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Research Article

JOURNAL OF ENVIRONMENTAL SCIENCE AND PUBLIC HEALTH

ISSN: 2575-9612

User Perception of Refillable Packaging for Use in Cosmetic Products

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Abstract

The present study aimed to assess the introduction of refillable packaging at cosmetic company, considering the material's sustainability, technical and behavioral factors, and market availability. Two cosmetic products that presented a greater possibility of refillable packaging were selected: a modulating gel and a moisturizer. A preliminary assessment conducted by three Brazilian cosmetic companies and six packaging suppliers led to selecting five types of flexible packaging as refillable options. Potential users of refillable packaging assessed these options and the habitual packaging via an electronic questionnaire disseminated nationwide. It was found that 75.1% of the interviewees were familiar with refillable packaging. Women, individuals with higher education levels (graduates or postgraduates), and those living in Southern Brazil exhibited more sustainable behavior. 63.7% of the women cleaned packaging before discarding it, while 82.7% of postgraduates and 100% of those consulted in the southern region dumped recyclable and non-recyclable waste separately. However, price was the most influential factor (92.7%) in purchasing refillable packaging products, which tend to be lower than the product in its original packaging. SWOT analysis showed that cosmetic products can be packaged in refillable packaging: standard stand-up pouch and stand-up pouch with cap, both made of the same material since mono-material packaging is more favorable for recycling.

Keywords: Packaging; Refillable; Cosmetics; Stand-up pouch; Perception.

Introduction

The purpose of packaging is to protect a product during transport and storage, maintaining its original characteristics. It also conveys information and communicates with consumers, instilling a desire to buy the product based on the data displayed [1]. However, packaging is generally designed for single use, accounting for a large part of municipal solid waste [2]. Among products that use packaging are cosmetics. The growth of the cosmetic industry has stimulated discussion on the possible impact of discarded packaging on the environment [3].

Recycling is an exciting alternative to minimize the adverse effects caused by the large amount of waste currently produced, given that reusing material reduces the need for raw materials. Several cosmetic brands sell products in recyclable refillable packaging [4].

Cosmetic packaging is divided into rigid and flexible. Among the rigid types are bottles, jars, and lids, while flexible packaging includes mono or multilayer films [5]. Flexible packaging facilitates product transfer to rigid packaging and is therefore used as refillable packaging [6]. Besides,

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Citation: Luiza Barreto, Thainá Salvador, Bianca Silva, Elen Pacheco, Felipe Santos. User Perception of Refillable Packaging for Use in Cosmetic Products. Journal of Environmental Science and Public Health. 9 (2025): 01-17.

Received: January 27, 2025
Accepted: February 04 2025
Published: February 12, 2025

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DOI:10.26502/jesph.96120216

compared to rigid packaging, it contains less material, expends less energy during production, and produces less waste on disposal [7].

Refilling original packaging significantly reduces the material used and transport costs and is most frequently employed for food, cleaning, hygiene, and beauty products [4]. Flexible packaging is present in different market sectors and can be used for solid, liquid, and pasty products. They are commonly composed of polyethylene (PE), polypropylene (PP), polyethylene terephthalate (PET), and aluminum-based polymer materials. This type of container can be classified into two large groups: mono or multiplayer [8].

Monolayer packaging consists of a polymer film. It is used when only one polymer can provide all the physicochemical barriers needed to package a product. Multilayer packaging comprises several films, including polymers, adhesives, and aluminum. In this case, various materials are used to protect the packaged product better [9-10].

In terms of the desired properties, it is essential that flexible packaging exhibits mechanical strength, stiffness, and sealability and acts as a barrier against gas and moisture exchange with the external environment. It is also essential that the outer layer has good printability, while the innermost layers need to act as a seal and provide stiffness to the structure [7].

Packaging is also a means of communicating with consumers and a relevant parameter in the most critical marketing moment, enticing them visually and emotionally to purchase the product [11]. Different elements influence consumer behavior, such as psychological, cultural, personal, and social factors. Colors, shapes, layouts, and purpose are responsible for consumers assimilating the product and stimulating the desire to acquire it [12].

A study on purchasing cosmetic products was conducted with 100 Brazilian women from different age groups [12]. Price is the predominant factor in attracting height attention, followed by habit, advertising, packaging, and curiosity. The practice was the most significant element in buying cosmetic products. A total of 70% of interviewees reported that packaging is a determining factor when purchasing cosmetics, and reusable packaging was deemed relevant by 85% of participants.

Another study with 100 individuals of both sexes investigated perceptions about sensory aspects (texture and smell) and perceived value (price and packaging) in cosmetic consumption [13]. Price and texture were more relevant for decision-making than packaging and fragrance. It was found that 75% of the interviewees reported that packaging sometimes influences cosmetic purchases but is not the main factor.

Comparison with previously mentioned studies demonstrated that price is a common factor in attracting shelf attention and is decisive in consumer buying behavior. Packaging plays a secondary role in product purchasing.

The brand is not a determining factor in purchases; consumers also desire more knowledge on the sustainable practices used in production, such as whether the manufacturer promotes recycling and reforestation [14]. Ecological labels have become increasingly popular in seeking cosmetic product acceptance [3].

Studies with Brazilians [15-16] from different regions assessed perceptions regarding preserving the biota, sustainability, environmental labeling, and ecological effects of acquiring a packaged product. Most participants demonstrated a positive and correct perception concerning environmental labeling data, but a significant portion showed a lack of spontaneous engagement with the topic.

Although packaging is an essential aspect of product selection, there has been little specific discussion regarding refillable packaging. This study assessed the introduction of refillable packaging and its application in a cosmetic company, assessing the best type based on the materials used, technical factors, practices, and market availability.

Materials and Methods

Product selection

First, the best-selling products (Table 1) were identified from the sales report of a large Brazilian cosmetic company.

The first product analyzed to select the case study products was excluded because it was a perfume, given that the packaging for this type of product involves a strong marketing strategy associated with a luxury context, which could be compromised by refillable packaging [17].

Table 1: Best-selling products of a Brazilian cosmetic company. Source: Brazilian cosmetic company studied.

#	Type of product	Type of packaging	Amount of product contained in the packaging
1	Perfume	Bottle with a valve and snap-on lid	100 mL
2	Moisturizer	Tube with a flip-flop cap	100 g
3	Moisturizer	Bottle with a flip-flop cap	140 g
4	Modeling gel	Jar with a screw-on lid	500 g
5	Moisturizer	Tube with a flip-flop cap	200 mL

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DOI:10.26502/jesph.96120216

The four remaining products were assessed for the feasibility of refilling their original packaging. Products 2 and 5 in Table 1 were disregarded because their tube packaging hinders product transfer from the refillable packaging to the original container.

Thus, two cosmetics (products 3 and 4) were selected as the target of the study (Figure 1) since the marketing strategy would not be compromised by introducing these products as refills for the original containers, which, in turn, do not hinder transferring the refill product into the original packaging.

The company reported that the original packaging of product 3 is a PET-based bottle and cap made from PP, while that of product 4 consists of a PP jar and lid. The original packaging of the items was referenced as "type A" (product 4) and "type B" packaging (product 3), as shown in Figure 1.

Figure 1: Original type A (Modeling gel) and B (Moisturizer) packaging can be reused via refills.

Identification of refillable packaging

Brazilian refillable packaging suppliers were surveyed on Google, and those whose portfolios contained options similar to the benchmark found in the catalogs of three other Brazilian cosmetic companies were selected.

The catalogs on the websites of these three Brazilian cosmetic companies were assessed to determine the types of refillable packaging used. As a result, refillable packaging for the following beauty, hygiene, and personal care products was considered: make-up, moisturizers, shampoos, conditioners, and liquid soaps. Packages consisted of stand-up pouches (may or may not exhibit variations, such as a spout), capsules, cans (used for powder make-up), and bottles.

In addition, four of the six refillable packaging suppliers contacted to determine the different types available in the Brazilian market responded [18-21]. One of these offered no specific suggestions for the case study, working only from orders with a predetermined model and material. The size and materials provided by the companies are illustrated in Table 2.

Questionnaire description

The perception of Brazilians regarding introducing refillable packaging to the cosmetics sector was assessed using an electronic questionnaire with questions on the use of refillable packaging in cosmetics, user identification, refill use habits, and perceptions about refillable packaging. The

Table 2: Characteristics of refillable packaging types commercialized by different suppliers.

Option	Packaging photo	Packaging type	Materials available	Volume (mL)	Reference
1		*Standard stand-up pouch*	PET+ PE, metal PET + PE, PET + metal PET + PET, brown kraft + PET + PE, brown kraft + metal PET + PE, matteVZ + PET + metal PET + PE, PET, PE, BOPP, aluminum, paper, plant-based PE, EVOH, PA, PP	100 - 500	[20-21]
2		*Stand-up pouch with* spout	PET + PA + PE	50 - 500	[18]
3		*Stand-up pouch* with cap	PET+ PE, metal PET + PE, PET + metal PET + PET, brown kraft + PET + PE, brown kraft + metal PET + PE, matte VZ + PET + metal PET + PE, PET, PE, BOPP, aluminum, paper, plant-based PE, EVOH, PP	70 - 500	[18,20,21]

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4		*Stand-up pouch with* side handle	PET, plant-based PE, paper, EVOH, PE, PP, aluminum	Until 2,000	[21]
5		*Stand-up pouch with* cap and side handle	PET, plant-based PE, paper, EVOH, PE, PP, aluminum	Until 2,000	[21]
6		*Shaped pouch*	PET, PE, BOPP, aluminum, paper, plant-based PE, EVOH, PP	50 - 500	[20-21]
7		*Box pouch*	Matte PET + metal PET + PE, brown kraft + metal PET + PE, PET + PE, white kraft + metal PET + PE, matte VZ + PET + metal PET + PE	70–1,800	[20]

PET- polyethylene terephthalate); PE -polyethylene; matte VZ–matte varnish; BOPP–biaxially oriented polypropylene; EVOH–ethylene vinyl alcohol copolymer; PA -polyamide; PP - polypropylene; PET metal - PET laminated with metal; brown kraft - brown kraft paper; white kraft- white kraft paper.

questionnaire was divided according to different aspects: participants' socioeconomic profile (Characterization of Questionnaire Respondents), potential users of refillable packaging (Assessment of the perception of respondents), and selection of the packaging type for products (Perception of refillable packaging selection). The questionnaire was disseminated on social media in the same way as reported by Incio and Seifert [22]. The latter studied social perception on a given topic through an online experiment, using social media to recruit participants.

The questionnaire included photographs of refillable packaging options so users could select the packaging they felt best suited to the products studied. The shaped pouch was not included because it does not offer a new functionality compared to the others, only an aesthetic difference. The box pouch packaging differs from the stand-up pouch, differing by the square bottom and side gusset. The box pouch was also not included in the questionnaire because it exhibited no new functionality and is currently associated more with food items (for humans and domestic animals) than cosmetics. Thus, the possibilities were based on the first five refillable packaging formats in Table 2.

Representative sample size (questionnaire answers) was calculated according to Eq. (1), considering Brazil's population as a parameter, which at the time of questionnaire completion was 203,080,756 [23], and the confidence level was set at 95% with a 5% margin of error.

$$n = \frac{p(1-p)Z^2N}{\varepsilon^2(N-1)+Z^2p(1-p)} \qquad (1)$$

Where n is the sample size, p is the expected proportion, Z is the standard distribution value for a given confidence level, N is the population size, and ε the margin of error. The value of Z is tabled, and the confidence level selected (95%) is 1.96. The sample proportion value used was p = 0.5 to maximize sample size – the value used in the present case [24]. With the values in Eq. (1), the sample size obtained was 385 participants.

SWOT assessment of refillable packaging

For the different refill types, participants' perceptions were initially assessed (via the questionnaire), and the technical aspects of the selected packaging were then analyzed using the SWOT matrix. The goal is to achieve greater confidence

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in ensuring a technically sound product with good consumer acceptance.

The SWOT matrix (Strengths, Weaknesses, Opportunities, and Threats) was devised between the 1950s and 60s to analyze companies' intrinsic strengths and weaknesses and extrinsic opportunities and threats. SWOT analyses are organized 2 x 2 in matrices, listing solid and weak points [25].

- Strengths: internal characteristics with total control that cause a favorable position, leading to a positive performance;
- Weaknesses: controlled internal factors that are unfavorable and may be deficiencies that compromise performance;
- Opportunities: positive external elements that cannot be controlled but result in favorable conditions;
- Threats: These are caused by external situations and may negatively impact a company's success.
- Its quadrants can be divided and interpreted as follows [26-28]:
- Quadrant I: S-O: leveraging internal strengths (S) to capitalize on external opportunities (O)- development;
- Quadrant II: S-T: leveraging internal strengths (S) to minimize external threats (T) –maintenance;
- Quadrant III: W-O: countering internal weaknesses (W) by exploiting external opportunities (O) to identify areas for improvement - growth;
- Quadrant IV: W-T: countering internal weaknesses (W) to mitigate external threats (T) (worst case) - survival.

Results

Characterization of Questionnaire Respondents

A total of 452 answers were obtained, exceeding the minimum sample number desired (385), which was established to represent the Brazilian population (203,080,756 inhabitants) [23]. The sample size was achieved, representing the population and guaranteeing a minor error for the same confidence level. Thus, at this confidence level, the margin of error was approximately 4.6% rather than the 5% initially expected.

Concerning the section "User identification", the participants consisted mainly of women (65%) aged between 20 and 30 (28.1%) and 50 and 60 years (25.6%), with a family income of more than six minimum monthly wages (63%), residents of Rio de Janeiro state (79.7%) and postgraduates (52.8%), as shown in Figures 2-6.

Assessment of the perception of respondents

Table 3 shows the answers to the questionnaire used to assess the perception of potential users of refillable packaging.

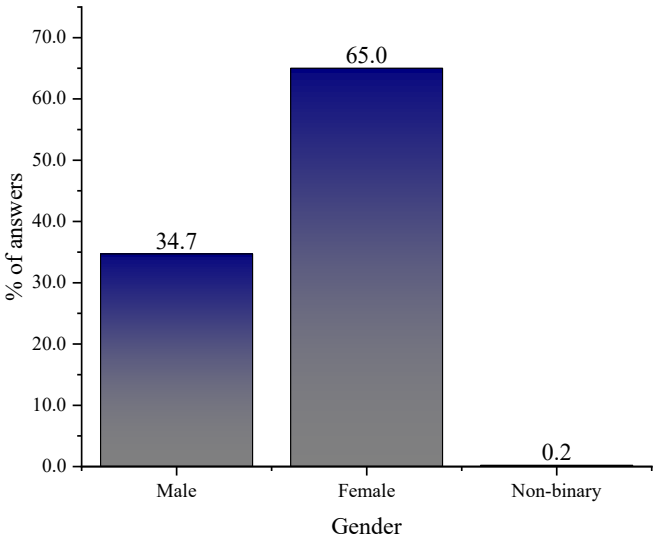

Figure 2: Respondent distribution by gender.

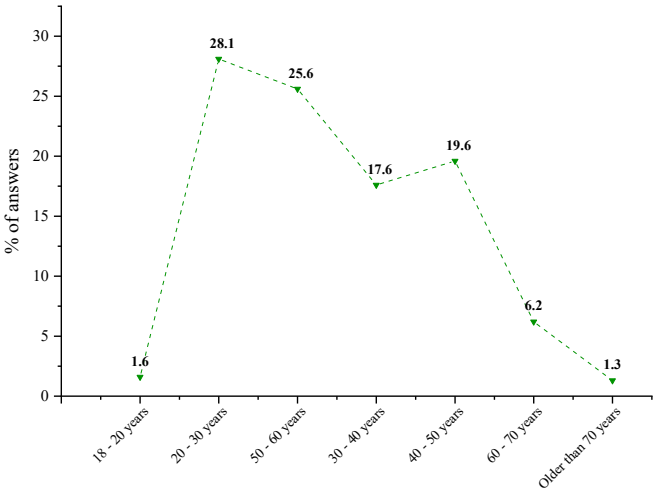

Figure 3: Age group distribution of respondents.

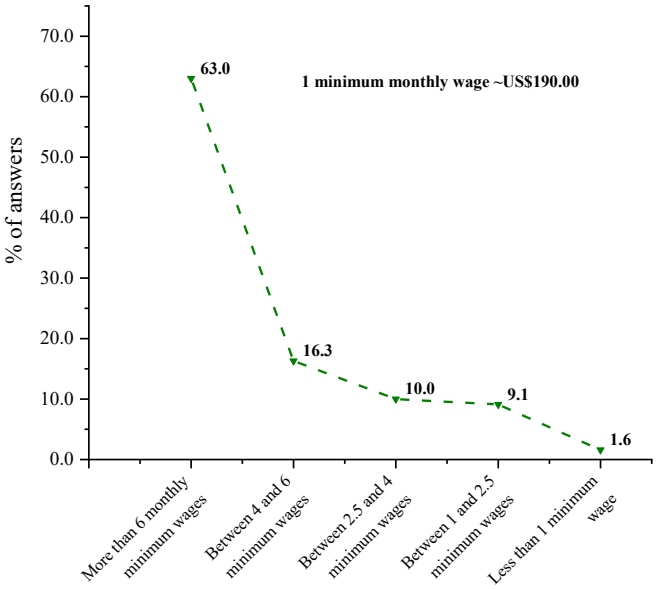

Figure 4: Distribution of respondents' monthly family income.

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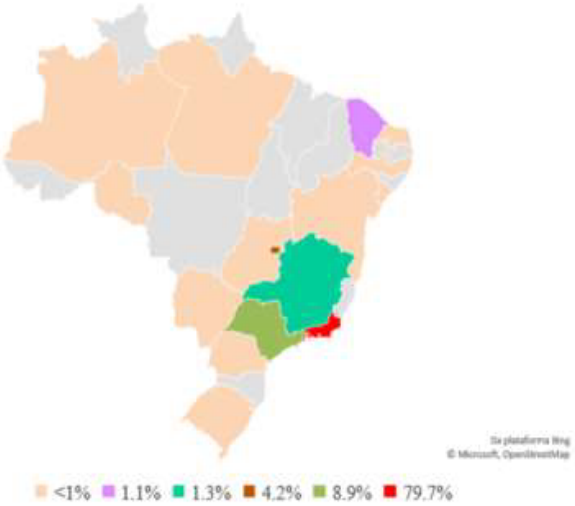

Figure 5: Distribution of respondent's state of residence.

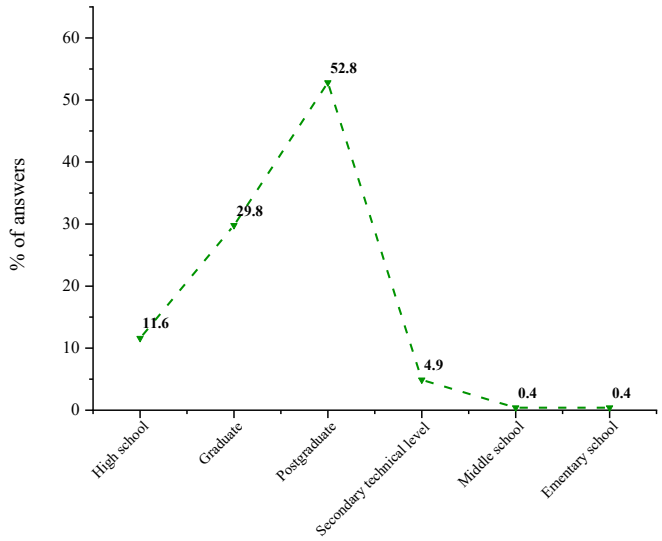

Figure 6: Distribution of respondents' educational level.

Table 3: Questionnaire answers

#	Topic	Topic specifications	TA[a]	PA[b]	IN[c]	PD[d]	TD[e]
			Number of answers (% of total)				
a	Refillable packaging purchasing habits	I always try to purchase products in refillable packaging	40.8	34.3	11.6	7.3	6.0
		I sporadically acquire products in refillable packaging	26.1	30.2	8.0	13.1	22.5
		I do not habitually purchase products in refillable packaging	10.9	20.9	7.8	22.7	37.6
b	Influence of sex on refillable packaging purchasing habits	Women I always try to purchase products in refillable packaging	45.9	36.3	6.8	6.2	4.8
		Men I always try to purchase products in refillable packaging	31.4	30.1	20.5	9.6	8.3
c	Influence of education level on refillable packaging purchasing habits	Postgraduates I always try to purchase products in refillable packaging	44.3	36.3	9.3	4.2	5.9
		Graduates I always try to purchase products in refillable packaging	37.3	33.6	14.9	9.0	5.2
		High school graduates I always try to purchase products in refillable packaging	36.5	25.0	11.5	17.3	9.6
d	Packaging disposal habits	After cleaning it, I dry the recyclable packaging before discarding it	19.5	19.5	6.5	13.0	41.4
		I clean recyclable packaging before discarding it	42.1	21.6	4.1	9.9	22.3
		I discard recyclable and non-recyclable waste separately	59.2	18.5	2.4	8.6	11.3
		I do not habitually separate recyclables from non-recyclables	16.1	13.0	2.7	12.3	55.8
e	Influence of sex on packaging disposal habits	Women I clean recyclable packaging before discarding it	42.1	21.6	4.1	9.9	22.3
		Men I clean recyclable packaging before discarding it	28.2	21.2	8.3	14.7	27.6
f	Influence of education level on packaging disposal habits	Postgraduates I discard recyclable and non-recyclable waste separately	65.4	17.3	1.3	8.0	8.0
		High school graduates I discard recyclable and non-recyclable waste separately	44.2	23.1	5.8	11.5	15.4
g	Influence of demography on packaging disposal habits	South I discard recyclable and non-recyclable waste separately	80.0	20.0	0.0	0.0	0.0
		Northeast I discard recyclable and non-recyclable waste separately	41.7	33.3	16.7	0.0	8.3
		Midwest I discard recyclable and non-recyclable waste separately	77.3	9.1	0.0	4.5	9.1
		North I discard recyclable and non-recyclable waste separately	25.0	25.0	0.0	0.0	50.0
		Southeast I discard recyclable and non-recyclable waste separately	57.1	19.0	2.5	9.1	12.3

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h	The motivation behind refill purchasing habits	I buy refills because of their lower price when compared to the product in its original packaging	61.5	28.2	6.4	1.9	1.9
		I buy refills because they damage the environment less	35.3	37.2	14.7	3.8	9.0
		I buy refills because I prefer this type of packaging	9.0	19.9	34.0	12.8	24.4
		I do not habitually buy products in refillable packaging	7.1	17.9	18.6	17.3	39.1
i	Influence of sex refill purchasing habits	Women I buy refills because they damage the environment less	56.5	28.8	7.5	4.1	3.1
		Men I buy refills because they damage the environment less	35.3	37.2	14.7	3.8	9.0
j	Influence of education level on refill purchasing habits	Graduates I buy refills because it damages the environment less	48.5	38.8	8.2	1.5	3.0
		High school graduates I buy refills because it damages the environment less	61.5	17.3	13.5	1.9	5.8
k	Influence of education level on refill purchasing habits	Postgraduates in the 20–30-year age group I buy refills because they damage the environment less	58.3	20.8	8.3	4.2	8.3
		Postgraduates in the 50–60-year age group I buy refills because they damage the environment less	43.9	28.0	11.0	8.5	8.5
l	Habits related to the influence of volume on refill purchasing	I would buy refills only if their importance is more significant than that of the original packaging	11.5	13.5	38.5	9.6	26.9
		I would buy refills only if their volume were the same as that of the original packaging	30.8	11.5	26.9	9.6	21.2
		I would buy refills only if their volume were smaller than that of the original packaging	7.7	3.8	32.7	5.8	50.0
		Refill volume is irrelevant to my purchase decision	53.8	1.9	15.4	7.7	21.2
m	Influence of income on the purchase of refills whose volume is equal to that of the original packaging	Income between 1 and 2.5 minimum monthly wages	39.0	24.4	22.0	4.9	9.8
		Income above six minimum wages	17.7	26.5	28.6	8.8	18.4
n	Influence of income on the purchase of refills whose volume is more significant than that of the original packaging	Income between 1 and 2.5 minimum wages	12.2	22.0	34.1	4.9	26.8
		Income above six minimum wages	6.4	17.7	33.2	16.3	26.5
o	Habits related to the influence of price on refill purchases	I would buy refills if they were cheaper than the product in its original packaging	48.3	37.3	6.2	3.8	4.5
		I would buy refills if they were the same price as the product in its original packaging	23.3	33.9	11.3	13.7	17.8
		I would buy refills if they were more expensive than the product in its original packaging	2.1	11.0	8.2	18.8	59.9
		The price of the refill is irrelevant to my purchase decision	5.5	11.0	7.5	19.2	56.8
p	Influence of education level on the purchase of refills whose price is equal to that of the product in its original packaging	Graduates I would buy refills if they were the same price as the product in its original packaging	18.7	31.3	12.7	11.9	25.4
		High school graduates I would buy refills if they were the same price as the product in its original packaging	34.6	36.5	15.4	5.8	7.7

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q	Influence of income on the purchase of refills whose price is lower than that of the product in its original packaging	Income between 1 and 2.5 minimum wages	58.5	29.3	4.9	2.4	4.9
		Income above six minimum wages	83	33.9	7.4	4.9	3.9
r	Influence of demography on the purchase of refills whose price is lower than that of the product in its original packaging	South I would buy refills if they were cheaper than the product in its original packaging	60.0	20.0	20.0	0.0	0.0
		Northeast I would buy refills if they were cheaper than the product in its original packaging	25.0	41.7	16.7	8.3	8.3
		Midwest I would buy the refills if they were cheaper than the product in its original packaging	45.5	50.0	0.0	0.0	4.5
		North I would buy the refills if they were cheaper than the product in its original packaging	75.0	25.0	0.0	0.0	0.0
		Southeast I would buy refills if they were cheaper than the product in its original packaging	49.8	36.2	6.4	3.9	3.7
s	Habits related to the influence of design on refill purchases	I would buy refills with a format different from that of the original packaging	38.5	10.9	43.4	1.3	5.8
		I would buy refills with the same design as the original packaging	24.5	12.0	45.9	4.0	13.6
		I would only buy refills with a solid color	8.7	6.9	55.2	3.6	25.6
		The design of refills is irrelevant to my purchase decision	62.1	11.8	16.7	4.5	4.9
t	Habits related to the influence of material on refill purchases	I would buy refills with packaging made from recycled material	72.6	14.5	11.4	0.0	1.6
		I would buy refills with packaging made from recyclable material	72.2	14.3	11.1	0.9	1.6
		I would buy refills with packaging made from conventional material	33.2	29.0	20.0	9.4	8.5
		The material of the refill packaging is irrelevant to my purchase decision	34.1	17.8	11.4	16.3	20.5
u	Influence of education level and material on refill purchases	Graduates The material of the refillable packaging is irrelevant to my purchase decision	36.6	18.7	12.7	12.7	19.4
		High school graduates The material of the refill packaging is irrelevant to my purchase decision	30.8	11.5	3.8	30.8	23.1
v	Influence of demography and material on refill purchases	South The material of the refillable packaging is irrelevant to my purchase decision	0.0	20.0	20.0	20.0	40.0
		Northeast The material of the refillable packaging is irrelevant to my purchase decision	33.3	25.0	25.0	8.3	8.3
		Midwest The material of the refillable packaging is irrelevant to my purchase decision	27.3	31.8	9.1	13.6	18.2
		North The material of the refillable packaging is irrelevant to my purchase decision	50.0	25.0	25.0	0.0	0.0
		Southeast The material of the refillable packaging is irrelevant to my purchase decision	34.7	16.7	10.8	16.7	20.9
x	Influence of sex on refill purchasing if the packaging material is recyclable	Women I would buy refills with packaging made from recyclable material	81.2	8.9	8.2	1.0	0.7
		Men I would buy refills with packaging made from recyclable material	55.8	23.7	16.7	0.6	3.2
z	Influence of sex on refill purchasing if the packaging material is recycled	Women I would buy refills with packaging made from recycled material	82.2	8.9	8.2	0.0	0.7
		Men I would buy refills with packaging made from recycled material	54.5	25.0	17.3	0.0	3.2

TA[a]– Total agreement; PA[b]– Partial agreement; IN[c]– Indifferent; PD[d]– Partial disagreement; TD[e]– Total disagreement

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The results were separated by topic in Table 3, identified with a letter.

In the section "Refill purchasing habits" (Table 3a), a significant portion of the public habitually purchases products in refillable packaging, with 75.1% agreeing (totally or partially) to always try to buy products in this packaging. According to Moura [12], 85% of the interviewees reported having purchased a product to reuse the packaging.

The habitual purchase of products in refillable packaging can also be observed in women, where the percentage that totally or partially agrees with always trying to buy products in this type of packaging was 82.2% versus 61.5% in men (Table 3b). The more frequent occurrence of this type of purchase may be related to the kinds of products generally acquired by each group, given that this packaging is standard in the hygiene and beauty industries [8], which usually have more female customers.

There was also greater consumption of this packaging in the more educated subjects, where the percentage of individuals who agreed (totally or partially) that they always buy this type of packaging was 61.5% for high school graduates, 70.9% for graduates, and 80.6% for postgraduates (Table 3c). This behavior may be related to a better understanding of the cost-benefit of this packaging from an economic or environmental standpoint.

Also assessed was the separate disposal of recyclable and non-recyclable waste (Table 3d), where 77% of the interviewees totally or partially agreed that they did so. However, cleaning the packages was less common (63.7% totally or partially agreed), as was washing and drying them before disposal (39% totally or partially agreed) (Table 3d).

Women more often clean recyclable packaging before discarding them (63.7% totally or partially agreed that they did versus 49.45 of men) (Table 3e). This may be because women are more responsible for domestic activities, discarding solid waste more responsibly and sustainably [29].

Another relevant factor during the separation of different types of waste was the education level of the interviewees (Table 3f), where 67.3% of high school graduates totally or partially agreed that they disposed of recyclables and nonrecyclables separately, against 82.7% of postgraduates. This may be related to more excellent knowledge and better environmental behavior due to the latter's higher education level.

Demographic influence (Table 3g) shows that the Southern region stood out in terms of separating recyclables from nonrecyclables, with 100% of the individuals totally or partially agreeing that they did so. The North was the least committed to correct separation for disposal, with 50% of the participants disagreeing with the statement. This behavior may be associated with the sustainability indices of the regions, showing that the South spends the most on environmentally correct treatment and final waste disposal (77.8%). In comparison, the North spends the least (7.32%). The proper destination also corroborates the conduct observed, demonstrating that 86% of the waste produced in the South is adequately disposed of, against 14.5% in the North. Thus, there is a pattern of encouraging and executing the correct disposal of waste in these regions. However, recycling in both is very low, with 7.7% in the South and only 0.4% in the North [30].

The lower price of refills compared to the product in its original packaging is the best motivator to buy products in refillable packaging (89.7% or partially agreed), followed by the lower environmental impact (72.5% or partially approved), as depicted in Table 3h. This is likely due mainly to the COVID-19 pandemic, which affected the economy by raising the price of products and their raw materials and causing historic drops in income. In 2020, there was a 4.6% decline in the per capita GDP of Brazilian families, resulting in a 6.2% per capita decrease in consumption [23]. The answers indicate that socioeconomic profile also influenced the choices made, especially in a country such as Brazil, where choices are price-driven. Nevertheless, the most ecological selections were considered because 72.5% of respondents approved or partially approved of the product that causes the least environmental impact.

Table 3h shows that personal preference for the type of refillable packaging is not predominantly decisive in purchase decisions, with a higher percentage (34%) for the "indifferent" option.

Once again, sex and education level are the most influential factors in the behavior of the interviewees. There was a trend to more significant environmental commitment by women (Table 3i) with a higher education level (Table 3j). 85.3% of the women agreed or partially agreed that they buy refills because they cause less environmental damage (Table 3i), against 72.4% of men. Concerning education level (Table 3j), 78.8% of high school graduates totally or partially agreed, against 87.3% of graduates.

In addition, younger generations are more concerned about the environment, but not significantly different from older generations, which is associated with changes in habits and the educational profile of the population. This is confirmed in Table 3k, which compares the graduates' answers in the 20-30 and 50-60-year age groups for "less environmental damage" when buying refills. Among the participants, 79.1 % of postgraduates aged between 20 and 30 years totally or partially agreed with the statement, versus 71.9% of those between 50 and 60 years.

When asked about the influence of product volume in the refillable packaging (Table 3l), the users reported not buying

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a product in refillable packaging whose volume is lower than that of the original. A total of 55.8% totally or partially disagreed that they "Would buy refills only if their volume was smaller than that of the original packaging". Purchase decisions were shown to be irrelevant in the statements "I would buy refills only if it had the same volume as that of the original packaging" and "I would buy refills only if their volume was larger than that of the original".

User identification factors demonstrated that family income influences the purchase intent of participants about refillable packaging volume (Tables 3m and 3n). Interviewees earning between 1 and 2.5 minimum monthly wages totally or partially agreed that they would buy refillable packaging only if it had the same volume (63.4%) as the original packaging and 34.2% if the volume was larger. For individuals earning more than six minimum wages, the percentages were 44.2 and 24.1%, respectively.

When asked about the influence of price on purchasing refills, it was found that the lower price of the product in its original packaging is an essential factor in the purchase decision. Of those interviewed, 85.6% totally or partially agreed that they would buy a refill if it were cheaper than the product in its original packaging, while 59.9% totally or partially disagreed with the statement "I would buy refills even if they were more expensive than the product in the original packaging and 76% totally or partially disagreed with the statement "The price of refills is irrelevant to my purchase decision", as shown in Table 3o. Thus, there is no predominant indifference concerning price: to be selected, refills should be the same price or cheaper (preferentially) than the product in its original packaging. This corroborates the cosmetic purchase behavior observed (Moura, 2017; Batista, 2024), where both studies report price as a significant element in purchase decisions.

The influence of education level showed that 71.1% of the high school graduates would buy a refillable packaging product if the price were equal to that of the product in its original packaging, against 50% of graduates (Table 3p). A possible explanation would be that people with a higher education level know that refillable packaging uses less material and energy in the production stage and incurs lower transport costs, resulting in products usually sold at lower prices than in their original packaging [4;7].

The family income of participants seemingly did not significantly influence refill purchase decisions. For example, individuals with a family income between 1 and 2.5 minimum monthly wages agreed slightly more (87.8%) than those earning more than six minimum wages (83.7%) that they would buy refills only if they were cheaper than the product in its original packaging, agreeing totally or partially, respectively, a variation of only 4.1%, as shown in Table 3q. The demographic influence revealed that all the regions, with more than 66.7%, totally or partially agreed that they would buy refills only if they were cheaper than the product in its original packaging (Table 3r). However, although all agreement percentages are high, the North predominated, where 100% of the individuals totally or partially agreed with the statement. This behavior may be associated with the socioeconomic profile of the region, which has the second highest inequality level and lowest average income in the country (after the Northeast), with an average monthly per capita family income of R$ 843.00 (~US$169.00). The average monthly family income in Brazil and the South region was R$ 1,353.00 (~US$272.00) and R$ 1,656.00 (~US$332.00), respectively [23].

Indifference predominated regarding refillable packaging design at the time of purchase (Table 3s). In the statements regarding buying refills with the same design as the original packaging, a different format, or only in a solid color, the prevailing answer was "Indifferent", with 45.9, 43.4, and 55.2%, respectively. In addition, 73.9% totally or partially agreed with the statement "Refill design is irrelevant in my purchase decisions", corroborating neutrality regarding refill design.

The influence of refillable packaging material in purchase decisions obtained positive answers regarding using recycled or recyclable materials: 87.1 and 86.4% agreed or partially agreed that they would buy these options. However, there is a lack of predominance of conventional materials or material irrelevance (Table 3t). As such, the material is an exciting difference but not a determining factor for most of the individuals surveyed at the time of purchase, where 51.9% totally or partially agreed that the refillable packaging material is irrelevant in their purchase decisions.

This behavior is reinforced by the influence of education level in terms of material, where 42.3% of high school graduates totally or partially agreed that material is irrelevant in their purchase decisions, rising to 55.3% for graduates (Tabela 3u). Incorrect waste disposal causes soil, surface water, groundwater, and even air pollution when waste is burned and threatens different animal species [31]. Moreover, of the 11.3 million metric tons of plastic used in refillable packaging produced in Brazil in 2018, only 145,000 (1.3%) were recycled [32,33]. Regarding plastic packaging, 54,000 metric tons were recovered in 2020 [33]. To improve this situation, the population must become environmentally aware and change their consumption and post-consumption behavior, such as using less ecologically harmful packaging (recyclables, recycled, renewable, etc.)

The behavior exhibited by the study participants corroborates Tamashiiro et al. [15] and Vizcaychipiet et al. [16], where the individuals assessed showed a predominantly good understanding of packaging and the environment but a lack of spontaneous engagement with the issue. Results

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were remarkably similar to those of Tamashiiro et al. [15], where almost everyone surveyed displayed a high ecological awareness and concern, but only around half demonstrated ecological purchasing behavior.

However, the demographic influence was significantly different between the North and South, with 75% of individuals from the former totally or partially agreeing that refill packaging material is irrelevant in their purchase decisions, against only 20% from the South partly and 0% settling (Table 3v).

However, women showed consistent ecological behavior, where 90.1% (Table 3x) totally or partially agreed that they would buy refillable packaging made with recyclable material and 91.1% (Table 3z) that they would buy refills with packaging made from recycled material. For men, the results were 79.5% for both types of material (Tables 3x and z).

Perception of refillable packaging selection

The fourth section of the questionnaire addresses the subjects' perception of the most suitable refillable packaging for the product in the original packaging. In type A packaging, three options exhibited very similar percentages: option 1 (standard stand-up pouch) with 25.6%, option 2 (stand-up pouch with spout) with 27.2%, and option 3 (stand-up pouch with cap, where packaging and lid are made of the same material) with 28.5%, as presented in Figure 7. Thus, no clear preference exists, meaning studying their positive and negative aspects is crucial to determining the most recommended options. However, multilayer packaging poses more challenges to recycling when compared to its monolayer counterpart, representing an environmental disadvantage [34]. As such, only packaging with monomaterial alternatives was selected for the case study, eliminating option 2 for original type A packaging. The positive and negative aspects (SWOT analysis) of packaging 1 and 3 will be assessed.

In the case of the cosmetic products in type B original packaging, there was a clear preference for option 3 (stand-up pouch with cap, where both are made of the same material), with 46.3% (Figure 8). The other two preferred options were option 5 (stand-up pouch with handle and cap, where packaging and lid are made of the same material) and option 2 (stand-up pouch with spout).

One hypothesis for this behavior is that the three options have a cap or spout, facilitating product transfer from the refill to the original packaging (especially for the smaller type B spout). Since this case exhibited a clear predominance, only option three's positive and negative points (SWOT analysis) will be assessed.

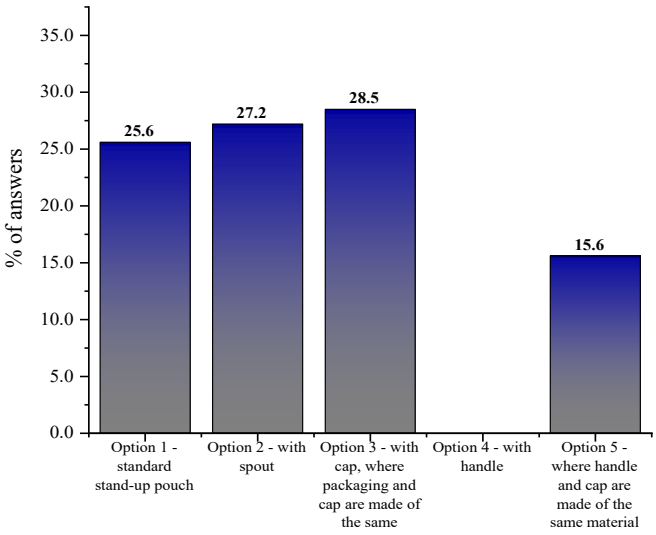

Figure 7: Design of the refillable packaging selected for type A packaging.

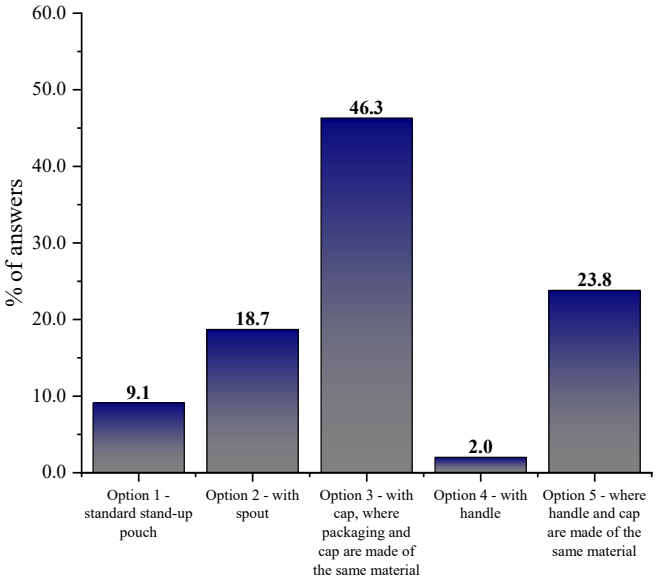

Figure 8: Design of the refillable packaging selected for type B original packaging.

Assessment of refill selection by SWOT analysis

The positive and negative aspects of refillable packaging were analyzed based on the SWOT matrix in terms of the most preferred type A (options 1 and 3) and B (option 3) original packaging shown in Table 4.

Table 5 shows the combination of SWOT matrix factors to help determine the refillable packaging with the most positive aspects.

After conducting a SWOT analysis of the three presented cases, it has been concluded that Option 1, which is the standard stand-up pouch, is the most suitable for packaging type A. Whereas, for packaging type B, Option 3, which is the stand-up pouch with a cap where both packaging and lid

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Table 4: SWOT matrix for type A (options 1 and 3) and B (option 3) original packaging.

#	Type of refillable packaging	Strengths	Weaknesses
INTERNAL FACTORS	Aspects common to all the packaging selected: packaging A (options 1 and 3) and B (option 3)	• Less spending on raw materials than on rigid packaging. • Occupies less transport, logistical, and storage space. • Its design allows it to remain upright on the shelf. • Available in monomaterials, facilitating recycling. • Available in plant material (polyethylene). • All the mono-material options are recyclable. • It can be disposed of as recyclable material. • Design art can be personalized.	
	Specific aspects of option 1 (standard stand-up pouch) for packaging A	• Can be vacuum sealed.	• Content is immediately transferred into the original packaging (this model has no cap or lid). • There is no cut line; users must tear or cut it themselves, which may result in waste. • It is not ergonomic; its shape is not particularly adapted to facilitate handling. • Common market design, which does not enhance shelf attraction. • Design hinders the cleaning needed before it can be disposed of as recyclable material.
	Specific aspects of option 3 (stand-up pouch with cap, where packaging and lid are made of the same material) for packaging A	• Can be vacuum-sealed.	• Spout reduces product flow during transfer between packaging, and the user may have to squeeze the package to accomplish the transfer. • It is not ergonomic; its design is not particularly adapted to facilitate handling. • Design hinders the cleaning needed before it can be disposed of as recyclable material.
	Specific aspects of option 3 (stand-up pouch with cap, where packaging and lid are made of the same material) for packaging B	• A spout facilitates transfer between packaging (essential in this case, where the type B spout is smaller) • A cap allows the packaging to be used for longer, with the product gradually transferred to the original packaging or even rendering the original unnecessary. • Recommended for liquid and viscous products. • Different design that attracts attention (cap).	• Spout reduces product flow during transfer between packaging, and the user may have to squeeze the package to accomplish the transfer. • It is not ergonomic; its design is not particularly adapted to facilitate handling. • Design hinders the cleaning needed before it can be disposed of as recyclable material.
		Opportunities	**Threats**
	Aspects common to all packaging selected: packaging A (options 1 and 3) and B (option 3)	• Easily obtained from suppliers.	

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EXTERNAL FACTORS	Specific aspects of option 1 (standard stand-up pouch) for packaging A	• Consumers are accustomed to this type of packaging. • The product flows out of the packaging easily; there is no need for squeezing; tilt it after opening (important point given that the product is heavier: 500 g). • Since the spout of type A packaging is comprehensive, there is less likelihood of the product spilling despite the extensive cut line of the packaging.	• Lack of a spout may result in product loss during transfer between packaging. • If the product is not poured all at once into the original packaging, it may be damaged by environmental exposure (e.g., oxidation) or lost to spillage. • Users may cut too short, hindering product flow, or too long, causing losses. • Because it is difficult to clean after disposal, consumers can discard it with traces of products, compromising its recycling. • Once opened, it is difficult for the consumer to transport the product in this packaging without incurring losses. • Packaging cannot be reused.
	Specific aspects of option 3 (stand-up pouch with cap, where packaging and cap are made of the same material) for packaging A	• A cap makes the product easy to transport, even after opening it. • Packaging can be reused to store other products.	• Introducing this model could prompt its use not as a refill but as original packaging, deviating from its purpose. • Since it is packaged for a heavier product (500 g), difficulty extracting the product may cause fatigue in the user. • Due to the difficulty in cleaning after use, consumers may discard it with traces of products, compromising recycling.
	Specific aspects of option 3 (stand-up pouch with cap, where packaging and cap are made of the same material) for packaging B	• A cap makes the product easy to transport, even after opening it. • Packaging can be reused to store other products.	• Introducing this model could prompt its use not as a refill but as original packaging, deviating from its purpose. • Since it is packaged for a heavier product (500 g), difficulty extracting the product may cause fatigue in the user.

Table 5: Result of combining SWOT matrix factors for type A (options 1 and 3) and B packagings (option 3)

		Type of packaging	**External environment**	
			Opportunity (O)	**Threat (T)**
INTERNAL ENVIRONMENT			**Quadrant I: Development**	**Quadrant II: Maintenance**
	Strength (S)	Option 1 (standard stand-up pouch) for packaging A	SO = 1 + 3 = 4	ST = 1 + 6 = 7
		Option 3 (stand-up pouch with cap, where packaging and lid are made of the same material) for packaging A	SO = 1 + 2 = 3	ST = 1 + 3 = 4
		Option 3 (stand-up pouch with cap, where packaging and lid are made of the same material) for packaging B	SO = 4 + 2 = 6	ST = 4 + 2 = 6
			Quadrant III: Growth	**Quadrant IV: Survival**
	Weakness (W)	Option 1 (standard stand-up pouch) for packaging A	WO = 5 + 3 = 8	WT = 3 + 6 = 9
		Option 3 (stand-up pouch with cap, where packaging and lid are made of the same material) for packaging A	WO = 3 + 2 = 5	WT = 3 + 3 = 6
		Option 3(stand-up pouch with cap, where packaging and lid are made of the same material) for packaging B	WO = 3 + 2 = 5	WT = 3 + 2 = 5

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are made of the same material, is the most appropriate. Both options exhibit more positive points regarding development and maintenance, making them ideal for implementation in their respective cases.

A spout in the stand-up pouch with a cap facilitates the transfer of content to the original packaging, especially type B, which has a narrow spout. In addition, the possibility of closing the packaging avoids waste and unnecessary product exposure to conserve it. A cap allows the packaging to be transported once opened and reused with other products. There is also a ready supply, and both packaging can be produced in mono-material, recyclables, and plant-based material. However, option B restricts product flow, requiring the consumer to squeeze the packaging to extract it.

The possible materials for options 1 and 3 for type A packaging and option 3 for type B, according to the suppliers surveyed, as shown in Table 2 (standard stand-up pouch and stand-up pouch with cap), are PET, PE, BOPP, aluminum, paper, plant-based PE, EVOH, PP and PA (the last only for the standard stand-up pouch).

Refillable packaging containing aluminum, paper (Kraft), PA, and EVOH were disregarded, given that aluminum foil exhibits poor resistance to acid products and low mechanical strength, which is why it is used with other laminated materials [35]. For example, the Kraft paper stand-up pouch has a plastic or aluminum layer to maintain barrier properties. It is often used in its mono-material form for dry products and food items [20]. PA and EVOH are hydrophilic, which reduces their oxygen barrier properties when in contact with moisture, so they are often used with at least two other layers of hydrophobic materials, such as PE and PP [36]. Since they have a cream or gel texture, EVOH, and PA were excluded as mono-materials for the study case's packaging.

BOPP is less suitable in terms of permeability to oxygen and water vapor. It is a variation of PP with high strength and flexibility and low vapor and high oxygen permeability. Among the other options, high-density polyethylene (HDPE), PP, and PET have insufficient oxygen and water vapor permeability rates, providing a better barrier to prevent accelerated product degradation [37]. However, all these materials are petroleum-based, a nonrenewable source.

Thus, PE is a sustainable option because it is the only renewable material. It is chemically identical to conventional polyethylene but contributes to the decline in greenhouse gases. Unlike standard polyethylene, which generates two metrics of CO2 for every metric ton of polyethylene produced, green polyethylene captures 2.78 metric tons of CO2 for every metric ton produced [38]. It is important to note that none of the abovementioned plastics, including green polyethylene, is biodegradable, allowing all of them to be recycled.

The mono-material packaging produced exhibits greater recycling efficiency when compared to composite materials. Multilayer materials containing plastic have a higher polluting effect on the environment [39]. Synthesized materials such as poly(butylene adipate co-terephthalate) have produced more biodegradable packaging and sustainable stand-up pouches [40,41].

Packagings made of cellulose [39] and cellulose coated with different types of fatty acids [42] instead of fossil-based materials have become a more sustainable option for the food and cosmetic industries, with less environmental impact and greater user awareness. Another possibility is a mixture containing up to 25% bioresin, which is used to manufacture a recycled polyethylene stand-up pouch [43]. Multilayer packaging involves separating different components or processing with other parts. Layers can be separated by dissolution and precipitation, mechanical, physical, or chemical delamination [44].

Stand-up pouch packaging containing aluminum foil is prone to vibration tearing when transported more than 2,000 km. However, they require fewer employees for handling, a better fuel economy, lower process costs, and less storage space [45,46]. In addition, factors such as light, oxygen permeability, oil and grease repulsion, and a moisture barrier are considered to promote changes in product quality [42,47-49]. Ergonomy and easy opening and closing for users of different ages are also significant aspects [50].

As such, mono-material packaging is more favorable and sustainable for different market uses in the cosmetics industry, which was the proposal of this study.

Conclusion

The different types of refillable packaging on the cosmetic market were analyzed, and those best suited to a modeling gel and moisturizer were assessed based on respondents' perceptions, which considered the characteristics of the packaging and type of material. A considerable portion of the subjects was familiar with refillable packaging and environmental commitment; for example, they always seek to buy products in refillable packaging, 76.6% discarded recyclable and nonrecyclable waste separately (totally or partially agreed), and 80.5% totally or partially agreed that they purchase refillable packaging due to its lower environmental impact. In addition, 86.4% and 87.1% of the individuals agreed or partly decided that they bought refills with recyclable and recycled material packaging, respectively. This demonstrates that the respondents are more open to sustainable practices.

In addition to more sustainable practices, the price is an influential factor in purchasing this type of packaging, which tends to be lower than that of the product in its original packaging. A total of 90% totally or partially agreed that they

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bought refills because of their lower price, and 73% only if they were cheaper than the product in its original packaging. Being more ecological and having a low economic value is relevant when purchasing refills. The Brazilian economic scenario and devaluation of its currency justify the answers obtained. Nevertheless, selection based on causing less environmental impact was also considered, which is satisfactory and promising.

Among the user characteristics, sex, education level, socioeconomic profile and demography were the most influential in participant choices. Women with higher educational levels (graduates or postgraduates) and inhabitants of Southern Brazil engaged in more environmentally sustainable habits. For example, 82.2% of the women and 80.6% of graduates totally or partially agreed that they always sought to buy products in refillable packaging; 82.7% of graduates and 100% of Southern Brazil inhabitants totally or partially agreed that they discarded recyclable and nonrecyclable waste separately; 63.7% of women cleaned recyclable packagings before tossing them separately from nonrecyclable trash, and 82.7% of graduates totally or partially agreed that they engaged in this practice; 85.3% of women and 87.3% of graduates totally or partially agreed that they bought refills due to their lower environmental impact. The higher percentage of female respondents is related to the fact that women outnumber men in the Brazilian population. Given Brazilian public environmental policies, environmental awareness initiatives have gained ground and engagement over the years, which may justify the percentages for separating waste.

Finally, individuals demonstrated no clear preference for any of the refillable packaging for modeling gel, obtaining similar percentages for the standard stand-up pouch (25.6%), stand-up pouch with spout (27.2%), and stand-up pouch with cap, where packaging and lid are made of the same material (28.5%). The preferred packaging for the moisturizer is a stand-up pouch with a cap, where both the packaging and the cap are made of the same material, according to 46.3% of the respondents. The SWOT analysis has also confirmed that the standard stand-up pouch is the most suitable for modeling gel packaging. Additionally, the analysis suggests that the stand-up pouch with a cap, where the packaging and the cap are made of the same material, is the best choice for moisturizer packaging. SWOT analysis validated respondents' choice for more ecological alternatives, including products made from a single material and better recyclability. It is believed that the greatest challenge in replacing traditional packaging with refills lies in the reverse logistics, given the sheer size of Brazil.

Acknowledgments

The authors are grateful to the National Council for Scientific and Technological Development (CNPq) and the Coordination for the Improvement of Higher Education Personnel (CAPES).

Author contributions

All the authors contributed equally to data collection and writing the manuscript. And all of them have read, review and agreed to the published version of the manuscript.

Funding

Professor Elen Beatriz Acordi Vasques Pacheco has a grant supported by National Council for Scientific and Technological Development– CNPQ (PQ-2/2021: 311352/2021-9).

Data availability

The data supporting this study's findings are available from the corresponding author upon reasonable request.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

Consent

The questionnaire respondents were informed that their answers would be used in scientific research and consented to its possible publication.

Consent to participate

Informed consent was obtained from all individual participants in the study.

Ethics statement

The questionnaire was applied to people over 18 years old, all of whom agreed to complete it in the knowledge that the results would be used in academic research. The respondents' names were not indicated or divulged, nor are they identifiable by their answers. No research conducted in this study was related to identifying information (names, dates of birth, national identity numbers, or biometrics {such as facial features, fingerprints, handwriting, voice patterns, DNA and other distinctive traits}). No photographs or genetic profiles were requested, and the ethical principles of care, respect, truthfulness, reliability and responsibility were followed.

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