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Different Route of Deliveries Vitamin C: Current Update on Knowledge and Perception among the Community in Malaysia.

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Abstract

Background: Products containing vitamin C have been widely used in aesthetics, but limited research has been conducted to assess the knowledge and perception of the community in Malaysia regarding vitamin C and its delivery routes in aesthetics. Vitamin C can be delivered to the human skin in various forms that appear to be popular among the community for their beauty benefits. Previous studies have found a beneficial effect in ultraviolet (UV) irradiation protection in formulations containing vitamin C and vitamin E. This study aimed to identify the current update on the usage pattern of vitamin C, the community's knowledge of vitamin C, and the community's perception regarding different routes of vitamin C delivery in aesthetics.
Methods: A cross-sectional study design was used using a self-administered online questionnaire. The number of participants included in the study were 385 participants. The data was collected and analysed using SPSS version 21 and presented as frequency and percentage.
Results: The findings revealed that 98.7% of respondents understand what vitamin C is including its functions, recommended intake, vitamin C sources etc and 82.3% have used vitamin C products. This study also highlighted moderate knowledge of vitamin C among respondents (49.1%) and moderate perception of different routes of vitamin C delivery in aesthetics (54%).
Conclusion: The Malaysian community has a favourable opinion of vitamin C products which provide various skin benefits. It is recommended that future studies target a larger population and more diverse socio-demographic characteristics to evaluate knowledge and perception of vitamin C use and its routes of delivery.

Keywords: *Vitamin C, Skin aging, Aesthetic, Routes of Delivery.*

Introduction

Human skin serves as a barrier between an individual's tissues and the environment. It also shields internal body tissues from trauma, foreign pathogens, external threats, and UV radiation from the sun[1]. There are a lot of vitamins and nutrients available in the market that benefits the skin like glutathione which improves wrinkles and skin elasticity and vitamin C, a potent antioxidant that can combat free radical scavengers)[1,2].

Recently, cosmetic products containing vitamin C have been widely used due to its antioxidant properties. Vitamin C (a water-soluble vitamin) is the main antioxidant found in human skin and is available in various forms[3]. It helps ensure skin health by promoting keratinocyte differentiation, reducing melanin synthesis, and protecting the skin against UV-induced photodamage[4]. A previous study stated that normal skin necessitates a high concentration of vitamin C to support collagen production and protect the skin from photodamage[1,5]. The oral route of vitamin C does not provide enough vitamin C to the skin because vitamin C cannot be transferred to the skin once it is saturated in the plasma[6]. Lack of vitamin C can contribute to the skin diseases like atopic dermatitis and porphyria cutanea tarda (a condition in which the skin blisters when exposed to sunlight)[4]. Aging is also linked to increased oxidative stress and an imbalance of redox reactions caused by antioxidant deficiency such as vitamin C[7]. Although there is no significant clinical evidence to support the use of vitamin C in dermatology[4], the demand for cosmetic products containing vitamin C is rising.

Vitamin C has been widely used in the aesthetics field even though, up until today, vitamin C has not yet been proven clinically to be effective in preventing anti-aging and – wrinkles as well as a material that causes whitening of the skin. Nevertheless, vitamin C is still one of cosmetic products' leading and essential materials. Previous researchers reported that a more significant proportion of females than males took vitamin C pills daily[8]. The reason behind this was due to health and beauty. In addition, cosmetics and pharmaceuticals consume a significant portion of people's daily expenses, especially females[9]. However, limited research has been conducted to assess the community's current knowledge and perception of vitamin C and its delivery routes in aesthetics. Therefore, awareness of vitamin C usage for skin health is essential. The current trend of vitamin C use urges the need for an explorative study to assess the community's knowledge. The study may aid in improving the awareness regarding vitamin C in protecting the human body's largest organ against various skin problems. The study aimed to explore the current knowledge and perception regarding different vitamin C delivery routes in aesthetics among Malaysia's community.

Materials and methods

This cross-sectional study was conducted from September 2021 to June 2022 through a self-administered online questionnaire (Google form) among the community in Malaysia. The sample size was calculated as 385 with a confidence level of 95% using the online sample size calculator (Raosoft®). The respondents were recruited by the convenience sampling method, in which participants above 21 years old and agreed to participate were included in the study. Participants with incomplete data were excluded from the study. The questionnaire was validated by two panels of experts, while a pilot study was conducted among ten participants to evaluate the reliability of the validated questionnaire. Respondents were provided with a link to an online questionnaire after giving their consent consenting to participate in the study. The participants were asked to select their preferred language for the consent form and filled the consent form. The questionnaire comprised twenty-six (26) questions divided into four different sections: socio-demographics, the pattern of vitamin C intake, knowledge regarding vitamin C, and perception of different routes of

deliveries vitamin C in aesthetics. The overall knowledge and perception of the respondents were classified using Bloom's cut-off point[10].

Scoring for section C: respondents' knowledge regarding vitamin C

This section contained eight statements in which the respondents were questioned about their knowledge regarding vitamin C. All statements were provided with yes, or no answers with an additional 'do not know' option. Each correct answer was given one (1) point, while the incorrect or do not know the answer was given zero (0) points. This section received an overall score of eight points. The level of respondents' knowledge was measured with the mean and standard deviation (S.D.). Respondents with at least 6.4 points and above eighty percent (≥ 80%) were considered to have good knowledge. If they scored 4.8–6.32 marks (60%-79%) from the total score, they were deemed to have moderate knowledge and poor knowledge if the score was less than 4.8 marks (< 60%) of the total score. The score varied from zero to eight, and all the responses from the participants were summed up.

Scoring for section D: respondents' perception towards different route of deliveries vitamin C in aesthetics.

There were seven statements in this section and the respondents were asked about their perceptions regarding different routes of deliveries vitamin C in aesthetics. The respondents had to answer on a Likert scale that ranged from strongly agree (S.A.), agree (A), neutral (N), disagree (D), and strongly disagree (S.D.). The rating scale was set up in the following order: strongly agree, agree, neutral, disagree, and strongly disagree, with scores of five (5), four (4), three (3), two (2), and one (1). The total score for this section was thirty-five (35) points. Respondents with a score of more than eighty percent (≥80%) were considered to have an excellent perception. Respondents were considered to have moderate perception if they scored between less than eighty percent (<80%) and more than sixty percent (≥60%). Respondents that scored less than sixty percent (<60%) had poor perception[11].

The Statistical Package for Social Science version 21 (SPSS Inc, Chicago, IL) for Windows was used to analyse the data. Descriptive analysis was used to illustrate socio-demographic characteristics, the usage pattern of vitamin C, knowledge and perception scores from respondents and the mean response scores within each section of the questionnaire for the cross-sectional survey.

Results

A total of 387 questionnaires were distributed to the community via Google Forms. However, two respondents were excluded due to their unwillingness to participate in this study. Table 1 illustrates the summarised data of 385 respondents' socio-demographic characteristics. Most respondents in this study were female (67.8%). More than half of the respondents (69.1%) were between the ages of 21 and 30, and 90.1% were Malay respondents. About 65.2% of the respondents were single and 25.5% were from Melaka. 217 respondents (51.6%) held a bachelor's degree, and most respondents were students (39.5%).

This study also investigated the usage pattern of vitamin C and sources of vitamin C awareness. As shown in Table 2, vitamin C was well known among the communities in Malaysia (98.7%), but only 82.3% used vitamin C products in their daily lives. The respondents occasionally used vitamin C (39.2%), and healthcare providers and social media became their sources of awareness regarding vitamin C supplements (61.0%).

All 385 respondents responded to eight questions regarding their knowledge about vitamin C. Table 3 shows that most respondents disagreed that the body cannot synthesize vitamin C (62.9%). Most of them knew that vitamin C was good for skin health (97.4%) and that it is one of the water-soluble vitamins (84.2%). More than half agreed that 1000 mg of vitamin C is the recommended

daily intake for adults (58.7%), while lack of vitamin C may lead to scurvy (63.4%). Almost all respondents admitted that fruits and vegetables are the best sources of vitamin C (97.4%). Moreover, 213 respondents (55.3%) out of 385 participants were unsure whether diarrhoea is a symptom of vitamin C toxicity.

Table 4 shows that the respondents have moderate knowledge of vitamin C (49.1%), while 31.7% have good knowledge, and 19.2% have poor knowledge.

Table 5 summarises the perception of various routes of vitamin C delivery in aesthetics (Section D). Most respondents (69.1%) responded positively regarding vitamin C serum which is suitable for skin whitening, and 357 respondents (92.8%) agreed that vitamin C tablet is good for the immune system. Most believed that pregnant women could safely use vitamin C (74%). Around 78.2% of respondents agreed that vitamin C cream helps to improve skin aging, while 45.2% responded that vitamin C injection could not be used to reduce wrinkles. Furthermore, the respondents have favourable opinions about the safety of using vitamin C injection for cosmetic purposes (49.9%). Respondents also agreed that vitamin C serum could protect the skin from UV rays (55.6 %).

As shown in Table 6, participants with moderate perception (54%), 44.7% had an excellent perception, and only 1.3% had a poor perception of different routes of vitamin C delivery in aesthetics.

Discussion

The overall results obtained from this study is that 98.7% of respondents understood what vitamin C was (functions, recommended dose, how to use, sources of vitamin C etc.), which is the opposite of what has been reported previously that only 43% of the participants (conducted in the northern border region of Saudi Arabia) knew what vitamin C was all about[12]. This may be because the current study mainly focuses on vitamin C. In contrast, the previous study covered vitamin C and other vitamins such as A, B, D, E, and K. More than 82.0% of them had used a vitamin C product in their daily routine. In this study, female respondents outnumbered males by 35.6%, demonstrating that the study discovered a high proportion of female respondents using vitamin C products. It was supported by a previous study in which females were more concerned about their health than males[12]. According to the current study, 39.2% of respondents used vitamin C occasionally, and 33.0% used it daily. Previous research showed that 29.0% of participants take vitamin C pills daily, while 21.0% take them occasionally[8]. Respondents had taken vitamin C daily in previous research compared to the current study, demonstrating the diversity of vitamin C intake daily. A previous study also found that a higher percentage of females than males took vitamin C pills daily, 60.0% and 40.0%, respectively[8]. Thus, it was an important finding because excessive vitamin C consumption can negatively affect the gastrointestinal tract[13]. The current study revealed that health care providers and social media platforms such as Twitter, Facebook, and Instagram are the most common sources of vitamin C information. Similarly, the previous research revealed that the most common source of information on vitamin supplementation was healthcare professionals, who are more knowledgeable in this field than others[14,15]. Meanwhile, a significant percentage of participants nowadays use social media and the internet to access information about vitamin C. The internet provides for unlimited access to that information, and billions of individuals have utilised social media to interact and share it with others.

According to the current study, nearly half of the participants (49.1%) have moderate knowledge, while only 19.0% have poor knowledge. The previous study shows that 52.21% of respondents were graded as having a good knowledge level on nutrition supplements[16]. The difference can be explained by the fact that the target population for the previous research was limited to students of Applied Medical Sciences, whereas the current

study includes a broader range of participants that may have an impact on the findings. Thus, more campaigns and advertisements can help to raise participants' knowledge and perception regarding vitamin C among community in Malaysia. Most respondents (62.9%) were unaware that humans could not synthesize vitamin C due to a lack of an enzyme known as L-glucono-gamma lactone oxidase[17]. However, they were aware that vitamin C is a water-soluble vitamin (84.2%) and comes in various forms (94.0%). Vitamin C is available in oral, injection, and topical preparations such as serum, transdermal patches and cream, and aqueous emulsion[18]. Since vitamin C has become a common ingredient in many cosmetic products, users have the opportunity to select their preferred vitamin C form as vitamin C bioavailability varies depending on the dosage form. This choice may help to improve skin health. Most respondents (58.7%) knew that the recommended daily vitamin C intake was 1000 mg. The European Food Standard Authority recommended a daily maximum of 1000 mg of vitamin C[19]. Previous study stated that only 8% of respondents take more than 1000 mg of vitamin C daily[8]. The current finding demonstrated that respondents understand the recommended daily vitamin C intake well. The difference can arise from lack of knowledge and studies in the past regarding vitamin C intake. But as time goes on, more studies have been conducted and the recommended daily intake of vitamin C is reported. However, more than 63.0% of respondents knew that a lack of vitamin C could result in scurvy. 55.3% of respondents were unsure that diarrhoea is one of the toxicity effects of vitamin C consumption. Researchers also stated that vitamin C overdosing might cause gastric pain and diarrhoea[13]. An individual must take vitamin C according to the recommended intake level, but it should not be excessive to avoid unwanted effects. 97.4% of the respondents said fruits and vegetables were the primary sources of vitamin C. Previous research found that vegetables and fruits account for up to 90% of vitamin C consumption[20]. It can be found naturally in citrus fruits like lemon and orange and some vegetables like broccoli and spinach. According to the National Institutes of Health, obtaining over 200 mg of vitamin C daily can be accomplished by eating five different portions of vegetables and fruits to prevent vitamin C deficiency[28]. Most respondents agreed that vitamin C benefits skin health (97.4%). However, previous research has proved that vitamin C is mainly used to prevent flu or cold[12]. This study has shown that vitamin C is good for health and helps the skin as vitamin C is a natural antioxidant which is good for skin rejuvenation and performs as photoprotectant against UV rays[5]. Furthermore, vitamin C does not work against the common cold in ordinary people. It is more beneficial for those with low vitamin C levels, such as the elderly and those who are subjected to intense physical activity or cold climates[29]. In this study, 54% of respondents showed a moderate perception of the different routes of delivering vitamin C in aesthetics. More than half of the respondents agreed that vitamin C serum is beneficial, especially for skin whitening. Serum containing 20% vitamin C, vitamin E, and raspberry leaf cell extract has been shown to lighten the skin colour and boost elasticity on the administered side after eight weeks of use[21]. Vitamin C helps to reduce melanin production, while vitamin E protects the skin from UV-induced hyperpigmentation. Most respondents (92.8%) agreed that vitamin C tablets benefit the immune system. A meta-analysis discovered that consuming 200 mg or more of vitamin C daily effectively reduces the duration and severity of the common cold and the incidence of the common cold when combined with physical stress[22]. This could be because of its role as a cofactor for numerous biosynthetic and gene regulatory enzymes. The respondents (74.0%) agreed that vitamin C is safe to take during pregnancy. Previous research has found that taking 100 mg of vitamin C daily helps to reduce the risk of premature membrane rupture and urinary tract infection in pregnant women[23]. The

European Union recommended 105 mg of vitamin C per day during pregnancy, while the United States suggested 85 mg[23]. Even though people know that pregnant women can safely take vitamin C supplements, the dosage still needs to stay within the prescribed range to avoid undesired outcomes. In addition, the respondents admitted that cream containing vitamin C affected skin aging. Previous studies have shown that 5% vitamin C cream positively affects skin relief transformation after six months of use[24]. Vitamin C cream is one of the most effective anti-aging and skin rejuvenation treatments. However, people also can slow aging process by limiting their exposure to environmental factors, such as prolonged sun exposure and poor dietary habits. Almost half of the respondents (45.2%) have a neutral opinion that vitamin C injections cannot be used to reduce wrinkles. There is no clinical study demonstrating the use of vitamin C injection as an anti-wrinkle, anti-aging, or whitening agent. However, researchers found that practitioners used intravenous vitamin C to treat cancers, infections, and other conditions[25]. A high dose of vitamin C is required to treat cancer patients because it protects essential biomolecules from oxidative stress, such as in patients with pancreatic cancer. Vitamin C injection decreased a marker of systemic oxidative stress (F2-isoprostanes), indicating that vitamin C injection has a systemic antioxidant effect[26].

In this study, only 49.9% agreed that vitamin C injection is not safe for cosmetic purposes. Meanwhile, 50.1% of those who responded disagreed. The results show that respondents have negative perceptions of the safety of vitamin C injections. The use of vitamin C injection for cosmetic purposes is not approved by the United States Food and Drug Administration (US FDA) or Malaysia's National Pharmaceutical Control Bureau. However, numerous facial spas and beauticians in Malaysia provide this service. According to a previous study, injecting vitamin C resulted in nausea, lethargy, vomiting, fatigue, and vein irritation[25]. Thus, the use of vitamin C injection in cosmetics can be prevented by implementing regulations. For example, Philippines is one of the countries that obey the FDA regulations and has also disapproved the use of injectable skin-lightening products like vitamin C and glutathione[27]. Finally, more than 50% of respondents agreed that vitamin C serum helps to protect the skin from UV rays. It is proven by previous researchers that applying a 5% vitamin C solution two hours before exposure to UV rays reduced skin damage caused by UV rays[24]. The current result indicated that respondents positively perceive vitamin C serum usage for skin protection.

Conclusion

Most participants were aware of vitamin C and sometimes used vitamin C products in their daily routines. Healthcare providers and social media became the primary sources of information about vitamin C supplements. The finding indicated that the community has a moderate amount of knowledge regarding vitamin C, including its sources, benefits, classification, recommended daily intake, and symptoms of toxicity. Meanwhile, Vitamin C is available in oral dosage forms and topical and injection forms for delivery to the skin. The current study also demonstrated that Malaysians' perceptions of the various routes for delivering vitamin C are moderate. Most participants felt that each vitamin C supplement offers significant advantages. However, some people were unaware of the risky use of vitamin C injections in cosmetic procedures. Thus, a campaign, flyers, educational activities involving communities, or media shall be conducted to enhance their knowledge and perception of vitamin C. Due to time constraints, the study may not be distributed evenly across all states, and there is a lack of references. It is suggested that additional research be conducted to obtain more variations in socio-demographic characteristics. Furthermore, it is recommended to assess the relationship between demographic characteristics and knowledge, as well as the perception of vitamin C and its delivery routes.

Conflict of Interest

The authors declare no conflict of interest.

Ethical Approval

This study was conducted after obtaining approval from the institute's ethics committee.

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Table 1. Socio-demographic characteristics of respondents.

Demographic characteristics (N=385)	Frequency, N (%)
Gender	
Female	261 (67.8)
Male	124 (32.2)
Age	
21 - 30	266 (69.1)
41 - 50	55 (14.3)
31 - 40	37 (9.6)
51 – 60	25 (6.5)
>60	2 (0.5)
Ethnicity	
Malay	347 (90.1)
Chinese	22 (5.7)
Indian	10 (2.6)
Others	6 (1.6)
Marital status	
Single	251 (65.2)
Married	130 (33.8)
Others	4 (1.0)
Residence state	
Melaka	98 (25.5)
Perak	54 (14.0)
Selangor	48 (12.5)
Kuala Lumpur	34 (8.8)
Kedah	31 (8.1)
Negeri Sembilan	27 (7.0)
Johor	26 (6.8)
Pulau Pinang	17 (4.4)
Kelantan	15 (3.9)
Terengganu	13 (3.4)
Pahang	11 (2.9)
Sabah	6 (1.6)
Putrajaya	2 (0.5)
Sarawak	2 (0.5)
Perlis	1 (0.3)
Highest education level	
Bachelor's Degree	217 (56.4)
Malaysia Higher School Certificate/Matriculation/ Foundation/Diploma	103 (26.8)
Malaysian Certificate of Education	51 (13.2)
Master	14 (3.6)
Current occupation	
Student	152 (39.5)
Private sector	100 (26.0)
Government sector	77 (20.0)
Unemployed	29 (7.5)
Self-employed/entrepreneur	27 (7.0)

Table 2. The usage pattern of vitamin C.

Variable (N=385)	Frequency, N (%)
Do you know what vitamin C is?	
Yes	380 (98.7)
No	5 (1.3)
Do you use any vitamin C products?	
Yes	317 (82.3)
No	68 (17.7)
How often do you take vitamin C in a day?	
Sometimes	151 (39.2)
Almost everyday	127 (33.0)
Rarely	88 (22.9)
Never	19 (4.9)
Sources of awareness of vitamin C supplements	
Healthcare providers	235 (61.0)
Social media	235 (61.0)
Internet	209 (54.3)
Friends	150 (39.0)
Relatives	120 (31.2)
Television/newspaper	111 (28.8)
Radio	29 (7.5)

Table 3. Respondents' knowledge regarding vitamin C.

No.	Statements	Responses, N (%)		Mean (SD)
		No / Do not know	Yes	
1.	Vitamin C cannot be synthesized in the body.	242 (62.9)	143 (37.1)	0.37 (0.484)
2.	Vitamin C is good for skin health.	10 (2.6)	375 (97.4)	0.97 (0.159)
3.	Vitamin C is a water-soluble vitamin.	61 (15.8)	324 (84.2)	0.84 (0.366)
4.	Vitamin C is available in various forms.	23 (6.0)	362 (94.0)	0.94 (0.237)
5.	Recommended daily intake of vitamin C for adults is 1000 mg.	159 (41.3)	226 (58.7)	0.59 (0.493)
6.	Scurvy is caused by the deficiency of vitamin C.	141 (36.6)	244 (63.4)	0.63 (0.482)
7.	Fruits and vegetables are the best sources of vitamin C.	10 (2.6)	375 (97.4)	0.97 (0.159)
8.	Diarrhoea is a symptom of vitamin C toxicity.	213 (55.3)	172 (44.7)	0.45 (0.498)

Table 4. Respondents' level of knowledge regarding vitamin C.

No.	Level of Knowledge	Frequency (%)
1.	Moderate	189 (49.1)
2.	Good	122 (31.7)
3.	Poor	74 (19.2)

Table 5. Respondents' perception on different route of deliveries vitamin C in aesthetics.

No.	Statements	Response, N (%)					Mean (SD)
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
1.	Vitamin C serum is good for skin whitening.	1 (0.3)	22 (5.7)	96 (24.9)	132 (34.3)	134 (34.8)	3.98 (0.923)
2.	Vitamin C tablet is good for the immune system.	0	0	28 (7.3)	150 (39.0)	207 (53.8)	4.46 (0.629)
3.	Vitamin C is safe for pregnant women.	3 (0.8)	6 (1.6)	91 (23.6)	126 (32.7)	159 (41.3)	4.12 (0.877)
4.	Vitamin C cream helps to improve skin aging.	1 (0.3)	8 (2.1)	75 (19.5)	147 (38.2)	154 (40.0)	4.16 (0.824)
5.	Vitamin C injection cannot be used in reducing wrinkles.	10 (2.6)	32 (8.3)	174 (45.2)	95 (24.7)	74 (19.2)	3.50 (0.979)
6.	Vitamin C injection is not safe for cosmetic purposes.	15 (3.9)	35 (9.1)	143 (37.1)	92 (23.9)	100 (26.0)	3.59 (1.086)
7.	Vitamin C serum protects the skin from U.V. rays.	13 (3.4)	35 (9.1)	123 (31.9)	115 (29.9)	99 (25.7)	3.65 (1.062)

Table 6. Respondents' perception level on different route of deliveries vitamin C in aesthetics.

No.	Perception's Level	Frequency (%)
1.	Moderate	208 (54.0)
2.	Good	172 (44.7)
3.	Poor	5 (1.3)

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