of cyanide poisoning is much higher when laetrile is taken orally [21-23] because intestinal bacteria and some commonly eaten plants contain enzymes (beta-glucosidases) that activate the release of cyanide after laetrile has been ingested.[17,22] Relatively little breakdown occurs to yield the (hydrogen) cyanide when laetrile is injected.[7,22] Administration schedules and the length of treatment in animal models and humans vary widely.

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History

Amygdalin was first isolated in 1830 by two French chemists.[1,2] It was used as an anticancer agent in Russia as early as 1845, and positive results were reported for the first patient treated.[3,4] The first recorded use of amygdalin in the United States as a treatment for cancer occurred in the early 1920s.[5] At that time, amygdalin was taken in pill form; however, the formulation was judged too toxic, and the work was abandoned. In the 1950s, a purportedly nontoxic intravenous form of amygdalin was patented as Laetrile.[1,6,7]

Laetrile has been tested on cultured animal cells, in whole animals, in xenograft models, and in humans to determine whether it has specific anticancer properties. As noted in the General Information section, hydrogen cyanide is believed to be the main cancer-killing ingredient in laetrile.[8,9] When amygdalin interacts with the enzyme beta-glucosidase or undergoes hydrolysis in the absence of enzymes, hydrogen cyanide, benzaldehyde, and glucose are produced.[1,7,8,10,11] Hydrogen cyanide can also be produced from prunasin, which is a less-than-complete breakdown product of amygdalin.[1,8]

Proponents of laetrile have proposed four different theories to explain its purported anticancer activity. The first of these incorporates elements of the trophoblastic theory of cancer, a theory that is not widely accepted as an explanation for cancer formation. According to the trophoblastic theory, all cancers arise from primordial germ cells, some of which become dispersed throughout the body during embryonic development and, therefore, are not confined to the testes or ovaries.[12-17] The rationale for laetrile use is the suggestion that malignant cells have higher than normal levels of an enzyme called beta-glucuronidase (which is different from the enzyme beta-glucosidase) and that they are deficient in another enzyme called rhodanese (thiosulfate sulfurtransferase). Another suggestion is that laetrile is modified in the liver, and that beta-glucuronidase breaks down the modified compound, ultimately producing cyanide. Rhodanese can convert cyanide into the relatively harmless compound thiocyanate. Thus, it has been proposed that cancer cells are more susceptible to the toxic effects of laetrile than normal cells because of an imbalance in these two enzymes.[10,13,18-20] Some experimental evidence does support the idea that normal tissues and malignant tissues differ substantially in their concentrations of beta-glucuronidase [21] and rhodanese.[22,23]

The second theory states that cancer cells contain more beta-glucosidase activity than normal cells and, as in the first theory, that they are deficient in rhodanese.[1,5,13,15,18,24,25] Again, elevated beta-glucosidase activity in the interstitial regions of some malignancies has been experimentally demonstrated.[26,27]

The third theory states that cancer is the result of a metabolic disorder caused by a vitamin deficiency. It states further that laetrile, or *amygdalin/vitamin B-17*, is the missing vitamin needed by the body to restore health.[18,28-30] Experimental evidence indicates that the level of intake of individual vitamins and/or the vitamin status of an organism can influence the development of cancer, but there is no evidence that laetrile

is needed for normal metabolism or that it can function as a vitamin in animals or humans.[31,32]

The fourth theory suggests that the cyanide released by laetrile has a toxic effect beyond its interference with oxygen utilization by cells. According to this theory, cyanide increases the acid content of tumors and leads to the destruction of lysosomes. The injured lysosomes release their contents, thereby killing the cancer cells and arresting tumor growth.[15] According to this theory, another consequence of lysosome disruption is stimulation of the immune system.

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Laboratory/Animal/Preclinical Studies

Preclinical investigations of the potential anticancer activity of laetrile have used numerous cultured cell lines and tumor models, and they explored the following issues:

- Whether laetrile, given alone or in combination with other substances, exhibits anticancer activity of any kind.
- The toxic effects associated with laetrile treatment.
- The location of laetrile breakdown in the body, and how this breakdown occurs.

- The route(s) of excretion for laetrile and its broken-down products.

Animal studies of laetrile have used rodents,[1-10] dogs,[11-13] rabbits,[13] and a cat.[11] Early work led to the hypothesis that enzymes were necessary to release hydrogen cyanide from amygdalin. When high levels of these enzymes were present, symptoms of cyanide poisoning were more pronounced.[1,13]

In two studies sponsored by the National Cancer Institute and published in 1975, various rodent cancers (osteogenic sarcoma, melanoma, carcinosarcoma, lung carcinoma, and leukemia) were transplanted into rats and mice.[2,3] In both studies, the animals were treated with intraperitoneal injections of amygdalin, with or without the enzyme beta-glucosidase. None of the solid tumors or leukemias that were investigated responded to amygdalin at any dose that was tested. No statistically significant increase in animal survival was observed in any of the treatment groups. Similar results were obtained in another study using human breast cancer and colon cancer cells implanted into mice.[10] Amygdalin at every dose level tested produced no response either as a single agent or in combination with beta-glucosidase. It was discovered that animals experienced more side effects when beta-glucosidase was given concurrently with amygdalin than when amygdalin was given alone.[2,3]

Additional cell culture and animal studies involving more than a dozen other tumor models have been published.[1,4,6,8,9,14,15] In one study, preliminary findings by one of the principal investigators that amygdalin inhibited the growth of primary tumors and the incidence of lung metastases in mice bearing spontaneous (not treatment-induced) mammary adenocarcinomas could not be confirmed.[4] However, positive results were obtained in another study.[9] A summary of study results is provided in Table 1 and Table 2 below.

Table 1. *In Vitro* Studies[a]

Reference	Cell Line	Outcome
[15]	Two human acute myeloid leukemia cell lines (KG-1 and HL-60)	A 50% inhibition of colony formation by both normal and leukemic cells was observed at an amygdalin concentration of 3.5 mg/mL using both drug sources; the colony-forming cells from the leukemic cell lines and normal marrow were found to be relatively resistant to amygdalin and its metabolites *in vitro*; there was no selective kill of clonogenic cells from the human leukemia

mg = milligram(s); mL = milliliter(s).

[a]Refer to text and the NCI Dictionary of Cancer Terms for additional information and definition of terms.

Reference	Cell Line	Outcome
		cell lines as compared to normal bone marrow
[16]	SNU-C4 human colon cancer cells	Modest (10%–30%) cytotoxicity seen with amygdalin concentrations of 0.5–5.0 mg/mL
[17]	Human prostate cancer cell lines (DU145 and LNCaP)	Dose-dependent cytotoxicity in DU145 with amygdalin concentrations of 0.01–10 mg/mL and in LNCaP cells at concentrations of 0.1–10 mg/mL
[18]	HepG2 human hepatoma cells	IC50 of amygdalin alone was 458.10 mg/mL and with beta-D-glucosidase was 3.2 mg/mL
[19]	HeLa human cervical cancer cells	Modest (10%–50%) cytotoxicity seen with amygdalin concentrations of 5–20 mg/mL

mg = milligram(s); mL = milliliter(s).

[a]Refer to text and the NCI Dictionary of Cancer Terms for additional information and definition of terms.

Table 2. *In Vivo* Studies[a]

Reference	Animal Model	Outcome
[2]	Four transplantable rodent tumors (L1210 lymphoid leukemia, P388 lymphocytic	No antitumor activity of amygdalin alone (25–3,200 mg/kg); potentiation of toxicity of

DMBA = dimethylbenz-alpha-anthracene; kg = kilogram(s); mg = milligram(s).

[a]Refer to text and the NCI Dictionary of Cancer Terms for additional information and definition of terms.

Reference	Animal Model	Outcome
	leukemia, B16 melanoma, and Walker 256 carcinosarcoma)	amygdalin when combined with beta glucosidase
[3]	Three transplantable rodent tumors (osteogenic sarcoma, Lewis lung carcinoma, and P388 leukemia)	No antitumor activity at 20% of lethal dose (LD20)
[4]	DMBA-induced rat mammary carcinoma and the following transplanted experimental tumors: sarcoma 180, plasma cell tumor LPC-1, leukemia L1210, Mecca lymphosarcoma, Ridgway osteogenic sarcoma, sarcoma T241, mammary carcinoma E0771, Taper liver tumor, Ehrlich carcinoma (solid and ascites), and Walker carcinosarcoma 256	Not effective at treating, preventing, or delaying development of tumors
[6]	B16 melanoma and BW5147 AKR leukemia	Ineffective
[9]	Murine mammary adenocarcinoma	No effect of amygdalin alone. Enhanced antitumor activity of combination of oral vitamin A, amygdalin given intramuscularly, and enzymes injected into and around the tumor
[10]	Human breast and colon xenografts	Inactive

DMBA = dimethylbenz-alpha-anthracene; kg = kilogram(s); mg = milligram(s).

[a]Refer to text and the NCI Dictionary of Cancer Terms for additional information and definition of terms.

Reference	Animal Model	Outcome
[19]	HeLa human cervical cancer cell xenografts	Modest tumor growth inhibition in mice receiving 300 mg/kg intraperitoneally daily for 14 days

DMBA = dimethylbenz-alpha-anthracene; kg = kilogram(s); mg = milligram(s).

[a]Refer to text and the NCI Dictionary of Cancer Terms for additional information and definition of terms.

The toxicity of laetrile appears to be dependent on the route of administration. Oral administration is associated with much greater toxicity than intravenous, intraperitoneal, or intramuscular injection.[1,5,7,8,12,20-22] As noted in the History section, most mammalian cells contain only trace amounts of the enzyme beta-glucosidase;[23] however, this enzyme is present in gastrointestinal tract bacteria and in many food plants.[5,7,13,24-26]

Two studies have examined the role of intestinal bacteria in the breakdown of orally administered amygdalin.[7,27] In one study, rats bred and raised under germ-free conditions and rats bred and raised under normal conditions were given oral amygdalin. The germ-free rats exhibited no side effects from the compound, and their blood concentrations of cyanide were indistinguishable from those of untreated rats. Many of the rats with normal quantities of intestinal bacteria showed signs of cyanide poisoning (e.g., lethargy and convulsions), and they had high levels of cyanide in their blood. In the second study, rats were either treated or not treated with the antibiotic neomycin before being given oral amygdalin.[5] In this study, urinary excretion of detoxified cyanide (i.e., thiocyanate) was measured. The amount of urinary thiocyanate was 40 times higher in rats that had not been given the antibiotic, indicating that more amygdalin had been broken down in animals with normal amounts of intestinal bacteria. In humans, as in rats, substantial breakdown of amygdalin occurs in the intestines; however, little breakdown of amygdalin occurs in humans, with most of the intact compound eventually excreted in urine.[25,28]

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Human/Clinical Studies

Laetrile has been used as an anticancer treatment in humans worldwide.[1] Although many anecdotal reports and case reports are available, findings from only two clinical trials [2,3] have been published. No controlled clinical trial of laetrile has ever been conducted.

Case reports and reports of case series have provided little evidence to support laetrile as an anticancer treatment.[1,4-8] The absence of a uniform documentation of cancer diagnosis, the use of conventional therapies in combination with laetrile, and variations in the dose and duration of laetrile therapy complicate evaluation of the data. In a case series published in 1962,[6] findings from ten patients with various types of metastatic cancer were reported. These patients had been treated with a wide range of doses of intravenous (IV) Laetrile (total dose range, 9–133 g). Pain relief (reduction or elimination) was the primary benefit reported. Some objective responses, such as decreased adenopathy and decreased tumor size, were noted. Information on prior or concurrent therapy was provided; however, patients were not followed up long-term to determine whether the benefits continued after treatment was stopped. Another case series that was published in 1953 included 44 cancer patients and found no evidence of objective response that could be attributed to laetrile.[9] Most patients with reported cancer regression in this series received recent or concurrent radiation therapy or chemotherapy. Thus, it is impossible to determine which treatment produced the positive results.

Benzaldehyde, which is one of laetrile's breakdown products, has also been tested for anticancer activity in humans. Two clinical series reported a number of responses to benzaldehyde in patients with advanced cancer for whom standard therapy had failed.[10,11] In one series, 19 complete responses and ten partial responses were reported among 57 patients who had received either oral or rectal beta-cyclodextrin benzaldehyde; however, precise response durations were specified for only two of the patients.[10] Another series by the same investigators used 4,6-benzylidene-alpha-D-glucose, which is an IV formulation of benzaldehyde.[11] In this series, seven complete responses and 29 partial responses were reported among 65 patients, with response durations ranging from 1.5 to 27 months. No toxicity was associated with either preparation of benzaldehyde, and it was reported that the responses persisted as long as treatment was continued. Almost all of the patients in these two series had been treated previously with chemotherapy or radiation therapy, but the elapsed time before the initiation of benzaldehyde treatment was not disclosed.

In 1978, the National Cancer Institute (NCI) requested case reports from practitioners who believed that their patients had benefitted from laetrile treatment.[12] Ninety-three cases were submitted, and 67 were considered evaluable for response. An expert panel concluded that two of the 67 patients had complete responses and that four of the others had partial responses while using laetrile.[13] On the basis of these six responses, the NCI agreed to sponsor phase I and phase II clinical trials.

The phase I study was designed to test the doses, routes of administration, and the schedule of administration judged representative of those used by laetrile practitioners.[3] The study involved six cancer patients. The investigators found that IV and oral amygdalin showed minimal toxicity under the conditions evaluated; however, two patients who ate raw almonds while undergoing oral treatment developed symptoms of cyanide poisoning.

The phase II study was conducted in 1982 and was designed to test the types of cancer that might benefit from laetrile treatment.[2] Most patients had breast, colon, or lung cancer. To be eligible for the trial, patients had to be in good general condition (not totally disabled or near death), and they must not have received any other cancer therapy for at least 1 month before treatment with amygdalin. Amygdalin, evaluated for potency and purity by the NCI,[14] was administered by IV for 21 days, followed by oral maintenance therapy, utilizing doses and procedures similar to those evaluated in the phase I study. Vitamins and pancreatic enzymes were also administered as part of a metabolic therapy program that included dietary changes to restrict the use of caffeine, sugar, meats, dairy products, eggs, and alcohol. A small subset of patients received higher-dose amygdalin therapy and higher doses of some vitamins as part of the trial. Patients were followed up until there was definite evidence of cancer progression, elevated blood cyanide levels, or severe clinical deterioration. Among 175 evaluable patients, only one patient met the criteria for response. This patient, who had gastric carcinoma with cervical lymph node metastasis, experienced a partial response that was maintained for 10 weeks while on amygdalin therapy. Fifty-four percent of the patients had measurable disease progression at the end of the IV course of treatment, and all of the patients had disease progression 7 months after completing IV therapy. Seven percent of the patients reported an improvement in performance status (ability to work or to perform routine daily activities) at some time during therapy, and 20 percent claimed symptomatic relief. In most patients, these benefits did not persist. Blood cyanide levels were not elevated after IV amygdalin treatment; however, they were elevated after oral therapy.[2]

Variations in commercial preparations of laetrile from Mexico, the primary supplier, have been documented.[14,15] Incorrect product labels have been found, and samples contaminated with bacteria and other substances have been identified.[14,15] When a comparison was made of products manufactured in the United States and Canada, differences in chemical composition were noted, and neither product was effective in killing cultured human cancer cells.[16]

Table 3. Clinical Studies of Laetrile/Amygdalin[a]

Reference	Trial Design	Condition or Cancer Type	Treatment Groups (Enrolled; Treated; Placebo or No	Results	Concurrent Therapy Used	Level Evider

			Treatment Control)[b]			
[2]	Consecutive case series	Various cancers	179; 178; N/A	No benefit reported	Metabolic therapy program of diet, vitamins, and enzymes	3iiDiii
[13]	Nonconsecutive case series	Various diseases	68; 68; 24	Two patients had complete response; four patients had partial response	Chemotherapy	3iiiDiii
[3]	Nonconsecutive case series	Advanced cancer	6; 6; N/A	No benefit reported	Vitamins, enzymes	3iiiDiii
[6]	Best case series	Various advanced cancers	9; 9; N/A	Pain relief	Unknown	4
[7]	Best case series	Various cancers	10; 10; N/A	Pain relief	Narcotics given to seven patients, but discontinued in five patients	4
[9]	Best case series	Various cancers	N/A; 44; N/A	No benefit reported	Unknown	4

N/A = not applicable.

[a]Refer to text and the NCI Dictionary of Cancer Terms for additional information and definition of ter

[b]Number of patients treated plus number of patient controls may not equal number of patients enro number of patients enrolled equals number of patients initially recruited/considered by the research who conducted a study; number of patients treated equals number of enrolled patients who were gi the treatment being studied AND for whom results were reported.

[c]Strongest evidence reported that the treatment under study has activity or otherwise improves the well-being of cancer patients. For information about levels of evidence analysis and an explanation o the level of evidence scores, refer to Levels of Evidence for Human Studies of Integrative, Alternative and Complementary Therapies.

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Adverse Effects

The side effects associated with laetrile treatment mirror the symptoms of cyanide poisoning. Cyanide is a neurotoxin that can cause the following side effects:

- Nausea and vomiting.[1]
- Headache.[1]
- Dizziness.[2,3]
- Cyanosis.
- Liver damage.[4,5]
- Hypotension.[1,6,7]
- Ptosis.[8,9]
- Ataxic neuropathies.[10]
- Fever.[7,8]
- Mental confusion.[6,11-13]
- Coma.[6,11-13]
- Death.[6,11-13]

Oral laetrile causes more severe side effects than injected laetrile. These side effects can be potentiated by the concurrent administration of raw almonds or crushed fruit pits, and by eating fruits or vegetables that contain beta-glucosidase (e.g., celery, peaches, bean sprouts, carrots),[3,5,14-16] or by taking high doses of vitamin C orally.[1,5,17,18]

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Summary of the Evidence for Laetrile/Amygdalin

To assist readers in evaluating the results of human studies of integrative, alternative, and complementary therapies for cancer, the strength of the evidence (i.e., the levels of evidence) associated with each type of treatment is provided whenever possible. To qualify for a level of evidence analysis, a study must:

- Be published in a peer-reviewed scientific journal.
- Report on a therapeutic outcome or outcomes, such as tumor response, improvement in survival, or measured improvement in quality of life.
- Describe clinical findings in sufficient detail that a meaningful evaluation can be made.

Separate levels of evidence scores are assigned to qualifying human studies on the basis of statistical strength of the study design and scientific strength of the treatment outcomes (i.e., endpoints) measured.

The resulting two scores are then combined to produce an overall score. For an explanation of the scores and additional information about levels of evidence analysis of integrative, alternative, and complementary therapies for cancer, refer to Levels of Evidence for Human Studies of Integrative, Alternative, and Complementary Therapies.

Changes to This Summary (04/07/2022)

The PDQ cancer information summaries are reviewed regularly and updated as new information becomes available. This section describes the latest changes made to this summary as of the date above.

Editorial changes were made to this summary.

This summary is written and maintained by the PDQ Integrative, Alternative, and Complementary Therapies Editorial Board, which is editorially independent of NCI. The summary reflects an independent review of the literature and does not represent a policy statement of NCI or NIH. More information about summary policies and the role of the PDQ Editorial Boards in maintaining the PDQ summaries can be found on the About This PDQ Summary and PDQ® - NCI's Comprehensive Cancer Database pages.

About This PDQ Summary

Purpose of This Summary

This PDQ cancer information summary for health professionals provides comprehensive, peer-reviewed, evidence-based information about the use of laetrile/amygdalin in the treatment of people with cancer. It is intended as a resource to inform and assist clinicians in the care of their patients. It does not provide formal guidelines or recommendations for making health care decisions.

Reviewers and Updates

This summary is reviewed regularly and updated as necessary by the PDQ Integrative, Alternative, and Complementary Therapies Editorial Board, which is editorially independent of the National Cancer Institute (NCI). The summary reflects an independent review of the literature and does not represent a policy statement of NCI or the National Institutes of Health (NIH).

Board members review recently published articles each month to determine whether an article should:

- be discussed at a meeting,
- be cited with text, or
- replace or update an existing article that is already cited.

Changes to the summaries are made through a consensus process in which Board members evaluate the strength of the evidence in the published articles and determine how the article should be included in the

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Levels of Evidence

Some of the reference citations in this summary are accompanied by a level-of-evidence designation. These designations are intended to help readers assess the strength of the evidence supporting the use of specific interventions or approaches. The PDQ Integrative, Alternative, and Complementary Therapies Editorial Board uses a formal evidence ranking system in developing its level-of-evidence designations.

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