Edible Films for Masking the Aversive Taste of an Oral Nutritional Supplement

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Background and Objective

We are developing rapidly dissolving oral films as an alternative format for nutritional supplements, building on prior formulation work involving vitamin D and vitamin B12. Retinyl palmitate is a fat-soluble ester of vitamin A commonly used in dietary supplements. Vitamin A supplements are frequently formulated as softgel capsules, which may be difficult for some individuals with dysphagia to swallow. When exposed in the oral cavity, retinyl-palmitate formulations may also produce undesirable taste and mouthfeel.

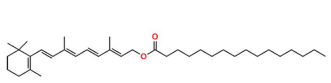
Previous attempts incorporating hydrophobic supplements into edible films demonstrated that the loading capacity can be increased by complexing with a long chain fatty alcohol, such as myristyl alcohol. These films also incorporate excipients that mask the aversive taste and mouthfeel of vitamin A, such as sucralose. The purpose of this study is to develop and characterize oral films that contain bioavailable amounts of vitamin A.

Materials and Methods

Retinyl palmitate in medium-chain triglyceride coconut oil was gently heated with myristyl alcohol and magnesium stearate. After cooling and pulverizing, the powder was mixed with a 3.25% pullulan solution that contained plasticizers and emulsifiers such as K-Carrageenan, xanthan gum, PEG-400, and 50% glycerol. The resultant solution was horn-sonicated eight times for 15 seconds each. The emulsion was cast, cooled at 4 °C for 10 minutes, cast dried overnight in weigh boats that had been wiped down with linoleic acid and 70% alcohol, and cut into approximately six 1 × 1-inch pieces per preparation.

We acquired FT-IR spectra at room temperature using a Thermo Scientific Nicolet iS5 across 4000–525 cm^{-1}, with 32 scans per sample. UV-visible spectra were acquired using a Pharmacia Ultraspec 2000. Heated wax and the unheated physical mixture were compared for potential Vitamin A decomposition. Film thickness was measured with a Lufkin micrometer at five locations per formulation; reported values are means.

Fig. 1. Formulation components and melting points



Retinyl palmitate in MCT oil
Melting point: 28 °C



Myristyl alcohol
Melting point: 37 °C



Vitamin A powder blend
Observed mixture melting point: 38 °C

Powder formulation: 1.30 g vitamin A powder + 0.300 g myristyl alcohol + 0.005 g magnesium stearate

Film formulations

Formulation	Reported components
I	Myristyl alcohol + coconut oil (no retinyl palmitate)
II	Retinyl palmitate + myristyl alcohol
III	Retinyl palmitate + myristyl alcohol + sucralose

Fig. 2. Formulation components.

Results

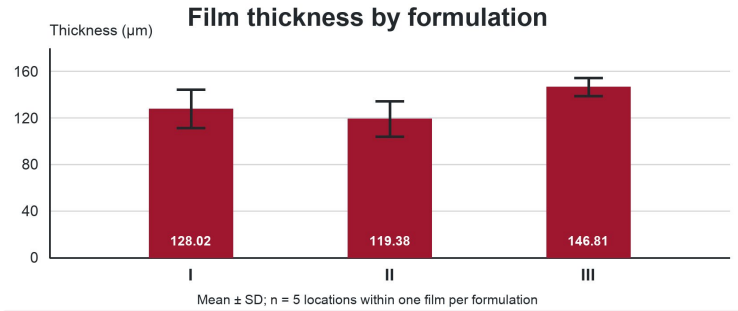


Fig. 3. Film thicknesses. Mean ± SD; n = 5 locations within one film per formulation.

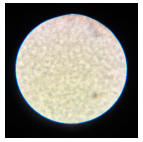


Fig. 4. Formulation II at 160×.

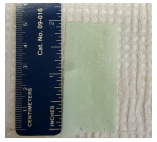


Fig. 5. Length of test strip.

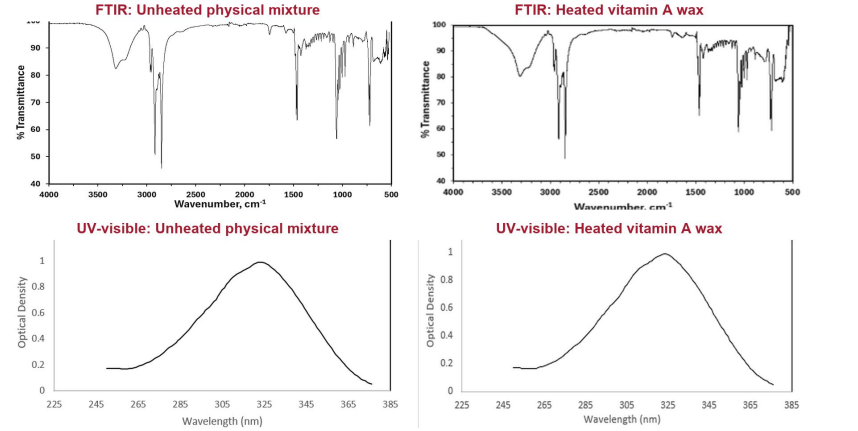
Initial drying measurement: Formulation II

Before drying	After drying	Mass loss
0.1045 g	0.1017 g	2.68%

Mass loss = 100 × [1 − (after/before)]; single preparation.

Fig. 6. Mass loss on initial drying, Formulation II

Fig. 7. FT-IR and UV-visible spectra



FT-IR (top) and UV-visible (bottom) spectra of the unheated physical mixture and the heated vitamin A wax.

Discussion and Conclusion

Retinyl palmitate retained comparable FT-IR and UV-visible profiles after heating, compared with the unheated physical mixture, indicating no detectable degradation from heating. Mean thicknesses were 128.02, 119.38, and 146.81 µm for Formulations I–III; each mean was based on measurements of five different film locations. In the initial drying measurement, Formulation II showed 2.7% mass loss.

The oropharynx consists of skeletal muscle, and its voluntary phase is under somatic motor control. For dysphagia sufferers and very small children who have trouble swallowing, films are an efficient way to deliver oral and sublingual medications. Subsequent experiments can focus on using first pass metabolic studies to see if the films can accidentally interfere with hepatic metabolism enzymes such as the cytochrome P450 family and induce hypervitaminosis A, i.e., chronic vitamin A toxicity. Eventually, these edible films will be assessed for oral drug delivery in gustatory studies.

Future studies will examine oral taste perception and physical properties of the three formulations, such as elasticity and dissolvability.**S**pectra compared heated and unheated wax only; thickness was measured at five locations within one film per formulation; mass loss was measured for one preparation of Formulation II. Taste, bioavailability and dissolution were not yet tested. Retinyl palmitate was incorporated into pullulan oral films without detectable spectral change from heating, providing a basis for planned taste and physical-property studies.

Acknowledgements and References

References
1. Smutzer G, Elamin O. A novel method for encapsulating nutritional supplements within edible films. J Pharm Sci. 2025;114(4):103706. doi:10.1016/j.xphs.2025.103706
2. Smutzer G, Elamin O, Lacerda FP, Karanam SP, Lin P. The development of rapidly dissolving oral films that contain a hydrophobic nutritional supplement. Food Res Int Rep. 2026;1:100015. doi:10.1016/j.frinr.2026.100015

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Acknowledgements: Poster printing and web hosting courtesy of Redox Education.