

Non-commercial ultrasound transmission gels: a scoping review

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Background

Point-of-care ultrasound (POCUS) has become a valuable tool in healthcare settings for several reasons including ease of use, portability, cost, and versatility as both a diagnostic tool and a procedural aid. It has been especially useful in low-resource environments where other imaging modalities may not be available or feasible. A commonly identified barrier to ultrasound use in these settings is the availability or cost of commercial ultrasound gel, which is necessary as a transmission medium to obtain adequate images. A variety of alternatives including already existing products and novel recipes made from common ingredients are being studied and compared against commercial ultrasound gel as possible solutions.

Objectives

This scoping review summarizes existing literature on non-commercial ultrasound gels. The review will describe what alternatives have been proposed as well as the methods previous researchers have used to compare image quality and other outcomes with commercial ultrasound gel.

Methods

The questions this scoping review aims to answer include:

1. What is described in the literature as alternatives to commercial ultrasound gel?
2. How are these non-commercial gels evaluated against commercial gel and how well do they compare in terms of image quality, safety/potential adverse effects to patient, integrity of probe/device, effort/cost/material availability, and stability?

A literature search was performed using the databases Medline, Google Scholar, and the Cochrane Library, and the references of all studies retrieved were reviewed for any additional sources. Clinicaltrials.gov was searched for any ongoing or unpublished trials. The study screening and data extraction was performed by two independent reviewers with a third to resolve disagreements. All studies that described a non-commercial ultrasound gel as an alternative transmission medium to commercial ultrasound gel were included in the review. Studies were excluded if the alternative gel was described for a purpose other than ultrasound image acquisition.

Methods

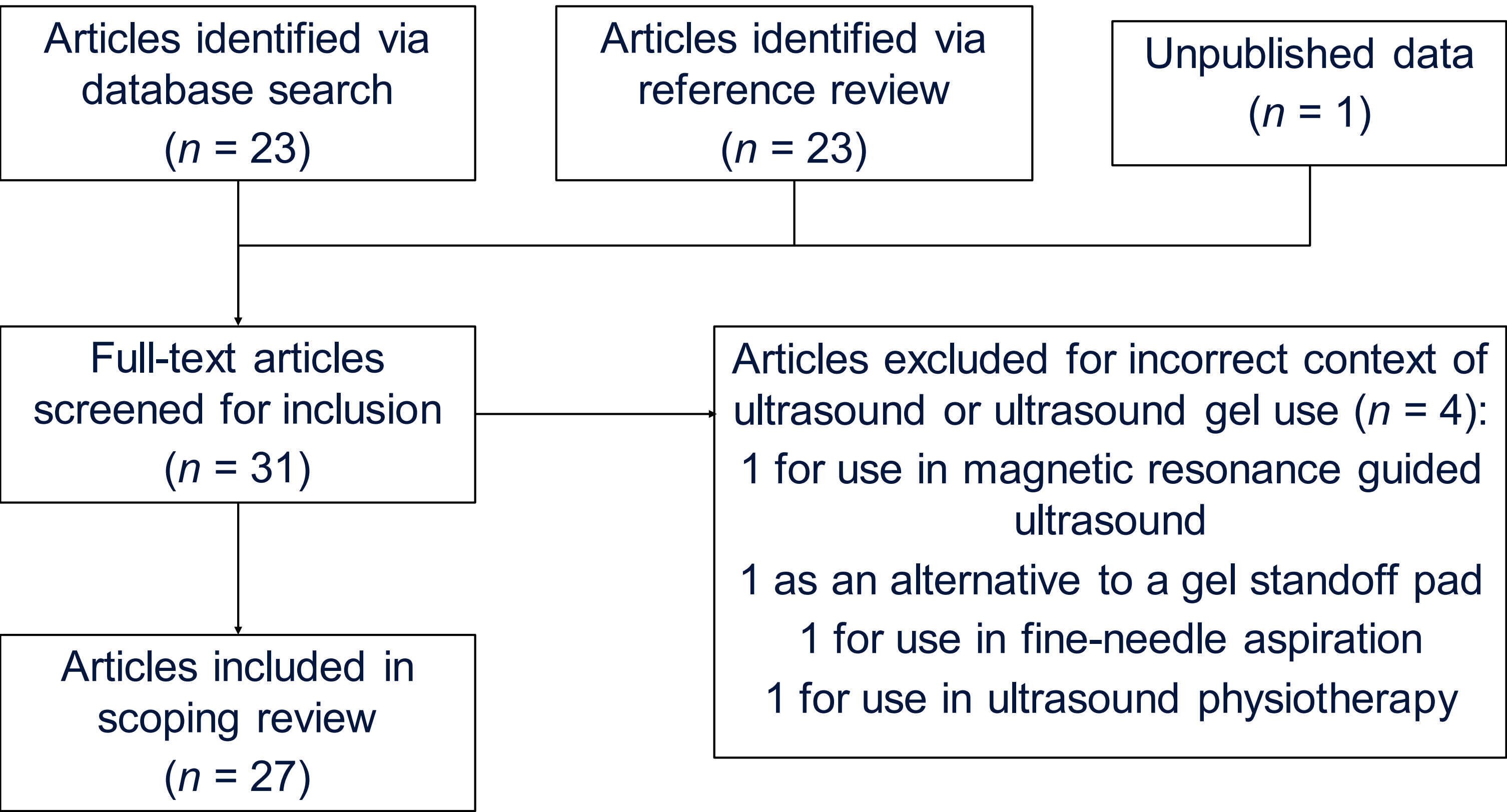


Figure 1. Flow chart of included articles

Results

What is described in the literature as alternatives to commercial ultrasound gel?

Homemade recipes	Repurposed medical supplies	Repurposed household items
Glucomannan (3)	Normal saline (4)	Water (2)
Cornstarch (3)	Hand sanitizer (2)	Olive oil (2)
Carbomer (3)	Povidone-iodine 10%	Body soap (2)
Aloe vera (3)	Hydrogen peroxide 3%	Shea butter
Guar gum (2)	Milk of magnesia	Mineral oil
Cassava root (2)	Dextrose 5% in water (D5W)	Toothpaste
Rice starch (2)	Half-strength commercial gel	Shaving cream
Bulla	Surgilube	Shaving gel
Guar glycerin		Shampoo
Xanthine gum		Body lotion
Cold glucomannan		Sunscreen
Hot concentrated glucomannan		Maple syrup
Hot low-concentration glucomannan		Energy gel
		Coconut oil

Table 1: Non-commercial ultrasound transmission gels

Most studies (n = 23) made an attempt to compare their proposed formulation with commercial ultrasound gel. 3 proposed an alternative ultrasound gel but made no comparison attempts and 1 obtained ultrasound images using their alternative gel but made no comparison with commercial ultrasound gel.



Results

Views obtained include right upper quadrant FAST, gallbladder, transthoracic echo, kidneys, pregnancy related scans and others

Assessment tools used included subjective visual assessment and ratings of image adequacy (yes/no), image quality, detail, and resolution (5- or 10-point scales)

19 of the 23 studies in which there was a formal comparison performed showed no significant difference in image adequacy, quality, detail, or resolution. *Binkowski et al.* found cornstarch gel to be superior to commercial gel in terms of image detail, resolution, and quality, but there was no difference in image adequacy

Secondary outcomes reported:

- Cost: cassava root (\$0.09), cornstarch (\$0.10), guar gum (\$0.12), glucomannan (\$0.25-0.30), and bulla (\$0.25)
- Skin irritation: cassava, glucomannan, and guar gum
- Patient satisfaction: no difference or slightly favorable (olive oil)
- Shelf-life: 2 days (glucomannan) to 1 year (carbomer)
- Probe damage: none after 1 month (glucomannan or guar gum)

Conclusion

This scoping review describes 27 primary studies proposing a non-commercial ultrasound gel. No significant difference was reported in image adequacy and quality with most gels. Secondary outcomes appear favorable. Limitations include heterogeneity of studies and publication bias. This review may be used as a reference for future research and development of alternative ultrasound gels.

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