

Article

An Exploratory Study of Consumers' Knowledge and Attitudes about Lignin-Based Sunscreens and Bio-Based Skincare Products

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Supplementary Materials:

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Table S1. Socio-demographic data.

Variable	Categories	n (%)
Age	18–25	41 (17.83%)
	26–35	94 (40.87%)
	36–45	47 (20.43%)
	46–55	36 (15.65%)
	56–65	8 (3.48%)
	66 +	2 (0.87%)
Gender	Undisclosed	2 (0.87%)
	Female	166 (72.17%)
	Male	58 (25.22%)
	Non-binary	1 (0.43%)
Educational level	Undisclosed	5 (2.15%)
	Primary	1 (0.42%)
	Secondary	17 (7.39%)
	Bachelor's degree	61 (26.52%)
	Master's degree	92 (40.00%)
	Doctorate	53 (23.04%)
Occupation	Undisclosed	6 (2.61%)
	Student	42 (18.26%)
	Employed	157 (68.26%)
	Unemployed	12 (5.22%)
	Retired	6 (2.61%)
	Other	8 (3.48%)
	Undisclosed	5 (2.17%)
	Slovenia	156 (67.83%)
Country of residence	Spain	20 (8.70%)
	France, USA	6 (2.61%)
	Italy	5 (2.17%)
	Undisclosed	4 (1.74%)
	Finland, United Kingdom	3 (1.30%)
	Croatia, Germany, India, Poland, Romania, Turkey	2 (0.87%)
	Austria, Australia, Belgium, Bosnia and Herzegovina, Brazil, Canada, Czech Republic, Iran, Mexico, Nepal, Pakistan, Philippines, Sweden, Switzerland, Ukraine	1 (0.43%)
	Very good	13 (5.65%)
Subjective socio-economic status	Good	88 (38.26%)
	Fair	109 (47.39%)
	Poor	14 (6.09%)
	Very poor	1 (0.43%)
	Undisclosed	5 (2.17%)
	I	35 (15.22%)
Fitzpatrick skin type	II	77 (33.48%)
	III	79 (34.35%)
	IV	29 (12.61%)
	V	8 (3.48%)
	Undisclosed	2 (0.87%)

Table S2. Data dictionary of numerical variables that were merged or single items representing a construct.

Variable Name	Variable Description	Included Items (Item's Code)	Formula	Values
Knowledge	Knowledge and awareness about the relation between sunscreen, health, the environment, and bio-based skincare	*Solar radiation is harmless. (Q9a)		
		*Having a tan is healthy. (Q9b)		
		Skincare products help to fight the effects of ageing. (Q9c)		
		Use of sunscreens can prevent sunburns, skin damage, skin ageing and skin cancer. (Q9d)		
		*The official recommendation is to always use a broad-spectrum sunscreen with SPF 50 or higher. (Q9e)		
		Ingredients from skincare and sunscreen products are being continuously released into the environment. (Q10a)		
		Synthetic UV filters, antioxidants, and preservatives are common ingredients in skincare. (Q10b)		
		Chemicals from skincare products tend to accumulate in living organisms. (Q10c)		
		Chemicals from skincare products have been detected in human fluids, such as urine, semen, breast milk, and the bloodstream. (Q10d)		
		*Chemicals from skincare products are harmless to ecosystems. (Q10e)		
Purchase behaviour	Purchasing behaviour related to bio-based skincare	Chemicals can cause dermatological side effects (skin allergies or irritation). (Q10f)		
		I usually check the ingredients of the products when buying it. (Q9f)		
		I tend to buy skincare products with ingredients of natural origin. (Q9g)		
Purchase intention	Intention to purchase bio-based skincare products in the future	I am willing to pay more for a bio-based skincare product if it is free of chemicals. (Q16d)		
		I will buy skincare products containing mainly bio-based ingredients in the future. (Q16h)		
		*Artificially made/synthetic ingredients are more efficient than natural ingredients. (Q9h)		
Bio-based attitude	Attitude towards bio-based ingredients	In addition to the origin of the ingredients, a sustainable method for their production is also important. (Q10g)		
		The environmental impact of synthetic ingredients concerns me. (Q10i)		
		The use of bio-based ingredients in skincare products would have a positive impact on the environment. (Q16a)		
		*Plant-derived ingredients cannot replace synthetic ingredients. (Q16b)		
		Skincare products containing bio-based ingredients are healthier for my skin than products with synthetic ingredients. (Q16c)		
		*Skincare products with bio-based ingredients are usually more expensive than synthetics. (Q16e)		
		*Good functionality/performance is what matters, not the origin of the ingredients. (Q16f)		
		*I prefer conventional chemical ingredients over bio-based ingredients. (Q16g)		
		Obtaining bio-based ingredients from agricultural waste is innovative. (Q16i)		
		*I would not want to use skincare/suncare products that are brownish in colour. (Q16j)		
Skincare interest	Self-assessed level of interest in skincare	Skincare interests me. (Q10h)		
Health attitude	Health consciousness; the person's awareness and readiness to do something about their health	I take good care of my health. (Q10j)		
Environmental attitude	The tendency to evaluate the natural environment with a certain level of favourableness	Protecting and preserving the environment should have priority over economic growth and development. (Q10k)		

$$= (Q9aR + Q9bR + Q9c + Q9d + Q9eR + Q10a + Q10b + Q10c + Q10d + Q10eR + Q10f) / 11$$

$$= (Q9f + Q9g + Q16d) / 3$$

$$= Q16h$$

1—Strongly disagree
2—Disagree
3—Neither agree nor disagree
4—Agree
5—Strongly agree
-99—Do not know

$$= (Q9hR + Q10g + Q10i + Q16a + Q16bR + Q16c + Q16eR + Q16fR + Q16gR + Q16i + Q16jR) / 11$$

$$= Q10h$$

$$= Q10j$$

$$= Q10k$$

Familiarity bio-based	Self-assessed familiarity with bio-based ingredients	Please choose the answer that best describes how familiar you were with the following subjects before this survey. Bio-based ingredients (substances of natural origin) for skincare (Q14b) Biopolymers (large molecules from plants or animals) from nature can be used as an ingredient for skincare and sun protection products. (Q14c) Natural biopolymers can be obtained from wood and plants, but also from renewable sourced leftover (residue) and waste materials from industry. (Q14d)	$= (Q14b + Q14c + Q14d) / 3$	1—I have never heard about it before 2—I have heard about it, but do not know much of it 3—I am familiar with the topic -99—Do not know
		Please choose the answer that best describes how familiar you were with the following subjects before this survey. Lignin (Q14a)	$= Q14a$	
Familiarity lignin	Self-assessed familiarity with lignin			
Buy lignin	Willingness to buy a lignin-based sunscreen	Would you buy a skincare product containing this ingredient? (Q18)	$= Q18R$	1—Yes 2—Probably 3—Maybe 4—No -99—Do not know
Skincare use	Frequency of using skincare products	How often do you use the following skincare products? Cleanser (Q1a) Moisturizer on the face (Q1b) Moisturizer on the body (Q1c) Repair or anti-ageing products (antioxidants, serums, exfoliators, etc.) (Q1d)	$= (Q1a + Q1b + Q1c + Q1d + Q1e + Q1f) / 6$	
		Sunscreen on the face (Q1e) Sunscreen on the body (Q1f) How often do you use sunscreen in the following conditions? On warm sunny days (Q2a) On cloudy days (Q2b) At the beach (Q2c) During recreation (e.g., jogging, cycling, walking, hiking) (Q2d) While doing outdoor domestic chores (e.g., lawn mowing, snow removal, gardening) (Q2e) While doing outdoor job-related tasks (e.g., construction work, delivery) (Q2f)	$= (Q2a + Q2b + Q2c + Q2d + Q2e + Q2f) / 6$	1—Never 2—Rarely 3—Sometimes 4—Often 5—Always -99—Do not know
Sunscreen use	Frequency of using sunscreen			

Note: Items with * were reverse coded (R) before merging them in a common variable.