DEVELOPMENT OF PINK GUAVA (*Psidium guajava* L.) AND GREEN TEA (*Camellia sinensis*) MIXED JAM

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This research was conducted to develop pink guava and green tea mixed jam and the best formulation was selected based on sensory test. Physicochemical properties, proximate composition and shelf life of the best formulation were determined. Factorial design used to obtain 8 formulations. Four best formulations were selected from BIB ranking test. Formulation F5 (40% pink guava puree, 5% green tea, 0.5% pectin, 0.5% citric acid, 48% sugar) was selected as the best formulation through Hedonic test. Formulation F5 consists of 24.13±1.21% moisture, 0.15±1.50% ash, 0.54±0.29% protein, 0.07±0.01% fat, 0.70±0.08% crude fiber and 74.21±0.86% carbohydrate. Vitamin C content in formulation F5 was 3.5mg/100g. Physicochemical test showed specification of 2.93±0.03 pH, 66.0±0.00 °Brix and 0.53±0.02% titrable acidity. Texture analysis reported that the firmness and stickiness of F5 were 696.33±0.98g and 288.34±1.08g respectively. Shelf life study was carried out for 8 weeks through physicochemical test, microbiology and sensory test. Physicochemical test showed that there were no significant difference (p>0.05) for formula F5 as pH and total soluble solid maintained at 2.93±0.03 and 66.0±0.00 °Brix respectively. Multiple Comparison Test showed that there were no significant differences in attributes during the entire storage. F5 was free from microbial growth with count less than 1.0 x 10⁻¹ cfu/g. Consumer test shows that 96% of the respondents like the product and 68% of the respondents will buy and 29% might purchase the jam. Hence, pink guava and green tea mixed jam is expected to have good market potential.
ABSTRAK

PENGHASILAN JEM JAMBU BATU MERAH CAMPURAN TEH HIJAU

Kajian ini dijalankan untuk menghasilkan jem jambu batu merah campuran teh hijau di mana formulasi terbaik dipilih berdasarkan ujian sensori. Ujian fizikokimia, analisis proksimat, and kajian mutu simpanan juga ditentukan. Rekabentuk faktorial digunakan untuk mendapatkan 8 formulasi. Empat formulasi terbaik dipilih melalui ujian pemerlingkatan. Formulasi F5 (40% puri jambu batu merah, 5% teh hijau, 0.5% pektin, 0.5% asid sitrik, 48% gula) dipilih sebagai formulasi terbaik melalui ujian skala hedonik. Formulasi F5 terdiri daripada 24.13±1.21% lembapan, 0.15±1.50% abu, 0.54±0.29% protein, 0.07±0.01% lemak, 0.70±0.08% serabut kasar dan 74.21±0.86% karbohidrat. Kandungan Vitamin C dalam formulasi F5 adalah 3.5mg/100g. Ujian fizikokimia menunjukkan F5 mempunyai nilai pH 2.93±0.03, 66.0±0.00 °Briks dan 0.53±0.02% asid pentitratan. Analisis tekstur menunjukkan 'firmness' dan 'stickiness' F5 adalah 696.33±0.98g dan 288.34±1.08g masing-masing. Kajian mutu simpanan dijalankan selama 8 minggu di mana ujian fizikokimia menunjukkan tiada perbezaan signifikan (p>0.05) bagi nilai pH dan Briks. Nilai pH dan Briks F5 masing-masing adalah 2.93±0.03 dan 66.0±0.00 °Briks. Ujian pemerlingkatan juga menunjukkan tiada perbezaan signifikan di antara atribut yang dikaji sepanjang tempoh penyimpanan selama 8 minggu. Formulasi F5 bebas daripada pertumbuhan mikrooragnisma dengan kiraan kurang daripada 1.0 x 10¹ cfu/g. Melalui ujian pengguna, didapati bahawa sebanyak 96% responden menyukai produk ini dan 68% responden akan membelinya. Manakala 29% responden berkemungkinan untuk membeli produk ini. Oleh itu, produk jem jambu batu merah campuran teh hijau dijangka akan mempunyai potensi pemasaran yang agak baik.
CONTENTS

<table>
<thead>
<tr>
<th>CONTENTS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DECLARATION</td>
<td>i</td>
</tr>
<tr>
<td>CERTIFICATION</td>
<td>ii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENT</td>
<td>iii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>iv</td>
</tr>
<tr>
<td>ABSTRAK</td>
<td>v</td>
</tr>
<tr>
<td>LIST OF CONTENTS</td>
<td>vi</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>x</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xi</td>
</tr>
<tr>
<td>LIST OF PICTURES</td>
<td>xii</td>
</tr>
<tr>
<td>LIST OF APPENDIX</td>
<td>xiii</td>
</tr>
<tr>
<td>LIST OF ABBREVIATION</td>
<td>xiv</td>
</tr>
<tr>
<td>LIST OF SYMBOLS AND UNITS</td>
<td>xv</td>
</tr>
</tbody>
</table>

CHAPTER 1: INTRODUCTION

1.1 Introduction 1
1.2 Objective 4

CHAPTER 2: LITERATURE REVIEW

2.1 Local jam industry
   2.1.1 Malaysia Consumer Price Index 6
2.2 Local fruit industry 9
2.3 Pink guava
   2.3.1 Taxonomy classification 10
   2.3.2 Origin and distribution 11
   2.3.3 Variety 11
   2.3.4 Maturity Index 13
   2.3.5 Nutritional value 15
   2.3.6 Medicinal value 15
2.4 Green tea
   2.4.1 Botany 16
   2.4.2 Chemical composition 16
   2.4.3 Medicinal value 17
2.5 Sugar 17
2.6 Citric acid 19
2.7 Pectin 20
2.8 Sensory evaluation test
   2.8.1 Importance 22
   2.8.2 Panelist selection 23
   2.8.3 Types 24
2.9 Failures in jam processing and
prevention method
2.9.1 Crystallization 25
2.9.2 Presence of air bubbles 25
2.9.3 Bleeding or weeping 26
2.9.4 Discolouration 26
2.9.5 Jam Slack 27
2.9.6 Mouldy jam 27

CHAPTER 3: METHODOLOGY

3.1 Raw materials 28
3.2 Chemical Substances 28
3.3 Apparatus and equipments 29
3.4 Formulation 29
3.5 Processing method 31
3.6 Sensory evaluation test
   3.6.1 Panelist selection 32
   3.6.2 Place preparation 33
   3.6.3 Sample preparation and presentation 33
3.7 Selection of final formulation
   3.7.1 Balance Incomplete Block Fractionation’s Test (BIB) 33
   3.7.2 Hedonic test 35
3.8 Physicochemical analysis
   3.8.1 pH value determination 35
   3.8.2 Brix° Test 36
   3.8.3 Titrable acidity 36
   3.8.4 Texture analysis 36
3.9 Proximate analysis
   3.9.1 Moisture content 37
   3.9.2 Crude Protein 38
   3.9.3 Crude Fat 38
   3.9.4 Crude Ash 39
   3.9.5 Crude Fiber 39
   3.9.6 Carbohydrate 41
   3.9.7 Vitamin C content 42
3.10 Energy content calculation 43
3.11 Storage study
   3.11.1 Physicochemical analysis 44
   3.11.2 Microbiology test
      a. Preparation of peptone water 44
      b. Sample preparation 45
      c. Preparation of PCA 45
      d. Preparation of PDA 45
      e. Plating 45
      f. Colonies counting 46
   3.11.3 Sensory evaluation 46
CHAPTER 4: RESULTS AND DISCUSSIONS

4.1 Sensory evaluation
   4.1.1 Balance Incomplete Block Fractionation's Test (BIB) 48
   4.1.2 Hedonic test
      a. Colour 50
      b. Aroma 51
      c. Sweetness 51
      d. Sourness 52
      e. Spreadability 52
      f. Overall acceptance 53

4.2 Physicochemical analysis
   4.2.1 pH, Total soluble solid and titrable acidity 54
   4.2.2 Texture analysis 55

4.3 Proximate Analysis
   4.3.1 Moisture content 56
   4.3.2 Crude Ash content 57
   4.3.3 Crude Protein content 57
   4.3.4 Crude Fat content 58
   4.3.5 Crude Fiber content 58
   4.3.6 Carbohydrate content 58
   4.3.7 Vitamin C content 59
   4.3.8 Energy content 59

4.4 Storage study
   4.4.1 Physicochemical analysis
      a. pH 60
      b. Total soluble solid 61
   4.4.2 Microbiological test 62
   4.4.3 Sensory evaluation
      a. Colour 64
      b. Aroma 65
      c. Sweetness 66
      d. Soursness 66
      e. Spreadability 66
      f. Aftertaste 67
      g. Overall acceptance 67

4.5 Consumer acceptance test 68

CHAPTER 5: CONCLUSIONS AND SUGGESTIONS

5.1 Conclusions 72
**LIST OF TABLES**

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 2.1</td>
<td>Total Import of Fruit Jams and Jellies in Sabah from years 1994-1995</td>
<td>6</td>
</tr>
<tr>
<td>Table 2.2</td>
<td>Malaysian Consumer Price Index for non-alcoholic food and beverage</td>
<td>7</td>
</tr>
<tr>
<td>Table 2.3</td>
<td>Malaysian Consumer Price Index for subgroup of non-alcoholic food and beverage</td>
<td>8</td>
</tr>
<tr>
<td>Table 2.4</td>
<td>Imports and exports of fresh and processed fruits from year 1985-1995</td>
<td>9</td>
</tr>
<tr>
<td>Table 3.1</td>
<td>Mango jam formulation</td>
<td>30</td>
</tr>
<tr>
<td>Table 3.2</td>
<td>Mixed fruit jam formulation</td>
<td>30</td>
</tr>
<tr>
<td>Table 3.3</td>
<td>Formulation of sample</td>
<td>31</td>
</tr>
<tr>
<td>Table 3.4</td>
<td>Methods of sample arrangement for BIB test</td>
<td>34</td>
</tr>
<tr>
<td>Table 4.1</td>
<td>Total rank sum for sample formulations</td>
<td>49</td>
</tr>
<tr>
<td>Table 4.2</td>
<td>Mean intensity of hedonic ratings for the formulated jam samples</td>
<td>50</td>
</tr>
<tr>
<td>Table 4.3</td>
<td>Mean pH, °Brix and titrable acidity value of sample</td>
<td>54</td>
</tr>
<tr>
<td>Table 4.4</td>
<td>Firmness and stickiness of sample</td>
<td>55</td>
</tr>
<tr>
<td>Table 4.5</td>
<td>Proximate analysis of jam</td>
<td>56</td>
</tr>
<tr>
<td>Table 4.6</td>
<td>Mean value of physicochemical analysis upon sample that were kept for eight weeks in room temperature</td>
<td>60</td>
</tr>
<tr>
<td>Table 4.7</td>
<td>Microbial population upon sample that were kept for eight weeks in room temperature</td>
<td>62</td>
</tr>
<tr>
<td>Table 4.8</td>
<td>Multiple Comparison Test mean scores for storage study</td>
<td>65</td>
</tr>
<tr>
<td>Table 4.9</td>
<td>Demographic factors of the consumer test</td>
<td>68</td>
</tr>
</tbody>
</table>
## LIST OF FIGURES

| Figure 4.1 | Overall perception of consumers towards pink guava and green tea mixed jam | 69 |
| Figure 4.2 | Purchasing intention of consumers towards pink guava and green tea mixed jam | 70 |
# LIST OF PICTURES

<table>
<thead>
<tr>
<th>Picture</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picture 2.1</td>
<td>Pink guava maturity index 1</td>
<td>13</td>
</tr>
<tr>
<td>Picture 2.2</td>
<td>Pink guava maturity index 2</td>
<td>14</td>
</tr>
<tr>
<td>Picture 2.3</td>
<td>Pink guava maturity index 3</td>
<td>14</td>
</tr>
<tr>
<td>Appendix</td>
<td>Description</td>
<td>Page</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Appendix A</td>
<td>Jam processing</td>
<td>92</td>
</tr>
<tr>
<td>Appendix B</td>
<td>BIB Test survey form</td>
<td>93</td>
</tr>
<tr>
<td>Appendix C</td>
<td>Hedonic Test survey form</td>
<td>94</td>
</tr>
<tr>
<td>Appendix D</td>
<td>Multiple Comparison Test survey form</td>
<td>95</td>
</tr>
<tr>
<td>Appendix E</td>
<td>Consumer Test survey form</td>
<td>97</td>
</tr>
<tr>
<td>Appendix F</td>
<td>Statistical data analysis of Hedonic Test</td>
<td>98</td>
</tr>
<tr>
<td>Appendix G</td>
<td>Statistical data analysis of proximate analysis</td>
<td>100</td>
</tr>
<tr>
<td>Appendix H</td>
<td>Statistical data analysis of physicochemical analysis for storage study</td>
<td>101</td>
</tr>
<tr>
<td>Appendix I</td>
<td>Statistical data for Multiple Comparison Test</td>
<td>102</td>
</tr>
<tr>
<td>Appendix J</td>
<td>Pink Guava fruit and extracted puree</td>
<td>104</td>
</tr>
<tr>
<td>Appendix K</td>
<td>Pink Guava and Green Tea Mixed Jam</td>
<td>105</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>SSMP</td>
<td>School of Food Science and Nutrition</td>
<td></td>
</tr>
<tr>
<td>RM</td>
<td>Ringgit Malaysia</td>
<td></td>
</tr>
<tr>
<td>TPC</td>
<td>Total Plate Count</td>
<td></td>
</tr>
<tr>
<td>PCA</td>
<td>Plate Count Agar</td>
<td></td>
</tr>
<tr>
<td>PDA</td>
<td>Potato Dextrose Agar</td>
<td></td>
</tr>
<tr>
<td>ANOVA</td>
<td>Analysis of Variance</td>
<td></td>
</tr>
<tr>
<td>TSS</td>
<td>Total Soluble Solid content</td>
<td></td>
</tr>
<tr>
<td>UMS</td>
<td>University Malaysia Sabah</td>
<td></td>
</tr>
<tr>
<td>MARDI</td>
<td>Malaysian Agriculture Research and Development Institute</td>
<td></td>
</tr>
<tr>
<td>MIDA</td>
<td>Malaysian Industrial Development Authority</td>
<td></td>
</tr>
<tr>
<td>BIB</td>
<td>Balanced Incomplete Block</td>
<td></td>
</tr>
<tr>
<td>USDA</td>
<td>United States Department of Agriculture</td>
<td></td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Packages for Social Science</td>
<td></td>
</tr>
<tr>
<td>AOAC</td>
<td>Association of Official Analytical Method</td>
<td></td>
</tr>
</tbody>
</table>
LIST OF SYMBOLS AND UNITS

%  Percentage
,  Coma
.  Point
/  Per
<  Less than
>  Greater than
±  Plus/minus
°C  Degree Celcius
g  gram
mg  milligram
ml  milliliter
cfu  colony forming units
kcal  kilocalories
H₃BO₃  Boric acid
H₂SO₄  Hydrochloric acid, Sulphuric acid
CuSO₄  Cuprum Sulfate
K₂SO₄  Kalium Sulfate
NaOH  Natrium Hydroxide
1.1 Introduction

Jam is an intermediate moisture food prepared through boiling fruit pulp with sugar (sucrose), pectin, acid and other ingredients such as preservative, colouring, and flavouring until achieve reasonably thick consistency, firm enough to hold fruit tissues in position (Lal et al., 1998). According to Food Regulations (2009), jam shall be prepared by boiling one or more types of fruits whether raw, processed or semi-processed, with a permitted sweetening substance with or without additional pectin. Jam also should contain not less than 35% fruits and 65% soluble solids that determined by refractrometry at 20°C where insoluble solid do not take into account. For jams that are made from more than one type of fruits, that jam should be labeled as “mixed fruit jam” and the first fruit that named must not be less from 50% of total fruits that are used (Food Act, 2009).

Fruits are foods that made up from biological substances which mean that it is a commodity that can deteriorate quickly if it is exposed to environment without a good protection, thus further lead to quality depreciation and spoilage (Murano, 2003). With the considerations of this factor, jam processing is invented from the effort to preserve fruits in time no fruits season or when there is insufficient fruit resources (Baker et al., 2005). Anon (1983) stated that fruit based products popularity and availability increased because of sugar which is a major source used in production of jam can be obtained easily. Jams are produced not only to lengthen the life span
storage, but also to give variety in the ways of enjoying foods and also to change the food substances according to desirable tastes (Mehas & Rodgers, 1994). Fruits preservation through jam processing and production is one of the earliest methods that was discovered by humans other than usage of salt, refrigeration and drying where this is the relatively simplest method of preservation if compare to other techniques (Richardson, 1986). These processed jams can be eaten with breads, cakes and biscuits in daily food consumption and also can be used as fillings in pastries, cookies and cakes (Zainun, 1992).

Fruits processing industry in Malaysia is a great potential to be developed towards replacement in import and export sectors. Malaysian Agriculture Research and Development Institute (MARDI) have successfully carried out processing of fruits that is bitter or sour like sentul, rokam masam, kundang, bacang, rambai, belimbing buluh, and cermai into pickles and jams (Che Rahani & Noraini, 1985). Pink guava fruit is becoming popular as a value added product in order to be processed into juice and purees. Therefore, investors are encouraged to plant pink guava more commercially to ensure the consistency of its supply and quality control. Many people begin to like pink guava because of the sweet and unique taste. But, now days, this fruit is very popular because it is processed into products as juices, jams, and nectars which are tasty, refreshing and rich with vitamins C and A (Rukayah Aman, 1999).

Tea is actually well-known as beverage that is processed from tea leaves. Originally, tea is used in the traditional medicine field, however, now tea are more popular as serving of drinks (Varnam and Sutherland, 1994). According to Cheng (2006), tea can be divided into three types depends on the level of fermentation namely green tea (no fermentation), Oolong tea (partial fermentation) and black tea (fermented). Among all these tea, demand on the green tea is increasing rapidly because of the high nutrition content and good taste. Some research shows that,
green tea has been categorized as functional food and it acts more as food that contains healing properties (Shi et al., 2005). So far, we can see green tea has been applied in the production of various food products as chocolate filling, candies and many more.

In regard to those factors, a decision has been made to develop jam with mixture of pink guava and green tea. Pink guava is chosen because of its high nutrition content especially fibers, 2.8-5.5mg per 100g fruit and vitamin C, three to six times more than oranges (Nadkarni and Nadkarni, 1999). Green tea based jams not yet been explored in food industry sector. As for green tea, it is chosen as one of the jam base because it does have many nutrients and its great importance in human daily diet (Ross, 2005).

This research paper aims to introduce pink guava and green tea mixed jam into the market so that society can diversify the consumption of healthy meals in daily diet. Rapid changes in present lifestyle have resulted increase in demand for healthy, nutritious and easy to prepare/ready to eat food (Food Industry June, 2007). Apart from that, this research can help all the tea lovers to consume tea in different manner than usual where tea always have known as drinks only. To date, green tea is only applied in food products such as candy, added substance in supplements and as beverage (Shi et al., 2005). By bringing up this product, indirectly it can expand the production of food based on fruits and tea, hence; upgrade the food industry standard in Malaysia.
1.2 Research Objectives

The main objective of this study is to produce a new product that is pink guava and green tea mixed jam to further diversify the jam products in market. Specifically, the objective of the study carried out is to:

a. Determine the best formulation to develop pink guava and green tea mixed jam through sensory evaluation.

b. Analyze the nutrition content of pink guava and green tea mixed jam through proximate analysis.

c. Determine the shelf life of pink guava and green tea mixed jam through physicochemical analysis, microbiological test, and sensory evaluation.

d. Study consumers’ level of acceptance towards pink guava and green tea mixed jam through consumer test.
CHAPTER 2

LITERATURE REVIEW

2.1 Local Jam Industry

According to Kamari (1986) food processing industry in Malaysia is a characteristic primitive where pineapple fruit canning is the major fruit that is processed. Jam processing is one of the ways that used to preserve fruits in order to minimize or avoid wastage and indirectly help local farmers who involves in this sector to increase their income (Zainun, 1992). In Malaysia, most of the jams that being marketed are jam that made from imported fruits such as apricot, strawberry, blackcurrant and gooseberry (Aminah and Tan, 2001). Rapid expansion in fruit processing technology that is favoured by consumers do increase the income of entrepreneurs in Malaysia and directly can reduce imported fruits which now still overwhelm the local market compare to local fruits (Khatijah et al., 1995).

In Sabah, most of the jam that being marketed is imported from Peninsular Malaysia and other countries like Australia, United States, Denmark and Romania (Department of Statistics Malaysia, 2000). Table 2.1 shows the total import of fruit jams and jellies in Sabah from year 1994 to 1999. From the table, can be concluded that the total import of jams in Sabah increasing over the years from 1994 to 1999.
Table 2.1: Total Import of Fruit Jams and Jellies in Sabah from Years 1994-1999

<table>
<thead>
<tr>
<th>Year</th>
<th>Quantity (1000 x kg)</th>
<th>Value in RM (million)</th>
<th>Main supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>305.1</td>
<td>1.55</td>
<td>Peninsular Malaysia, Romania, Denmark</td>
</tr>
<tr>
<td>1995</td>
<td>640.1</td>
<td>2.91</td>
<td>Peninsular Malaysia, Australia, United State of America</td>
</tr>
<tr>
<td>1996</td>
<td>892.0</td>
<td>3.57</td>
<td>Peninsular Malaysia, Australia, China</td>
</tr>
<tr>
<td>1997</td>
<td>942.7</td>
<td>3.92</td>
<td>Peninsular Malaysia, United State of America, Jerman</td>
</tr>
<tr>
<td>1998</td>
<td>617.8</td>
<td>2.30</td>
<td>Peninsular Malaysia, China, Turkey</td>
</tr>
<tr>
<td>1999</td>
<td>738.5</td>
<td>3.27</td>
<td>Semenanjung Malaysia, Australia, Switzerland</td>
</tr>
</tbody>
</table>

Source: Department of Statistics Malaysia (2000)

2.1.1 Malaysia Consumer Price Index 2010

Department of Statistics Malaysia classified jam as non-alcoholic food and beverage (Makanan dan Minuman Bukan Alkohol). According to Department of Statistics Malaysia (2010), consumer price index for non-alcoholic food and beverage for the month of September 2010 compared to the same month of 2009, its shows 2.7% increment. As for the time period from January to September 2010, index for non-alcoholic food and beverage shows increment of 2.3%. Index for non-alcoholic food and beverage remained unchanged in 124.3 for the month of August and September 2010 as indicated in Table 2.2. During this period, jams group has shown significant rise on consumer price index. Table 2.3 explains the price index change for non-alcoholic food and beverage from September 2009 to 2010. This proves that jam increasingly favoured and consume by many consumers in Malaysia.
Table 2.2: Malaysia Consumer Price Index for Non-alcoholic Food and Beverage (2005=100)

<table>
<thead>
<tr>
<th>Kumpulan</th>
<th>Indeks</th>
<th>% Perubahan</th>
</tr>
</thead>
<tbody>
<tr>
<td>JUMLAH</td>
<td>100.0</td>
<td>112.4</td>
</tr>
<tr>
<td>Makanan &amp; Minuman Bukan</td>
<td>31.4</td>
<td>121.0</td>
</tr>
</tbody>
</table>

Source: Department of Statistics Malaysia (2010)
REFERENCES


Malaysian Nutrient Composition Database. 2011.


Yapo, B. M. 2009. Pectin quantity, composition and physicochemical behaviour as influenced by the purification process. *Food Research International*. **42**: 1197-1202.


Zandstra et al. 1999. Laboratory hedonic ratings as predictors of consumption. *Food Quality and Preference*.