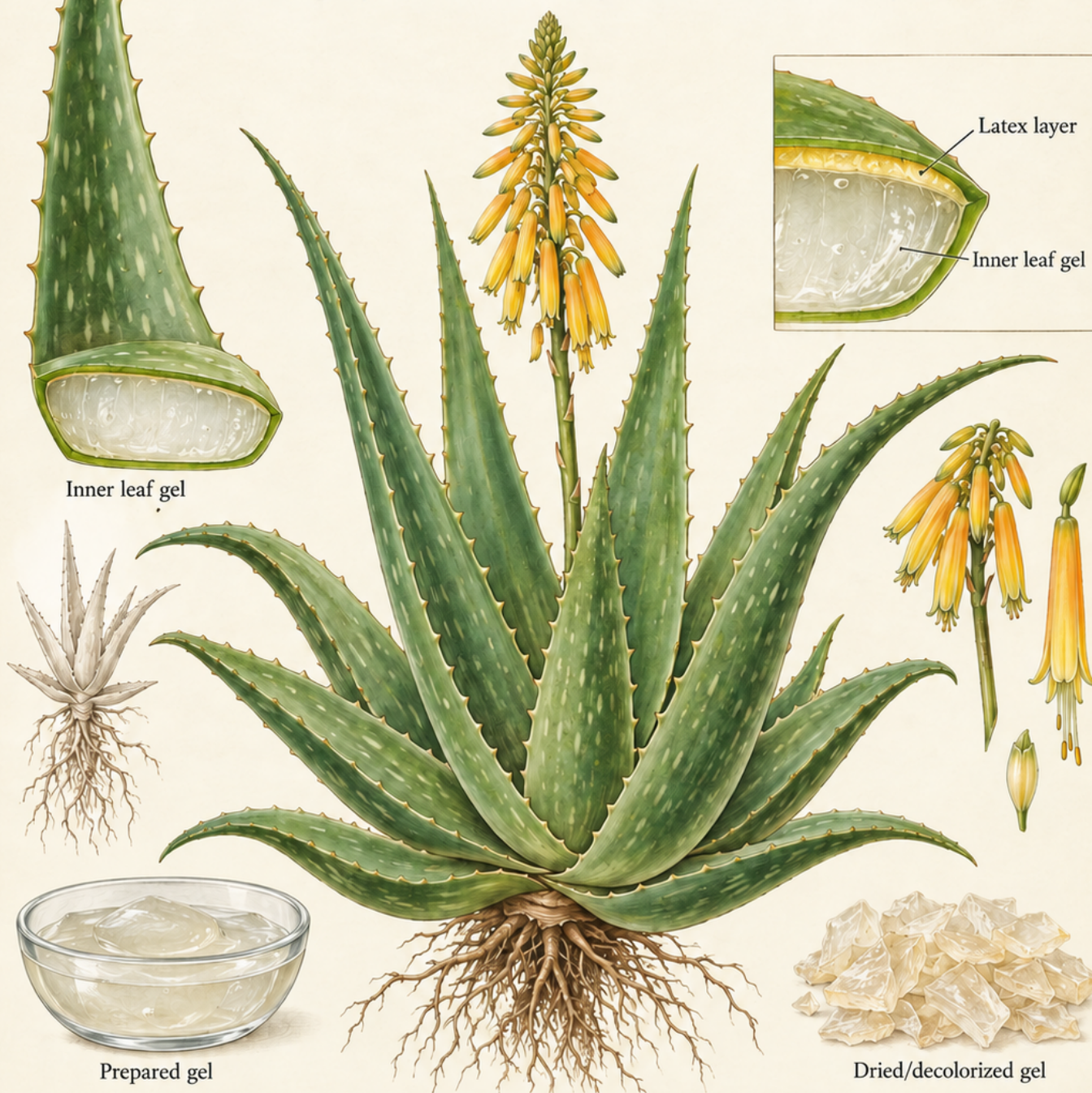


ALOE VERA

Aloe vera (L.) Burm.f.

NPM Educational Materia Medica Botanical Plate

Pharmacognosy • Constituents • Preparations • Evidence • Safety



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Source-Visible Evidence • Responsible Reasoning • Faculty-Ready Education

Aloe vera

Botanical identity · Gel and latex distinctions · Evidence · Safety

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1. Aloe vera: orientation and identity

Aloe vera (L.) Burm.f.

Inner-leaf gel, acetylated polysaccharides, latex hydroxyanthracene derivatives, pharmacognosy, mechanisms, evidence and safety.

The governing distinction: inner-leaf gel, dried latex and whole-leaf extract are different materials. A result for one is not evidence for the others. This plate is an educational appraisal, not a use protocol.

Identity field	Verified description
Accepted name and family	Aloe vera (L.) Burm.f.; Asphodelaceae. Aloe barbadensis Mill. is a synonym, not a second active ingredient. [S01]
Names and origin	Aloe, true aloe, Barbados aloe. The accepted Kew record places the native range in northern Oman; the species is widely cultivated and introduced elsewhere. [S01, S07]
Material focus	Fresh or stabilized inner-leaf gel and its polysaccharides; separately, bitter yellow leaf exudate/latex and dried exudate. “Aloe juice” without a part and processing description is ambiguous. [S03, S06, S08]
Do not conflate	Aloe ferox and other Aloe species are not synonyms of A. vera. Current family placement takes precedence over older monographs using Liliaceae, Aloaceae or Xanthorrhoeaceae. [S01, S08]

Learning contract

Postgraduate learners should be able to authenticate the material, distinguish preparation-specific evidence, separate target activity from clinical outcomes, appraise quality and interaction uncertainties, and rewrite an overstated claim without recommending treatment.

Risk: R2 evidence-bearing biomedical education. **Verification:** V2 evidence-grounded draft. **Release state:** evidence_checked — review required. Source review: **10 September 2026**. The search was a targeted evidence update, not a registered systematic review.

This material is for education, research literacy, and practitioner training only. It is not medical diagnosis, treatment, prescribing, or individualized care advice. Patient-specific use, medication changes, dosing, pregnancy/pediatric/oncology decisions, and polypharmacy questions require review by a qualified clinician.

2. Pharmacognosy and authentication

Morphology, tissues and sensory description

A. vera is a short-stemmed, offset-forming succulent with a basal rosette of thick, tapering leaves. Leaves are green to glaucous, may show pale spotting, and have toothed margins. A tall flowering axis bears racemes of tubular yellow flowers; the fruit is a capsule. Morphology varies with age and growing conditions. Use a botanical key and a voucher, not a generated picture, for species authentication. [S01, S02]

Observation	Interpretation and limitation
Macroscopic leaf	Inspect rosette architecture, leaf shape, marginal teeth, surface and fresh transverse tissue pattern. Aloe is not a cactus; similar succulent appearance is not taxonomic proof. [S02]
Tissue compartments	The rind and peripheral vascular region are distinct from the pale, water-rich inner parenchyma. Yellow exudate arises near the outer tissues; it is not the clear mucilaginous inner gel. [S03]
Microscopy	A hydrated cross-section can assess epidermal/outer tissue, vascular organization and large inner parenchyma. Processing collapses hydrated tissues; cryo-microscopy research illustrates preparation artifacts. This is not a complete validated microscopy monograph. [S03, S34]
Organoleptic features	Inner gel is translucent and slippery; latex is yellow and intensely bitter, becoming darker on drying. Odour, colour or bitterness alone cannot identify an extract or quantify residual aloin. Do not taste an unknown material. [S03, S08]

Orthogonal identity checks

A defensible identity record combines a traceable species voucher and harvest material with a chemistry fingerprint. HPLC can quantify aloin A/B; proton NMR can characterize acetylated polysaccharide and matrix components. Each method answers a different question. [S23–S25]

DNA methods may complement raw-material identity, but species DNA cannot establish leaf fraction, latex removal, polysaccharide integrity or finished-product potency. Highly processed products may yield little usable DNA. This is a method-selection inference, not validation of an Aloe-specific barcode assay.

HPTLC or LC–MS can be considered for an authenticated reference fingerprint or marker confirmation only after matrix-appropriate validation. No exact universal fingerprint, numerical acceptance range or current pharmacopoeial microscopy standard is asserted here.

3. Traditional context and preparation literacy

T — Traditional/ethnobotanical evidence: topical gel and orally used bitter exudate have distinct historical roles. WHO’s 1999 volume treats “Aloe” and “Aloe Vera Gel” separately. Current Canadian monographs retain part-specific herbal-use contexts. A recorded use is evidence of practice, not proof of modern efficacy. [S04, S06, S07]

Names such as Ghritakumari and Lu Hui occur in ethnobotanical literature, but name recognition does not verify an exact Ayurvedic, Siddha, Unani or Chinese preparation. This review did not independently establish each system’s primary-text formulation. Culinary, ceremonial and medicinal uses must not be merged into a claim of universal ancient use. [S03; verification gap]

Preparation	Composition question	Educational implication
Fresh inner-leaf gel	Was the inner fillet separated from the peripheral exudate?	Fresh tissue is not automatically microbiologically controlled or suitable for every route. [S03]
Stabilized gel; dried/reconstituted gel	What processing, solids content, carrier and preservative are present?	A “concentrate” ratio alone cannot show preserved acemannan structure. [S25, S26]
Decolorized whole-leaf extract	Was whole leaf carbon-treated; which residual markers were measured?	Decolorization is a processing claim, not equivalence to inner fillet or proof of zero risk. [S03, S12]
Nondecolorized whole-leaf extract	Are gel, rind and anthranoid-containing tissues retained?	Keep this toxicology material separate from low-aloin gel preparations. [S12]
Latex / dried leaf exudate	Does “dried juice” mean anthranoid-rich exudate?	The EMA laxative monograph concerns this material, not ordinary gel. [S08, S09]
Topical cream, gel or oral-mucosal product	What vehicle, co-ingredients, sterility requirements and local exposure apply?	Evidence from a tested finished formulation cannot identify the contribution of aloe alone. [S17, S18]
Isolated acemannan, aloin or aloe-emodin	Is it a purified experimental substance?	Concentration, route and exposure differ from a whole product. [S21, S22, S28]

Not interchangeable: gel powder, latex, whole-leaf beverages, extracts and isolated constituents cannot be substituted on the basis of the word “aloe.”

4. Constituent map

Chemical identity is not a therapeutic claim. Acemannan is not aloin; aloin is not aloe-emodin. The table separates matrix components from hydroxyanthracene-related safety markers. [S03, S27]

Constituent / class	Principal material	Proposed biological relevance	Evidence level	Analytical / formulation	Main limitation
Acemannan / acetylated mannans	Mannose-rich acetylated polysaccharides associated with inner gel.	Cell and animal studies of immune signalling, fibroblasts and repair responses. [S21, S22]	D: preclinical	Molecular distribution and acetylation matter; NMR can assess acetylated polysaccharide signals.	No established human target-exposure relationship for all gel products.
Pectic / galacturonic-acid-rich polysaccharides	Cell-wall fractions; not identical to the gel storage	Matrix, hydration and possible biological effects require fraction-specific study. [S27]	D/E; composition established	Extraction changes the fraction recovered; total polysaccharide is not an acemannan-	A pooled carbohydrate number hides chemical diversity.
Aloin A and aloin B	Anthrone C-glycosides enriched in latex/exudate; possible	Intestinal conversion to active anthrones supports the exudate's stimulant-laxative	R; pharmacology context	HPLC method validated in specified raw/finished matrices; use appropriate	A marker value does not characterize every hydroxyanthracene
Aloe-emodin	Anthraquinone aglycone studied as an isolated molecule; related to anthranoid-	Metabolism, cellular injury and protein-adduct research; not a proven gel therapeutic target. [S28, S29]	D: cell / animal	Measure separately where relevant; do not label aloin and aloe-emodin chemically identical.	Experimental exposure and purity differ from human product use.
Chromones and other phenolics	Secondary-metabolite fractions reported in aloe	Chemical-fingerprint interest; pathway claims require compound-specific	L/E in this plate	Use a defined standard and validated identification; do not infer from a nonspecific	No patient-important benefit attributed here to aloesin or a mixed
Water, sugars, organic acids and minerals	Bulk gel/product matrix; processing may add carriers,	Composition and stability indicators rather than automatic therapeutic actives.	Analytical evidence	NMR can assess several organic constituents and matrix changes; full ingredient disclosure	Natural content, added excipients and degradation signals must be

5. Mechanism map: what is actually connected?

Material → model	Observed or proposed process	Evidence label	Human bridge / claims
Acemannan → stimulated RAW264.7 murine macrophages	Nitric-oxide/iNOS responses were investigated in an interferon- γ context, with signalling evidence	Supported by preclinical evidence	Immune activation in one stimulated cell model is not generic anti-inflammation or
Acemannan → gingival fibroblasts and rat oral wounds	Proliferation, growth-factor/ collagen-related signals and repair measures were investigated. [S22]	Supported by preclinical evidence	Human cells in a dish are not a human trial. Local wound outcomes do not establish
Aloe polysaccharide fractions → intestinal cell / animal models	Barrier, mucus and immunomodulatory pathways are research hypotheses synthesized in a	Supported by preclinical evidence; clinical translation	A plausible barrier pathway cannot establish remission, mucosal healing or
Aloe exudate glycosides → intestinal metabolism	Microbial conversion and local effects on motility/secretion explain the anthranoid laxative framework.	Mechanistically plausible; official pharmacology context	Historical/monograph use and laboratory pharmacology do not make “detoxification” an
Specific oral gel → adults with diabetes	Glucose and HbA1c changed in a small add-on trial. [S16]	Verified in human evidence: biomarker finding, not a verified	An observed biomarker does not identify the responsible constituent, receptor or long-
Specific topical products → clinical outcomes	Wound-healing time or symptom scores were studied in particular populations. [S14, S17, S18]	Verified in human evidence: formulation-specific observations	Clinical outcomes do not prove a proposed NF- κ B, collagen or antioxidant mechanism caused
Isolated aloe-emodin → hepatic models	CYP-related metabolism and protein-reactivity pathways are investigated as toxicity mechanisms. [S28, S29]	Supported by preclinical evidence	Do not turn these findings into a quantified human injury risk or a proven interaction for

No automatic arrow from mechanism to benefit. Material identity → achievable exposure → target engagement → clinically meaningful effect → acceptable safety must each be demonstrated. A gap at any arrow remains a gap.

No AI-generated mechanism is offered as established evidence. “Aloe reverses cancer,” “repairs all gut barriers” and “boosts immunity safely” are unsupported clinical generalizations, not conclusions of this map.

6. Pharmacokinetics and pharmacodynamics

Absorption, metabolism and exposure

There is no single pharmacokinetic profile for “aloe.” A large acetylated polysaccharide, an anthrone glycoside and an anthraquinone aglycone differ in chemistry and likely disposition. Human plasma exposure, tissue distribution and elimination of intact acemannan from ordinary gel products are not established by the sources reviewed here.

Material / study	What is supported	What remains unproven
Anthranoid-containing exudate	The EMA assessment describes intestinal activation and metabolism, including anthraquinone-related transformation/conjugation. [S09]	This is not a measured human PK profile for all inner-leaf gel or whole-leaf preparations.
Isolated aloe-emodin	Hepatic metabolism was studied in human/rat microsomes and cellular systems. [S28]	Cellular concentration-response is not a validated oral human exposure–response curve.
Gel or whole-leaf preparation plus vitamins	A small human crossover study measured vitamin C/E time profiles after coadministration. [S20]	It did not measure aloe’s own bioavailability or prove improved health outcomes. Nominal vitamin C exposure differences were not statistically significant.
Processing and matrix	Acetylation and matrix characteristics can change with processing conditions. [S26]	A higher dry-solids ratio, “stabilized” label or delivery claim does not establish greater effective systemic exposure.

Pharmacodynamic interpretation

Concentration-response findings in macrophages or fibroblasts are preclinical pharmacodynamics, not proof that comparable free concentrations reach a human tissue. Target engagement, effect duration and reversibility have not been demonstrated consistently for the commercial materials represented by the word aloe. [S21, S22; translational limitation]

Local topical actions need not require high systemic absorption. Conversely, a change in oral glucose biomarkers does not identify a receptor or prove improved complications, function or survival. Claims involving food effects, lipid enhancement, transporter inhibition or superior new delivery systems require their own preparation-specific human evidence.

Keep four endpoints separate: pharmacokinetic change; biomarker change; patient-important clinical benefit; safety consequences. Success at one does not establish the others.

A missing human PK dataset is reported as an evidence gap, not filled with an assumed half-life, oral absorption percentage or recommended dose.

7. Human evidence: formulation-specific findings

The letter ratings below are educational judgments for this plate, not a reproduction of a formal GRADE assessment. B = moderate human support; C = limited human support. Outcomes, comparators and material identity matter more than the label. No universal “aloe benefit” is inferred.

Skin and oral-mucosal research

Domain /	Intervention and	Duration	Observed endpoint	Appraisal and limitation
Burn healing Second-degree burns; 2024 systematic review of randomized	Topical aloe preparations versus other topicals; 9 trials, 6 contributing healing-time data.	Varied across trials; search through 9 Oct 2022	Pooled healing time: mean difference –3.76 days (95% CI –5.69 to –1.84). Pain and infection differences were not statistically significant.	B–C, outcome-specific. Heterogeneous formulations and controls; do not extrapolate to all burns or wounds. Infection CI was wide; failure to detect a
Acne 60 people with mild-to-moderate	Aloe-containing topical gel plus tretinoin versus vehicle plus tretinoin	8 weeks.	Lesion and tolerability findings favored the tested adjunctive regimen.	C. Combination evidence: not aloe-alone efficacy, not a replacement claim. Vehicle effects and replication remain
Oral lichen planus 54 participants. [S18]	Topical aloe gel versus placebo.	8 weeks.	Clinical response and symptom measures favored aloe in this small trial; complete remission	C. Short follow-up and one small study; no evidence here for long-term disease control or cancer prevention.

Outcome literacy: a shorter recorded healing interval is different from reduced infection, less pain, improved function or avoidance of grafting. A benefit on one endpoint cannot be silently transferred to the others.

Trial concentrations and administration schedules are intentionally not reproduced as instructions. This plate does not select a dressing, assess burn severity, or recommend a product.

Human evidence: metabolic, bowel and oncology contexts

Domain /	Intervention and	Duration	Observed endpoint	Appraisal and limitation
Type 2 diabetes 70 adults on oral glucose-lowering therapy. [S16]	Oral aloe leaf-gel capsules as an add-on versus placebo; not insulin replacement.	2 months.	Lower fasting glucose and HbA1c in the reported trial. No long-term complication endpoint.	C. Small, formulation-specific biomarker study. Background treatment, batch characterization and durability limit generalization.
Active ulcerative colitis 44 evaluable adults with mild-to-moderate activity. [S15]	Oral aloe gel versus placebo.	4 weeks.	Clinical response: 47% versus 14%. Remission: 30% versus 7%, not statistically significant ($P = .09$). Endoscopic/laboratory outcomes did	C. Small and short; response is not remission, maintenance efficacy or established mucosal healing. Not a basis for replacing IBD treatment.
Radiation dermatitis prevention Two breast/chest-wall radiotherapy trials, 194 and	Topical aloe gel versus placebo in one trial and versus no treatment in another.	During radiotherapy; weekly assessments.	No demonstrated prevention advantage for the tested gel regimens.	B–C for this negative formulation-specific finding. Do not omit a negative trial because smaller or differently formulated studies are favorable; do not infer oncology safety for ingestion.

Preclinical and traditional evidence remain separate

A 2026 review of intestinal-barrier and immune hypotheses did not turn the limited clinical bowel evidence into established clinical benefit. Mechanistic interest is substantial; reproducible formulation-specific human outcomes remain the necessary bridge. [S30]

Traditional topical or exudate use belongs in T. Regulatory descriptions belong in R. Neither category upgrades an underpowered clinical trial to high-certainty evidence. The official laxative context is evaluated separately because it concerns dried exudate rather than ordinary gel. [S04, S08]

Not established by this review: universal wound healing, cancer prevention or treatment, “detoxification,” diabetes cure, safe immunostimulation, or reliable replacement of a prescribed therapy. Such statements exceed the retrieved evidence.

8. A–X evidence ladder

A: high-quality human evidence · B: moderate human evidence · C: limited human evidence · D: preclinical · E: mechanistic plausibility · T: traditional/ethnobotanical · R: regulatory/monograph · L: low or indirect · U: unsupported · X: unsafe or prohibited claim. These are categories, not one continuous hierarchy.

Layer	What belongs / strength	Teaching interpretation and limitation	Appropriate educational statement	Overstated or unsafe statement
1. Traditional use	Part-specific historical practice. T [S04, S06, S07]	A documented practice supplies context. Different systems and preparations must be identified	“Gel and exudate have distinct documented use traditions.”	“Ancient use proves aloe is safe and effective for everyone.”
2. Identity and pharmacognosy	Accepted taxonomy; morphology; authenticated material. Direct identity	Identity establishes what is studied, not that it works. A photograph cannot characterize an extract.	“A. barbadensis is a synonym of A. vera; A. ferox is a different species.”	“Every succulent sold as aloe is interchangeable.”
3. Constituent chemistry	Polysaccharide and aloin measurement; defined matrices. Analytical evidence [S23, S24, S27]	Analytical validity is not clinical efficacy. One marker cannot represent the entire material.	“Acemannan-related signals and aloin require different analytical questions.”	“A high polysaccharide result proves clinical potency.”
4. Preclinical mechanisms	Cell/animal signalling, wound and toxicity models. D/E [S21, S22, S28]	The model, stimulus and concentration constrain interpretation. Human exposure is often	“Acemannan altered responses in specific experimental systems.”	“NF-κB activity proves that aloe treats inflammatory disease.”
5. Human biomarkers	Glucose and HbA1c with a specified add-on gel formulation.	A biomarker may be clinically relevant without proving complications or medication-replacement benefit	“A small trial reported glycemic marker changes.”	“Aloe cures diabetes and removes the need for insulin.”

A is not assigned to a broad Aloe vera therapeutic claim in this draft. This does not mean no useful finding exists; it means that broad claims do not inherit the strongest isolated result.

Evidence ladder: outcomes, safety and claims

Layer	What belongs / strength	Teaching interpretation and limitation	Appropriate educational statement	Overstated or unsafe statement
6. Symptoms / function	Specific clinical outcomes, including burn healing and negative radiotherapy findings.	Comparator, route and outcome remain attached to the conclusion. Statistical uncertainty is not universal efficacy.	"Some topical burn studies suggest shorter healing time; not all outcomes improved."	"Aloe is a proven treatment for every wound."
7. Formulation / PK	Process characterization; exploratory human coadministration studies.	Vitamin exposure is not aloe PK; preservation of a marker is not patient benefit.	"Formulation can affect measured composition and exposure-related findings."	"Enhanced absorption guarantees superior outcomes."
8. Safety	Animal hazard, adverse case reports and route-specific monograph cautions.	Hazard identification is not a human incidence estimate. Case reports need careful causality assessment.	"Nondecolorized whole-leaf extract produced clear rat carcinogenicity evidence."	"All aloe causes cancer" or "purified gel has no possible risk."
9. Interactions	Exudate-related electrolyte effects; metabolic hypotheses; biomarker-based caution.	Separate established pharmacologic concern from replicated clinical interaction trials.	"Latex-associated potassium loss can increase concern with cardiac glycosides."	"Every aloe gel is a proven CYP3A4 inhibitor."
10. Regulatory / claims	Product-, route- and jurisdiction-specific documents. R [S06–S11, S31–	A monograph is not global product authorization. Court proceedings require a current status check.	"Regulatory context depends on the preparation and jurisdiction."	"Aloe is FDA-approved for all claims" or "legally banned everywhere."

U identifies unsupported claims; **X** identifies unsafe or prohibited deployment, such as medication replacement. Name the material, evidence, endpoint and uncertainty. Quoting a false claim for educational critique does not authorize its use.

9. Safety: route and material first

Material / risk	Evidence-aligned interpretation
Topical gel	Irritation, burning, itching or contact-type reactions have been reported. Vehicle ingredients and preservatives can also matter. Tolerability in one formulation is not a guarantee for damaged skin, mucosa or every age group. [S05, S07, S19]
Oral latex / dried exudate	Stimulant effects can produce cramps and diarrhea; excessive exposure may disturb fluid and electrolytes. The EMA context is short-term occasional constipation, not daily “cleansing.” [S08, S09]
Oral gel / leaf extracts	Rare acute liver-injury reports create a safety signal. Case reports do not establish incidence, a universally causal constituent, or equal risk across products. Product identity, coexposures and alternative causes matter. [S13]
Nondecolorized whole-leaf extract	NTP’s chronic drinking-water study found clear large-intestinal carcinogenicity evidence in male and female rats; mice did not show carcinogenicity evidence. This tested material must not be equated with all gel products. [S12]
Decolorized whole leaf / low-aloin gel	Removal or reduction of markers changes the material. It does not by itself establish comprehensive long-term human safety. A quality threshold is not a clinical guarantee. [S03, S06]

Hazard, risk and uncertainty

IARC’s possible-carcinogen classification concerns the assessed whole-leaf extract context; it is hazard identification, not an estimate of an individual’s cancer probability. Conversely, absence of long-term human data cannot be presented as proof that a low-aloin product is harmless. [S03]

Short trials reporting few adverse events cannot exclude uncommon, delayed or interaction-related harms. A plausible toxicity pathway for isolated aloe-emodin may help generate research questions, but it does not identify the cause of every reported aloe-associated hepatitis case. [S13, S28, S29]

This review does not establish aloe-specific clinical bleeding, gallstone, iron-depletion or essential-oil risks as a class. An aloe-specific warning requires its own evidence. Where evidence is missing, the correct label is uncertainty rather than an invented contraindication.

High-risk populations and review boundaries

The following are education-only flags for qualified clinician and pharmacist review. The table distinguishes an official caution from precaution driven by vulnerability or an evidence gap; it does not decide whether any individual should use aloe.

Population / context	Why the question requires review	Evidence basis
Pregnancy and breastfeeding	Oral exposure cannot be treated as routinely safe; the exact preparation and route matter.	Official oral safety/label cautions. [S05, S06, S08]
Pediatrics	Adult trials do not establish child safety. A topical monograph's defined age scope must not be extrapolated to ingestion.	Route-specific official context plus evidence gap. [S07, S08]
Frailty / older adults / kidney disease	Diarrhea, volume loss, altered electrolytes and multiple medicines may be more consequential.	Exudate pharmacology and vulnerability-based inference. [S08, S09]
Obstruction, unexplained bowel symptoms, active bowel disease	Laxative-exudate hazards differ from experimental oral-gel research in bowel disease.	Monograph caution; clinical evidence does not neutralize it. [S08, S15]
Cardiac disease / rhythm vulnerability	Potassium depletion can affect risk with cardiac glycosides and antiarrhythmics.	Official interaction concern for exudate-related loss. [S08]
Diabetes / glucose-lowering medicines	A biomarker signal raises an additive-effect question; formulation and monitoring context matter.	Small human study and oral monograph caution. [S06, S16]
Liver disease / prior supplement injury	Rare reported injury warrants careful product and causality review.	Pharmacovigilance case signal, not a measured incidence. [S13]
Oncology / transplantation / polypharmacy	Consequences of an unrecognized interaction or contamination may be substantial; disease-treatment substitution is unsafe.	Precaution and evidence gap; preclinical metabolism is not a clinical interaction map. [S28]
Surgery / hypotension / dehydration risk	Perioperative intake, fluid balance and product disclosure need professional context.	Precautionary inference; no universal aloe stop interval or proven class-wide bleeding effect is supplied.

Gallbladder disease, bleeding disorders or iron deficiency are not labeled aloe-specific contraindications on the evidence reviewed. Such conditions may still make any proposed supplement question clinically complex. Do not manufacture an aloe mechanism to justify that general complexity.

10. Interaction considerations

Medicine / product	Proposed mechanism	Evidence type /	Clinical uncertainty	Educational safety
Digoxin / cardiac glycosides; selected antiarrhythmics	Exudate-associated potassium loss can alter susceptibility to toxicity	R: official pharmacologic warning. [S08]	Not a quantified interaction trial for every aloe	Treat the exact material, bowel effects and electrolyte context as
Potassium-depleting diuretics, systemic	Additive potassium depletion if diarrhea/exudate effects occur.	R/L: monograph concern. [S08, S09]	Magnitude depends on exposure and coexisting factors.	Do not assume a decolorized beverage and latex share equal risk.
Glucose-lowering medicines	Potential additive glucose effect with the studied oral gel	C/L: human biomarker finding; interaction	Replicated clinically important interaction outcomes were not	Do not propose medication reduction. Clinician/pharmacist interpretation
CYP3A4 substrates / inhibitors; immunosuppressan	Isolated aloe-emodin metabolism suggests a research question, not	D: microsomes and cells. [S28]	No reliable product-wide interaction magnitude or	Avoid declaring all aloe a CYP blocker. High-consequence medicines
Other laxatives; products affecting hydration	Potential additive diarrhea/fluid loss.	L/R: pharmacodynamic inference from	Preparation and exposure determine relevance.	Ingredient reconciliation matters; “herbal cleanse” combinations are not
Oncology or potentially hepatotoxic	Overlapping injury signals or uncharacterized	L: precaution; aloe injury cases do not prove pairwise	No general safe-combination list is supported.	Independent professional review; never use aloe to replace or modify oncology
Anticoagulants, antiplatelets, blood-pressure drugs, iron	No reproducible class-wide aloe interaction was verified in this review.	Evidence gap; not proof of absence.	Evidence for another botanical or isolated compound does not establish an aloe	Evaluate the specific product and medicine. Avoid invented bleeding, CYP or iron-absorption

Evidence hierarchy: a database warning, a theoretical mechanism, a case report, a measured pharmacokinetic interaction and a demonstrated clinical interaction are not equivalent. This table does not establish any combination as safe or unsafe for a particular person.

11. Quality, stability and supply-chain literacy

Quality question	Useful evidence or method	Limit of interpretation
Is it the right species and part?	Voucher-linked supply chain, material description, manufacturing records and orthogonal fingerprints. [S01–S03]	An “Aloe vera” label alone does not verify identity or tissue fraction.
Was exudate contamination controlled?	Aloin A/B assay with a matrix-suitable validated method; document quantitation limit and batch result. [S23]	“Not detected” means below the stated method limit, not chemically zero.
What happened to polysaccharides?	NMR acetylated-polysaccharide assessment plus composition/process records. [S24, S25]	Total carbohydrate or gel percentage does not establish acemannan identity, molecular integrity or clinical efficacy.
Are carriers or other ingredients disclosed?	Full formulation, mass-balance/context and appropriate fingerprinting; assess sugars, preservatives or carriers. [S25]	Maltodextrin/dextrin can be an excipient. Its presence is not fraud unless undeclared or inconsistent with the specification.
Are contaminants controlled?	Risk-based microbial, elemental, pesticide and relevant solvent tests; supplier qualification and manufacturing controls. [S06]	These are quality expectations, not a claim that all aloe is contaminated. A certificate must match the batch and method.
Is stability demonstrated?	Validated packaging, storage and in-use conditions with microbial and chemical specifications over time. Processing may change polysaccharide features. [S26]	Do not invent a universal shelf life, temperature limit or superiority of one drying method.

Reading a certificate of analysis

Ask whether the document names the tested batch, material, units, analytical method, detection/quantitation limit, acceptance criterion, test date and accountable laboratory. Confirm that an ingredient-level certificate actually represents the finished product. A passing selected marker cannot certify every contaminant, all clinical claims or long-term safety.

Traceable cultivated supply, harvest/processing records, transport conditions and evidence behind environmental claims are relevant procurement questions. No quantitative sustainability advantage, current market share, or species-specific trade exemption is asserted here; those were not independently verified.

The practical quality question is not “Is aloe standardized?” but “Standardized to which analyte, by which method, in which material, for which purpose?”

12. Regulatory and monograph context

Jurisdiction / document	Verified scope	What it does not establish
Canada: Aloe Vera — Leaf Gel, Oral 28 March 2025. [S06]	Natural health product licence/label guidance for the specified oral leaf-gel material. Includes antioxidant and herbal demulcent contexts. Finished-product hydroxyanthracene	Not a comprehensive clinical review, a universal safe-exposure level or approval of every aloe beverage. The numerical specification is a quality limit, not a dosing recommendation.
Canada: Aloe — Aloe Vera, Topical 29 August 2025. [S07]	Fresh leaf-gel topical monograph with herbal-use contexts for minor burns, wounds and irritation; defined route/population and	Not proof that every topical product has equivalent efficacy, or authorization to extend claims to oral use or serious wounds.
European Union: EMA/HMPC Monograph and assessment, 22 November 2016; safety	Dried exudate/leaf juice of specified aloe sources; short-term occasional constipation context. The assessment explicitly distinguishes inner gel.	Not an inner-leaf-gel efficacy monograph. Current national product authorizations and food-law status need separate verification.
United States: FDA final rule 9 May 2002; effective 5	Aloe stimulant-laxative ingredients were removed from the OTC monograph framework because adequate safety/	Not a blanket ban on aloe and not approval of supplements, cosmetics or alternative indications.
WHO / pharmacopoeial context WHO volume 1, 1999.	Historical separate monographs for Aloe and Aloe Vera Gel. EMA's assessment refers to Barbados and Cape aloes pharmacopoeial	Current USP, European Pharmacopoeia and AHP full texts/editions were not independently verified. Do not label this draft pharmacopoeia-
EU food-law litigation T-189/21, 13 November 2024; appeal C-38/25 P lodged 22 January 2025.	Annulment concerning the Aloe-leaf preparation entry in Regulation 2021/468 and a subsequent Commission appeal are documented.	Final appellate disposition and the current product-specific legal position were not established in this review. Do not publish an unqualified "EU aloe ban" or permission claim.

R means regulatory context, not clinical certainty. Legal status depends on the material, product, route, claim and jurisdiction. This is claims literacy, not legal advice.

13. Claims literacy and applied scenario

Claim type / problematic wording	Evidence-aligned educational rewrite
Educational description	"The inner gel and the anthranoid-rich exudate are compositionally distinct materials." [S03, S09]
Traditional-use claim	"Specified gel preparations have a documented herbal-use context for minor skin complaints." Keep the preparation and tradition visible. [S07]
Structure/function-style language: "supports digestion"	A general phrase is not automatically compliant or substantiated. U.S. supplement structure/function claims have specific requirements and cannot be disease claims in disguise. [S31]
Disease claim: "Aloe cures diabetes or colitis"	"Small formulation-specific trials examined glycemic markers or short-term bowel-disease outcomes; cure or treatment replacement was not established." [S15, S16]
Superiority claim: "More acemannan guarantees better healing"	"An analytical difference alone does not demonstrate superior patient outcomes." [S24; inference]
Unsafe claim: "Natural, cancer-preventing and safe for everyone"	"Safety depends on route, material, exposure and context; broad cancer-prevention and universal-safety claims are not supported." [S12, S13]

Applied postgraduate learning scenario

A fictional label reads: **"Aloe vera whole-leaf gel, decolorized, 200× concentrate, 30% polysaccharides. Clinically proven to repair the gut, eliminate inflammation and replace glucose medication."** Its certificate lists only total polysaccharide and microbial count. A cited paper reports a macrophage response to isolated acemannan.

Appraisal: identify the ambiguous whole-leaf/gel description; request the reconstitution basis, carrier, residual aloin method and batch value. Classify the cited experiment as D, not a clinical outcome. Total polysaccharide does not authenticate acemannan. Decolorization does not supply the missing clinical evidence.

Conservative rewrite: "This product contains a processed aloe preparation. Experimental studies of isolated aloe polysaccharides do not establish that this finished product repairs intestinal disease or replaces medication." The case requires quality clarification and clinician/pharmacist review of any medicine-related question, not a treatment recommendation.

Learner task: state which additional product, source and safety records would change your confidence—and which unsupported claims remain unacceptable even after a satisfactory certificate.

14. Knowledge check with answer rationales

Questions 1–2: material identity and outcome appraisal

1. Which result can be transferred across materials?

Objective: preserve material identity. **Difficulty:** advanced application. A two-year rat study used nondecolorized whole-leaf extract. Which conclusion is most defensible?

- A. Every topical aloe gel causes human intestinal cancer.
- B. The study identifies a hazard for the tested material; comparison with other preparations requires composition and exposure data.
- C. Carbon treatment guarantees the absence of every long-term risk.
- D. Any product labelled “natural aloe” is equivalent to the tested extract.

Correct answer: B. The inference remains attached to the tested material and model. NTP reported rat carcinogenicity evidence, not a human incidence estimate or a comparison of every marketed gel. [S12]

Distractors: A changes both material and species without a bridge. C converts processing into an unsupported universal safety guarantee. D replaces chemistry and exposure characterization with a marketing category.

Evidence: D/R safety context. **Safety/claims note:** neither blanket reassurance nor blanket cancer prediction follows from the experiment.

2. How should a nonsignificant infection result be read?

Objective: interpret uncertainty across endpoints. **Difficulty:** advanced appraisal. A burn meta-analysis reports an infection risk ratio of 1.10 with a 95% confidence interval of 0.34–3.59. Which wording is best?

- A. Aloe is conclusively infection-preventing.
- B. Aloe and comparator have proven identical infection risk.
- C. No statistically significant difference was detected; clinically important differences remain compatible with the interval.
- D. A healing-time benefit proves an infection benefit.

Correct answer: C. The interval is imprecise and includes materially different effects. Statistical nonsignificance is not equivalence or a prespecified noninferiority result. [S14]

Distractors: A claims an effect not demonstrated. B confuses failure to reject a difference with proof of equality. D transfers an outcome to a different endpoint.

Evidence: B–C, endpoint-specific educational rating. **Safety/claims note:** avoid “no increased infection risk” as a conclusive safety guarantee.

Questions 3–4: pharmacokinetics and regulatory scope

3. What does a vitamin coadministration study establish?

Objective: distinguish pharmacokinetics from benefit. **Difficulty:** advanced application. A small crossover study measured vitamin C/E profiles with aloe preparations. Which inference is supported?

- A. Aloe's own systemic half-life is established.
- B. Every drug is absorbed better with aloe.
- C. A measured vitamin profile establishes superior health outcomes.
- D. The findings concern the measured vitamins and tested coadministration conditions; they do not establish aloe PK or clinical benefit.

Correct answer: D. The analyte and study endpoint define the evidence. A nominal exposure difference must also be distinguished from a statistically supported difference. [S20]

Distractors: A substitutes aloe for the measured analyte. B extrapolates across unrelated drugs and mechanisms. C confuses exposure with patient-important outcomes.

Evidence: C/L, exploratory human exposure evidence. **Safety/claims note:** do not use the study to recommend altering medicine administration.

4. What is the scope of the EMA aloe monograph?

Objective: interpret a monograph's material and claim boundaries. **Difficulty:** intermediate-to-advanced. Which statement correctly interprets the verified EMA documents?

- A. The dried exudate/leaf-juice material has a short-term occasional-constipation context; this does not make inner gel the same medicine.
- B. Any product with the word aloe is approved for inflammatory bowel disease.
- C. A monograph authorizes the same claim in every jurisdiction.
- D. "Dried juice" necessarily means freeze-dried inner-leaf gel.

Correct answer: A. Official scope is linked to specified botanical sources and dried exudate, distinct from gel. [S08, S09]

Distractors: B invents an indication. C ignores jurisdiction and product authorization. D erases a crucial pharmacognostic distinction.

Evidence: R. **Safety/claims note:** regulatory context is not a patient-specific recommendation or a transferable global marketing permission.

Scoring guidance: one point for each correct option plus one point for a rationale that names the mistaken inference. These are teaching criteria, not a validated competency examination.

Questions 5–6: short-answer evidence appraisal

5. Is an adjunctive acne result aloe-alone evidence?

Objective: identify what a comparator can isolate. **Difficulty:** advanced. A trial compares aloe gel plus tretinoin with vehicle plus tretinoin. Write a two-sentence conclusion and name three limitations that matter before applying it to a different aloe product.

Model answer: The study can inform the incremental effect of the tested aloe-containing formulation when used with tretinoin under the study conditions. It cannot establish aloe monotherapy or justify replacing tretinoin. Relevant limitations include the finished formulation/vehicle, sample and duration, co-treatment context, replication and product comparability. [S17]

Rationale: both arms share tretinoin, so attribution depends on the between-arm difference and the formulation. An adjunctive signal cannot be recast as a stand-alone treatment effect.

Scoring: award credit for the adjunctive distinction, an appropriately qualified conclusion, and three relevant limitations. Do not award full credit for a conclusion recommending treatment.

Evidence: C. **Safety/claims note:** no medication substitution follows. **Distractors:** not applicable to a constructed-response item.

6. Does a favourable response establish remission?

Objective: separate endpoints and statistical evidence. **Difficulty:** advanced. In the small ulcerative-colitis trial, response favoured aloe, while the remission comparison had $P = .09$. What should an abstract-to-marketing review reject, and what additional information should a reviewer seek?

Model answer: Reject “proven remission,” “heals the bowel” and “replaces IBD medication.” Review exact endpoint definitions, analysis populations, missing data, effect sizes and intervals, endoscopy/histology results, background treatment, adverse events, product characterization and longer-term replication. [S15]

Rationale: response and remission are not synonyms. A small exploratory result may justify additional study without supporting a durable disease-control claim. A nonsignificant result does not prove no effect, but it also does not establish the claimed effect.

Scoring: credit endpoint separation, restraint about both positive and negative inference, and a research plan covering design, material and outcomes.

Evidence: C. **Safety/claims note:** disease-treatment decisions remain outside this educational task. **Distractors:** not applicable.

Questions 7–8: mechanism, safety and claims

7. Interpret the mechanism map

Objective: identify a missing translational bridge. **Difficulty:** advanced synthesis. A slide shows: acemannan → increased macrophage nitric oxide → “immune enhancement” → fewer human infections. Mark each arrow as demonstrated, hypothesized or unsupported, and explain what evidence is missing.

Model answer: a response in the specified stimulated macrophage model is a demonstrated experimental observation. “Immune enhancement” is an imprecise interpretation, not a validated clinical endpoint. Fewer human infections is unsupported by that experiment. Missing links include material comparability, achievable exposure, human target engagement, controlled infection outcomes and safety. [S21]

Rationale: a model-specific increase in a signalling product does not establish a universally desirable immune effect. More activity is not necessarily better activity.

Evidence: D for the experiment; E or U for untested bridges. **Safety/claims note:** avoid immunostimulation claims in oncology/transplant contexts without appropriate evidence and review. **Distractors:** not applicable.

8. Correct a safety-and-claims failure

Objective: integrate assay limits, interactions and claims boundaries. **Difficulty:** advanced synthesis. A fictional “aloe cleanse” capsule lists leaf extract but not the fraction. A certificate says “aloin: not detected” without a quantitation limit. Marketing says it can safely replace glucose medicine and is compatible with digoxin. Give an education-only reviewer response.

Model answer: the material and analytical claim are not adequately characterized. Request the plant part, processing, finished-product batch, method and quantitation limit. Reject the replacement and compatibility claims. Review exudate-related electrolyte concerns and the difference between a glycemic biomarker signal and a proven medication interaction; these questions require qualified clinician/pharmacist review. [S08, S16, S23]

Rationale: an undefined negative test cannot certify zero exposure, all constituents or safe drug combinations. A quality document cannot authorize unsupported treatment instructions.

Evidence: R/L interaction concern; analytical evidence for testing; X for medication-replacement deployment. **Safety/claims note:** do not recommend dosing or medication changes. **Distractors:** not applicable.

Learning completion does not establish clinical competence, accreditation or permission to prescribe. These questions support evidence literacy and require faculty judgment when used for assessment.

15. Claim-to-source verification ledger

Keys resolve to the exact named records in section 16. VERIFIED means the cited source supports the limited wording shown; it is not a claim of independent expert approval. Date/version and access limits remain attached to each source.

Material claim	Exact source key	Source type	Date /	Level	Population / model	Finding supported	Important limitation	Claim status
Accepted name / family	S01 Kew; S02 FNA	Taxonomy / flora	Live; 2002	ID	Species record / descriptive flora	A. vera (L.) Burm.f.; current family Asphodelaceae;	Old floras may use older family/origin concepts; current Kew record	VERIFIED
Gel and exudate are distinct	S03 IARC; S09 EMA assessment	Official assessment	2016	R	Leaf / processed materials	Different tissue fractions and anthranoid	A product's actual fraction is not established by its	VERIFIED
Separate historical use contexts	S04 WHO; S06–S07 HC	Monographs	1999; 2025	T/R	Defined materials	Separate gel/ exudate contexts; part-specific	Not a primary-text review of every traditional medical	TRADITIONAL USE
Aloin A/B can be quantified	S23 Brown et al.; DOI in references	Analytical validation	2014	Anal.	Specified matrices	Validated HPLC assay in tested raw/finished	Transfer to another matrix needs suitability	VERIFIED
NMR / processing literacy	S24 Davis; S25 Monakhova; S26	Analytical / process studies	2009 – 2019	Anal.	Formulations / gel blends	Acetylated-polysaccharide and matrix	No universal assay-to-efficacy correlation or shelf life	VERIFIED
Acemannan mechanism	S21 Ramamoorthy; S22 Jettana-	Primary experiments	1996; 2009	D	Murine cells; fibroblasts / rats	Specific immune and repair-related model responses.	Human clinical target engagement not established.	VERIFIED

Status legend: ID = direct identity evidence; Anal. = analytical evidence rather than a therapeutic ladder rank. “Reasonable inference” is deliberately distinct from a directly measured endpoint.

Claim-to-source ledger: human outcomes

Material claim	Exact source key	Source type	Date /	Level	Population / model	Finding supported	Important limitation	Claim status
Topical burn healing signal	S14 Huang et al.; PMID 38605441	Systematic review	2024	B–C	Burn RCTs	Shorter pooled healing time in studied topical comparisons.	Endpoint-specific; heterogeneous preparations; infection	VERIFIED
Acne adjunctive finding	S17 Hajheydari et al.; PMID 23305716	Randomized trial	2014	C	60 acne participants	Tested combination differed from	Not aloe monotherapy or product-wide	VERIFIED
Oral lichen planus response	S18 Choonhakarn et al.; PMID 21112112	Randomized trial	2008	C	54 participants	Short-term gel/ placebo clinical response finding.	Small, short; no long-term disease or cancer	VERIFIED
Diabetes biomarker finding	S16 Huseini et al.; JMP 11(43)	Randomized trial	2012	C	70 adults	Glycemic markers in an add-on oral-gel trial.	No replacement, complications or long-term safety	VERIFIED
Ulcerative-colitis response	S15 Langmead et al.; PMID 15303511	Randomized trial	2004	C	44 evaluable adults	Response signal; remission comparison not	Short, small; endpoint distinctions	VERIFIED
Radiation skin prevention	S19 Williams et al.; PMID 8892458	Two controlled trials	1996	B–C	194 and 108 participants	No prevention benefit for tested gel regimens.	Not proof that all possible formulations have	VERIFIED
Vitamin study is not aloe PK	S20 Vinson et al.; PMID 16323295	Crossover study	2005	C/L	Small adult samples	Measured vitamin exposure profiles with	Not aloe disposition or clinical benefit;	VERIFIED

Claim-to-source ledger: safety and claims

Material claim	Exact source key	Source type	Date /	Level	Population / model	Finding supported	Important limitation	Claim status
Material-specific chronic hazard	S12 NTP TR577; S03 IARC108	Animal / hazard assessment	2013; 2016	D/R	Rats and mice; assessed extract	Rat intestinal carcinogenicity for nondecolorized whole-leaf extract.	No human incidence estimate or all-gel equivalence.	VERIFIED
Rare oral injury signal	S13 LiverTox Aloe Vera	Case-based review	24 May 2022	L	Reported human liver injury	A safety signal associated with oral aloe products.	Composition, alternative causes and frequency	PARTIALLY VERIFIED
Aloe-emodin toxicity mechanisms	S28 Hu; S29 Dong	Primary laboratory studies	2022; 2026	D	Microsomes, cells / mice	Metabolic and reactive-protein hypotheses.	Not a proven clinical interaction or gel-wide causal	MECHANISTIC HYPOTHESIS
Barrier mechanism ≠ IBD efficacy	S30 Gong et al.; PMID 42575330	Research review	10 Aug 2026	D/L	Mainly preclinical literature	Mechanistic interest; clinical translation remains	Review does not substitute for controlled human	VERIFIED
Exudate electrolyte	S08–S10 EMA	Official assessment	2016; 2022	R/L	Dried exudate	Potassium-loss concern with	Not a measured risk for every gel	VERIFIED
Canadian quality/label scope; US OTC	S06–S07 HC; S11 FDA final rule	Official documents	2025; 2002	R	Specified regulatory materials	Defined monograph and rule scope.	Not blanket efficacy, safety or global authorization.	VERIFIED
Current EU final legal position	S32 T-189/21; S33 C-38/25	Court / appeal notice	2024; 2025	R	Aloe-related food-law entry	Annulment and subsequent appeal verified.	Final appellate disposition/product legality not	PARTIALLY VERIFIED
Medication replacement / universal	S14–S16; S31 FDA; source limits	Claim appraisal	Review 2026	U/X	Proposed broad claims	No retrieved source supports the proposed	No recommendation or marketing	PROHIBITED CLINICAL CLAIM

16. References and retrievable source basis

Numbered keys are used throughout. Source titles are linked to official or primary records; DOI, PMID, document number or other identifiers remain visible for print use. Retrieval cut-off: 10 September 2026.

[S01] [Royal Botanic Gardens, Kew. Aloe vera \(L.\) Burm.f. Plants of the World Online.](#)

Live taxonomic record; consulted 10 Sep 2026.

Accepted name, synonymy and native-range record; older descriptive excerpts were not used to override current taxonomy.

[S02] [Flora of North America Editorial Committee. Aloe vera. Flora of North America North of Mexico, volume 26.](#)

2002; eFloras species account.

Morphological description; historical family and origin statements are not treated as current taxonomy.

[S03] [IARC Working Group. Aloe vera. In: Some Drugs and Herbal Products. IARC Monographs, volume 108.](#)

2016. NCBI Bookshelf NBK350431.

Official exposure/hazard assessment; material-specific interpretation, not individual risk prediction.

[S04] [World Health Organization. WHO Monographs on Selected Medicinal Plants, volume 1. Entries: Aloe; Aloe Vera Gel.](#)

1999. ISBN 92-4-154517-8.

Historical separate-entry context verified from indexed records; full monograph access was incomplete in this review.

[S05] [National Center for Complementary and Integrative Health. Aloe Vera.](#)

Content updated February 2025; consulted 10 Sep 2026.

Public-domain federal overview. For species-specific animal carcinogenicity, the primary NTP report takes precedence over overview wording.

[S06] [Health Canada. Natural Health Product: Aloe Vera — Leaf Gel, Oral.](#)

28 March 2025.

Official licence-application/label guidance; relevant PDF pages and specification text inspected.

[S07] [Health Canada. Natural Health Product: Aloe — Aloe Vera, Topical.](#)

29 August 2025.

Official topical monograph; source-material and use-context pages visually inspected.

[S08] [European Medicines Agency/HMPC. European Union herbal monograph on Aloe barbadensis Mill. and on Aloe \(various species, mainly Aloe ferox Mill. and its hybrids\), folii succus siccatus.](#)

22 November 2016. EMA/HMPC/625788/2015.

Official indexed passages consulted; complete PDF retrieval was not consistently available.

[S09] [European Medicines Agency/HMPC. Assessment report on Aloe barbadensis Mill. and on Aloe \(various species, mainly Aloe ferox Mill. and its hybrids\), folii succus siccatus.](#)

22 November 2016. EMA/HMPC/759585/2015.

Official indexed passages; exudate pharmacology and explicit exclusion of inner gel. No dosing protocol reproduced.

References 10–18

[S10] [European Medicines Agency/HMPC. Addendum to assessment report on Aloe barbadensis Mill. and Aloe \(various species, mainly Aloe ferox Mill. and its hybrids\), folii succus siccatus.](#)

26 January 2022. EMA/HMPC/2199/2022.

Safety-review context; no unverified checklist outcome or new authorization inferred.

[S11] [U.S. Food and Drug Administration. Status of Certain Additional Over-the-Counter Drug Category II and III Active Ingredients. Final rule.](#)

9 May 2002. 67 FR 31125–31127; effective 5 November 2002.

Official rule text; restricted interpretation to the aloe stimulant-laxative OTC framework.

[S12] [National Toxicology Program. Toxicology and Carcinogenesis Studies of a Nondecolorized Whole Leaf Extract of Aloe barbadensis Miller in F344/N Rats and B6C3F1 Mice \(Drinking Water Studies\).](#)

August 2013. NTP Technical Report 577.

Official report/abstract; corrected material descriptor “nondecolorized” retained.

[S13] [National Institute of Diabetes and Digestive and Kidney Diseases. Aloe Vera. LiverTox: Clinical and Research Information on Drug-Induced Liver Injury.](#)

Updated 24 May 2022. NCBI Bookshelf NBK548634.

Case-based safety assessment; neither incidence nor product-wide causal equivalence established.

[S14] [Huang YN, Chen KC, Wang JH, Lin YK. Effects of Aloe vera on Burn Injuries: A Systematic Review and Meta-Analysis of Randomized Controlled Trials.](#)

J Burn Care Res. 2024;45(6):1536–1545. DOI: 10.1093/jbcr/irae061. PMID: 38605441.

Publisher/PubMed abstract; numerical endpoints verified. Full outcome-specific GRADE tables not reproduced.

[S15] [Langmead L, et al. Randomized, double-blind, placebo-controlled trial of oral aloe vera gel for active ulcerative colitis.](#)

Aliment Pharmacol Ther. 2004;19(7):739–747. DOI: 10.1111/j.1365-2036.2004.01902.x. PMID: 15043514.

Indexed trial report/abstract; response and remission kept separate.

[S16] [Fallah Huseini H, et al. Aloe vera Leaf Gel in Treatment of Advanced Type 2 Diabetes Mellitus Needing Insulin Therapy: A Randomized Double-Blind Placebo-Controlled Clinical Trial.](#)

Journal of Medicinal Plants. 2012;11(43):19–27.

WHO EMRO-hosted journal report of the 70-participant advanced-diabetes trial.

[S17] [Hajheydari Z, et al. Effect of Aloe vera topical gel combined with tretinoin in treatment of mild and moderate acne vulgaris: a randomized, double-blind, prospective trial.](#)

J Dermatolog Treat. 2014;25(2):123–129. DOI: 10.3109/09546634.2013.768328. PMID: 23336746.

Indexed abstract; publication year distinguished from online-first 2013.

[S18] [Choonhakarn C, et al. The efficacy of aloe vera gel in the treatment of oral lichen planus: a randomized controlled trial.](#)

Br J Dermatol. 2008;158(3):573–577. PMID: 18093246.

Publisher/PubMed record; short-term topical oral-mucosal study.

References 19–26

- [S19] [Williams MS, et al. Phase III double-blind evaluation of an aloe vera gel as a prophylactic agent for radiation-induced skin toxicity.](#)
Int J Radiat Oncol Biol Phys. 1996;36(2):345–349. DOI: 10.1016/S0360-3016(96)00320-3. PMID: 8892458.
Research repository/indexed trial abstract; two trial populations and negative prevention result retained.
- [S20] [Vinson JA, et al. Effect of Aloe vera preparations on the human bioavailability of vitamins C and E.](#)
Phytomedicine. 2005;12(10):760–765. DOI: 10.1016/j.phymed.2003.12.013. PMID: 16323295.
Small crossover study; vitamin analytes, not aloe pharmacokinetics.
- [S21] [Ramamoorthy L, Kemp MC, Tizard IR. Acemannan, a beta-\(1,4\)-acetylated mannan, induces nitric oxide production in macrophage cell line RAW264.7.](#)
Mol Pharmacol. 1996;50(4):878–884. PMID: 8863833.
Primary model study; stimulation context retained.
- [S22] [Jettanacheawchankit S, et al. Acemannan stimulates gingival fibroblast proliferation; expressions of keratinocyte growth factor-1, vascular endothelial growth factor, and type I collagen; and wound healing.](#)
J Pharmacol Sci. 2009;109(4):525–531. DOI: 10.1254/jphs.08204fp. PMID: 19372635.
Cell/animal work; not a human clinical trial.
- [S23] [Brown PN, et al. Determination of Aloin A and Aloin B in Aloe vera Raw Materials and Finished Products by High-Performance Liquid Chromatography: Single-Laboratory Validation.](#)
J AOAC Int. 2014;97(5):1323–1328. DOI: 10.5740/jaoacint.13-028. PMID: 25902982.
Analytical validation; not therapeutic standardization.
- [S24] [Davis B, Goux WJ. Single-Laboratory Validation of an NMR Method for the Determination of Aloe Vera Polysaccharide in Pharmaceutical Formulations.](#)
J AOAC Int. 2009;92(6):1607–1616. DOI: 10.1093/jaoac/92.6.1607.
Publisher record; acetylated-polysaccharide measurement in tested formulations.
- [S25] [Monakhova YB, Randel G, Diehl BWK. Automated Control of the Organic and Inorganic Composition of Aloe vera Extracts Using ¹H NMR Spectroscopy.](#)
J AOAC Int. 2016;99(5):1213–1218. DOI: 10.5740/jaoacint.16-0020.
Compositional fingerprinting; no commercial adulteration prevalence inferred.
- [S26] [Rodríguez-Rodríguez, et al. Effects of UV-C irradiation and traditional thermal processing on acemannan contained in Aloe vera gel blends.](#)
Carbohydr Polym. 2019;222:114998. DOI: 10.1016/j.carbpol.2019.114998. PMID: 31320065.
Processing study in gel blends; no universal shelf-life extrapolation.

References 27–34

[S27] [Compositional and Structural Features of the Main Bioactive Polysaccharides Present in the Aloe vera Plant.](#)

J AOAC Int. 2018;101(6):1711–1719. DOI: 10.5740/jaoacint.18-0119. PMID: 29895349.

Structural/compositional research record; storage and cell-wall polysaccharides distinguished.

[S28] [Hu, et al. Inhibition of CYP3A4 enhances aloe-emodin induced hepatocyte injury.](#)

Toxicol In Vitro. 2022. DOI: 10.1016/j.tiv.2021.105276. PMID: 34875353; online 4 December 2021.

Primary microsomal/cellular study; not a demonstrated gel–drug clinical interaction.

[S29] [Dong, et al. The Binding Ability of Aloe-Emodin to Free L-Cysteine on Hepatic Protein-Induced Hepatocyte Toxicity.](#)

Phytochem Anal. Online 14 July 2026. DOI: 10.1002/pca.70083. PMID: 42444304.

Online-first laboratory record; isolated-constituent mechanisms only.

[S30] [Gong, et al. The Aloe vera polysaccharides in inflammatory bowel disease: An ethnopharmacological review on the mechanisms of intestinal barrier repair and immunomodulation.](#)

J Ethnopharmacol. Online 10 August 2026;122286. DOI: 10.1016/j.jep.2026.122286. PMID: 42575330.

Recent review abstract; preclinical hypotheses do not close clinical evidence gaps.

[S31] [U.S. Food and Drug Administration. Structure/Function Claims.](#)

Content date 28 March 2024; consulted 10 Sep 2026.

Official U.S. claims framework; not approval of any aloe wording or product.

[S32] [General Court of the European Union. Judgment in case T-189/21.](#)

13 November 2024. ECLI:EU:T:2024:802; Official Journal notice C/2025/158.

Annulment concerning the specified Aloe-leaf entry; later procedural status must be checked.

[S33] [Court of Justice of the European Union. Appeal brought by the European Commission in case C-38/25 P.](#)

Appeal lodged 22 January 2025. Official Journal C/2025/1414, 10 March 2025.

Appeal notice verified; no final appellate disposition asserted.

[S34] [An Optimized Methodology to Observe Internal Microstructures of Aloe vera by Cryo-Scanning Electron Microscope.](#)

Applied Microscopy. 2016;46(2):76–82.

Primary microscopy record; used only to illustrate hydrated-tissue preparation artifacts.

17. Evidence, Safety, and Claims Review

1. Evidence strength

Human: selected topical outcomes show signals, but formulation, endpoint and comparator matter; negative findings are included. **Preclinical:** immune, repair and toxicity pathways are experimentally interesting but incompletely translated. **Traditional:** documented gel and exudate use is distinct from clinical substantiation. **Regulatory:** monographs and rules provide preparation-specific context, not a global endorsement. [S04, S08, S14, S19, S21, S22]

2. Main evidence limitations

Important limits include small or short studies, variable formulations and comparators, incomplete blinding, uncertain publication bias and uneven reporting of chemical identity. Biomarkers do not establish patient-important benefit. Human PK, target engagement and longer-term safety cannot be assumed from laboratory concentrations or processing claims.

This was a targeted review, not an exhaustive systematic search or independent re-analysis. Some research was available as indexed abstracts only. WHO/EMA full-text retrieval was incomplete. No correction or retraction notice was observed in the consulted records; a comprehensive update and full-text verification remain requirements for authorized review. The B–C ratings are educational judgments, not formal GRADE results.

3. Safety considerations

Preparation and route are central. Dermal reactions, exudate-related fluid/electrolyte effects, rare reported oral liver injury and material-specific chronic animal hazards should not be collapsed into a single “safe” or “unsafe” plant label. Batch quality and background exposures remain important sources of uncertainty. [S05, S08, S12, S13]

4. High-risk population cautions

Pregnancy/breastfeeding, children, frail older adults, renal or hepatic disease, gastrointestinal obstruction or active bowel disease, rhythm vulnerability, diabetes, surgery, oncology, transplantation and polypharmacy warrant qualified review. Some flags reflect official cautions; others are vulnerability-based precautions rather than proven aloe-specific effects.

5. Interaction considerations

Distinguish exudate-associated potassium-loss concerns from biomarker-based additive-effect hypotheses and isolated-compound laboratory metabolism. This document does not provide a validated safe-combination list, a medication-adjustment plan, or a universal perioperative stop interval. [S08, S16, S28]

6. Regulatory and claims caution

Permitted claims and legal status are product- and jurisdiction-specific. Current EU litigation status remains an identified review gap. “Natural,” “decolorized,” “standardized” or “clinically studied” does not independently authorize a disease claim. [S31–S33]

Evidence, Safety, and Claims Review — conclusion

7. Educational conclusion

Aloe vera is a useful teaching example because a single common name spans very different tissues, preparations and exposures. Whole material and isolated constituents are not equivalent; historical relevance is not modern clinical proof; mechanistic richness is not demonstrated treatment benefit. Product composition, formulation, route and endpoint must remain attached to every conclusion.

A measured change in a marker, an exposure curve, or a laboratory pathway can support a research question without supporting a therapeutic promise. Conservative claim language is not merely stylistic: it preserves the distinction between what was tested and what remains uncertain.

8. Source and review date

Final targeted source review: **10 September 2026**. This version uses the sources listed in section 16 and the claim ledger in section 15. References should be rechecked before external reuse, especially online-first research and evolving regulatory proceedings.

9. Verification and release status

V2 evidence-grounded educational draft. Independent authorized review required before external or institutional release.

Artifact assurance	Status
Artifact ID / version	AV-BP-2026-09-10-v0.2 · Aloe vera Botanical Plate
Purpose / audience	Education and evidence appraisal; postgraduate botanical medicine, pharmacognosy, pharmacology and related training.
Evidence and citation status	Source-linked targeted review; access and uncertainty limits disclosed. No claim of comprehensive clinical validation.
Human review / release	Independent subject-matter, safety, rights and institutional authorization remain pending. External release is not approved by this draft.
Ownership / rights / brand	Accountable institutional owner and source-rights manifest not supplied. Cover remains blank by request; no third-party artwork is reproduced.
Access and interoperability	Word headings, static visible contents, repeating table headers and readable tables. Assistive-technology testing remains an institutional review task.
Corrections / concern route	Report the artifact ID, section, claim and source concern to the commissioning faculty/ editor; a named institutional route has not yet been assigned.

This material is for education, research literacy, and practitioner training only. It is not medical diagnosis, treatment, prescribing, or individualized care advice. Patient-specific use, medication changes, dosing, pregnancy/pediatric/oncology decisions, and polypharmacy questions require review by a qualified clinician.