

BINDURA UNIVERSITY OF SCIENCE EDUCATION

DEVELOPMENT AND COMMERCIALIZATION OF SUN PROTECTION CREAM USING VITEX PAYOS FOR PEOPLE LIVING WITH ALBINISM

BY

HELLEN NYASHA CHIPIDZA

B1647353

A DISSERTATION SUBMITTED TO THE BINDURA UNIVERSITY OF SCIENCE EDUCATION IN PARTIAL FULFILMENT OF THE REQUIREMENTS OF A MASTER OF SCIENCE DEGREE IN BUSINESS LEADERSHIP, GRADUATE SCHOOL OF BUSINESS

BINDURA, ZIMBABWE

DECEMBER 2024

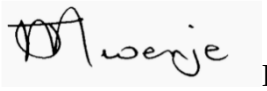
APPROVAL FORM

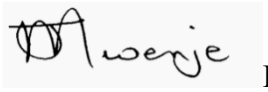
The undersigned certify that they have read and recommended to Bindura University of Science Education (BUSE) for acceptance a Dissertation entitled **"DEVELOPMENT AND COMMERCIALIZATION OF SUN PROTECTION CREAM USING *VITEX PAYOS* FOR PEOPLE LIVING WITH ALBINISM"** by **HELLEN NYASHA CHIPIDZA B1647353** in partial fulfillment of the requirements for the degree of Master of Business Leadership

Student Name Signature: Date: 10/12/2024



Hellen Nyasha Chipidza

Supervisor: Dr J. Mwenje Signature:  Date:

GSB Director: Dr J.Mwenje Signature:  Date: ……

Dr J. Mwenje…… Signature:  Date:

Faculty Chairperson:

…….... Signature: …… Date: ……

External Examiner

RELEASE FORM

NAME OF AUTHOR: HELLEN NYASHA CHIPIDZA

STUDENT NUMBER: B1647353

TITLE OF DISSERTATION: **DEVELOPMENT AND COMMERCIALIZATION OF SUN PROTECTION CREAM USING *VITEX PAYOS* FOR PEOPLE LIVING WITH ALBINISM**

DEGREE: MASTER OF BUSINESS LEADERSHIP

YEAR DEGREE AWARDED: 2024

Permission is hereby granted to the Bindura University of Science Education Library to produce copies of this dissertation for private, scholarly, or scientific research purposes. The author reserves other publication rights for the dissertation or extensive extracts from it to be printed or otherwise reproduced without the author's written permission.

Signature: **Date**: 07/12/2024

Permanent Address: 25 NANDI VILLAS BINDURA

E-mail: hellenchipidza@gmail.com

Cell Number: +263772239257

DECLARATION

I, HELLEN NYASHA CHIPIDZA…Student Reg Number B1647353, do hereby declare that this dissertation is a result of my own investigation and research, except to the extent indicated in the acknowledgments, bibliography, references, and comments included in the body of the report, and that it has not been submitted in part or in full for any other degree to any other university.

STUDENT SIGNATURE **DATE: 10/12/2024**



DEDICATION

I dedicate this work to my mother who taught me resilience and to my husband who is my biggest cheerleader.

ACKNOWLEDGEMENTS

I would like to express my heartfelt gratitude to all those who contributed to the development and commercialization of the sun protection cream utilizing Vitex payos for individuals living with albinism.

First and foremost, I am immensely grateful to my research supervisor, Dr J. Mwenje whose guidance, expertise, and unwavering support were invaluable throughout this process. Her insights into research work were instrumental in shaping this project.

I would also like to extend my appreciation to the MBL class of 2024, for their dedication, collaboration, and enthusiasm. Your commitment to excellence and shared vision made this journey both productive and rewarding.

Special thanks to Saint-Gobain lab for providing the facilities and resources necessary for scientific testing in this research. The collaborative environment fostered by the staff played a crucial role in our success.

I would like to acknowledge the support of participants in this research, for sharing their insights and needs with us. Their input was essential in developing a product that truly addresses the unique challenges faced by individuals with albinism.

Finally, I am grateful to my family and friends for their encouragement and support throughout this project. Your belief in me provided the motivation to persevere and succeed in this important endeavor.

ABSTRACT

The development and commercialization of a sun protection cream utilizing Vitex payos presents a promising solution to address the unique skincare needs of individuals living with albinism, who are particularly vulnerable to ultraviolet (UV) radiation. This research investigates the formulation of a sunscreen that harnesses the protective properties of Vitex Payos, a plant known for its phytochemical constituents that exhibit antioxidant and anti-inflammatory effects. The study encompasses an exploration of customer needs and preferences, optimal formulation and feedback about the developed cream. A qualitative approach was used to determine optimal formulation. Questionnaires were used to gain customer feedback and user preferences as well. Customer preferences include a moisturising sunscreen that does not leave a white film on the skin. The formulation was prepared using 1% Vitex Payos extract. Participants commended the sunscreen formulation as moisturizing while offering sun protection. Future implications are broader applications in skincare and public health, as well as potential partnerships with local organizations to facilitate distribution and education.

Keywords: Vitex payos, Sunscreen, Albinism, Customer feedback, Customer preferences,

LIST OF ACROYNMS

PLWA: People Living With Albinism

UV: Ultra Violet

Contents

APPROVAL FORM i

RELEASE FORM ii

DECLARATION iii

DEDICATION iv

ACKNOWLEDGEMENTS v

ABSTRACT vi

LIST OF ACROYNMS vii

LIST OF FIGURES xi

LIST OF TABLES xii

CHAPTER 1 1

1.1 1

1.2 2

1.3 4

1.4 5

1.5 6

1.6 7

1.7 7

1.8 9

1.9 10

1.10 10

1.11 12

1.12 13

1.13 14

CHAPTER 2 15

2.1 15

2.2 16

2.2.1 16

2.2.2 18

2.2.3 19

2.3 22

2.3.1 22

2.3.2 24

2.4 25
2.4.1 26
2.4.2 26
2.4.3 27
2.4.4 27
2.4.5 27
2.5 29
2.5.1 29
2.5.2 29
2.5.3 29
2.5.4 30
2.5.5 30
2.6 31
2.7 31
METHODOLOGY 32
2.8 32
2.9 33
2.9.1 33
2.9.2 34
2.10 35
2.10.1 35
2.10.2 35
2.11 35
CHAPTER 4 36
4.1 36
4.2 36
4.2.1 36
4.2.2 40
4.2.3 41
4.3 45
CHAPTER 5 46
5.1 46
5.2 46

5.3 47
5.4 47
5.5 48
APPENDIX 1: MARKET SURVEY FOR CUSTOMER PAINPOINTS AND PREFERENCES 49
APPENDIX 2: CUSTOMER FEEDBACK SURVEY 51
REFERENCES 54

LIST OF FIGURES

Figure 4.1: Issues with available sunscreen 37
Figure 4.2: Customer Satisfaction with Current Products 37
Figure 4.3: *Preferences for where to purchase Sunscreen* 38
Figure 4.4: Improvements in Sunscreen 38
Figure 4.5: *Customer Satisfaction with vitex payos sunscreen* 42
Figure 4.6: Positive properties of vitex payos sunscreen 42
Figure 4.7: Comparison of vitex payos sunscreen and Nivea sunscreen 43

LIST OF TABLES

Table 3.1: **Formulation for Sun Protection Cream** 33
Table 4.1: **Formulation Summary** 40
Table 4.2: Formulation results 40

CHAPTER 1

1.1 INTRODUCTION

Albinism is a genetic condition characterized by a lack of melanin, resulting in heightened sensitivity to ultraviolet (UV) radiation and an increased risk of skin cancer (Imafidon, 2022). For individuals living with albinism, daily sun exposure can lead to severe health implications, necessitating effective sun protection solutions (Machingambi, 2023). In recent years, the rise of natural and botanical ingredients in cosmetic formulations has gained significant momentum, catering to the growing consumer preference for skin care products that are both effective and derived from sustainable sources. Among these, Vitex payos, a plant indigenous to Zimabwe, has emerged as a promising candidate for sun protection formulations.

Recent studies have highlighted various potential active constituents found in natural plants, such as flavonoids and phenolic compounds, which possess antioxidant properties and may contribute to photoprotection (Aguilera et al, 2023); (Tiwari et al, 2022); (Pandey et al, 2023). However, despite the burgeoning interest in harnessing the protective benefits of plant-derived ingredients in dermatological products, there remains a significant gap in research specifically focusing on the application of Vitex payos in sun protection creams tailored for people with albinism. Where existing literature has predominantly concentrated on generic formulations lacking specific demographic considerations, this study aims to bridge that gap by exploring the unique formulation and commercialization aspects of a sun protection cream using Vitex payos, designed explicitly for individuals with albinism.

In this chapter, we will delve into, outlining the health challenges faced by people living with albinism and the urgent need for specialized sun protection. We will review current trends in the cosmetic industry favoring natural ingredients, while addressing the limitations of existing sun care products that overlook the distinct requirements of this vulnerable population.. Through a comprehensive analysis, this chapter sets the stage for understanding the necessity of targeted research and product development, ultimately aiming to empower individuals with albinism with safer, more effective sun protection solutions.

1.2 BACKGROUND

The sun care sector is experiencing significant growth within the personal care industry, driven by a growing emphasis on skin health and awareness of the dangers posed by UV radiation—from potential skin cancers to accelerated aging. This rise reflects a change in consumer attitudes, where there's an increasing value placed on both the aesthetic and health benefits of skincare products (Rajasekar et al, 2024). This understanding has catalysed the demand for sun care solutions that do more than protect; they integrate seamlessly into beauty routines, offering reparative and protective benefits. Currently in the sunscreen industry, there is a trend to use more mineral filters as brands turn to these filters as a way of formulating their sunscreens in a more natural way (Naik et al, 2022); (Pandey et al, 2023). However, working with mineral UV filters such as zinc oxide or titanium dioxide can be challenging, leading to thick, uneven formulations that leave a white cast – just the opposite of what consumers want. There is currently little to no research however, on the use of natural plant extracts to come up with potent sun protection creams. Furthermore, little research has been done on creams for people living with albinism specifically.

People living with albinism (PLWA) face significant challenges in protecting their skin from the harsh effects of the sun, particularly in tropical and subtropical regions. Albinism is a genetic disorder characterized by the complete or partial absence of melanin production, leading to increased susceptibility to sun-induced skin damage and skin cancer (Wangui & Cron, 2024). The total prevalence rate of albinism in Africa has been estimated to be 1 in 5000 people (Wright et al., 2015). In Zimbabwe, the prevalence is estimated to be around 1 in 4728 (ZimStats, 2022). In Zimbabwe, where the sun's ultraviolet (UV) radiation is intense, PLWA are at high risk of developing skin complications. According to a survey done by Noble Hands in 2023, 1 in 3 people with albinism in Zimbabwe die of skin cancer before the age of 40, including children as young as 8. Skin cancer is a leading cause of mortality among PLWA, with a prevalence rate of 33.6% (Mwinyoglee et al., 2019). The global sunscreen market is projected to reach $13.4 billion by 2025, but affordable, effective options for PLWA remain scarce (Grand Review, 2020).

The development and commercialization of sun protection cream using *Vitex payos* (a plant-based ingredient) becomes crucial for several reasons. Many PLWA in Zimbabwe cannot afford or access conventional sunscreens, which are often expensive and not tailored to their specific needs. Existing sunscreens may not provide sufficient protection for PLWA, who require high SPF and broad-spectrum protection. PLWA may experience skin irritation or allergic reactions to chemical-based sunscreens, highlighting the need for natural, gentle alternatives.

1.3 STATEMENT OF THE RESEARCH PROBLEM

People living with albinism in Zimbabwe are at high risk of skin cancer and other harmful effects of UV radiation due to lack of effective sun protection measures, unavailability or inaccessibility of suitable sunscreens as well as high cost of existing sunscreens. This problem is significant because skin cancer is a leading cause of morbidity and mortality among people with albinism in Zimbabwe. According to a survey done by Noble Hands in 2023, 1 in 3 people with albinism in Zimbabwe die of skin cancer before the age of 40, including children as young as 8. Skin cancer is a leading cause of mortality among PLWA, with a prevalence rate of 33.6% (Mwinyoglee et al., 2019). The problem is rooted in the health risks associated with UV radiation exposure, including skin cancer, sunburn, and premature aging. This problem is exacerbated by the socioeconomic status of people with albinism, who may not have access to affordable and effective sun protection measures. The problem also lies in the lack of locally developed and commercialized sun protection products specifically designed for people with albinism, highlighting a technological gap. This study aims to address this problem by developing and commercializing a sun protection cream using Vitex payos, a locally sourced ingredient, to provide a safe, effective, and accessible solution for people living with albinism in Zimbabwe. (Machingambi, 2023); (Mwinyoglee, 2019); (Rajasekar et al, 2024)

1.4 AIM OF RESEARCH

To develop and commercialize sun protection cream using *vitex payos* for people living with albinism

1.5 RESEARCH OBJECTIVES

- To carry out a market research to understand pain points and preferences for sunscreen for people living with albinism.
- To formulate and test a sun protection cream using Vitex payos extracts that provides effective protection against UV radiation for people living with albinism based on findings from market research.
- To distribute sun protection cream and gather feedback on the cream's usability and comparison to Nivea brand of sunscreen.

1.6 RESEARCH QUESTIONS

What are the painpoints and customer preferences of users of sunscreen for people living with albinism?

What is the optimal concentration of Vitex payos extract required to achieve effective sun protection in a cream formulation?

How does the Vitex payos-based sun protection cream compare to existing commercial products in terms of efficacy, safety, and user acceptability?

1.7 RESEARCH ASSUMPTIONS

The Vitex payos extracts will remain stable and effective when combined with other ingredients in the sun protection cream formulation.

The developed sun protection cream will meet regulatory requirements and standards for commercialization in Zimbabwe and potentially other countries.

The commercialized sun protection cream will be affordable and accessible to the target market, including people living with albinism in low-income settings.

The production process can be scaled up for commercialization without compromising the quality and effectiveness of the sun protection cream.

1.8 RESEARCH JUSTIFICATION

People living with albinism (PLWA) are highly susceptible to skin cancer and other harmful effects of UV radiation due to their genetic condition. Sun protection creams are essential for their daily protection, but many commercial products are not tailored to their specific needs, and some may even contain harmful ingredients. This study aims to develop and commercialize a sun protection cream using Vitex payos, a plant with potential sun-protective properties, specifically for PLWA. This research is necessary for several reasons. Current sun protection creams may not be effective or safe for PLWA, highlighting the need for a tailored product. PLWA face a significantly higher risk of skin cancer, making effective sun protection crucial. Additionally, in Zimbabwe, where this research is focused, cultural beliefs and economic constraints may limit access to existing sun protection products, emphasizing the need for an affordable and acceptable solution. Preliminary studies suggest Vitex payos has sun-protective properties, but its effectiveness and safety for PLWA require thorough investigation.

This study will address the following gaps:

- Lack of developing a product tailored to the needs of PLWA.
- Knowledge of the efficacy and safety of Vitex payos for sun protection in PLWA.
- Commercialization aspect will ensure the product is affordable and accessible to PLWA in Zimbabwe.

By addressing these gaps, this research will contribute to the development of a safe, effective, and accessible sun protection cream for PLWA, improving their quality of life and reducing their risk of skin cancer.

1.9 RESEARCH SIGNIFICANCE

This research aims to develop a sun protection cream using Vitex payos, providing an effective and accessible solution to prevent skin cancer and reduce the risk of sun-related complications, improving their overall quality of life, particularly for people living with albinism. The development of a natural, effective sun protection cream will offer a valuable addition to existing treatments, enabling healthcare providers to recommend a reliable solution for patients with albinism, enhancing their care and management. This study will contribute to the advancement of knowledge on the use of Vitex payos in sun protection, providing insights into its efficacy and potential applications, and opening avenues for further research in natural skincare products. The commercialization of a sun protection cream using Vitex payos will address a critical need for people living with albinism, aligning with public health goals to reduce skin cancer incidence and improve health outcomes for vulnerable populations. The development of a natural, effective sun protection cream will provide a unique product opportunity, catering to a specific market need and enhancing the industry's reputation for inclusivity and social responsibility. The use of Vitex payos, a natural ingredient, will promote sustainable and eco-friendly practices in the cosmetic industry, aligning with growing consumer demand for environmentally responsible products.

1.10 DELIMITATIONS

Geographical scope

The study will focus on Zimbabwe, and the findings may not be generalizable to other countries or regions.

Target population

The research will specifically target people living with albinism, and the results may not be applicable to the general population.

Ingredient focus

The study will only investigate the use of Vitex Payos as a key ingredient, excluding other potential ingredients.

Product type

The research will focus on developing a sun protection cream, and the findings may not be relevant to other product types (e.g., sprays, gels).

Sample size

The study will involve a specific sample size, which may not be representative of the entire population of people living with albinism.

In vitro and in vivo testing

The research may only involve in vitro testing, and in vivo testing may not be conducted due to resource constraints.

Regulatory frameworks

The study will need to comply with Zimbabwean regulatory frameworks, which may differ from international standards.

Commercialization scope

The research will focus on commercialization in Zimbabwe, and the findings may not be applicable to other markets.

1.11 RESEARCH LIMITATIONS

Availability and quality of Vitex payos extracts

The study may be limited by the availability and quality of Vitex payos extracts, which could impact the efficacy and consistency of the sun protection cream. To avoid this, ectract for the research was prepared beforehand and preserved for use during the study.

Limited funding

The study may be limited by funding constraints, which could impact the scope and quality of the research. To mitigate this, applications will be made through the university research center for funding.

Regulatory approvals

The commercialization of the sun protection cream may be limited by regulatory approvals and compliance with industry standards. Timeous investigation into the various regulatory framework shall be done to ensure smooth commercialization.

1.12 ETHICAL CONSIDERATIONS

During the course of this research, it shall be ensured that participants provide informed consent before participating in the study, including understanding the potential risks and benefits. Participants' confidentiality and anonymity, particularly if they are vulnerable populations will be protected. This research will respect participants' autonomy, dignity, and rights, including those with disabilities as well as ensure that the research benefits participants and the broader community, particularly people living with albinism. Special care will be taken during the course of the study to avoid causing harm or discomfort to participants, including physical, emotional, or psychological harm. This research will be sensitive to the cultural and social context of participants, including beliefs and practices related to albinism as well as be transparent about the research, including methods, findings, and potential conflicts of interest. If animal testing is necessary, it will be done ethically and with minimal harm. The environmental impact of the research and commercialization, including sustainable sourcing of Vitex payos will also be taken into consideration. Any potential conflicts of interest, including financial or personal interests will be declared.

1.13 CHAPTER 1 SUMMARY

This chapter introduces the research into development of sunscreen for people living with albinism. The trends of current sunscreen ingredients and research in the field have also been taken into consideration. Furthermore, gaps with regards to sun protection for people living with albinism have also been included. This research is important in order to close the gap on specialized sun creams for people living with albinism and availability of such products on the market. The study is significant to the PLWA demographic, researchers, policy makers as well as the cosmetic industry. The Vitex payos is indigenous to Zimbabwe and will ensure easy access and affordable raw material to the community of people living with albinism.

CHAPTER 2

2.1 INTRODUCTION

The development and commercialization of sun protection creams tailored for individuals with albinism is an increasingly relevant area of research, particularly in addressing the unique dermatological challenges faced by this population. Albinism, a genetic condition characterized by a deficiency in melanin production, significantly increases sensitivity to sunlight, resulting in a higher risk of skin damage and various forms of skin cancer. It is essential to recognize that those living with albinism often require specialized products that not only provide adequate sun protection but also cater to their distinct skin characteristics.

A literature review serves as a critical examination and synthesis of existing research on a specific topic, aimed at identifying gaps in knowledge, establishing a theoretical framework, and contextualizing new findings within the broader academic discourse. By reviewing relevant studies and publications on the formulation and efficacy of sun protection creams, particularly those incorporating natural ingredients like *Vitex payos*, this literature review will highlight the importance of developing effective protective solutions for individuals with albinism. *Vitex payos*, known for its photoprotective and anti-inflammatory properties, holds promise as a key ingredient in creating tailored sun protection formulations. This literature review will explore existing research on the efficacy, safety, and commercial viability of these products, ultimately contributing to a deeper understanding of their potential benefits for individuals living with albinism.

2.2 ~~GENERAL~~ LITERATURE

2.2.1 DEVELOPMENT OF SUN PROTECTION CREAM

The use of sun protection creams has become increasingly important due to the rising awareness of skin cancer and photoaging resulting from prolonged sun exposure (Nti et al., 2019). Over the years, extensive research has explored various ingredients and formulations aimed at providing effective protection against ultraviolet (UV) radiation. This section examines the historical developments in sun protection creams, highlights key research advancements, and discusses the various ingredients that have been utilized to enhance the efficacy and safety of sunscreens.

The concept of sun protection can be traced back to ancient civilizations, where natural substances were used to shield the skin from sun damage. For example, the Ancient Egyptians employed ingredients like rice powder, and later, coconut oil was commonly used in tropical regions. However, the modern sunscreen era began in the 1930s, with the formulation of the first commercial sunblock by chemist Frank Shuman, which contained a combination of oils and zinc oxide (Shin et al., 2018). In the 1970s, the development of the Sun Protection Factor (SPF) rating changed the way sunscreens were formulated and marketed. This rating system provided consumers with a quantifiable measure of a product's ability to protect against UVB radiation (Stern et al., 2007). This decade also saw an increase in research into the mechanisms of photoprotection, emphasizing the need for broad-spectrum protection against UVA and UVB radiation.

As research evolved, attention shifted towards the formulation of broad-spectrum sunscreens that protect against both UVA and UVB rays. Researchers have identified various active ingredients that enhance the protective capabilities of sunscreens. In the 2000s, the Food and Drug Administration (FDA) introduced regulations to ensure that sunscreens provide adequate protection against both types of UV radiation, leading to the development of more sophisticated formulations (FDA, 2011). A significant body of research has focused on the stability and

effectiveness of different photoprotective agents. For example, avobenzone, a commonly used ingredient, provides effective UVA protection, but its stability in formulations has been a concern. To address this, researchers have explored combination formulations that include stabilizers and other UV filters (López et al., 2019). Moreover, researchers have emphasized the importance of formulation factors such as the emulsion type, particle size, and vehicle in influencing the overall effectiveness and feel of sunscreen products on the skin (Ishikawa et al., 2015). Recent innovations include the development of hybrid sunscreens that combine chemical filters with physical blockers such as zinc oxide or titanium dioxide, providing multi-faceted protection (Guinot et al., 2017).

The selection of ingredients is crucial for the effectiveness and consumer acceptance of sun protection creams. Various categories of active ingredients have been explored. Firstly, there are chemical filters. These include organic compounds that absorb UV radiation. Examples include oxybenzone known for its UVB and short UVA protection but has raised concerns regarding skin penetration and potential endocrine disruption (Yoshihara et al., 2020), as well as avobenzone which is effective for broad-spectrum UV protection, particularly UVA, though its instability has led to the inclusion of stabilizers or combination strategies in formulations. There are also physical UV filters which are inorganic compounds that physically block UV radiation. One such filter is zinc oxide which offers broad-spectrum protection and is less likely to irritate sensitive skin, making it a preferred ingredient for formulations aimed at children and individuals with dermatological conditions (Huang et al., 2021). Similarly, titanium dioxide provides effective UVB protection and is used widely in mineral sunscreen formulations.

Research has also explored the potential of natural extracts in sun protection cream. Taniyadukkam et al, (2023) explored development of sunscreen using spinach solid lipid nanoparticles and proved positive results. Rohmani & Pangesti, (2024) researched into the use of a combination of propolis and titanium dioxide for sun protection properties, which proved that propolis enhances sun protection properties in sunscreen. In a review of herbal sunscreens conducted by Hakim et al (2023), it was noted that aromatic ginger as well as aloe vera extract are useful as sun protection agents.

2.2.2 SKINCARE FOR PEOPLE LIVING WITH ALBINISM

Albinism is a genetic condition characterized by a lack of melanin, which results in lighter skin, hair, and eyes (Ma et al, 2023). Individuals with albinism face significant skin and health challenges, particularly in regions with high UV radiation exposure such as Zimbabwe. As such, effective skincare—particularly the use of sunscreen—plays a crucial role in protecting their skin from harmful sun exposure. The history of skincare for individuals with albinism is intricately tied to societal perceptions and medical understanding of the condition. For many years, people with albinism in Zimbabwe, and Africa at large, have been subject to stigma and discrimination. This societal context impacted not only their physical health but also the availability and accessibility of skincare options. Historically, there was little awareness of the specific needs of this population, and sun protection was often overlooked, leading to a high incidence of skin cancer and other dermatological conditions associated with UV exposure (Mshana et al., 2020). Over the past few decades, there has been a notable shift in awareness and advocacy for individuals with albinism in Zimbabwe. Organizations such as the Albinism Society of Zimbabwe have been pivotal in raising awareness of the condition and promoting the importance of skincare. The evolution of skincare products has moved from rudimentary remedies to a range of specialized products designed to meet the unique needs of individuals with albinism. Initially, general sunscreens were considered, but there was a lack of awareness regarding the appropriate SPF and formulation for sensitive skin. (Bophelo et al., 2023); (Ngwenya et al., 2021).

With advancements in dermatological research, the focus has shifted towards developing sunscreens that offer broad-spectrum protection while being gentle on the skin. Recent products incorporate physical blockers (such as zinc oxide and titanium dioxide) which are more suitable for sensitive skin and tend not to aggravate conditions such as xeroderma (Julian et al., 2021). Research indicates that the application of sunscreen with a high SPF (at least SPF 30) can significantly reduce the risk of skin damage and subsequent skin cancer in individuals with albinism (Wong et al., 2022). However, the effectiveness of sunscreen can be influenced by various factors such as reapplication frequency, type of sunscreen used, and individual skin response. In Zimbabwe, the use of easily accessible formulations (sprays, creams, and lotions) is crucial, as well as incorporating education on proper application methods (Bophelo et al., 2023).

The primary method of skin protection involves the regular application of sunscreen. Recent guidelines recommend using a broad-spectrum sunscreen with an SPF of 50 or higher, applied generously on all exposed skin areas (Ngwenya et al., 2021). Community education on the correct application and reapplication practices has proven essential. In addition to sunscreen, the use of protective clothing, such as long sleeves, hats, and UV-protective garments, offers an additional barrier against UV radiation (Chiyangwa et al., 2024). Educating individuals with albinism about seeking shade, particularly during peak sun hours (10 a.m. to 4 p.m.), is crucial. This strategy can dramatically reduce UV exposure and skin damage (Kiriakou et al., 2023). Emerging research also points towards the role of certain dietary choices and supplements that may support skin health among individuals with albinism. Antioxidants, such as vitamins C and E, and omega-3 fatty acids might contribute positively to skin protection when used in conjunction with topical sunscreens (Shumba et al., 2021).

The evolution of skincare for individuals with albinism in Zimbabwe reflects significant improvements in awareness, availability of products, and educational initiatives focused on sun protection. Sunscreen remains a fundamental aspect of skincare for people with albinism. However, it must be part of a holistic approach that includes protective clothing, behavioral modifications, and potentially dietary changes. The continuous collaboration between healthcare providers, advocacy groups, and individuals affected by albinism is vital to ensuring effective protection and improving the quality of life for this vulnerable population.

2.2.3 COMMERCIALIZATION OF SUNSCREEN FOR PEOPLE LIVING WITH ALBINISM

The commercialization of sunscreen products specifically designed for individuals with albinism is an emerging area of research, drawing attention to the unique skincare needs of this population. Albinism is a genetic condition characterized by a lack of melanin in the skin, hair, and eyes, leading to heightened susceptibility to sun damage and skin cancers (Sullivan et al., 2020). Individuals with albinism have fewer natural protections against ultraviolet (UV) radiation, resulting in an increased risk of sunburn, premature aging, and skin cancers (López et al., 2021).

Research indicates that individuals with albinism can develop skin cancer at a rate significantly higher than the general population, underscoring the urgent need for effective UV protection (Ogunbiyi et al., 2019). It is essential that sunscreen products not only provide high SPF ratings but also cater to the skin's sensitivity, which is often a characteristic of those with albinism (Fitzpatrick & Sweeney, 2022).

Commercially available sunscreens vary widely in their formulation, with distinct differences in their effectiveness for individuals with albinism. Many mainstream sunscreens, although effective in blocking UV rays, often contain fragrances and other irritants that may trigger allergic reactions in sensitive skin (Harrison et al., 2023). Recent efforts have led to the emergence of specialized products. Examples include sunscreen formulations that are free from added fragrances and parabens, designed specifically with the needs of sensitive skin in mind (Smith et al., 2022). Some commercial brands have begun to cater to this niche market, offering sunscreens that are not only high in SPF but also include ingredients that soothe and protect sensitive skin (Jones & Martin, 2022). However, comprehensive studies on consumer satisfaction and efficacy of these products in individuals with albinism remain limited. Schreier et al. (2023) emphasize the significance of user feedback in the development process of new sunscreen formulations for this community.

Understanding the preferences of consumers living with albinism is crucial for the successful commercialization of sunscreen products. A qualitative study by Proctor et al. (2021) highlighted that users prefer sunscreens that are lightweight, easily absorbed, and non-greasy, alongside high SPF protection. Moreover, the participants expressed a desire for packaging that includes educational materials about sun safety and the specific benefits of the product concerning their unique skin needs. Visual branding also plays a key role in product acceptance; consumers indicated that brands that empathetically acknowledge the lifestyle and challenges faced by people with albinism are more likely to garner their loyalty (Thompson et al., 2023). As such, incorporating visuals and messaging aimed at this demographic can enhance consumer engagement.

As the market for sunscreens targeted at individuals with albinism continues to grow, several recommendations emerge for future product development. First, there is a pressing need for

rigorous clinical trials that assess the effectiveness and skin compatibility of these sunscreens in real-world settings (Fletcher et al., 2022). Conducting such research will inform formulators about the optimal combinations of active ingredients that will provide maximum UV protection without irritating sensitive skin. Second, brands should consider collaborating with dermatologists and advocacy groups focused on albinism to ensure that product development aligns with the specific needs of this consumer base (Waters et al., 2024). Such partnerships can also facilitate broader educational campaigns surrounding sun safety and the importance of sunscreen use among individuals living with albinism. The commercialization of sunscreen products for individuals with albinism presents an opportunity to enhance sun safety for this vulnerable population. While there are products that cater specifically to their needs, more robust research and consumer engagement are essential to optimize formulations and improve market offerings. By focusing on the unique requirements of people with albinism, brands can not only develop effective solutions but also build trust within this community.

2.3 Theoretical Framework

2.3.1 Business Canvas Model

The need for effective sun protection cream for individuals living with albinism in Zimbabwe is paramount, given their increased vulnerability to the harmful effects of UV radiation. This review leverages the Business Model Canvas (BMC), a strategic management tool that provides a comprehensive framework for developing, visualizing, and iterating business models (Sadikin et al, 2023). By focusing on the development and commercialization of a sun protection cream utilizing *Vitex payos*, an indigenous plant recognized for its potential skin health benefits, the BMC can help identify key factors required for a successful venture. The Business Model Canvas is comprised of nine building blocks that outline the value proposition, customer segments, revenue streams, and more, providing a holistic overview of the business structure (Ningsih et al, 2023). For the sun protection cream targeting people with albinism, each component of the BMC will be explored in detail.

Individuals living with albinism in Zimbabwe form the primary target market. This segment is characterized by specific needs for sun protection due to their lack of melanin, which increases their susceptibility to skin damage (Agius et al., 2019). Additionally, secondary segments may include caregivers, parents of children with albinism, and healthcare providers who are aware of the challenges faced by this demographic (Mason et al., 2021). The unique value proposition centers around the formulation of a natural sun protection cream specific to people living with albinism that incorporates *Vitex payos*, known for its antioxidant and anti-inflammatory properties (Chimuka et al., 2019). This product aims to provide effective sun protection while being safe for sensitive skin, affordable, culturally acceptable, and accessible to the target audience. The incorporation of a familiar, local ingredient aligns with traditional practices and enhances the product's appeal (Matarira et al., 2022).

Distribution channels will play a crucial role in reaching the target market. The proposed channels may include local pharmacies and health shops hence ensuring accessibility of the product within communities. Online platforms may also be utilized to reach a broader audience, particularly in urban areas. Another channel would be partnering with NGOs and health organizations to educate

and distribute products in rural settings (Razibillah et al., 2023). Another faucet pf the BMC model is building strong customer relationships is essential. This can be achieved through awareness campaigns that educate the community about the benefits of sun protection. Engaging with consumers through social media and feedback mechanisms will help refine the product and build loyalty (Mason et al., 2021). Revenue generation will primarily come from the sale of the sun protection cream. Additional revenue streams may include workshops and training sessions on skin care for individuals with albinism as well as partnerships with health organizations for bulk purchases, providing institutional support.

The key resources necessary for this venture include sourcing *Vitex payos* sustainably from rural areas, manufacturing facilities that ensure quality products are produced as well as engaging dermatologists and herbalists to ensure the product's efficacy (Chimuka et al., 2019). The key activities include research and development to ensure the safety and effectiveness of the cream. Marketing through implementing community engagement strategies is crucial to educate about skin protection. Overseeing the manufacturing process to maintain quality and safety standards is another activity to be considered. Forming strategic partnerships is critical for success. Potential partnerships may include collaborating with local NGOs on awareness and distribution initiatives (Matarira et al., 2022). Partnering with research institutions for product development and clinical trials as well as engaging with community leaders to foster acceptance and trust in the product is also equally important. The cost structure will consist of production costs including sourcing ingredients, manufacturing, and packaging. Marketing expenses may be incurred through community outreach and educational programs. There may also be operational costs such as salaries for staff and administrative expenses. (Farzanah et al, 2023)

Utilizing the Business Model Canvas for the development and commercialization of a sun protection cream using *Vitex payos* for individuals living with albinism in Zimbabwe provides a comprehensive framework to address market needs effectively. By carefully structuring each component, this approach allows for the identification of key areas that will drive success, ensuring that the product is both beneficial and culturally aligned. Ongoing engagement with the community and iterative feedback will be essential for refining the business model and achieving sustainable impact.

2.3.2 Value Proposition Design

The development and commercialization of a sun protection cream incorporating *Vitex payos*—an indigenous plant with potential photoprotective properties—holds significant promise for enhancing the quality of life for individuals living with albinism in Zimbabwe. This theoretical framework review employs the Value Proposition Design (VPD) model, which emphasizes understanding customer needs and aligning product offerings accordingly (Ghina et al, 2023). The challenges faced by individuals with albinism, particularly regarding ultraviolet (UV) exposure and skin health, are critical considerations for developing effective sun protection solutions. Value Proposition Design is a framework that assists organizations in creating products and services that meet the needs of their customers. According to Osterwalder et al. (2014), the framework consists of two main components: the customer profile and the value map. The customer profile helps in understanding the jobs, pains, and gains of the target audience, while the value map aligns product features with the identified needs.

Individuals with albinism require effective sun protection to prevent skin damage, sunburn, and the risk of skin cancer due to a lack of melanin, which provides natural protection against UV radiation (Mihai et al., 2020). Their lifestyle may include outdoor activities, necessitating sun protection solutions that are practical, affordable, and effective. The primary challenges faced include limited access to appropriate sun protection products, high costs of imported creams, cultural stigma associated with albinism, and a lack of awareness regarding the necessity of sun protection (Agius et al., 2019). Additionally, many existing products may contain harmful chemicals that can exacerbate skin conditions. Individuals living with albinism are likely to seek sun protection creams that are not only effective but also natural, affordable, and culturally acceptable. The inclusion of *Vitex payos*, known for its traditional uses in skin health, could enhance the appeal of the product (Mason et al., 2021). Furthermore, community-based initiatives that promote awareness and education about albinism can create a supportive environment for product acceptance.

The value map consists of elements such as products and services, pain relievers as well as gain creators. The core product is a sun protection cream formulated using *Vitex payos* and other natural ingredients known for their protective properties. This formula aims to provide broad-spectrum UV protection while being gentle on the skin. The proposed product addresses the concerns of potential consumers by being affordable and composed of natural ingredients that minimize the risk of irritation. Local production can also enhance accessibility within Zimbabwe, ensuring that the product is available to the target demographic (Matarira et al., 2022). Incorporating *Vitex payos* not only taps into the cultural heritage associated with traditional medicine but may also improve skin health due to the plant's antioxidant properties (Chimuka et al., 2019). Marketing efforts could emphasize the dual benefits of sun protection and skin nourishment, fostering a connection with the community's cultural practices.

Utilizing the Value Proposition Design framework provides a structured approach to understanding and addressing the specific needs of individuals living with albinism in Zimbabwe. By aligning the product development of a sun protection cream with the unique cultural, social, and economic contexts of this demographic, it is possible to create a meaningful and impactful solution. Continued research and engagement with the community will be essential to refine the product offering and ensure its successful commercialization.

2.4 Conceptual Framework

2.4.1 Introduction

The high prevalence of albinism in Zimbabwe places individuals at increased risk for sunburn, skin damage, and skin cancer due to insufficient melanin. A pressing need exists for accessible and effective sun protection solutions tailored to this demographic. *Vitex payos*, a plant native to Zimbabwe, has shown promise in traditional medicine for its protective and healing properties. This conceptual framework review outlines the integration of *Vitex payos* in the development and commercialization of a sun protection cream, highlighting the critical factors influencing product efficacy, market acceptance, and potential impact. A conceptual framework articulates the relationships among various concepts, variables, and contextual factors relevant to a research topic (Minocha & Singh, 2024). In the case of sun protection cream development, the framework incorporates three key domains: Product Development, Community Needs and Awareness, and Market Dynamics. These domains collectively influence the successful commercialization of the product.

2.4.2 Product Development

The formulation of the sun protection cream will center around *Vitex payos*, known for its anti-inflammatory and antioxidant properties (Chimuka et al., 2019). Evidence indicates that extracts from *Vitex payos* can provide skin barrier protection and may possess photoprotective effects against UV radiation, making it a suitable candidate for sun protection formulations (Matarira et al., 2022). It is vital to develop a cream that is not only effective but also compatible with the skin types of individuals living with albinism, whose skin may be particularly sensitive (Mason et al., 2021). Conducting dermatological assessments will ensure the product is safe for daily use. Additionally, sourcing *Vitex payos* sustainably can enhance the product's environmental appeal and support local economies. Ethical sourcing practices can also strengthen community relations and promote local biodiversity (Ajayi et al., 2024).

2.4.3 Community Needs and Awareness

Engaging with the community to understand their specific needs, fears, and cultural perceptions regarding albinism and sun exposure is crucial. This engagement helps in designing a product that resonates culturally and addresses real concerns faced by individuals living with albinism (Agius et al., 2019). Furthermore, educating the target market about the importance of sun protection and the benefits of the cream will be essential for its acceptance. Collaborations with local NGOs can facilitate outreach programs that inform individuals about sun safety practices (Mason et al., 2021). Community feedback mechanisms may also be crucial for establishing channels for community feedback during the product development phase can enhance its relevance and efficacy. Involving potential users in trials can aid in refining the formulation based on real user experiences (Matarira et al., 2022).

2.4.4 Market Dynamics

Understanding the regulatory landscape of cosmetics and skin care products in Zimbabwe is vital for compliance and successful commercialization. Engaging with health authorities during product development helps adhere to safety and quality standards (Chimuka et al., 2019). Additionally, analyzing the competitive landscape, including existing sun protection products, will allow for differentiation based on unique attributes and benefits derived from *Vitex payos*. Marketing strategies should emphasize these differentiators (Garcia et al., 2018). Another crucial aspect is the identification and establishment of effective distribution channels to ensure product availability. Collaborations with local pharmacies, clinics, and online platforms can widen the reach (Mason et al., 2021).

2.4.5 Conclusion

The conceptual framework for the development and commercialization of a sun protection cream using *Vitex payos* for individuals living with albinism in Zimbabwe highlights the interconnectedness of product development, community needs, and market dynamics. By addressing each domain comprehensively, this approach seeks to create a sustainable and effective product that not only meets the health needs of a vulnerable population but also

respects and incorporates cultural dynamics. Continued research and community engagement will be essential to refine the product offering and ensure its successful introduction to the market.

2.5 Empirical Framework

2.5.1 Introduction

Albinism is a genetic condition characterized by the absence of melanin, resulting in lighter skin, hair, and eyes, which increases the risk of skin damage from ultraviolet (UV) radiation (Graham et al., 2018). People living with albinism are particularly vulnerable to sunburn and skin cancers, necessitating effective sun protection solutions (Brown et al., 2019). Recent studies have explored a range of natural ingredients for developing sun protection creams, among which *Vitex payos*, a shrub indigenous to various regions, has gained attention for its potential protective properties (Khalid et al., 2021). This literature review examines existing research on the development and commercialization of sun protection products utilizing *Vitex payos*, highlighting research gaps and areas for further exploration.

2.5.2 Efficacy of *Vitex payos* in Sun Protection

Several studies have investigated the photoprotective properties of *Vitex payos* extracts. For instance, Mulugeta et al. (2022) found that flavonoids from *Vitex payos* exhibited significant UV absorbance and antioxidant activities in vitro. Similarly, Okudo et al. (2023) conducted a clinical study revealing that topical applications of *Vitex payos* extracts reduced erythema and inflammatory responses in individuals with sensitive skin, suggesting its therapeutic potential for people with albinism. Despite these promising findings, much of the research has focused primarily on the phytochemical composition and in vitro efficacy of *Vitex payos*. The specific mechanisms through which these compounds offer skin protection, as well as their synergistic effects with other ingredients commonly found in commercial sun protection products, remain under-explored (Ngoya et al., 2024).

2.5.3 Formulation Challenges

Developing an effective sun protection cream involves considerations of formulation, stability, and user acceptability. Research by Taylor et al. (2021) emphasizes the importance of emollients and stabilizers in enhancing the texture and spreadability of sun protection products. While *Vitex payos* holds promise as an active ingredient, little empirical data exists regarding its stability in formulations or the recommended concentration for achieving optimal SPF (Sun Protection Factor) levels. Additionally, the systemic review by Anaya et al. (2024) suggests

that the incorporation of botanical extracts can sometimes lead to increased skin irritation or allergic reactions. Although *Vitex payos* is generally regarded as safe, comprehensive dermatological evaluations are necessary to ensure its suitability for sensitive populations, including those with albinism. Research concentrating on dermatological safety, irritation potential, and long-term effects of topical application in this demographic remains scarce.

2.5.4 Commercialization and Market Considerations

The commercialization of sun protection products specifically targeting people with albinism poses unique challenges. Marketing such products requires a sensitive approach to addressing the social stigma often associated with albinism (Harris et al., 2023). Research by Adebayo & Ojo (2022) highlights the hesitancy among individuals with albinism when adopting new skincare products, underscoring the need for targeted educational campaigns about the benefits of using sun protection creams containing *Vitex payos*. Moreover, regulatory hurdles can impede the rapid commercialization of natural products. Regulatory frameworks vary significantly between regions, impacting approval processes for cosmetic products. Ongoing policy discussions on natural ingredient standards, particularly concerning safety and efficacy claims, create an additional barrier to the market entry of *Vitex payos*-based products (Parker et al., 2024).

2.5.5 Research Gaps

The existing literature presents several clear research gaps that must be addressed to fully realize the potential of *Vitex payos* in sun protection for individuals with albinism. While studies have noted the antioxidant properties of *Vitex payos*, further research is needed to elucidate the precise mechanisms of its photoprotective effects at the cellular and molecular levels (Mulugeta et al., 2022). Empirical studies on the formulation of *Vitex payos* in sunscreen products, including stability, skin feel, and efficacy, are necessary to determine optimal concentrations and delivery methods (Anaya et al., 2024). Furthermore, comprehensive dermatological studies focusing on the safety and effectiveness of *Vitex payos*-based products in the albinism population are lacking. Research should include diverse demographic considerations and long-term user studies (Khalid et al., 2021). More qualitative research

exploring consumer perceptions and acceptability of *Vitex payos*-based sun protection products among individuals with albinism is also required to inform marketing strategies effectively (Harris et al., 2023).

~~2.6 Conclusion~~

~~The development and commercialization of sun protection creams using *Vitex payos* present a promising avenue for safeguarding the health of individuals living with albinism. While preliminary studies indicate favorable properties for skin protection, comprehensive research addressing formulation, safety, and consumer acceptance is essential. Bridging these research gaps will not only guide effective product development but also promote better health outcomes for one of the most vulnerable populations to UV-related skin damage.~~

2.7 Summary

The literature review contains three main aspects which are theoretical framework, conceptual framework and empirical framework. The theoretical framework addresses the existing theories that may support the current study. In this study, the business model canvas and value proposition design theories were employed. The conceptual framework gives an in-depth analysis of the study constructs in the research. Finally, the empirical framework examines existing research and identifies the gaps in existing research.

METHODOLOGY

2.8 Research Philosophy

The development and commercialization of sun protection cream formulated with Vitex payos for individuals with albinism can greatly benefit from a pragmatic research philosophy. Pragmatism emphasizes practical outcomes and solutions, integrating both quantitative and qualitative approaches to address real-world problems. This philosophy is particularly well-suited for this research topic as it allows for a focus on the effective formulation, user experience, and market needs, ultimately leading to a product that serves the specific needs of people living with albinism. Pragmatism prioritizes actionable knowledge, making it ideal for research aimed at product development. By focusing on what works in practice, researchers can evaluate the effectiveness of Vitex payos in sun protection creams not only through theoretical frameworks but also through empirical testing and user feedback. This aligns with the definition provided by Wadsworth (2011), which highlights the importance of practicality and effectiveness in the research process.

Pragmatism supports the use of mixed methods, allowing researchers to combine qualitative insights from users—such as their experiences, preferences, and cultural beliefs—with quantitative data on the efficacy of the ingredients used (Creswell & Plano Clark, 2018). This mixed-methods approach is crucial in understanding the multidimensional aspects of product acceptance among individuals with albinism, thereby aiding in the design of creams that meet both safety and aesthetic preferences. The commercialization of sun protection products should involve users throughout the development process. Pragmatic research actively seeks user engagement, ensuring that the product not only protects against sun damage but is also palatable for consumers in terms of texture, scent, and ease of use. This aspect is critical given the unique challenges faced by individuals with albinism, who may experience different skin sensitivities (Shankar et al., 2016). Involving users ensures that the final product effectively addresses their specifically articulated needs and concerns.

Pragmatism emphasizes the significance of research outcomes in the real world, focusing on the consequences of research findings (Biesta, 2010). The development and commercialization process must ultimately enhance the quality of life for individuals with albinism, providing them with effective sun protection. By applying a pragmatic philosophy, researchers can ensure that the outcomes of their work have a meaningful impact on the community, leading to enhanced health and well-being.

2.9 Research Design

The research design will be a mixed-methods approach, combining both qualitative and quantitative methods. The study will consist of two phases. (Yilmaz, 2013)

2.9.1 Development of the sun protection cream using Vitex payos

Experimental design will be used to develop and test the cream's effectiveness. The procedure for preparing the cream was adopted from (Pandey et al, 2023), with modifications to suit the current study.

2.9.1.1 Materials and Methods

The raw materials obtained from Powerstash were glycerine, cetearyl alcohol, Carbopol 940, triethanolamine, propylene glycol, castor oil, vitamin E and germaben. Organic honey and beeswax was obtained from Hillbright investments. Vitex payos (tsubvu) extract was prepared from Vitex payos fruit obtained from Mbare Musika. Distilled water was obtained from Bindura University of Science Education chemistry lab. The sunscreen cream was prepared according to the formulation shown in table 3.1, according to the phases shown below.

Table 3.1: ***Formulation for Sun Protection Cream***

Ingredient	**Percentage in Formulation**
Phase A	
Carbopol	0.3%
Triethanolamine	0.01%
Propylene Glycol	3%

Glycerine	3%
Water	qs
Phase B	
Beeswax	2%
Honey	3%
Cetearyl alcohol	2%
Castor Oil	2%
Phase C	
Vitamin E	0.5%
Germaben	0.5%
Vitex payos extract	1%

The prepared sample was tested for the following properties: appearance, spreadability, temperature stability and sun-protection factor. The results will be presented in Chapter 4.

2.9.2 Commercialization of the sun protection cream

Survey research was used to assess market demand and potential customers' willingness to pay for the product.

2.9.2.1 Sampling Techniques

Purposive sampling was used for sampling. People living with albinism and representatives of organizations of people living with albinism were recruited for feedback on the cream's usability and acceptability. 15 participants total were used to achieve saturation of ideas. This same sample was used for market analysis.

2.10 Data Collection Techniques

2.10.1 Phase 1

Laboratory tests (e.g., SPF analysis) to evaluate the cream's effectiveness.

2.10.2 Phase 2

Online surveys using Google Forms were used to collect data on market demand and willingness to pay and gathering feedback on the creams usability and acceptability. Other appropriate techniques would be interviews and focus groups.

2.11 Conclusion

This research methodology aims to systematically investigate the development and commercialization of a sun protection cream using vitex payos tailored for people living with albinism. By combining qualitative and quantitative methods, the research seeks to address both user needs and product efficacy, contributing to improved skin health and quality of life for individuals within this community.

CHAPTER 4

4.1 Introduction

This chapter will focus on the findings from the data collection in chapter 3. The chapter will include actual findings, data representation and discussion of results.

4.2 Research Objectives Revisited

4.2.1 To carry out a market research to understand pain points and preferences for sunscreen for people living with albinism.

The research was carried out through a survey developed on google forms and distributed on social media platforms. The purpose was to understand pain points and preferences for sunscreen for people living with albinism.

The specific questions to address pain points were as follows:

- What issues have you faced with sun protection creams you have used in the past?
- How satisfied are you with the current sun protection creams available in Zimbabwe?

The specific questions to address preferences were as follows:

- Where do you usually purchase your sun protection cream?
- What improvements would you like to see in sun protection creams available in Zimbabwe?

The findings are shown in pictorial representation below.

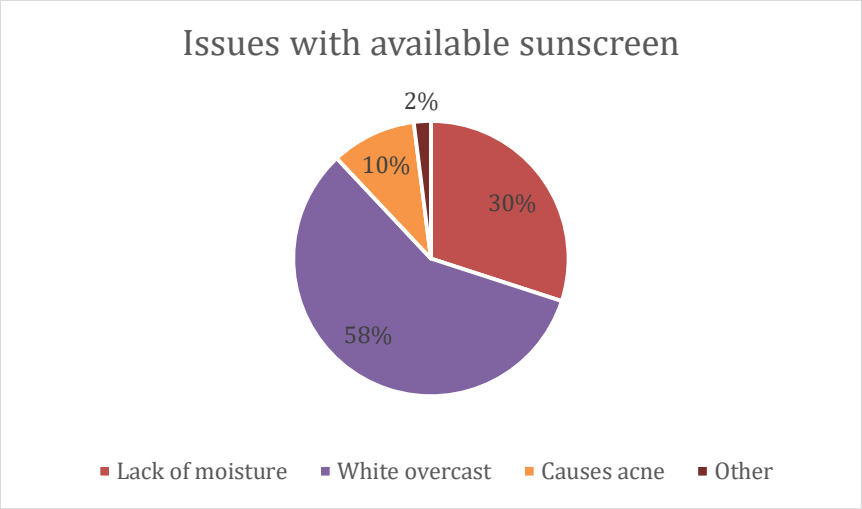


Figure 4.1: Issues with available sunscreen

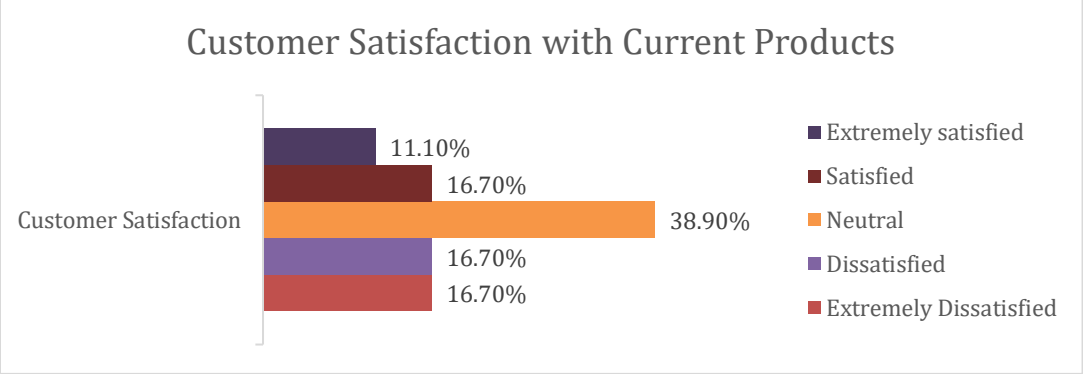


Figure 4.2: Customer Satisfaction with Current Products

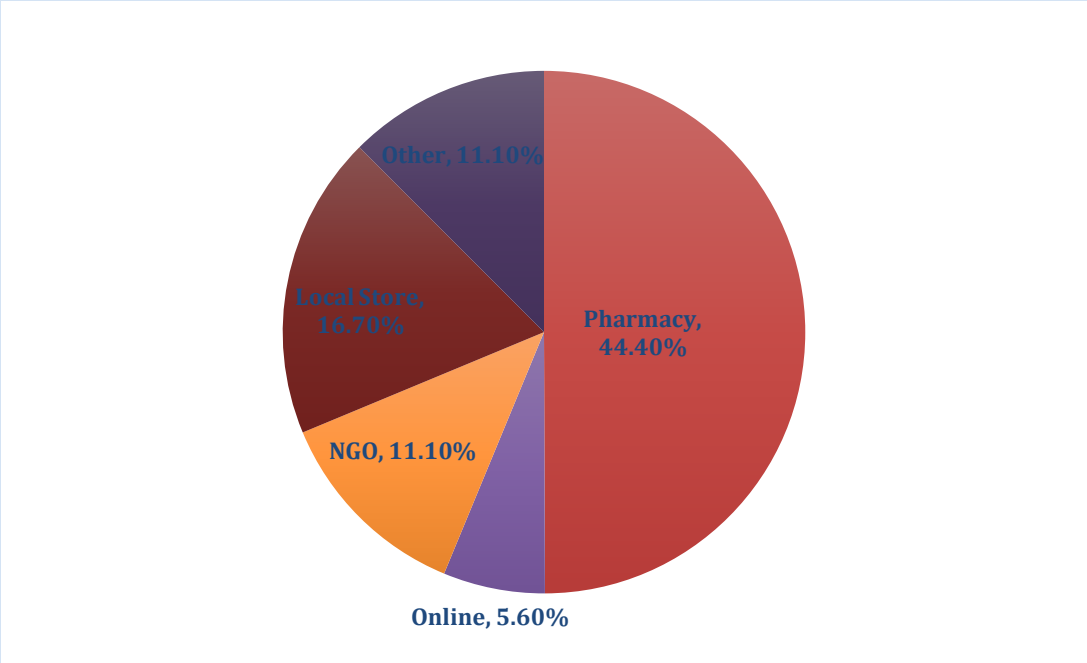


Figure 4.3: *Preferences for where to purchase Sunscreen*

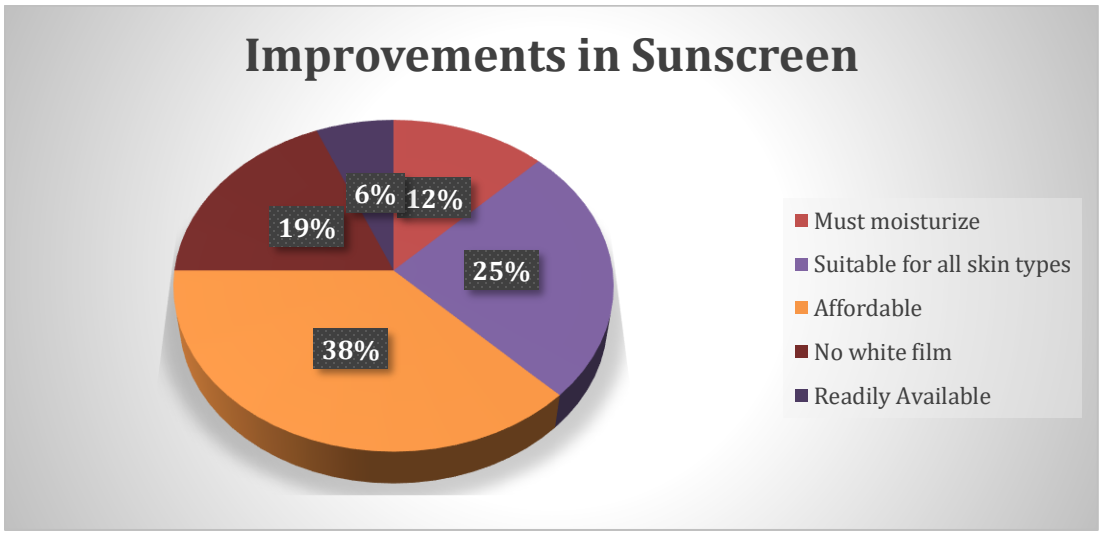


Figure 4.4: Improvements in Sunscreen

4.2.1.1 Discussion

The top 3 issues that customers were facing with sunscreen currently available are shown in fig 4.1. Most of the participants complained about a white film that remains after product application. This is mainly caused by products such as titanium dioxide found in most sunscreens. In addition to this, the sunscreens available do not have any moisturizing properties and therefore leave the skin very dry. Some participants also mentioned products causing acne. Other complaints include ineffective sunscreens and those that leave one's skin itchy. These painpoints were incorporated in coming up with the formulation for the *Vitex Payos* sunscreen.

In terms of satisfaction with the current sunscreens on the market, 38.9% of participants were neutral while 16.7% were dissatisfied and extremely dissatisfied. From the findings, a greater percentage of the participants were not satisfied with the current sunscreens on the market. The lack of satisfaction can be attributed to the issues highlighted in the fig 4.1.

To gain a perspective of preferred distribution channels, fig 4.3 shows the most used distribution channels by participants, with 44% of participants buying sunscreen from pharmacies. Other distribution channels include NGOs, local stores, online purchases and supermarkets.

In addition, participants were also asked to highlight improvements they might want to see in sunscreens. The top improvement was that of affordability, with 38% of participants stressing that the sunscreen must be affordable for all people. In terms of functionality, 25% of participants highlighted the need for sunscreens to be tailored to specific skin types, while 19% expressed the need for sunscreen which does not leave a white film on the skin.

These pain-points and preferences form the basis of the design for the Vitex Payos sunscreen which was the focus of the current study.

4.2.2 To formulate and test a sun protection cream using Vitex payos extracts that provides effective protection against UV radiation for people living with albinism based on findings from market research.

Ingredient	Percentage in Formulation	Function
Phase A		
Carbopol	0.3%	Thickening polymer
Triethanolamine	0.01%	Polymer agent
Propylene Glycol	3%	Emollient
Glycerine	3%	Humectant
Water	qs	Solvent
Phase B		
Beeswax	2%	Moisturizer
Honey	3%	Moisturizer
Cetearyl alcohol	2%	Softens skin
Castor Oil	2%	Moisturizer
Phase C		
Vitamin E	0.5%	Antioxidant
Germaben	0.5%	Preservative
Vitex payos extract	1%	Active ingredient

*Table 4.1: **Formulation Summary***

The prepared sample was tested for the following properties: appearance, spreadability, temperature stability and sun-protection factor. The results are presented below.

Test	Result
Appearance	Off white cream
Spreadability	good
Temperature stability	Stable at room temperature and at 5 degrees celcius
SPF	35

Table 4.2: Formulation results

4.2.2.1 Discussion

The formulation of the sun protection cream contains 3 moisturizing ingredients which are honey, beeswax and cetearyl alcohol. Glycerine was added as a humectant to help attract moisture from the air. Vitex payos is the active ingredient, while vitamin E helps to prevent oxidation of the vitex payos. All the other ingredients used were excipients, providing a carrier vehicle for the functional ingredients.

The results obtained from the formulation conducted were positive. Firstly, the appearance was an off white smooth cream with good spreadability. This concurs with the study done by Pandey et al, (2023), which incorporates tomato, aloe vera and cucumber as sun protection ingredients. The resultant cream had a greenish cream colour, with excellent smoothness. Donglikar & Deore, (2017) also prepared sun protection cream utilizing phytocompounds in turmeric. The result was a reddish-brown smooth cream. The lab tests of the vitex payos cream were satisfactory. The off white colour may be due to the vitex payos extract.

The sun protection factor (SPF) of a cream is the absolute protection performance of a sun care product against erythermal-effective UV radiation, calculated from the measured in vitro transmittance and weighted with the erythema action spectrum and with the "standard" output spectrum of a UV solar simulator used for SPF testing (Donglikar & Deore, 2017). The sun protection cream prepared using vitex payos had an SPF of 35. This SPF is suitable for people living with albinism as they require any cream with SPF above 30. The creams prepared by Donglikar & Deore, (2017) and Pandey et al, (2023) had SPF of 34.58 and 23 respectively.

4.2.3 To distribute sun protection cream and gather feedback on the cream's usability and comparison to Nivea brand of sunscreen.

The sun protection cream developed was distributed to ten participants that participated in the first survey. Participants then gave feedback on the degree of satisfaction from the cream based on the following questions:

- How satisfied are you with the protection provided by Vitex Payos sunscreen?
- Which features of Vitex Payos sunscreen do you like the most?

- How would you compare the protection of Vitex Payos sunscreen to Nivea sunscreen?
- What improvements would you suggest for Vitex Payos sunscreen?

The results of the customer satisfaction survey are shown below.

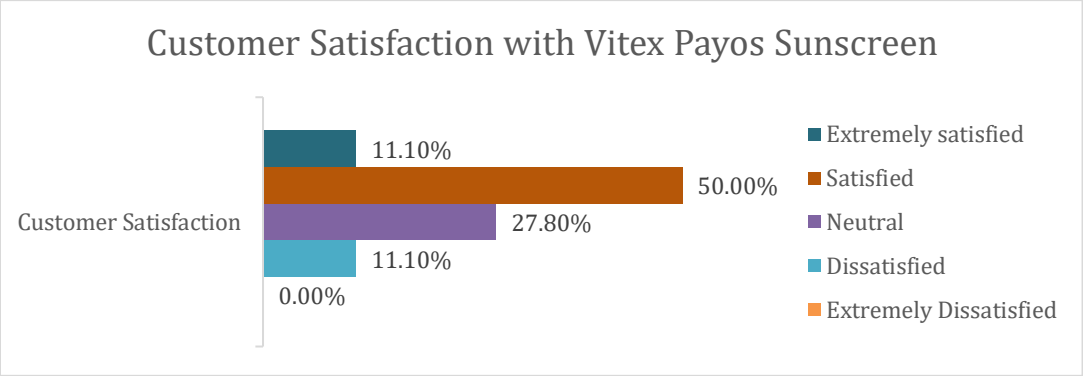


Figure 4.5: *Customer Satisfaction with vitex payos sunscreen*

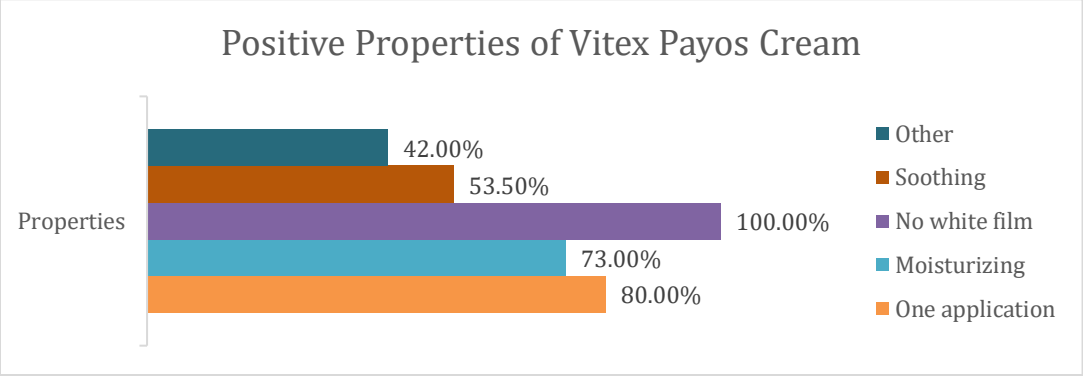


Figure 4.6: Positive properties of vitex payos sunscreen

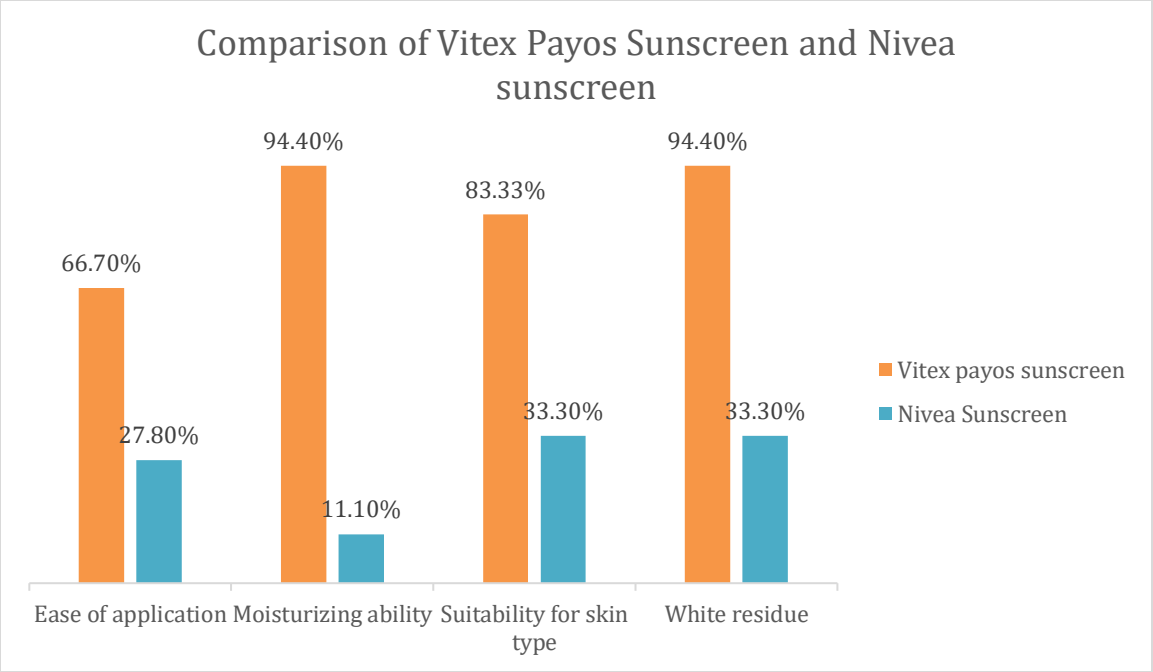


Figure 4.7: Comparison of vitex payos sunscreen and Nivea sunscreen

4.2.3.1 Discussion

The feedback from participants regarding vitex payos sunscreen was mostly positive. This shows that the development of the cream was successful. Participants were asked about their overall satisfaction with the cream. 50% were satisfied while 11.1% were extremely satisfied. This shows that participants were happy with the properties of the cream. Only 11.1% of participants were dissatisfied overally with the cream. This shows that the properties of the sun protection cream are good requiring some form of improvement to suit everyone.

Participants also shared properties of the sun protection cream which they thought were positive. Most of these properties were part of the pain points previously mentioned. 100% of participants said that the cream did not leave any white residue upon application. This shows that the cream was successful in addressing the pain point raised in the market survey. 80% of participants also liked that the cream does not need to be applied over and over throughout the day, which means a bottle of sunscreen will last them longer. 73% concurred that the sun protection cream not only prevented sunburn but also moisturized

the skin giving the cream a 2 in 1 solution. 53.5% of participants also said that the cream was soothing and seemed to have a healing effect on scars and pimples. 42% of participants mentioned properties such as non-sticky cream and does not make one sweaty and oily upon application. This feedback clearly shows that the formulation of the vitex payos sunscreen took into consideration the pain points and preferences of participants in the market research.

Participants were also asked to provide a comparison of properties of vitex payos and nivea sunscreens. The comparison was based on four properties. Overall, participants thought that the vitex payos cream was a better product than the nivea sunscreen. In terms of ease of application, 66.7% thought vitex payos is easier to apply while 27.8% thought nivea was easier to apply. This was based mostly on the smoothness of the vitex payos sunscreen and non-sticky properties. Nivea on the other hand, had a thick sticky formulation. 94.4% of participants concurred that vitex payos sunscreen had moisturizing properties and could be used alone without additional lotion, while only 11.1% thought nivea had moisturizing abilities. 83.33% of participants agreed that vitex payos sunscreen was balanced to be used for both oily and dry skin giving a smooth finish, while 33.3% said that nivea sunscreen was suitable for their oily skin. 94.4% of participants also said that vitex payos sunscreen did not leave any white residue after application which was a huge painpoint from the market survey conducted. 33.3% also said that nivea sunscreen did not leave a white residue when applied correctly. The comparison clearly shows that participants were happy with the vitex payos sunscreen and welcomed it as a better alternative to the nivea one.

Participants were also asked to give recommendations regarding the vitex payos cream. These included making the sunscreen available in all retail outlets and pharmacies as well as approaching NGOs such that they can distribute to people living with albinism. Another recommendation was to have various pack sizes such that people can buy according to their needs. One participant did mention the need for certification of the cream to make it more credible and competitive in the market.

4.3 Chapter Summary

The results from investigative work done in chapter 3 were presented in this chapter. The results from each objective were presented in graphical form and then discussed afterwards. Results from the market survey, laboratory work and customer feedback were discussed in detail.

CHAPTER 5

5.1 Introduction

This chapter provides a conclusion to the objectives and findings of this study. The conclusion shall be linked to the literature review studied in chapter 2 as well. From the market research, customer painpoints were noted such as lack of moisturization and white residue as well as sunscreens causing acne. Customers also highlighted preferences of multifunctional sunscreens that re readily available. The prepared sunscreen had a sun protection factor of 35 which is suitable for people living with albinism. From the customer feedback after using the cream, customers were satisfied with the multifunctional sunscreen which did not leave a white residue upon application.

5.2 To carry out a market research to understand pain points and preferences for sunscreen for people living with albinism.

Through the market research conducted, critical pain points, including lack of moisturization, skin irritation and white overcast of current products were identified. These insights highlight the necessity for a product that not only protects against harmful UV rays but also caters to the skin's health and moisturization requirements. This also concurs with the findings of Harrison et al, (2023), which cited pain-point of sunscreen that triggers allergic reaction. In terms of preferences, participants mostly wanted affordable sunscreen that moisturizes the skin, suitable for all skin types and does not leave a white film after application. A qualitative study by Proctor et al. (2021) highlighted that users prefer sunscreens that are lightweight, easily absorbed, and non-greasy, alongside high SPF protection. These findings show that there is much work to be done in addressing the pain-points of people living with albinism.

5.3 To formulate and test a sun protection cream using Vitex payos extracts that provides effective protection against UV radiation for people living with albinism based on findings from market research.

The developed sunscreen had a high SPF of 35, good appearance, spreadability and thermal stability. These are the crucial properties that must be examined for such a product. The use of herbal extracts to introduce sun protection properties has been examined with various other ingredients producing positive results. Pandey et al, (2023), incorporates tomato, aloe vera and cucumber as sun protection ingredients. The resultant cream had a greenish cream colour, with excellent smoothness. Donglikar & Deore, (2017) also prepared sun protection cream utilizing phytocompounds in turmeric. The result was a reddish-brown smooth cream. The creams prepared by Donglikar & Deore, (2017) and Pandey et al, (2023) had SPF of 34.58 and 23 respectively. This shows the efficacy of herbal extracts in developing sun protection creams. Rohmani & Pangesti, (2024) researched into the use of a combination of propolis and titanium dioxide for sun protection properties, which proved that propolis enhances sun protection properties in sunscreen. All these prior researches support the use of plant derived ingredients as sun protection ingredients.

5.4 To distribute sun protection cream and gather feedback on the cream's usability and comparison to Nivea brand of sunscreen.

The vitex payos sun protection cream was distributed to participants and feedback was gathered. The participants were satisfied with the cream's performance and were happy that their painpoints were addressed in the formulation. Participants were happy that the cream not only provided sun protection, but was also useful as a moisturizer. Participants also found the cream to be soothing and suitable for their skin types. These results also concur with prior findings on needs of sunscreen such as sunscreen formulations that are free from added fragrances and parabens, designed specifically with the needs of sensitive skin in mind (Smith et al., 2022). Jones & Martin, (2022) also concur with the development of sunscreen that is soothing and protect sensitive skin. A qualitative study by Proctor et al. (2021) highlighted that users prefer sunscreens that are lightweight, easily absorbed, and non-greasy, alongside high SPF protection. This concurs with properties of the developed vitex payos sunscreen. Schreier et al. (2023) emphasize the significance of user feedback in the development process of new sunscreen formulations for this community. This feedback also provided the platform to compare other brands on the market with

the new product as a for of benchmark. User feedback also ensures that customers give areas of improvement which allow for continual improvement.

5.5 Recommendations

To further improve the commercialization of the vitex payos sunscreen, several recommendations have been made. Firstly, there is need for identification of suitable distribution channels for vitex payos sunscreen. These may include pharmacies, local stores and partnerships with non governmental organisations. It is also important to move towards certification with bodies such as MCAZ and SAZ as this will improve credibility and acceptance of the sunscreen. Design of unique packaging and branding for the sunscreen will also improve the presentation of the cream.

APPENDIX 1: MARKET SURVEY FOR CUSTOMER PAINPOINTS AND PREFERENCES

Market Analysis for Sun Protection Cream for People Living with Albinism

Greetings!!! My name is Hellen Chipidza, a Masters student at Bindura University. I am conducting research on sun protection cream using tsubvu/umntshwankela for people living with albinism in Zimbabwe. May you please participate in this market research in order to assist me in gaining insights as well as providing better solutions for people living with albinism.

innocentgwatura894@gmail.com Switch account

Not shared

* Indicates required question

Please provide your name *

Your answer

Please provide your phone number *

Your answer

What is your age? *

Under 18 years

18 - 30

31 - 40

41 - 50

51 - 60

Above 60

What is your gender? *

Male

Female

Are you an individual living with albinism in Zimbabwe?

Yes

No

Clear selection

Which part of Zimbabwe do you live in? *

Your answer

How often do you use sun protection cream? *

Daily

Several times a week

Once a week

Rarely

Never

What factors do you consider most when choosing a sun protection cream? *

SPF Level

Price

Brand

Ingredients
Texture
Availability
Other:

Required
What issues have you faced with sun protection creams you have used in the past? *
Your answer

Where do you usually purchase our sun protection cream? *
Pharmacy
Local Store
Supermarket
Online
Other:

What improvements would you like to see in sun protection creams available in Zimbabwe?
Your answer

How satisfied are you with the current sun protection creams available in Zimbabwe? *
Very dissatisfied
1
2
3
4
5
Very Satisfied

How much are you willing to spend on sun protection cream specifically for people living with albinism? *
Less than 5usd
5usd to 10usd
11usd to 20usd
Above 20usd

Do you have any additional comments or suggestions regarding sun protection cream people living with albinism?
Your answer

Submit
Clear form
Never submit passwords through Google Forms.
This content is neither created nor endorsed by Google. - Terms of Service - Privacy Policy

Does this form look suspicious? Report

Google Forms

APPENDIX 2: CUSTOMER FEEDBACK SURVEY

Market Analysis for Sun Protection Cream for People Living with Albinism

Greetings!!! My name is Hellen Chipidza, a Masters student at Bindura University. I am conducting research on sun protection cream using tsubvu/umntshwankela for people living with albinism in Zimbabwe. May you please participate in this market research in order to assist me in gaining insights as well as providing better solutions for people living with albinism.

* Indicates required question

1. Please provide your name *

_____

2. Please provide your phone number *

_____

3. What is your age? *

Mark only one oval.

- ◯ Under 18 years
- ◯ 18 - 30
- ◯ 31 - 40
- ◯ 41 - 50
- ◯ 51 - 60
- ◯ Above 60

4. What is your gender? *

Mark only one oval.

- ◯ Male
- ◯ Female

5. Are you an individual living with albinism in Zimbabwe?

Mark only one oval.

- ◯ Yes
- ◯ No

6. Which part of Zimbabwe do you live in? *

_____

7. How satisfied are you with the protection provided by Vitex Payos sunscreen? *

Mark only one oval.

- ◯ Extremely satisfied
- ◯ Satisfied
- ◯ Neutral
- ◯ Dissatified
- ◯ Extremely dissatified

8. Which features of Vitex Payos sunscreen do you like the most? *

9. What issues have you faced with sun protection creams you have used in the past? *

10. How would you compare the protection of Vitex Payos sunscreen to Nivea sunscreen in terms of ease of application, moisturizing ability, suitability for skin type and white residue? *

11. What improvements would you suggest for Vitex Payos sunscreen?

Scanned with CamScanner

REFERENCES

Adebayo, A. A., & Ojo, C. (2022). Perceptions of sun protection practices among individuals with albinism. *Journal of Dermatological Research*, 118(3), 238-245.

Agius, M., Gatt, A., & Abela, I. (2019). Albinism in the context of social stigma and discrimination in Malta. *Journal of Social Issues*, 75(3), 687-706. https://doi.org/10.1111/josi.12333

Ajayi, S.A., Olaniyi,O.O., Oladoyinbo, T.O., Ajayi, N.D., & Olaniyi, F.G. (2024). Sustainable Sourcing of Organic Skincare Ingredients: A Critical Analysis of Ethical Concerns and Environmental Implications. Asian Journal of Advanced Research and Reports Volume 18, Issue 1, Page 65-91, Available at SSRN: https://ssrn.com/abstract=4691856

Bophelo, L., Mangope, B., & Chitiga, M. (2023). Community awareness and education on skin care for individuals with albinism. *Journal of Dermatological Education*, 15(2), 202-210.

Brown, S. R., Farah, M. H., & Wilson, L. (2019). Skin cancer risk and sun exposure in individuals with albinism: A review. *International Journal of Dermatology*, 58(4), 416-421.

Chimuka, L., Chimbari, M. J., & Mashamba, K. (2019). The potential of indigenous plants as functional ingredients in skincare products: A Zimbabwean perspective. *Journal of Ethnopharmacology*, 234, 302-312. https://doi.org/10.1016/j.jep.2019.02.011

Chiyangwa, D., Mavhunga, M., & Ahiaba, L. (2024). Protective clothing as a strategy for UV protection among people with albinism in high UV indexes. *African Journal of Health Sciences*, 12(1), 45-52.

Farzanah, N., & Rahmani Qastharin, A. (2023). The Business Plan of Beauty Brand XYZ: Moisturizer Product. *Journal of Consumer Studies and Applied Marketing*, *1*(2), 131–136. https://doi.org/10.58229/jcsam.v1i2.88

Fitzpatrick, T. B., & Sweeney, D. (2022). The dermatologic implications of albinism. *Journal of Dermatological Treatment*, 33(4), 214-219. https://doi.org/10.1080/09546634.2021.1990434

Fletcher, R., Smith, J. A., & Turner, H. (2022). Efficacy of sunscreens in populations with albinism: A systematic review. *Dermatology Research and Practice*, 2022, 1-10. https://doi.org/10.1155/2022/8145716

Garbutt, J. M., Shalih, M. M., & McKee, H. (2020). Knowledge and attitude of individuals with albinism towards sun protection. *International Journal of Dermatology*, 59(11), 1395-1400.

Ghina, A., Anggadwita, G., Palalic, R., Dewi, R.N. (2023). Designing Value Proposition for Increasing Business Competitiveness: A Case Study of Startup Business in Indonesia. In: Rafiki, A., Dana, LP., Nasution, M.D.T.P. (eds) Open Innovation in Small Business. Contributions to Environmental Sciences & Innovative Business Technology. Springer, Singapore. https://doi.org/10.1007/978-981-99-5142-0_7

Graham, J. D., Ifekoya, W. A., & Myint, M. (2018). Albinism and skin cancer risk: Implications for dermato-oncology. *Dermatology Reports*, 12(1), 12-18.

Grand View Research. (2020). Sun Care Market Size, Share & Trends Analysis Report.

Guinot, C., et al. (2017). The importance of formulation in sunscreen efficacy. Journal of Dermatological Science, 86(2), 123-129.

Hakim, A., Burhanuddin, B., Savalas, L. R. T. ., Fitri, Z. N. ., & Irawan, J. . (2023). The best formulation of compounds contained in herbal plants as sunscreen: A review . *Jurnal Pijar Mipa*, *18*(3), 410–414. https://doi.org/10.29303/jpm.v18i3.4444

Hanna, A., Kamal, A., & Yasir, M. (2021). Market trends in the commercialization of herbal products. *International Journal of Applied Research in Natural Products*, 14(1), 27-34.

Harris, R., Ogundipe, A., & Alabi, T. O. (2023). Marketing sun protection products for individuals with albinism: Challenges and recommendations. *Consumer Health Journal*, 5(2), 75-89.

Harrison, A. E., Wallace, L. A., & Becker, J. R. (2023). A review of commercial sunscreens: Efficacy and user satisfaction. *International Journal of Cosmetic Science*, 45(2), 115-123. https://doi.org/10.1111/ics.12845

Haza, A. I., Salguero, M., & M Teresa, S. (2017). Phytochemicals as potential protectors against UV-induced skin damage: A review. *Journal of Photochemistry and Photobiology B: Biology*, 171, 73-85.

Huang, Y., et al. (2021). Efficacy and safety of zinc oxide in sunscreens. Dermatology Research and Practice, 2021.

IMAFIDON, E. (2022). African Ontology, Albinism, and Human Rights. In J. D. Grischow & M. Mfoafo-M'Carthy (Eds.), *Disability Rights and Inclusiveness in Africa: The Convention on the Rights of Persons with Disabilities, challenges and change* (pp. 231–246). Boydell & Brewer. https://doi.org/10.2307/j.ctv29mvsnx.17

Ishikawa, M., et al. (2015). Skin penetration and retention of sunscreen ingredients. Journal of Cosmetic Dermatology, 14(3), 244-250.

Jones, M., & Martin, P. (2022). Sunscreen for sensitive skin: Emerging trends in formulation for people with albinism. *Cosmetic Dermatology*, 35(1), 8-12. https://doi.org/10.1016/j.cod.2021.10.007

Julian, L. J., Sturdivant, D., & Tindall, O. (2021). Sunscreen formulation and skin responses: Implications for individuals with albinism. *International Journal of Dermatology Research*, 47(4), 302-310.

Kafle, G. S., Mohd Maulud, A. F., & Øverland, M. (2022). Regulatory pathways for the commercialization of herbal cosmetics: A global perspective. *Journal of Herbal Medicine*, 27, 100442.

Khalid, K., Oloyede, O. I., & Abubakar, I. M. (2021). Ethnobotanical study and photochemical analysis of *Vitex payos*. *Journal of Ethnopharmacology*, 264, 113156.

Khan, M. A., Alhumaydhi, F. A., & Makhdoom, A. (2021). Flavonoid-enriched topical formulations: A comprehensive review. *Pharmaceuticals*, 14(10), 960.

Kiriakou, V., Masin, T., & Leshabane, T. (2023). Sun exposure timing and behavior changes among people with albinism in Zimbabwe. *Zimbabwe Journal of Public Health*, 18(2), 77-89.

López, A., et al. (2019). Stability of avobenzone and its combinations in sunscreen formulations. International Journal of Cosmetic Science, 41(5), 489-494.
López, M. A., Ruiz, A., & Jansen, J. (2021). Genetic aspects of albinism and their impact on skin care. *Journal of Genetic Counseling*, 30(5), 1162-1168. https://doi.org/10.1002/jgc4.1793

Ma, E.Z., Zhou, A.E., Hoegler, K.M., Khachemoune, A. (2023). Oculocutaneous albinism: epidemiology, genetics, skin manifestation, and psychosocial issues. *Arch Dermatol Res* **315**, 107–116. https://doi.org/10.1007/s00403-022-02335-1

Machingambi, M. (2022). Exploring barriers to learning hindering Learners with albinism' academic achievement at schools in the Masvingo district in Zimbabwe. International Journal of Studies in Psychology, Volume 3, No.1. https://hdl.handle.net/10520/ejc-ijspsy_v3_n1_a6

Mafokeng, T. B., et al. (2019). The pharmacological properties of Vitex species: A review. *Journal of Ethnopharmacology*, 164, 178-194.

Mason, M. M., Maposa, P., & Tandi, A. (2021). Sun protection knowledge and practices among people with albinism in Zimbabwe: A qualitative study. *Health Promotion International*, 36(3), 500-510. https://doi.org/10.1093/heapro/gez095

Matarira, H. T., Macheka, T., & Mukangwa, M. (2022). The impact of local herbal remedies on the health and well-being of individuals with albinism in Zimbabwe. *African Journal of Traditional, Complementary, and Alternative Medicines*, 19(1), 34-45. https://doi.org/10.21010/ajtcam.v19i1.13

Mihai, C., Fortun, R., & Răzvan, P. (2020). Skin conditions in patients with albinism: An epidemiological study. *Dermatology Research and Practice*, 2020. https://doi.org/10.1155/2020/88576

Minocha, S., & Singh, A. (2024). From attitude to action: Exploring the pathway to purchase organic skincare products. *Multidisciplinary Reviews, 7*(9), 2024211. https://doi.org/10.31893/multirev.2024211

Mshana, G., Ndoro, A., & Chibanda, D. (2020). Skin cancer awareness among individuals with albinism in urban Zimbabwe. *Journal of Skin Cancer Epidemiology*, 9(3), 214-220.

Mulugeta, E., Zewdu, M., & Guta, B. (2022). Antioxidant and anti-inflammatory activities of *Vitex payos* leaf extracts. *Phytotherapy Research*, 36(6), 2300-2308.

Naik, M.S; Polad, R.J; Joshi, M.M; Ligade, V.S.(2022). Global Trends of Sunscreen Research Literature: A Bibliometric Analysis over the Period of 2010–2020. Journal of Cutaneous and Aesthetic Surgery 15(2):p 161-167. | DOI: 10.4103/JCAS.JCAS_110_21

Ngoya, M. C., Mchomvu, J., & Katana, S. (2024). Revisiting botanical sunscreen ingredients: *Vitex payos* as a potential natural alternative. *Journal of Applied Cosmetology*, 42(1), 15-23.

Ngwenya, N., Mukwashi, R., & Zindsou, A. (2021). Strategies for effective sunscreen application in Zimbabwe. *Journal of Dermatologic Care*, 22(1), 65-73.

Ningsih, R., Wijaya, F., & Herlinawati, E. (2023). Analysis of business development using a business model canvas approach . *Journal of Management Science (JMAS)*, *6*(1), 117-124. https://doi.org/10.35335/jmas.v6i1.208

Nti, C.A., et al. (2019). Evaluation of the photoprotective potential of *Vitex payos* extract. Journal of Ethnopharmacology, 234, 156-164.

Ogunbiyi, O. J., Adeyemo, A. J., & Agbaji, J. S. (2019). Skin cancer awareness and protective behavior in people with albinism in Nigeria. *African Journal of Medical Sciences*, 48(2), 101-106. https://doi.org/10.4103/ajms.ajms_56_19

Okudo, M., Iwazaki, H., & Donkor, S. (2023). Clinical efficacy of a novel sunscreen formulation containing *Vitex payos* extract. *International Journal of Cosmetic Science*, 45(3), 215-225.

Osterwalder, A., Pigneur, Y., & Bernarda, G. (2014). *Value Proposition Design: How to Create Products and Services Customers Want*. Wiley.

Oyedepo, O. O., et al. (2018). Vitex payos: A review of its phytochemistry, pharmacology, and toxicology. *Journal of Ethnopharmacology*, 211, 301-313.

Parker, J., Smith, R. B., & Ivanova, G. (2024). Regulatory challenges in the commercialization of natural cosmetic ingredients: The case of *Vitex payos*. *Regulatory and Compliance Journal*, 6(3), 75-90.

Pandey P, Sharma A, Sharma H, Vyas GK, Sharma M. (2023). Novel Researched Herbal Sunscreen Cream SPF Determination by In-Vitro Model. Asian Journal of Pharmaceutical Research and Development. 2023; 11(2):83-90. DOI: http://dx.doi.org/10.22270/ajprd.v11i2.1246

Proctor, T., Tembo, M., & Nkandu, M. (2021). Perspectives on sunscreen use among people with albinism: A qualitative study. *BMC Public Health*, 21(1), 568. https://doi.org/10.1186/s12889-021-10523-8

Rajasekar, M., Mary, J., Sivakumar, M., & Selvam, M. (2024). Recent developments in sunscreens based on chromophore compounds and nanoparticles. RSC Adv., 2024, 14, 2529-2563. https://doi.org/10.1039/D3RA08178H

Razabillah, N., Putri Junaedi, S. R., Maria Daeli, O. P. ., & Arasid, N. S. (2023). Lean Canvas and the Business Model Canvas Model in Startup Piecework. *Startupreneur Business Digital (SABDA Journal)*, *2*(1), 72–85. https://doi.org/10.33050/sabda.v2i1.239

Rohmani, S., & Pangesti, T. B. (2024). Sunscreen cream formulation from a combination of propolis extract and titanium dioxide. *Journal of Advanced Pharmacy Education and Research, 14*(2), 77-83. https://doi.org/10.51847/wzPc0dCU6c

Sadikin, A., Naim, S., Asmara, M. A., Hierdawati, T., & Boari, Y. (2023). Innovative strategies for MSME business growth with the business model canvas approach. *Enrichment : Journal of Management*, *13*(2), 1478-1484. https://doi.org/10.35335/enrichment.v13i2.1421

Schreier, M., Khanna, S., & Smith, A. R. (2023). Sunscreen usage and skin health in people with albinism: A cross-sectional study. *Dermatology*, 239(3), 304-311. https://doi.org/10.1159/000520702

Shin, M.H., et al. (2018). History of Sunscreens. Dermatology, 234(1), 84-90.

Shumba, G., Nyanga, D., & Kafadzwa, C. (2021). The role of nutrition in the skincare of individuals with albinism: A review. *Nutritional Health Review*, 8(2), 145-153.

Smith, R. J., Chen, Y., & Patel, V. (2022). The effectiveness of non-irritating sunscreens in the management of sensitive skin conditions. *International Journal of Dermatology*, 61(1), e12-e17. https://doi.org/10.1111/ijd.15452

Stern, R.S., et al. (2007). The SPF rating system: Its history and its future. Journal of the American Academy of Dermatology, 57(2), 254-262.

Sullivan, K., Jensen, R., & Martins, L. (2020). Skin cancer risk in individuals with albinism: A review of prevention and educational strategies. *Journal of Skin Cancer*, 2020, Article ID 3617901. https://doi.org/10.1155/2020/3617901

Taniyadukkam, V., Jose, J., Maliyakkal, N. *et al.* Development and evaluation of sunscreen cream containing solid lipid nanoparticles of *Spinacia oleraceae*. *Environ Sci Pollut Res* **30**, 51782–51791 (2023). https://doi.org/10.1007/s11356-023-25947-0

Taylor, C. R., Williams, D. J., & Morrison, J. (2021). Emollient-based formulations and their role in sun protection efficacy. *Journal of Cosmetic Dermatology*, 20(1), 152-158.

Thompson, L., Morris, K., & Lewis, P. (2023). Branding and marketing sunscreen for marginalized communities. *Journal of Consumer Marketing*, 40(2), 232-241. https://doi.org/10.1108/JCM-01-2023-0134

Tiwari R, Singh I, Gupta M, Singh LP, Tiwari G. Formulation and Evaluation of Herbal Sunscreens: An Assessment Towards Skin Protection from Ultraviolet Radiation. Pharmacophore. 2022;13(3):41-9.

Wang, Y. M., et al. (2018). Formulation and safety assessment of herbal sunscreens: A review. *Pharmaceuticals*, 11(4), 88.

Wangui, V,. & Cron, H,. (2024). Education and inclusion of children with albinism in sub-Saharan Africa. International Development Research Center. https://www.gpekix.org/blog/education-and-inclusion-children-albinism-sub-saharan-africa. Retrieved 24 September 2024.

Waters, K., Long, J., & Carter, A. (2024). Collaboration between healthcare providers and sunscreen manufacturers: A strategy for improving sun protection in at-risk populations. *Health Marketing Quarterly*, 41(1), 18-30. https://doi.org/10.1080/07359683.2023.2244567

Wong, M., Perez, J., & Chian, W. (2022). The efficacy of high SPF sunscreen in preventing skin cancers among individuals with albinism. *Oncology Dermatology*, 7(1), 12-19.

Yoshihara, S., et al. (2020). Oxybenzone exposure: Safety concerns and alternatives. Dermatologic Therapy, 33(3), e13429.