

AMARA: A User-Centered Redesign of Ghee Packaging for Improved Hygiene, Usability, and Sustainability

V R Mahalakshmi¹, Mudita Upadhyay², Aastha Deshpande³

^{1,2}Student, Product design, World university of design

³Professor, Product design, World university of design

ABSTRACT

Ghee's a staple in Indian kitchens. But while we obsess over how long the stuff lasts or what the tub is made of, nobody really talks about how annoying the actual packaging is to handle mid-cook. It is a mess. You've got grease around the jar rim, tubs that turn into bars of soap once your hands get oily, pouches that won't close back up, and cartons that pour, spilling everywhere. Just not a very good design. That's where I introduced Amara, a redesign (originally a product design project, now framed as design-based research) aimed at fixing these problems. The literature on this stuff is actually pretty deep. The research is about ghee and oil ergonomics: how we touch packages, finger friction, how we pick our grip, how easy things are to squeeze or open, hand movement, and the whole packaging angle. So, the research goes down to a few specific physical buttons. I will be writing about the grip, friction, the lid shape, the force required to crack it open, how it pours, and just how big the container is overall.

Keywords: Packaging Redesign, Ghee Packaging, Hygiene, Usability, Ergonomics, Sustainable Design, Design Thinking, User-Packaging Interaction



It's a dual-walled squeeze bottle featuring a smart dispensing valve, a backup closure, and an outer shell you can attach for winters when the ghee solidifies. The workflow was standard. It moved from spotting the problem and doing empathy work through ideation, building the concept, CAD models, and finally a comparative look at the results. It checked all the boxes. It handles hygiene, grip, dispensing control, resealing, seasonal quirks, and even the tricky task of separating materials so the whole thing doesn't just end up in a landfill. In this project, I couldn't test the final packaging with users to collect my final data, but in my research I have identified the problem and solved it, so the next step for me is to test it.

INTRODUCTION

Packaging is not just the outer part of the products. It is not for just protecting the whatever is inside, because packaging goes to many things like interaction with hands, we are picking up, touching, holding the package with our hands and it matters a lot.

This is something is happening everyday in every household, as ghee is one of the essential ingredients of cooking. Especially in traditional households, ghee is used in almost every food. I spent time observing how people deal with ghee packaging every day, and honestly, the same problems is noticed almost everywhere, grease building around the lid, people wiping or washing their hands every time after ghee comes in contact with the hand, counters end up messy.

That's not just something I felt though, Chavadi (2018) found that people's satisfaction with ghee packaging actually comes down to the technical and functional details of the container, not just whatever's inside it, which lines up with what I was noticing too, that the packaging isn't some cover sitting around the product or for holding it, it's part of using it.

So, from there is was about figuring about where things are going wrong and people struggles at which part. One of the main problems observed was when in winters ghee hardens and we use a spoon to take the ghee out. Another problem noticed is different people have different hand sizes, some may have good grips some may not, which is why I stress that different hand sizes and angle make a huge difference. Example, it may work for a teenager but not for older people, so looking at hand sizes is another important point. SO, the issue is not just about the ghee but the package and how people interact with it.

2. LITRETURE REVIEW

2.1 Ghee Packaging

One study of 199 families and four different container types proved that these details really drive how loyal a customer stays (Chavadi et al., 2018). But then there is also a problem, the ghee needs to be kept fresh for every time use. Back in the late eighties, a team compared tin against polyethylene by watching how the stuff changed chemically and tasted after sitting at 37°C for 195 days (Chauhan & Wadhwa, 1987). Designing a better packaging with all these points is going to take a lot of time and effort. It shows the whole industry has been obsessed with shelf-life and materials, which is fine (if a bit narrow) but they've basically ignored how regular people actually grab and open the jar. Oil containers also has the same problem like how people hold and open them. Because research into edible-oil bottles highlights ergonomic factors like how the handle feels, cap mechanics, or holding patterns (Tirpude et al., 2018), We shouldn't think of ghee containers just to hold ghee but also about the whole user experience, how easy it is to pick up, hold, open, pour and use.

2.2 User–packaging interaction and ergonomics

The way we use and handle the boxes is very important. Mumani and Stone (2018) looked at over a hundred studies and basically said we should not judge packaging by how it looks on the shelf, we need to look throughout the process. It isn't just about looks and aesthetics. Real-world testing. Grip is difficult since different people have different ways of holding objects and everyone's hand size is not size. So the way people open a lid may vary. So, Amara have a good grip area so that it wont slip even if the hand is damp or wet.

2.3 Friction and oily surfaces

One of the reason why good ghee packaging is very important is because as we know ghee is oily, so when some of the oil gets on the package, it makes your hand slip.

Research in inclusive design challenges the idea of designing for "average," promoting technologies and packaging that consider actual variations in strength, dexterity and hand size (Langley et al., 2005). The torque required to initially open a jar presents its own accessibility challenge, since reducing that torque would allow more people to use the jar (Voorbij & Steenbekkers, 2002). Younger and older adults apply torque, squeeze, and compress differently as they open jars (Carse et al., 2011).

How much grip or friction you have on the package affects how easy it is to open.

Package → Grip → Easy Opening

Research on wide-mouth closures found that people often struggle with them because their fingers slip around the lid, not due to lack of strength (Yoxall & Janson 2008). In the end how easy a package is to use depends on the on its surface, its grip, its shape and size and how much force is needed to open it.

2.4 Squeeze-based packaging and dispensing

Research on squeezability revealed that only the shape and material of a bottle affect the force required to deform that bottle. The shape of the nozzle, however, controls how the product flows out of it (Blakey et al., 2009). Squeeze packaging is thus an engineered relationship: it's not just "a flexible container". This insight pushed us to the front of ideation for squeeze-based dispensing: it combines gripping and dispensing into one action, and eliminates the need for a spoon or being a wide mouth. Ghee is not like most squeeze products as its consistency changes with temperature. Thus, it is a hypothesis that requires testing in real life and not a solution.

2.5 Opening mechanisms and packaging design

The way a package/a cap is closed, the way the person holds it and the person's age can all actually affect how much twisting force they can apply. A study with three mouthwash packages showed that larger cap diameters allow for higher torque (Bonfim et al. 2016). This study was about mouthwash, even though this does not belong to the category of ghee, the information is relatable because the outcome in the end simply means the shape and size of the cap affect how people use their hands to open it.

When a food package was modified, it exhibited a higher satisfaction value when compared to the standard package. The study was conducted on live patients suffering from hand osteoarthritis (Hensler et al., 2015). Usability can be assessed directly not just through preference. Research on semi-rigid packaging examined peel angle, peel force, tab dimensions, and grip choice as testable variables (de la Fuente, 2013). Amara doesn't have a peel tab but similar idea: realism of usability claims is greater when anchored in measurable interaction.

2.6 Sustainable food packaging

The packaging I designed, Amara's disassemblable systems don't make the environment any better. Anything that has made locally does not always mean it is environmentally sustainable. A larger review asserts sustainability should be looked at over the whole food-and-package system other safety, functionality, social and economic factors, and life-cycle ecological impact (Dörnyei et al., 2023).

Why amara's chose this material . The design of its separable polypropylene components and detachable outer wall is aimed at separability and reuse, not at proven environmental benefits. It is designed like this so that it can be separated and reused in summers and winters.

2.7 Research Gap

The grip, ergonomics, sealing, hygiene, cleaning, all these areas have been studied separately but the missing part in the existing research is a package that considers all these areas/problems together. My goal is to create a ghee package that solves all these issue all together at the same time and is designed with the user's needs. Amara fills that gap, not by suggesting that these issues go unnoticed, but by bringing all this

together in one place, including the temperature and cultural importance. This is a design case rather than a controlled experimental.

METHODOLOGY

This research explains how I designed and improved the ghee package (Amara) using my research findings, it aims at redesigning Amara so that every step explains why that particular design is used, either based on a user-associated issue or supportive literature, meaning a real problem that people actually struggle with in every day life or that is supported by the previous studies. The process is categorised into four stages: Empathise and Define – Understand the user and their real problems faced, Ideate – Coming up with different possible ideas, Develop – Developing the finalised idea, and Deliver – Finalising the design.

Stage 1: Problem Identification and Empathy

The beginning of the study started with noticing how people use the package every day, after observing, the issues were divided into two categories: physical (adhesion, slippery surfaces, contamination, hard-to-control dispensing) and their consequences (continuous wiping of hands, untidy handling, dispensing inaccessibility, almost drops, messy kitchen counters). The former were justified by finger-friction and edible-oil research, while the latter were interpreted through the lens of ergonomic flaws, not personal biases (Lewis et al., 2007; Tirpude et al., 2018).

Stage 2: Problem Definition

After observing and understanding the problems and how people use it every day, I put every point together into one design goal: developing a ghee packaging, which would minimize hand-oil contact, provide a firm grip, manage the dispensing process, eliminate external residue, facilitate resealing, and resist multiple uses. The goal was to develop a ghee package that is clean, easy to hold, easy to dispense, suitable for hot and cold weathers. The annual seasonal variations were also considered, as the product was anticipated to be used in both warm and cold environments, whereby the latter would benefit from a superior consistency after freezing (Dörnyei et al., 2023).

Stage 3: Ideation

In brainstorming session I came up with a number of sketches, ideas, featuring jars, bottles, flask-shaped containers, pouches, pumps, droppers, screw caps, and squeezed spouts. I sketched different types of package to understand which would be best for the final package that supports all the points. The literature on squeezing techniques demonstrated the tendency to use a squeezable plastic bottle with a controlled dispensing opening (Blakey et al., 2009), while the friction analysis suggested a working surface, which would not require a thumb-area grip (Lewis et al., 2007). Therefore, the final decision was made to pursue the squeeze-type packaging, which would provide an adequate grip and dispensing in one motion. So basically, you wouldn't need a lot of steps like

Pick up → Open → Scoop → Pour → Close lid

Instead, the idea was,

Hold → Squeeze → Ghee comes out in a controlled amount

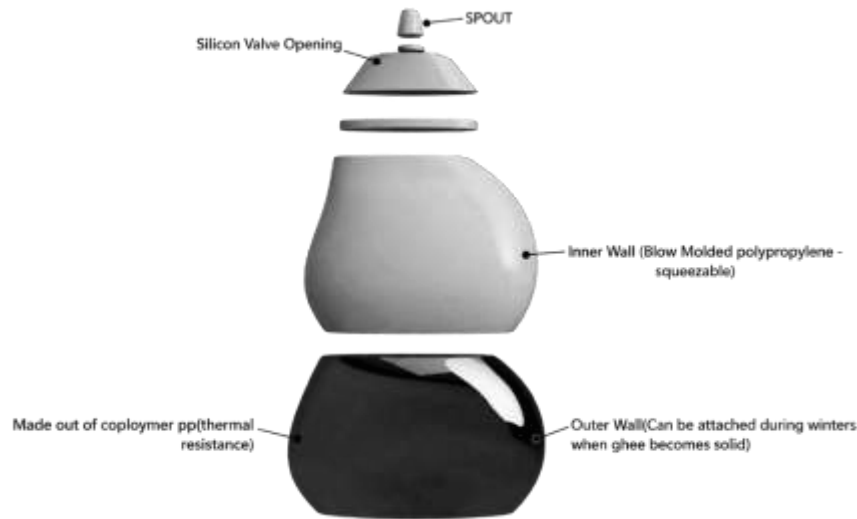
Stage 4: Concept Development

The final concept has two separate layers, the outer layer which is detachable, which comprised an inner squeezable blow-moulded polypropylene piece and an exterior detachable co-polymer polypropylene piece, for the thermal insulation in cold seasons, to help liquefy the solid ghee in winters.

At the top there is a slit valve opening when only allows a controlled amount of ghee to come out. And the spout it simply guides the direction for the ghee and avoid spillage. I developed the design in AutoCad.

4. RESULTS

4.1 Structure and material outcomes



Labelled diagram showing the spout, outer detachable wall, inner wall, valve opening.

The final idea of the ghee packaging (Amara) is it has two walls, the inner wall is made of polypropylene which can be squeezed and an outer wall is detachable, it provides thermal insulation, which is planned to liquefy the ghee in winters. In winters you can attach it put the bottle in the warm or hot water for 3-5 minutes, and it will be possible to use liquid ghee.

4.2 Dispensing and sealing outcomes

The ghee comes out through the small silicone slit valve in the spout. You squeeze the body of the bottle and only a controlled amount of ghee comes out depending on how hard you squeeze. And when you stop the squeeze the valve opening it closes and returns to its position. The spout helps the ghee move in a direction and it avoids spillage issue. This way the ghee don't get stuck around any lid area.

4.3 Ergonomics and hygiene outcome

Amara's concept (ghee packaging I designed) solves the problem by making sure the part where the ghee comes out and the part where you hold the bottle is not touching at all so that hands won't get oily. Therefore, the person's hands won't slip, giving a better grip.

4.4 Comparative evaluation

Parameter	Existing Package	Proposed ghee Packaging
Hygiene	Become greasy	Outer Wall clean
Grip and handle	Turns Slippery	Controlled amount comes
Cleaning effort	Needs cleaning	No leakage outside
Resealing	Hared to reseal	Easy to reseal
Season change	Hardens the ghee	Thermal insulation wall

DISCUSSION

I realised that even something that is as ordinary as a ghee package can be redesigned to actually work with the person using it. My ghee package is designed not for just holding ghee but also for how the hand is holding it, how the hand interacts with the package, the hand movement, the angle. The initial issue was

how the person uses the package, the interaction during the unpacking, dispensing, cleaning, and then the storage of the product. This is justified since human–package interaction takes place at multiple stages of use, while ergonomic research highlights the importance of grip, movement, and closure mechanisms during unpacking (Mumani & Stone, 2018; Bošnjaković & Vladić, 2020).

In turn, the oily surface of the package indicated a possible lack of friction needed for an improved grip. The study of Lewis et al. (2007) proves that the adhesion of oil on the skin decreases friction and makes the surface slippery. So, basically, I separated the part where the ghee comes out and the person holding it so that when the inside of the spout area gets oily, it won't come out and make contact with the hands. The grip hasn't been tested with real users yet, so it cannot be proven until user testing has been conducted.

Finally, the decision for the final squeeze idea has a strong research reason behind it, why I decided to go with the squeeze method. Indeed, the dispensing area's squeezability depends on the material, geometry, and dispensing properties (Blakey et al., 2009). For my Amara ghee packaging, I used a similar principle but applied it to ghee, a product with a different consistency that is highly temperature-dependent. Thus, it is necessary to perform different tests at different temperatures (Summer, winter) to make sure that it doesn't still be a solid after warming it up during winters and is not very hard to squeeze in summers.

Finally I added the detachable layer which can be attached when the ghee hardens during winter season and it needs to be melted without just taking it out with a spoon and making a whole mess. The current packaging melts when put in hot water whereas I used the material co polymer pp which has thermal insulation. This helps warm the ghee. Overall, I identified the problem, researched and studied about existing packages and previous discoveries on the topic to come up with a solution.

RESEARCH GAP

The research areas cover in this paper includes consumer thoughts of ghee packaging, ergonomics, user package interactions, grip, squeezability. Each of these areas have been researched separately and put everything together for a solid solution.

Therefore, the research paper aims to present that each of these has been studied before separately, whereas the present idea delivers all these the elements have been put into one package. I have used research evidence and design reasoning but the large user text experiment is yet to be done.

FUTURE RECOMMENDATIONS

The next step is to develop a working prototype, to build it and take the user testing and how will it be when exposed to various temperatures (Summer, Winter), the right material selection, squeezing forces, valve performance, and flow rates (How quickly the ghee comes out).

After building the prototype, I will distribute it with people of different age group having different hand sizes and levels of physical strength as everyone's hands are different. By doing this I will get the actual measurements of the grip and angle, the squeezing force, dispensing speed, amount of residue left, is there any risk of spillage issue. Then for thermal testing, another most important, temperature testing which is when the ghee cold, hard and solid and summer when it is in liquid form. I have to test the ghee package in the condition of hot and cold climates to see whether the insulation works and if the ghee can be dispensed properly. Then we look at manufacturing cost part, So basically to look if it can be manufactured easily and affordably because it has two walls (one detachable), a silicone valve, the spout. Now, In terms of materials, it will be necessary to make sure that the chosen material is right, safe for storing ghee, is strong enough, can survive repeated use, don't create environmental problems when thrown away. It will

also be important to test how easy it is to clean it and the overall appeal of the product, how it looks and feels, whether the people find the design attractive. Finally, a consumer study should be necessary to find out whether they find it as a useful improvement for the household.

CONCLUSION

This paper introduces Amara, my redesigned ghee package. It came from an earlier product design where I came up with a design project where I noticed that existing normal ghee packaging has so many problems that people are ‘used to’ by now in the household but still find it annoying, such as greasy hands, oily kitchen counters, messy packages, poor resealing and problems caused by seasonal changes.

The cited research supports the suggested problems in the existing ghee packaging, as the factors, which include grip, friction, closure geometry, opening force, dispensing and user capabilities, are reported to impact the overall user experience of a package (Lewis et al., 2007; Rowson & Yoxall, 2011; Mumani & Stone, 2018). Meanwhile, squeeze-packaging research highlights the material, bottle geometry and dispensing considerations as essential variables for any squeeze packaging system, with dispensing being identified as a key contributor to the overall dispensing experience (Blakey et al., 2009).

Based on all the findings, Amara was designed as a double-walled squeeze container with a silicone slit valve, secondary spout cap and detachable outer wall for the winter season when the ghee solidifies, dispensing control, seasonal changes and maintain good hygiene around the kitchen.

It is important to note that the direct comparison has not yet been conducted. I have seen some positive results based on research of the material and problems that is faced in the household, such as dispensing, seasonal changes and hygiene. The paper aims to show how we take a traditional ghee package and rethink and redesign it based on the real user problems and existing research.

REFERENCES

1. Blakey, S., Rowson, J., Tomlinson, R. A., Sandham, A., & Yoxall, A. (2009). Squeezability. Part 1: A pressing issue. *Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science*, 223(11), 2615–2625. Web.
2. Bošnjaković, G., & Vladić, G. (2020). Research methodologies for assessing the ergonomics of packaging products – A review. 10 th International Symposium on Graphic Engineering and Design. Web.
3. Bonfim, G. H. C., Medola, F., & Paschoarelli, L. (2016). Correlation among cap design, gripping technique and age in the opening of squeeze-and-turn packages: A biomechanical study. *International Journal of Industrial Ergonomics*, 54, 178–183. Web.
4. Carse, B., Thomson, A., & Stansfield, B. W. (2011). A novel device for evaluating forces during the dynamic jar opening action—Do older and younger adults do things differently? *Medical Engineering & Physics*, 33(4), 521–525. Web.
5. Chauhan, P., & Wadhwa, B. K. (1987). Comparative evaluation of ghee in tin and polyethylene packages during storage. *Journal of Food Processing and Preservation*, 11(1), 25–30. Web.
6. Chavadi, C. A., Vishwanatha, M. R., & Mubeen, S. (2018). Ghee with glee: A study of how consumers evaluate product packaging. *Metamorphosis*, 17(2), 100–110. Web.
7. de la Fuente, J. (2013). Usability of tabs in semi-rigid packaging [Doctoral dissertation]. California Polytechnic State University. Web.

8. Dörnyei, K. R., et al. (2023). Sustainable food packaging: An updated definition following a holistic approach. *Frontiers in Sustainable Food Systems*. Web.
9. Hensler, S., Herren, D. B., & Marks, M. (2015). New technical design of food packaging makes the opening process easier for patients with hand disorders. *Applied Ergonomics*, 50, 1–7. Web.
10. Klimchuk, M. R., & Krasovec, S. A. (2012). *Packaging design: Successful product branding from concept to shelf* (2 nd ed.). Wiley.
11. Langley, J., Janson, R., Wearn, J., & Yoxall, A. (2005). 'Inclusive' design for containers: Improving openability. *Packaging Technology and Science*, 18(6), 285–293.
12. Lewis, R., Menardi, C., Yoxall, A., & Langley, J. (2007). Finger friction: Grip and opening packaging. *Wear*, 263(7–12), 1124–1132. Web.
13. Mumani, A. A., & Stone, R. (2018). State of the art of user-packaging interaction (UPI). *Packaging Technology and Science*, 31(6), 401–419. Web.
14. Rowson, J., & Yoxall, A. (2011). Hold, grasp, clutch or grab: Consumer grip choices during food container opening. *Applied Ergonomics*, 42(5), 627–633.