

A STUDY ON FOSTERING PUBLIC AWARENESS AND EDUCATION ABOUT FROZEN PRODUCTS

Submitted in partial fulfillment of the requirements for the award of

MASTER OF BUSINESS ADMINISTRATION

By

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**DEPARTMENT OF BUSINESS ADMINISTRATION
SCHOOL OF MANAGEMENT STUDIES**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade “A++” by NAAC | 12B Status by UGC |

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BONAFIDE CERTIFICATE

This is to certify that this project is the bonafide work of **JAIDEESH P (42410163)** who carried out the project entitled “**A Study on Fostering Public Awareness and Education about Frozen Products**” under my supervision from October 2023 to December 2023.

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TABLE OF CONTENTS

CHAPTER NO.	TITLE	PAGE.NO
	Abstract	vii
	List of Tables	viii
	List of charts	ix
1	INTRODUCTION	1
	1.1 Introduction	1
	1.2 Objectives for the study	4
	1.3 Need of the study	5
	1.4 Scope of the study	5
2	REVIEW OF LITERATURE	6
3	RESEARCH METHODOLOGY	24
	3.1 Research design	24
	3.2 Source of Data	24
	3.3 Sampling Size	25
	3.4 Sampling Method	25
	3.5 Area of study	25
	3.6 Analytical tools	25
4	DATA ANALYSIS AND INTERPRETATION	27
	4.1 Percentage analysis	27
	4.2 Correlation	51
	4.3 Anova	53

5	FINDINGS, SUGGESTIONS AND CONCLUSION	53
	5.1 Findings of the study	53
	5.2 Suggestions and recommendations	54
	5.3 Conclusions	55
	References	56
	Annexure – I Questionnaire	58
	Annexure – II Research Article	62

ABSTRACT

This study explores noteworthy patterns in the behavior of consumers of frozen food, indicating a predominant inclination towards frozen products among a considerable majority across diverse demographic dimensions. Noteworthy trends surface in safety concerns, particularly in their correlation with purchasing frequency, yielding intriguing insights. The acceptance of alternative hypotheses in correlation tests illuminates nuanced relationships between consumer frequency, perception, and safety concerns. Conversely, the rejection of hypotheses in ANOVA suggests a less definitive link between specific variables. Together, these findings offer valuable insights into consumer preferences and safety considerations in the frozen food market. The study establishes a foundational comprehension for industry analysis, providing guidance for stakeholders to adjust strategies, align with evolving consumer expectations, and contribute to the strategic considerations for the adaptable and enhanced future of the frozen food industry.

LIST OF TABLES

TABLE NO.	PARTICULARS	PAGE.NO
4.1.1	Age of the respondents	28
4.1.2	Gender of the respondents	29
4.1.3	Educational Qualification	30
4.1.4	Frequency of buying	31
4.1.5	Importance of cold storage	32
4.1.6	Types of packages	34
4.1.7	Healthy and safety concerns	35
4.1.8	Primary Concerns	36
4.1.9	Types preferred for purchase	38
4.1.10	Quality issues in a product	39
4.1.11	Satisfaction from a customer	40
4.1.12	Retailer Location	42
4.1.13	Shopping experience	43
4.1.14	Incorporating frozen foods	44
4.1.15	Safety while using product	46
4.1.16	Knowing Recommended Temperature	47
4.1.17	Identifying Sign while burning	49
4.1.18	Checking best before while using the product	50

LIST OF CHARTS

TABLE NO.	PARTICULARS	PAGE.NO
5.1.1	Age of the respondents	27
5.1.2	Gender of the respondents	29
5.1.3	Educational Qualification	30
5.1.4	Frequency of buying	31
5.1.5	Importance of cold storage	32
5.1.6	Types of packages	33
5.1.7	Healthy and safety concerns	35
5.1.8	Primary Concerns	36
5.1.9	Types preferred for purchase	37
5.1.10	Quality issues in a product	39
5.1.11	Satisfaction from a customer	40
5.1.12	Retailer Location	41
5.1.13	Shopping experience	43
5.1.14	Incorporating frozen foods	44
5.1.15	Safety while using product	45
5.1.16	Knowing Recommended Temperature	47
5.1.17	Identifying Sign while burning	48
5.1.18	Checking best before while using the product	50

CHAPTER 1

INTRODUCTION

1.1 Introduction

In order to promote public knowledge regarding frozen products, this mini-project highlights the importance of disseminating accurate information. We explore the dynamic environment of the frozen food sector in an era defined by technical advancements and evolving consumer tastes. Through this investigation, we hope to learn more about consumer preferences and attitudes while highlighting the vital role cold chain logistics play in guaranteeing the safety and quality of frozen goods. With a focus on cold chain logistics innovations and problems, the project investigates processes from production to consumption. The objective is to develop a more knowledgeable consumer base by encouraging safe handling and consumption procedures for frozen goods and, in the end, encouraging a well-rounded understanding of their advantages.

History

The history of cold chain logistics for frozen products is intricately linked with the evolution of refrigeration technology and the dynamic growth of the frozen food industry. Originating in the 19th century, the concept of preserving food through cold storage utilized icehouses and natural ice for limited refrigeration and transportation of perishable goods.

Early Beginnings: The early 20th century witnessed a transformative shift with the widespread adoption of mechanical refrigeration. This revolutionized the cold chain, enabling refrigerated warehouses and transport vehicles to expand the storage and distribution of frozen products on a larger scale after World War II.

Development of frozen products: The 1950s and 1960s marked a pivotal period, as quick-freezing technologies reshaped the frozen food supply chain, enhancing product quality and extending shelf life for broader consumer accessibility.

Globalization and technological advances: With the advent of globalization in the late 20th century, the demand for efficient cold chain logistics intensified. Advanced freezing techniques, temperature monitoring systems, and swift transportation methods became integral for preserving product quality during long-distance transit.

Integration of IT and automation: The late 20th century to the present era witnessed a crucial integration of information technology and automation. Advanced tracking systems, real-time monitoring, and automated warehouses have ensured precise temperature control, minimized spoilage risks, and maintained product quality.

Sustainability and Environment: The 21st century brought forth heightened considerations for sustainability and the environment. The cold chain industry responded by exploring eco-friendly refrigerants and energy-efficient technologies, showcasing a commitment to reducing its carbon footprint. This historical progression underscores a continuous adaptation to technological advancements and a steadfast dedication to preserving the quality and safety of frozen products throughout the supply chain.

Issues

Cold Chain Management Issues can significantly impact freight shipments, and drivers play a crucial role in proactively addressing these challenges to prevent complications. In the realm of supply chain management, common issues are a tangible concern, prompting drivers to remain vigilant and proactive.

Product Quality Issues: One primary challenge involves product quality issues, especially for perishable items like food and produce. The process necessitates thorough sanitizing, cleaning, and sorting before packaging and loading to uphold quality standards. Adequate packaging is equally critical to prevent contamination and transport-related damage, with careful attention given to airflow.

Lack of Proper Documentation: Ensuring proper documentation at every step of cold supply chain management is imperative, particularly during transit. Utilizing data loggers that meticulously record storage temperatures becomes essential, acting as a

safeguard against inadequate conditions that could compromise the integrity of the shipment.

Shipment/ transport delays: The issue of shipment or transport delays poses a substantial risk, particularly in the time-sensitive nature of cold chain logistics. Drivers must exercise strategic planning to minimize delays, recognizing their potential detrimental impact on the efficacy of cold chain technology.

Disrupted climate control or temperature: Temperature variation emerges as a significant challenge in cold chain logistics, stemming from various factors such as frequent door openings, loading from the field, inadequate pre-cooling, extreme weather, or malfunctioning cooling devices. Drivers play a pivotal role in managing climate control settings, navigating loading procedures, and addressing adverse conditions to ensure consistent temperatures and preserve the integrity of the cold chain.

Strategies

Educational Outreach for Awareness:

- Execute extensive educational campaigns across diverse platforms.
- Utilize social media, websites, and traditional media for broad dissemination.
- Collaborate with influencers and nutrition experts to bolster credibility.

In-Store Marketing Initiatives:

- Collaborate with retailers to devise in-store promotional events.
- Craft signage and displays spotlighting the advantages of frozen products.
- Amplify visibility and awareness at the point of purchase.

Feedback Collection through Surveys:

- Formulate surveys and questionnaires to amass feedback from consumers.
- Disseminate through online platforms, emails, and in-store interactions.
- Obtain insights into preferences, concerns, and expectations.

Active Engagement on social media:

- Employ social media monitoring tools to actively engage in public conversations.
- Identify trends, sentiments, and prevalent issues related to frozen products.
- Swiftly respond to address concerns and foster audience engagement.

Insights from Focus Group Discussions:

- Organize focused group sessions to delve deeper into consumer perspectives.
- Facilitate discussions on experiences, perceptions, and improvement ideas.
- Extract qualitative insights for strategic decision-making.

Educational Resources for Optimal Storage:

- Develop easily comprehensible educational materials, including brochures and online resources.
- Offer guidelines on the proper storage and handling of frozen products.
- Disseminate information through diverse channels for widespread accessibility.

Health Professional Collaboration:

- Partner with nutritionists and dietitians to curate educational content.
- Conduct workshops educating the public on optimal storage practices.
- Leverage the expertise of health professionals to enrich educational initiatives.

Interactive Learning Platforms:

- Establish interactive online platforms or mobile apps.
- Provide tips, quizzes, and tutorials on secure storage practices.
- Foster user engagement and offer incentives for participation.

1.2 OBJECTIVES FOR THE STUDY

- Raise public awareness about the importance of Frozen products.
- Collect feedback and insights from the public on Frozen Products.

- Evaluate public knowledge about storing Frozen Products.

1.3 NEED OF THE STUDY

- It's critical to close the knowledge gap in the public regarding the advantages and common misconceptions about frozen foods.
- Direct consumer insight collection is crucial to comprehending changing frozen product expectations, concerns, and preferences.
- For companies and stakeholders in the frozen food sector, it is critical to recognize and adjust to customer needs based on feedback.
- Evaluating the public's knowledge of the best ways to store food is essential to cutting down on food waste and guaranteeing the integrity and safety of frozen goods.
- The project is to improve customer knowledge, encourage ethical behavior, and have a beneficial effect on the frozen food sector.

1.4 SCOPE OF THE STUDY

- Examine how much the general public currently knows about the advantages, nutritional content, and sustainability of frozen foods.
- Evaluate attitudes, pinpoint misunderstandings, and examine current marketing initiatives in the frozen food industry.
- Compile thorough input regarding consumer expectations, worries, and preferences regarding different kinds of frozen products.
- Hold focus groups, interviews, and surveys to gather a range of viewpoints and attitudes.
- Determine how much information the general public is aware of about handling safety procedures and the ideal temperature for storing frozen goods.

CHAPTER 2

REVIEW OF LITERATURE

The rapidly expanding frozen food industry requires thorough research on consumer input, public awareness, and storage expertise. Current studies, which frequently have a wide focus, ignore the particular dynamics of the frozen goods industry. By exploring the nuances of public views, consumer preferences, and understanding of storage techniques, this study aims to close these gaps. It strives to give a thorough grasp of customer behavior in the frozen food industry through surveys, interviews, and focus groups. This research aims to provide detailed insights that will help shape industry practices and educational initiatives, resulting in a more knowledgeable and adaptable approach to frozen product management.

Vaccine cold chain management and cold storage technology-Nugroho Agung, Alfin Saifuddin, Indra Mamad, Rahmat Romadhon (2022)

This paper examines vaccine cold chain management, highlighting its significance for ensuring immunization efficacy and the security of global health. Temperature regulation, waste minimization, and stakeholder competency are major issues. The study examines safety precautions including refrigeration and surveillance technology. In order to avoid vaccination inefficacy, proper storage is essential. Stakeholders can benefit from its special emphasis on cold storage in vaccine distribution because it suggests improved training and cutting-edge cold chain enhancements.

Freezing in the vaccine cold chain an ongoing issue-Celina M. Hanson, Anupa M. George, Adamma Sawadogo, Benjamin Schreiber (2017)

Children's health is put at danger and money is wasted when vaccines are exposed to poor cold chain temperatures. This revised literature analysis evaluates the frequency of temperature deviations along the cold chain and builds on a 2007 study (Matthias et al., 2007). 29 of the 45 studies are concerned with "too cold" temperatures. 41 articles focused on storage segments, 15 on transportation, and 4 on outreach activities. According to the analyzed data, 37.1% of vaccinations were stored in

suboptimal temperatures in lower income countries, compared to 33% in wealthier nations. Higher income countries reported exposure in 38% of instances during shipping, compared to 19.3% in lower income countries. In order to address these problems, healthcare professionals must get training on improving supply chain integrity and temperature management.

Time–Temperature Management Along the Food Cold Chain- Samuel Mercier, Sebastien Villeneuve, Martin Mondor, Ismail Uysal (2017)

The cold chain, which is tasked with keeping perishable commodities at the right temperature while in storage and transit, frequently performs insufficiently. Frequent temperature variations above or below ideal ranges result in more food being thrown away and raise safety issues. In this assessment, flaws in precooling, shipping, retail display, domestic refrigeration, and business handling procedures are highlighted as they relate to time-temperature conditions at crucial points in the cold chain. We address the possible efficiency gains from managing time-temperature conditions as well as the obstacles preventing their implementation. The report proposes a combination of experimental and modeling studies on precooling uniformity, responsive food inventory systems, and cold chains in poor countries to improve the global cold chain.

Evaluation, Awareness, Practice and Management of Cold Chain- Rao, Nafar, Baliga, Unnikrishnan (2012)

In Dakshina Kannada District, South India, this study evaluated the cold chain management in primary healthcare facilities. It was discovered that 95.8% of centers had deep freezers and 98.6% of them had ice-lined refrigerators, while 97.2% of centers had dial thermometers, cold boxes, frozen packs, and voltage stabilizers. However, 10% of centers had inappropriate vaccination storage. Only 61.8% of medical personnel correctly executed deep freezer defrosting procedures, despite the majority showing good equipment knowledge and practices. To address these problems and guarantee the integrity of delivered vaccines, the study suggests that cold chain operators receive pertinent training.

***Assessment of factors affecting vaccine cold chain management practice-
Hewan Adam Bogale, Abebe Feyisa Amhara & Alemtsehay Adam Bogale (2017)***

In this study, the East Gojam region of Ethiopia's vaccine cold chain management was the main emphasis. 76.7% of the 60 healthcare facilities evaluated had working refrigerators, 35% had back-up generators, and 46.6% had ways to transport vaccines in case of power outages. Only 38.3% of respondents indicated that they knew enough about vaccine cold chain management, and only 58.3% showed that they were using it appropriately. Knowledge gaps and occupations strongly impacted vaccine cold chain management practice, according to a logistic regression analysis. The study highlights the need for increased supervision and training at all levels of healthcare to improve the knowledge and skills of healthcare professionals involved in cold chain management.

Pharmaceutical cold chain management on wheels- James Vesper MPH, Umit Karole MD, DPH, Rafik Bishara PhD, Thomas Reeves PhD (2017)

The study examines the value of hands-on training in maintaining the quality, safety, and effectiveness of pharmaceutical products that are sensitive to temperature. Pharmaceutical Cold Chain Management on Wheels, a weeklong experiential learning program, was created by the World Health Organization to give trainees practical experience in handling, storing, and distributing such items in the cold chain system. Participants in this event, which has been held yearly in Turkey since 2008, include representatives from the pharmaceutical business, healthcare organizations, regulatory bodies, and suppliers. It emphasizes collaborative learning and mentorship and is consistent with social learning and experiential learning theories. Its success was attributed to five main aspects, which may provide guidance for other experiential learning programs and online learning occasions.

Evaluation of the cold chain management options to preserve the shelf life of frozen shrimps- Nodali Naraha, Wenchi Sung, Sinisa (2019)

Concerns about temperature control during delivery have been brought up by the rise in demand for chilled and frozen food products to be delivered to homes. This study

evaluated the temperature conditions encountered by major Taiwanese delivery service providers during shipment. The findings showed that frozen shrimp's shelf life could be significantly shortened by unfavorable temperatures. Temperature control within a specific range worked well. These discoveries have a wider worldwide application and can be used to manage temperature in cold chains for home delivery, maintaining food quality and safety.

***Conjoint analysis on COVID-19 and food cold chain systems-
Jaipongan, Xiangyi Yu, Li Jiang, Han Yang, Wenbin Wau (2022)***

Frozen foods can transmit and propagate SARS-CoV-2, according to recent reports, although cold chains are essential for maintaining food quality and minimizing losses. The necessity for COVID-19 control measures in the food cold chain is addressed in this study. It examines 45 events involving frozen products in China and suggests an IoT and blockchain-based management solution. During COVID-19, the system facilitates international food trade while improving real-time monitoring, data security, and event tracing. It provides an innovative way to reduce pandemic-related issues in the food cold chain. In-depth investigation is required for accurate risk assessment and management.

***Evaluation of the cold chain of fresh-cut endive from farmer to plate-
Hans Raiders, Marijke Claes, Luc Peeters, Kris A. Willems (2009)***

This study evaluated the influence of the cold chain on endive microbiology. The supply chain's correct upkeep was discovered via temperature monitoring. Small temperature changes had little impact on mesophilic bacteria, whereas endive at the best-before date had much higher amounts of coliforms and Enterobacteriaceae, according to many rounds of microbiological investigation. This study is the first to combine temperature profiling and microbiological analysis in a real food supply chain.

***Identification of issues in the cold chain of Indian frozen food-Madhu
Arora, Rupesh Kumar, T. Bangar Raju (2023)***

This study addresses the challenges in the frozen food cold chain in India. It reviews existing literature and identifies issues affecting cold chain performance, including infrastructure, traceability, sustainability, awareness, safety, and more. The study aims to benefit stakeholders by enhancing cold chain management for frozen food products.

Food cold chain management- Shashi, Piera Centibels, Roberto Carcione, Myriam Ertz (2020)

This study employs bibliometric and network analysis of 1189 food cold chain (FCC) research articles to provide insights into the field's intellectual development. It identifies influential countries, authors, and research streams, including RFID technologies, planning models, postharvest waste, and critical issues. The findings offer valuable directions for future FCC research, benefiting practitioners, researchers, and policymakers.

Importance of the cold chain logistics in the marketing process of aquatic products-Salami'Il M (2021)

Aquaculture depends heavily on aquatic products, including processed goods and aquatic animals. Their transportability and marketability are crucial. Food safety issues include bacterial infection and oxidation. In order to prevent product quality and safety issues during circulation and transit, cold chain logistics, especially for aquatic items, is essential.

Food cold chain management-Shashi, Roberto Carcione Rajinder Singh, Piera Centibels, Amir Shabani (2018)

In this report, 89 studies on food cold chain management (FCCM) from 2001 to 2016 are reviewed. It pinpoints the gaps in the literature on measurements, drawbacks, and sustainability as they apply to FCC performance measurement. The study serves as an important tool for researchers and practitioners in the field by providing possible research questions (RQs) to improve FCCP evaluation and management.

Risk quantification in cold chain management-Henry Lau, Yung Po Lau, Yung Nkandla, Carman Kumble (2021)

This paper discusses risk management for items that are temperature- and time-sensitive in the cold supply chain. In order to quantify the hazards associated with the cold chain, it offers a Federated Learning-enabled Multi-Criteria Risk Evaluation System (FMRES) that combines FL with the Best-Worst Method (BWM). The strategy is illustrated through a case study of an Australian e-grocery supply chain, providing a novel method for systematically evaluating cold chain hazards.

Cold chain management-J C de Timóteo Malimbe G Bjune (2007)

This study investigates the Niassa province of Mozambique's Expanded Program on Immunization (EPI), with a focus on cold chain management. According to data from 44 healthcare facilities, outlying facilities with staff that is less educated and less experienced have trouble managing the cold chain. In order to improve cold chain processes and successfully integrate knowledge, the study emphasizes the significance of training and supervision, particularly at the periphery level.

Applying back propagation network to cold chain temperature monitoring- Kai-Ying Chen, Yi-Cheng Shaw (2016)

Recent supply chain management talks have placed a strong emphasis on enhancing contactless, real-time features and data transmission, particularly in the cold chain industry. It is essential to automatically collect temperature data using tools like RFID. This study evaluates the usage of artificial neural networks and Exponentially Weighted Moving Average (EWMA) control charts for temperature monitoring in cold chain management. EWMA charts track changes while back-propagation neural networks anticipate temperature shifts. This integrated system is useful for real-time temperature data gathering in cold chain management employing active RFID tags with temperature sensors because it can immediately respond to abnormalities, as shown in a simulation using LEGO® bricks.

***DESIGN OF AN INNOVATIVE BLOOD COLD CHAIN MANAGEMENT SYSTEM
USING BLOCKCHAIN TECHNOLOGIES-Seung Eun Kim and Yongsoo Kim
(2018)***

Current centralized blood management systems don't provide real-time, comprehensive information, which can delay the delivery of blood during crises, particularly in hospitals that are far away. Blockchain technology, which is renowned for its quickness and dependability, is used in many fields. In this work, a blockchain-based blood cold chain system is introduced to improve information visibility and reduce blood transfer times, particularly in urgent situations.

***Assessing the effectiveness of cold chain management for childhood vaccines-
Nikki Turner, Athene Laws and Loretta Roberts (2018)***

This study evaluated how well New Zealand's cold chain preserved vaccination potency between 2002 and 2008. On a sample of kid's vaccines, scientists used heat- and freeze-sensitive monitors to find improvements in cold chain management. The large reduction in heat and cold exposure failures, which resulted in significant yearly savings of about NZ\$4 million, was probably due to improved tools, methods, instruction, training, and quality standards.

***Cold Chain Management using an Ultra Low Power Wireless Sensor Network
Ruud Riem-Vis, PhD***

This paper describes the architecture and implementation of a self-configuring wireless sensor network used in a cold chain management tool. Categories and subject descriptors: B.4.1 [Input/Output and Data Communications]: Data Communications Devices; C.2.1 [Computer Communication Networks]: Network Architecture and Design – Wireless communication; C.2.2 [Computer Communication Networks]: Network Protocols – Applications; General Terms: Design, Measurement, Security. Keywords: Sensor, Ad-hoc network, Low power consumption.

Management of COVID-19 vaccines cold chain logistics-Madhubala Loganathan Fahrni, Intan An-Nisaa' Ismail, Norlina Che Yaakob, Kamilah Md Saman, Nur Farhani Mansor, Narasimha Noordin & Zaheer-Ud-Din Babar

This scoping review investigates effective COVID-19 vaccine cold chain management. It featured 14 publications from different nations and pinpointed three major themes: legal requirements, storage and packaging, and distribution and transportation. In order to ensure vaccinations, reach target groups and reduce loss, the study underlines the significance of an effective and resilient vaccine supply chain backed by temperature monitoring systems.

Quality assessment of cold chain storage facilities for regulatory and quality management compliance in a developing country context- Tout Amarachi Chukwu, Maxwell Adiba (2021)

This investigation of cold chain drug supply management is being conducted in Abuja, Nigeria. It demonstrates that the majority of storage facilities (66.7%) do not meet essential requirements for the quality of cold chain products. In terms of cold chain management, hospital and retail pharmacists both do poorly (50.4%). With 43.6% of facilities missing automated systems for power failure and 66.7% lacking equipment calibration, many quality management standards and recommendations are not being followed. The report emphasizes the requirement for better cold chain pharmaceutical supply chain management and quality control in Nigeria.

Towards Effective Management of Cold Chain Shahbaz Khan, Mohd Imran Khan and Abid Haleem (2019)

From manufacture to consumption, effective cold chain management is essential for maintaining temperature-sensitive items. This study highlights cold chain management obstacles and looks at how they relate to one another. A major obstacle is a deficient infrastructure, and other factors that limit management effectiveness include a lack of regulatory frameworks and top management commitment. To address these concerns and enhance food security and environmental preservation, the government should strengthen networks, upgrade infrastructure, and enforce

rules. The interrelated barriers in cold chain management can be better understood by governments and businesses thanks to this research.

Postharvest quality monitoring and cold chain management of fresh garlic scopes based on a wireless multi-sensors system-Zhiqiang Zhu, Ruanqin Ma, Andjela Draga Nic, Irena Norovich, Xyshaun Zhang, Xiang Wang, Yingjie Wang (2021)

A seasonal vegetable with a limited shelf life is fresh garlic scopes. It requires effective cold chain management to provide year-round supply. In order to track environmental factors like temperature, humidity, gas composition, and vibration during transportation and cold storage, this study created a wireless sensor network-based system. The solution was successful in supplying real-time data, enhancing transparency and managing the cold chain for the supply of fresh garlic scopes. For better data management and quality, additional improvements are required.

Time-temperature abuse in the food cold chain: Review of issues, challenges, and recommendations-Nodali Naraha, Hsin I Hsiao, Jelena Vlasic, Ming-Feng Yang, Hong-Ting Victor Lin (2018)

The management of the food cold chain is becoming more important, with a focus on temperature control for different food types. The majority of research focuses on refrigerated goods, including meat, dairy, fish, fruits, and vegetables. The majority of occurrences of temperature abuse happen in wealthy nations, while information on developing countries is scarce. Although promising, advanced temperature monitoring methods require more research. Reduced food waste may result from improved temperature control. Future studies should examine new opportunities in the control of the food cold chain.

Improving cold chain systems: Ashvin Ashok, Michael Brison, Yann LeValley (2018)

In impoverished nations, the provision of vaccines depends on effective cold chain infrastructure. Since 2010, The Clinton Health Access Initiative, Inc. (CHAI) has

worked to strengthen the cold chains for vaccines in ten different nations. Common cold chain problems have been discovered, along with their causes and remedies. Assessing capacity shortages, upgrading technology, and preventing temperature excursions and equipment malfunctions through monitoring, technician training, and the availability of spare parts are just a few of the recommendations.

Public Health Challenges in the Supply Chain Management of Cold Chain Medicines (2012)

To maintain product quality, the pharmaceutical supply chain must adhere to stringent international laws when handling pharmaceuticals that are temperature-sensitive. To ensure proper cold chain management, many nations, including Canada, the UK, and South Africa, have enacted regulations. This study looks at how Ghana keeps up its cold chain supply systems in the face of difficulties like erratic power, insufficient storage, and lax monitoring. The findings showed a lack of quality management, poor contingency planning for power outages, and poor cold storage and transportation requirements. To safeguard the health and safety of the public, regulatory control is required.

A cold chain network for food exports to developing countries-Victoria Salin, Rodolfo M. Nagy Jr (2003)

The American Potato Trade Alliance is the main subject of this article's investigation of corporate relationships in the cold chain for food exports to underdeveloped nations. Case studies from Thailand and the Philippines show how larger and smaller businesses manage technological difficulties and pricing schemes for cold chain services. In emerging regions, consumer behavior has an impact on long-term commitment among chain partners and private investment in cold chain infrastructure.

Integrating wireless sensor networks with statistical quality control to develop a cold chain system in food industries-Chih-Wen Shih, Chih-Hsuan Wang (2016)

This study offers a time-temperature indicator (TTI) based cold-chain system as a solution to the problems with managing the cold chain in the food business. It incorporates ISO 22,000-compliant Critical Control Point (CCP) requirements and uses wireless sensors to monitor temperature data. The system includes four business models, including home delivery, indirect and direct delivery to convenience stores (CVS), and in-flight culinary service. These models improve sales, open up new revenue streams, and use less energy, all of which have a positive impact on the food industry.

Blockchain-enabled pharmaceutical cold chain- Seyed Mojtaba Hosseini Bamaca, Shima Ghasemzadeh Moghaddam, Sajed Dehghan Mans Hadi (2021)

The use of blockchain technology in managing pharmaceutical cold chains is examined in this article, with a focus on how it could improve data integrity, transparency, and waste control. It analyzes case studies of blockchain-based projects in the pharmaceutical industry and reviews current restrictions and research obstacles in the implementation of blockchain in pharmaceutical supply chains. The research demonstrates how blockchain can be used to handle the unique needs of pharmaceutical cold chains.

Trading off cost, emission, and quality in cold chain design: A simulation approach- Yun Fan, Caroline de Cleaver, Sander de Leeuw, Behzad Bohdan (2021)

Cost, quality, and environmental factors all need to be taken into account while managing the cold chain. Divergent stakeholder perspectives and potential conflicts of interest make balancing these elements a difficult task. This paper offers insights from a case study of the global banana supply chain and introduces an agent-oriented simulation framework to assist decision-making in cold chain design. The outcomes show how the model can evaluate scenarios and trade-offs between logistical cost, emissions, and product quality. The study emphasizes the difficulties of maximizing vessel speed for energy consumption while maintaining product quality as

well as the advantages of fusing quality control with logistics to save costs and emissions.

RFID based Mobile Cold Chain Management System for Warehousing- G. Prakash, Bohdan Renold, Bohdan (2012)

For the preservation of temperature-sensitive goods, a cold chain is essential. It is essential to keep an eye on the temperature while moving and storing things. Thermotron buttons and RFID readers are combined in this paper's proposed system to track and control warehouse temperatures. Administrators are alerted when thresholds are exceeded so they can take corrective action remotely, cutting down on manual work and waste.

Fish product quality evaluation based on temperature monitoring in cold chain- W Tingman, Z Jian, Z Xyshaun (2013)

In this study, RFID technology was utilized to track temperature variations in a refrigerator carrying frozen tilapia fillets. Three different temperature ranges were tested: stable at -18°C, fluctuating at -18°C within 2°C, and ambient temperature. Temperature data was used to assess product quality using TVB-N value and sensory analysis at various points throughout the vehicle. The results showed that although lower temperature changes increased shelf life by two months, temperature variances had no effect on product quality. With time spent in storage, quality decline accelerated.

Tools and approaches to ensure quality of vaccines throughout the cold chain- Umit Karole & Julie Milstein (2014)

Vaccines that either tolerate heat but not freezing or tolerate freezing but not heat were initially the focus of the Expanded Program on Immunization. Despite limited resources, a global cold chain for vaccine storage and transportation was constructed. Recent advancements include diversely characterized novel vaccines, enhanced heat stability, awareness of the issue of vaccine freezing, regulatory routes, and sophisticated temperature monitoring equipment. With the help of these tools,

vaccines that can be stored in flexible cold chains have been created, opening up new opportunities for vaccine delivery systems in the future.

Assessing the Readiness of Farmers towards Cold Chain Management- Rohit Joshi, Sudhanshu Joshi (2016)

The purpose of the paper is to evaluate Indian farmers' knowledge of and behavior related to the postharvest cold chain. It concludes that the main obstacles to advancement are small-scale and marginalized farmers, low literacy rates, and a lack of awareness. Limited resources also result in the underutilization of cold storage. Farmers' earnings are impacted by complex intermediate systems and market changes. Reducing post-harvest losses and enhancing food quality and safety in the Indian fresh food business require addressing these concerns.

Ensuring the quality of meat in cold chain logistics- Qing-Shan Ren, Kui Fang, Xin-Ting Yan, Jia-Wei Han (2022)

The importance of meat packaging and intelligent monitoring in preserving meat quality, safety, and shelf life is covered in this essay. It emphasizes the necessity of thorough packing materials and cutting-edge quality assessment techniques in cold chain logistics (CCL). The analysis highlights the transition to smart and effective CCL through digital and intelligent improvements while also identifying obstacles.

Simulation analysis of cold chain performance based on time temperature data- Giuseppe Aiello. Scalia, Rosa (2012)

The difficulties in handling perishable items in the retail industry are discussed in this article, with a focus on the financial, moral, and environmental issues raised by product deterioration. Based on supply chain design and time-temperature data, it suggests a methodology utilizing Monte Carlo simulation to assess cold chain performance and calculate the fraction of perishable products.

The obstacles to cold chain implementation in developing countries-David Gligor, Albert Tan, The Nhi Trang Nguyen (2018)

This study, which focuses on Vietnam, strives to pinpoint barriers preventing the introduction of cold chains in developing nations. It uses the grounded theory methodology and incorporates senior manager interviews and archival data analysis. There were ten major challenges noted, such as inadequate skills, inadequate infrastructure, exorbitant expenses, and insufficient government backing. This study offers insightful information on the difficulties adopting a cold chain in poor countries.

A multi-echelon dynamic cold chain for managing vaccine distribution-Vijaya Kumar Manumatic, Tobias Schoenherr, Nachiappan Subramanian, M. Ramkumar Bhanushree Soni, Suraj Panigrahi (2021)

The difficulties of distributing COVID-19 vaccinations on a global scale are discussed in this study, taking into account storage, transportation, and financial considerations. It creates a decision-making model that gives vaccination distribution for entire populations a higher priority while accounting for the finite number of vaccine doses. To optimize cold storage facility allocation and distribution, the model combines predictive analysis, decision tree analysis, synthetic control analysis, and mixed-integer linear programming. The study's conclusions provide crucial decision support for healthcare administrators dealing with challenging pandemic vaccine logistics.

Capsule-based colorimetric temperature monitoring system for customizable cold chain management-Jin-Ok Chu, Hye-Seon Jeong, Jong-Pill Park, Yongsoo Park, Sun-Ki Kim, Hyunmin Yi, Chang-Hyung Choi (2023)

This study introduces a colorimetric temperature monitoring system based on capsules that is intended to improve cold chain management. A phase-change oil (PCO) layer is used to make microcapsules using a microfluidic approach. PCO undergoes a liquid-solid phase transition below its freezing point, which results in a noticeable color change. This system is a useful tool for maintaining the security of temperature-sensitive goods in the supply chain since it provides accurate and scalable temperature monitoring over diverse ranges.

Guidelines for maintaining and managing the vaccine cold chain-Centers for Disease Control and Prevention (CDC) (2003)

The new General Recommendations on Immunization were published in February 2002 by the American Academy of Family Physicians (AAFP) and the Advisory Committee on Immunization Practices (ACIP). These suggestions stressed how crucial it is to manage the cold chain properly for vaccines in order to retain vaccine efficacy. To ensure proper handling and storage of vaccines and to optimize the advantages of immunization in avoiding vaccine-preventable diseases, this study provides standards for storage units, temperature monitoring, and program assessment.

Development of cold chain logistics transportation system based on 5G network and Internet of things system (2021)

Using the Internet of Things (IoT) and a wireless controller FPGA running Xilinx software, cold chain products are tracked and monitored in real time. The system maximizes total economic gains by optimizing transportation routes for goods traveling through certain places. For those making decisions about the design of a cold chain logistics network, this method offers useful insights. Optimized IoT data model and Predictive Data Transfer Technology (PDTT) are used. In order to assure food safety in cold chain logistics, the study underlines the significance of freezing temperature monitoring and remote tracking of freight container locations. The Wireless Scaling Method (WSM) that has been proposed incorporates a wireless microcontroller FPGA running Xilinx software.

Special Issue on Next-Generation Cold Supply Chain Management: Research, Applications and Challenges- Kune-Muh Tsai, K.S. Pawar (2018)

For perishable items like food and medicines to remain safe and of high quality, a cold supply chain, often referred to as a temperature-controlled supply chain, is necessary. However, it encounters difficulties like waste, convoluted logistics, and the requirement for accurate temperature control. The numerous facets of cold supply chains are examined in this special issue, including conceptual frameworks, optimization, risk, resilience, digitalization, packaging, and laws. To create

comprehensive standards and solutions for effective cold supply chain management, more study is required.

Transforming cold chain performance and management in lower-income countries- Mike Brison, Yann LeValley (2017)

For fair access to immunization in many countries, upgrading cold chain and logistics (CCL) systems is essential. The importance of improving CCL performance by putting an emphasis on indicators, stakeholder collaboration, and effective resource use is highlighted in this article. To improve CCL systems, such as equipment deployment, temperature control, and stock management, it leverages on work done by the Clinton Health Access Initiative in eleven Gavi-supported countries.

Sustainable food cold chain logistics-Qian Chen, Qian, Han, Wenbin Wu (2022)

Food cold chain logistics (FCCL) is a methodical procedure that guarantees food quality and safety while minimizing food waste and its negative effects on the environment. FCCL must balance resource costs with greenhouse gas emissions in order to meet sustainability goals. In this examination, advancements in technology, management, and industry are highlighted as it examines microenvironmental monitoring, life cycle assessment, and worldwide impact. Global collaboration, system integration, and intelligence are essential to FCCL's sustainable future.

An intelligent risk management framework for context-aware ubiquitous cold chain logistics- Kwando Kim, Hyunjin Kim, Sang Kuk Kim, Jae-Yoon Jung (2016)

Assuring correct environmental conditions for delicate commodities during distribution is the responsibility of ubiquitous cold chain logistics (UCCL). This study introduces RM, a context-aware real-time risk management system for UCCL that can handle a variety of risk circumstances. Semantic ontologies are used by I-RM to specify the rules for risk management functions such as context identification, risk detection, and response action evaluation. It uses event-based processing approaches to manage

risk management duties in UCCL, from information gathering to real-time reactions, proving its efficacy in a practical UCCL scenario.

A comprehensive review of cold chain logistics for fresh agricultural products- Jia-Wei Han, Min Zuo, Wen-Ying Zhu, Jin-Hua Zuo, En-Li Lu, Xin-Ting Yang (2021)

Cold chain logistics (CCL) plays a vital role in preserving the quality of agro-products and boosting rural industry in China. This review highlights research areas, gaps, and future challenges in CCL, emphasizing low-carbon and intelligent innovation. Next-gen tech like IoT, blockchain, and AI is driving modernization. However, national policies and financial intervention will be crucial in bridging the gap between China and more developed nations in CCL development.

Optimized cold chain to save food-Samuel Mercier, Martin Mondor, Ultan McCarthy, Sebastien Villeneuve, Graciela Alvarez, Ismail Uysal (2019)

Perishable food needs to be kept in the cold chain to be preserved. The stages, technology, and food loss or waste are all examined in this chapter. It highlights the need for better management in industrialized countries as well as better refrigeration in retail and consumer handling. Despite improvements, food loss hasn't considerably decreased in the past 20 years. Remote villages suffer as a result of inadequate cold chains. Loss and waste can be reduced by using data and mathematical modeling.

Shipping mode choice in cold chain from a value-based management perspective- Xinyan Zhang, Jasmine Siu Lee Lam (2018)

Using a value-based methodology, this study investigates the modal option between reefer bulk and container boats in cold chain management. By taking into account variables like commodity kind and travel distance, it develops a decision model with Economic Value Added as the goal. Through numerical analysis, numerous scenarios' modal and route choices are examined.

Time-temperature transparency in the cold chain- Hsin Hsiao, Kuan-Lin Huang (2016)

The study's main focus was on how chilled and frozen food supply chains shared time-temperature information. A total of 1774 Taiwanese food manufacturing businesses received questionnaires, with a 7.0% response rate. The factors affecting information sharing differed depending on whether you were getting processed product data from manufacturers or raw material data from suppliers. Sharing of raw material information was driven by the relative strength of manufacturers, business strategy, and uncertainty around raw material quality, whereas sharing of processed product information was influenced by business strategy and uncertainty surrounding processed product quality. When sharing tactics were broken down by subsector, it became clear that the chilled food sector was more inclined to share than the frozen food sector.

Cold Chain Management in Pharmaceutical Industry: Logistics Perspective- Yoon, Yuri (2014)

This essay discusses cold chain management, focusing on how important it is to the delivery of pharmaceuticals that are temperature-sensitive. It highlights the requirement for more advancement in this intricate logistics system. Currently, a select few international businesses with cutting-edge technologies rule this sector. Extensive cold chain development is required to meet the growing demand for pharmaceuticals, particularly in emerging economies. To satisfy consumer and commercial demand in this specialized yet lucrative industry, a strong cold chain infrastructure is required.

CHAPTER 3

RESEARCH METHODOLOGY

A detailed literature research will examine consumer attitudes and industry marketing methods in an effort to increase awareness of the significance of frozen products. A mixed-methods approach is used in the feedback collection process to understand preferences and experiences through the use of qualitative techniques such as interviews and quantitative surveys. Assessing the general public's understanding of frozen product storage requires comparative analysis, surveys, and empirical research. Qualitative themes and quantitative trends are integrated in data analysis. Transparency and participant confidentiality are given top priority in ethical issues. Restrictions are minimized, including possible sampling bias. With regard to public attitudes, preferences, and knowledge regarding frozen items in the modern food scene, this methodology seeks to provide nuanced insights.

3.1 RESEARCH DESIGN

Mixed review Method

"Mixed review method involves evaluating something by considering both positive and negative aspects. It combines favorable and unfavorable feedback to provide a balanced assessment in various contexts."

3.2 SOURCE OF DATA

Primary Data Collection: Original data obtained straight from the source is referred to as primary data. It is first-hand data collected for particular research or analysis objectives using techniques like surveys, interviews, or experiments.

Secondary Data Collection: Existing information that was gathered by another party for a different goal than the current one is referred to as secondary data. It contains information gathered for study or research from sources like books, journals, government publications, and databases.

3.3 SAMPLE SIZE

The sampling size of the project is 50 respondents

3.4 SAMPLING METHOD

Surveying method is used

3.5 AREA OF STUDY

General public who are buying frozen products

HYPOTHESIS

HYPOTHESIS-1

H0: There is no significant difference between consumer frequency of buying and consumer perception

H1: There is significant difference between consumer frequency of buying and Consumer perception

HYPOTHESIS-2

HO: There is no significant difference between consumer frequency and safety concerns

H1: There is significant difference between consumer frequency and safety concerns

Tools of analysis

Percentage Analysis

Analyzing a component's proportionate relationship to the total in terms of percentages is the goal of percentage analysis. In order to evaluate changes, trends, and distributions, it is extensively utilized in statistics, business, and finance. Values expressed as percentages make comparison easier and shed light on the relative importance of various dataset pieces.

3.6 ANALYTICAL TOOLS

- Correlation
- Anuva

CORRELATION

The statistical association between two variables is measured by correlation, which shows the direction and intensity of the relationship between them. Positive correlations indicate that variables move in the same direction, while negative correlations show the opposite movement. Positive correlations range from -1 to 1. Recognizing correlation facilitates pattern analysis and prediction within datasets.

ANOVA TEST

Its statistical technique called ANOVA (Analysis of Variance) compares the means of several groups to determine whether observed differences are statistically significant. It helps distinguish between variations caused by real differences and chance by dividing total variance into within-group and inter-group components.

One way nova

One-way ANOVA is used to compare the means of three or more groups in order to assess the statistical significance of observed differences.

CHAPTER 4

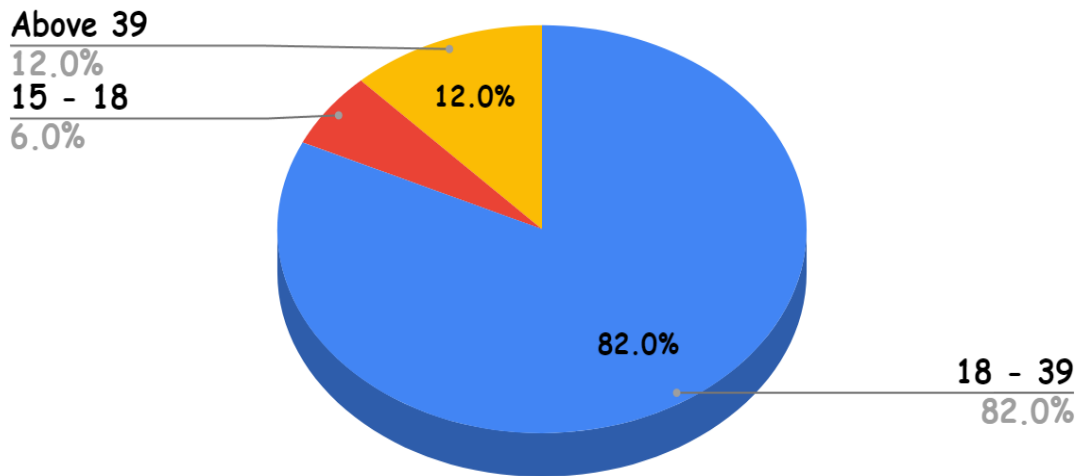
DATA ANALYSIS AND INTERPRETATION

4.1 Percentage analysis

1. THE AGE OF THE RESPONDENTS

AGE

50 Response



4.1.1 TABLE INDICATING AGE OF THE RESPONDENTS

S.NO	AGE	No. of respondents	Percentage Analysis
1	Below 15	0	0
2	15- 18	3	6%
3	18- 39	6	12%
4	Above 39	41	82%
Total		50	100%

INTERPRETATION

Based on the preceding table, it can be inferred that of the 50 respondents, those Below 15 ages represent 0, those between 15- 18 ages represent 6%, those between 18-39 ages represent 82%, and those above 39 ages represent 12%.

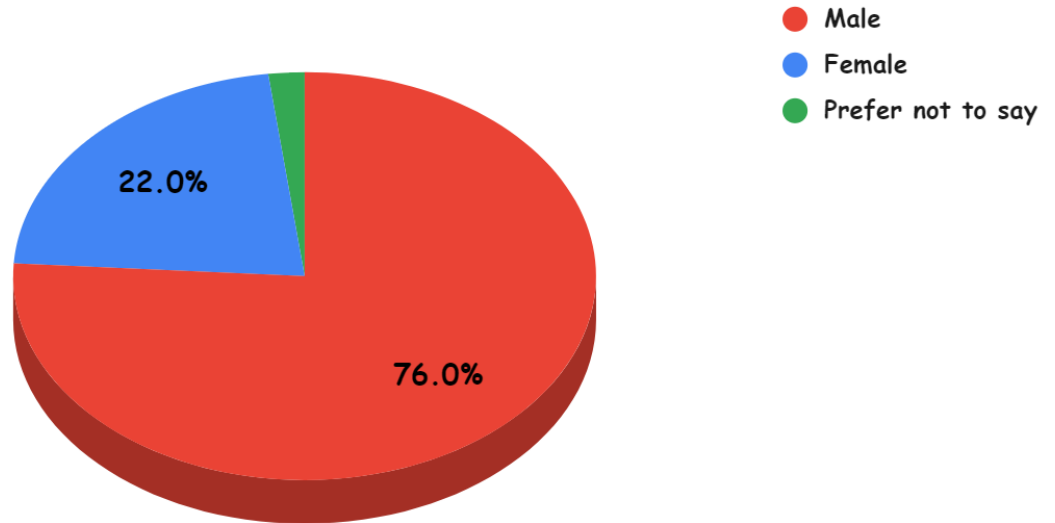
INFERENCE

Majority 82% of the respondents belong to the age group of 18- 39 category.

2. THE GENDER OF THE RESPONDENTS

GENDER

50 Response



4.1.2 TABLE INDICATING GENDER OF THE RESPONDENTS

S.NO	GENDER	No. of respondents	Percentage analysis
1	Male	38	76%
2	Female	11	22%
3	Prefer not to say	1	2%
Total		50	100%

INTERPRETATION

According to the above table, 76% of respondents are male, 22% are female, and 2% would prefer not to respond.

INFERENCE

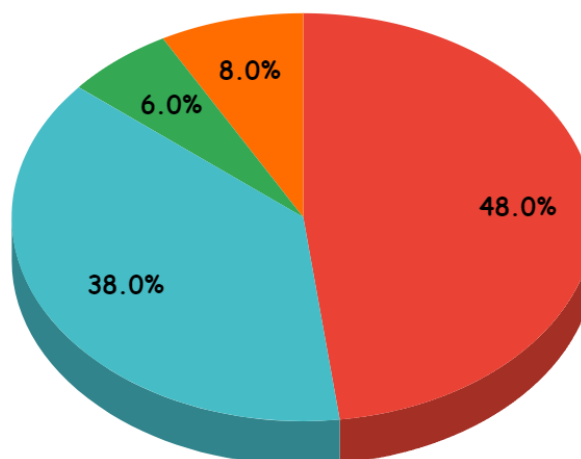
Majority 76% of the respondents are male.

3. EDUCATIONAL QUALIFICATION

EDUCATIONAL QUALIFICATION

50 Response

- Under Graduate
- Post Graduate
- HSC
- SSLC



4.1.3 TABLE INDICATING EDUCATIONAL QUALIFICATION

S.NO	EDUCATIONAL QUALIFICATION	NO. OF RESPONDENTS	PERCENTAGE ANALYSIS
1	SSLS	4	8%
2	HSC	3	6%
3	Under Graduate	24	48%
4	Post Graduate	19	38%
TOTAL		50	100%

INTERPRETATION

According to the above table, there are 8% of respondents who are SSLC, 6% who are HSC, 48% who are undergraduates, and 38% who are postgraduates.

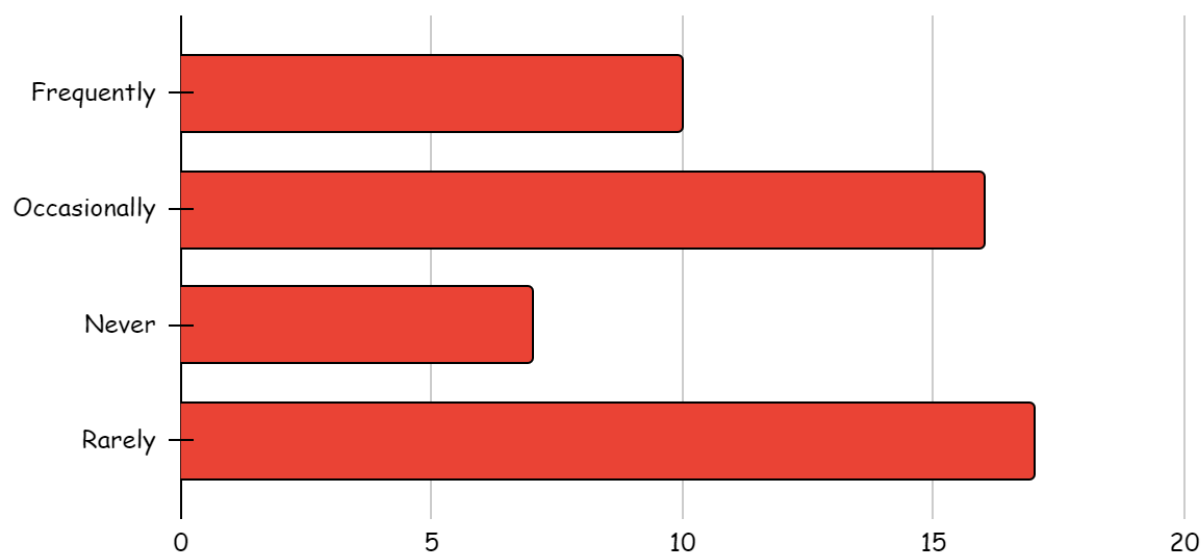
INFERENCE

Majority 48% of the respondents belongs to Under Graduate Educational Qualification.

4. How often do you buy frozen products like frozen vegetables, fruits, or ready-made frozen meats?

Frequency of Buying Frozen Vegetables, Fruits, and Ready-Made Frozen Meats

50 Response



4.1.4 TABLE INDICATING FREQUENCY OF BUYING

S.NO	FREQUENCY OF BUYING	NO. OF RESPONDENTS	PERCENTAGE ANALYSIS
1	Frequently	10	20%
2	Occasionally	16	32%
3	Rarely	17	34%
4	Never	7	14%
Total		50	100%

INTERPRETATION

According to the above table there are 20% respondents who are frequently, 32% on occasionally, 34% are Rarely, and 14% are respondents are never.

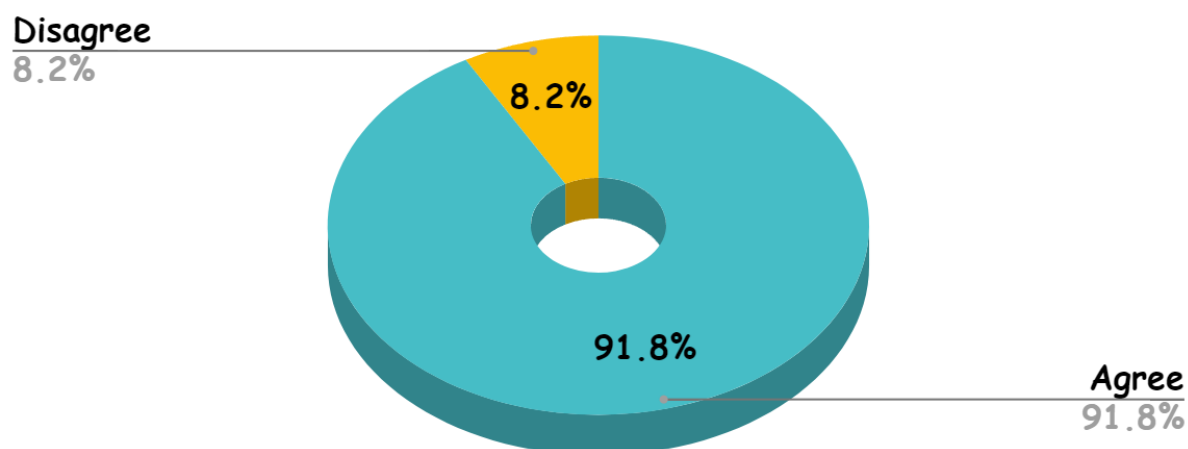
INFERENCE

Majority 34% of respondents who are belongs to Rarely Used.

5. Have you ever learned about why it's important to keep some products, like food, vaccines, or medicines in cold?

Understanding the Importance of Cold Storage for Products such as Food, Vaccines, and Medicines

50 Response



4.1.5 TABLE INDICATING IMPORTANTS OF COLD STORAGE

S.NO	IMPORTANCE OF COLD STORAGE	NO. OF RESPONDENTS	PERCENTAGE ANALYSIS
1	AGREE	45	91.8%
2	DISAGREE	5	8.2%
TOTAL		50	100%

INTERPRETATION

According to the above table there are 91.8% who are agree and 8.2% who are disagree the question.

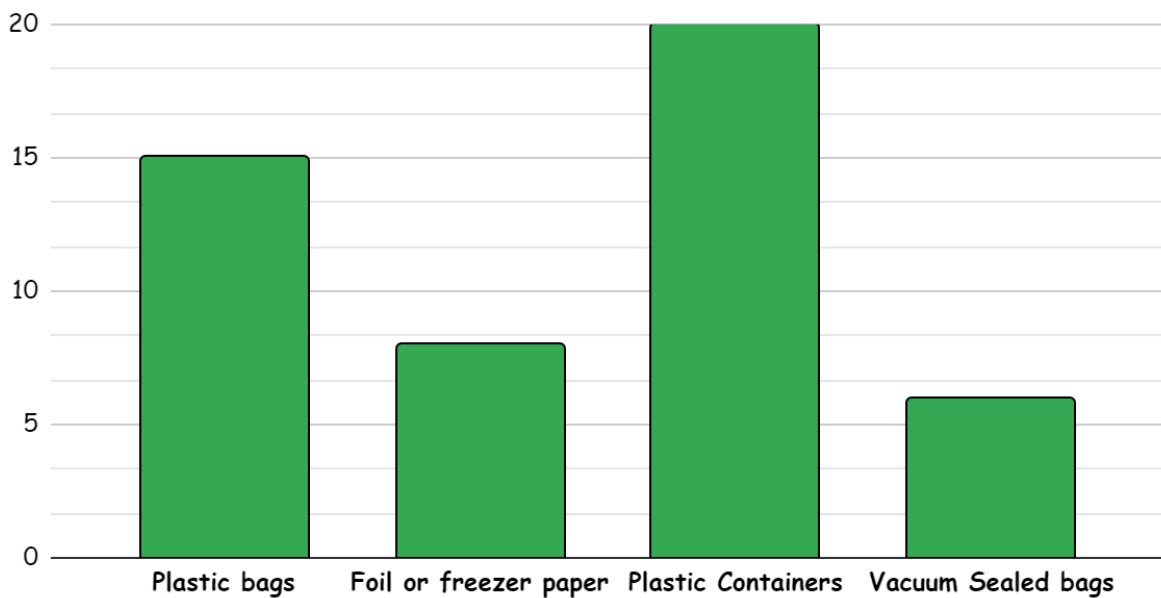
INFERENCE

Majority 91.8% respondents who are agree the question.

6. What type of packaging or containers do you use for storing frozen products?

Types of Packaging for Storing Frozen Products

50 Response



4.1.6 TABLE INDICATING TYPES OF PACKAGES

S.NO	TYPES OF PACKAGES	NO. OF RESPONDENTS	PERCENTAGE ANALYSIS
1	Plastic Bags	15	30.6%
2	Plastic Containers	20	40.8%
3	Foil or freezer paper	9	16.4%
4	Vacuum sealed bags	6	12.2%
Total		50	100%

INTERPRETATION

According to the above table 30.6% respondents who are plastic bags, 40.8% on Foil or freezer paper, 16.4% are plastic containers, 12.2 are vacuum sealed bags.

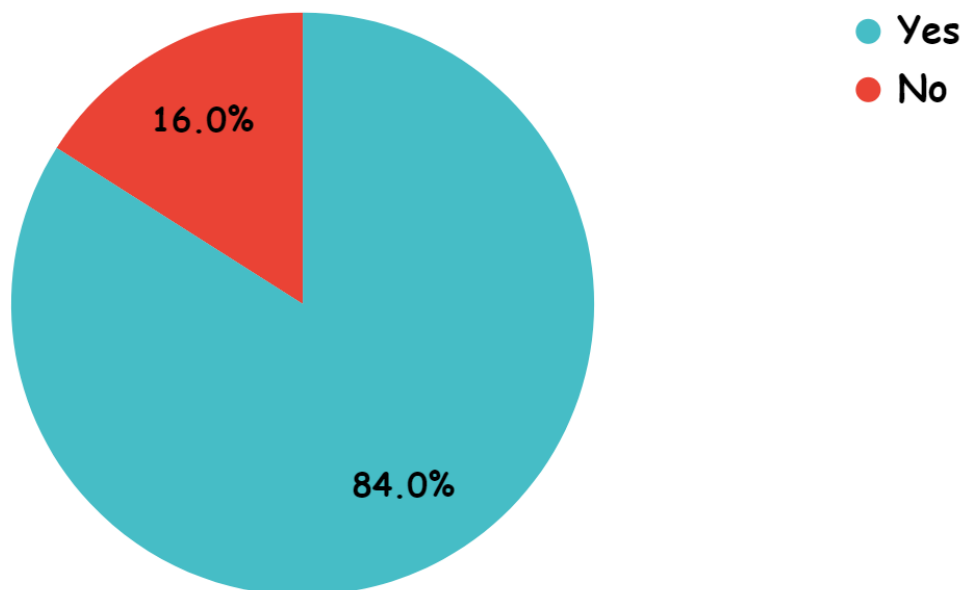
INFERENCE

Majority 40.8% who are using plastic containers.

7. Have you had concerns about the health and safety of frozen products?

Health and Safety Concerns Regarding Frozen Products

50 Response



4.1.7 TABLE INDICATING HEALTHY AND SAFETY CONCERNS

S.NO	HEALTH AND SAFETY CONCERNS	NO. OF RESPONDENTS	PERCENTAGE ANALYSIS
1	YES	42	84%
2	NO	8	16%
Total		50	100%

INTERPRETATION

According to the above table 84% of respondents who are YES in safety concerns and 16% are NO.

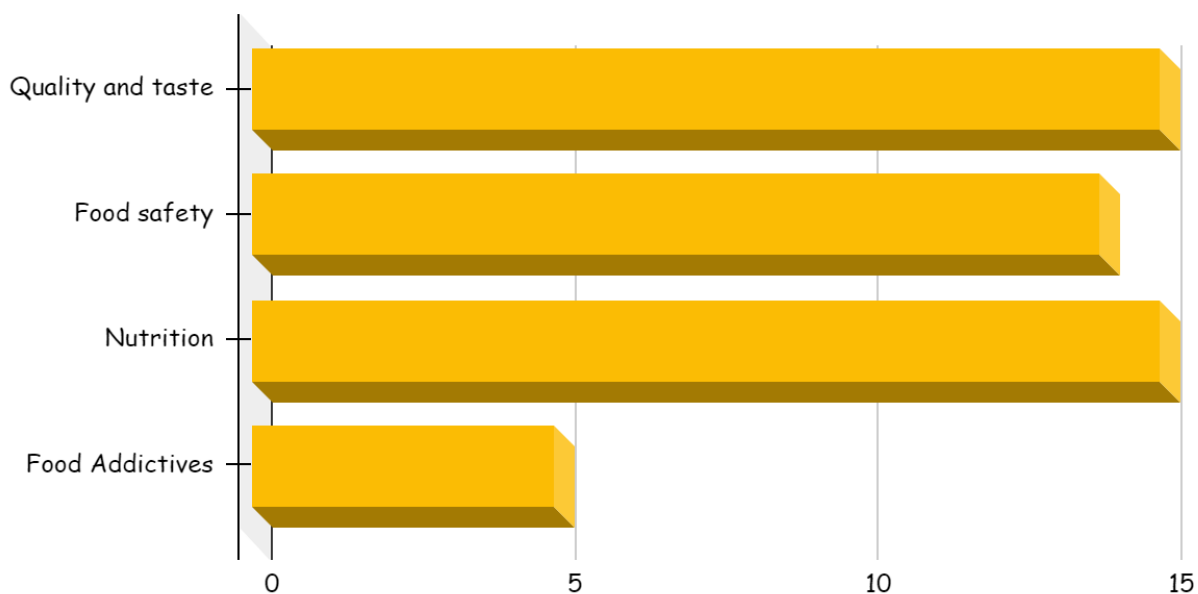
INFERENCE

Majority 84% who are responded Yes in Safety Concerns

8. If yes, what are your primary concerns?

Primary concerns

50 Response



4.1.8 TABLE INDICATING PRIMARY CONCERNS

S.NO	PRIMARY CONCERNS	NO. OF RESPONDENTS	PERCENTAGE ANALYSIS
1.	Quality and taste	15	30.6%
2	Nutrition	15	30.6%
3	Food additives	5	10.2%
4	Food safety	15	28.6%
Total		50	100%

INTERPRETATION

According to the above table 30.6% respondents are both belongs to Quality & taste and Nutrition, 10.2% are Food additives and 28.6% are Food safety.

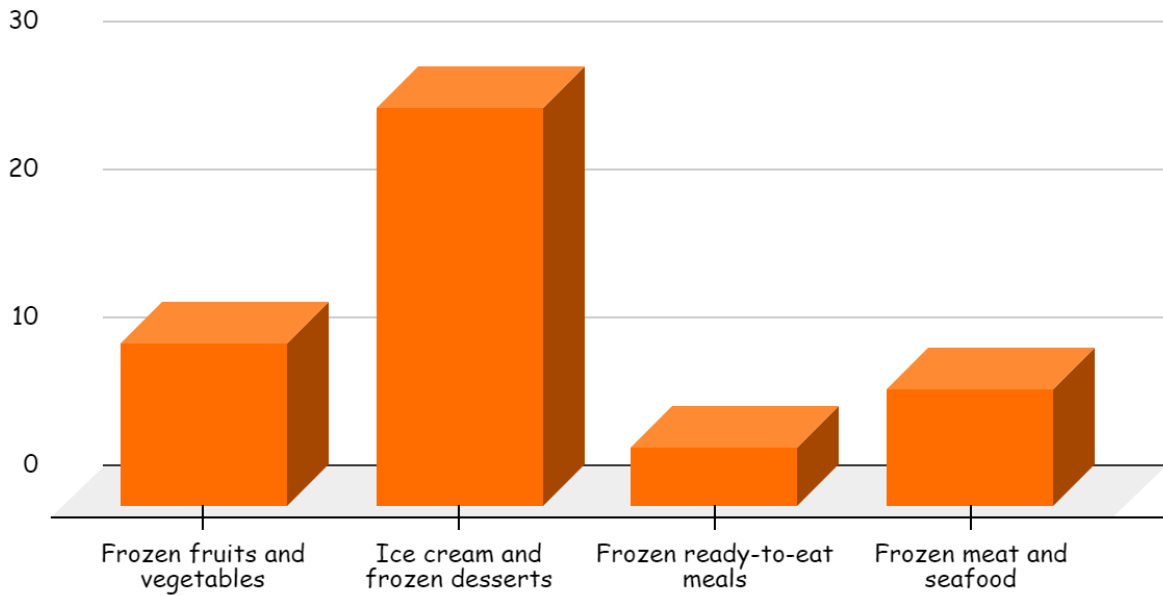
INFERENCE

Majority 30.6% primary concerns are Quality and taste and nutrition.

9. What type of frozen products do you prefer buying?

Analyzing the Types Preferred for Purchase

50 Response



4.1.9 TABLE INDICATING TYPES OF PREFERRED FOR PURCHASE

S.NO	TYPES PREFERRED FOR PURCHASE	NO. OF RESPONDENTS	PERCENTAGE ANALYSIS
1	Frozen fruits and vegetables	11	22%
2	Frozen meat and seafood	8	16%
3	Frozen Ready to eat meals	4	8%
4	Ice creams and desserts	27	54%
Total		50	100%

INTERPRETATION

According to the above table 22% of respondents are frozen fruits and vegetables, 16% who are frozen meats and seafood, 8% are frozen ready to eat meals and 54% are ice creams and desserts.

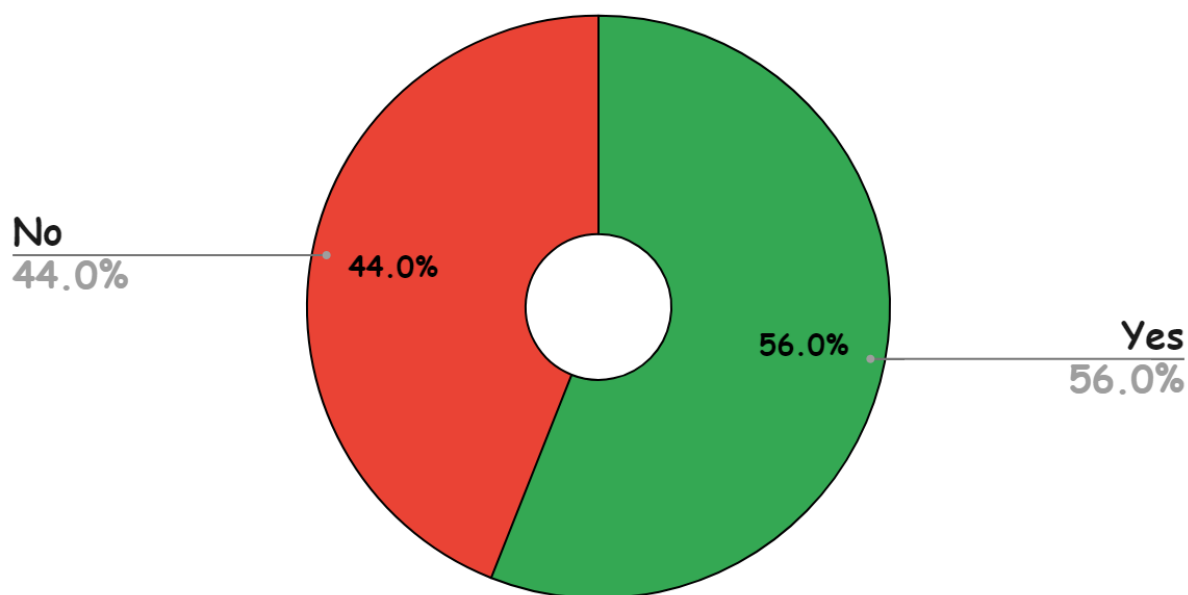
INFERENCE

Majority 54% are belonging to Ice creams and desserts.

10. Have you ever encountered issues with the quality of frozen products you've purchased?

Quality Issues with Purchased Frozen Products

50 Response



4.1.10 TABLE INDICATING QUALITY ISSUES IN A PRODUCT

S.NO	QUALITY ISSUES	NO. OF RESPONDENTS	PERCENTAVGE ANALYSIS
1	Yes	28	56%
2	No	22	44%
TOTAL		50	100%

INTERPRETATION

According to the above table 56% of respondents who are YES in quality issues and 44% are NO.

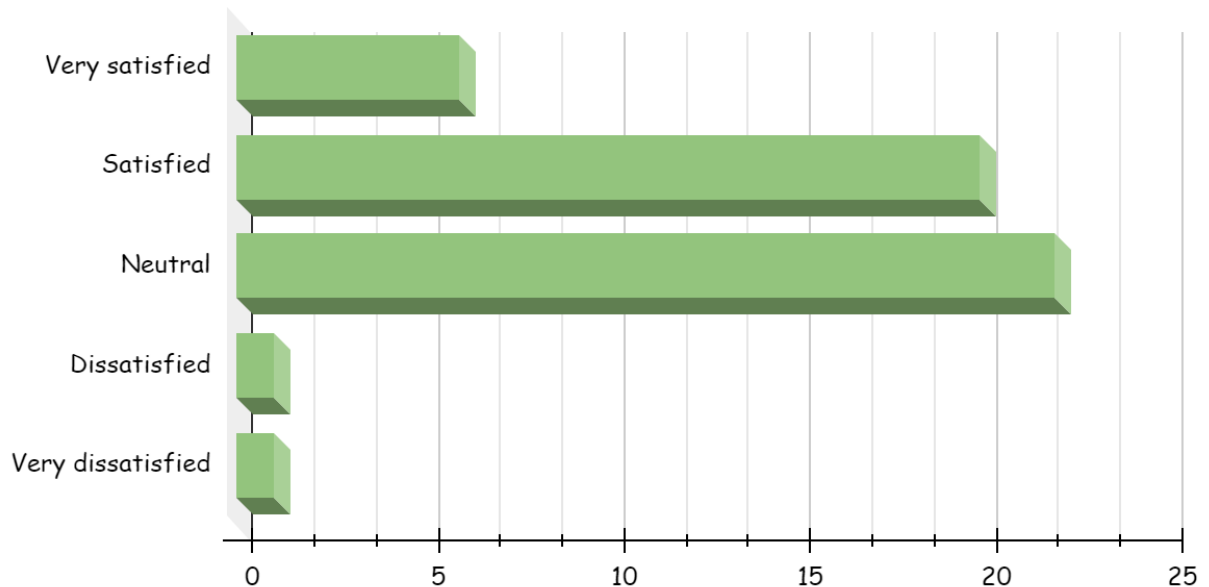
INFERENCE

Majority 56% respondents who are having issues in Frozen products.

11.How satisfied are you with the variety and quality of frozen products available in stores?

Variety and Quality of Frozen Products in Stores

50 Response



4.1.11 TABLE INDICATING SATISFACTION FROM A CUSTOMER

S.NO	SATISFACTION	NO. OF RESPONDENTS	PERCENTAGE ANALYSIS
1	Very Satisfied	6	12%
2	Satisfied	20	40%
3	Neutral	22	44%
4	Dissatisfied	1	2%
5	Very Dissatisfied	1	2%
Total		50	100

INTERPRETATION

According to the table 12% of respondents who are Very Satisfied, 40% belongs to Satisfied, 44% are in Neutral, 2% are in Dissatisfied and 2% are Very Dissatisfied.

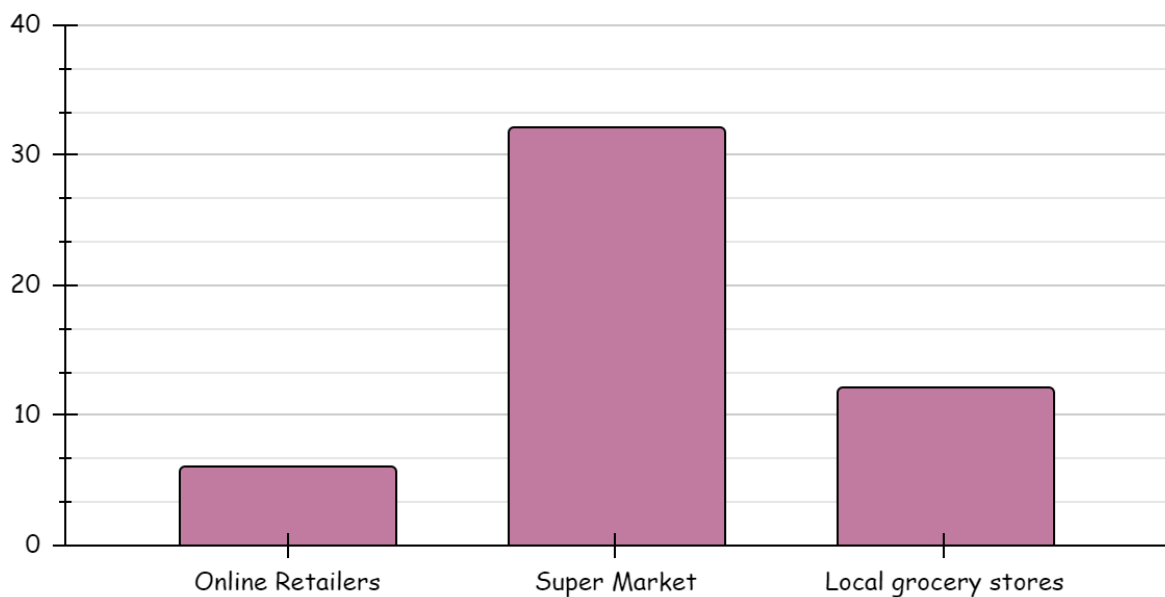
INFERENCE

Majority 44% are neutral in satisfaction of quality and variety in frozen products.

12. Where do you prefer to buy frozen products, and why?

Purchasing Frozen Products at Different Retail Locations

50 Response



4.1.12 TABLE INDICATING RETAILER LOCATION

S.NO	RETAIL LOCATION	NO. OF RESPONDENTS	PEERCENTAGE ANALYSIS
1	Local Grocery store	12	24%
2	Super market	32	64%
3	Online retailers	6	12%
Total		50	100%

INTERPRETATION

According to the above table 24% of respondents are local grocery store, 64% are belongs to super market, and 12% are online retailers.

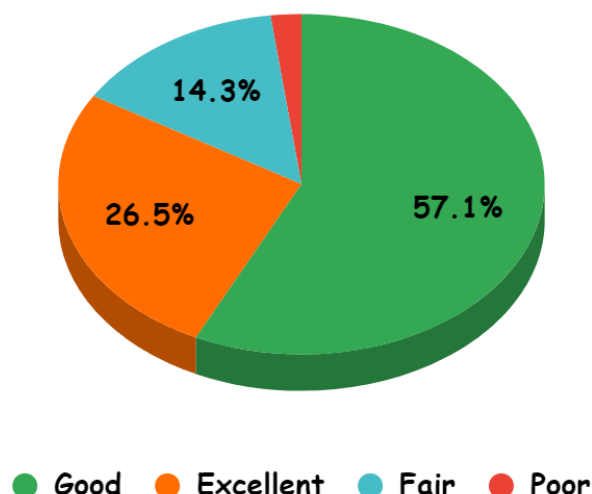
INFERENCE

Majority 64% are used to purchase in Super market.

13. How would you rate your overall shopping experience when purchasing frozen products?

Overall Shopping Experience for Purchasing Frozen Products

50 Response



4.1.13 TABLE INDICATING SHOPPING EXPERIENCE

S.NO	SHOPPING EXPERIENCE	NO. OF RESPONSE	PERCENTAGE ANALYSIS
1	Excellent	14	26.6%
2	Good	28	57.1%
3	Fair	7	14.3%
4	Poor	1	2%
Total		50	100%

INTERPRETATION

According to the above table 26.6% of respondents are experienced excellent, 57.1% are belongs to good 14.3% are fair and 2% are in poor.

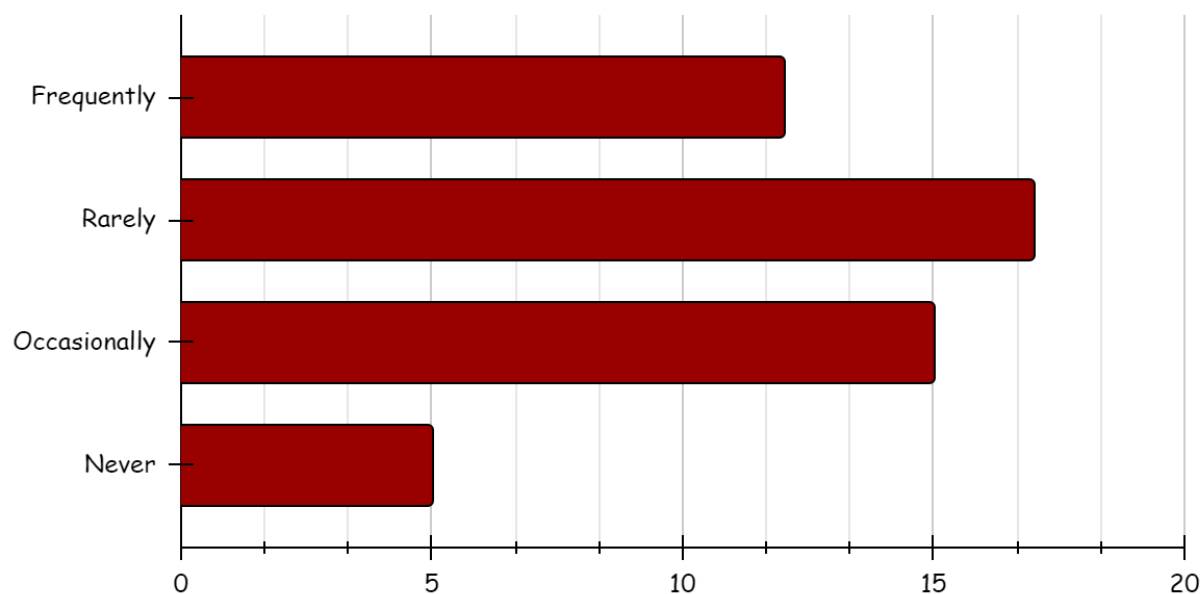
INFERENCE

Majority 57.1% are experienced good while purchasing frozen products.

14. How often do you incorporate frozen products into your meals or snacks?

Incorporating Frozen Products into Meals and Snacks

50 Response



4.1.14 TABLE INDICATING INCORPORATING FROZEN FOODS

S.NO	INCORPORATING FROZEN PRODUCTS	NO. OF RESPONDENTS	PERCENTAGE ANALYSIS
1	Frequently	12	24.5%
2	Occasionally	15	30.6%
3	Rarely	18	34.7%
4	Never	5	10.2%
Total			100%

INTERPRETATION

According to the above table there are 24.5% respondents who are frequently, 30.6% on occasionally, 34.7% are Rarely, and 10.2% are respondents are never.

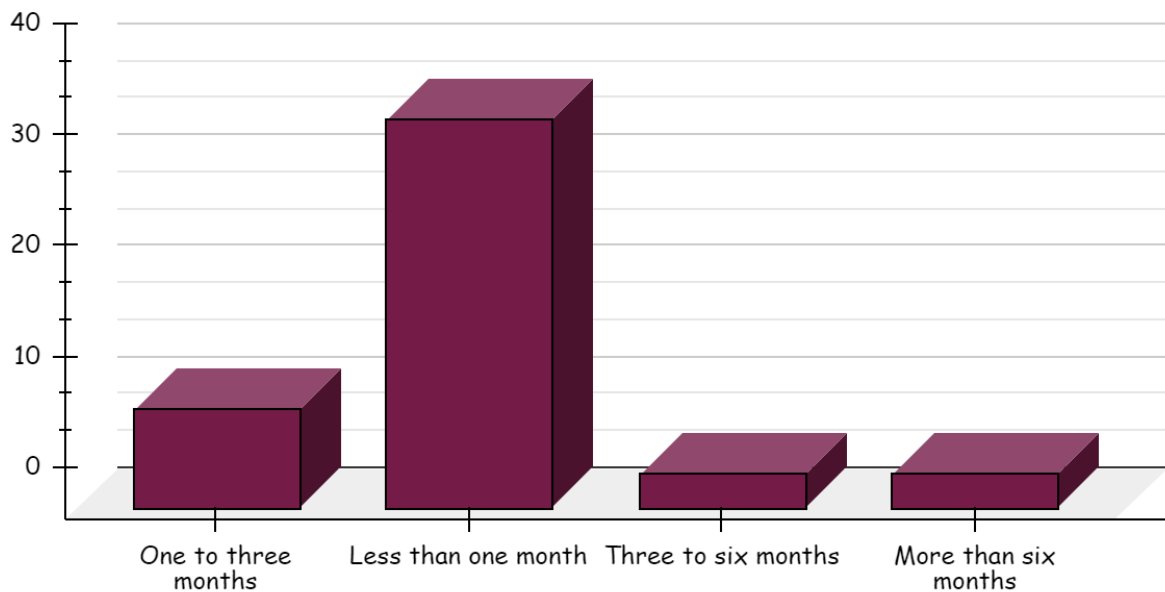
INFERENCE

Majority 34.7% of respondents are incorporating the frozen foods in their meals or snacks.

15. How long can froze food typically be safely stored in a home freezer?

Safe Duration for Home Freezer Storage

50 Response



4.1.15 TABLE INDICATING SAFETY WHILE USING PRODUCT

S.NO	SAFETY	NO. OF RESPONSE	PERCENTGE ANALYSIS
1	Less than one month	35	70%
2	One to three months	9	18%
3	Three to Six months	3	6%
4	More than Six months	3	6%
Total		50	100%

INTERPRETATION

According to the above table 70% of respondents are less than one month, 18% who are one-to-Three months,6% are both three to six months and more than six months.

INFERENCE

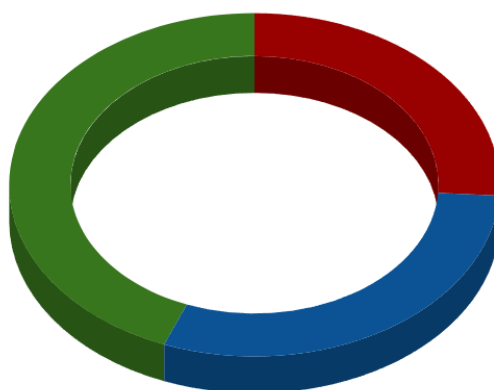
Majority 70% respondents are well safe while storing the products in freezer less than one month.

16. Do you know the recommended temperature for storing frozen products to keep them fresh?

Recommended Storage Temperature for Maintaining Freshness of Frozen Products

50 Response

● No ● Not sure ● Yes



4.1.16 TABLE INDICATING KNOWING RECOMMENDED TEMPERATURE

S.NO	DO YOU KNOW THE RECOMMENDED TEMPERATURE	NO. OF RESPONSE	PERCENTAGE ANALYSIS
1	YES	22	44%
2	NO	13	26%
3	NOT SURE	15	30%
TOTAL		50	100%

INTERPRETATION

According to the above table 44% of respondents who are YES in know the Recommended temperature, 26% are NO and 30% are not sure.

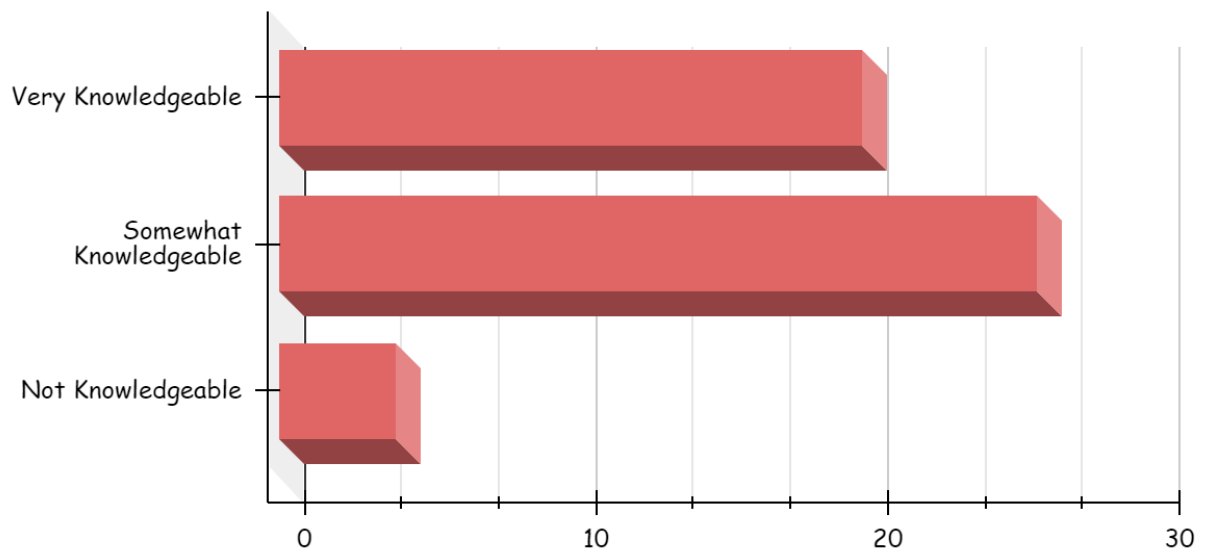
INFERENCE

Majority 44% are knowing the recommended temperature while storing products in freezer.

17. Can you identify signs that frozen products might not be safe to eat, such as freezer burn or changes in color?

Signs of Frozen Product Safety Issues, Including Freezer Burn and Color Changes

50 Response



4.1.17 TABLE INDICATING IDENTIFYING SIGN WHILE BURNING

S.NO	IDENTIFYING SIGNS	NO. OF RESPONSE	PERCENTAGE ANALYSIS
1	Very knowledgeable	20	40%
2	Somewhat Knowledgeable	26	52%
3	Not Knowledgeable	4	8%
Total		50	100%

INTERPRETATION

According to the above table 40% of respondents are very knowledgeable by identifying signs, 52% who are some what knowledgeable and 8% are not knowledgeable.

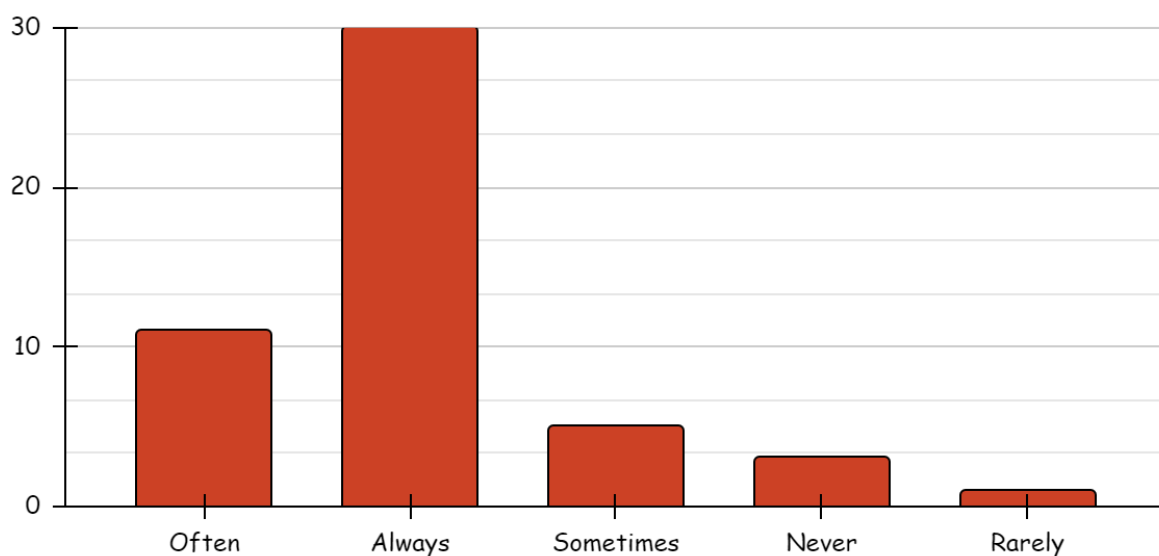
INFERENCE

Majority 52% are some what knowledgeable by identifying signs of frozen products

18. How often do you check the "best before" or expiration dates on frozen products before purchasing?

Checking "Best Before" or Expiration Dates on Frozen Products Before Purchase

50 Response



4.1.18 TABLE INDICATING CHECKING BEST BEFORE WHILE USING THE PRODUCT

S.NO	CHECKING BEST BEFORE	NO. OF RESPONDENTS	PERFORMANCE ANALYSIS
1	Always	30	60%
2	Often	11	22%
3	Sometimes	5	10%
4	Rarely	1	2%
5	never	3	6%
Total		50	100%

INTERPRETATION

According to the table 60% respondents are always check the best before, 22% are often, 10% belongs to sometimes, 2% are rarely, 6% are never.

INFERENCE

Majority 60% of respondents are always check the best before using the products.

HYPOTHESIS-1

H0: There is no significant difference between consumer frequency of buying and consumer perception

H1: There is significant difference between consumer frequency of buying and Consumer perception

Correlations		Consumer	Awareness
Consumer	Pearson Correlation	1	-.129
	Sig. (2-tailed)		.372
	N	50	50
Awareness	Pearson Correlation	-.129	1
	Sig. (2-tailed)	.372	
	N	50	50

INTERPRETATION

The p value is -.129 which is lesser than the significance value (0.05) Hence alternative hypothesis (H1) is accepted and H0 is rejected.

INFERENCE

Therefore, there is a significance difference between the consumer frequency of buying and consumer perception

HYPOTHESIS-2

HO: There is no significant difference between consumer frequency and safety concerns

H1: There is significant difference between consumer frequency and safety concerns

Correlations

		Consumer	knowledge	SafetyConcerns
Consumer	Pearson Correlation	1	.194	.147
	Sig. (2-tailed)		.178	.308
	N	50	50	50
knowledge	Pearson Correlation	.194	1	.336 [*]
	Sig. (2-tailed)	.178		.017
	N	50	50	50
SafetyConcerns	Pearson Correlation	.147	.336 [*]	1
	Sig. (2-tailed)	.308	.017	
	N	50	50	50

*. Correlation is significant at the 0.05 level (2-tailed).

INTERPRETATION

The p value .147 which is greater than the significance value (0.05) Hence null hypothesis (H0) is accepted and (H1) is rejected.

INFERENCE

There is no significant difference between consumer frequency and safety concerns

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
SafetyConcerns	Between Groups	2.215	3	.738	.567	.639
	Within Groups	59.865	46	1.301		
	Total	62.080	49			
knowledge	Between Groups	2.301	3	.767	2.128	.110
	Within Groups	16.579	46	.360		
	Total	18.880	49			

INTERPRETATION

The p value .639 which is greater than the significance value (0.05), Hence null hypothesis (H0) is accepted and (H1) IS Rejected.

INFERENCE

There is no significant difference between consumer frequency and safety concerns

CHAPTER 5

FINDINGS, SUGGESTIONS, AND CONCLUSION

5.1 FINDINGS OF THE STUDY

1. Majority 82% of the respondents belong to the age group of 18- 39 category.
2. Majority 76% of the respondents are male.
3. Majority 48% of the respondents belongs to Under Graduate Educational Qualification.
4. Majority 34% of respondents who are belongs to Rarely Used.
5. Majority 91.8% respondents who are agree the question.
6. Majority 40.8% who are using plastic containers.
7. Majority 84% who are responded Yes in Safety Concerns
8. Majority 30.6% primary concerns are Quality and taste and nutrition.
9. Majority 54% are belonging to Ice creams and desserts.
10. Majority 56% respondents who are having issues in Frozen products.
11. Majority 44% are neutral in satisfaction of quality and variety in frozen products.
12. Majority 64% are used to purchase in Super market.
13. Majority 57.1% are experienced good while purchasing frozen products.
14. Majority 34.7% of respondents are incorporating the frozen foods in their meals or snacks.
15. Majority 70% respondents are well safe while storing the products in freezer less than one month.
16. Majority 44% are knowing the recommended temperature while storing products in freezer.

17. Majority 52% are somewhat knowledgeable by identifying signs of frozen products
18. Majority 60% of respondents are always check the best before using the products.
19. By using correlation for finding the relationship between consumer frequency of buying and consumer perception? that the p value is -.129 which is lesser than the significance value (0.05) Hence alternative hypothesis (H1) is accepted and H0 is rejected.
20. By using correlation for finding the relationship between consumer frequency and safety concerns? that the p value .147 which is greater than the significance value (0.05) Hence null hypothesis (H0) is accepted and (H1) is rejected.
21. By using ANOVA for finding the relationship between consumer frequency and safety concerns? That The p value .639 which is greater than the significance value (0.05), Hence null hypothesis (H0) is accepted and (H1) IS Rejected.

5.2 SUGGESTIONS

- Examine the connection between age, gender, and education levels and customer preferences when it comes to buying frozen food.
- Examine the ways in which age, gender, and educational attainment affect consumers' decisions while purchasing frozen goods.
- Examine the relationship between issues with frozen food products, general satisfaction, and safety concerns.
- Examine consumer purchase patterns, taking into account variables such as frequency, favored goods, and favorite retail sites.
- Look at how customers see the nutritional value, flavor, and quality of frozen food products.
- Provide practical insights into customer behavior, preferences, and safety issues based on the study's findings in the conclusion.

- Provide advice tailored to the frozen food business based on the statistical results, advancing a more sophisticated comprehension of the factors influencing the market.

5.3 CONCLUSION

- The study uncovers noteworthy trends in frozen food consumer behavior.
- A significant majority across age, gender, and education displays a strong preference for frozen products.
- Intriguing patterns emerge in safety concerns, particularly in correlation with purchasing frequency.
- The acceptance of alternative hypotheses in correlation tests highlights nuanced relationships between consumer frequency, perception, and safety concerns.
- The rejection of hypotheses in ANOVA suggests a less conclusive link between certain variables.
- These findings collectively provide valuable insights into consumer preferences and safety considerations in the frozen food market.
- The study establishes a foundational understanding for further industry analysis.
- Insights offer guidance for industry stakeholders to adapt strategies and improve.
- Stakeholders can align strategies with evolving consumer expectations and preferences.
- The study contributes to strategic considerations for the frozen food industry, fostering adaptability and improvement.

REFERENCES

- Makarios Laham, I. K., and Lee, T. C. 1993. "Protein Hydrolysis and Quality Deterioration of Refrigerated and Frozen Seafood Due to Obligately Psychrophilic Bacteria." *Journal of Food Science*
- Gonçalves, A. A., and Junior, C. S. G. G. 2009. "The Effect of Glaze Uptake on Storage Quality of Frozen Shrimp." *Journal of Food Engineering*
- Venugopala, N. G., Prasanna, K. R., Channa Keshava, B.C., Narayanaswamy, S., Krishnamurthy, N., and Suresha, H. S. 2014. "Influence of Plant Population and Nutrition on Seed Yield and Quality in Field Bean (Suresha, H. L. Sweet.) cv. Hebbal Avare-3." Editorial Committee
- Alur, M. D., Neckar, D. P., and Venugopal, V. 1988. "Growth and Protease Secretion by Spoilage Bacteria: Influence of Nitrogen Fractions of Proteinaceous Foods on *Aeromonas hydrophila*." *Journal of Food Science*
- Porret, S., Summate, T., Romaine, S., Sumaya, K and Kerr, W. L. 2007. "Changes in the Ultrastructure and Texture of Prawn Muscle (*Microbrachid Rosenberger*) during Cold Storage." *LWT-Food Science and Technology*
- C., Hogeboom, B., Hogeboom, R., and Lee, C.1999. "Causes for Soft Flesh in Giant Grenadier (*Albatrosses pectoralis*) Fillets." *Journal of Aquatic Food Product Technology*
- Mud afar, M., & Alessiani, H. A. (2019). An Expression Study Profile of Proinflammatory Cytokines in Asthma Patient. *Journal of Asian Scientific Research*
- Caroche, M., Del Mazo, M. L., Torrejon, P., and Tejada, M. 1998. "Importance of Frozen Storage Temperature in the Type of Aggregation of Myofibrillar Proteins in Cod (*Gadus mohua*) Fillets." *Journal of Agricultural and Food Chemistry*
- De Koning, A. J., and Mol, T. H. 1991. "Quantitative Quality Tests for Frozen Fish: Soluble Protein and Free Fatty Acid Content as Quality Criteria for Hake

(*Merluccius capensis*) Stored at -18 °C.” Journal of the Science of Food and Agriculture

- Singh, R. P., and Wang, C. Y. 1977. “Quality of Frozen Foods—A Review.” Journal of Food Process Engineering
- Rodríguez Herrera, J., Pastoriza, L., and Sampedro, G. 2000. “Inhibition of Formaldehyde Production in Frozen-Stored Minced Blue Whiting (*Micromeritica potassium*) Muscle by Cry stabilizers: An Approach from the Glassy State Theory.” Journal of Agricultural and Food Chemistry
- Kennedy, C. J. 2000. “Freezing Processed Foods.” In Managing Frozen Foods, 137-58.
- Pollack, S. L. 2001. “Consumer Demand for Fruit and Vegetables: The US Example.” Changing Structure of Global Food Consumption and Trade Effect of Frozen Storage on the Quality of Frozen Foods
- Holcomb, R. 2000. Food Industry Overview: Frozen Pizza.
- Luh, B. S., Wang, C., and Daoud, H. N. 1975. “Several Factors Affecting Color, Texture and Drained Weight of Canned Dry Lima Beans.” Journal of Food Science
- Fennema, O., and Powrie, W. D. 1964. “Fundamentals of Low-Temperature Food Preservation.” Advances in Food Research
- Khan, M. M. R. 1963. “The Concept of Cumulative Trauma.” The Psychoanalytic Study of the Child
- Erickson, M. C., and Hung, Y. C. 2012. Quality in Frozen Food. Springer Science & Business Media.
- Kramer, A. 1966. “Effect of Packaging on Desiccation and Other Factors of Quality of Vegetables Held Storage.” Maryland Processor Rept.
- A., and Twigg, B. A. 1968. “Measure of Frozen Food Quality and Quality Changes.” In the Freezing and Aeriation of Foods, 4th ed. Westport, Conn: Avi Publishing Co.

ANNEXURE I - QUESSSTIONNAIRE

A Study on Fostering Public Awareness and Education about Frozen Products

Email-

Name-

Age

- Below 15
- 15-18
- 18-39
- Above 39

Gender

- Male
- Female
- Prefer not to say

Education

- SSLC
- HSC
- Under Graduate
- Post Graduate
- PHD

1. How often do you buy frozen products like frozen vegetables, fruits, or ready-made frozen meals?

- Frequently
- Occasionally
- Rarely

- Never

2. Have you ever learned about why it's important to keep some products, like food, vaccines, or medicines in cold?

- Agree
- Disagree

3. What type of packaging or containers do you use for storing frozen products?

- Plastic bags
- Plastic containers
- Foil or freezer paper
- Vacuum-sealed bags

3. Have you have concerns about the health and safety of frozen products?

- Yes
- No

If yes, what are your primary concerns? (Select all that apply)

- Quality and taste
- Nutrition
- Food additives
- Food safety

4. What type of frozen products do you prefer buying?

- Frozen fruits and vegetables
- Frozen meat and seafood
- Frozen ready-to-eat meals
- Ice cream and frozen desserts

5. Have you ever encountered issues with the quality of frozen products you've purchased?

- Yes
- No

6. How satisfied are you with the variety and quality of frozen products available in stores?

- Very Satisfied
- Satisfied
- Neutral
- Dissatisfied
- Very Dissatisfied

7. Where do you prefer to buy frozen products, and why?

- Local grocery stores
- Supermarkets
- Online retailers

8. How would you rate your overall shopping experience when purchasing frozen products?

- Excellent
- Good
- Fair
- Poor

9. How often do you incorporate frozen products into your meals or snacks?

- Frequently
- Occasionally
- Rarely

- Never

10. How long can frozen food typically be safely stored in a home freezer?

- Less than one month
- One to three months
- Three to six months
- More than six months

11. Do you know the recommended temperature for storing frozen products to keep them fresh?

- Yes
- No
- Not Sure

12. Can you identify signs that frozen products might not be safe to eat, such as freezer burn or changes in color?

- Very Knowledgeable
- Somewhat Knowledgeable
- Not Knowledgeable

13. How often do you check the "best before" or expiration dates on frozen products before purchasing?

- Always
- Often
- Rarely
- Never

ANNEXTURE II - RESEARCH ARTICLE

A STUDY ON FOSTERING PUBLIC AWARENESS AND EDUCATION ABOUT FROZEN PRODUCTS

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ABSTRACT

This study explores noteworthy patterns in the behavior of consumers of frozen food, indicating a predominant inclination towards frozen products among a considerable majority across diverse demographic dimensions. Noteworthy trends surface in safety concerns, particularly in their correlation with purchasing frequency, yielding intriguing insights. The acceptance of alternative hypotheses in correlation tests illuminates nuanced relationships between consumer frequency, perception, and safety concerns. Conversely, the rejection of hypotheses in ANOVA suggests a less definitive link between specific variables. Together, these findings offer valuable insights into consumer preferences and safety considerations in the frozen food market. The study establishes a foundational comprehension for industry analysis, providing guidance for stakeholders to adjust strategies, align with evolving consumer expectations, and contribute to the strategic considerations for the adaptable and enhanced future of the frozen food industry.

Introduction

In order to promote public knowledge regarding frozen products, this mini-project highlights the importance of disseminating accurate information. We explore the dynamic environment of the frozen food sector in an era defined by technical

advancements and evolving consumer tastes. Through this investigation, we hope to learn more about consumer preferences and attitudes while highlighting the vital role cold chain logistics play in guaranteeing the safety and quality of frozen goods. With a focus on cold chain logistics innovations and problems, the project investigates processes from production to consumption. The objective is to develop a more knowledgeable consumer base by encouraging safe handling and consumption procedures for frozen goods and, in the end, encouraging a well-rounded understanding of their advantages.

OBJECTIVES FOR THE STUDY

- Raise public awareness about the importance of Frozen products.
- Collect feedback and insights from the public on Frozen Products.
- Evaluate public knowledge about storing Frozen Products.

NEED OF THE STUDY

- It's critical to close the knowledge gap in the public regarding the advantages and common misconceptions about frozen foods.
- Direct consumer insight collection is crucial to comprehending changing frozen product expectations, concerns, and preferences.
- For companies and stakeholders in the frozen food sector, it is critical to recognize and adjust to customer needs based on feedback.
- Evaluating the public's knowledge of the best ways to store food is essential to cutting down on food waste and guaranteeing the integrity and safety of frozen goods.
- The project is to improve customer knowledge, encourage ethical behavior, and have a beneficial effect on the frozen food sector.

SCOPE OF THE STUDY

- Examine how much the general public currently knows about the advantages, nutritional content, and sustainability of frozen foods.

- Evaluate attitudes, pinpoint misunderstandings, and examine current marketing initiatives in the frozen food industry.
- Compile thorough input regarding consumer expectations, worries, and preferences regarding different kinds of frozen products.
- Hold focus groups, interviews, and surveys to gather a range of viewpoints and attitudes.
- Determine how much information the general public is aware of about handling safety procedures and the ideal temperature for storing frozen goods.

REVIEW OF LITERATURE

Food cold chain management- Shashi, Piera Centibels, Roberto Carcione, Myriam Ertz (2020)

This study employs bibliometric and network analysis of 1189 food cold chain (FCC) research articles to provide insights into the field's intellectual development. It identifies influential countries, authors, and research streams, including RFID technologies, planning models, postharvest waste, and critical issues. The findings offer valuable directions for future FCC research, benefiting practitioners, researchers, and policymakers.

Importance of the cold chain logistics in the marketing process of aquatic products-Salami'Il M (2021)

Aquaculture depends heavily on aquatic products, including processed goods and aquatic animals. Their transportability and marketability are crucial. Food safety issues include bacterial infection and oxidation. In order to prevent product quality and safety issues during circulation and transit, cold chain logistics, especially for aquatic items, is essential.

Food cold chain management-Shashi, Roberto Carcione Rajinder Singh, Piera Centibels, Amir Shabani (2018)

In this report, 89 studies on food cold chain management (FCCM) from 2001 to 2016 are reviewed. It pinpoints the gaps in the literature on measurements, drawbacks, and sustainability as they apply to FCC performance measurement. The study serves as an important tool for researchers and practitioners in the field by providing possible research questions (RQs) to improve FCCP evaluation and management.

Risk quantification in cold chain management-Henry Lau, Yung Po Lau, Yung Nkandla, Carman Kumble (2021)

This paper discusses risk management for items that are temperature- and time-sensitive in the cold supply chain. In order to quantify the hazards associated with the cold chain, it offers a Federated Learning-enabled Multi-Criteria Risk Evaluation System (FMRES) that combines FL with the Best-Worst Method (BWM). The strategy is illustrated through a case study of an Australian e-grocery supply chain, providing a novel method for systematically evaluating cold chain hazards.

Cold chain management-J C de Timóteo Malimbe G Bjune (2007)

This study investigates the Niassa province of Mozambique's Expanded Program on Immunization (EPI), with a focus on cold chain management. According to data from 44 healthcare facilities, outlying facilities with staff that is less educated and less experienced have trouble managing the cold chain. In order to improve cold chain processes and successfully integrate knowledge, the study emphasizes the significance of training and supervision, particularly at the periphery level.

RESEARCH DESIGN

- **Primary Data Collection:** Original data obtained straight from the source is referred to as primary data. It is first-hand data collected for particular research or analysis objectives using techniques like surveys, interviews, or experiments.
- **Secondary Data Collection:** Existing information that was gathered by another party for a different goal than the current one is referred to as secondary data. It contains information gathered for study or research from sources like books, journals, government publications, and databases.

HYPOTHESIS

HYPOTHESIS-1

H0: There is no significant difference between consumer frequency of buying and consumer perception

H1: There is significant difference between consumer frequency of buying and Consumer perception

HYPOTHESIS-2

HO: There is no significant difference between consumer frequency and safety concerns

H1: There is significant difference between consumer frequency and safety concerns

PERCENTAGE ANALYSIS

- Analyzing a component's proportionate relationship to the total in terms of percentages is the goal of percentage analysis. In order to evaluate changes, trends, and distributions, it is extensively utilized in statistics, business, and

finance. Values expressed as percentages make comparison easier and shed light on the relative importance of various dataset pieces.

1

S.NO	FREQUENCY OF BUYING	NO. OF RESPONDENTS	PERCENTAGE ANALYSIS
1	Frequently	10	20%
2	Occasionally	16	32%
3	Rarely	17	34%
4	Never	7	14%
Total		50	100%

2

S.NO	IMPORTANCE OF COLD STORAGE	NO. OF RESPONDENTS	PERCENTAGE ANALYSIS
1	AGREE	45	91.8%
2	DISAGREE	5	8.2%
TOTAL		50	100%

3

S.NO	HEALTH AND SAFETY CONCERNS	NO. OF RESPONDENTS	PERCENTAGE ANALYSIS
1	YES	42	84%
2	NO	8	16%
Total		50	100%

S.NO	QUALITY ISSUES	NO. OF RESPONDENTS	PERCENTAVGE ANALYSIS
1	Yes	28	56%
2	No	22	44%
TOTAL		50	100%

INTERPRETATION

- ¹ According to the above table there are 20% respondents who are frequently, 32% on occasionally, 34% are Rarely, and 14% are respondents are never.
- ² According to the above table there are 91.8% who are agree and 8.2% who are disagree the question.
- ³ According to the above table 84% of respondents who are YES in safety concerns and 16% are NO.
- ⁴ According to the above table 56% of respondents who are YES in quality issues and 44% are NO.

INFERENCE

- ¹ Majority 34% of respondents who are belongs to Rarely Used.
- ² Majority 91.8% respondents who are agree the question.
- ³ Majority 84% who are responded Yes in Safety Concerns
- ⁴ Majority 56% respondents who are having issues in Frozen products.

CORRELATION

		CONSUMER	AWARENESS
CONSUMER	PEARSON CORRELATION	1	-.129
	SIG (2- tailed)		.372
	N	50	50
AWARENESS	PEARSON CORRELATION	-.129	1
	SIG (2- tailed)	.372	
	N	50	50

INTERPRETATION

The p value is -.129 which is lesser than the significance value (0.05) Hence alternative hypothesis (H1) is accepted and H0 is rejected.

ANOVA

	Sum of Squares	df	Mean Square	F	sig
<u>Safety Concerns</u>	2.215	3	.738	.567	.639
Between Groups	59.885	46	1.301		
Within Groups	62.080	49			
Total					
<u>Knowledge</u>					
Between Groups	2.301	3	.767	2.128	110
Within Groups	16.576	46	360		
Total	18.880	49			

INTERPRETATION

The p value .639 which is greater than the significance value (0.05), Hence null hypothesis (H0) is accepted and (H1) IS Rejected.

FINDINGS OF THE STUDY

22. Majority 82% of the respondents belong to the age group of 18- 39 category.
23. Majority 76% of the respondents are male.
24. Majority 48% of the respondents belongs to Under Graduate Educational Qualification.
25. Majority 34% of respondents who are belongs to Rarely Used.
26. Majority 91.8% respondents who are agree the question.
27. Majority 40.8% who are using plastic containers.
28. Majority 84% who are responded Yes in Safety Concerns

29. Majority 30.6% primary concerns are Quality and taste and nutrition.
30. Majority 54% are belonging to Ice creams and desserts.
31. Majority 56% respondents who are having issues in Frozen products.
32. Majority 44% are neutral in satisfaction of quality and variety in frozen products.
33. Majority 64% are used to purchase in Super market.
34. Majority 57.1% are experienced good while purchasing frozen products.
35. Majority 34.7% of respondents are incorporating the frozen foods in their meals or snacks.
36. Majority 70% respondents are well safe while storing the products in freezer less than one month.
37. Majority 44% are knowing the recommended temperature while storing products in freezer.
38. Majority 52% are somewhat knowledgeable by identifying signs of frozen products
39. Majority 60% of respondents are always check the best before using the products.
40. By using correlation for finding the relationship between consumer frequency of buying and consumer perception? that the p value is -.129 which is lesser than the significance value (0.05) Hence alternative hypothesis (H1) is accepted and H0 is rejected.
41. By using correlation for finding the relationship between consumer frequency and safety concerns? that the p value .147 which is greater than the significance value (0.05) Hence null hypothesis (H0) is accepted and (H1) is rejected.
42. By using ANOVA for finding the relationship between consumer frequency and safety concerns? That The p value .639 which is greater than the significance value (0.05), Hence null hypothesis (H0) is accepted and (H1) IS Rejected.

SUGGESTIONS

- Examine the connection between age, gender, and education levels and customer preferences when it comes to buying frozen food.
- Examine the ways in which age, gender, and educational attainment affect consumers' decisions while purchasing frozen goods.
- Examine the relationship between issues with frozen food products, general satisfaction, and safety concerns.
- Examine consumer purchase patterns, taking into account variables such as frequency, favored goods, and favorite retail sites.
- Look at how customers see the nutritional value, flavor, and quality of frozen food products.
- Provide practical insights into customer behavior, preferences, and safety issues based on the study's findings in the conclusion.
- Provide advice tailored to the frozen food business based on the statistical results, advancing a more sophisticated comprehension of the factors influencing the market.

CONCLUSION

- The study uncovers noteworthy trends in frozen food consumer behavior.
- A significant majority across age, gender, and education displays a strong preference for frozen products.
- Intriguing patterns emerge in safety concerns, particularly in correlation with purchasing frequency.
- The acceptance of alternative hypotheses in correlation tests highlights nuanced relationships between consumer frequency, perception, and safety concerns.
- The rejection of hypotheses in ANOVA suggests a less conclusive link between certain variables.
- These findings collectively provide valuable insights into consumer preferences and safety considerations in the frozen food market.
- The study establishes a foundational understanding for further industry analysis.

- Insights offer guidance for industry stakeholders to adapt strategies and improve.
- Stakeholders can align strategies with evolving consumer expectations and preferences.
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- Makarios Laham, I. K., and Lee, T. C. 1993. "Protein Hydrolysis and Quality Deterioration of Refrigerated and Frozen Seafood Due to Obligately Psychrophilic Bacteria." *Journal of Food Science*
- Gonçalves, A. A., and Junior, C. S. G. G. 2009. "The Effect of Glaze Uptake on Storage Quality of Frozen Shrimp." *Journal of Food Engineering*
- Venugopala, N. G., Prasanna, K. R., Channakeshava, B.C., Narayanaswamy, S., Krishnamurthy, N., and Suresha, H. S. 2014. "Influence of Plant Population and Nutrition on Seed Yield and Quality in Field Bean (Suresha, H. L. Sweet.) cv. Hebbal Avare-3." Editorial Committee
- Alur, M. D., Neckar, D. P., and Venugopal, V. 1988. "Growth and Protease Secretion by Spoilage Bacteria: Influence of Nitrogen Fractions of Proteinaceous Foods on *Aeromonas hydrophila*." *Journal of Food Science*
- Porret, S., Summate, T., Romaine, S., Sumaya, K and Kerr, W. L. 2007. "Changes in the Ultrastructure and Texture of Prawn Muscle (*Microbrachid Rosenberger*) during Cold Storage." *LWT-Food Science and Technology*
- C., Hogeboom, B., Hogeboom, R., and Lee, C.1999. "Causes for Soft Flesh in Giant Grenadier (*Albatrosses pectoralis*) Fillets." *Journal of Aquatic Food Product Technology*
- Mud afar, M., & Alessiani, H. A. (2019). An Expression Study Profile of Proinflammatory Cytokines in Asthma Patient. *Journal of Asian Scientific Research*

- Caroché, M., Del Mazo, M. L., Torrejón, P., and Tejada, M. 1998. "Importance of Frozen Storage Temperature in the Type of Aggregation of Myofibrillar Proteins in Cod (*Gadus morhua*) Fillets." *Journal of Agricultural and Food Chemistry*
- De Koning, A. J., and Mol, T. H. 1991. "Quantitative Quality Tests for Frozen Fish: Soluble Protein and Free Fatty Acid Content as Quality Criteria for Hake (*Merluccius capensis*) Stored at -18 °C." *Journal of the Science of Food and Agriculture*