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44. Artificial Intelligence - The road ahead with special reference to Banking sector

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Abstract

The banking sector has always been the driving force behind the application of new technologies. Artificial intelligence is more an opportunity than a threat. It is a tool to make the banking services more efficient and better. So it's a speed shift rather than a trend shift. AI adoption is greatest in sectors that are already strong in Digital adopters. Digital solution providers state that 75 % of the current banking operations can undergo robotic process automation (RPA). Automated systems can ensure compliance with internal regulation every time and collect data that will be further used to calibrate the system even more. Digitilisation and robotics boost hitpoints between the customers and the bank. The banks seem to be competing with each other to launch their AI solutions and stay ahead in the technology adoption curve to meet intense competition and customer expectation.

Key Words : Artificial Intelligence, Automation, AI powered Solutions, Robotics, Digitilisation

Introduction

To achieve our vision of digital equality, we need to understand how new technologies are shaping society; where they present opportunities to make people's lives better, and indeed where they threaten to create harm. Artificial intelligence is a reality today and it is impacting our lives faster than we can imagine.

Artificial intelligence is the blend of three advanced technologies – machine learning, natural language processing and cognitive computing. The concept of Artificial Intelligence is to simulate the intelligence of humans into artificial machines with the help of sophisticated machine learning and natural language processing algorithms. The prime motive for the idea of transferring the intelligence from humans to machines is to overcome the very barrier of human intelligence: scalability. There's always a limit to the speed with which humans can perform the given tasks. Artificial intelligence looks to overcome this very challenge with human intelligence by transferring the human intelligence to cognitive machines with supreme computational

capabilities. Financial institutions are beginning to explore how artificial intelligence decrease costs, enhance revenue, reduce fraud and improve the customer experience. While there are challenges, it is time for organizations of all sizes to invest, learn and partner with experts who can help exploit the benefits of AI.

Some of the key applications of artificial intelligence in the Banking industry that will revolutionize the industry in the coming years.

AML Pattern Detection

Anti-money laundering (AML) refers to a set of procedures, laws or regulations designed to stop the practice of generating income through illegal actions. In most cases, money launderers hide their actions through a series of steps that make it look like money that came from illegal or unethical sources are earned legitimately. Most of the major banks across the globe are shifting from rule based software systems to artificial intelligence based systems which are more robust and intelligent to the anti-money laundering patterns. Over the coming years, these systems are only set to become more and more accurate and fast with the continuous innovations and improvements in the field of artificial intelligence.

Chat bots

Chat bots are artificial intelligence based automated chat systems which simulate human chats without any human interventions. They work by identifying the context and emotions in the text chat by the human end user and respond to them with the most appropriate reply. With time, these chat bots collect massive amount of data for the behaviour and habits of the user and learns the behaviour of user which helps to adapts to the needs and moods of the end user. Chat bots are already being extensively used in the banking industry to revolutionize the customer relationship management at personal level. Bank of America plans to provide customers with a virtual assistant named "Erica" who will use artificial intelligence to make suggestions over mobile phones for improving their financial affairs. Allo, released by Google is another generic realization of chat bots.

Algorithmic Trading

Reports claim that more than 70% of the trading today is actually carried out by automated artificial intelligence systems. Most of these hedge funds follow different strategies for making high frequency trades (HFTs) as soon as they identify a trading opportunity based on the inputs.



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Principal

"A Study to Know the Ambience Variables Which Small and Medium Apparel Retail Outlets Consider Important"

*Prof. Satish Agarwal

* **Privanka Sharma

Abstract

In today's competitive Business Environment importance of Store Ambience in promoting small and medium apparel retail outlets cannot be overlooked. Atmospheric involves a conscious designing of store space to affect customer's sensory experience. Therefore it is essential for the owners of small and medium apparel retail outlets to critically analyse the various variables of store ambience and make a perfect combinations of them which will help in attracting and retaining customers. Store ambiances not only help in retaining customers for a longer period of time but also persuade them for unplanned purchases which results in additional sales and profit. Store ambience attributes plays an important role in making choice of shopping store. Owners of apparel retail outlets are focussing on various ways of altering store ambience factors so as to provide customers a unique shopping experience and investing little time and effort on physical environment will definitely increase sales, affect customer purchase intention and make a world of difference

Retailers, Researchers and academicians have recognised that store ambience plays an important role in the success of a Business. The main focus of this paper is to provide a systematic overview of the concept of store atmosphere and to explore and identify the various factors of store atmosphere by reviewing existing literature available and also conducting an empirical research to know the store ambience variables which owners of small and medium apparel retail outlets consider important.

Key Words: - Store Ambience, factors of Store Ambience.

Introduction

In Apparel sector the level of competition is very high. In order to survive in this challenging business era, owner of Apparel retail outlets should focus on customers preferences and critically analyse the factors which attracts the customers towards their shops and influences their purchasing decisions. Owners of apparel outlets has realised that in addition to the quality of a products being offered, the Store ambience of the shop also plays a prominent role in attracting and retaining customers. Singh Priyanka, Katiyar Neha, Verma Gaurav (2014) in their research suggested that store ambience attributes affects the image of the store. Ambience Planning is a complex task as main objective is to maximise sales and minimize cost. It affects the customer's perception of a store. Kotler defines atmospheric as "the effort to design buying environment to produce specific emotional effect in the buyer that enhance his

"A Study to Know the Ambience Variables Which Small and Medium Apparel Retail Outlets Consider Important"
Prof. Satish Agarwal & Priyanka Sharma

purchase probability" Kotler(1973)suggested that use of atmospheric can be used as competitive tool to attract and maintain a specific target market especially where product and price differences are nominal. Faldu Rajesh(2012)in their research paper concluded that Lifestyle in India is changing from soberness to hedonism due to dual-income nuclear family unit, a steady shift towards an ambition of a global lifestyle. A consumer of today spends to attain the "feel good" factor. Shopping therefore has developed from a need-based activity to a spare-time entertainment. In the Indian context, a study was done on store choice behaviour indicated Indian shoppers on an overall basis give importance to proximity of the store, merchandise and service provided by the store and stores dealing in apparels are also chosen based on ambience. Daniel P.,Dr. Narayana M.S. ,Prof. Kumar P. Vijay,(2016)concluded that retailers faces a more knowledgeable and demanding consumer and since business exists to satisfy the needs of the consumers, the demands and expectations of the consumers often have forced retail organizations to change their formats and product offerings. Store atmospherics includes store's physical characteristics such as music, scent, temperature, lighting, colour and much more that are used to develop an image and draw customers. Kotler (1973) recommended that along with the trends toward retail innovation and evolution, retailers and store managers now interested in how shoppers get experience while they come to the store. It has long been recognized that consumers respond not only based on the product or service quality itself but they also take much attention on the store environment. It is because; besides product and services, the atmosphere of the store is also one of the influential factors in the purchase experience.

Review of Literature

Singh Priyanka, Katiyar Neha, Verma Gaurav (2014) concluded that owners of apparel shops has claimed that they have influenced customer's buying behaviour by manipulating store atmospheric via layout, colour, lighting and music. Donovan, Robert and John Rossiter (1982)found that pleasant environments encouraged consumer to stay longer in the selling environment and to make unplanned purchase. Store atmospheric attributes such as colour, lighting, interior decoration or music form the overall context within which shoppers make store selection and patronage decisions, and are likely to have a significant impact on store image. Selection of a specific retail outlet involves a comparison of the available alternative outlets on the evaluative criteria of a consumer. Donovan R. J., & Rossiter J. R., Marcoolyn G., & Nesdale A.(1994)said that in our competitive era, an attractive store ambience is essential in encouraging customers to buy products. A considerable number of studies have been performed based on the proposition of the environment of the store on satisfaction level and purchase behaviour of the consumer. Prasad Y.Ramakrishna (2012)concluded that apparel retailing is considered as one of the fast moving consumer goods retailing (FMCG). Hence the goods should be moved or sold faster than we expect, otherwise the retailers should face problems in selling. Terblanché and Boshoff (2006) affirmed that the store's décor is an essential element in the store's overall outlook, and can be designed to enhance customer

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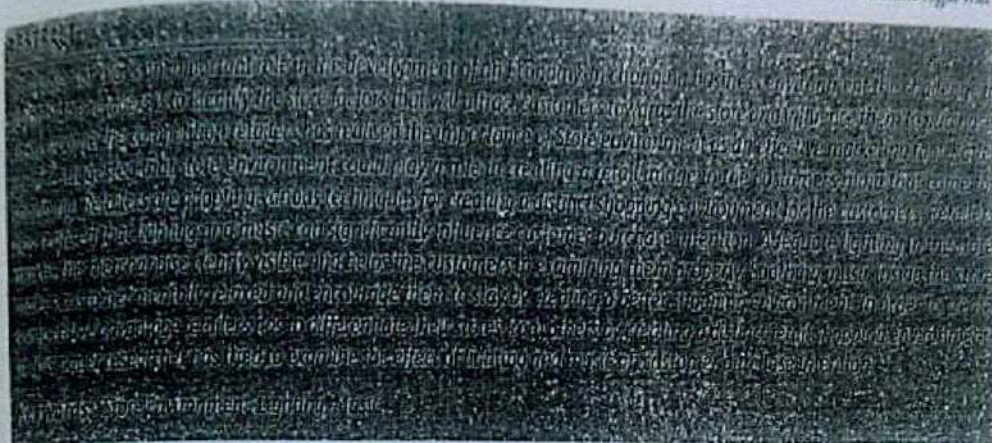
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A Research to Study the impact of Lighting and Music on Customer Purchase Intention with special reference to Big Bazaar of Jaipur

Ms. Priyanka Sharma*
Prof. Satish Agarwal**



INTRODUCTION

Retailing is one of the biggest sectors and it is witnessing revolution in India. It is expected to grow tremendously in next few years. With the change of taste and preferences of customers, Retail Industry is getting more popular these days. According to Sikri Sunita, Wadhwa Dipti "The word Retailing refers to any activity that involves the direct sale to an individual customer or end user. McGoldrick(1990);Marsh,(1999)said in their studies that competing with other retailers beyond the basic concepts of price, convenience, and assortment is the key to success in today's competitive scenario. As a means of differentiating itself with others, retailers through store atmospheric elements such as flat screen videos of graphics, music, smells, and lighting excite the senses of shoppers. According to Levy and Weitz(2009)store environment is referred to as the attribute that aims to intensify the store environment with the combination of different cues such as lighting, colour, music, and scent. Chitra K Vijaya(2009)said atmospheric includes stores physical characteristics that are used to develop the retail unit image and draw customers. It describes the physical elements in a store's design that appeals to customers and encourages them to buy. Banerjee Sonali, Saha Sunetra(2012)concluded that smart brands and retailers will spend more effort in-store in terms of improving not only store interiors but also the overall shopping experience, even if they are high value-seeking ones. In today's Post-modern Era shopping has become a social and leisure activity, reducing the number of cognitively planned purchases made by customers. Ambient are crucial tangible components of the service product that give cues to customers and create a perceptual image in the minds of customers.

REVIEW OF LITERATURE

Gilboa and Rafsali (2003) in our competitive era, an attractive store ambiance is essential in encouraging customers to buy products. Many researchers, retailers, marketers and practitioners have investigated the influence of ambient factors on customer patronage and customer behaviour in general. Bitner (1992) the ambient factors play a significant role in forming customers' impression.

Music

According to Basera Clay Hutama, Mutsikiwa Munyaradzi & Dhliwayo Kossam (2013)the music played affects buyers' behaviour, creates image, attracts attention or controls store traffic. Volume and tempo can control the crowd in store. Levy Michael & Weitz, Barton A (2012) said that Music can be used to section-off different departments in a store, for example use music that will distinguish women's wear from children's wear. According to

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Krishna A (2010) sound is an important element that retailers should carefully consider, as it may play a vital role in the customer's consumption experience. Ruchi G., Zillu, R. & Ishwar K(2010)said that using proper music in retail store is able to stimulate the mind of customers and corresponding with customer emotional response. Proper music means that playing the right music at the right time to create positive effect of patronage intention. Grewal D., Baker, J., Levy M. & Voss G.B(2002)said that music is an important element in enhancing in-store feelings and emotions. According to Mattila AS & Wirtz J(2001)Music have impact on both how long customers spend in a shop and how much they buy. According to L. W. Turley & Ronald E. Milliman (2000) Music played in a store can have a significant impact on a variety of behaviours including sales, arousal, perceptions of and actual time spent in the environment, in-store traffic flow, and the perception of visual stimuli in the retail store. Holbrook Morris B. & Meryl P. Gardner (1993)said that fast music tempo increase arousal. Milliman Ronald E (1986) said that Music is one of the most efficient and effective ways in generating positive mood and communicating with customers in non-verbal way. Grewal D., Baker J., Levy M. & Voss G.B (2002)in agreement with Mattilia and Wirtz(2001)said that music is an important element in enhancing in-store feelings and emotions. Basera, Clay Hutama, Mutsikiwa Munyaradzi, Dhliwayo, Kossam(2013)carried out a research which indicated that musical types are more appropriate for certain stores and failure to matches the music and the shop can have negative results. When preferred music is played, customers stay longer, become more comfortable and relaxed, and are likely to order more items. The opposite is also true, when ambient noise is, fast, loud and causing discomfort, customers will spend less time in a retail shop.

Lighting

Basera Clay Hutama, Mutsikiwa Munyaradzi & Dhliwayo Kossam (2013)in their research concluded that lighting has an influential impact on how customers react and finally reach at the purchase decisions. According to Hultén B., Broweus N. & Van Dijk M(2009) appropriate lighting has the ability to create an appropriate mood, which in itself attracts and captures the customer's interest. According to Vaccaro (2008)when the store environment is brighter, buyers are likely to observe and touch the commodities in the store. Areni & Kim(1994)said that Lighting directly influences customer perception towards store image and their mood to shop in the store. In-store lighting influences customer's perception, value and expenditure. The impact of lighting was examined by Areni C. S. & Kim D (1994)that lighting factors can influence both the store image and handling of merchandise. Boyce & Raynham (2009); Rea(2000)concluded that the main functions of retail lighting are to provide ambience illumination, attract attention and accentuate merchandise. In general, lighting arrangement, brightness level, light source property, uniformity and contrast are important factors to be considered in retail lighting design. Summers and Hebert (2001) demonstrated that lighting plays an important role in increasing behavioural intentions in store's atmosphere. Additional accent lighting was found to be more time spending, product touching and picking up. Schielke (2010) suggested that coloured light could convert identity of retail space, such as price level, style, expressiveness and attractiveness. Schielke and Leudesdorff (2015) suggested that store types and lighting arrangements could affect a store's brand image in which that decorating lighting (e.g., accent lighting, wall washing, grazing lighting) could increase positive emotions and enhance retail identity. Taylor and Socov's research showed that light influences the route customers take through the store. This study indicates that people are drawn to light and that they, therefore, will choose the more illuminated path when passing an obstacle. Areni and Kim added to this knowledge by doing experiments with wine bottles in a store. Under 'bright lighting' conditions bottles were more often examined and touched than under 'dim lighting' conditions. Magnum took this one step further and showed that lighting influences the attractiveness of products in a store. James and Mehrabian (1976)said that lighting can be the main factor of store environment that has greater impact on customer behaviour. This means that bright light helps customers to have positive attitude towards the business or retail brand. Basera, Clay Hutama, Mutsikiwa Munyaradzi, Dhliwayo, Kossam (2013) People believe that bright lights allow them to see the merchandises clearly and also some believe that it livens up the store environment According to Levy and Weitz (2009) lighting in a shop involves more than just illuminating space. Lighting helps in creating a sense of excitement in the retail shop. This means that bright lighting induces shoppers to behave positively towards a business or a retail brand. It gives an accurate colour rendition of the goods in the shop. One essential use of light is called popping the merchandise that is focusing spotlights on special items. Popping the



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STORE ENVIRONMENT- A STRATEGY FOR SUCCESS IN RETAILING

Priyanka Sharma*
Prof. Satish Agarwal**

Abstract

Ambience of a shop plays an important role in creating an image in the minds of the customers. The influence of store Ambience on buying behaviour is increasing with the rise in two income and single head of household families who are mostly making more purchase decisions in the store. Retailers has also realised the impact of store environment on shopping behaviour and are therefore devoting considerable amount of resources to their store design and merchandise presentation in order to attract and retain customer. How good a retail store may be in offering the best of products at the best bargains, but all efforts would be fruitless if there are no people walking through the door. Therefore to beat the competition and survive in the market retailers need to make their store visually attractive from the inside and welcoming from the outside. The main focus of this paper is to identify the factors of store Ambience which customers consider important.

Keywords: Store Environment, Store Ambience, Atmosphere, Lighting, Sales Person, Retailing.

Introduction

Store atmosphere plays an important role in influencing customer buying behaviour. Kotler (1973) defined Atmosphere as a conscious design of an area in order to create a desired effect on consumers. It is the effort to design a shopping environment that produces emotional effects on the individual in order to increase their likelihood of purchase. Zomerdijk & Voss(2010)concluded by saying that there is an important difference between "desired atmosphere" and "perceived environment". The first refers to the set of sensory qualities designed for the artificial environment in order to establish a specific "ambience". On the other hand, perceived atmosphere can vary from one individual to another, one's reaction to colors, sounds, noise and temperature are partially learned, and they cannot be fully controlled by organizations. Turley & Milliman (2000) said that The atmospheric characteristics of a store are relevant for they influence a wide variety of consumer evaluations and behaviours. Soars(2009) said that atmosphere is a useful mean to draw the attention of consumers through the use of colors, sounds, sights, smells, touch and movements, to differentiate themselves from others. Kotler (1973) warns that even the atmospheres considered successful must undergo a periodic review, as its influence declines over time, depending on the customers getting used to it or the progress of competitors in the direction of more efficient and new atmospheres. Verhoef et al. (2009) said that creating a superior customer experience seems to be one of the central objectives in today's retailing environments. Bitner (1990) said that significant effort has been made to understand which specific environmental cues need to be modified in a store in order to increase sales, extend the time spend in the store or other approach behaviours.

Review of Literature

Turley & Milliman (2000) said that the store atmosphere is the stimulus that causes the consumer evaluation in relation to the environment, and some behavioural responses. A major reason for non-functional in store purchases corresponds to sensory stimulation. The store atmosphere can enhance the quality perceived by consumers, which leads to higher levels of persuasion According to Kotler (1973).

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The atmosphere is always presented as the quality of space "around" and it is described in sensory terms. The main sensory channels to the atmosphere are vision, hearing, smell and touch. Specifically, the most relevant visual dimensions of the store atmosphere are: colour, brightness, size and shapes. The main dimensions are: volume and pitch; Olfactory: smell and freshness; Tactile: softness, smoothness and temperature. Turley & Chebat (2002) said that complete reformulation of atmosphere is not a simple challenge, but it has the ability to significantly alter the perception of the consumer on the store. Thus, the components present in a sensory retail environment emerge as tools for the provision of experiences to consumers, which can bring competitive advantages if worked differently and consistently with the market segments targeted. Colours produce different reactions in individuals and retailers are trying to use colours to bring consumers to a mood state that leads to product purchase. Playing the appropriate background music can help retailers develop a desirable atmosphere, which contributes to the image of the store and consumer choice. The elements under control of the retailer (retail atmosphere) are usually those related to the customer's senses. For instance, the store can manage the amount of light, the colours on the walls, the kind of music played on the background, etc, and the olfactory cues can exert a strong influence on the consumer responses related to a specific store atmosphere. Bone and Ellen(1999) argued that retailers, once perceiving the power of olfactory stimulus have searched competitive advantage through this variable Herrmann et al. (2013) a store that presents smells that are pleasant is better evaluated by the consumer. The use of perfumes in environment or odours in the atmosphere as means of influencing human behaviour seems to be growing. Pine and Gilmore (1999) indicated that creating a unique customer experience can provide financial value for the company. Baker et al. (2002) said that Store atmosphere can interact with consumer perceptions to affect behaviour. The notion that store atmosphere influences consumer behaviour was introduced to marketing research by Kotler, who initially defined atmosphere to be a component of store image along with other variables, such as brightness and crowding. Baker (1987) identified environmental cues in a store to be either Ambient Factors, Design Factors, or Social Factors Also an extreme ambient factor, such as very high or very low temperature can lead to avoidance behaviour. Music has an impact on sales, time spent in the environment and the state of arousal. Yalch & Spangenberg (2000) said that the extend of the effect depends on the type of music, e.g., foreground vs. background music, the tempo and volume of music and the age of the patron Yalch & Spangenberg (1990) Several studies have confirmed that the mere presence or absence of a scent has a significant influence on consumer behaviour, irrespective of the odour. Bone and Ellen (1999) identified 34 studies showing statistically significant effects of scent presence on consumers' response. Parsons (2009) In general it can be assumed that pleasantly scented environments lead to approach behaviours while unpleasant environments cause avoidance Spangenberg et al.(2006). Presence of a pleasant but non associated scent may even lead to negative responses. The presence of mediation variables, such as gender, needs to be considered. one study confirmed that in the presence of gender-congruent ambient scent ('rose maroc' for men, 'vanilla' for women) shoppers perceive to have spent more time in the store, bought more items and spent more money on their purchases. Griffitt (1970) ambient temperature level was found to influence interpersonal attraction of people. Baker (1987). It seems likely that while acceptable levels of temperature go unnoticed by customers, too high or low levels increase the probability of avoidance behaviour. Wakefield & Baker(1998) said that the decor, layout, music, etc. of a mall are especially important to keep customers in a mall once they enter. Gagnon & Osterhaus (1985) said that a prominent floor display of a product increases sales significantly irrespective of the type or size of retail store. Turley & Milliman (2000)said that retail personnel's number, appearance and behaviour impacts consumer's perception of a firm and therefore influences behaviour Bitner (1990) concluded that when service failures occur, employees dressed in unprofessional attire have been shown to negatively influence a customer's attribution and satisfaction. Baker, Levy & Grewal (1992) said that the number and friendliness of employees has a positive impact on levels of pleasure and arousal, which in turn impacts willingness to buy. Hutton & Richardson (1995) Stores with more sales personnel on the shop floor greeting customers were perceived as providing a higher service quality than stores with less staff not offering a greeting. Harrell & Hutt (1976) an individual's assessment of the presence of others in a limited space will be referred to as the perception of crowding. It is important to differentiate this from density, i.e. the actual

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An Empirical Study of Efficient Resource Allocation Using Modified Particle Swarm Optimization in Cloud Environment

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Abstract--- It is evident that in rising computing paradigms such as cloud computing systems, efficient resource allocation is one of the main segments to take advantages of the capabilities. The cloud computing environment is an active environment which allows the services to be shared among many users. Cloud environment requires new allocation methods customized to specifications. In this paper Modified Particle Swarm Optimization (MPSO) algorithm is used to achieve an allocation that benefits the users who utilize the resources in cloud. It is a technique inspired by the behaviour of birds flocking where particles search the problem space to find an optimal solution. The algorithm was developed with the aim of allocating the resources efficiently in a cloud environment. The proposed algorithm shows better results in terms of flowtime and task execution cost when compared with Particle Swarm Optimization (PSO) and Genetic Algorithm (GA).

Keywords--- Resource Allocation, Modified Particle Swarm Optimization, Cloud Computing, Flow Time, Task Execution.

I. Introduction

One of the main services of cloud environment is resource allocation. The process of assigning the available resources in an effective way over the internet to multiple clients is called Resource allocation. For efficient resource allocation, available resources in cloud should be assigned to different activities taking into consideration the availability of resource and project time. Resources starvation will occur if the allocation is not managed precisely. Resource Allocation is integrated with cloud provider activities for utilizing and allocating resources within the limit of cloud environment so as to meet the needs of cloud applications. It requires the type and amount of resources needed by each application in order to complete a user job. The objective of this paper is to make an efficient allocation of resources in cloud environment. The proposed algorithm helps in meeting the objective by measuring the resource usage to exhibit better flow time and minimized task execution cost. Advantage of this algorithm is that it has an expanded search space when compared with PSO and GA. Its convergence rate is also high. It also makes computations more efficient.

II. Literature Review

Substantial quantity of research using server consolidation and task consolidation is available for resource allocation. A framework for communication between resource owner and cloud using Resource Cloud Communication Paradigm (RCCP) [7] has been proposed. Performance factors and optimum cost have been considered to create virtual machines for efficient utilization of resources[4][6]. These performance factors depend on communication channel cost, reliability and overall resource cost. An energy efficient resource management system was proposed for virtualized Cloud data centers that reduced operational costs and provided the required Quality for Service (QoS). Heuristic approach for dynamic reallocation of VMs using live migration revealed substantial energy savings [2][3][13] based on current requirements. The performance of PSO based on uniform design (PSO-UD) [1] was compared with PSO and the results revealed that PSO-UD algorithm was faster in the convergence than the standard PSO algorithm. Simulated Annealing Particle swarm optimization algorithm, a new population intelligence algorithm had good performance on optimization[15]. Simulation result highlighted that the disadvantage of getting in the local best point of standard PSO was overcome effectively and the ability of global optimality was toned up. A new hybrid particle swarm algorithm based on 'P systems' [5] was proposed by

analyzing the functionality of elementary particle swarm algorithm. Experiment results shown that the designed algorithm has better performance in seeking Optimization solution quality, robustness and convergence speed [8][9] [10][14]. Existing works on resource allocation highlighted on attributes like operational cost, quality of service with standard PSO and other algorithms whose convergence is not as efficient as MPSO. So the present work evaluates the flow time and energy efficiency with MPSO.

III. Methodology

Modified Particle Swarm Optimization algorithm has been adopted in the proposed work to obtain efficient allocation of resources in cloud. The Particle swarm optimization (PSO) [11][12][16] is a nature inspired optimization method based on the social behaviour of birds flocking or fish training. There are many variants of PSO, and it could constantly develop expedite in converging to an optimal solution. In Basic Variant of PSO, the rate clamping, Inertia Weight, Constriction Coefficient, Synchronous Vs Asynchronous are considered. In Modification Variant of PSO, the Single Solution of PSO, Niching with PSO, Constraint Optimization with PSO, Multi-objective optimization, Dynamic Environment of PSO, Discrete PSO are considered.

In modified PSO, the population diversity factor is used to alter the inertia weight for solving the defined problem in cloud computing. Parameters required for solving the problem and how a mapping is obtained between the solution and the particles of algorithm has been identified. Each particle is a possible solution for allocating the resource to the tasks for a problem. Each particle vector is of length N which denotes number of input tasks. Each element of the vector is a random number between 1 and M (total available resources).

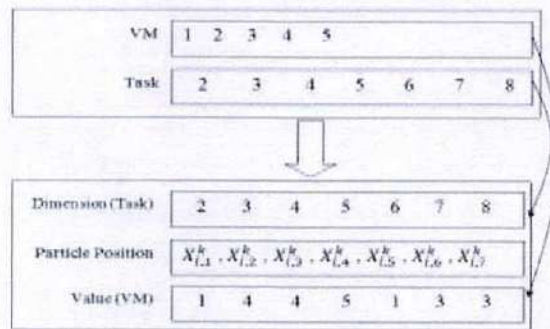


Figure 1: Generation of Initial Population

In the proposed method, the initial population is generated as random integers ranging from 1 to M to execute the task at hand. Randomness helps in maintaining population diversity and unbiasedness in selecting members of the population. The overall performance can be improved with population diversity and inertia weight. In this method, a regulator represented by kb is used. During the search, the regulator improves the static weight w by controlling the population diversity through negative feedback. The regulator index is shown with e and is expressed as follows:

$$e(t) = \frac{D_t(t) - D_0(t)}{D_t(t)} = \frac{D_0(t-1) - D_0(t)}{D_0(t-1)} \quad (1)$$

Where $D_0(t-1)$ is the extent of diversity at time interval $t-1$ and D_0 is the extent of diversity at time interval t . Using the regulator index kb , static weight is defined as

$$w(t) = kb \times e(t) = kb \left(1 - \frac{D_0(t)}{D_0(t-1)} \right) \quad (2)$$

The suitable range for kb is between 0.9 and 1.6. The value 1.4 is a good choice for most situations. In the proposed method, static weight will be adjusted according to population diversity. In the course of the search, if D_0 decreases rapidly, inertia weight w will increase to improve global search. If D_0 decreases very slowly, a small inertia weight w will be introduced to improve local search and when D_0 fluctuates, a negative inertia weight $-w$ will be used to reduce particle diversity. With this technique, the balance between global and local search will be maintained without converging to local optima. The Modified Particle Swarm Optimization algorithm chooses the particle with maximum fitness while iterating. Its position is initialized randomly for increasing the chaos ability of particles which results in the particle searching more domains. The fitness of the particle which has the best value in last iteration would be acceptable.

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Systematic Review of RCT's in mHealth interventions focusing on Maternal and Child Health

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ABSTRACT

The widespread availability of mobile phones makes them a prospective tool for health related interventions. MHealth interventions have been studied in many research areas like HIV, Cancer, Smoking Cessation, Diabetic care etc. But extensive research has been limited to general areas. The aim of this review is to examine the current evidence on RCT's of mHealth interventions in the field of Maternal and Child Health.

Keywords: Randomised Control Trial (RCT), Child health, mHealth Intervention, Maternal, Awareness

INTRODUCTION

According to WHO, "Mobile Health (mHealth) is an area of electronic health (eHealth) and it is the provision of health services and information via mobile technologies such as mobile phones and Personal Digital Assistants (PDAs)". The integration of mobile telecommunication technology into health is called as mobile health¹

Globally, SMS is the most widely used form of communication wherein a message is sent from a sender to receiver in text form. The messages can also be sent in bulk from computer to person or vice versa. The proponents of SMS technology advocate that SMS is a simple, direct and cost effective medium of communication² Of late recorded voice over calls is also used to deliver health messages to vulnerable population. It has been credited as a useful public health tool, particularly in underserved settings.

Randomized Controlled Trial i.e RCT is a study in which people are allocated at random (by chance alone) to receive one of several clinical interventions. One of these interventions is the standard of comparison or control. The control may be a standard practice, a placebo ("sugar pill"), or no intervention at all. Someone who takes part in a randomized controlled trial (RCT) is called a participant or subject. RCTs seek to measure and compare the outcomes after the participants receive the interventions. Because the outcomes are measured, RCTs are quantitative studies.

In sum, RCTs are quantitative, comparative, controlled experiments in which investigators study two or more interventions in a series of individuals who receive them in random order. The RCT is one of the simplest and most powerful tools in clinical research.

Search Methods: Online databases like Pubmed, Popline, Cochrane library, peer reviewed journals, online clinical registry and gray literature were searched for relevant studies. The search included all the studies done till February 2017. The study was started in November 2016. After filtering the articles from the exclusion criteria, eleven studies were narrowed down which met the inclusion criteria. They were thoroughly read and examined to understand the scope and reach of MHealth.

Inclusion Criteria: The criteria for inclusion were that all the studies should have used mobile phone as a tool for Health Communication. It should have included Randomized Controlled Trial in its study. There were no geographical boundaries for this study. But only studies available in English were included. The subjects/participants of the RCT should be women who were pregnant/young mothers at the time of study. One study was about women who aborted their children. So women who were pregnant but lost their child were also included in the study.

Data Collection and Analysis: The data was collected by the author since November 2016. The first stage of data collection was from online databases like Pubmed and Popline. Then the author reviewed online peer reviewed

journals to find relevant studies. Since there were very limited studies with RCT in its design including gray literature was essential. So academia and researchgate were searched for similar studies. The reference list in all the published articles were thoroughly studied by their title and when necessary with abstracts as well. In addition to all these things, the author constantly searched general Google search engine for studies which were not widely published.

The keywords used were 'mHealth, RCT, Pregnancy, Neonatal, Maternal, Child Health, mobile, text messages, and voice over calls etc'.

After collecting all the articles, articles which were repeated were removed. The author made it a point to include only completed studies. There were few studies which were still in the analysis stage, but those studies weren't included because they were yet to prove their study. Similarly, only RCT's with relevant field work were included in the study and studies explaining only the protocol for future trials were excluded.

The available data was then analyzed for a general pattern in mHealth interventions, their success failure, implications etc. The data was scrutinized to see the popular areas of research in Maternal and Child Health which uses MHealth as a Health Communication tool. The location of all the studies were also identified. Then the gaps in the research were analyzed.

Important Results

Location: Since MHealth is an amazing tool to serve the Low and Middle Income Countries, due to their lack of well developed health setup, nine out of the twelve studies were conducted in Low and Middle Income Countries with a majority in African nations.

Areas where MHealth is used as a tool for Health Communication

1. MHealth intervention for adherence to medication: A study in Mumbai was done by ARMMAN, a NGO in partnership with babycenter, India³. This project focused on adherence to medication. In their baseline survey they had found out that around 70% pregnant women fell off the iron tablets course given to them by the Government Hospital for free of cost, citing forgetfulness (54%), general dislike of pills (11%) and constipation (7%). So automated

voice calls were sent to pregnant women for three days in a week, as a reminder for adherence to take iron supplements regularly along with some basic health information. RCT was conducted among 130 women for a period of three months. The difference between the treatment group and control group was 0.43grams per decilitre on average. Since, this project met with unforeseen challenges in retrieving for women with follow up visits, it lacks statistical power. But it assures that the automated voice calls can be beneficial for pregnant women.

2. MHealth intervention to create awareness about women's health, contraceptive methods and child's health:

ARMMAN conducted a RCT in 250 villages of Rural Maharashtra. The districts covered were Osmanabad, Sholapur and Washim. The study was conducted from January 2013 to December 2015. In addition to voice calls the intervention included eight animation videos which were played by the health worker to the family members of the pregnant or new mother.

- a. The result showed an increase of 36% for women who knew the importance of consuming iron and folic acid tablets.
- b. There was a 46.95% increase on the women knowing at least three types of family planning methods.

In the infant scale,

- i. there was an increase by 33.79% in the oral intake of ORS during a Diarrhea episode.
- ii. Adherence to exclusive breast feeding increased by 43.4%.
- iii. 13.5% increase in the number of infants who tripled their birth weight at the end of one year.
- iv. 89.32% of the enrolled women were satisfied with the content.

Similarly, in Cambodia⁴ the effect of mobile phone based intervention on post abortion contraception was studied with a RCT design. The Mobile Technology for Improved Family Planning (MOTIF) study involved women who sought safe methods to abort. 249 women were placed in a Mobile phone based intervention. There were six automated messages, interactive voice messages with counselor phone support as

and when required. 251 women were in a control group receiving standard care. It was observed that there was an effective contraceptive usage after four and twelve months of abortion – 64% vs 46% of the controlled group. Adding a mobile phone based intervention in the abortion care services had brought in significant changes in Cambodia.

In Kenya⁵ family planning information was sent via text messages. Beneficiaries of m4RH, a mHealth service in Kenya were randomly selected for this trial. They were assigned with full access or limited access to the content. The content was then followed by questions sent via messages. Even though the response rate for the questions seem to be very low, the authors had concluded that the knowledge about contraception in the intervention group was 14% better than the controlled group. The authors had also observed that mHealth messages can play a vital role in increasing the knowledge but they may insufficient to cause behavior change.

In Kenya, in a RCT named as Mobile WaCH⁶ SMS messages were sent to pregnant women to invite them to have their delivery in a hospital. Reminder messages were sent for their iron intake. Two way SMS was facilitated where in the patients can ask their queries. This study reported a 61% interest among the subjects.

3. MHealth intervention to aid community workers in data collection and counseling: In Uttar Pradesh, a project called as MSakhi was introduced to Accredited Social Health Activists (ASHA's). MSakhi is an audio/video based mobile app that provides support to ASHA's in routine activities in Maternal and Child Health Care. The content was based on National Rural Health Mission's manual and Home based New Born Care, Guidelines and formats. ASHA's used it for two purposes. First for their self education and second as a job aided counseling, registration and decision support. It has been very useful in referring and tracking high risk pregnant women, recently delivered women, newborns and infants. Auto referral was based on the ANC service delivery data. In case of death, the date, time and type of death was registered through MSakhi. While more than half of the beneficiaries (55%)

surveyed in the experimental arm reported that ASHAs used mSakhi during counseling, less than a quarter (22%) of surveyed comparison arm beneficiaries reported that ASHAs used the paper-based flipbooks. Beneficiaries found mSakhi to be engaging and also reported other family members' interest in the counseling messages because of the multimedia mobile content.

4. MHealth intervention for antenatal care, vaccination: In Khushi project, a cluster randomized controlled trial was conducted in 96 villages of Udaipur District, Rajasthan⁷ They were randomly divided into three arms. Near Field Communication sticker, Near Field Communication pendant, Near Field Communication pendant with voice call reminder in local dialect. The result showed that the pendant and pendant with voice call reminder arms did not significantly improve adherence compared to the sticker group. But the point estimates showed that there were higher odds of on time completion in the pendant with voice call group in comparison to the remaining groups.

In a RCT to assess the Khushi Project 208 mothers and 128 children were enrolled from August to December 2015 for a study period of seven months⁹ Findings suggest that the necklace worn with a Near Field Communication Pendant is the preferred form of Wearable for infants and their mothers too agreed to like it compared to a simple Near Field Communication sticker.

In Zanzibar¹⁰ 44% of women in the intervention group received the recommended four or more antenatal visits, compared with 31% in the control group. The odds for receiving four or more antenatal care visits were 2.39 (1.03–5.55) for women benefitting from the mobile phone intervention. 59% of intervention women stated that received text messages influenced the number of times they attended antenatal care.

In Kenya¹¹, of the 397 subjects, 3.6 in the intervention group had less than four antenatal visits while 9.7% of those in the Controlled Group had less than 4 visits. Of the participants, 7.4% of those followed up had less than four antenatal visits while 18.6% of those not followed up had less than four visits.

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IMPACT OF EXTRINSIC CUES ON CONSUMER PREFERENCE FOR STORE BRANDS VIS-A-VIS NATIONAL BRANDS: AN EXPERIMENTAL APPROACH

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ABSTRACT

The objective of this paper is to study the impact of brand name on consumer preference for store brands vis-à-vis national brands. 272 consumers were involved in a blind and non-blind taste test of two table butter brands (store and national brand). Since store brands have now become premium products, an investigation into the impact of brand name on the competing brands was done. The responses of the participants were analyzed using Paired 't' statistics. The results show that under blind test condition, the impact of intrinsic cue of taste has led consumers to evaluate the store brand higher on overall preference. However in the non-blind condition, consumers are influenced by the extrinsic cue – brand name – and rate the national brand higher on overall preference. Our study indicates that store brands have improved in quality but need to take efforts to improve their brand equity to generate brand preference in stores. Future research can be done on private label impact in other non-dairy food categories.

Keywords: Cues, brand name, store brands, consumer preference.

Introduction:

Store brands are defined as "brands that are owned, controlled, and sold exclusively for and by retailers" (Lewison and Balderson, 1999). Research has suggested that Private label brands (PLB), also commonly referred to as "own brands" or "store brands", consist of merchandise produced and sold by a specific retailer or chain of retail stores (Kumar and Steenkamp, 2007). They are manufactured to retailer specifications and sold under their store name or as another brand sold exclusively in their store.

The consumer perception of these brands was also categorized accordingly. National brands were viewed as brands that delivered high quality at high price and generic brands an acceptable quality of product at a lower price. Store brands, were introduced and gained

popularity amongst consumers in America, Europe in the late 1970s and early 1980s (Burt, 2000). The store brands provided the mid-range alternative to shoppers on both quality and price. The presence of this traditional structure in the minds of the consumer is now changing. Research in the areas of attitudinal shifts of consumers towards PLBs indicates that consumers are increasingly accepting PLBs (Verhoef et al., 2002). Economies and markets in recent years have been witness to the rise in the power of retailers. The shift in power from manufacturers to retailers has further accentuated the growth of private labels (Kumar, 2007). Buoyed by higher profits and customer loyalty retailers are aggressively pursuing PLB in their merchandise mix to empower their increase in bargaining power over manufacturers

(Batra and Sinha, 2000). The commercial interest in store brands has been increasing in recent years (Horowitz, 2000; Semeijn et al., 2004; Velousou et al., 2004). At a global scale, there exists a phenomenon of continuous private label progress which is a result of a growing number of categories being included under the store brand merchandising by retailers. This progress, though not uniform in terms of market shares across economies, does show a uniform pattern of growth. Although strong national brands do dominate the market place and command a greater share of the category space, the store brands are increasingly positioned for the value shopper as a strong challenger brand for choice. (Sudhir and Talukdhara 2004:)

Globally, India is one of the top 10 retail markets at an estimated valuation of US\$520 billion of which is 7.5% is accounted for by the organized sector (Ernest & Young Research, 2014). The organized retail market in India is expected to grow between 19-20% per annum to reach a penetration figure of 10% by 2018. However, store brands are nascent in India and constitute only about 6.7% of modern trade as compared to 43% in the UK (Nielsen, 2014). Store brands represents an opportunity to 'up-trade' at a price that represents value while still being affordable. 75% of the total sale of store brands in India is accounted for by food products like packaged foods, edible oils, cereals, ketchups. Globally, the private label brand trends in packaged food industry reveal refrigerated packaged foods (including butter) having the maximum overall share of the industry with an aggregated value share of 32% (Nielsen, 2005).

The dairy sector is one of the key food processing industries in India. The sector is divided into traditional dairy commodities comprising of milk, white butter and value added dairy products like packaged table butter, yoghurt and cheese. India's organized dairy sector is estimated to be USD 10 billion in the year 2012 -13 and is expected to grow at 13-15% annually until 2019-20. (GAIN Report, 2013) With the expansion of organized retail acting as a platform for driving value-added sales, the market share of value-added products will increase from 21 percent to 31 percent by 2019-20.

Table butter is one of the products in this category whose growth is dependent on the organized retail platform. This sub-category is dominated by a strong national brand (Amul- since 1950) pitted against smaller regional brands in the domestic market. A strong store brand in Tamilnadu is Nilgiris (since 1905). These two brands were therefore chosen for investigation to perform a comparison study on the impact of brand name on consumer preference for store brands vis-a-vis national brands. A brand pair (national brand and private label in the same product category) have been tested for taste and brand preference in this study

The objective of this study was to examine through an experimental design, in blind and non-blind condition of the paired brands, whether taste perceptions and overall preference for ready to consume dairy food products are influenced by the awareness and presence of a strong brand name (store brands vis-a-vis national brands) in the emerging store brand scenario in the Indian modern format retail stores.

2. Theoretical background and Research Hypothesis

The growth of store brands as a global phenomenon has attracted interest both from researchers and practitioners. Store brand research has been done in areas such as strategic role of store brand in category management (Makoto, 1995; Burt, 2000; Horowitz, 2000), market performance (Ailawadi, 2001) differences between national and store brands (Richardson et al., 1994; Aggarwal and Cha, 1998), characteristics of store brand prone consumers (Baltas et al., 1997) and drivers to store brand purchase (McNeill & Wyeth, 2011). Academic interest in store brands has been concentrated around two consumer specific areas - factors correlating and influencing store brand proneness, while others investigated the consumer attitudes towards store brands and strength of these brands (Richardson et al., 1996). There however exists a knowledge gap on the competitive position of the store brands vis-a-vis the national brands (Cotterill et al., 2000).

Consumers tend to buy familiar brands out of habit or because of loyalty are willing to pay more for the branded product as against an unbranded one. This is the result of an expected favorable consequence of brand use (Solomon, 2004). In general, a brand name serves as a relevant quality cue for consumers, as food products are typically bought regularly, routinely and often under time pressure (Bredahl, 2004).

Amongst various food product categories, familiar brands have been associated stronger purchase intentions (Ares et al., 2010; Bower et al., 2003; Carneiro et al., 2005) choice preferences (Goodman, 2009; Hoyer and Brown, 1990) and purchase loyalty (Esch et al., 2006; Espejel et al., 2007). Since food products have emerged as the dominant category in the sale of store brands, taste can be expected to play an important role in influencing consumer preference for store brands. However, our survey of literature has revealed that there has been little research in Indian context in the area of influence of brand names on taste perception on store brands vis-a-vis national brands.

Cue Utilization:

Researchers have used cue utilization theory to assess consumer perception of quality. According to this theory, products consist of an array of cues that serve as surrogate indicators of quality to shoppers. Intrinsic cues represent cues that are attribute related which cannot be manipulated without changing the physical

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Hemalatha J & Lalitha Balakrishnan Consumer Prudence –A Key to Consumer Satisfaction in Online Shopping

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Consumer Prudence – A Key to Consumer Satisfaction in Online Shopping

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Abstract

India is the second largest internet market in the world. The country's population is taking to online retail in a big way and India's youth remain the key age demographic for online shopping. Despite its numerous advantages, consumers are wary of the threats that online shopping may pose. In order to secure the maximum benefits offered by online shopping and to avert risks, consumers need to take necessary precautions by exercising prudence. This study focuses on the consumer behavior of female college-going millennials in Chennai and examines the exercise of Consumer Prudence in four aspects namely, Website Safety, Product Selection, Payment Safety and Transaction Safety and its impact on Consumer satisfaction.

Keywords: *Online Shopping, Consumer Prudence, Consumer Satisfaction, Millennials*

Introduction

Online shopping has become a popular and

easy way for customers. India is the second largest Internet market in the world and its population is taking to online retail in a big way. In this fast-paced world, people are able to select from a wide range of merchandise, anytime, anywhere according to their convenience and shop at ease with a click of a button. Because of its numerous advantages, consumers increasingly prefer to shop online over shopping in traditional, physical retail outlets. India today, thus has a growing market for online shopping, offering numerous business opportunities in this sector.

Motivations That Lead Consumer to Buy Online

Convenience

Compared to a traditional retail store, online shopping is more convenient as shopping can be done at any time, any place, with a click of a computer button. (Hofacker, 2001; Wang et al., 2005; Yu and Wu, 2007). Also, shopping can be done at ease without the problems of crowds and influence of

forceful salespersons. They can get assortments and ranges of numerous products from different sellers all in one place.

Easier Product Comparison and Selection

Complete information about wide varieties of products and services are available online. Hence, it is also easy to shop for specific merchandise and also compare features of a wide variety of products. Also, recommendations from other shoppers are easily and readily available through online reviews.

Time Saving

This market has 24-hour shopping availability. With online network connectivity, consumers can shop in their own location with their computer or mobile phone and get the products delivered to the desired place without having to physically travel for the same.

Better Prices

Price comparisons from different suppliers are easier online. Also many online sites are able to offer cheaper prices and greater discounts than a physical retail store, mainly due to the minimal involvement of middlemen.

Convenient Payment Options

Today, customers can choose from a host of a variety of online payment modes through debit cards, credit cards, prepaid wallets, net banking, merchant payment gateways like

PayPal, etc.

Factors That Impede Consumers from Online Shopping

Despite its many benefits, online shopping also poses risks mainly because the shopper neither meets the seller directly nor inspects the product personally. Such risks can be relating to the product, financial, security or privacy.

Product Risk

The customer might not get a satisfactory and desired product due to numerous reasons such as - deceptive online reviews, defect in the product, product not as per description or default in delivery.

Financial Risk / Source Risk

The customer gets exposed to this risk due an insecure online payment portal or hidden / false claims on cost of the product.

Privacy Risk

Web users today are getting increasingly victimised to new kinds of cybercrimes posing threat to their security. Examples of cybercrimes are spam mails, phishing, identity theft.

Other Risks

Also there may problems caused by slow shipping, technology and unverified information online may result in slow virus and bothersome emails.

Literature Review

Despite its numerous advantages, consumers are wary of the threats that online shopping may pose which e-tailers have to be sensitive to. Many researches have shed



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RESEARCH ARTICLE

FORMULATION OF A TRADITIONAL SWEET USING JACK FRUIT SEED FLOUR AS A SUBSTITUTE FOR COMMERCIAL FLOUR

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Water absorption.

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ABSTRACT

Jackfruit (*Artocarpus heterophyllus*) belongs to the family moraceae, Mulberry family. The seeds of which are used in several culinary operations. Seeds were sun-dried, roasted and ground to a fine powder. Ladoo was prepared using JSF. Bulk density, swelling power, water absorption and oil absorption capacity of the JSF was 0.67, 5.24, 7.65 and 8.61 respectively. The overall acceptability of the product was 8.7. Thus, the aim of the study was to formulate a traditional sweet using jackfruit seed flour, which is an edible by-product.

INTRODUCTION

Jackfruit is one of its own kind of tropical fruits, recognized for its unique shape, size, and fruity flavor. The ripe fruit contains wellflavored yellow sweet bulbs and seeds (embedded in the bulb). The edible bulbs of ripe jackfruit are consumed fresh or processed into canned products. Seeds make-up around 10 to 15% of the total fruit weight and have high carbohydrate and protein contents (Bobbio *et al.*, 1978 and Kumar *et al.*, 1988). Seeds are normally discarded or steamed and eaten as a snack or used in some local dishes. As fresh seeds cannot be kept for a long time, seed flour can be an alternative product, which can be used in some food products. Jackfruit seed is encased inside a thin, transparent outer cover. It largely composes of starch and protein. Each seed measures about 2 to 4 cm in length, and 1 to 3 cm in thickness. Jackfruit seeds are good sources of thiamine and riboflavin. These seeds also provide at least small amounts of the minerals zinc, iron, calcium, copper, potassium and manganese. Zinc is important for immune function, iron and copper for forming red blood cells and calcium for forming strong bones. Jackfruit seeds contain compounds that may have an antimicrobial effect, potentially helping to prevent contamination with bacteria that cause food borne illnesses. These seeds have also been used in traditional medicine to help with digestion and treat diarrhea,

although more research is necessary to verify these potential benefits. Thus, usage of jackfruit seed flour in the preparation of the traditional sweet is a boon as it contains numerable health benefits. It tries to help improve commercial flour in terms of spoilage and shelf life.

MATERIALS AND METHODS

Materials

Fresh and sound Jack fruit (*Artocarpus heterophyllus*) was procured from a local market in Chennai, Tamil Nadu.

Preparation of Jackfruit seed flour

The fruit was cut and the seeds were carefully removed. The seeds were dried under direct sun for 3-4 days until considerable amount of moisture is removed. The seeds are then dry roasted in a frying pan. The thin peelings crack open with the application of heat. The peel was removed from the seeds and are crushed in a mortar and pestle. Finally the seeds are ground to a fine powder in a mixer grinder.

Preparation of Ladoo using Jack fruit seed flour

A smooth batter was made using the seed flour and water. Sugar syrup was prepared by dissolving sugar and water in the ratio 1:1 until it reached one thread consistency. The batter was stirred into the sugar syrup along with saffron threads and

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mixed thoroughly. The mixture was topped with melon and cardamom seeds. Ladoos are prepared by applying ghee on both hands and rolling the mixture to desired size

Determination of bulk density

50 gram of the peel powder was taken in a 100ml measuring cylinder. The volume occupied by the peel powder was noted.

Determination of swelling power

1g of the peel powder was taken in a centrifuge tube along with 10ml water. The tube was heated at 80°C for 30 minutes. The tube was then centrifuged at 1000rpm for 15 minutes after which the supernatant was discarded. The weight of the paste was noted.

Determination of Water absorption capacity

1g of the peel powder was taken in a centrifuge tube along with 10ml water. It was left to stand at room temperature for 1 hour. Centrifuged at 200rpm for 30 minutes.

Determination of Oil absorption capacity

1g of the peel powder was taken in a centrifuge tube along with 10ml oil. It was left to stand at room temperature for 1 hour. Centrifuged at 200rpm for 30 minutes.

Determination of moisture content

5g of the peel powder was weighed in a moisture dish. It was kept in hot air oven at 105°C for 4 hours. The weight of the dish before and after drying was noted.

Determination of Ash content

5g of the peel powder was weighed in a crucible and charred over Bunsen burner till fumes ceases. It is then burnt in a muffle furnace at 500°C for 4 hours. The empty weight and the final weight was noted.

Determination of crude fiber

Crude fibre was estimated by giving acid and alkali wash for the peel powder. The residue was collected and burnt in a muffle furnace 500°C for 4 hours. The empty weight and the final weight was noted.

Determination of Iron content

Iron content was estimated by using a series of reagents like sulphuric acid, potassium persulphate and potassium thiocyanate. Color was let and to develop and read calorimetrically.

Determination of fat

5g of the peel powder was taken in a thimble and it was fixed in the Soxhlet apparatus using petroleum ether as the solvent. The thimble is loaded into the main chamber of the Soxhlet extractor. The extraction solvent to be used is placed in a distillation flask. The flask is placed on the heating element.

The Soxhlet extractor is placed atop the flask. A reflux condenser is placed atop the extractor.

Determination of Protein content

The first step for the estimation of protein is the digestion of the sample. 1 g of sample is digested with 20 ml of concentrated sulphuric acid which acts as an oxidizing agent, 5g of sodium sulphate which raises the boiling point and speeds up the rate of the reaction, 0.5 g of copper sulphate which acts as a catalyst. During digestion nitrogen in the food is converted is converted to ammonium sulphate. Once the digest is cooled and diluted with water ammonium sulphate is converted to ammonia by heating with sodium hydroxide. Ammonia is then steam distilled into excess boric acid solution to trap the volatile ammonia to form ammonium borate. The amount of borate formed is determined by titration with standard hydrochloric acid or sulphuric acid.

Sensory analysis

Sensory analysis was carried out for the product using a 9 point hedonic scale. 10 semi- trained panelist were selected and the product was evaluated for properties like color, flavor, texture, taste, after taste, mouth feel and overall acceptability on a 9- point hedonic scale. (9= like extremely and 1 = extremely dislike).

RESULTS AND DISCUSSION

The bulk density of the jack fruit seed flour was found to be 0.67 compared to the bulk density of Bengal gram flour which was 0.52(R.K. Raigar *et al.*,2015). This shows that the seed flour has a less moisture content and the flour does not have clumps. The swelling power of the jack fruit seed flour was found to be 5.24swelling power of corn flour is 7% (Bajpai and Johnson, 2005). The water absorption capacity of the jack fruit seed flour was found to be 7.65whereas Bengal gram flour has water absorption of 3.04 (Kayode Adebawale *et al.*,2001). The oil absorption capacity of thejack fruit seed flour was found to be 8.61whereas Bengal gram flour had oil absorption of 2.40 (Kayode Adebawale *et al.*,2001). Moisture content in thejack fruit seed flour was 9.045±0.02 where as Bengal gram flour has a moisture content of 13.06 (Raigar *et al.*,2015).Low moisture content can aid in extending the shelf life of the product. The ash content in thejack fruit seed flour 2.345±0.04 whereas the ash content of Bengal gram flour was 1.1 % (Afroza Sultana *et al.*, 2014). This shows that the seed flour has high mineral content.

Table 1. Physico – Chemical analysis of the jack fruit seed flour

Tests	Values
Bulk density	0.67
Swelling power	5.24
Water absorption capacity	7.65
Oil absorption capacity	8.61
Moisture content	9.045±0.02
Ash content	2.345±0.04
Crude fibre	20±0.01 %
Total Fat	13.33%
Iron content	0.2mg

Crude fibre in the jack fruit seed flour was 20±0.01% whereas crude fibre in Bengal gram flour is only 1.3 % (Afroza Sultana

et al.). This shows that the product has a good fibre content. Fat content in the jack fruit seed flour was 13.33% whereas Bengal gram flour has fat content of 6.1% (Afroza Sultana *et al.*, 2014). This is mainly due to the amount of oil present in the seed. Iron content in the jack fruit seed flour was 0.2mg whereas Bengal gram flour has about 4mg iron.

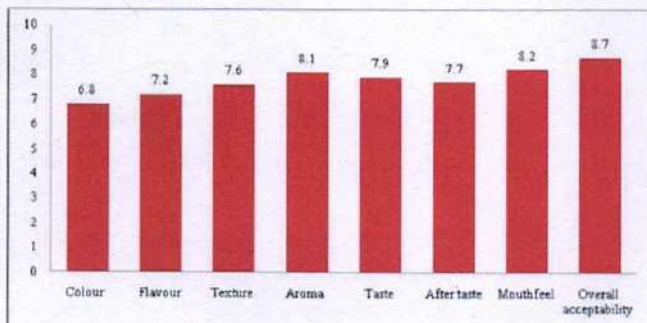


Figure 1. Sensory analysis of Ladoo using jack fruit seed flour

An overall organoleptic acceptance 8.7 ± 0.2 was recorded for the Ladoo prepared from jack fruit seed flour. The formulated product paves way for Value added sweet product.

Table 2. Sensory analysis of Ladoo using jack fruit seed flour

Parameters	Values
Color	6.8
Flavor	7.2
Texture	7.6
Aroma	8.1
Taste	7.9
After taste	7.7
Mouthfeel	8.2
Overall acceptability	8.7

Conclusion

Jackfruit seeds are the valuable edible seeds that should not go waste in country like ours. The sweet formulated using jack fruit seed flour makes it a preferred product for health-conscious consumers.

The sweet had a good organoleptic properties. The formulated product has decreased calories and it's a good source of dietary fibre. Thus this study reveals the possibility of making a value added traditional sweet product using jack fruit seed flour.

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RESEARCH ARTICLE

FORMULATION AND QUALITY ASSESSMENT OF CURRY LEAF SOUP POWDER BY USING DEHYDRATED PEAS POWDER AS A THICKENING AGENT

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INTRODUCTION

Curry leaf (*Murraya koenigii*) is an important leafy vegetable. Its leaves are widely used in Indian cookery for flavouring foods. The leaves have a slightly pungent, bitter and feebly acidic taste, and they retain their flavour and other qualities even after drying. Due to its abundance quantity and various health benefits, curry leaves were chosen for this study. The product was formulated using dried and powdered ingredients like curry leaves, peas, pumpkin, onion, garlic, carrot, corn along with seasonings. The main nutrients found in curry leaves are carbohydrates, energy, fiber, calcium, phosphorous, iron, magnesium, copper and minerals. It also contains various vitamins like nicotinic acid and vitamin C, vitamin A, vitamin B, vitamin E, antioxidants, plant sterols, amino acids, glycosides and flavonoids. Also, nearly zero fat (0.1 g per 100 g) is found in curry leaves. Curry leaves have several medicinal properties such as anti-diabetic, antioxidant, antimicrobial, anti-inflammatory, anti-carcinogenic and hepato-protective (capability to protect liver from damage) properties. Research studies conducted by Mylarappa B.

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ABSTRACT

Curry leaves are a popular leaf-spice used in very small quantities for their ability to improve digestion. They are natural flavouring agents and have various health benefits like antioxidant properties, ability to control diarrhoea, indigestion and so on. This study aims at development and quality assessment of soup using curry leaves. Curry leaves and other ingredients were dried using a traydrier at appropriate time and temperatures. The vegetables which were mature and fresh were selected, followed by cleaning, washing, drying and milling. The product was subjected to various physico-chemical analysis and sensory analysis.

Ningappa et al. at Jawahar Lal Nehru Center for Advanced Scientific Research, Molecular Parasitology and Protein Engineering Laboratory in Bengaluru, India have indicated that curry leaves or *Murraya Koenigii* is a good source of antioxidants. The presence of various vitamins like vitamin A, B, C and E help in reducing oxidative stress and free radical scavenging activity.

This study aims,

- To formulate and prepare a soup mix using Curry leaves and various other ingredients.
- To analyse the properties of peas as thickener
- To test the product for various physico-chemical parameters.

MATERIALS AND METHODOLOGY

Procurement of raw materials: The raw materials used for preparation of the experimental consist of curry leaves, peas, pumpkin, onion, garlic, carrot, corn and other seasonings. Curry leaves were hand plucked from a local resident in Chennai. The other raw materials were procured in a single lot from a local market in Chennai.

Pre-preparation: The raw materials were cleaned with running water, peeled and diced. They were then subjected to

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dehydration using a tray drier under controlled time and temperature. (Refer table No.1)

Table 1. Dehydration temperature and time for raw materials

INGREDIENTS	TEMPERATURE	TIME
Curry leaves	50° - 60°C	4 hours
Peas	50°C	5 hours
Pumpkin	70°C	10 hours
Corn	50°C	5 hours
Carrot	65°C	6 hours
Onion and garlic	70°C	10 hours

Preparation of soup mix: The dehydrated curry leaves, pumpkin, onion, garlic and peas were removed from the tray drier and powdered separately using a clean mixer grinder. The dehydrated Peas, corn and carrot were retained in the whole forms to add texture to the product. Many initial trials were conducted in the laboratory to standardise the soup mix powder. Finally the product was formulated using 30% curry leaf powder, 10% onion & garlic powder, 10% pumpkin, 10% dried carrot, 15% pea powder, 10% dried corn, and 5% dried peas along with the spices to derive best tasting soup mix.

Preparation of soup (100ml): Take 100ml of portable water in a clean vessel. Bring the water to a boiling stage. Add 1 teaspoon of soup mix to the boiling water. Allow the mixture to steep for 4 - 5 minutes. Remove from flame and serve hot.

Determination of physico-chemical parameters:

- Bulk density: 50 gram of the peel powder was taken in a 100ml measuring cylinder. The volume occupied by the peel powder was noted.(AOAC, 920.12)
- Swelling power: 1g of the peel powder was taken in a centrifuge tube along with 10ml water. The tube was heated at 80°C for 30 minutes. The tube was then centrifuged at 1000rpm for 15 minutes after which the supernatant was discarded. The weight of the paste was noted. (AOAC, 2006)
- Water absorption capacity: 1g of the peel powder was taken in a centrifuge tube along with 10ml water. It was allowed to stand at room temperature for 1 hour. Centrifuged at 200rpm for 30 minutes. (AOAC, 2006)
- Oil absorption capacity: 1g of the peel powder was taken in a centrifuge tube along with 10ml oil. It was allowed to stand at room temperature for 1 hour. Centrifuged at 200rpm for 30 minutes. (AOAC, 2006).
- Moisture content: 5g of the peel powder was weighed in a moisture dish. It was kept in hot air oven at 105°C for 4 hours. The weight of the dish before and after drying was noted. (AOAC, 2005)
- Ash content: 5g of the peel powder was weighed in a crucible and charred over Bunsen burner till fumes ceases. It is then burnt in a muffle furnace at 500°C for 4 hours. The empty weight and the final weight were noted. (AOAC, 2006)
- Crude fibre: Crude fibre was estimated by giving acid and alkali wash for the peel powder. The residue was collected and burnt in a muffle furnace 500°C for 4 hours. The empty weight and the final weight were noted. (AOAC, 962.09)

Determination of physico-chemical parameters:

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- Ash content: 5g of the peel powder was weighed in a crucible and charred over Bunsen burner till fumes ceases. It is then burnt in a muffle furnace at 500°C for 4 hours. The empty weight and the final weight were noted. (AOAC, 2006)
- Crude fibre: Crude fibre was estimated by giving acid and alkali wash for the peel powder. The residue was collected and burnt in a muffle furnace 500°C for 4 hours. The u b8i 0140empty weight and the final weight were noted. (AOAC, 962.0)

Determination of physico-chemical parameters

- **Bulk density:** 50 gram of the soup mix powder was taken in a 100ml measuring cylinder. The volume occupied by the peel powder was noted.(AOAC, 920.12)
- **Swelling power:** 1g of the soup mix powder was taken in a centrifuge tube along with 10ml water. The tube was heated at 80°C for 30 minutes. The tube was then centrifuged at 1000rpm for 15 minutes after which the supernatant was discarded. The weight of the paste was noted.(AOAC, 2006)
- **Water absorption capacity:** 1g of the soup mix powder was taken in a centrifuge tube along with 10ml water. It was allowed to stand at room temperature for 1 hour. Centrifuged at 200rpm for 30 minutes. (AOAC, 2006)
- **Oil absorption capacity:** 1g of the soup mix powder was taken in a centrifuge tube along with 10ml oil. It was allowed to stand at room temperature for 1 hour. Centrifuged at 200rpm for 30 minutes.(AOAC, 2006).
- **Moisture content:** 5g of the soup mix powder was weighed in a moisture dish. It was kept in hot air oven at 105°C for 4 hours. The weight of the dish before and after drying was noted.(AOAC, 2005)
- **Ash content:** 5g of the soup mix powder was weighed in a crucible and charred over Bunsen burner till fumes ceases. It is then burnt in a muffle furnace at 500°C for

4 hours. The empty weight and the final weight were noted. (AOAC, 2006)

- **Crude fibre:** Crude fibre was estimated by giving acid and alkali wash for the peel powder. The residue was collected and burnt in a muffle furnace 500°C for 4 hours. The empty weight and the final weight were noted. (AOAC, 962.09)

Determination of Nutrients

- **Iron content:** Iron content was estimated by using a series of reagents like sulphuric acid, potassium persulphate and potassium thiocyanate. Color was let and to develop and read calorimetrically.
- **Fat content:** Fat content was determined by Soxhlet method.

Sensory analysis

Sensory analysis was carried out for the soup using a 9 point hedonic scale (9= like extremely and 1 = extremely dislike). 20 semi-trained panelists were selected and the soup was evaluated for properties like color, flavor, texture, taste, after taste, mouth feel and overall acceptability.

RESULTS AND DISCUSSION

The experimental product was subjected to physico-chemical analysis such as moisture, ash, fat, crude fibre, iron, bulk density, swelling capacity and water absorption capacity to the dried product. The physico-chemical analysis were carried out using standard procedures from "Handbook of analysis and quality control for fruit and vegetable products – Ranganna"

Physical Analysis

Physical analysis such as bulk density, water absorption and swelling power were conducted for the product and the results were obtained. (Refer Table No.2)

Table 2. Physical parameter values

TEST	VALUE
Bulk density	1.35
Water absorption	6.37
Swelling power	2.9

Chemical Analysis

Chemical analysis such as moisture, fat, ash, crude fibre and iron for the product was conducted and the results were obtained. (Refer Table no.3)

Moisture: Moisture content of the dry soup mix was found to be 6.57±0.05 which is less compared to the commercially available soup mix having a moisture percentage of 14.5±0.5 (Jayasinghe *et al.*, 2016). Low moisture content can aid in extending the shelf life of the product.

Fat: Significantly higher amount of fat content was observed in the product which was found to be 14.5±0.2 compared to the commercial product, which was only 3.9±0.5.

Ash: The ash content of the soup mix was found to be 8.6±0.05 which was sufficiently good when compared to the commercially available soup which was 9.3±0.2. (Jayasinghe *et al.*, 2016).

Crude fibre: The crude fibre content was found to be 1.46±0.02 in the soup mix.

Iron: The soup mix powder was found to have an iron content of 2.8mg. The iron content found in 100g of dried curry leaves is about 12mg (Suman singh *et al.*, 2014).

Table 3. Chemical parameter values

TEST	VALUE
MOISTURE	6.57±0.05
FAT	14.5±0.2
ASH	8.6±0.05
CRUDE FIBRE	1.46±0.02
IRON	2.8mg

Sensory evaluation: Sensory analysis was carried out for the product using a nine – point hedonic scale 20 semi-trained panellist were selected and the product was evaluated on attributes like colour, flavour, taste, after taste, mouth feel, aroma and overall acceptability on a 9- point hedonic scale. (9=like extremely and 1 = extremely dislike). Sensory analysis was carried out for the cooked product, (Refer Table No.4).

Table 4. Sensory scores

ATTRIBUTES	AVERAGE SCORE
Colour	7.8
Flavour	7.9
Taste	8.4
After Taste	8.1
Aroma	7.7
Mouthfeel	7.8
Overall acceptability	9.1

All the organoleptic characteristics of the soup were in category of "Moderately likely" to "likely". Thus, the product was found to be acceptable among the sensory panelist.

Conclusion

Curry leaves are abundant in nature and it is merely used in cooking, thus the above study enhanced the use curry leaves in soup for its flavour and various health benefits. Curry leaves soup was formulated and its quality was tested using various physico-chemical and sensory parameters. The test analyses were in par with the commercially available soup powders. The soup was also found to be acceptable among the sensory panelists.

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RESEARCH ARTICLE

UTILIZATION OF TOMATO PEEL POWDER AS A NATURAL THICKENER IN SOUPS

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ABSTRACT

Tomato peel contains large amount of polysaccharides such as fiber and pectin, which represents potential materials to be used as ingredient in the food industry. The peels from fresh and sound tomatoes were carefully removed and dried in a tray drier at 80°C for 6 hours, cooled, milled and sieved. Tomato soup was prepared using tomato peel as a thickener. Bulk density, swelling power, water absorption and oil absorption capacity of the peel powder was 10, 4.56, 6.16 and 7.83 respectively. The peel powder was also tested on other physico-chemical parameters. The overall acceptability of the soup was 8.4.

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INTRODUCTION

Food waste management is becoming a major task in food processing industries. The only solution to overcome the food processing waste is by recovering the by-products. The aim of the present study was to formulate a soup using tomato peel (powder), a by-product of tomato processing. Tomato (*Lycopersicon esculentum*) is one of the most consumed vegetables in the world, either as raw fruit or as a processed product. It has been reported that tomatoes are the major dietary source of the antioxidant lycopene which has been linked to many health benefits, including reduced risk of heart disease and cancer. They are also great source of Vitamin C, Vitamin K, Potassium and Folate. The water content of tomatoes is around 95%. The other 5% consist mainly carbohydrates and fibre. Tomato seeds contained a good quantity of proteins and lipids, and could represent an alternative source of oil. From the industrial point of view, fibre and pectin may also give some important physical properties such as water absorption and increased viscosity to food preparation.

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These properties can make tomato peels, conveniently treated, a cheap and natural replacer to be used instead of other expensive hydrocolloids in food products. The direct use of food processing by-products is a means of reducing waste and causing less environmental damage. Thus adding a by-product back to the product could mean returning these valuable ingredients to the food.

MATERIALS AND METHODOS

Materials

Fresh and sound fruits of tomato (*Lycopersicon esculentum*) were sourced from a local market in Chennai, Tamil Nadu.

Preparation of peel powder

Tomatoes were cleaned and the peels were carefully removed. The peels were dried in a tray drier at 80°C for 6 hours and cooled. The dried peels were then milled using a laboratory milling machine and sieved.

Preparation of soup

Tomato soup was prepared using standard procedure - In a small pressure cooker, butter was melted, bay leaves and

roughly chopped garlic were added. Tomatoes and 1 cup of water was added to it. It was pressure cooked for 2 whistles and the peels were removed. The tomatoes were well blended in a mixer grinder without the addition of water. It was then strained through a metal strainer to remove the seeds. The peel that was removed was dried according to the above stated procedure and added to the soup as a thickener. It was boiled for 3-4 minutes until desired consistency is reached. Salt and pepper were added according to taste.

Determination of physico-chemical parameters

- **Bulk density:** 50 gram of the peel powder was taken in a 100ml measuring cylinder. The volume occupied by the peel powder was noted.(AOAC, 920.12)
- **Swelling power:** 1g of the peel powder was taken in a centrifuge tube along with 10ml water. The tube was heated at 80°C for 30 minutes. The tube was then centrifuged at 1000rpm for 15 minutes after which the supernatant was discarded. The weight of the paste was noted.(AOAC, 2006)
- **Water absorption capacity:** 1g of the peel powder was taken in a centrifuge tube along with 10ml water. It was allowed to stand at room temperature for 1 hour. Centrifuged at 200rpm for 30 minutes. (AOAC, 2006)
- **Oil absorption capacity:** 1g of the peel powder was taken in a centrifuge tube along with 10ml oil. It was allowed to stand at room temperature for 1 hour. Centrifuged at 200rpm for 30 minutes.(AOAC, 2006).
- **Moisture content:** 5g of the peel powder was weighed in a moisture dish. It was kept in hot air oven at 105°C for 4 hours. The weight of the dish before and after drying was noted.(AOAC, 2005)
- **Ash content:** 5g of the peel powder was weighed in a crucible and charred over Bunsen burner till fumes ceases. It is then burnt in a muffle furnace at 500°C for 4 hours. The empty weight and the final weight were noted.(AOAC, 2006)
- **Crude fibre:** Crude fibre was estimated by giving acid and alkali wash for the peel powder. The residue was collected and burnt in a muffle furnace 500°C for 4 hours. The empty weight and the final weight were noted. (AOAC, 962.09)

Determination of Nutrients

- **Iron content:** Iron content was estimated by using a series of reagents like sulphuric acid, potassium persulphate and potassium thiocyanate. Color was let and to develop and read calorimetrically.
- **Vitamin C content:** Vitamin C was estimated by following the indophenol titration method. An aliquot of the sample was mixed with met phosphoric acid solution to a standard volume. The mixture was titrated against 2, 6 dichlorophenol-indophenol solution to a pale pink color. The same process was repeated with ascorbic acid as standard.
- **Fat content:** Fat content was determined by Soxhlet method.

Sensory analysis

Sensory analysis was carried out for the soup using a 9 point hedonic scale (9= like extremely and 1 = extremely dislike). 20 semi- trained panelist were selected and the soup was evaluated

for properties like color, flavor, texture, taste, after taste, mouth feel and overall acceptability.

RESULTS AND DISCUSSION

The bulk density of the tomato peel powder was found to be 10 ± 0.02 compared to 51.81 of corn flour (common thickener) (Abdullah, Geldart, 1999) which indicates that corn flour is more stable than tomato peel powder. The swelling power of the tomato peel powder was found to be 4.56 ± 0.03 whereas that of corn flour is 7% (HESTER.E *et al.*, 1956). The water absorption capacity of the tomato peel powder was found to be 6.16 ± 0.01 whereas that of cassava starch was 114.

Table 1. Physico – Chemical analysis of the peel powder

PARAMETERS	VALUES
Bulk density	10
Swelling power	4.56
Water absorption capacity	6.16
Oil absorption capacity	7.83
Moisture content	6.62 ± 0.02
Ash content	9.56 ± 0.04
Crude fibre	20.12 ± 0.01 %
Total Fat	15%
Vitamin C content	21.78mg
Iron content	1.4mg

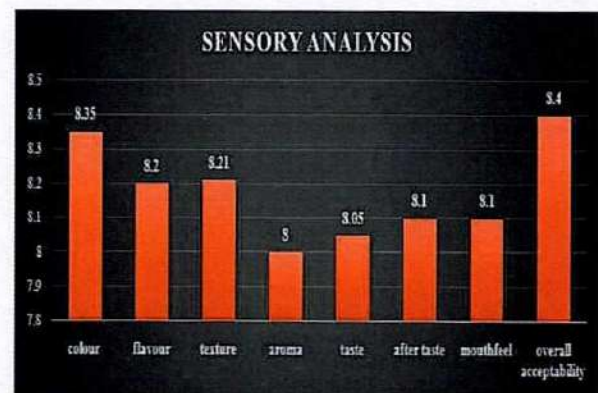


Figure 1. Sensory Analysis of Tomato Soup using Tomato Peel Powder as a Thickener

Table 2. Sensory analysis of Tomato Soup using Tomato Peel Powder as a Thickener

PARAMETERS	VALUES
Color	8.35
Flavor	8.2
Texture	8.21
Aroma	8
Taste	8.05
After taste	8.1
Mouthfeel	8.1
Overall acceptability	8.4

(Witonoa *et al.*, 1978). The oil absorption capacity of the tomato peel powder was found to be 7.83 ± 0.01 . Moisture content in the tomato peel powder was 6.62 ± 0.02 which is less compared to the commercially available soup mix having a moisture percentage of 14.5 ± 0.5 (Jayasinghe *et al.*, 2016). Low moisture content can aid in extending the shelf life of the product. The ash content in the tomato peel powder was 9.56 ± 0.04 which was sufficiently good when compared to the commercially available soup mix which was 9.3 ± 0.2 .

(Jayasinghe *et al.*, 2016). Crude fibre in the tomato peel powder was $20.12 \pm 0.01\%$ compared to the crude fibre of corn flour which is only 2 % (Jansen *et al.*, 1990). This indicates that the peel powder is a good source of crude fibre. Fat content in the tomato peel powder was 15% whereas the fat content of corn starch is only 1% (Tasha Kori, *et al.*, 2010). The increased fat content in tomato peel is mainly due to the presence of oil in the tomato peel. Vitamin C content in the tomato peel powder was 21.78mg whereas corn starch does not contain Vitamin C (Danny K. Asami *et al.*, 2003). This indicates that the peel powder is also a good source of vitamin C. Iron content in the tomato peel powder was 1.4mg whereas iron content in corn flour is only 0.5mg (A.E.C. Peres *et al.*, 1999). This indicates that the tomato peel powder is rich in iron when compared with corn flour. An overall organoleptic acceptance 8.4 ± 0.2 was recorded for the product prepared from the tray dried tomato peel powder. The addition of tomato peel to the soup also enhanced the color of the soup.

Conclusion

The study concluded that dried tomato peel powder could be used as an effective thickener in the preparation of soups. The direct use of food processing by-products is a means of reducing waste and causing less environmental damage. For its chemical characteristics, peel fraction of tomato could be used as thickening agent in tomato soups, purees, sauces to increase product consistency and replace the traditional starch based thickeners. The dried peel powder has a decent color, flavor and good functional values. Thus, adding a by – product could mean returning the valuable material to the product.

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RESEARCH ARTICLE

PHYSICOCHEMICAL AND ORGANOLEPTIC PROPERTIES OF COOKIES MADE USING TENDER COCONUT PULP AS A FAT REPLACER

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ABSTRACT

The present study was conducted to understand the effect of substitution of butter with tender coconut pulp in cookies in terms of its physicochemical and organoleptic properties. Three variations of the cookies were formulated; (a) Control (100% butter), (b) Variation 1 (25% tender coconut pulp + 75% butter), (c) Variation 2 (50% tender coconut pulp + 50% butter). The physicochemical analysis of the cookies showed a significant reduction in the fat content and a significant increase in the moisture, protein, fibre and ash content in the cookies made with tender coconut pulp. The control cookies were found to have the highest diameter and spread ratio. The organoleptic properties of the variation cookies were studied through sensory evaluation carried out by semi-trained panellist and the results were found similar for both the variations. The cookies made with tender coconut pulp had a good acceptability.

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INTRODUCTION

Snack food consumption has been on the rise because of urbanization and increase in the number of working women. Food based industry can exploit this development by fabricating nutritious snack foods. Among ready-to-eat snacks, cookies possess several attractive features including wider consumption base, relatively long shelf-life, more convenience and good eating quality (Tsen *et al.* 1973; Akubor 2003; Hooda and Jood 2005). The growth of bakery industry is about 10% per annum and the products are increasingly becoming popular among all sections of people (Indrani *et al.* 1997). The coconut pulp is the major edible portion of coconut that has been used in the extraction of oil, coconut milk, cream, in bakeries, cooking and so on. Coconut oil can be used both for edible as well as industrial applications. The coconut pulp contains amino acids, minerals, antioxidants like phenolics and tocopherols (Abdul and Zafar 2011). It has 50–60 % fat. Coconut oil is rich in medium chain fatty acid (MCFA) (59.7 %) having 92.7 % saturated fatty acids (SFA), 6.1 % monounsaturated fatty acids (MUFA) and 1.2 % polyunsaturated fatty acids (PUFA). Lauric acid is the main fatty acid in coconut oil (49.1 %) (Bhatnagar *et al.* 2009).

MCFA is easily burnt for the energy production rather than storing in the body (Kiyasu *et al.* 1952). The replacement of butter with tender coconut pulp will upgrade the nutritional quality of cookies. It would provide nutritionally balanced food because of the expected improved protein quality and reduced fat content. Therefore, in the current study the feasibility of partially replacing butter with tender coconut meal for cookie production was investigated.

MATERIAL AND METHODS

Materials

Ingredients for the cookies that include refined wheat flour, Cooking Butter, Sugar, Baking Powder, Baking Soda, Water and Vanilla Essence were procured from the local market in Chennai, Tamil Nadu. Tender Coconut meal was obtained from the tender coconut purchased from the local market in Chennai, Tamil Nadu. The tender coconut meal was separated from the nut and blended using a waring blender to achieve smooth, butter-like consistency.

Methods

Formulation of Cookies

The cookies recipe used in this study is given in Table 1. Tender coconut meal was used to replace a part of the butter

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(0%, 25% and 50%) in the standard recipe. Refined wheat flour was sieved along with baking soda and baking powder. Butter, tender coconut meal and sugar were creamed together till light and fluffy. Vanilla essence and water was added. The flour mixture was worked in to form a dough which was then cling wrapped and chilled in the refrigerator for 15 minutes. Once removed, the dough was divided into balls of 9 grams each which were rolled to a diameter of 3.5 cm. The moulded dough was then arranged on a lightly greased baking tray. The control cookies, 25% tender coconut meal and 50% tender coconut meal were baked at the temperature of 170°C for 13 minutes, 165°C for 15 minutes and 150°C for 18 minutes, respectively. The baked cookies were removed from the baking pan and cooled to room temperature before the analysis.

Table 1. Formulation of cookies

Ingredients	Control	Variation 1	Variation 2
Butter (g)	120	90	60
Tender Coconut Meal (%)	0	25%	50%
Sugar (g)	110	110	110
Refined Wheat Flour (g)	180	180	180
Baking Powder (g)	2.5	2.5	2.5
Baking Soda (g)	2.5	2.5	2.5
Vanilla Essence (mL)	5	5	5
Water (mL)	7.5	7.5	7.5

Chemical Analysis

Moisture content: 5g of ground cookies was weighed into a moisture dish. It was kept in hot air oven at 105°C for 4 hours. The weight of the dish before and after drying was noted. (AOAC, 2005). Ash content: 5g of the ground cookies was weighed into a crucible and charred over Bunsen burner till fumes cease. It was then burnt in a muffle furnace at 500°C for 4 hours. The empty weight and the final weight of the crucible were noted. (AOAC, 2006). Fat content: Fat was determined by Soxhlet Method (AOAC, 1990). Carbohydrate: Carbohydrate was estimated by 'Total Carbohydrates by Difference' method. Formula – 100 - (% Protein + % Ash + % Fat + % Moisture). Protein: Protein in the sample was estimated using Micro-Kjeldahl Method. (AACCI Method 46-13.01). Crude fibre: Crude fibre was estimated by giving acid and alkali wash to the ground cookies. The residue was collected and burnt in a muffle furnace 500°C for 4 hours. The empty weight and the final weight of the crucible were noted. (AOAC, 962.09).

Physical Analysis

Weight: The cookies were weighed using an analytical balance. Diameter: To measure the diameter of cookies, four samples were placed next to one another and the total diameter was measured using a Vernier Calliper. All the cookies were then rotated at 90° and the new diameter was measured. The average of the two measurements divided by four was taken as the final diameter of the cookie. Thickness: Thickness was also measured using a Vernier Calliper by stacking the cookies one above the others and restacking four times. Spread Ratio: The spread ratio was calculated using the formula: Diameter divided by Thickness of cookies. (Noor Aziah *et al.*, 2011). Bulk Density: Bulk density of cookies was determined using the formula: Weight divided by Bulk volume of cookies. (Anu Bala *et al.*, 2015)

Sensory Analysis

A ten-membered semi-trained panel comprising of students from the Food Science Department evaluated the samples using the 9 points hedonic scale method: 9 (excellent) to 1 (very poor). Sensory testing was done on Variation 1 and Variation 2 cookies. Each sample was replicated twice. Each panellist was presented with 4 samples. The samples were coded with random three-digit numbers and the positions of the samples were randomized. The score was analysed by ANOVA. (Noor Aziah *et al.*, 2011)

RESULTS AND DISCUSSION

Cookie Composition

The proximate composition of the cookies found through analysis is shown in Table 2. The fat content and the carbohydrate content were found highest in Control Cookies followed by Variation 1 and then Variation 2, whereas, the moisture content, protein content, ash content and crude fibre were found highest in Variation 2 followed by Variation 1 and then control.

Table 2. Proximate Composition of Three Types of Cookies

Parameter	Control Cookies	Variation 1	Variation 2
Fat	22.26%	16.62%	12.387%
Moisture	0.599%	2.49%	4.21%
Protein	1.8%	5.95%	11.8%
Ash	1.397%	4.235%	6.205%
Carbohydrates	73.944%	70.705%	65.398%
Crude Fibre	0.6%	3.7%	7.2%

Physical Analysis

The physical characteristics of the three types of cookies are shown in Table 3. The results indicate that the weight, diameter, bulk density and spread ratio were highest in Control cookies followed by Variation 1 and then Variation 2, whereas, the thickness was least in Control cookies followed by Variation 1 and then Variation 2.

Table 3. Physical Characteristics of Three Types of Cookies

Parameter	Control Cookies	Variation 1	Variation 2
Weight	8.395g	7.89g	7.544g
Thickness	1.26cm	1.32cm	1.43cm
Diameter	4.88cm	4.7cm	4.53cm
Bulk Density	0.652 g/m ³	0.625 g/m ³	0.588 g/m ³
Spread Ratio	3.87	3.56	3.167

Sensory Evaluation

The sensory scores of Variation 1 and Variation 2 cookies are shown in Table 4. The Variation 1 cookies were rated higher in flavour, aroma, taste, after taste and overall acceptance with a significant difference ($p < 0.05$) as compared to Variation 2 cookies. Whereas, Variation 2 cookies were rated higher in texture with a significant difference ($p < 0.05$).

Table 4. Results of Sensory Evaluation of the Variation Cookies

Parameter	Variation 1	Variation 2
Flavour	8.17 ± 0.62	7.8 ± 1.46
Aroma	8.17 ± 0.70	7.61 ± 0.99
Texture	8.28 ± 0.67	8.5 ± 0.51
Taste	8.44 ± 0.61	7.83 ± 0.87
After Taste	7.83 ± 0.98	7.39 ± 1.44
Overall Acceptance	8.28 ± 0.67	7.78 ± 0.98

Conclusion

Cookies prepared with Tender Coconut Pulp as a fat replacer were found to have reduced fat and carbohydrate content, whereas increased protein and crude fibre content. Variation 1 Cookies (25% Tender Coconut Pulp) had a better acceptance than Variation 2 Cookies (50% Tender Coconut Pulp).

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An Approach to Mutation Testing with Automated Debugging Tools for Software Testing

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ABSTRACT

Debugging is an extremely difficult and time consuming task in software testing. Individuals have put in a great deal of effort in creating automated tools and techniques for supporting different debugging tasks. Most techniques that are in current practice focus on picking subsets of possibly erroneous statements and prioritizing them based on some standard. A program faces a failure in certain circumstances. The overall objective of this study is to examine how software developers/testers utilize and attain benefit from these automated tools. We also perceive on possible directions for future work in the zone of automated debugging and try to combine automated debugging techniques (designed based on delta debugging algorithm) and mutation testing with a specific end goal to lessen the measure of cost and time involved in the Software Testing phase.

Keywords : Statistical debugging, user studies, testing, delta debugging, debugging aids

I. INTRODUCTION

On occurrence of a software failure, developers perform three main tasks to eliminate the cause for the failure. Fault localization is the first task involving of identifying the statements in the program responsible for failure [18]. The next is fault understanding, which involves understanding root cause for the failure. Finally, fault correction involves in determining how code can be modified to remove the root cause. These three tasks are collectively termed as debugging.

Debugging is always a dreary and tedious experience that plays a critical part of cost in maintaining software [1]. Hence, reducing the cost of debugging through methods that can enhance efficiency and effectiveness of such tasks is vital. Over the most recent couple of years, there have been an exceptional number of research techniques that help automated debugging activities [2, 3, and 20].

However, there are many difficulties in these techniques that must be tended before proceeding to place them in the hands of developers.

In this paper, we give an insight on how mutation testing can be done with automated debugging tools to prove and isolate failure causes and speedup software testing. Basically, this method sets up subsets of the original circumstances, and tests these configurations whether the failure still occurs. Eventually, these methods return a subset of circumstances where every single circumstance is pertinent for delivering the failure.

Automated Debugging Techniques

Throughout the years, analysts have characterized progressively complex debugging methods, moving from for the manual to profoundly automated ones. Simultaneously, foundation to help these tasks has



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