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# The Importance of Aesthetic Medicine in Increased Healthy Longevity and Affluence

*Kenneth Thean, Editor*

## Introduction

Resistance to physical decay and the desire to retain one's youthful appearance is not a new phenomenon in human history. Today, with advancements in medicine and nutrition, combined with an increased awareness of individual healthcare, people live longer, eat better, and enjoy greater health, productivity, and activity. As the population ages and healthy longevity becomes more common, an increasing number of individuals seek methods to enhance their appearance for both personal and professional reasons.

Despite recent efforts to promote diversity and acceptance in societies, beauty and youth continue to be significant determinants of economic security. Additionally, as more countries become increasingly affluent, there has been a corresponding exponential increase in global demand for aesthetic procedures in recent years [1]. The global medical aesthetics market was estimated to be worth \$13.9 billion in 2022 and is projected to reach \$23.5 billion by 2027, growing at a CAGR of 11.0% from 2022 to 2027 [2].

In societies that have achieved a level of material and technological development where survival and comfort require only a small fraction of time, affluent members often seek alternative ways to occupy themselves [3]. This pursuit can include recreational activities and, in many cases, aesthetic procedures.

## *Living Healthier and Living Longer*

Since the mid-twentieth century, it has been well-documented that human populations are living longer, a trend that has extended to many developing countries [4]. As Deaton [5] noted in his book *The Great Escape: Health, Wealth, and the Origins of Inequality*: "The greatest escape in human history is the escape from poverty and death". The dramatic increases in longevity can be attributed to advancements in medical and public health: controlling infectious diseases with antibiotics, antivirals, and vaccines; improving diet, water, and sanitation; and expanding access to education and pharmaceuticals. From antibiotics to stem-cell therapies, scientific advances have revolutionized the human experience, enhancing not only the length but also the quality of life.

In the field of longevity research, also known as geroscience, scientists are helping us understand how and why we age, with the potential to develop treatments that delay, prevent, or even reverse the effects of aging. Researchers have begun to identify key characteristics of aging. Despite the lack of consensus on the number, hierarchy, or order of importance of these hallmarks, certain processes such as cellular senescence, stem-cell exhaustion, and macromolecular dysfunction have been identified as key components of the aging process. Promising insights from longevity research are now making it possible to develop



treatments that may delay, prevent, or even reverse aging [6]. While the speed of pharmaceutical and biomedical innovation is likely to further increase life expectancy, increased longevity in societies presents its own challenges—particularly, the aging population.

### *Anti-Aging in Aging Populations*

Globally, most developed nations are confronting the challenge of aging populations. As the quality of life improves, affluent societies are experiencing declines in both mortality and fertility rates. Estimates from the United Nations suggest that by 2050, one out of six people in the world will be over 65 (16%), an increase from one in eleven in 2019 (9%) [7]. With increased affluence, citizens in developed nations are able to purchase more anti-aging products and services, driving growth in both product and service markets. Additionally, significant opportunities exist in the aging market, primarily due to its higher disposable income.

The aging population phenomenon, for example, is leading to increased demand for anti-aging products in China. According to Euromonitor, the number of elderly people in China alone is projected to increase by nearly 90 million by 2030 [8]. In 2019, Chinese consumers' growing awareness of aesthetic procedures, coupled with the expanding elderly population, accounted for the largest share of the anti-aging market in the Asia-Pacific region. While studies have noted a rising trend of younger patients seeking aesthetic procedures due to the influence of social media, many people are increasingly interested in aesthetic procedures as they age. They seek to look better, feel younger, and maintain a youthful appearance as they live longer [9].

### *The Vanishing Taboo of Aesthetic Procedures*

Societal attitudes toward aesthetic procedures have changed dramatically over the past few decades [10]. Along with the increased demand for these procedures, growing interest and

awareness have contributed to their mainstream acceptance. A global trend report by Allergan Aesthetics [10] found that 92% of respondents believed aesthetic treatments should be discussed openly without judgment. As a result, discussions about the demand for aesthetic procedures have become increasingly positive. These procedures are now considered a key component of the evolving field of anti-aging medicine, which focuses on the application of knowledge to delay the aging-related deterioration of the body and mind associated with senescence to the end of life. In this anti-aging context, aesthetic procedures are often referred to as “rejuvenative” rather than “transformative.” They are designed to reduce or modify the signs of aging rather than drastically alter natural facial features. These procedures aim to restore an individual's appearance to what it was previously, rather than creating a new look [11].

### *Anti-Aging in Aesthetic Procedures*

The development of anti-aging aesthetic procedures has evolved alongside the expanding medical discourse on anti-aging. Advanced techniques have made these procedures less intimidating, offering less invasive options and faster recovery times. Biotechnological advancements, such as energy-based devices—including new lasers—have enabled the reduction of signs of aging that were once considered irreversible [12]. Today, various energy-based devices are routinely used to address signs of aging such as wrinkles and fine lines. Additionally, neurotoxins and fillers are commonly injected to minimize expression lines and smooth out frown lines.

### *The Future of Aesthetic Procedures*

In affluent societies, the focus of preventive medicine has shifted towards “aging well.” While “aging gracefully” once described those who chose not to undergo aesthetic procedures as they grew older, this perspective now seems somewhat outdated. Aesthetic procedures, once

considered taboo, are now widely accepted. Aging gracefully no longer requires patients to proudly display their wrinkles. Instead, they can embrace aging with confidence by slowing down or even reversing the signs of aging. As the prevalence of aesthetic procedures and anti-aging technologies continues to grow, aging well involves not only maintaining a healthy, active body through diet and exercise but also preserving a youthful appearance.

## Conclusion

With the combination of healthy longevity, increasing affluence, and evolving personal aspirations, the medical aesthetic industry is on the brink of exciting changes. Rapid advancements in technology and treatment innovations, along with a growing number of well-informed patients, are driving significant shifts in the practice of medical aesthetics. As humanity continues to push boundaries in various aspects of life, aging well by maintaining a youthful appearance and staying healthy is becoming the new aspirational benchmarks for a generation of men and women worldwide.

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# Coix Seed Extract on Skin Aging

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**Abstract:** Aging is unavoidable; however, the aging of the skin not only causes various problems and disorders but also becomes an obstacle to individual aesthetics. Notably, there are several anti-aging medicines and cosmetics available today, and Coix seed extract, a traditional Chinese medicine, is among them. This extract has shown improvement in onycholysis, characterized by the painless detachment of the nail from the nail bed, as aging is also a factor, in a case report of a 62-year-old woman. Further research is required to explore the potential of Coix seed extract as an anti-aging agent.

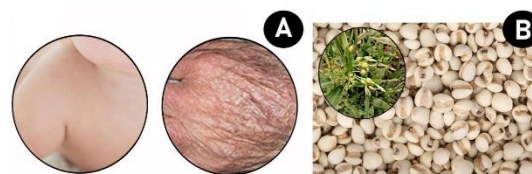
Keywords: Anti-aging Agents, Coix Seed Extract, Medicinal Plants, Skin Aging,

Dear editor,

As aging progresses, not only systemic diseases, but also skin disorders from aesthetic problems to skin diseases are observed. Infants, children, and young people have firm and lustrous skin; however, this firmness diminishes with age (Figure 1A), largely due to changes in the number and function of dermal fibroblasts. [1]. It is not without reason that the age of 26 years is often referred to as the turning point for the skin, as it has been shown that the activity of dermal fibroblasts shifts from tissue activation to inhibition around this age [2]. Although we cannot return to our youth, anti-aging agents like retinoids are being developed in the beauty and cosmetic industry [3] to delay the aging process.

Coix seed (C-S) extract (Figure 1B), a traditional Chinese medicine [4], is widely marketed, claiming to have whitening properties and able to improve senile warts. The author observed that it can improve age-related thinning of the skin during wart treatment in elderly patients, although not dramatically (unpublished

data). This letter examines the effect of Coix seed extract on skin aging.

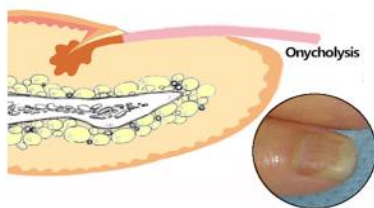


**Figure 1 A;** Clinical photographs of skin of an infant and old individual. **B;** Coix seed and its plant.

In daily practice, elderly individuals often experience thinning and weakening of the skin, making them more prone to internal bleeding, such as senile purpura, particularly on the forearms, and skin peeling with minor trauma. Oral administration of C-S extract has been observed to be effective in suppressing skin peeling due to age-related weakening of skin tissue and promoting skin turnover by a small extent. Onycholysis (Figure 2) is characterized by the painless detachment of the nail from the nail bed which is sporadically associated with several diseases, the use of certain agents, and is one of the changes observed as part of the aging process



[5, 6], though its exact cause remains unknown. The author reported a case of onycholysis in a 62-years-old female treated with the C-S extract [5]. Aging appears to be a contributing factor, as seen in the effects of C-S extract on elderly individuals with onycholysis [5], though the development thresholds may vary. The author speculates that C-S extract may help modulate impaired turnover in skin-to-nail keratinization. These patient experiences suggest that C-S extract might promote the restoration of epidermal turnover, similar to retinoids [3], and thus has the potential to be used as an anti-aging agent.



**Figure 2** Illustrated schema of onycholysis and its clinical photo.

The C-S extract, a traditional Chinese medicine, is commonly used based on a long history of empirical evidence [4]. The high level of safety of C-S extract supports its long-term use, even if its effects are not particularly strong, based on established practice and accumulating evidence. However, sufficient scientific research supporting its efficacy, particularly as an anti-aging agent, may still be lacking. Future studies are needed to determine the specific mechanisms through which C-S extract promotes skin turnover, as this extract holds potential for clinical use in addressing skin aging.

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### Potential Conflict of Interest

The author declares that there are no conflicts of interest.

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# The Factors Influencing Cosmetic Product Purchasing Among Malaysian Consumers: A scoping review

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**Abstract:** The Malaysian cosmetics industry has experienced significant growth, yet the factors influencing consumer purchasing behaviour in this sector remain underexplored. The current study aimed to systematically assess the factors influencing cosmetic product purchasing among Malaysian consumers. A systematic review of relevant articles was conducted using three electronic databases: Web of Science, Scopus, and ScienceDirect, covering the period from 2013 to 2023. The inclusion criteria were all study designs investigating or reporting factors influencing cosmetic product purchasing, with full-text articles available. Articles were excluded if they were conference proceedings, books, encyclopaedias, protocols, or published in languages other than English. Predetermined search strings were used to identify relevant articles. A total of 2,823 research articles were located, and 38 articles were included in the review. The majority of the studies utilized the Theory of Reasoned Action and the Theory of Planned Behaviour (n=18) as theoretical frameworks to predict consumer purchasing behaviour for cosmetic products. The Stimulus-Organism-Response (SOR) Model was used in the current study as a conceptual framework to classify the factors influencing consumer purchasing behaviour. The identified factors were categorised into stimuli, organism, and response. The stimuli identified included social and marketing stimuli, with marketing stimuli, consisting of extrinsic and intrinsic factors, emerging as the predominant factors studied (n=74) compared to social stimuli (n=16). These stimuli trigger consumer evaluation, known as the organism, and lead to a response. The organisms identified were theoretical adaptation (n=65) and psychological evaluation (n=3), which ultimately determine consumer purchasing behaviour and actual product purchasing. This study has illuminated the multifaceted stimuli influencing consumer behaviour, encompassing marketing and social stimuli. These stimuli shape consumers' beliefs, values, and perceptions, subsequently developing their purchasing behaviour. Recognising and adapting to these drivers enables companies to tailor their strategies effectively, addressing the evolving needs and preferences of Malaysian consumers related to cosmetic products.

Keywords: Consumer behaviour, Cosmetics, Malaysia, Marketing stimuli, Purchasing factors

## Introduction

Nowadays, people perceive the application of cosmetic products as a necessity rather than a luxury to achieve desired beauty standards. The cosmetics market has experienced progressive growth since the Egyptian, Greek, and Roman eras, subsequently developing into one of the most invaluable industries worldwide [1]. The global cosmetics market is projected to generate approximately £294.40 billion in sales by 2027 due to the significant growing demand for cosmetic products [2]. Similarly, the cosmetics market in the Asia-Pacific region alone has shown progressive development to satisfy high consumer demand [3,4]. Notably, Malaysia has emerged as a prominent industrial player, showing rapid growth in the cosmetics industry [5-7]. Moreover, the cosmetics industry in Malaysia is projected to reach £1,214 million by 2027, with an annual growth rate of 10% [2,8].

The use of “cosmetic product” and “skincare product” terminologies is often ambiguous, as both terms are used interchangeably by consumers. “Cosmetic product” is an umbrella term that comprises various subcategories, including skincare products, hair care products, oral care products, nail care, and makeup, while “skincare product” is a subcategory under cosmetic products. Both terms are used to refer to products designed for cleansing, massaging, moisturizing, and other functions aimed at optimizing the external parts of the human body, including the skin, nails, and lips [9-12]. Among the cosmetic subcategories, skincare products are the leading products within the global cosmetic industry. They are particularly significant in Malaysia, where the skincare market constitutes approximately 30% of the overall cosmetics market [13-15].

Several factors have been reported to influence the increasing demand for cosmetic products. In contemporary society, more people are conscious of their appearance, leading to a growing number of individuals seeking healthier skin, improved self-image, and enhanced appearance [15-17]. Furthermore, cosmetic products are no longer exclusive to women. A

survey study by Infante et al. [18] among 49 men and 52 women residing in Brazil revealed that both genders show interest in cosmetic products driven by different motivations. Similar findings were observed in Malaysia, where it was revealed that most Malaysian male consumers invest in skincare products to achieve healthy skin, a good appearance, and to reduce acne or freckles [9]. Good quality for healthy skin encompasses radiance, a glowing, and rejuvenated appearance [19]. Consequently, many individuals opt to purchase skincare products to age gracefully while seeking methods to mitigate skin problems such as wrinkles and acne [16, 20-23].

Purchase decisions on skincare products among younger generations are often triggered by concerns about the progressive deterioration of facial appearance due to aging [24-26]. It has been reported that cosmetic products improve self-esteem and help individuals engage confidently in their social and professional relationships [27]. Increasing public awareness of fashion, health, fitness, and beauty, along with rising incomes, has also contributed to the growth of the cosmetic industry [15,24,28-30]. Moreover, technological advancements and social media have played a pivotal role in influencing market trends and consumer preferences by disseminating information and raising awareness among a broader audience. Consequently, several small and medium-sized enterprises (SMEs) have developed and marketed their own skincare products, further bolstering the skincare market to meet the high and growing demand from customers.

With the growing demand for cosmetic products in Malaysia, there is a need to assess the conceptual framework and determinant factors associated with cosmetic product purchasing in the country. Additionally, past studies have reported a lack of awareness and understanding of the factors underpinning consumer purchasing behaviour among cosmetic product manufacturers and marketers [13,31]. Therefore, this study aims to conduct a scoping review to provide a better understanding of the determinant factors and conceptual framework involved in cosmetic product purchasing in

Malaysia. The findings of this study are anticipated to be of substantial value to cosmetic product retailers and marketers, helping them strengthen their marketing strategies and effectively meet the evolving needs of their customers.

## Methodology

This study was conducted as a scoping review of prior research investigating the factors that may influence cosmetic product purchasing among consumers in Malaysia. The study employed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement to report the study outcomes and the process of retrieving relevant articles. The process comprised three search strategies: identification, screening, and inclusion, as illustrated in **Figure 1**.

### Identification

Initially, all relevant articles were systematically searched and identified across three electronic databases: Web of Science (WOS), Scopus, and ScienceDirect, from 25th August 2023 to 1st September 2023. The current study employed a specific search string comprising: ((Purchase OR Buy OR Consume) AND (Factor OR Determinant) AND (Intention OR Behaviour OR Decision) AND (Cosmetic OR Personal Care OR Skin Care OR Beauty Care) AND (Malaysia)). Boolean operators, such as “AND” and “OR,” were strategically used to enhance the sensitivity and specificity of the article retrieval process. Subsequently, the identified articles were meticulously imported into a reference manager, Mendeley®, to ensure that the retrieved articles were organized systematically.

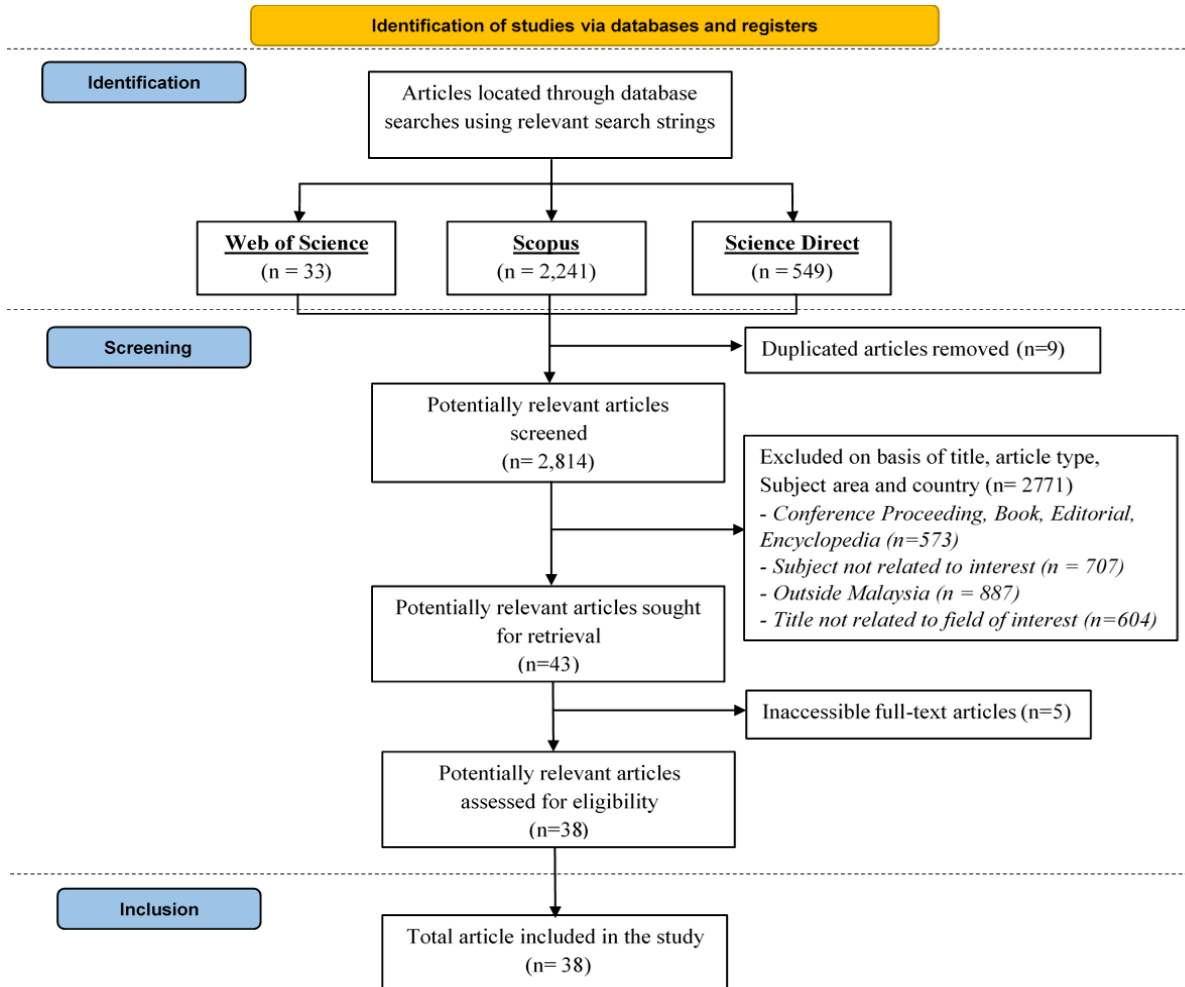
### Screening

The articles underwent a rigorous screening process to determine their eligibility based on

predefined inclusion and exclusion criteria, which encompassed evaluations of their title, abstract, and full-text content. The inclusion criteria were as follows: studies conducted between 2013 and 2023, reporting determinant factors influencing cosmetic product purchases, and accessibility to the full-text articles. Conversely, the exclusion criteria included conference proceedings, books, encyclopaedias, protocols, and articles published in languages other than English. These screenings were conducted to ensure that the selected articles were relevant, peer-reviewed, and of high quality [32]. The initial screening involved assessing article titles, followed by a review of abstracts and main findings by MFR, with cross-checking by EMH. In cases where uncertainty or ambiguity arose, a collaborative review by both MFR and EMH preceded the final determination of article inclusion or exclusion.

### Inclusion

All included and excluded full-text articles were assessed independently by MFR and EMH to ensure the validity of the process. Any discrepancies in article exclusion and inclusion were resolved through a consensus-based approach. Relevant information pertaining to key study characteristics, such as authorship, publication year, study design, research setting, study objectives, and findings on the determinant factors influencing cosmetic product purchasing, was extracted from all eligible articles and documented in an extraction table. The current study applied the Stimulus-Organism-Response (SOR) model to categorize the included determinant factors involved in cosmetic product purchasing into three distinct categories: stimuli, organism, and response. MFR and EMH extracted the data individually and compared the results to identify similarities and discrepancies. Reasons for article exclusion were recorded in a spreadsheet.



**Figure 1** PRISMA flow chart on the summary of the screening process for articles selection.

## Results

The current study located 2,823 research articles across three electronic databases: Web of Science (WOS), Scopus, and ScienceDirect, using the predefined search query. Based on the inclusion and exclusion criteria, a total of 38 pertinent research articles were included in the study, while the remaining 2,785 articles were excluded. The exclusions were primarily due to several factors: titles not related to the field of interest (n=604), studies not conducted in Malaysia (n=887), irrelevance to the subject field of interest (n=707), conference proceedings (n=573), duplication (n=9), and inaccessibility to full-text articles (n=5), as illustrated in **Figure 1**.

## Research article characteristic

Among the 38 research articles included in the analysis, the majority were quantitative studies (n=31), followed by qualitative studies (n=5) and mixed-method studies that combined both qualitative and quantitative approaches (n=2). A substantial portion of the quantitative studies employed self-administered questionnaires (n=32), while the qualitative studies predominantly involved interviews (n=2) and literature reviews (n=7) extracted from electronic databases. Interestingly, varied terminologies were used to denote cosmetic products, such as 'beauty product' (n=4) and 'skincare products' (n=4). Nevertheless, the majority of articles used the term 'cosmetic product' in their studies (n=26).



A notable proportion of the research studies aimed to assess Halal cosmetic products (n=19), followed by general cosmetic products (n=17), non-Halal certified cosmetic products (n=1), and luxury brand cosmetic products (n=1). Moreover, four articles evaluated eco-friendly products, encompassing organic, natural, or green cosmetic products (n=4). With respect to study design, the majority of quantitative studies used convenience sampling techniques to recruit respondents (n=15), while qualitative studies employed content analysis (n=4) to extract relevant research articles. Furthermore, most respondents were approached via online surveys (n=14) through email, WhatsApp, and social media platforms such as Facebook and Instagram. Additionally, survey studies were primarily centred in the Klang Valley region, Malaysia (n=16), followed by Penang (n=2), the east coast of Malaysia (n=1), and Johor (n=1). It's worth noting that a number of articles did not specify the precise location within Malaysia (n=16).

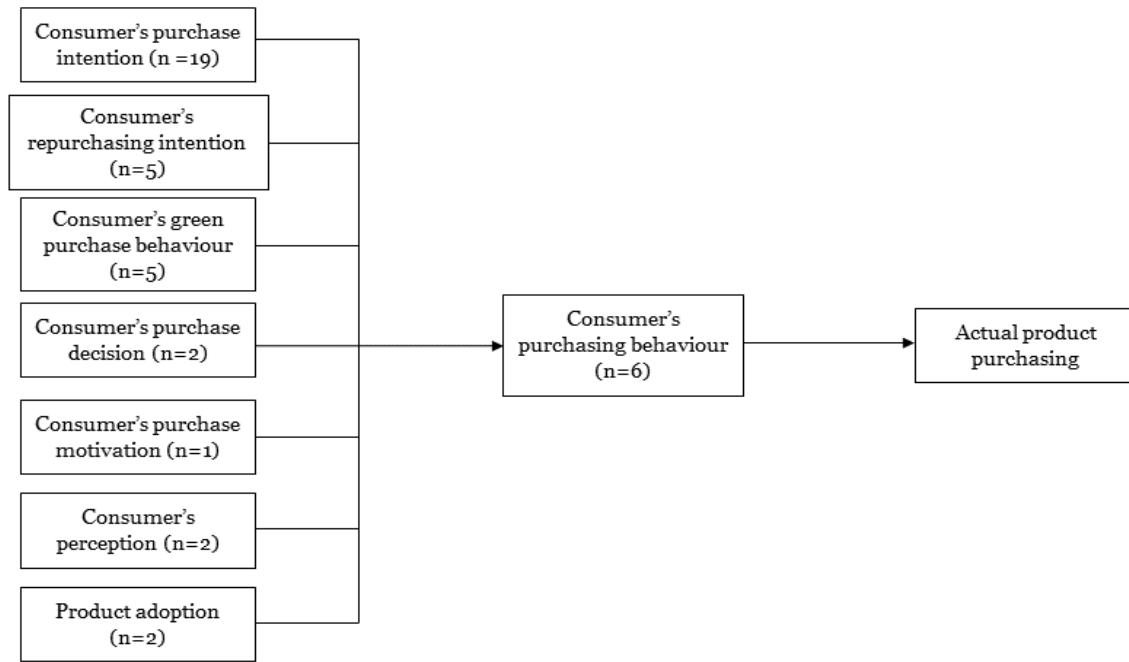
Regarding respondents' demographics, some studies focused on Muslim consumers (n=9) and non-Muslim consumers (n=1) for cosmetic product use, although the majority involved the general consumer population (n=28). Most studies did not explicitly specify respondents' ages in the sample inclusion criteria (n=18); nonetheless, most studies primarily focused on young Malaysian adults aged between 18 and 40 years. In relation to sample size, the majority of studies involved a moderate sample size ranging from 100 to 299 respondents (n=16). The current study observed that different articles employed varied responses or outcomes to elucidate consumer purchasing behaviour towards cosmetic products. These responses predominantly included purchase intention (n=19), followed by repurchase intention or continuance of use (n=5), purchase behaviour (n=6), green purchase behaviour (n=5), purchase decision (n=2), purchase motivation (n=1), consumer perception (n=2), and

product adoption (n=2), as shown in **Figure 2**.

In terms of theoretical frameworks, most research articles incorporated two closely interrelated theories to evaluate consumer purchasing behaviour for cosmetic products: The Theory of Planned Behaviour (n=10) and the Theory of Reasoned Action (n=8). Additionally, it is noteworthy that the Value-Belief-Norms theory was the primary theoretical framework (n=3) applied in assessing green purchase behaviour towards eco-friendly cosmetic products. The theoretical frameworks used in the included studies serve as a basis for understanding consumer behaviour and decision-making processes in cosmetic product purchasing. The summary of study characteristics related to cosmetic product purchasing is presented in **Table 1**.

#### *Determinant factors*

The current study applied the Stimuli-Organism-Response (SOR) model due to its comprehensive perspective, flexibility, good predictive power, and widespread acceptance in classifying the determinant factors into stimuli, organism, and response [69]. The SOR model, introduced by Mehrabian and Russell in 1974, is derived from the input-output model and explains rational purchasing behaviour decisions [70]. In this model, stimuli are categorized into social stimuli and marketing stimuli, while the organism encompasses theoretical adaptation and psychological evaluation, which subsequently leads to the response that determines consumer behaviour. Notably, the results revealed that marketing stimuli (n=74) were the primary focus of investigation in the research articles, compared to social stimuli (n=16). The investigated marketing stimuli primarily consisted of extrinsic factors (advertisement, celebrity endorsement, branding, and product image) (n=58), followed by intrinsic factors (product quality, product value, product ingredients and safety,



**Figure 2** Consumer’s purchasing behaviour predictors.

**Table 1** Summary of retrieved study characteristic.

| <b>Characteristic</b>  | <b>Studies, n</b> |
|--|-------------------|
| <b>Publication year</b>  |                   |
| 2013   | 1                 |
| 2014   | 1                 |
| 2015   | 1                 |
| 2016   | 3                 |
| 2017   | 3                 |
| 2018   | 5                 |
| 2019   | 6                 |
| 2020   | 5                 |
| 2021   | 3                 |
| 2022*  | 8                 |
| 2023   | 2                 |
| <b>Publishing journal</b>  |                   |
| Journal of Social Science  | 1                 |
| Journal of Islamic Marketing*                                    | <b>5</b>          |
| Journal of Social Sciences & Humanities                          | 1                 |
| Cosmetics, MDPI  | 1                 |
| International Journal of Ethics and System                       | 1                 |
| International Journal of Pharmaceutical and Healthcare Marketing | 2                 |
| Journal of Cosmetic Dermatology                                  | 1                 |
| International Journal of Environmental Research & Public Health  | 1                 |
| Global Journal Al-Thaqafah                                       | 1                 |
| Sustainability, MDPI   | 1                 |
| Procedia Economics and Finance                                   | 2                 |
| Journal of Retailing and Consumer services                       | 1                 |

|  |    |
|--|----|
| Procedia Social and Behavioural Science                | 1  |
| Malaysian Journal of Consumer and Family Economics*    | 5  |
| International Journal of Supply Chain Management       | 1  |
| Academy of Entrepreneurship Journal                    | 1  |
| American Scientific Publishers                         | 1  |
| Management Science Letters                             | 2  |
| Journal of Islamic Monetary Economics and Finance      | 1  |
| Iranian Journal of Management Studies (IJMS)           | 1  |
| International Journal of Business and Society          | 1  |
| Journal of Computational and Theoretical Nanoscience   | 1  |
| Malaysian Journal of Syariah and law                   | 1  |
| WSEAS Transactions on Business and Economics           | 1  |
| Journal of Islamic Accounting and Business Research    | 1  |
| Journal of Asia Business Studies                       | 1  |
| Romanian Journal of Communication and Public Relations | 1  |
| <b>Terminology used to refer cosmetic product</b>      |    |
| Cosmetic product*                                      | 26 |
| Beauty product   | 4  |
| Personal care product                                  | 2  |
| Skincare product                                       | 4  |
| Nutricosmetic product                                  | 2  |
| Facial care product                                    | 1  |
| <b>Cosmetic product type</b>                           |    |
| Halal*   | 19 |
| General  | 17 |
| Non-halal certified                                    | 1  |
| Luxury brand   | 1  |
| Eco-friendly / organic / natural / green               | 4  |
| <b>Study design</b>                                    |    |
| Quantitative study*                                    | 31 |
| Qualitative study                                      | 5  |
| Mixed  | 2  |
| <b>Methodology</b>                                     |    |
| Self-administered questionnaire*                       | 32 |
| Interview  | 2  |
| Literature review                                      | 7  |
| <b>Sampling technique (quantitative)</b>               |    |
| Systematic sampling                                    | 2  |
| Convenience sampling*                                  | 15 |
| Selective sampling (judgemental / purposive)           | 9  |
| Quota sampling   | 2  |
| Simple random sampling                                 | 1  |
| Not mentioned  | 4  |
| <b>Data extraction method (qualitative)</b>            |    |
| PRISMA   | 2  |
| Content analysis approach*                             | 4  |
| Thematic analysis                                      | 1  |
| ROSES  | 1  |

|                                  |    |
|----------------------------------|----|
| <b>Setting</b>                   |    |
| Mall / supermarket               | 10 |
| University                       | 4  |
| Online*                          | 14 |
| Not specified                    | 3  |
| In-person                        | 7  |
| Electronic database              | 7  |
| <b>Location</b>                  |    |
| Klang Valley, Malaysia*          | 16 |
| Penang, Malaysia                 | 2  |
| Johor, Malaysia                  | 1  |
| East Coast, Malaysia             | 1  |
| Location not specified*          | 16 |
| <b>Respondents</b>               |    |
| Muslim                           | 9  |
| Non-Muslim                       | 1  |
| General*                         | 28 |
| <b>Inclusion age</b>             |    |
| 18 – 60 years old                | 15 |
| Not specified*                   | 18 |
| Not applicable                   | 5  |
| <b>Sample respondents</b>        |    |
| <100                             | 3  |
| 100-299*                         | 16 |
| 300-499                          | 12 |
| > 500                            | 2  |
| <b>Measurement outcome</b>       |    |
| Purchase Intention*              | 16 |
| Repurchase Intention/Continuance | 5  |
| Purchase Decision                | 2  |
| Purchase Behaviour               | 5  |
| Green Purchase Behaviour         | 5  |
| Product Adoption                 | 2  |
| Consumer's Perception            | 2  |
| Purchase Motivation              | 1  |
| <b>Theoretical framework</b>     |    |
| Theory of Reasoned Action        | 8  |
| Theory of Planned Behaviour*     | 10 |
| Economic Signalling Theory       | 1  |
| Value-Belief-Norm Theory         | 3  |
| Stimulus-Organism-Response       | 4  |
| Diffusion of Innovation          | 2  |
| Theory of Consumption Value      | 2  |
| Elaboration Likelihood Model     | 1  |
| Social Cognitive Theory          | 1  |
| Social Identity Theory           | 1  |
| Social Influence Theory          | 1  |
| Self-Congruity Theory            | 1  |

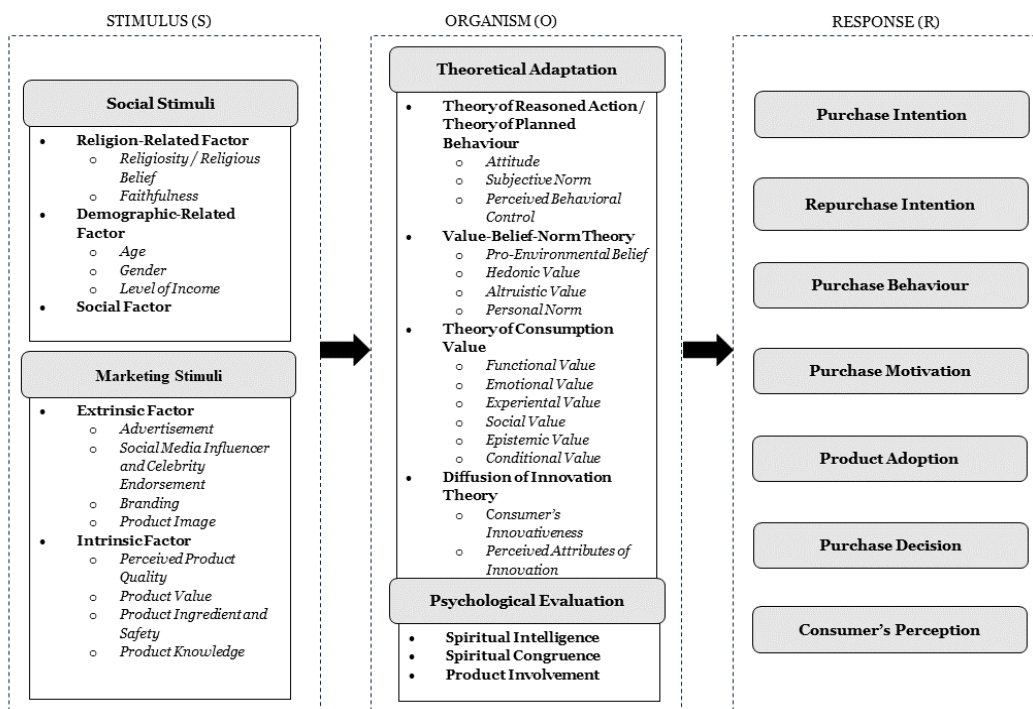
|  |   |
|--|---|
| Social Media Marketing Theory                | 1 |
| Theory of Customer Behaviour (Not Specified) | 1 |
| Not mentioned                                | 8 |

\*Highest number of studies involved in each parameter or characteristic.

product knowledge) (n=16). These stimuli serve as triggers for establishing the consumer's internal evaluation and belief, known as the organism, which mediates the relationship between stimulus and response. The primary organisms involved were theoretical adaptation (n=65), which included the Theory of Reasoned Action and Theory of Planned Behaviour (n=24), the Value-Belief-Norm (n=23), the Theory of Consumption Value (n=15), the Diffusion of Innovation Theory (n=2), and unspecified theoretical adaptations (n=1), followed by psychological evaluation (n=3).

These theories were developed to predict consumer purchase behaviour based on the consumer's beliefs, internal evaluations, and external evaluations. For instance, the Theory of Planned Behaviour includes attitude, subjective norm, and perceived behavioural control, which together determine consumer purchasing behaviour. Additionally, four studies reported that attitude was found

to be the most influential predictor (n=4) and served as a potential mediator in developing positive cosmetic product purchase intentions. These stimuli and organisms facilitate the development of responses, or consumer purchase behaviours. Purchase behaviour was translated into several responses, with the majority of studies predominantly investigating purchase intention (n=19) as the response. This was followed by purchase behaviour (n=11), repurchase intention (n=5), purchase decision (n=2), purchase adoption (n=2), consumer perception (n=2), and purchase motivation (n=1). The term "purchase intention" was the most commonly studied because it measures the likelihood and intention of a customer to buy a product. The summary of determinant factors in cosmetic product purchasing is presented in **Table 2** and illustrated in **Figure 3**. All retrieved articles detailing study characteristics and main findings are presented in **Table 3**.



**Figure 3**  
Summary of determinant factors via SOR model framework application.



**Table 2** Summary of determinant factors in cosmetic product purchasing.

| Determinant Factors  | Factor mentioned in study (n) |
|--|-------------------------------|
| <b>STIMULI: Social Stimuli</b>   |                               |
| Religion-related factor<br>(religiosity, religious belief, faithfulness)   | 9                             |
| Demographic-related factor<br>(age, gender, income level)  | 6                             |
| Social factor (not specified)  | 1                             |
| <b>Total</b>   | <b>16</b>                     |
| <b>STIMULI: Marketing Stimuli</b>  |                               |
| <b>Extrinsic Factor</b>  |                               |
| Advertisement<br>(advertising, usefulness and feature of ads and blog, exposure to information, perceived credibility blog, sponsored ads, Islamic promotional ethics, social media marketing, promotional influence, eWOM, perceived CEO's image) | 17                            |
| Social Media<br>Influencer/Celebrity Endorsement<br>(attractiveness, familiarity, trustworthiness, influence, expertise, perceived authenticity, parasocial relationship, communication)   | 11                            |
| Branding<br>(brand awareness, brand consciousness, brand name, brand image)  | 11                            |
| Product Image<br>(product availability, price, labelling and packaging, halal-related factors: awareness/logo & certification/ /perception/ knowledge)   | 19                            |
| <b>Intrinsic Factor</b>  |                               |
| Perceived product quality  | 3                             |

|   |           |
|---|-----------|
| Product value<br>(product positioning, product attributes, perceived product characteristic)              | 4         |
| Product ingredient and safety<br>(ingredient safety, safety value, perceived safety, product suitability) | 6         |
| Product knowledge   | 3         |
| <b>Total</b>  | <b>74</b> |

#### **ORGANISM: Theoretical Adaptation**

|  |    |
|--|----|
| Theory of Reasoned Action/Theory of Planned Behaviour<br>(attitude, subjective norms, perceived behavioural control)                     | 24 |
| Value-Belief-Norm Theory<br>(pro-environmental belief, hedonic value, altruistic value, personal norm)                                   | 23 |
| Theory of Consumption Value<br>(functional value, emotional value, experimental value, social value, epistemic value, conditional value) | 15 |
| Diffusion of Innovation Theory<br>(consumer innovativeness, perceived attributes of innovation)  | 2  |

#### **ORGANISM: Psychological Evaluation**

|                        |           |
|------------------------|-----------|
| Spiritual Intelligence | 1         |
| Spiritual Congruence   | 1         |
| Product Involvement    | 1         |
| <b>Total</b>           | <b>67</b> |

#### **RESPONSE: Consumer's Behaviour**

|                       |           |
|-----------------------|-----------|
| Purchase Intention    | 19        |
| Repurchase Intention  | 5         |
| Purchase Behaviour    | 11        |
| Purchase Motivation   | 1         |
| Product Adoption      | 2         |
| Purchase Decision     | 2         |
| Consumer's Perception | 2         |
| <b>Total</b>          | <b>42</b> |

**Table 3.** Summary of the retrieved articles from electronic databases

| No | Authors<br>(Year of<br>Publication)                   | Study Design                        | Study Setting   | Study Objective  | Factors and Theory Involved   | Finding   |
|----|---|-------------------------------------|---|--|---|---|
| 1  | Hussin SR et al.<br>(2013)                            | Quantitative<br>Study (Survey)      | <b>Location:</b> Malaysia<br>( <i>Location not specified</i> )<br><b>Setting:</b> Online and In-<br>person<br><b>Respondents:</b> 200 | To evaluate the<br>relationship between<br>factors involved with<br>moderating effect<br>(labelling with<br>advertising) towards halal<br>cosmetic purchase<br>intention.  | 1. Brand [S]<br>2. Price [S]<br>3. Quality [S]<br>4. Ingredients [S]<br>5. Labelling [S]<br>6. Advertising (Mediator) [S]<br><br><b>Theory:</b> Economic Signalling<br>Theory | 1. All five factors showed a<br>significant relationship towards<br>halal cosmetics purchase<br>intention.<br>2. Advertising was found to<br>mediate only for price-<br>purchase intention<br>relationship.   |
| 2  | Hashim AJ,<br>Musa R (2014)                           | Qualitative<br>Study<br>(Interview) | <b>Location:</b> Klang Valley,<br>Malaysia<br><b>Setting:</b> In-person<br>interview<br><b>Respondents:</b> 20                        | To evaluate the<br>relationships between<br>factors involved towards<br>halal cosmetic purchasing.   | 1. Content/Ingredient*<br>2. Product Suitability<br>3. Halal<br>4. Price<br><br><b>Theory:</b> Not Mentioned  | 1. The level of awareness towards<br>halal cosmetics is still low<br>2. Halal is not the main factor in<br>choosing cosmetic products.<br>3. Content/ingredient was ranked<br>to be the most important factor<br>followed by product suitability,<br>halal and price for both user<br>and non-user halal cosmetics. |
| 3  | Rahman AA,<br>Asrarhaghighi<br>E, Rahman SA<br>(2015) | Quantitative<br>Study<br>(Survey)   | <b>Location:</b> Malaysia<br>( <i>Location not specified</i> )<br><b>Setting:</b> Not specified<br><b>Respondents:</b> 110            | To assess the relationship<br>between the factors<br>involved and the<br>difference between<br>consumer's attitudes<br>towards Halal cosmetics<br>and Halal food products. | 1. Knowledge [NS]<br>2. Religiosity [S]<br>3. Attitude [S]<br><br><b>Theory:</b> Theory of Reasoned<br>Action (TRA)   | 1. Attitude and religiosity showed<br>a significant relationship<br>towards halal cosmetics<br>product purchase intention.<br>2. Malaysian consumers showed<br>more significant positive<br>attitudes and purchase  |

|   |  |   |  |   |  |  |
|---|--|---|--|---|--|--|
|   |  |   |  |   |  | intentions towards Halal food products than towards Halal cosmetic products.   |
| 4 | Mohezar S, Zailani S, Zainuddin Z (2016) | Quantitative Study (Survey)                 | <b>Location:</b> Kuala Lumpur, Malaysia<br><b>Setting:</b> Supermarket<br><b>Respondents:</b> 238  | To investigate the relationship between the factors towards young adult Muslim consumer's attitude towards halal cosmetic adoption.   | <ol style="list-style-type: none"> <li>1. Perceived Product Characteristic [S]</li> <li>2. Social Influence [S]</li> <li>3. Consumer Innovativeness [S]</li> <li>4. Religiosity (Moderator) [S]</li> </ol> <p><b>Theory:</b> Diffusion of Innovation (DOI) Theory</p>  | <ol style="list-style-type: none"> <li>1. All factors showed a significant relationship towards halal cosmetics product adoption with religiosity as a moderator for each factor.</li> </ol>   |
| 5 | Yeo BL, Mohamed RH, Muda M (2016)        | Qualitative Study (Conceptual Review Paper) | <b>Location:</b> Extensive literature review from previous studies (Content Analysis Approach)<br><b>Setting:</b> Electronic Database<br><b>Retrieved articles:</b> Not mentioned. | To assess the relationships between factors involved towards halal cosmetics product purchasing by expanding the Theory of Consumption Value (TCV). This paper proposes brand value as a new value dimension to the original framework. | <ol style="list-style-type: none"> <li>1. Functional Value</li> <li>2. Social Value</li> <li>3. Emotional Value</li> <li>4. Epistemic Value</li> <li>5. Conditional Value</li> <li>6. Perceived Value</li> <li>7. Customer Satisfaction</li> <li>8. Brand Value (Brand Image)</li> </ol> <p><b>Theory:</b> Theory of Consumption Value (TCV)</p> | <ol style="list-style-type: none"> <li>1. Positive perceived value develops positive customer satisfaction and leads to customer retention.</li> <li>2. The proposed brand value (brand image) is posited to have a relationship between perceived value and customer satisfaction.</li> </ol> |
| 6 | Jihan A, Musa R, Hassan F (2016)         | Quantitative Study (Survey)                 | <b>Location:</b> Klang Valley, Malaysia<br><b>Setting:</b> In-person survey<br><b>Respondents:</b> 470   | To assess and validate the relationships between factors involved towards Halal skin care product purchase intention and continuation.  | <ol style="list-style-type: none"> <li>1. Spiritual Intelligence (SQ)</li> <li>2. Spiritual Congruence (SC)</li> <li>3. Product Image (PI)</li> <li>4. Product Involvement (PV)</li> </ol> <p><b>Theory:</b> Self-Congruity Theory (SCT)</p>   | <ol style="list-style-type: none"> <li>1. The results confirmed a 4-factor structure as conceptualized (SQ, SC, PI, PV) for the underlying factors to predict consumer's attitudes towards Halal skin care product purchase intention and continuation.</li> </ol>                             |

|    |                               |                             |   |  |  |   |
|----|-------------------------------|-----------------------------|---|--|--|---|
| 7  | Ghazali E et al. (2017)       | Quantitative Study (Survey) | <p><b>Location:</b> Malaysia<br/>(<i>Location not specified</i>)</p> <p><b>Setting:</b> Organic shops, events and members from Malaysian organic-related organizations</p> <p><b>Respondents:</b> 317</p> | To investigate the relationships between factors related to consumer's perceived value (CPV) involved towards re-purchase intentions of organic personal care product (PCP). | <ol style="list-style-type: none"> <li>1. CPV (Health Value) [S]</li> <li>2. CPV (Safety Value) [S]</li> <li>3. CPV (Social Value) [NS]</li> <li>4. CPV (Hedonic Value) [S]</li> <li>5. CPV (Environmental Value) [S]</li> <li>6. Product Knowledge [S]</li> <li>7. Attitude [S]*</li> <li>8. Subjective Norms [NS]</li> <li>9. Perceived Behavioural Control [S]</li> </ol> <p><b>Theory:</b> Theory of Planned Behaviour (TBP)</p> | <ol style="list-style-type: none"> <li>1. All factors (except social value and subjective norms) showed a significant relationship with attitude towards the repurchasing of organic PCP.</li> <li>2. Attitude is a strong predictor for the repurchase intention of organic PCP.</li> <li>3. Better product knowledge about organic PCP would lead to more positive attitudes toward re-purchasing the product.</li> </ol> |
| 8  | Anuar MI et al. (2017)        | Quantitative Study (Survey) | <p><b>Location:</b> Kuala Lumpur, Malaysia</p> <p><b>Setting:</b> Not specified</p> <p><b>Respondents:</b> 200</p>  | To assess the relationships between factors involved towards purchase intention of metrosexuals towards men's facial care products.  | <ol style="list-style-type: none"> <li>1. Price Consciousness [S]</li> <li>2. Attitude [S]*</li> </ol> <p><b>Theory:</b> Not Mentioned</p>   | <ol style="list-style-type: none"> <li>1. Price consciousness and attitude showed positive relationship towards purchase intention for men's facial care products with attitude to be the strongest predictor.</li> </ol>   |
| 9  | Mohammad N, Baharun R. (2017) | Quantitative Study (Survey) | <p><b>Location:</b> Klang Valley, Malaysia</p> <p><b>Setting:</b> Mall</p> <p><b>Respondents:</b> 350</p>   | To assess the relationships between factors involved towards consumer purchase intention for halal cosmetic adoption organic personal care products.                         | <ol style="list-style-type: none"> <li>1. Perceived Quality [NS]</li> <li>2. Perceived Safety [S]</li> </ol> <p><b>Theory:</b> Not Mentioned</p>   | <ol style="list-style-type: none"> <li>1. Perceived Safety showed significant relationship on organic personal care product purchase intention as opposed to perceived quality.</li> </ol>  |
| 10 | Ahmad SN, Omar A (2018)       | Quantitative Study (Survey) | <p><b>Location:</b> Malaysia<br/>(<i>Location not specified</i>)</p> <p><b>Setting:</b> Not specified</p> <p><b>Respondents:</b> 226</p>  | To investigate consumers' perspectives and the relationships between factors involved towards  | <p><b>Perceived Value-</b></p> <ol style="list-style-type: none"> <li>1. Functional Value [S]*</li> <li>2. Experiential Value [NS]</li> <li>3. Symbolic Value [NS]</li> </ol>  | <ol style="list-style-type: none"> <li>1. Only functional value, environment and health consciousness showed a significant positive relationship</li> </ol>   |

|    |                         |                             |   |  |  |   |
|----|-------------------------|-----------------------------|---|--|--|---|
|    |                         |                             | natural beauty product repurchasing.  | <b>Personal Value-</b><br>1. Health Consciousness [S]<br>2. Environment Consciousness [S]<br>3. Appearance Consciousness [NS]                | towards organic beauty product purchase intention.<br>2. Functional value was ranked to be the strongest predictor followed by environment and health consciousness.   |   |
|    |                         |                             |   | <b>Theory:</b> Theory of Consumption Value (TCV)   |  |   |
| 11 | Haque A et al. (2018)   | Quantitative Study (Survey) | <b>Location:</b> Kuala Lumpur, Johor, and Penang, Malaysia<br><b>Setting:</b> Online<br><b>Respondents:</b> 232 | To investigate the relationships between factors involved towards halal cosmetic product consumer purchase behaviour among Muslim consumers. | 1. Purchase Intention [S]<br>2. Attitude [S]<br>3. Subjective Norm [NS]<br>4. Perceived Behavioural Control [S]<br>5. Religiosity [S]<br><b>Theory:</b> Theory of Planned Behaviour (TPB)  | 1. Only three factors (Attitude, perceived behavioural control, and religiosity) had significant relationships with Purchase intention.<br>2. Purchase intention showed significant positive relationship towards purchase behaviour. |
| 12 | Ali Q et al. (2019)     | Quantitative Study (Survey) | <b>Location:</b> Kuala Lumpur, Malaysia<br><b>Setting:</b> Mall & Online<br><b>Respondents:</b> 275             | To evaluate the relationships between factors involved towards halal cosmetic adoption.  | 1. Halal Cosmetic Awareness and Understanding (AU) [S]<br>2. Perceived Attributes of Innovation (PAI) [S]<br>3. Financial Cost (FC) [S]<br>4. Social Influence (SI) [S]<br>5. Religiosity (Moderator) [S]<br><b>Theory:</b> Diffusion of Innovation (DOI) Theory | 1. All factors (AU, PAI, FC and SI) showed significant positive relationship towards halal cosmetic adoption.<br>2. Religiosity showed significant and positive moderating effect on each factor towards halal cosmetic adoption.     |
| 13 | Hafiz KA, Ali KA (2019) | Quantitative Study (Survey) | <b>Location:</b> Klang Valley, Malaysia<br><b>Setting:</b> Malls  | To evaluate the relationships between factors involved with  | 1. Product Attributes (PA) [S]<br>2. Perceived Brand Image (PBI) [S]   | 1. All factors have significant positive influence on young consumer purchase decisions.  |



**Respondents:** 475

mediating effect (perceived brand image (PBI), perceived CEO's image (CEO), and perceived quality (PQ)) towards halal cosmetic consumer purchase decision.

3. Perceived CEO Image (CEO)[S]
4. Perceived Quality (PQ) [S]

**Theory:** Stimuli-Organism-Response (SOR) Model

2. PA show significant relationship towards PBI, CEO and PQ.
3. There are no mediating effects from PBI, CEO and PQ for relationship between PA and the young consumers' purchase decision of makeups.

14 Ishak S et al. (2019)

Quantitative Study (Survey)

**Location:** Bangi, Selangor, Malaysia  
**Setting:** Higher Education Institute  
**Respondents:** 150

To assess the relationships between factors involved towards cosmetics product purchase behaviour of young, educated Muslim females in Malaysia.

1. Halal Perception [S]
2. Product Knowledge [S]
3. Advertisement [S]
4. Brand Name [S]

**Theory:** Not Mentioned

1. All factors showed significant relationship towards purchase decision with brand name to be the most significant factor.
2. Millennial Muslim cosmetic purchase behaviour categorize into the "Limited Decision Making" classification.
3. Young, educated female consumers prefer branded cosmetic items and willing to accept the higher prices for the branded items although they concerned for the halal products.

15 Jan MT et al. (2019)

Quantitative Study (Survey)

**Location:** Malaysia (*Location not specified*)  
**Setting:** Online  
**Respondents:** 428

To investigate the relationships between factors involved towards consumer buying behaviour for skincare products.

1. Usefulness of Ads [S]
2. Exposure to Information [NS]
3. Feature of Ads [S]

**Theory:** Not Mentioned

1. Only usefulness of advertisement and features of advertisement showed significant relationship towards consumer buying behaviour.
2. Feature of advertisement showed significant relationship towards usefulness of

advertisement.

|  |  |   |   |  |   |
|--|--|---|---|--|---|
| 16 Quoquab F, Mohammad J, Shahrin R (2019) | Mixed Study (Qualitative: Interview, Literature Review & Quantitative Study: Survey) | <p><b>Location:</b> Klang Valley, Malaysia<br/> <b>Setting:</b> Online &amp; Mall<br/> <b>Respondents:</b> 448</p> <p><b>Location:</b> Science Direct, Emerald, Sage, Elsevier, Taylor and Francis (Content Analysis Approach)<br/> <b>Setting:</b> Electronic database<br/> <b>Retrieved articles:</b> Not mentioned</p> | To develop a valid and reliable scale to measure pro-environmental behaviour in nutricosmetics purchase (PEB-NP).   | <p><b>Pro-Environmental Behaviour (PEB) Dimensions</b></p> <ol style="list-style-type: none"> <li>1. Conservation Behaviour <ol style="list-style-type: none"> <li>a. Recycle</li> <li>b. Reuse</li> </ol> </li> <li>2. Health Consciousness</li> <li>3. Environmental Aesthetics</li> </ol> <p><b>Theory:</b> Theory of Planned Behaviour (TPB) &amp; Theory of Reasoned Action (TRA)</p> | <ol style="list-style-type: none"> <li>1. PEB-NP is a hierarchical multi-dimensional construct that exhibits environmental aesthetics, conservation behaviour (reduce and recycle)” and health consciousness.</li> <li>2. Pro-environmental behaviour showed positive relationship on happiness.</li> </ol> |
| 17 Shahrin R et al. (2019)                 | Quantitative Study (Survey)  | <p><b>Location:</b> Klang Valley, Malaysia<br/> <b>Setting:</b> Malls<br/> <b>Respondents:</b> 448</p>  | To evaluate the relationships between factors involved with mediating effect (PER) towards consumer’s pro-environmental belief (PEB) for nutricosmetic consumption. | <ol style="list-style-type: none"> <li>1. Compensatory Health Beliefs (CHBs) [S]</li> <li>2. Environmental Self-Identity (ESI) [S]</li> <li>3. Perceived Environmental Responsibility (PER) [S]</li> </ol> <p><b>Theory:</b> Social Cognitive Theory (SCT) And Social Identity Theory (SIT)</p>  | <ol style="list-style-type: none"> <li>1. All factors showed significant positive relationship on consumers’ PEB in nutricosmetics consumption</li> <li>2. CHB and ESI show positive and significant effect on PER.</li> <li>3. PER mediates the relationship between CHB, ESI and PEB.</li> </ol>          |
| 18 Khan N, Sarwar A, Tan BC (2020)         | Quantitative Study (Survey)  | <p><b>Location:</b> Malaysia (<i>Location not specified</i>)<br/> <b>Setting:</b> Private Universities<br/> <b>Respondents:</b> 262</p>   | To investigate the relationship between factors involved and consumers’ perspectives towards halal cosmetic   | <ol style="list-style-type: none"> <li>1. Religious Belief [S]</li> <li>2. Ingredient Safety [S]*</li> <li>3. Halal Logo [S]*</li> <li>4. Promotional Influence [S]</li> </ol>   | <ol style="list-style-type: none"> <li>1. All four factors showed a significant relationship towards consumer purchase intention among generation Y consumers in Malaysia.</li> </ol>   |

|    |                        |                             |   |   |  |   |
|----|------------------------|-----------------------------|---|---|--|---|
|    |                        |                             |   | purchase intention.   | <b>Theory:</b> Theory of Planned Behaviour (TBP)   | 2. Ingredient Safety was ranked as the most important factor followed by halal logo, promotional influence and religious belief in influencing purchase intention among young Muslim consumers.   |
| 19 | Jaini A et al (2020a)  | Quantitative Study (Survey) | <b>Location:</b> Malaysia<br>( <i>Location not specified</i> )<br><b>Setting:</b> Online<br><b>Respondents:</b> 150 | To investigate the relationship between factors involved with mediating effect (personal norm (PN) and pro-environmental belief (PEB)) towards cosmetic product green purchase behaviour (GPB). | <ol style="list-style-type: none"> <li>1. Hedonic Value [S]</li> <li>2. Altruistic Value [NS]</li> <li>3. Pro-Environmental Belief [S]</li> <li>4. Personal Norm [S]</li> </ol> <p><b>Theory:</b> Value-Belief-Norm (VBN) Theory</p>   | <ol style="list-style-type: none"> <li>1. Hedonic value (HV) showed a significant relationship towards PEB as opposed to Altruistic value (AV).</li> <li>2. PEB showed significant positive relationship towards PN and subsequently towards GPB.</li> <li>3. PEB mediates HV-PN relationship while PN mediates PEB-GPB relationship.</li> </ol>                  |
| 20 | Jaini A et al. (2020b) | Quantitative Study (Survey) | <b>Location:</b> Malaysia<br>( <i>Location not specified</i> )<br><b>Setting:</b> Online<br><b>Respondents:</b> 318 | To evaluate the relationship between factors involved with mediating effect (electronic word-of-mouth (eWOM)) towards cosmetic product green purchase behaviour (GPB).                          | <ol style="list-style-type: none"> <li>1. Pro-Environmental Belief [S]</li> <li>2. Hedonic Value [S]</li> <li>3. Altruistic Value [S]</li> <li>4. Personal Norm [S]</li> <li>5. Electronic Words of Mouth (eWOM) (Moderator) [S]</li> </ol> <p><b>Theory:</b> Theory of Value-Belief-Norm (VBN) And Elaboration Likelihood Model (ELM)</p> | <ol style="list-style-type: none"> <li>1. AV and HV showed significant and positive relationship towards PEB and subsequently PN.</li> <li>2. PN showed significant and positive towards GPB.</li> <li>3. PEB mediates AV-PN and HV-PN relationship.</li> <li>4. PN mediates PEB-GPB relationship.</li> <li>5. eWOM moderates the PN-GPB relationship.</li> </ol> |

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| 21 Quoquab F, Jaini A, Mohammad J (2020)   | Quantitative Study (Survey) | <b>Location:</b> Malaysia<br>( <i>Location not specified</i> )<br><b>Setting:</b> Online<br><b>Respondents:</b> 240 | To investigate the relationship between factors involved with moderating effect (gender) towards cosmetic product green purchase behaviour (GPB). | <ol style="list-style-type: none"> <li>1. Pro-Environmental Belief [S]</li> <li>2. Hedonic Value [S]</li> <li>3. Altruistic Value [S]</li> <li>4. Personal Norm [S]</li> <li>5. Gender (Moderator)[S]</li> </ol> <p><b>Theory:</b> Value-Belief-Norm (VBN)</p>   | <ol style="list-style-type: none"> <li>1. AV and HV showed significant and positive relationship towards PEB and subsequently towards PN.</li> <li>2. Gender moderates the relationships between AV-PEB, PEB-PN, and PN-GPB.</li> </ol>  |
| 22 Khalid NR, Wei CA, Mokhtaruddin. (2020) | Quantitative Study (Survey) | <b>Location:</b> Klang Valley, Malaysia<br><b>Setting:</b> In-person<br><b>Respondents:</b> 359                     | To assess the relationships between factors involved with moderating effect (Product positioning) towards Halal cosmetic purchase intention.      | <ol style="list-style-type: none"> <li>1. Attitude [S]</li> <li>2. Subjective Norm [S]</li> <li>3. Positioning [S]</li> </ol> <p><b>Theory:</b> Theory of Planned Behaviour (TPB) &amp; Theory of Reasoned Action (TRA)</p>  | <ol style="list-style-type: none"> <li>1. All factors showed significant relationships towards purchase intention for cosmetic products.</li> <li>2. Product positioning showed a significant role as moderator in assessing the influence of attitude on consumer purchase intention.</li> </ol>  |
| 23 Mamun AA et al. (2020)                  | Quantitative Study (Survey) | <b>Location:</b> Malaysia<br>( <i>Location not specified</i> )<br><b>Setting:</b> Online<br><b>Respondents:</b> 300 | To evaluate the relationships between factors involved towards consumer purchase intention for green skincare products.                           | <ol style="list-style-type: none"> <li>1. Environmental Concern (EC) [S]</li> <li>2. Attitude (ATT) [S]</li> <li>3. Subjective Norms [NS]</li> <li>4. Perceived Behavioural Control [NS]</li> <li>5. Availability of Green Skincare Products [S]</li> <li>6. Purchase Intention [S]</li> </ol> <p><b>Theory:</b> Theory of Planned Behaviour (TPB)</p> | <ol style="list-style-type: none"> <li>1. Only EC and ATT showed significant relationship towards purchase intention of green skincare products.</li> <li>2. Purchase intention showed significant relationship on the green skincare products purchase.</li> <li>3. Purchase intention mediated the effect of EC and ATT on the purchase of green skincare products.</li> </ol> |

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| 24 | Nghah AH et al. (2021a) | Quantitative Study (Survey) | <p><b>Location:</b> Malaysia<br/>(<i>Location not specified</i>)</p> <p><b>Setting:</b> Three universities offering Islamic studies program</p> <p><b>Respondents:</b> 501</p> | <p>To assess the relationship between factors involved with moderating effect (gender) towards halal cosmetic purchase intention among Muslim consumers.</p>  | <ol style="list-style-type: none"> <li>1. Attitude [S]*</li> <li>2. Subjective Norms [S]</li> <li>3. Perceived Behavioural Control [S]</li> <li>4. Brand Image [S]</li> <li>5. Gender [NS]</li> </ol> <p><b>Theory:</b> Theory of Planned Behaviour (TPB)</p>              | <ol style="list-style-type: none"> <li>1. All factors (except gender) showed a significant relationship towards halal cosmetics purchase intention for the overall dataset (male and female)</li> <li>2. All four factors' effect towards purchase intention differ between female and male consumers.</li> </ol>  |
| 25 | Nghah Ah et al. (2021b) | Quantitative Study (Survey) | <p><b>Location:</b> Selangor, Kuala Lumpur, East Coast Malaysia</p> <p><b>Setting:</b> University</p> <p><b>Respondents:</b> 578</p>   | <p>To evaluate the relationship between factors involved towards the continuance of use intention (CoU) for non-halal certified cosmetics consumption among Muslim university students in Malaysia.</p> | <ol style="list-style-type: none"> <li>1. Celebrity Endorsement (Ce) [S]</li> <li>2. Attitude (ATT) [S]</li> <li>3. Brand Image (BI) [S]</li> <li>4. Religion (Moderator) [S]</li> </ol> <p><b>Theory:</b> Stimuli-Organism-Response (SOR) Model</p>                       | <ol style="list-style-type: none"> <li>1. CE showed significant influences towards ATT and BI.</li> <li>2. BI showed significant influences towards ATT.</li> <li>3. BI and ATT showed significant influence CoU.</li> <li>4. Both ATT and BI mediate relationship between CE and CoU</li> <li>5. High religiosity (moderator) will weaken relationship between attitude and CoU.</li> </ol> |
| 26 | Jalil MI et al. (2021)  | Quantitative Study (Survey) | <p><b>Location:</b> Malaysia<br/>(<i>Location not specified</i>)</p> <p><b>Setting:</b> Online</p> <p><b>Respondents:</b> 60</p>   | <p>To evaluate the relationships between factors involved towards halal cosmetic repurchase intention among consumers in Malaysia.</p>  | <ol style="list-style-type: none"> <li>1. Social Media Marketing (SMM)* [S]</li> <li>2. Brand Awareness (BA) [S]</li> <li>3. Electronic Words-Of-Mouth (eWOM) [NS]</li> </ol> <p><b>Theory:</b> Theory of Reasoned Action (TRA) &amp; Theory of Social Media Marketing</p> | <ol style="list-style-type: none"> <li>1. SMM showed significant relationship towards on repurchase intention, BA, and eWOM</li> <li>2. SMM influence stronger on BA, followed by repurchase intention and eWOM.</li> <li>3. BA showed significant influence on repurchase</li> </ol>  |



intention as opposed to eWOM.

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| 27 | Osman S,<br>Cheng KW,<br>Wider W<br>(2022) | Quantitative<br>Study<br>(Survey) | <b>Location:</b> Klang Valley,<br>Malaysia<br><b>Setting:</b> Mall<br><b>Respondents:</b> 389                                       | To assess the<br>relationships between<br>factors involved towards<br>halal cosmetics<br>purchasing behaviour.  | 1. Halal Awareness [S]<br>2. Halal Knowledge [S]<br>3. Attitude [S]*<br><br><b>Theory:</b> Not Mentioned   | 1. All three factors showed a<br>significant relationship towards<br>halal cosmetics purchasing<br>behaviour.   |
| 28 | Abdullah SI, Ali<br>SF, Teng PK<br>(2022)  | Quantitative<br>Study<br>(Survey) | <b>Location:</b> Klang Valley,<br>Malaysia<br><b>Setting:</b> Mall<br><b>Respondents:</b> 240                                       | To assess the<br>relationships between<br>factors involved towards<br>consumers' attitudes and<br>purchase intention of<br>luxury cosmetic brands<br>among urban women in<br>Malaysia.                    | 1. Social Media Influencer<br>(SMI) Attractiveness [S]<br>2. SMI Trustworthiness [S]<br>3. Attitude [S]<br><br><b>Theory:</b> Social Influence Theory<br>(Sit)                               | 1. Both SMI's attractiveness and<br>trustworthiness showed a<br>significant relationship towards<br>consumer attitude.<br>2. SMI attractiveness has stronger<br>effect compared to<br>trustworthiness.<br>3. Consumer attitude shows<br>significant positive relationship<br>towards purchase intention.<br>4. Consumer attitude mediates<br>the relationship between SMI's<br>attractiveness and luxury<br>cosmetic brands' purchase<br>intention. |
| 29 | Ariffin SK, Lee<br>TM, Mohsin<br>AM (2022) | Quantitative<br>Study<br>(Survey) | <b>Location:</b> Malaysia<br>( <i>Location not specified</i> )<br><b>Setting:</b> Online & In-<br>person<br><b>Respondents:</b> 338 | To evaluate the<br>relationships between<br>factors involved towards<br>positive and negative<br>appeals in mobile<br>advertising of cosmetics<br>products and cosmetic<br>product purchase<br>intention. | <b>Positive Emotion</b><br>1. Happiness [S]<br>2. Contentment [S]<br>3. Pride [NS]<br><b>Negative Emotion</b><br>1. Sadness [S]<br>2. Fear [S]<br>3. Shame [NS]<br><b>Mobile Advertising</b> | 1. Positive emotion (Happiness<br>and contentment) positively<br>influence consumer attitude<br>towards positive appeals of<br>mobile advertising of cosmetic<br>products.<br>2. Negative emotions (sadness<br>and fear) have significant<br>negative effects on attitudes  |

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|-----|------------------------|--|---|---|---|
|     |                        |  |   | <p><b>Appealing</b></p> <ol style="list-style-type: none"> <li>1. Positive [S]</li> <li>2. Negative [S]</li> </ol> <p><b>Theory:</b> Not Mentioned</p>  | <p>towards the negative appeal of mobile advertising.</p> <ol style="list-style-type: none"> <li>3. Consumers develop positive attitudes towards positive appeals of mobile advertising which will significantly influence purchase intention towards cosmetic products and vice versa.</li> </ol>  |
| 30. | Cheng WH et al. (2022) | Quantitative Study (Survey)                      | <p><b>Location:</b> Penang, Malaysia</p> <p><b>Setting:</b> Malls</p> <p><b>Respondents:</b> 175</p>                              | <p>To investigate the relationships between factors involved under the influence of beauty blogs towards consumer purchase intention of beauty and cosmetic products in Malaysia.</p> <ol style="list-style-type: none"> <li>1. Advertising Intent</li> <li>2. Experience Goods</li> <li>3. Brand Awareness</li> <li>4. Perceived Credibility</li> <li>5. Perceived Usefulness</li> <li>6. Attitude Towards Sponsored Recommendation Post (Mediator)</li> </ol> <p><b>Theory:</b> Theory of Planned Behaviour (TBP) &amp; Theory of Reasoned Action (TRA)</p> | <ol style="list-style-type: none"> <li>1. The results showed that advertising intent, brand awareness, perceived credibility, and perceived usefulness are related to purchase intention.</li> <li>2. Attitude towards sponsored recommended posts mediates the relationships between all the psychological antecedents and purchase intention, except experience goods.</li> </ol> |
| 31  | Fauzi MA (2022)        | Qualitative Study (Systematic Literature Review) | <p><b>Database:</b> Web of Science and Scopus</p> <p><b>Setting:</b> Electronic database</p> <p><b>Retrieved Articles:</b> 35</p> | <p>To assess relevant studies concerning halal-certified products purchase.</p> <ol style="list-style-type: none"> <li>1. Halal</li> <li>2. Religiosity</li> <li>3. Theory Adaptation</li> </ol> <p><b>Theory:</b> Theory of Planned Behaviour (TBP) &amp; Theory of Reasoned Action (TRA)</p>  | <ol style="list-style-type: none"> <li>1. Malaysia is the leading halal purchasing behaviour (11 articles).</li> <li>2. Only five articles found mentioning halal cosmetic product.</li> <li>3. Two articles involve TRA, one article involve TBP while only one involve Expectancy-value theory (EVT) and one article</li> </ol>   |

did not include theory.

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| 32 Zaidi FLA, Jamaludin MA, Tukiran NA (2022) | Qualitative Study (Review Paper) | <p><b>Location:</b> Extensive literature review from previous studies (Content Analysis Approach)</p> <p><b>Setting:</b> Electronic database</p> <p><b>Retrieved articles:</b> Not mentioned</p> | To evaluate the relationships between factors involved towards Muslim consumers' perception of counterfeit cosmetic products. | <ol style="list-style-type: none"> <li>1. Religiosity</li> <li>2. Brand Consciousness</li> <li>3. Demographic Background</li> </ol> <p><b>Theory:</b> Not Mentioned</p>                                | <ol style="list-style-type: none"> <li>1. Muslim consumer's awareness on the importance of halalan tayyiban in cosmetic product are relatively low</li> <li>2. Demographic background (education, age, level of income and education) and brand consciousness may influence consumer's perception on counterfeit products.</li> <li>3. The influence of religiosity and halal knowledge towards perception of counterfeit may depend on individual Muslim consumers' levels of faith.</li> <li>4. Consumers who have higher brand consciousness on counterfeit cosmetic products are least likely to purchase counterfeit cosmetic products.</li> </ol> |
| 33 Aw YC (2022)                               | Quantitative Study (Survey)      | <p><b>Location:</b> Malaysia (<i>Location not specified</i>)</p> <p><b>Setting:</b> Online</p> <p><b>Respondents:</b> 257</p>  | To investigate the relationships between factors involved towards consumer purchase intention for Korean skin care products.  | <ol style="list-style-type: none"> <li>1. Price Consciousness [NS]</li> <li>2. Brand Image [S]</li> <li>3. Celebrity Endorsement [NS]</li> </ol> <p><b>Theory:</b> Theory of Reasoned Action (TRA)</p> | <ol style="list-style-type: none"> <li>1. Brand image showed significant positive influence on Korean skincare purchase intention among Malaysian female Gen Y.</li> </ol>  |

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| 34 | Septiarini DF et al. (2022) | Quantitative Study (Survey) | <p><b>Location:</b> Singapore, Indonesia, Malaysia<br/>(<i>Location not specified</i>)</p> <p><b>Setting:</b> Online &amp; In-person</p> <p><b>Respondents:</b> Total: 400 (Malaysia: 99)</p> | <p>To assess the relationships between factors involved towards consumer attitude and behavioural intention for Korean skin care products among non-Muslim consumers.</p> | <ol style="list-style-type: none"> <li>1. Halal Logo [S]</li> <li>2. Halal Brand Image [S]</li> <li>3. Halal Awareness [S]</li> <li>4. Attitude [S]</li> </ol> <p><b>Theory:</b> Theory of Customer Behaviour</p> | <ol style="list-style-type: none"> <li>1. All factors have significant effect on non-Muslim consumers' attitudes and behavioural intentions.</li> <li>2. Safety, comfort and cleanliness of product ingredients should be provided to halal products to attract non-Muslim consumers.</li> <li>3. Attitude shown significant effect on behavioural intention.</li> <li>4. The buying behaviour of non-Muslims in Malaysia depends on the ethical quality of the overall information content or credibility of the label.</li> <li>5. Malaysian consumers are more price sensitive, loyal consumers, receptive to product innovation and consider shopping as recreation than Indonesian consumers.</li> <li>6. Malaysian consumers prefer well-known brand and best quality products.</li> <li>7. Malaysian consumers tend to be impulsive consumers.</li> </ol> |
| 35 | Taher SS et al. (2022)      | Quantitative Study (Survey) | <p><b>Location:</b> Malaysia<br/>(<i>Location not specified</i>)</p> <p><b>Setting:</b> Online</p> <p><b>Respondents:</b> 190</p>   | <p>To investigate the relationships between factors involved with mediating effect (Parasocial relationship) towards consumer</p>   | <ol style="list-style-type: none"> <li>1. Social Media Influencers (SMIs) Communication Skills [S]</li> <li>2. SMIs' Influence [NS]</li> <li>3. SMIs' Perceived Authenticity [NS]</li> </ol>                      | <ol style="list-style-type: none"> <li>1. SMIs' communication skills and expertise showed significant relationship on parasocial relationships.</li> <li>2. The parasocial relationship showed significant relationship</li> </ol>   |

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|----|------------------------------------|--|--|---|--|---|
|    |                                    |  |  | purchase intention for beauty products.   | 4. SMIs' Expertise [S]<br>5. Parasocial Relationship [S]   | 3. Parasocial relationship was found to mediate the relationship between the expertise of social media influencers and purchase intention.  |
| 36 | Isa RM et al. (2023)               | Qualitative Study (Systematic Literature Review) | <b>Location:</b> Web of Science and Scopus<br><b>Setting:</b> Electronic Database<br><b>Retrieved Articles:</b> 14   | To assess the halal cosmetic concept and the relationship between factors involved towards halal cosmetic purchasing. | 1. Marketing Stimuli (Product, Price, Promotion and Place-Related Factors)<br>2. Other Stimuli (Social Factors, Religion-Related Factors and Characteristic-Related Factors)   | 1. 14 Articles related to halal cosmetic product purchasing were included.<br>2. Religiosity and product factors (ingredients, halal logo and halal certification) showed the strongest motivators in halal cosmetics product purchasing.<br>3. The factors were categorized into Marketing stimuli and other stimuli using SOR Theory. |
| 37 | Masood A, Hati SR, Rahim AA (2023) | Qualitative Study (Systematic Literature Review) | <b>Location:</b> Web of Science, Scopus, Google Scholar, ScienceDirect and Springer Link<br><b>Setting:</b> Electronic Database<br><b>Retrieved Articles:</b> 31 | To identify existing factors from past studies towards consumer purchase behaviour.                                   | <b>Marketing Elements</b><br>1. Price, Place, Promotion, Social Media/Celebrity, Halal Brand, Brand Loyalty and Brand Innovation<br><b>Ethics</b><br>1. Manufacturer/Producer, Islamic Marketing<br><b>Consumer Behaviour</b><br>1. Purchase Behaviour, Purchase Intention, Customer's | 1. Almost all business and management research were conducted in Malaysia and Indonesia.<br>2. Cosmetic market in Malaysia is dominated by large international companies.<br>3. The most influential factors were product quality, halal certification, ease of purchase, and price.<br>4. Malaysian Muslims' intentions                |



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|    |   |   |   | Experience/Satisfaction, Perceived Value, Religiosity, Awareness /Knowledge, Attitude)   |   | and attitudes toward halal cosmetics are affected by their degree of devoutness.   |
|    |   |   |   | <b>Governance</b>  |   |  |
|    |   |   |   | 1. Halal Certification, Supply Chain/Integrity, Governing Authority  |   | 5. The majority of Malaysians, regardless of religion, held positive perceptions and attitudes toward natural and halal cosmetic products.   |
|    |   |   |   | <b>Theory:</b> Theory of Planned Behaviour (TBP) & Theory of Reasoned Action (TRA)   |   | 6. Malaysia's cosmetic manufacturers are aware of the halal certification process and are competent in obtaining halal certification.  |
| 38 | Zaidi FL, Jamaludin MA, Tukiran NA (2023) | Mixed Study (Qualitative: Literature Review & Quantitative Study: Survey) | <b>Location:</b> Putrajaya, Malaysia<br><b>Setting:</b> In-person<br><b>Respondents:</b> 277<br><b>Location:</b> Extensive literature review from previous studies (Content Analysis Approach)<br><b>Setting:</b> Electronic database<br><b>Retrieved articles:</b> Not mentioned | To assess the relationships between factors involved towards consumer's perception of counterfeit cosmetic products among Muslim consumers in Putrajaya. | 1. Demographic Background<br>a. Age [S]<br>b. Gender [NS]<br>c. Income Level [S]<br>2. Religiosity [NS]<br>3. Brand Consciousness [S]<br><b>Theory:</b> Theory of Planned Behaviour (TBP) | 1. Age, level of income, and brand consciousness showed significant relationship on Muslims consumers' perception in Putrajaya towards counterfeit cosmetics.<br>2. Muslim consumers in Putrajaya are very much aware of the existence of counterfeit cosmetic products in the local market and even have used the products. |

\*Strongest predictor, [S]: Significant, [NS]: Non-significant

## Discussion

The current study evaluated the determinant factors and theoretical framework underpinning cosmetic product purchasing in Malaysia based on previously reported research articles. Notably, the majority of the studies employed a quantitative study design, utilizing self-administered questionnaires via convenience sampling to recruit a large number of respondents from the Malaysian population. Additionally, most of the studies were conducted in Klang Valley, Malaysia. Klang Valley is a densely populated region in Malaysia, boasting a large consumer base with easy access to cosmetic products [71]. Moreover, the predominant focus of these investigations was on young Malaysian adults, specifically Generation Y, as they are recognized as a pivotal market segment due to their potential as the largest targeted consumer demographic and their significance in sustaining customer retention. This is further supported by previous studies, which described the younger generation as exhibiting greater spending power, impulsive buying behaviour, materialism, and interest in fashion, trends, and shopping [3,14].

In this study, the SOR model was used to classify determinant factors, revealing that various potential stimuli could trigger the consumer's cognitive and emotional evaluation (organism) and subsequently lead to the development of the consumer's purchasing behaviour (response). The application of the SOR model contributes to a global understanding of consumer behaviour theories and highlights its universal applicability. Marketing stimuli, which comprised extrinsic and intrinsic factors, were found to be the most studied among the included articles. Exposure to information and product knowledge acquisition are initial steps in influencing the consumer's internal and external evaluation. Hence, information pertaining to the product from marketing cues is required to drive the consumer's assessment and motivation to purchase the product. Utilizing effective

advertising platforms and technologies will help ease the consumer's product evaluation and reduce selection risks while establishing brand consciousness simultaneously. Consequently, exposure to information will facilitate the consumer's perception, awareness, familiarity, and understanding of brand products. Jan et al. (2019) concurred that consumers will only plan to behave positively towards a product if they are properly informed about it, thus signifying the importance of exposure to information [45]. The significant role of digital marketing and social media in influencing consumer purchasing decisions, as observed in Malaysia, reflects a global shift towards digitalization in consumer engagement strategies.

Additionally, advertising and celebrity endorsement are key in developing a positive brand image and product familiarity, subsequently enhancing brand loyalty once people are exposed to the product information. Consumers tend to develop brand trust and form a positive perception of the product as they prefer familiar brands to mitigate purchasing risks, provided the products meet their expectations [72]. Product image, such as packaging, ingredients, and price, also potentially influences positive purchase intentions. The inclusion of brand name, packaging design, halal logo, and product ingredients in labelling and packaging enhances the branding process by establishing a unique brand identity and aiding consumers in assessing product benefits and risks. The credibility of the product can be further strengthened through clinical testing and rigorous safety and efficacy tests, ensuring consumer protection [73]. This is important as consumers are knowledgeable and have risk-averse tendencies [10].

Price also plays an important role in influencing consumer purchase behaviour since Malaysian consumers are price sensitive [67]. Nonetheless, the study by Rani and Krishnan [2018] on male and female Malay students aged 18 and above around Klang Valley reported otherwise, indicating that

young Malaysian consumers were willing to spend more for halal, safer, branded, and high-quality products, even if they were expensive [74]. Moreover, a low product price was reported to suggest product quality inferiority and lack of value [75]. Additionally, there is a belief that branded cosmetic products with higher prices are of better quality [76]. These stimuli will subsequently trigger and develop one's evaluation, knowledge, value, and belief, known as the organism in the SOR model. Similarly, factors such as price, quality, and advertising identified in Malaysia have also been observed in emerging markets like France and the United States, with additional factors including prior learning, historical, and traditional factors influencing consumer purchase behaviour [77].

The present study observed that theoretical adaptations are used in the research articles to predict consumer purchase behaviour, as they provide insights into how individuals' values, perceptions, and beliefs influence their purchase decisions. In addition, the Theory of Reasoned Action and the Theory of Planned Behaviour were mostly used as the study framework to explain and predict the initial intention of behavioural development [78]. Both theories are interrelated, with Theory of Planned Behaviour being an extension of Theory of Reasoned Action that integrates perceived behavioural control as an additional predictor alongside attitudes and subjective norms to enhance the model's predictive power [79]. Notably, attitude was found to be the most influential predictor in developing positive cosmetic product purchase intention. Similarly, past studies have shown a strong positive relationship between attitudes and willingness to buy cosmetic products [3, 80, 81]. Consumers with a positive attitude are more likely to make an actual purchase as opposed to those with a negative attitude. Attitude development depends on the factors or stimuli that influence it, including the consumer's personal evaluation and knowl-

edge of the product's merits, value, and benefits.

Diverse approaches have been employed in evaluating consumer purchasing behaviour towards cosmetic products, with a prevailing focus on the assessment of purchase intention as the primary indicator of actual purchase behaviour. Purchase intention plays an important role as a key metric in assessing consumer interest and preference. Purchase intention reflects the consumer's willingness to purchase a product and is measured by the likelihood of actual product acquisition based on their personal evaluations and attitudes towards the product [82]. Previous studies have assessed the importance of purchase intention in predicting consumer purchase behaviour and revealed a positive relationship between purchase intention and consumer purchase behaviour [83-85]. Schiffman and Kanuk [86] added that purchase intention greatly drives the desire to purchase the product.

The current study has several limitations. Firstly, the study focused solely on assessing predictors influencing consumer purchase behaviour within the cosmetic product context in Malaysia. Therefore, it did not cover influencing factors related to other products and regions. Consequently, the factors identified in the study might influence purchasing behaviour differently between consumers from diverse social, regional, and cultural backgrounds. Furthermore, research article identification and searching were limited to English-language publications in selected electronic databases, namely Web of Science (WOS), Scopus, and ScienceDirect, published between 2013 and 2023. Future studies could assess varying sociodemographic factors and cross-country comparisons in predicting consumer purchase behaviour. Additionally, conducting longitudinal studies could provide valuable insights into monitoring changes in consumer preferences and trends over time.

## Conclusion

This study helps illuminate the multifaceted nature of consumer behaviour in the cosmetic industry, encompassing social and marketing factors that trigger consumer beliefs, values, and perceptions, ultimately influencing their purchase behaviour. Additionally, the findings from Malaysian consumer purchasing behaviours provide comparative insights with other countries and offer a roadmap for international brands in tackling the cosmetic market in Malaysia. Understanding determinant factors such as product image, brand, and advertisement is essential for businesses aiming to thrive in this dynamic cosmetic market in Malaysia. Recommended marketing strategies should focus more on advertising and enhancing brand exposure to develop brand familiarity among potential consumers. The product's pricing and quality should meet consumer expectations, ultimately fostering brand loyalty. Future studies could explore differences in consumer purchase behaviour between races and cultures in Malaysia, given the country's multicultural context. By acknowledging and adapting to these influences, companies can tailor their marketing strategies and policies to meet the evolving needs and preferences of Malaysian consumers in the cosmetic industry. Future research may also explore the evolving role of technology in influencing consumer choices, including augmented reality beauty apps and personalized skincare solutions.

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which has been invaluable in the development and completion of this research.

## Potential Conflict of Interest

The authors declare that there are no conflicts of interest.

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# Prevalence, Assessment and Underdiagnosed Impact of Body Dysmorphic Syndrome (BDD) in Cosmetic and Aesthetic Clinical Practice: A Narrative Review

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**Abstract:** Body Dysmorphic Disorder (BDD) is considered one of the high-risk psychological health disorders due to its significant impact on patients. However, it is often overlooked. This review aims to discuss BDD and highlight the importance of cosmetic and clinical practitioners in distinguishing BDD patients from other individuals seeking aesthetic or cosmetic treatments, as well as to explore the impact of BDD on cosmetic and clinical practice. It was found that BDD patients are often found in primary care and dermatology settings because they may not recognize the need for psychiatric treatment. Many seek cosmetic treatments, which usually do not alleviate their distress and result in temporary satisfaction, leading to dissatisfaction and shifting blame to practitioners. BDD patients can exhibit aggressive behaviours, posing risks to cosmetic providers, including verbal, physical, and legal threats. Therefore, raising awareness and understanding of BDD among clinical and cosmetic practitioners is crucial to care for these patients effectively and to avoid unnecessary financial, physical, and psychological strains of unwarranted procedures.

Keywords: Aesthetic and Cosmetic clinical practice, Body dysmorphic disorders, Psychological health

## Introduction

Body Dysmorphic Disorder (BDD) is defined as an excessive preoccupation with perceived or minor flaws in one's appearance, which are often invisible to others, and it is considered part of a psychiatric disorder [1]. Individuals with BDD suffer from great distress and interference, which can be extreme due to their concerns with perceived flaws as they engage in repetitive behaviours to hide or fix their flaws [2]. It is

considered one of the high-risk psychological health disorders due to its impact on the patient. Nevertheless, it is often overlooked. This oversight is partly due to patients seeking cosmetic or aesthetic treatments to address their perceived defects, believing them to be genuine physical imperfections [2]. Moreover, most BDD patients conceal their body image concerns, driven by embarrassment, fear of judgment, believing their clinician would not understand their worries, not being aware of the availability



of BDD treatment, not being queried about BDD, perceiving BDD as insignificant, do not want to acknowledge that their body image concern is a problem and assuming others do not face similar problems [3].

Patients with BDD often find themselves dissatisfied with the outcomes of aesthetic treatments, with symptoms sometimes worsening post-treatment [4,5]. Research by Sarwer et al. [4] revealed that 88% of patients became more conscious about their perceived flaws following aesthetic treatment, and 76% reported developing new concerns. Additionally, almost 98% of BDD patients gain no benefit from cosmetic interventions, and 16% perceive a deterioration in their self-image [5,6].

There is general agreement that screening BDD before aesthetic procedures and reassessing after that for the emergence of any new psychological problem is very important [7]. Failure to do so may have negative effects on both patients and practitioners [8], including instances where practitioners face violence or legal threats from BDD patients [9,10]. Early identification of BDD allows for appropriate management, emphasizing psychiatric approaches over cosmetic interventions [11]. Failure to recognize BDD may be detrimental to patients, physically and psychologically [12], as without proper treatment, the condition will become more severe [13].

This narrative review aims to consolidate the current literature on BDD, focusing on its prevalence, assessment tools, and the importance of distinguishing BDD patients in aesthetic and cosmetic settings. It also addresses how underdiagnosed BDD patients may impact cosmetic and aesthetic clinical practice and the necessity for increased awareness and screening among practitioners.

## Methodology

This paper reviews BDD using the Google Scholar system. Research articles published between

2016 and 2022 were searched using the term 'body dysmorphic disorder' in titles. Relevant articles on BDD were screened for inclusion, including its prevalence, assessment tools, and the importance of clinical practitioners in distinguishing BDD patients from those seeking aesthetic or cosmetic treatments. The potential impact of underdiagnosed BDD patients on cosmetic and aesthetic clinical practice was also considered. Citations and references from these articles were searched, retrieved, and evaluated following the same criteria as the original search.

## What is Body Dysmorphic Disorder

In the recently released International Classification of Diseases 11 (ICD-11) by the World Health Organization, BDD is defined as a continuous preoccupation with one or more perceived defects in appearance that are either imperceptible or only minimally noticeable to others [14]. This persistent fixation frequently leads to repetitive actions such as frequent mirror checking and attempting to conceal these perceived flaws or camouflaging [15], thus causing a negative impact on various aspects of one's life functioning [16,17,18]. This condition is also known as "dysmorphophobia" and "dermatologic hypochondriasis" in the medical literature [19].

BDD is categorized as an obsessive-compulsive related condition rather than a somatoform disorder. It encompasses a pathological fear of ugliness regarding certain aspects of appearance being perceived as "not right" or even "hideous" even though no such flaws are noticeable to others or are considered minor [20]. It is a relatively common yet under-recognized psychiatric disorder that often presents to non-psychiatric physicians [21].

Typically, BDD begins in early adolescence, and due to its chronic nature, BDD persists into adulthood, often leading to increasingly severe consequences [13,22]. The perceived physical defect can involve any part of

the body, with skin, hair, or nose becoming the most common areas of concern [23]. The body parts that are frequently affected in BDD patients include skin (65%), hair (55%), nose (39%), eyes (19%), specifically for women are breasts (18%) and for men, bones (14%) [24]. Another form of BDD is known as muscle dysmorphia and BDD by proxy. Muscle dysmorphia refers to a condition where an individual perceives their muscles to be too small or inadequate, while in BDD, by proxy, an individual becomes preoccupied with a perceived physical flaw in another person [3]. According to various studies conducted among practitioners, most of them agreed that BDD is a contradiction for aesthetic or cosmetic treatment [4,25,26].

### History of Body Dysmorphic Disorder

BDD has been recorded for centuries. However, recently, it has started to receive more attention in research [27]. BDD was initially described as "Dysmorphophobia" in 1886 by an Italian psychopathologist called Enrique Morselli [28]. Dysmorphophobia originates from the Greek term "dysmorfia," which pertains to unattractiveness, particularly in facial features. This term was initially introduced in the "Histories of Heroditus." It alludes to a legend about the "least attractive girl in Sparta," who, upon being touched by a goddess, changes into a stunning woman [28]. A French psychologist, Pierre Janet, has labeled this disease as "l'obsession de la honte du corps," which means "obsessions of shame of the body" [19]. More than centuries ago, Sigmund Freud, a psychologist, described a probable case of BDD referred to as the "Wolf Man," which involved his patient, who was so preoccupied with his nose, causing him considerable social distress [29].

BDD was first described in the Diagnostic and Statistical Manual of Mental Disorders, third edition (DSM-3) in 1980 as an atypical somatoform disorder and was then classified as a distinct somatoform disorder in 1987 [29]. In

1980, the DSM-III included BDD under the term "dysmorphophobia," denoting an excessive worry about one's appearance [27]. This disorder was then renamed BDD in the fourth edition of the DSM [29], and in the DSM-5, BDD is now categorized under obsessive-compulsive and related disorders [19].

### Symptoms and Impact of Body Dysmorphic Disorder in Daily Life

BDD is regarded as a psychological disorder where sufferers grapple with distress and preoccupation regarding the perceived flaws in their appearance, often resulting in substantial impairment in their social, occupational, and interpersonal functioning [30,31]. In more serious cases, BDD patients may find themselves incapable of leaving their homes or interacting with others to fulfil social and occupational obligations [32]. Individuals with BDD often experience feelings of shame and disgust [5] due to their exaggeration of any minor anomalies, causing a detrimental impact on their Quality of Life (QoL) [33-35]. BDD patients are too self-conscious and frequently experience ideas of reference, such as a strong belief that others are observing, evaluating, or discussing the perceived defect or flaw [14].

Individuals with BDD are prone to displaying signs of social anxiety and engaging in avoidant behaviours due to fear of being ridiculed or excluded [36]. Their preoccupation with perceived bodily defects is often associated with fear of negative judgment by others, which is similar to the Social Anxiety Disorder (SAD) feature [37]. SAD is defined as 'a marked and persistent fear of social or performance situations in which embarrassment may occur' according to the DSM-IV [38]. SAD, characterized by concern about others' perceptions [39], encompasses anticipatory anxiety, cognitive and physical symptoms in social contexts, and avoidant behaviours when the distress becomes persistent [40]. As the main

feature of SAD is fear of being negatively judged by others, various social situations can trigger the anxiety, including performing in public (such as speaking, eating, or writing), starting or maintaining conversations, attending parties, dating, meeting new people, or interacting with authority figures. Among these, public speaking is the most frequently feared situation [37].

Many studies indicate that BDD and social anxiety share common features with one another [37,41,42], specifically the fear of being negatively judged by others and the fear of embarrassment [43]. Based on clinical observation, both BDD and social anxiety involve a fear of negative evaluation in social settings [44] and a tendency to avoid social interactions [45]. However, in BDD, social fear and avoidant are primarily linked to perceived physical "defects" [46]. A study involving 50 participants with BDD found that self-reported evaluations of social phobia and anxiety symptoms were notably high [47]. Additionally, individuals with BDD exhibited greater withdrawal from activities due to appearance-related concerns compared to those with eating disorders and nonclinical controls [48]. Another study found that individuals with BDD tend to perceive social situations as more threatening compared to controls or individuals with Obsessive-Compulsive Disorder (OCD) [44].

The resulting anxiety arises from their perception of having an abnormal appearance, which often leads to excessive grooming, frequent mirror checking, and various other obsessive behaviours [36]. Individuals with BDD often engage in repetitive behaviours or avoidant behaviours to alleviate the negative feelings caused by their perceived bodily 'defects' such as anxiety [49]. Repetitive behaviours include mirror checking, skin picking, seeking reassurance, undergoing repeated plastic surgeries, and excessive grooming. In contrast, avoidant behaviours might include avoiding social interactions or situations like attending school or parties [50]. Since these repetitive and

avoidant behaviours can provide temporary relief from negative emotions, they are negatively reinforced, which is thought to perpetuate dysfunctional beliefs associated with BDD [49]. Moreover, these repetitive behaviour acts may last around 3 to 8 hours per day on average and are typically time-consuming, difficult to manage, and distressing to the individual with BDD [23].

Additionally, patients frequently report experiencing hopelessness, shame, or discomfort regarding their appearance and body image. Such feelings can contribute to the development of depressive symptoms and mask the underlying BDD condition [29,47,51,52]. These circumstances will then lead to isolation and social withdrawal, which, in turn, perpetuates and sustains suicidal thoughts, creating a vicious cycle [53,54]. BDD may result in self-harming behaviours or, in extreme cases, suicidal tendencies [1,55]. The report shows that BDD patients have high rates of suicidal thoughts (46%) and suicide attempts (18%), and this condition is often comorbid with other psychiatric disorders, including Major Depressive Disorder (MDD), SAD, and OCD [16, 55-57]. The risk of suicidality in individuals with BDD is estimated to be 4 to 2.6 times higher than that of the general population with regard to both suicidal thoughts and suicide attempts [55]. The delusional form of BDD is regarded as more severe and is associated with a higher risk of suicide [55,58]. BDD seems to foster the four psychological factors believed to predict suicide, including feelings of burdensomeness, thwarted belongingness, low fear of death, and high tolerance for physical pain [59].

### **Role of Cognitive Distortions in Body Dysmorphic Disorder**

Symptoms of BDD arise from cognitive distortions, which can lead to negative behaviours such as excessive preoccupation with appearance, avoidant behaviour, and other

related actions. Cognitive distortions are defined as flawed and ineffective thinking patterns that arise during information processing [60] and will make us believe something false as though it were true [61]. This will lead to dysfunctional behaviours and emotions, fostering negative thoughts about oneself and others [62,63]. Most psychological disorders involve distorted thinking patterns [64], and this includes BDD.

Patients with BDD tend to have selective attention to perceived appearance flaws and abnormalities in holistic processing [27]. Based on clinical observations, individuals with BDD tend to selectively attend to one appearance's flaws while disregarding the rest of their body. These observations are supported by studies that evaluated the abnormalities in holistic processing in BDD patients. For instance, a study using the Rey-Osterrieth Complex Figure Test (RCFT) found that people with BDD were more likely to concentrate on minor details of a complex figure rather than its overall shape when asked to draw it from memory [65]. Individuals with BDD tend to process visual information in a detail-focused manner rather than a holistic one. This style of processing can hinder their ability to properly contextualize visual details (such as scars or pimples), causing these features to seem larger or more distorted than they are [27].

Additionally, BDD patients possess maladaptive beliefs about self-appearance or distorted body image. They view themselves as flawed or unattractive despite evidence showing otherwise. This distorted perception strengthens negative self-beliefs like feeling unattractive, unworthy, or inadequate [66]. They may overemphasize the significance of attractiveness and equate attractiveness to overall happiness, such as, "If I were more attractive, my whole life would be better." The BDD patient might also have maladaptive interpretations, including thinking, "My skin is so repulsive that no one will ever love me" or "Everyone will be focused on my ugly face" [27].

Reasoning and interpretive biases are

significant aspects of BDD. Individuals with BDD often have poor insight and delusional thinking. As a result, they may exhibit cognitive biases that disrupt their reasoning processes, such as making hasty conclusions without adequate evidence or struggling to interpret ambiguous information [27]. Research indicates that individuals with BDD exhibit a disorder-specific negative interpretive bias when faced with ambiguous information [67]. This bias can reinforce their distorted beliefs about themselves and their body image. For example, on a self-report questionnaire featuring ambiguous scenarios (e.g., "While talking to colleagues, you notice that some people seem to pay special attention to you. What thoughts come to mind?"), those with BDD are more likely to interpret the situation negatively (e.g., "I'm sure they are judging my appearance") compared to individuals with OCD and those without any disorders [67].

Individuals with BDD also display a troubling pattern of referential thinking and "mind reading," wherein they believe that others are focusing on their appearance and judging, mocking, or rejecting them due to their looks [68]. Such thoughts contribute to negative or threatening interpretations of ambiguous social information. For example, individuals with BDD often misinterpret neutral facial expressions as signs of anger or contempt [69] and mistakenly interpret ambiguous self-referent situations, perceiving negative appearance-related outcomes as probable explanations for the ambiguity [44,70]. Individuals with BDD are sensitive to facial expressions due to intense fear of negative evaluation by others and the frequent presence of ideas of reference, such as believing that others are staring at them. For instance, individuals with BDD might view a neutral facial expression as negative. Furthermore, their poor insight and ideas of reference, which are common in BDD patient, can lead to a tendency to perceive others' emotional expressions as threatening and as being rejected, which can further intensify their

worries about their own appearance and social appeal [71]. Moreover, it can also exacerbate BDD symptoms and lead to greater social avoidance [69, 71-72].

### Differentiating Body Dysmorphic Disorder from Related Disorders

BDD often overlaps with other psychological disorders. Many symptoms of BDD also occur in other psychiatric conditions, while psychiatric disorders are common comorbidities in individuals with BDD. BDD is frequently associated with several other conditions, including eating disorders, anxiety disorders, MDD, substance use disorders, social phobia, OCD, panic disorder, and post-traumatic stress disorder [58,68,73,74]. A study found that the

most common associated disorders among individuals with BDD were MDD (76%), followed by SAD (37%) and OCD (32%) [74]. Approximately 94% of BDD patients have reported experiencing depression at some point due to their disease [68]. Additionally, OCD and social phobia are notably prevalent among individuals with BDD, with prevalence rates ranging from 32–33% and 37–39%, respectively. Approximately 10–15% of individuals with BDD have a history of anorexia nervosa or bulimia nervosa, and 2–7% have experienced somatoform disorders [73,74,75]. Therefore, due to this symptom overlap, BDD is often misdiagnosed and not properly identified. **Table 1** shows several differential diagnoses for BDD and their similarities [76,77].

**Table 1** Differential diagnoses of BDD.

| Condition/Disorder                  | Similarities and Differences with BDD  |
|-------------------------------------|--|
| Normal appearance concern           | <b>Similarities:</b> Concern about appearance flaws.<br><b>Differences:</b> Unlike BDD, normal concerns about appearance include a lack of obsessive preoccupations, compulsive behaviours, and any psychological distress or functional impairment.   |
| Obvious bodily defects              | <b>Similarities:</b> Preoccupied with bodily defects.<br><b>Differences:</b> To distinguish this condition from BDD, all DSM-5-TR diagnostic criteria for BDD must be met in these cases.  |
| Isolated dysmorphic concern         | <b>Similarities:</b> Presence of perceived bodily dysmorphic concern.<br><b>Differences:</b> Absence of compulsive, repetitive, or ritual behaviours in BDD.   |
| Obsessive-compulsive disorder (OCD) | <b>Similarities:</b> Involves time-consuming, repetitive behaviours, including grooming rituals.<br><b>Differences:</b> In OCD, grooming rituals are not aimed at correcting perceived appearance flaws but may be driven by fears of contamination or a need for things to feel "just right." |
| Excoriation disorder                | <b>Similarities:</b> Repetitive skin picking.<br><b>Differences:</b> In excoriation disorder, skin picking is not aimed to improve appearance. In BDD, skin picking is done to improve the appearance of perceived skin defects.   |



|                         |   |
|-------------------------|---|
| Trichotillomania        | <b>Similarities:</b> Repetitive hair pulling.<br><b>Differences:</b> Trichotillomania refers to a condition where individuals struggle to resist the urge to pull out their hair. However, this behaviour is not aimed at enhancing appearance. In BDD, hair pulling is intended to address perceived defects in facial or body hair. |
| Eating disorders        | <b>Similarities:</b> Distressing and impaired preoccupation with appearance.<br><b>Differences:</b> In eating disorders, the focus of preoccupation is on body weight and shape, leading to disordered eating behaviours to lose weight.  |
| Social anxiety disorder | <b>Similarities:</b> Avoidance and distress in social situations.<br><b>Differences:</b> Social avoidance in SAD stems from a fear of embarrassment due to one's actions or words. In BDD, social anxiety is specifically related to fears of negative judgments about perceived appearance flaws.                                    |
| Depression              | <b>Similarities:</b> May include feelings of ugliness as part of low self-esteem.<br><b>Differences:</b> In depression, concerns about appearance are not the primary focus. Unlike BDD, depression does not usually involve repetitive behaviours like mirror checking or excessive grooming.  |

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Therefore, when differentiating BDD from other conditions, it is crucial to determine if the core issue revolves around perceived flaws in one's appearance [27]. For instance, although BDD and OCD are frequently comorbid and share traits like perfectionism, recurrent thoughts, and repetitive and avoidant behaviour [78], BDD is diagnosed when the concerns are specifically related to appearance, such as having obsessive thoughts about one's skin not being smooth [27]. In contrast to compulsions in OCD, BDD-specific rituals are carried out to hide, improve, or check perceived appearance flaws, like repeatedly checking one's appearance in the mirror or seeking cosmetic surgery. Similarly, distinguishing between BDD and SAD involves identifying whether the fear of negative evaluation by others is due to one's appearance rather than broader concerns such as being embarrassed, being liked, or being viewed as unintelligent [27].

When it comes to distinguishing between BDD and anorexia nervosa or other eating disorders, one way to differentiate them is by

identifying the presence of eating pathology, which is less typical of BDD [79]. However, weight concerns might be less informative for this distinction as clinically significant weight concerns can also occur in individuals with BDD [80]. Specifically, muscle dysmorphia, a subtype of BDD, may have greater overlap with eating disorders due to excessive dieting, exercise, and preoccupation with weight and body shape. Muscle dysmorphia is more common in males, but research on its connection with eating disorders is still limited [79].

BDD may involve delusional beliefs that can occur on a continuum, which can sometimes resemble psychotic thinking. However, it differs from disorders like schizophrenia or schizoaffective disorder, which involve a broader range of psychotic symptoms and unusual behaviour, as the delusional belief in BDD only involves one's appearance. In summary, BDD shares various features with other disorders, but it is distinguishable by a significant disconnect between physical appearance and body image, poor insight, and high levels of suicidality [27].



## Prevalence of Body Dysmorphic Disorder in Aesthetic or Cosmetic Setting

The estimated prevalence of BDD in the general population ranges from 0.7% to 3.2% [81-83]. Veale et al. [83] reported higher prevalence rates in specific settings such as adult psychiatric outpatients (5.8%) and inpatients (7.4%). Moreover, prevalence rates surged even higher in non-psychiatric settings, including general cosmetic surgery (13.2%), rhinoplasty surgery (20.1%), orthognathic surgery (11.2%), orthodontics/cosmetic dentistry settings (5.2%), dermatology outpatients (11.3%), and cosmetic dermatology outpatients (9.2%).

BDD is notably more prevalent among individuals seeking aesthetic treatments, particularly concerning facial features [8, 11]. Singh and Veale [3] found higher frequencies of BDD in cosmetic-related settings such as dermatology (11.3%), cosmetic surgery (13.2%), orthognathic surgery (11.2%), and rhinoplasty surgery (20.1%). A systematic review by Minty & Minty [84] revealed varying prevalence rates among dermatology patients (2.1% to 36%) and general cosmetic surgery patients (2.9% to 57%). Kattan et al. [25] reported a prevalence of approximately 5% in cosmetic patients, consistent with findings by Bouman et al. [26]. Furthermore, Salari et al. [85], in a recent systematic review and meta-analysis based on 48 articles, found a BDD prevalence of 19.2% among 14,913 individuals seeking cosmetic surgery.

Given that BDD often manifests in preoccupations with facial features, skin, and hair [17,18,83], dermatologists are frequently consulted by individuals with BDD [86, 87]. This explains the higher prevalence rate found in cosmetic and aesthetic clinical settings compared to the general population.

## Screening and Diagnosis Tools of Body Dysmorphic Disorder

Presently, there are no established clinical guidelines for accurately screening BDD [8]. Nevertheless, there are several screening and diagnosis tools available for identifying BDD patients, including the diagnostic criteria such as the Structured Clinical Interview for DSM-IV (SCID) [5], DSM-5 [1] as well as Body Dysmorphic Disorder Questionnaire (BDDQ) [29]. Diagnostic tools are recommended for use not only for diagnosis purposes but also for the screening phase [88].

The SCID is a reliable, valid semi-structured interview and can be utilized to diagnose BDD as well as any comorbid conditions. It is the standard used for diagnosing psychological disorders in a psychiatric setting [89]. It is a 24-question, structured clinical interview designed for DSM-IV Axis I Disorders. However, this questionnaire can take anywhere from 15 minutes to several hours to administer, which may make it impractical in busy clinical settings. Furthermore, it was developed primarily for psychiatric contexts and has not been validated for use in cosmetic surgery settings [5].

The DSM-5 and BDDQ have proven valuable tools and have been extensively used for assessing BDD prevalence in specific patient groups and the general population [25]. Phillips and Hollander [90] strongly recommended the use of DSM-5 criteria to screen for BDD due to its potential impact on cosmetic post-procedural outcomes. To diagnose BDD using the DSM-5, the following criteria must be met [91]:

1. The individual is preoccupied with perceived defects or flaws in their physical appearance that are either imperceptible or only minimally noticeable to others.
2. The individual engages in repetitive behaviours due to their preoccupation.
3. This preoccupation causes significant distress or impairment in one or more major areas of their daily life.
4. The preoccupation cannot be better explained by an eating disorder.

BDDQ is a four-item tool designed based on the established criteria for BDD as outlined in DSM-5 [92]. The BDDQ is a self-administered screening tool that is brief (taking 1-2 minutes to complete), allowing patients to fill it out while waiting to see the surgeon [5]. The BDDQ has been validated using the SCID-V, the gold standard diagnostic tool that can be used for BDD within the field of plastic and reconstructive surgery [93]. This questionnaire has high sensitivity (94%) and specificity (90%) for identifying BDD [94], making it a robust alternative to the gold standard for identifying BDD symptoms and recommended to be included as a standard assessment tool in these fields [11, 94-96]. This screening tool has shown good predictive value outside psychiatric settings. It has been employed in numerous studies to estimate the prevalence of BDD across various populations, including those undergoing oculoplastic surgery, oral and maxillofacial surgery, rhinoplasty, and patients with acne. [11,97,98]. The BDDQ is the preferred questionnaire in dermatology, plastic surgery, and dentistry due to its concise self-report questions that align with the DSM-5 diagnostic criteria [95,96]. The BDDQ also serves as the basis for modified versions tailored to specific populations, such as the BDDQ-DV and BDDQ-AS [95].

There are additional tools available that can assist in diagnosing BDD by differentiating it from other comorbid disorders. For instance, the

Hospital Anxiety and Depression Scale (HADS) is useful for assessing levels of anxiety and depression. HADS can aid in diagnosing BDD by ruling out comorbid conditions such as depression or SAD, which are commonly associated with BDD. The HADS is a 14-item self-report tool and has been validated for use to screen anxiety disorders and depression effectively in various settings, including non-psychiatric hospitals, general practice, psychiatric clinics, and among individuals in the general population [99,100].

Individuals with BDD often feel reluctant to disclose their symptoms, particularly to clinicians. Therefore, administering a Health-Related Quality of Life (HRQoL) assessment can offer valuable insights into the patient's daily life and help identify underlying issues. Since preoccupation with perceived flaws that cause significant distress or impairment in one or more major areas of daily life is a diagnostic criterion for BDD, assessing a patient's QoL can provide important information for diagnosing the condition. Ishak et al. [101] stated that patients with BDD experience significant symptom severity and functional impairments and endure a substantial negative impact on their QoL. It was found that factors such as the severity of BDD symptoms are strongly associated with the impairment of QoL [16].

BDD also impacts various aspects of QoL, such as family life, overall well-being, and job security. Compared to the general population, individuals with BDD tend to have lower incomes, are less likely to live with a partner, and have higher unemployment rates [30]. Low health-related QoL, often reported in BDD patients [102], includes low general mental health, enjoyment, social adjustment, and social functioning [103]. Furthermore, patients with BDD often have significantly poor mental health status and mental health-related QoL, including diminished mental health, role limitations due to emotional problems, and impaired social functioning [101]. Evidence indicates that greater

severity of BDD symptoms is strongly associated with poorer mental health-related QoL [101]. Additionally, BDD also impacts physical health-related QoL, such as physical functioning, bodily pain, and role limitations due to physical problems. However, these effects are not as pronounced as those on mental health-related QoL [102].

Among HRQoL tools that can be utilized is the disease-specific QoL, such as the Dermatology Life Quality Index (DLQI), as patients with BDD are likely to visit dermatology settings due to their concerns about appearance. The DLQI is a validated self-report tool specifically designed for assessing QoL in dermatological contexts and has been widely used [104]. It consists of 10 questions that

evaluate QoL in six subdomains: symptoms and feelings, daily activities, leisure, work and school, personal relationships, and treatment. The higher the score on the DLQI, the greater the impairment in the individual's QoL [33]. Brohede et al. [33] conducted a prevalence study in dermatology settings using BDDQ along with HADS and DLQI. The study found that patients who screened positive for BDD exhibited high levels of anxiety and depression, and their QoL was significantly impaired. Scores for both HADS and DLQI are higher in BDD-positive patients.

In addition to the tools mentioned above, other questionnaires have also been used in clinical settings. **Table 2** shows several of these tools for screening and diagnosing BDD (for more information, see Sjogren [88]).

**Table 2** Tools for Screening and Diagnosing BDD [88].

| Type of tools   | Purposes               |
|---|------------------------|
| Body Dysmorphic Disorder Questionnaire (BDDQ)                         | Screening              |
| Body Dysmorphic Disorder Questionnaire- Dermatology Version (BDDQ-DV) | Screening              |
| Body Image Disturbance Questionnaire (BIDQ)                           | Screening              |
| Structured Clinical Interview for DSM-5, with BDD module (SCID)       | Diagnosis              |
| Body Dysmorphic Disorder Examination (BDDE)                           | Diagnosis and severity |

However, there are several limitations to the screening and diagnostic tools discussed above and other tools available in the literature. Some of the existing tools, such as SCID, are time-consuming and challenging to interpret without specialized psychometric training [8]. Furthermore, many of these tools have not been extensively validated, and those that have been validated are often limited to specific fields. A

review conducted by Pereira et al. [95] concluded that, despite its high prevalence, there are still limited validated screening tools available for BDD, specifically within the aesthetic field [81,82,105-107]. Further research is needed to identify and develop optimal screening tools that can be effectively used in clinical settings for diagnosing BDD.

## **Underdiagnosed of Body Dysmorphic Disorder in Cosmetic and Aesthetic Clinical Practice**

BDD is currently underdiagnosed in cosmetic and aesthetic medical settings. It is often ignored by cosmetic or aesthetic medical practitioners, especially when it involves monetary gains from performing the procedures. According to Kattan et al. [25], the prevalence of BDD was indeed underestimated by cosmetic treatment providers based on the reported prevalence of BDD in cosmetic settings [9,108], along with the results of their study. BDD patients tend to hide the presence of their illness to undergo any form of cosmetic procedure [26].

Studies have shown that there are difficulties in accurately diagnosing BDD or identifying patients during preoperative cosmetic or aesthetic medical consultations. This situation will increase the likelihood of conducting unnecessary treatment with ethical and medicolegal repercussions [7,109]. In a survey conducted among American Society for Dermatologic Surgery (ASDS) practicing members, it was discovered that 61% of ASDS dermatologists identified cases of BDD in individuals only after a procedure had been carried out, even though 94% of the surveyed dermatologists were acquainted with BDD, and 62% considered it a contradiction to aesthetic treatment [4]. Besides that, a survey among members of the American Society for Aesthetic Plastic Surgery (ASAPS) revealed that 85% of respondents had conducted surgery on a patient with BDD, which they discovered only after the procedure. Additionally, of those surgeons, 82% reported that these patients experienced unsatisfactory postoperative results [110].

Among factors for the underdiagnosis of BDD cases may be a lack of training or experience in diagnosing psychological disorders among cosmetic and aesthetic clinical practitioners. Therefore, they might find it especially challenging to assess if the preoccupation with

appearance is excessive, particularly in cases of mild defects, contributing to the ongoing debate about whether the BDD incidence in the aesthetic population is underestimated [8,82]. A survey conducted on 402 participants revealed that only two participants were correctly diagnosed as BDD patients by aesthetic surgeons when 42 of them were screened positive on a BDD questionnaire, and 16 were clinically suspected of having BDD [5]. Therefore, greater familiarity with BDD diagnostic criteria may lead to a higher rate of accurately identifying cases of BDD [25] by clinical practitioners.

Other factors contributing to the underdiagnosed of BDD is that it can be challenging to distinguish BDD from other psychiatric disorders with overlapping features, such as social anxiety, depression, OCD, and eating disorders [76] as BDD may cooccur with these psychiatric conditions. BDD is rarely identified, even within inpatient psychiatry, unless a detailed diagnostic interview is carried out [111]. The symptoms can overlap with other comorbidities, which complicates the diagnosis of BDD [112]. For instance, both eating disorders and BDD involve disturbances in body image. However, dissatisfaction with eating disorders is primarily centred on body weight and shape. In contrast, in BDD, concerns about appearance are more varied and are not typically associated with dysfunctional eating behaviours [113]. Therefore, there is a possibility that the patient will receive a diagnosis of a comorbid disorder while the presence of BDD remains undetected [3].

## **Discussion**

### *Impact of treating body dysmorphic disorder patient towards cosmetic and clinical medical practice*

BDD patients are commonly found in primary care and dermatology settings compared to psychiatric practice [114]. This is because most of the patients have a limited understanding of their

own condition and thus might not be aware of the importance of undergoing psychiatric treatment [33]. Many BDD patients find themselves seeking aesthetic or cosmetic treatments instead of mental health professionals, which is most likely unnecessary and fails to alleviate their internal distress [115,116]. Their satisfaction following treatments is temporary, and their anxiety will then be shifted to another part of their body [29]. Ultimately, the treatment they received left them with unsatisfying results even though it was medically successful [117]. As individuals with BDD frequently experience dissatisfaction with the treatments they receive, they may potentially shift the blame to the clinical practitioners providing those treatments. They may demand a comprehensive assessment, multiple consultations, and consult various physicians, among other actions [118]. Some of them might assert that the treatment yielded no results and even worsened their appearance [92,119].

BDD patients are also associated with physical aggression and violence [36]. Approximately one-third of individuals with BDD reported violent or aggressive behaviours related to their condition [120,121]. Consequently, there is a possibility that the interaction between BDD patients and cosmetic providers is getting out of hand, placing the latter at risk of physical harm. Several surveys conducted among clinical and cosmetic practitioners showed that there have been occasions where they have been threatened by BDD patients either verbally, physically, or even legally. The study by Bouman et al. [26] found that around 16.2% of the participants reported having been threatened verbally by BDD patients, and 6.4% faced legal threats. Meanwhile, Sarwer [110] discovered that 33% of the participants had experienced legal threats, 10% had encountered both legal and physical threats, and 2% had faced physical threats alone from BDD patients. In another study, Sarwer et al. [4] found that 9% of participants had been subjected to legal threats, and 2% experienced

physical threats from BDD patients. Besides that, Kattan et al. [25] reported that 9.2% of the participants had been verbally threatened by BDD patients, while 1% had been threatened physically. Furthermore, there has been an instance where BDD patients carried out an attack due to dissatisfaction with the postoperative or post-treatment outcomes [32]. One case involved a patient assaulting a plastic surgeon with a knife. At the same time, another attempted to murder a dermatologist, and there was a case where one dermatologist and two plastic surgeons were murdered by BDD patients [68,122].

Therefore, addressing the underdiagnosis of BDD is of paramount importance, especially among clinical and cosmetic practitioners, to avoid unwanted outcomes. Besides that, it is imperative to raise awareness about BDD among clinical and cosmetic practitioners, and they should familiarize themselves with clinical guidelines and diagnostic criteria of BDD, which will enable them to effectively care for these patients, ultimately sparing them from unnecessary financial, physical, and psychological strains of unwarranted procedures [25].

#### *Approach to managing body dysmorphic disorder*

Evidence indicates that BDD frequently remains undiagnosed despite its prevalence and impact [83]. As mentioned earlier, this may be partly due to BDD sufferers' reluctance to seek mental health support due to feelings of shame and embarrassment, lack of self-awareness, and preferences for non-mental health treatment like cosmetic surgery [123]. However, even when individuals with BDD do seek mental health care, they are unlikely to openly discuss their appearance concerns [83]. The combination of patients' reluctance to disclose their symptoms and clinicians' limited awareness of BDD can lead to misdiagnosis, with BDD symptoms sometimes



being mistaken for other common comorbid conditions such as depression or SAD [83]. Additionally, distinguishing mild BDD symptoms from normal concerns about appearance can be particularly challenging, especially among adolescents [124].

A key aspect in effectively managing BDD is the prompt recognition of its clinical presentation. For detection of BDD, screening tools and direct questioning about the symptoms help identify the condition as the patient will often not disclose their symptoms voluntarily. This will prompt referral to psychiatric evaluation [91]. The direct questioning approach should be approached with sensitivity and in a non-judgmental manner to aid in detecting BDD symptoms [91]. Refrain from engaging in arguments with the patient, especially regarding their physical appearance, as arguing to correct the patient's fixed false beliefs is not effective. Instead, focus on optimizing the treatment of the patient's psychiatric symptoms [125] by referring the patient to mental health professionals.

In the initial psychiatric evaluation, the objectives are to establish a trusting relationship, gather detailed historical information related to the presenting issue, and perform a mental status examination. Building rapport with patients with BDD is crucial, especially for those with a lack of insight who may be reluctant to disclose their history or engage in their treatment plan. The evaluation should incorporate interview questions that effectively address each of the DSM5-TR diagnostic criteria for BDD [91].

### *Way forward*

The level of awareness and understanding of BDD among the public and health professionals in Malaysia is still low. Additionally, the prevalence of the disorder remains unknown, contributing to a low detection rate. To address this issue, the first step should be determining the prevalence of BDD among Malaysians. Only

then can appropriate countermeasures be developed. Besides studying prevalence, research on the awareness and knowledge of BDD among clinicians and the public should be conducted in various settings.

Meanwhile, public awareness can improve over time, but it remains a major obstacle for individuals with BDD to spontaneously disclose their symptoms, even when these are their primary concerns. As previously stated, individuals with BDD are often more likely to present to clinicians outside of a psychiatric setting initially. Therefore, it is crucial for clinicians to screen for BDD to enhance its recognition. Professionals in dermatology, plastic surgery, primary care, and dentistry can play a vital role in diagnosis by conducting screenings and identifying the condition. Following this, clinicians should refer patients to psychiatric healthcare professionals and work together to create a comprehensive treatment plan for the patient [26].

Hence, collaboration between aesthetic clinicians and mental health professionals is important for providing comprehensive care to individuals with BDD, as these patients warrant a referral for psychiatric evaluation. Given that many individuals with BDD seek aesthetic or cosmetic procedures to address their perceived flaws, aesthetic clinicians are often among the first to identify and refer patients who may have underlying psychological health issues. Fostering this collaboration will ensure that patients receive appropriate treatment for both their psychological and physical concerns, preventing them from undergoing unnecessary or excessive cosmetic procedures that could potentially exacerbate their condition. A standardized guideline for the referral process needs to be developed to ensure a smooth referral flow. A regulatory body needs to be formed to develop these guidelines. Several important key points can be included in this guideline:



1. Screening method for BDD:

- Develop standardized screening tools for BDD specifically for the Malaysian population.
- Provide detailed information about the patient's concerns and any observations related to their appearance-focused behaviour. This helps in making a diagnosis and classifying the urgency of the referral.

2. List of mental health professionals for treating BDD:

- Establish a directory of mental health professionals who are experienced in treating BDD to facilitate smooth referrals and ensure that patients receive appropriate treatment and support.

3. After-Referral Follow-Up Procedures:

- Establish procedures to ensure patients receive appropriate care after being referred to mental health professionals.
- Implement a method to monitor the patient's progress and adherence to the treatment plan and modify the treatment plans as necessary.

## Conclusions

Screening for BDD by aesthetic practitioners is critically important [126] as it may help them recognize the patient with BDD or other psychiatric conditions that might pose a contraindication for procedures [127,128]. A thorough understanding of the diagnostic criteria for BDD may result in a higher number of accurate BDD diagnoses and fewer cases going undetected [25]. In Malaysia, there is a significant lack of information on the prevalence and awareness of BDD among cosmetic and clinical practitioners. Addressing this research gap is essential to improve clinical outcomes and patient care.

Future studies should focus on assessing BDD prevalence specifically within Malaysian populations, as well as evaluating the level of awareness and knowledge among aesthetic and cosmetic practitioners. Additionally, research should explore the barriers that hinder the recognition and diagnosis of BDD in clinical practice. By bridging these gaps, we can enhance early detection, ensure appropriate management, and mitigate potential adverse impacts on both patients and practitioners.

## Conflicts of Interest

The authors declare no conflict of interest.

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# Prevalence of Cutaneous Malignancies in Johor Bahru: A 6-Year Retrospective Study at a Single Centre

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**Abstract:** Cutaneous malignancies, including basal cell carcinoma (BCC), squamous cell carcinoma (SCC), and malignant melanoma (MM), are among the most common forms of skin cancer, particularly in regions with high ultraviolet (UV) exposure. Despite their prevalence, these malignancies are relatively underreported in Malaysia, where public awareness remains limited. This study aimed to analyse the epidemiology, demographic distribution, and associated risk factors of cutaneous malignancies among patients at Hospital Sultanah Aminah, Johor Bahru (HSAJB), between 2015 and 2020 to fill gaps in local data and inform public health strategies. A retrospective, cross-sectional study was conducted, encompassing all patients diagnosed with and histopathologically confirmed to have cutaneous malignancies at the Department of Plastic and Reconstructive Surgery, HSAJB, from January 2015 to December 2020. Descriptive statistics summarized socio-demographic variables, while logistic regression was employed to assess the association between lifestyle factors, comorbidities, and the risk of developing specific types of cutaneous malignancies. Out of 262 confirmed cases, 219 were included in the analysis. The majority of patients were male (59.8%) and of Chinese ethnicity (60.7%), with most cases occurring in the elderly population (mean age  $68.60 \pm 13$  years). Basal cell carcinoma was the most common malignancy, followed by SCC and MM. Lesions predominantly occurred in sun-exposed areas, particularly the head and neck. A significant association was found between smoking and the risk of developing SCC ( $P < 0.05$ ), but not with BCC and MM. Co-morbidities such as hypertension and diabetes mellitus did not significantly influence the risk of cutaneous malignancies. The prevalence of cutaneous malignancies was 15 per 1,000 people in Johor Bahru during the study period. The study highlights a higher prevalence of cutaneous malignancies among the Chinese population and males in Johor Bahru. Public health initiatives focusing on increasing awareness, early detection, and preventive measures such as sun protection and smoking cessation are essential to reduce the incidence and improve outcomes for cutaneous malignancies in Malaysia. Further research is needed to explore the impact of comorbidities and other risk factors on these malignancies.

Keywords: Cutaneous malignancies, Johor Bahru, Malaysia, Skin cancer

## Introduction

Malaysia, encompassing a total area of approximately 330,534 square kilometres, is divided into Peninsular Malaysia and East Malaysia. As of 2020, Malaysia's diverse population, including non-citizens, stood at 32.4 million. Malaysian citizens comprised 52.3% males and 47.7% females, with Bumiputra forming the majority at 69.4%, followed by Chinese (23.2%), Indian (6.7%), and others (0.7%). Johor, located in the southern part of Peninsular Malaysia, had a total population of 4 million in 2020, with Johor Bahru having approximately 1.71 million residents [1].

According to the Malaysia National Cancer Registry Report 2012-2016 [2], skin cancer or cutaneous malignancies rank among the top ten most prevalent cancers in Malaysia, accounting for 2.6% of all cancer cases. Notably, the incidence of cutaneous malignancies is higher within the Chinese community compared to the overall Malaysian population [3]. Despite its prevalence, cutaneous malignancies remain relatively underreported and receive limited public attention in Malaysia. The World Health Organisation (WHO) has highlighted an increase in both melanoma and non-melanoma cutaneous malignancies in recent years [4].

Globally, cutaneous malignancies remain among the most common forms of cancer, particularly in regions with high UV exposure. The depletion of the ozone layer has resulted in reduced atmospheric protection, allowing more solar ultraviolet (UV) radiation to reach the Earth's surface, thereby increasing the risk of developing cutaneous malignancies [5]. Incidence rates of cutaneous malignancies are highest in Australia and New Zealand, reflecting high UV radiation levels and prevalent outdoor lifestyles. In contrast, regions with lower UV exposure, such as Northern Europe, have significantly lower incidence rates [6,7].

Since the 1960s, the incidence of basal cell carcinoma (BCC) and squamous cell carcinoma (SCC) among Caucasians has increased by 3 to 8% annually. Individuals with darker skin benefit

from greater epidermal melanin, enhanced melanocyte activity, and more scattered melanosomes, which can filter twice as much ultraviolet B (UVB) radiation compared to lighter-skinned individuals, such as Caucasians [3,8,9]. The incidence of malignant melanoma (MM), a potentially lethal tumour due to its high mortality rate, has increased over the years. Although less common than other cutaneous malignancies, MM accounts for the majority of skin cancer-related deaths, as reported by the WHO [6]. In addition to the three most prevalent cutaneous malignancies—SCC, BCC, and MM—other types can also occur, though they are relatively rare. These include Merkel cell carcinoma, sarcoma-like tumours, trichilemmal carcinoma, and metastatic skin cancer [8–10].

While Asians generally have lower incidence rates of cutaneous malignancies compared to Caucasians, the prevalence of these malignancies is on the rise in Asian countries. The Asian population is not homogeneous, with significant regional variations in skin types influenced by geographical conditions [11–13]. Early recognition of suspicious skin lesions and prompt referral to tertiary hospitals are crucial for effective management [14].

Several risk factors contribute to the development of cutaneous malignancies, including genetic predisposition, smoking, UV exposure, skin type, age, and immunosuppression. A family history of cutaneous malignancies increases individual risk, and prolonged exposure to UV radiation from the sun or artificial sources, such as tanning beds, is a significant risk factor. Lighter skin types (Fitzpatrick I-III) are more susceptible to UV damage, and the risk of cutaneous malignancies increases with age due to cumulative UV exposure. Conditions that weaken the immune system, such as HIV/AIDS or the use of immunosuppressive medications, also increase the risk of cutaneous malignancies [15].

Understanding the relationship between lifestyle and the risk of developing cutaneous malignancies is crucial for improving patient outcomes and developing targeted prevention

strategies. Some studies suggest that medical conditions such as diabetes mellitus and smoking may be associated with an increased risk of certain cutaneous malignancies. It has been found that smoking, in particular, may increase the risk of SCC. However, the relationship between cardiovascular disease and cutaneous malignancies may not directly increase the risk [16,17]. Effective prevention strategies include public education on the risks of UV exposure, the importance of regular skin checks, and the use of sun protection measures such as sunscreen and protective clothing. These strategies have been shown to reduce the incidence of cutaneous malignancies by promoting protective behaviours [16,18].

However, data and literature on cutaneous malignancies at the local and national levels in Malaysia are limited. Therefore, this study aims to analyse retrospective data on the epidemiology of cutaneous malignancies at Hospital Sultanah Aminah, Johor Bahru (HSAJB). By examining data over a six-year period, this research seeks to fill gaps in local and national information, providing insights that can inform public health strategies for addressing trends in cutaneous malignancies. Enhanced public awareness and early detection are crucial for reducing the burden of cutaneous malignancies and improving outcomes in Malaysia.

## Methodology

### *Study Design*

This retrospective, cross-sectional study included all patients referred to, diagnosed with, and histopathologically confirmed to have cutaneous malignancies who received treatment at the Department of Plastic and Reconstructive Surgery, HSAJB, between January 2015 and December 2020. Data were extracted from patient's case notes spanning this period and were subsequently entered into the Skin Cancer

Proforma. Ethical approval for this study was obtained from the Medical Research and Ethics Committee (MREC), Ministry of Health Malaysia. The study was also registered with the National Medical Research Registry under protocol number NMRR-21-1883-61570.

### *Statistical Analysis*

All data were entered and analysed using IBM's Statistical Package for Social Sciences (SPSS) version 24. Socio-demographic variables of the patients were summarized using descriptive analysis and logistic regression. Numerical data were displayed as mean (SD) or median (IQR), depending on the normality of the distribution, while categorical data were presented as frequency and percentage (%). Cases with missing or incomplete data, or those for which case notes could not be identified, were excluded from the study.

## Results

### *Demographic Data*

From 2015 to 2020, 262 patients were histopathologically confirmed to have cutaneous malignancies. Due to missing and insufficient data, this study comprised only 219 participants, and the demographic data are summarized in **Table 1**. The majority of these 219 patients (81 patients, 37.0%) were between the ages of 71 and 80, with an average age of  $68.60 \pm 13$  years. Most patients were male (131 patients; 59.8%), resulting in a male-to-female ratio of 1.5:1. Additionally, the majority were from the Chinese community (133 patients, 60.7%).

### *Point Prevalence*

Between 2015 and 2020, the prevalence of cutaneous malignancies in Johor Bahru, Johor, Malaysia, was 15 per 1,000 people.



### Cutaneous Lesions Size

The size of cutaneous lesions varied widely among the patients (**Table 2**). The mean lesion size was 725.76 mm<sup>2</sup> with a standard deviation of 2555.24 mm<sup>2</sup>, indicating a broad range of lesion sizes from as small as 4.00 mm<sup>2</sup> to as large as

34,500.00 mm<sup>2</sup>. This wide range reflects variability in the stage at which the malignancies were diagnosed, as well as differences in lesion growth rates and tumour types.

**Table 1** Demographic data of cutaneous malignancies patients.

| Demographic Variables  | Frequency, n (%) |
|------------------------|------------------|
| <b>Age (years old)</b> |                  |
| 0 - 10                 | 0 (0)            |
| 11-20                  | 0 (0)            |
| 21 - 30                | 4 (1.8)          |
| 31 - 40                | 7 (3.2)          |
| 41 - 50                | 9 (4.1)          |
| 51 - 60                | 36 (16.4)        |
| 61 -70                 | 48 (21.9)        |
| 71 - 80                | 81 (37.0)        |
| 81 - 90                | 29 (13.2)        |
| 91 - 100               | 5 (2.3)          |
| <b>Gender</b>          |                  |
| Male                   | 131 (59.8)       |
| Female                 | 88 (40.2)        |
| <b>Ethnicity</b>       |                  |
| Malay                  | 77 (35.2)        |
| Chinese                | 133 (60.7)       |
| Indian                 | 2 (0.9)          |
| Others                 | 7 (3.2)          |

**Table 2** Cutaneous lesions size of patients.

| Cutaneous lesion size, mm <sup>2</sup> |                  |
|--|------------------|
| Mean ± SD                              | 725.76 ± 2555.24 |
| Range                                  | 4.00 - 34500.00  |

### Distribution of Cutaneous Malignancies by Demographics and Anatomical Location

**Table 3** provides a comprehensive overview of the distribution of cutaneous malignancies among patients (n=219) treated at HSAJB. The analysis focuses on gender, ethnicity, and anatomical location, providing valuable insights

into the demographics and characteristics of these patients. When examining specific types of cutaneous malignancies, BCC was fairly evenly distributed between males (52.5%) and females (47.5%). In contrast, SCC was predominantly found in males, accounting for 81.8% of the cases, compared to only 18.2% in females. Similarly, MM was more common in males (71.4%) than in



females (28.6%). The ethnic breakdown of patients revealed that the Chinese population had the highest incidence of cutaneous malignancies, representing 133 cases (60.7%). This was followed by the Malay population, which accounted for 77 cases (35.2%). Incidences among Indians and other ethnicities were much lower, with 2 cases (0.9%) and 7 cases (3.2%), respectively. Within specific malignancy types, BCC was most prevalent among the Chinese population (66.3%), followed by Malays (30.6%), with no cases reported among Indians. For SCC, the distribution was slightly more balanced but still showed a higher incidence in the Chinese (50%) compared to Malays (43.2%) and Indians (4.5%). Malignant melanoma was equally distributed among the Chinese and Malays (42.9% each), with no cases among Indians. The anatomical distribution of cutaneous malignancies highlighted that the vast majority of lesions were located in the head and neck region, accounting for 195 cases (89%). This trend was particularly pronounced in BCC, where 96.3% of cases were on the head and neck. SCC also showed a high concentration in this area (68.2%), followed by the upper limbs (15.9%) and anterior trunk (11.4%). Malignant melanoma had a more varied distribution, though the head and neck remained the most common site (57.1%), with significant cases also found on the lower

limbs (28.6%) and posterior trunk (14.3%).

### *Lifestyle and Co-Morbidity*

**Table 4** reveals that a significant majority of patients (86.8%) were non-smokers, with only 13.2% reporting a history of smoking. Approximately 22.4% of patients had no recorded medical illnesses, indicating that a significant portion of patients with cutaneous malignancies may not have other underlying health conditions. About 23.7% of patients had one type of medical illness, while the highest proportion of patients had two types of medical illnesses (27.4%). Additionally, 22.4% of patients had three types of medical illnesses, and a small fraction (4.1%) had four or more medical illnesses. The co-morbidities or medical illnesses included hypertension, diabetes mellitus, and cardiovascular disease. Further analysis using logistic regression (**Table 5**) revealed that smoking was significantly associated with an increased risk of developing squamous cell carcinoma (SCC), with a p-value < 0.05. However, no significant association was found between smoking and the development of BCC or MM. Additionally, the analysis indicated that the number of medical illnesses did not significantly affect the likelihood of developing any type of cutaneous malignancy.

**Table 3** Distribution of cutaneous malignancies according to gender, ethnicity and anatomical location.

|                            | Frequency, n (%) |           |          |          |            |
|----------------------------|------------------|-----------|----------|----------|------------|
|                            | BCC              | SCC       | MM       | Others   | Total      |
| <b>Gender</b>              |                  |           |          |          |            |
| Male                       | 84 (52.5)        | 36 (81.8) | 5 (71.4) | 6 (75.0) | 131 (59.8) |
| Female                     | 76 (47.5)        | 8 (18.2)  | 2 (28.6) | 2 (25.0) | 88 (40.2)  |
| Total                      | 160(100)         | 44 (100)  | 7 (100)  | 8 (100)  | 219 (100)  |
| <b>Ethnicity</b>           |                  |           |          |          |            |
| Malay                      | 49 (30.6)        | 19 (43.2) | 3 (42.9) | 6 (75.0) | 77 (35.2)  |
| Chinese                    | 106 (66.3)       | 22 (50.0) | 3 (42.9) | 2 (25.0) | 133 (60.7) |
| Indian                     | 0 (0.0)          | 2 (4.5)   | 0 (0.0)  | 0 (0.0)  | 2 (0.9)    |
| Others                     | 5 (3.1)          | 1 (2.3)   | 1 (14.2) | 0 (0.0)  | 7 (3.2)    |
| Total                      | 160 (100)        | 44 (100)  | 7 (100)  | 8 (100)  | 219 (100)  |
| <b>Anatomical location</b> |                  |           |          |          |            |
| UL                         | 2 (1.3)          | 7 (15.9)  | 0 (0.0)  | 0 (0.0)  | 9 (4.2)    |

|             |            |           |          |          |            |
|-------------|------------|-----------|----------|----------|------------|
| LL          | 0 (0.0)    | 0 (0.0)   | 2 (28.6) | 0 (0.0)  | 2 (0.9)    |
| Ant trunk   | 0 (0.0)    | 5 (11.4)  | 0 (0.0)  | 1 (12.5) | 6 (2.7)    |
| Post trunk  | 4 (2.4)    | 2 (4.5)   | 1 (14.3) | 0 (0.0)  | 7 (3.2)    |
| Head & neck | 154 (96.3) | 30 (68.2) | 4 (57.1) | 7 (87.5) | 195 (89.0) |
| Total       | 160 (100)  | 44 (100)  | 7 (100)  | 8 (100)  | 219 (100)  |

\*BCC= basal cell carcinoma; SCC= squamous cell carcinoma; MM= malignant melanoma; UL = upper limb; LL = lower limb; Ant = anterior; Post = posterior

**Table 4** Lifestyle and co-morbidity of patients with cutaneous malignancies.

| Variables                          | Frequency, n (%) |
|------------------------------------|------------------|
| <b>Smoking Behaviour</b>           |                  |
| Yes                                | 29 (13.2)        |
| No                                 | 190 (86.8)       |
| <b>Co-morbidity</b>                |                  |
| No medical illness                 | 49 (22.4)        |
| One co-morbid disease              | 52 (23.7)        |
| Two co-morbid diseases             | 60 (27.4)        |
| Three co-morbid diseases           | 49 (22.4)        |
| More than three co-morbid diseases | 9 (4.1)          |

**Table 5** Binary logistic regression analysis of cutaneous malignancies with lifestyle factors and co-morbidities.

| Variables                            | B       | S.E.      | Exp B      | Wald $X^2$ | df | p     |
|--------------------------------------|---------|-----------|------------|------------|----|-------|
| <b>Squamous Cell Carcinoma (SCC)</b> |         |           |            |            |    |       |
| Smoking                              | -1.100  | 0.432     | 0.333      | 6.478      | 1  | 0.011 |
| One co-morbid disease                | -0.186  | 0.483     | 0.830      | 0.149      | 1  | 0.700 |
| Two co-morbid diseases               | -0.284  | 0.471     | 0.753      | 0.363      | 1  | 0.547 |
| Three co-morbid diseases             | -0.581  | 0.520     | 0.559      | 1.250      | 1  | 0.264 |
| More than three co-morbid diseases   | -0.964  | 1.124     | 0.381      | 0.736      | 1  | 0.391 |
| <b>Basal Cell Carcinoma (BCC)</b>    |         |           |            |            |    |       |
| Smoking                              | 0.808   | 0.419     | 2.243      | 3.714      | 1  | 0.054 |
| One co-morbid disease                | -0.008  | 0.428     | 0.992      | 0.000      | 1  | 0.985 |
| Two co-morbid diseases               | 0.484   | 0.435     | 1.623      | 1.236      | 1  | 0.266 |
| Three co-morbid diseases             | 0.563   | 0.464     | 1.756      | 1.473      | 1  | 0.225 |
| More than three co-morbid diseases   | 1.364   | 1.110     | 3.914      | 1.512      | 1  | 0.219 |
| <b>Malignant Melanoma (MM)</b>       |         |           |            |            |    |       |
| Smoking                              | 17.915  | 7310.895  | 60321780.4 | 0.000      | 1  | 0.998 |
| One co-morbid disease                | 1.075   | 1.175     | 2.930      | 0.837      | 1  | 0.360 |
| Two co-morbid diseases               | -0.194  | 1.429     | 0.824      | 0.018      | 1  | 0.892 |
| Three co-morbid diseases             | 0.767   | 1.245     | 2.154      | 0.380      | 1  | 0.538 |
| More than three co-morbid diseases   | -17.310 | 13148.712 | 0.000      | 0.000      | 1  | 0.999 |

## Discussion

The aim of this study was to gain a comprehensive understanding of the distribution of cutaneous malignancies in Johor, Malaysia. Cutaneous malignancies rank as the 17th most common malignancies worldwide, with the highest incidence rates in Australia, New Zealand, and Northern European countries, and the lowest in certain African regions. This variation is likely due to differences in Fitzpatrick skin types, which affect lighter skin more than darker skin, as well as geographical location, UV exposure, and cultural habits [4,6,7]. Between 2015 and 2020, the prevalence of cutaneous malignancies in HSAJB was found to be 15 per 1000 people. As the study was confined to Johor Bahru only, comparisons with recent studies from neighbouring countries such as Singapore and Indonesia were not possible. These countries, along with Malaysia, have ethnically diverse populations with skin complexions ranging from Fitzpatrick III to VI [3,9,12].

The study found that cutaneous malignancies were most prevalent among the fair-skinned Chinese community in Johor, followed by the Malay population, and were least common among the Indian population. Furthermore, the Chinese population shows a higher incidence of cutaneous malignancies, particularly BCC, compared to other ethnic groups. The Chinese ethnic group's lower Fitzpatrick skin type compared to Malays and Indians contributes to their higher risk of cutaneous malignancies [3,19].

The most common types of cutaneous malignancies identified were BCC, followed by SCC and MM. This finding aligns with research conducted in various nations worldwide [4]. Furthermore, the majority of cutaneous malignancies, whether BCC, SCC, or MM, were significantly more prevalent in the elderly population. Generally, males exhibited a higher incidence of all cutaneous malignancies, with a male-to-female ratio of 1.5:1. This is consistent

with global research, which indicates that men are more likely than women to develop cutaneous malignancies [8,9,12]. The increased risk in men may be attributed to a lower awareness of sun protection measures, such as the use of sunscreen. Further study is needed to understand the reasons behind this finding [15].

Regarding the anatomical location of cutaneous malignancies, the majority of lesions were found in sun-exposed areas, primarily the head and neck. This contrasts with the Caucasian population, where BCC distribution is more homogeneous across the body [8,12,20,21]. Cultural factors may influence this difference. In Malaysia, people commonly wear modest clothing that covers most of their bodies, which may reduce sun exposure. Additionally, the lack of sun protection measures, such as sunscreen, hats, and umbrellas, increases the risk of developing cutaneous malignancies, especially in the head and neck region. This pattern underscores the critical role of UV exposure in the development of cutaneous malignancies [18].

The relatively low percentage of smokers among the patients might reflect general population trends; however, the significant association between smoking and certain cutaneous malignancies, such as SCC, should not be overlooked. The significant association between smoking and SCC observed in this study aligns with existing literature [17]. Smoking is a well-established risk factor for SCC. Carcinogens present in tobacco smoke, such as polycyclic aromatic hydrocarbons and nitrosamines, contribute to DNA damage and mutations in skin cells, leading to the development of SCC. Furthermore, the association of smoking with BCC and MM is less pronounced in this study. Several studies have found no significant association between smoking and BCC, suggesting that other factors may contribute to the development of BCC. Similarly, the relationship between smoking and MM is complex, and other factors may need to be considered in the development of MM [16,17].

The finding that the number of medical illnesses did not significantly influence the risk of developing cutaneous malignancies is intriguing and warrants further investigation. In this study, medical illnesses such as hypertension, diabetes mellitus, and ischemic heart disease did not show a significant association with cutaneous malignancies. This could be due to the specific population studied or the relatively small sample size, highlighting the need for larger, multi-centre studies to clarify these relationships. Some research suggests that chronic medical conditions, particularly those that impair the immune system, could potentially increase the risk of cutaneous malignancies, such as immunosuppressive conditions. However, previous studies have also shown mixed results regarding the impact of co-morbidities on cutaneous malignancies [15,16].

## Conclusion

This study provides a detailed assessment of cutaneous malignancies, including their prevalence and characteristics in Johor Bahru, Johor, Malaysia. It underscores the need for increased public awareness of cutaneous malignancies, irrespective of gender, skin colour, ethnic group, or age. Early detection of new and suspected skin lesions is crucial. Preventive measures to reduce the risk of cutaneous malignancies are essential, including education and awareness among healthcare providers and communities to improve early detection and diagnosis. For instance, studies indicate that emphasizing the effectiveness of educational campaigns in increasing the use of sunscreen and protective clothing, highlighting the dangers of smoking, and encouraging regular skin checks can significantly reduce the incidence of malignancies. Currently, cutaneous malignancy initiatives at both the hospital and community levels in Malaysia are insufficient and need improvement. One limitation of this study is the potential underreporting of cases. Therefore, there is a need for standardized national data collection procedures for similar research

investigations, particularly for cutaneous malignancies.

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## Conflict of Interest

The authors declare no potential conflicts of interest.

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# RF (Body Contouring Treatment) Induced Partial Thickness Burn Complicated by Cellulitis: A Case Report Following Selective Radiofrequency Therapy for Fat Reduction

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**Abstract:** Non-invasive body contouring has rapidly gained prominence as one of the most rapidly evolving fields in aesthetic medicine. A notable addition to this arena is Vanquish™ a novel non-invasive treatment designed to reduce waist circumference through the thermolysis of subcutaneous fat. Vanquish™ employs a selective, focus-field radiofrequency (RF) mechanism to achieve deep tissue heating, specifically targeting the abdomen and flanks. In this case report, we presented a case of partial thickness burn and cellulitis following selective contactless multipolar RF as a body-shaping treatment in a 62-year-old lady with co-morbidities and a BMI of 39.2. After the first session, the patient developed complications and was scheduled for treatments and daily dressings at the clinic. However, she expressed a preference for self-dressing at home. This case highlights the importance of patients following up with healthcare providers, communicating any changes in their condition, and adhering to recommended referral pathways to ensure appropriate and timely medical care. Complications can best be avoided through proper patient selection, adequate counselling, and ensuring sufficient hydration before and after the procedure.

Keywords: Burns, Cellulitis, Non-invasive body contouring, Radiofrequency, Subcutaneous fat

## Introduction

Abdominal adiposity, the accumulation of fat in the abdominal area, is recognized as a significant risk factor for cardiovascular diseases and diabetes. Beyond its impact on physical health, obesity can also lead to concerns about appearance, potentially resulting in psycho-

logical issues [1]. The proposed biological mechanism behind this is the dysregulation of the hypothalamic–pituitary–adrenocortical (HPA) axis and its overactivity due to obesity, particularly abdominal obesity [2]. This theory aligns with findings that associate abdominal adiposity with anxiety and depression in both males and females [1].

The intersection of health and aesthetics has driven a gradual increase in the demand for fat reduction and body-shaping procedures [3]. While liposuction remained the most common surgical procedure in 2022, non-surgical and non-invasive fat reduction methods have also gained popularity, with an estimated annual growth rate of 21% [4]. Recent global survey data from the International Society of Aesthetic Plastic Surgery (ISAPS) found that non-surgical fat reduction is among the top five most popular non-surgical procedures [5]. Several techniques aim to reduce localized fat deposits without the need for surgery, including cryolipolysis, low-level lasers, high-intensity focused ultrasound (HIFU), and radiofrequency (RF) devices.

The body contouring device using RF employs selective focused-field RF to heat subcutaneous adipose tissue. The key principle is the targeted application of RF energy to adipose tissue while minimizing its impact on the skin. The differentiation in water content and impedance between adipocytes (fat cells) and the skin allows for focused energy delivery [6]. Adipose tissue, being higher in impedance and lower in water content compared to the skin, selectively absorbs and retains RF energy. This selective absorption generates heat primarily within the subcutaneous adipose tissue. The goal is to induce heat that leads to fat cell disruption or reduction without significantly affecting the surrounding skin. The ability to concentrate RF energy in the target tissue, based on differences in water content and impedance, is a key feature of the technology [6].

While contactless selective RF devices are designed to minimize direct contact with the skin, it is crucial to recognize that adverse effects or complications, such as burns, may still occur. Even without direct contact, the transfer of energy through the skin carries inherent risks, and individual responses can vary. Advances in technology, proper training of practitioners, and adherence to safety protocols aim to minimize these risks. Nonetheless, as with any medical procedure, there are potential risks, and patients should be informed about possible complications before undergoing treatment. In this report, the

authors present a previously unreported case of partial thickness burn and cellulitis following non-invasive selective RF therapy (Vanquish™) for fat reduction.

## Case Presentation

A 62-year-old woman with a history of obesity, type 2 diabetes, hypertension, and a minor stroke with no residual weakness sought treatment at an aesthetic clinic for weight loss management. Her initial anthropometric measurements (**Table 1**) included a weight of 91.7 kg, a height of 153 cm, and a body mass index (BMI) of 39.2 kg/m<sup>2</sup>, classifying her as obese class II. Her body fat percentage was 46%, visceral fat was 16%, and water content was 42.7%, as measured by bioelectrical impedance analysis (BIA) (Tanita Body Composition Analyzer, BC-418). Her abdominal circumference measured 42.5 inches in the upper abdomen, 44 inches in the middle abdomen, and 47.5 inches in the lower abdomen. Her blood sugar levels ranged between 3.0 and 8.0 mmol/L at home, and her blood pressure was 130/85 mmHg prior to treatment.

She was presented with several options for managing her weight, including oral weight loss medication, subcutaneous weight loss injections, and non-invasive RF machines. Due to her frequent hypoglycaemic episodes, she was advised against oral and subcutaneous injection treatments. She chose to try an inch-loss treatment using a contactless RF machine. On examination, she had a flabby stomach but with healthy skin. There were no signs of skin excoriation or non-healing wounds on the abdomen.

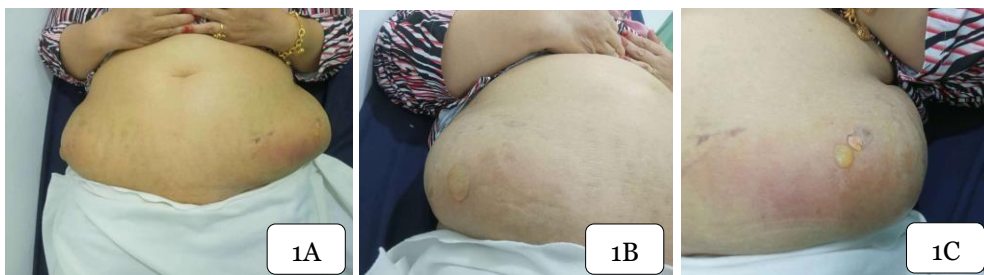
The treatment was performed according to the protocol. The patient lay beneath the device with the applicator positioned approximately 1 cm away from the skin, using a standard supplied spacer to standardize the distance and deliver RF-based energy. An initial power setting of 180W was used, with average tuning between 95% and 100%, and skin temperature was checked every 15 minutes using an infrared thermal imager.

**Table 1** Anthropometric measurement, abdominal circumference and vital signs of the patient.

| Parameters                         | Measurement            |
|------------------------------------|------------------------|
| <b>Anthropometric measurements</b> |                        |
| Weight                             | 91.7 kg                |
| Height                             | 153 cm                 |
| Body mass index (BMI)              | 39.2 kg/m <sup>2</sup> |
| Body fat percentage                | 46 %                   |
| Visceral fat percentage            | 16 %                   |
| Body water percentage              | 42.7 %                 |
| <b>Abdominal circumference</b>     |                        |
| Upper                              | 42.5 inches            |
| Middle                             | 44.0 inches            |
| Lower                              | 47.5 inches            |
| <b>Blood pressure</b>              | 130/85 mmHg            |
| <b>Blood sugar level</b>           | 3.0- 8.0 mmol/L        |

During the treatment, she did not report any direct skin contact with the machine but experienced some hotspots after 15 minutes. At that point, her skin temperature ranged between 39.4°C and 40.2°C, which was within the therapeutic range for fat apoptosis (39°C to 42.5°C). She was reassured, and the treatment continued for a total of 45 minutes. By the end of the procedure, the patient had no complaints.

On Day 1 post-treatment, the patient developed redness and discomfort on both sides of the abdomen. Subsequently, on Day 2, she developed several blisters in the bilateral hypogastric region. On examination, there were blisters on the right hypogastric region, located 6 cm superolateral to the anterior superior iliac spine (ASIS), measuring 4 x 3 cm. Additionally, two blisters were observed in the left hypogastric region: one 10 cm superior to the ASIS, measuring 1x1 cm (ruptured), and another 2x2 cm intact blister with erythematous surrounding skin and tenderness upon light palpation (**Figure 1**).



**Figure 1A** Blisters in the bilateral iliac fossa.; **1B** Blister in the hypogastric region (size 4x3 cm); **1C** Blister (size 2x2 cm) and a ruptured blister in the left hypogastric region.

She was prescribed with prophylactic amoxicillin tablets (500 mg three times daily for one week) to prevent bacterial infection as patient is diabetic and at risk of getting infection, moist exposed burn ointment (MEBO) cream application every 6 hours, and paracetamol tablets (1 g as needed). She was also advised on maintaining good hygiene and attending daily dressings at the clinic. However, the patient chose to perform normal saline dressings at home, MEBO ointment application every 4 to 6 hours and covering the wound with gauze and Tegaderm. She was followed up once a week at

the clinic. The wound initially developed dry, necrotic patches, which eventually detached after three weeks (**Figures 2A and 2B**). Later, the wound exhibited granulation tissue mixed with pus discharge (**Figure 2C**).

Despite advice and a hospital referral, the patient insisted on continuing her daily self-dressing routine at home. Additionally, her blood sugar levels were poorly controlled, ranging from 8 to 10 mmol/L. After two months, the wound and swelling on the left side worsened. Examination revealed that the wound over the right hypogastric region had healed well, showing



**Figure 2A** Ruptured abscess wound, 5 cm in size, with a dry necrotic patch 1 cm apart over the left hypogastric region; **2B** Surrounding skin erythema with a dry necrotic patch measuring 6x6 cm; **2C** Ruptured abscess wound, 2 cm in size, with an ulcerated wound 4 cm wide and 2 cm deep, showing moderate pus discharge, surrounded by soft tissue swelling and erythema in the left hypogastric region.

no redness or tenderness. However, the swelling in the hypogastric area had increased in size to 10x6 cm and was erythematous, indurated, tender, and discharging pus. The patient was hospitalized and treated for an abdominal wall abscess with cellulitic changes. She received a 10-day course of intravenous (IV) Augmentin, along with daily normal saline dressings, and was discharged in good condition (**Figure 3**).



**Figure 3** Skin burn healed well following intravenous antibiotic treatment and daily dressings.

## Discussion

Radiofrequency technology is an effective, non-invasive aesthetic treatment commonly used for reducing circumference and improving abdominal contouring [7]. The medical application of RF involves an oscillating electrical current that causes collisions between charged molecules and ions, which are then converted into heat. When the temperature of subcutaneous tissue reaches 44-45°C, apoptosis of adipocytes occurs with minimal impact on the skin, muscle, and other internal organs [8]. The tissue heating

produced by RF induces different biological and clinical effects depending on the depth of the targeted tissue and the frequency used [9]. **Table 2** illustrates the heat effects on cells or tissues.

Selective focused field RF therapy works by overheating fat without direct contact with the patient's body, targeting the adipose tissue layer while minimizing the risk of overheating the skin, muscle, or internal organs. Complications such as second- and third-degree burn injuries are typically associated with percutaneous RF treatments but are less common with transcutaneous RF [10]. Reports of RF burn injuries related to Magnetic Resonance Imaging (MRI) accidents indicate that such burns most frequently occur when the human body comes into contact with an object [11,12].

**Table 2** Heat effects on cells/tissues

| Temperature | Effect on cells/tissues                           |
|-------------|---|
| 40 – 45°C   | Denaturation of protein and collagen in skin [8]. |
| 42°C        | Maximum temperature for skin and muscle [8].      |
| 44 – 45°C   | Apoptosis of adipocytes [8].                      |
| >49 °C      | Second-degree burn occurs [24]                    |

As the RF field heats the human body, the accumulation of heat on the skin may be a key factor in RF burn injuries in this patient. The patient subsequently developed an infection following a thermal burn, complicated by underlying poorly controlled diabetes mellitus.



Studies have shown that diabetic patients are more likely to experience complications after burns, with infections being more prevalent compared to non-diabetic patients [13]. Therefore, strict diabetic control should be advised before the procedure, as complications from the RF device can be exacerbated by poorly managed diabetes mellitus. Other possible side effects include pain during or after the procedure, swelling, temporary increased skin sensitivity to heat, and occasional excessive sweating at the end of the treatment [8].

### *Superficial partial thickness burn management*

In this patient, the progression of a superficial second-degree burn to skin necrosis, involving partial thickness of the skin extending from the epidermis into part of the dermis, is rather unusual. Normally, first-degree and superficial partial thickness burns heal with conservative treatment and do not result in scar development [14]. For both acute and chronic wound, wound toilet or wound bed preparation is considered the first step in the local treatment. This process involves removing the slough, non-vital tissue, and necrosis tissue through thorough cleaning and mechanical debridement. This approach helps reduce bacterial load and stimulates granulation tissue formation. Generally, cleaning the wound with sterile water is sufficient to remove debris. Management of blisters in patients with partial thickness burns is controversial; however, compelling evidence suggests that small blisters (less than 6 mm) should be left intact, while large blisters with thin walls should be debrided [15].

Topical antimicrobial agent or an absorptive occlusive dressing should be used in treating partial-thickness burn to reduce pain, promote healing, and prevent wound desiccation. A commonly used topical antimicrobial agent is silver sulfadiazine (SSD) [16]. However, for this patient, we prescribed MEBO ointment as the topical treatment. This oil-based herbal paste Moist Exposed Burn Ointment (MEBO) or Moist Exposed Burn Therapy (MEBT) was created in Beijing in 1989. Its main ingredient is beta-

sitosterol, which is a plant-derived sterol with reported anti-inflammatory, antibacterial, and analgesic properties [17-19]. Additionally, supportive pharmacological treatment, such as oral analgesics (e.g., paracetamol tablets), was also administered to the patient.

In order to facilitate tissue regeneration, the ideal wound dressing should be easy to apply and remove, protect the wound, provide a moist environment and maintain an appropriate wound temperature [20]. Particularly, a moist wound dressing as it creates a desired environment that helps to accelerate wound healing process thus promote tissue regeneration and lowers the risk of infection, scarring, and discomfort. Moist dressings can be categorized into films, foams, hydrocolloid dressings, hydrogels, and alginate dressings [21].

Dressing changes are mostly dependent on the condition of the wound and can be unpredictable. The dressing's absorptive capacity and its integrity in terms of structure or attachment to the wound are the two main variables that affect how long it takes to wear out. Dressing changes should be frequent enough to control exudate but not so frequent as to interfere with wound reepithelialisation. Depending on the type of dressing, changes can vary from 2 to 7 days [21]. For this patient, a film dressing (Tegaderm and gauze) was used, with MEBO ointment applied every 4 to 6 hours. Since patient is diabetic and at risk of infection, prophylactic oral antibiotics were started. However, a systematic review showed that prophylactic systemic antibiotics are not recommended for burns [22]. In order to reduce the length of empirical antibiotic therapy, early specimen collection for microbiological testing of the wound is advocated. This enables early drug adjustments based on the detected microbial flora thus preventing the emergence of multi-drug resistance bacteria and improve the precision and efficacy of therapy [23].

### **Conclusion**

In conclusion, the increasing use of selective RF therapy for abdominal weight loss raises the risk



of skin burns at the treatment site. As demonstrated in our case report, there remains a risk of skin burns even when all appropriate guidelines and protocols are followed. Although there have been no reported cases of second-degree burns with this machine, such complications are significant and may require long-term follow-up and wound care, especially in patients with underlying medical conditions. Chronic illnesses such as hypertension and diabetes must be well-controlled, as maintaining stable blood pressure and glucose levels supports burn wound healing and helps prevent secondary complications like infection and ulceration. Adjusting medications and implementing dietary changes, such as a low-salt and low-glycemic diet, can further enhance the healing process. Additionally, proper wound care and patient adherence to post-care advice are essential for achieving better outcomes.

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### Potential Conflict of Interest

Authors declare no potential conflict of interest.

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# Treatment of Epidermal Melasma Using a Combination of Dual Yellow Laser, Oral and Topical Tranexamic Acid, and Alpha Arbutin

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**Abstract:** Melasma is a common hyperpigmentation disorder that poses a significant challenge in terms of effective treatment. Conventional therapies often yield limited success, necessitating the exploration of alternative modalities. This case report demonstrates the efficacy of a dual yellow laser (511 nm and 578 nm) in combination with oral tranexamic acid and topical anti-pigment cream in the treatment of melasma. A 38-year-old Chinese woman with a 2-year history of melasma had previously sought multiple laser treatments at beauty centres but achieved unsatisfactory results. She opted for the Norseld dual yellow laser due to its minimal downtime and comfort. Due to financial constraints, she underwent four sessions of dual yellow laser (settings as per manufacturer protocol), two months of oral tranexamic acid, and depigmentation cream (5% tranexamic acid/alpha arbutin 2%). The mMASI score was reduced from 3.6/24 to 0.6/24 after four sessions of treatment. No side effects were reported following the yellow laser treatment. It can be concluded that the combination of dual yellow laser, oral tranexamic acid, and depigmentation cream holds promise as an effective and safe treatment modality for melasma. Further research and larger clinical studies are warranted to validate these findings.

Keywords: Alpha arbutin, Dual yellow laser, Melasma, Oral tranexamic acid

## Introduction

Melasma is a skin condition characterized by the development of brown or grey-brown patches, typically on the face. These patches result from the overproduction of melanin, the pigment responsible for the colour of skin, hair, and eyes

[1]. The areas of increased pigmentation are well-defined, often with scalloped edges. Although melasma affects individuals of all races, it is much more common in women and is more prevalent among those with darker skin tones. The lesions tend to darken with sun exposure. Several factors can trigger melasma, including

sunlight, pregnancy, oestrogens, oral contraceptives, scented cosmetics, thyroid dysfunction, and photosensitizing drugs [1].

The treatment of melasma is often challenging, and achieving complete patient satisfaction can be difficult [1]. While some patients find hydroquinone-based bleaching agents helpful, others do not [1]. Among the various treatment options for melasma, laser therapy is commonly used, but its effectiveness varies depending on the wavelength and energy applied. According to the theory of Selective Photothermolysis (SP), specific wavelengths can selectively target melanosome chromophores [2]. The optimal wavelengths for treating melasma should match the absorption coefficient for melanin pigments, which range from 400 nm to 1200 nm. As a result, lasers such as the Argon laser (488 nm), Nd laser (1064 nm), and Dual Yellow laser (511 nm and 578 nm) are frequently chosen for this purpose.

The Dual Yellow Laser, also known as the copper bromide (CuBr) laser, is a technology used in aesthetic medicine for various skin-related treatments. It is named "Dual Yellow" due to its emission of two specific wavelengths: 511 nm, which is strongly absorbed by melanin, and 578 nm, which is strongly absorbed by hemoglobin [3]. This laser has been proven effective in treating vascular lesions [4-6] demonstrated that using the Dual Yellow laser to treat melasma resulted in improvements in the Melasma Area and Severity Index (MASI), pigmentation intensity, and redness after four sessions.

In addition, several therapeutic agents have been employed to treat melasma, particularly those that inhibit melanin production by reducing melanogenesis and melanocyte proliferation. Topical agents such as azelaic acid, kojic acid, and tranexamic acid have demonstrated significant efficacy in reducing melasma and should be considered before proceeding with chemical peels or laser therapy. Kligman's formula, which combines hydroquinone, tretinoin, and dexamethasone in

a cream base, is among the most effective treatments [7].

Moreover, a recent randomized controlled trial has shown that topical isoniazid offers a significant depigmenting effect with acceptable efficacy and tolerability [8]. However, further research is needed to assess its safety and long-term side effects. Oral treatments with systemic distribution, including tranexamic acid and plant-based supplements such as Polypodium leucotomos extract, carotenoids, and melatonin, have also been acknowledged for their role in treating melasma [8].

Combination therapy appears to deliver promising results for melasma treatment. For instance, the combined use of topical treatments and chemical peels may enhance and accelerate treatment outcomes, even in cases of resistant melasma [9]. Therefore, this case report explores the use of combination therapy, specifically the Dual Yellow Laser alongside oral and topical treatments, as a potential approach for managing epidermal melasma.

## Case Presentation

A 38-year-old Chinese woman with no known medical illnesses presented with a history of skin hyperpigmentation over her bilateral cheeks for less than two years. She first noticed the pigmentation after attending several days of outdoor school activities for her child. Initially, she thought it was just sunburn and did not pay much attention to it. However, the faint hyperpigmentation gradually became more noticeable over the months, and she realized it worsened with prolonged sun exposure, such as during her recent vacation in Langkawi earlier this year. She denied having a similar skin condition in the past but mentioned that her sister also had comparable pigmentation issues.

She has no significant gynaecological or obstetric history, is married with two children, and has never taken contraceptive pills. Her menstrual cycle is regular, occurring every 23 to 27 days. She works as an executive and spends

most of her time in the office. For recreation, she typically engages in walking or jogging with her family at the park two to three times a week, usually after 5 p.m. on weekends. Her skincare routine consists of a gentle cleanser, moisturizer, and occasional use of sunscreen.

Further history reveals that the patient had attempted to remove the pigmentation at several beauty centres over the past year, but these efforts were unsuccessful. She is unsure of the specific type of laser used during her visits, but she was informed that it was a picosecond laser. She reported being traumatized by the pain experienced during the procedures, which ultimately led her to discontinue the treatment after several sessions. Following this experience, she began to accept that her skin condition might be lifelong and expressed that any treatment that could lighten the pigmentation would be satisfactory.

On examination, she is classified as Fitzpatrick Skin Type III and presents with prominent, almost symmetrically distributed brown-black macular patches on the malar regions of both cheeks, as shown in **Figure 1**. Examination with a Wood's lamp further accentuated the hyperpigmented patches, and the findings from non-polarized dermoscopy supported the diagnosis of epidermal melasma. Polarized dermoscopy also revealed increased vascularity in the form of telangiectasia. Based on the relatively short duration of the pigmentation and the positive clinical findings, she is diagnosed with epidermal melasma.

## Management and Outcome

The client's personal preferences, financial constraints, and fear of pain due to previous experiences at the beauty centre have unfortunately limited our treatment options for her epidermal melasma, including the use of pico laser. After obtaining her consent, she agreed to be treated with the Norseld Dual Yellow laser for 4 sessions, in addition to topical and oral medications for 2 months which were tailored

according to her limited monetary budget. She started on tranexamic acid tablets (250 mg twice daily), along with a topical cream containing active depigmenting ingredients: Tranexamic acid 5% and alpha arbutin 2% as a day cream. Additionally, she was advised to continue regular application of SPF 50 sunscreen for photoprotection and to prevent further exacerbation. Due to budget constraints, only 4 treatment sessions were initially planned.



**Figure 1** Front, right, and left views of the patient's face. The melasma lesions are visible on both sides of the malar region.

For each session of the Dual Yellow laser treatment, photographs of the patient are taken from three angles: front view, 45 degrees to the left, and 45 degrees to the right. These photos are captured before and immediately after each laser session using a standardized camera (iPhone 12 Pro) in a room with consistent lighting conditions. Improvement and differences are evaluated using the modified Melasma Area and Severity Index (mMASI) scoring system by comparing the photos taken at the beginning of the treatment with those taken after 4 sessions of laser treatment (see **Figure 2** to **Figure 4**).

For the treatment of epidermal melasma, a dual yellow laser machine with a pulse duration of 45 microseconds and wavelengths of 511 nm and 578 nm was used. One treatment session consisted of three steps (Table 1). The settings used were according to the manufacturer's protocol for melasma. In the first step, the 578 nm yellow laser was used with a 5 mm spot size, delivering a total of 1600 J (20 J/cm<sup>2</sup>) to the whole face. The second step involved the Y10G setting (yellow laser with 10% 511 nm green)



using the same 5 mm spot size, delivering a total of 800 J (20 J/cm<sup>2</sup>) to the full face. The third step used the Y10G setting (yellow laser with 10% 511 nm green) with a 1 mm spot size, delivering a total of 300 J (10 J/cm<sup>2</sup>) specifically to the melasma lesions, as shown in **Table 1**.

After four treatment sessions with the dual yellow laser, along with the concurrent use of topical and oral medication, the client was re-evaluated. The mMASI score before starting the treatment was 3.6/24, and after four sessions, it had improved to 0.6/24 (**Table 2**). The client

had reported no discomfort during the sessions and did not experience any side effects such as post-inflammatory hyperpigmentation (PIH), skin dryness, or erythema. A future treatment plan was discussed with the client, considering the likelihood of recurrence and exacerbation of melasma. However, due to financial constraints, the client chose not to continue further treatment sessions at that time. The client was advised to continue regular sunscreen application and to use over-the-counter topical depigmenting creams or serums.



**Figure 2A** Front views of the patient's face at baseline; **2B** Front views of the patient's face after four treatment sessions.



**Figure 3A** Right views of the patient's face at baseline; **3B** Right views of the patient's face after four treatment sessions.



**Figure 4A** Left views of the patient's face at baseline; **4B** Left views of the patient's face after four treatment sessions.

**Table 1** Laser settings used for each treatment session with a 2-week interval.

| Laser mode<br>(pulse duration: 45 microseconds) | Spot size | Area (cm <sup>2</sup> ) | Total energy                   | Fluence (J/cm <sup>2</sup> ) |
|---|-----------|-------------------------|--------------------------------|------------------------------|
| 1st Step: Yellow laser (578 nm)                 | 5 mm      | 80                      | 1600 J<br>(Whole face)         | 20                           |
| 2nd Step: Yellow laser with 10% Green (511 nm)  | 5 mm      | 40                      | 800 J<br>(Whole face)          | 20                           |
| 3rd Step: Yellow laser with 10% Green (511 nm)  | 1 mm      | 30                      | 300 J<br>(Over melasma lesion) | 10                           |

**Table 2** The mMASI score at baseline and after four treatment sessions.

|             | Baseline | After four treatment sessions |
|-------------|----------|-------------------------------|
| Total score | 3.6      | 0.6                           |

## Discussion

Melasma is a common disorder characterized by hyperpigmentation of the skin, primarily affecting the face [10]. It is often classified into epidermal, dermal, and mixed types based on the level of melanin deposition in the epidermis (epidermal melanosis) and/or the dermis (dermal melanosis) [11]. Although the pathogenesis of melasma remains unclear, it is recognized as a disorder often associated with photoaging [10]. Multiple etiological factors have been identified as leading cause to the release of

vascular mediators that stimulate angiogenesis which lead to the subsequent activation of melanocytes [12].

Factors implicated include:

**Ultraviolet (UV) light** – UV light can penetrate the epidermis and is thought to induce the formation of reactive oxygen species and promote melanin production (melanogenesis) in the skin [13]. Shorter wavelengths of visible light, such as blue and purple light, have been shown to induce long-lasting hyperpigmentation, parti-

cularly in darker skin types [14]. Prolonged sun exposure can lead to increased pigmentation in the skin, which often persists for an extended period [10].

**Family history** – It is an important risk factor for developing melasma. Some studies have reported that up to approximately 60% of patients with this condition have a positive family history, suggesting a genetic predisposition [10,15].

**Hormonal influences** – Oestrogen and progesterone may be implicated in the development of melasma, especially given its increased prevalence during pregnancy, in addition to the use of oral contraceptives containing these hormones, menopausal hormone therapy, and intrauterine devices and implants [12,16,17]. The activities of oestrogen and progesterone are mediated by specific receptors expressed in human skin, and these hormonal factors have been implicated in approximately a quarter of affected women [10]. Melasma on the extra-facial aspect of body such as forearm has been associated with the perimenopausal state and the use of topical oestrogen replacement therapy. Oestrogen is considered relatively a more significant mediator than progesterone [10].

**Medications** – Ingredients found in some perfumed soaps and cosmetic products may cause phototoxic reactions that can trigger melasma [10]. Systemic agents, including anti-epileptic, antimalarial, antipsychotic, and cytotoxic/antineoplastic medications, have also been reported to potentially induce hyperpigmentation [18].

**Heat exposure** – Extended occupational heat exposure or exposure to cooking fires has been suggested as a possible link to the development of melasma through thermal and UV damage. [11]. Thus, in this case, the main risk factor for the patient is exposure to UV light and sunburns,

which aggravated her skin condition by inducing melanocyte activity and increasing hyperpigmentation, Specifically in the bilateral malar regions. Given its frequent involvement of the face, melasma significantly impacts her quality of life.

Satisfying results have been demonstrated with combination therapy for melasma. Therefore, this study aims to evaluate the efficacy of dual yellow laser therapy in combination with oral and topical agents for treating epidermal melasma. In this case report, the combination of dual yellow laser with oral and topical depigmenting creams was found to be effective in treating melasma. The dual yellow laser is known for its effectiveness in addressing various skin conditions, including pigmented lesions, vascular lesions (such as blood vessels), and tattoos. Its different wavelengths target various chromophores in the skin, providing a versatile and comprehensive approach to skin rejuvenation and treatment [19].

Energy-based devices, such as lasers, have been utilized in the treatment of melasma and other pigmentation conditions, especially in cases refractory to topical treatments or chemical peels [20]. The dual yellow laser treats pigmentation by selectively targeting melanin, the pigment responsible for skin colour, through several mechanisms. This laser employs the principles of selective photothermolysis, which involves targeting specific chromophores (color-absorbing molecules) in the skin without damaging surrounding tissues. In the context of pigmentation, melanin is the primary chromophore. The dual yellow laser uses two specific wavelengths: 532 nm (greenish-yellow) and 577 nm (yellow-orange), both of which are well absorbed by melanin, the pigment responsible for the brown color in the skin. When melanin absorbs the laser energy, some of it is converted into heat, causing thermal damage to the pigmented cells. This damage fragments the pigmented cells, which are then eliminated through the body's natural processes. Additional benefits of the dual yellow laser include its ability

to stimulate collagen production through the generation of heat during the procedure. This stimulation can provide structural support to the skin, contributing to skin tightening and rejuvenation. Additionally, the dual yellow laser is a non-invasive procedure, making it relatively safe and minimizing damage to surrounding tissues [15].

Although many topical agents have been introduced, the key strategy for managing melasma remains consistent photoprotection. This involves the application of broad-spectrum sunscreens with a high sun protection factor (SPF) of 50+ or more [13]. Patients with melasma are at high risk of clinical relapses, making prolonged use of photoprotection highly recommended [21].

## Conclusion

In summary, successfully treating epidermal melasma often requires a multifaceted approach. This approach may include various treatments such as dual yellow laser therapy, oral medications like tranexamic acid, and topical anti-pigment agents such as tranexamic acid and alpha arbutin. Additionally, applying sunscreen is crucial for protecting the skin from further pigmentation and preventing the recurrence of melasma.

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## Potential Conflict of Interest

Authors declare no potential conflict of interest.

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