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## DEVELOPMENT AND ACCEPTABILITY OF TAMARILLO HONEY JAM AMONG PRESCHOOLERS (4-5 YEARS) AND ADULTS IN KAKAMEGA, KENYA

Asianut DO<sup>1\*</sup>, Aswani AM<sup>1</sup> and A Sigot<sup>1</sup>



Dorcas Asianut Opo

\*Corresponding author email: [dasianut91@gmail.com](mailto:dasianut91@gmail.com)

<sup>1</sup>Department of Nutritional Sciences, Masinde Muliro University of Science and Technology, P.O Box 190- 50100, Kakamega-Kenya



## ABSTRACT

Fighting malnutrition in all its forms among adults and children faces a great challenge in the 21st century. Utilization of fruits in jam production has been on the rise. Exploring the use of honey for food value addition has also gained popularity. Tamarillo as a fruit has a high antioxidant activity, contents of carotenoids, ascorbic acid, Vitamin B6, minerals and provitamin A. Globally, tamarillo is an underutilized, sustainable fruit crop with great potential for value-added product preparations such as salads, sauces, soups, jams, ice creams, juices and liqueurs. In Kenya, tamarillo has gained traction in the recent past due to the increasing awareness of its nutritional value and economic potential. This study sought to develop tamarillo honey jam and determine its acceptability among preschoolers (4-5) years and adults (parents included) (25-60) years. Fresh ripe tamarillo fruits were collected along with honey from Kitale and Marigat farms. The acceptability tests done with preschoolers used the 9-point hedonic scale and Focus Group Interview guide for adults. The sensory evaluation parameters used were: smell, appearance/colour, mouth feel, taste, fluidity and general acceptance. Coded and transcribed videos were analyzed with NVIVO 20 for qualitative data and SPSS version 25 for the descriptive statistics. Developed tamarillo honey jam consisted of 64.93% (4.3 kg) fruit pulp, 32.45% (2.15 kg) honey, 2.59% (0.172 kg) pectin and 0.03% (0.002 kg) preservatives. The results showed that the smell, appearance/colour, taste, mouthfeel and fluidity of tamarillo honey jam were important factors in accepting the jam. More than 75% of both adults and preschoolers liked the jam with less than 25% having negative test preferences. The findings revealed that tamarillo jam was acceptable among the adults and preschoolers. Findings indicate that honey can be incorporated in jams for consumption of variety value added nutritious products and help address macronutrients and micronutrient public health concerns alongside diets.

**Key words:** Tamarillo, Honey, Sugar, Jam, Analysis, Adults, Preschoolers, Acceptable

## INTRODUCTION

Triple burden of malnutrition, which entails micronutrient deficiency, overweight and obesity and under nutrition has been a major drawback globally as a contributor to morbidity and mortality rates [1]. Worldwide, the burden of micronutrient deficiency of either Zinc, Iron or Vitamin C among preschoolers and for reproductive age women is more than 50% [2]. Micronutrient deficiency leads to unrealized human potential and low economic productivity in a society. It also leads to increased mortality and morbidity rates, impaired physical and mental growth [3].

Fruits demonstrate important benefits in disease prevention and promoting health of individuals. Fruits have a high nutrient density in terms of minerals, trace elements and vitamins, high dietary fibre content, lowered energy density and various dietary bioactive components like polyphenols, terpenes and betalains [4]. There is a high demand for tamarillo fruit as a result of the increasing awareness of its nutritional qualities and unique flavour [5]. Tree tomato and tamarillo have been used interchangeably to refer to the same fruit. Utilization of tree tomato fruit in Africa is among the fast-growing techniques being incorporated in dishes.

In Kenya, tamarillo is grown in different areas such as Kakamega, Migori, Meru, Nyandarua, Nyeri and Kericho [6]. Most farmers have been producing it for household consumption and few for market use. Tamarillo is utilized raw as a fruit, as an appetizer, as a salad and in other food preparations such as sauces, soups, jams, ice creams, juices and liqueurs. It is highly coveted in food industries for processing due to its high levels of pectin used in production of preserves and jams, production of dairy products like ice creams, yoghurts and shakes. Other products like chutney, baby food and sauces are made due to its desirable ability of canning in syrup [7].

Jam is a thick spread made from entire fruits inclusive of the fruit pulps. The fruits are combined with sugar and heated until an even consistency is attained then packed in storage containers [8]. Jams could also mean an intermediate moisture food prepared by cooking sugar with fruit pulp, acid and other ingredients to achieve a sensible consistency [8]. Customarily jams are not consumed as whole meals but instead are used on breads and scones as spreads and also incorporated in other food recipes. They are prepared and served while cold and at room temperature. This study sought to incorporate honey instead of sugar in the formulation of tamarillo jam, honey was utilized due to its high nutritional value and

medicinal properties. Unlike sugar, honey has a lower glycemic index, contains polyphenols, trace elements, vitamins, enzymes and proteins in small amounts [9].

Honey is a source of natural healing [10]. It is not only an intensified mixture of two monosaccharides: glucose and fructose but also rich in components such trace elements, proteins, vitamins, organic acids, flavonoids, phenolic acids and enzymes. It possesses various properties of benefit to human health. It has antioxidants, antimicrobials, anti-inflammatory, antidepressant, and hepatoprotective and immunomodulation activity [10]. Ferreira *et al.* [11] outlines that honey can impede the growth of pathogens like *Bacillus subtilis*, *Escherichia coli* and *Pseudomonas aeruginosa*. Honey also showed success against *Salmonella enterica* Typhi and *Pseudomonas aeruginosa* which are human health important bacteria in vitro studies. It has also demonstrated antiviral properties and in particular Manuka honey which was found to be useful in inhibiting the influenza virus activity. Influenza virus is a threat to human health both among children and adults and is an infectious respiratory disease transmitted by coughing and sneezing through air [11].

This study focused on tamarillo honey jam development as a possible solution to addressing macronutrient and micronutrient deficiencies. The study sought to determine the acceptability of tamarillo honey jam on preschool children (4-5) years and adults (25-60) years. The study was conducted within Kakamega County with a keen focus on Lurambi sub-County.

## MATERIALS AND METHODS

### Study area and population

The study was conducted in Lurambi, sub-County, Kakamega County. Kakamega County is located in Western part of Kenya thirty kilometers North of the equator and about 46 kilometers from Kisumu City. As per 2019 (Kenya Population Housing Census Survey Report), it had a total population of 1,867,579 people, with 897,133 males, 970,406 females and 40 intersex persons [12]. The study area was purposively selected since there is scanty information on successful and sustainable food product innovations focusing on better and improved nutritional and health needs of preschool children and adults. The county hosts a total of 1,631 preschools with an enrolment of 105,426 children as per the Ministry of Education, Science and Technology report (2014) [13]. The study population included 7 preschools with the preschool children 4-5 years whose parents had consented, parents and teachers 25-60 years within Lurambi sub-county of Kakamega. Participants were randomly selected for tamarillo honey jam

acceptability test. The parents and teachers who consented were randomly selected to participate in the Focus Group Discussions of the study. The children whose parents denied consent and those with cold and flu were excluded.

### Study design

This study adopted a descriptive cross-sectional design. Qualitative and quantitative techniques for data collection were employed.

### Sample Size and Sampling Strategy

Sampling was done based on the total enrolment of preschool children in Kakamega County as per the Ministry of Education, Science and Technology report [13]. A sample size of ninety ( $n=90$ ) for children 4-5 years, was calculated using Fisher's *et al.* [14] statistical formula. Purposive sampling was used in selecting the parents and teachers within the selected schools arriving at six ( $n=6-10$ ), which is the number of participants preferred for a focus group session [15]. This study utilized multi-stage sampling strategy in selection of the study area. Kakamega County was purposively selected as the geographical area of study. Lurambi sub-County was purposively selected since there is scanty information on successful and sustainable food product innovations focusing on better and improved nutritional and health needs of Kakamega County occupants, thus necessitating the need for this study. It was then followed by simple random sampling of the preschools where the actual study was conducted.

### Collection of Raw Materials

Various field visits were conducted in Kakamega, Kitale and Eldoret to identify the best tamarillo fruit used in the study. *Cyphomnandra betacea* (red tamarillo in colour) was selected, since it was the most available in the three areas which are closer to the study area. A farm in Kitale was identified with ready fruits for harvesting. Honey was sourced from a Bee farmer in Marigat, Baringo County. Laboratory experimental analysis, post-harvest and storage operations, safety analysis and the shelf-life stability of Tamarillo honey jam was observed during processing at Kenya Industrial Research and Development Institute (KIRDI). Tamarillo honey jam was then produced followed by sensory evaluation and consumer acceptability studies.





**Figure 1: A photo of tamarillo fruit**

### **Tamarillo jam development**

Tamarillo jam was produced at Kenya Industrial Research and Development Institute (KIRDI), Kisumu. The researchers established a method for developing tamarillo honey jam which adopted the following mixing ratio, defined by the researchers and quantity and increased based on production level as shown in Table 1. Mature and ripe tamarillo fruits were selected from the farm together with raw honey. The researchers mixed and tested various ratios in developing the product and finally settled on one ratio which met the suitability index.

### **Preparation of Raw Materials**

The raw materials were measured using a weighing scale, the weights recorded and set aside as illustrated in the Table 1. The fruits were sorted, washed and the outer cover peeled off. The pulp was then blended to reduce the cooking time of the pulp to preserve the nutrients and separated from the seeds by sieving. The pulp was then cooked at 95°C. After 10 minutes pectin, followed by honey was added by constantly stirring using a moderate fire, previously establishing the water-honey ratio for Brix grades required by the product for a maximum of 60 seconds at 80°C during the cooking process. Potassium sorbet and/or sodium benzoate were added and stirred to mix uniformly before being left to cool and set. The jam was then packaged in sterilized containers and sealed while hot to minimize possible chances of microbial growth as illustrated in the Figure 1. The

nutrient analysis of both proximate and micronutrients was done. Moisture content was tested using ISO 6496 Test method, crude protein as per the AOAC 2001.11, fat content according to AOAC 2003.05 method and sugar content using Lane and Eynon method and Crude fibre the ISO 6541 formula. Total ash and carbohydrates were determined using ISO 936 test, according to FAO 2003 method. The micronutrient levels were also determined using various test methods. Trace elements Zinc, Iron, Potassium, Sodium and Magnesium were determined using AOAC 999.10 method. Fat-soluble vitamins A, E and C were tested using ISO 20633 method. The B vitamins and folate were tested using the ISO 21470 in the developed tamarillo honey jam.

### Production process

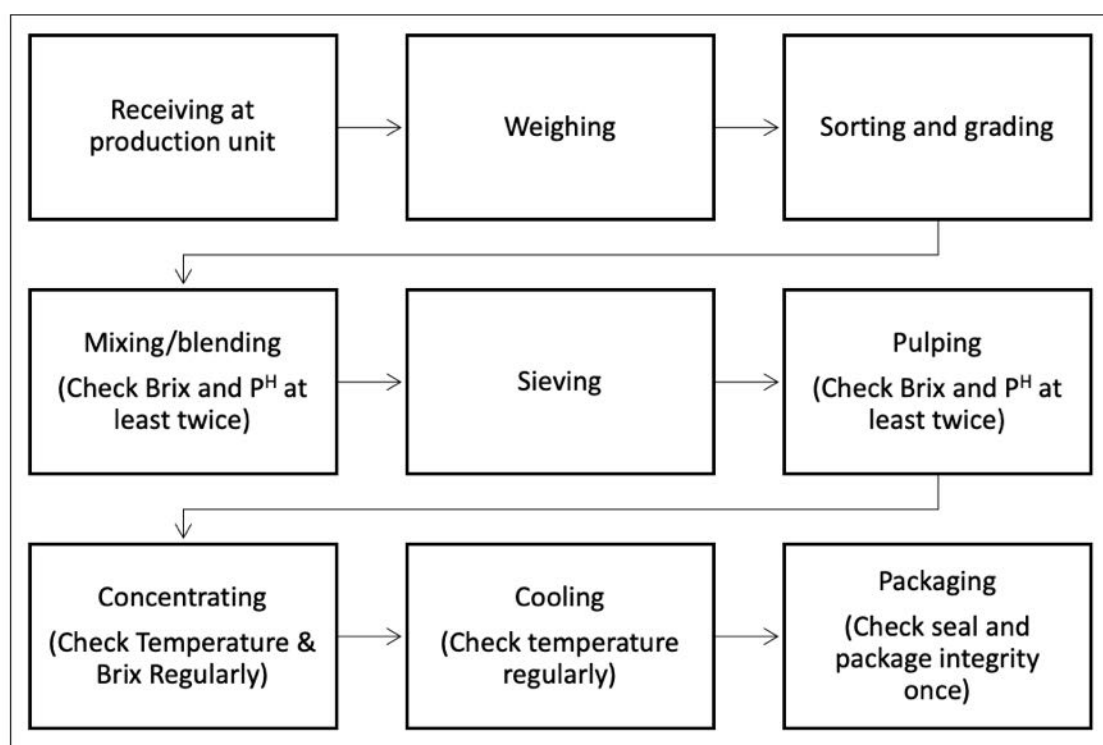


Figure 2: Flowchart Process for Tamarillo Honey Jam - Adapted and Modified from FAO [30]





**Figure 3: A photo of packaged and labelled tamarillo honey jam**

### Data collection Methods

Acceptability of tamarillo honey jam was tested among the preschoolers and adults. Focus Group Discussions (FGD) were used for gathering qualitative data among the adults, that is parents and teachers. Discussions for focus groups were conducted after administration of tamarillo honey jam samples of 85g each to all parents and teachers of the 7 selected schools. Tamarillo jam was served with scooping spoons and participants were encouraged to participate freely. The discussions lasted a period of 50 minutes. The researchers sought responses on: how familiar they were with the jam, what were the things they liked and did not like about the jam, what would most likely influence them to buy the jam, if there was anything to be improved, what would that be and would they recommend it to others. The participants gave feedback based on the sensory evaluation information and general acceptance of tamarillo honey jam. A semi- structured questionnaire with a 9-point hedonic scale was used for collecting data on acceptability of tamarillo honey jam among preschoolers [16]. The researchers gathered sensory evaluation information on smell, appearance/colour, mouth feel, taste, fluidity and general acceptance among preschoolers. Tamarillo honey jam samples of 85g with scooping spoons were given to each preschooler. The researcher and research assistants observed the preschoolers' reactions while taking the jam and asked them relevant questions on the colour, taste, likes and dislikes as per the scale parameters and recorded the feedback of the preschoolers without any external influence.

## Data analysis

Quantitative data were keyed into Microsoft Excel 2013 before being loaded to Statistical Package for Social Sciences (SPSS) version 26 data sheets for descriptive analysis. Charts and tables were generated. In qualitative analysis, NVIVO Version 20 software was used. The focus group discussions were recorded and the videos and audios were transcribed in NVIVO and evaluated for the relevant codes. The qualitative data for adults' perceptions were drawn from the objective of the study, which sought to determine its acceptability. This was further broken down into major codes of familiarity with the product, taste and texture, smell, likes and dislikes of the product and their recommendations among the adults.

## Ethical considerations

Ethical review and approval to conduct the study was sought from Masinde Muliro University of Science and Technology Institutional Ethics and Review Committee, with an Approval number MMUST/IERC/028/2021. A Research Licence with licence number, NACOSTI/P/21/14247 was obtained from the National Commission for Science, Technology and Innovation (NACOSTI). Kenya Bureau of Standards (KEBS) certification was sought for safety analysis of tamarillo honey jam. Written consent was also sought from the research participants and their parents together with teachers. The data collected were assigned serial numbers instead of personal identifiers. No harm was done to any participant and the procedures were non-invasive since Tamarillo Honey Jam had been tested and certified for human consumption. Tamarillo jam was subjected to a laboratory test under the acceptance criteria and specification (KS EAS 947: 2019, Kenya Standard Specification for Jams, Jellies and Marmalades) at KEBS for analysis of microbiological limit of yeasts and moulds, salmonella and *Escherichia coli* according to the law of Kenya.

## RESULTS AND DISCUSSION

### Development of Tamarillo Honey Jam and its Nutrient Composition

The final product consisted of 64.93% (4.3 kg) of fruit pulp, 32.45% (2.15 kg) of honey, 2.59% (0.172 kg) of pectin and 0.03% (0.002 kg) of the preservatives. According to Mohd *et al.* [17] in jam production during manufacturing, the raw materials, sugar and fruits are mixed in same proportions, which is 50% of fruit pulp and 50% of sugar. The mixture is then cooked to produce delicious product with a longer shelf life. Several fruits have been used to add value to food products like jams. Tamarillo honey jam on the other hand sought to use the tamarillo fruits and honey instead of sugar as raw materials, which were mixed in different

proportions. The amount of honey used was lesser 32.45%, unlike sugar, which usually used at 50%, demonstrating that honey is rich in natural glucose and fructose that is sweeter. The carbohydrate content reported was 77.82%. Majorly jams carbohydrate content are attributed to the sugars added. In this case honey was added, which is a rich source of monosaccharides that is glucose and fructose according to Keskin *et al.* [10] unlike the table sugar commonly referred to as sucrose which is rich in glucose alone. Tamarillo fruit is naturally high in pectin but concentrated on the peels which are not utilized during the tamarillo jam production process. Commercial pectin was used instead to help in gelling the jam. For this particular product, pectin used was at 3% of the fruit pulp that led to the desired firm but soft consistency of the jam that is easily spreadable. Potassium sorbet and/or sodium benzoate were added at 0.05% that is a tolerable limit [18], to prevent spoilage and inhibiting growth of moulds and yeasts. This, therefore, justifies the need for use of preservatives in most jam processing. The final Brix of 730 brix revealed that honey incorporation in jams, increases the amount of total soluble solids in the final product due to its high concentration of sugar as in the case for sugar-based jams [10]. Jams could also mean an intermediate moisture food prepared by cooking sugar with fruit pulp, acid and other ingredients to achieve a sensible consistency [8], in this case acid was eliminated during the production process. The citric acid which [18], is added to improve the pH of the fruit was withdrawn since the first trial and the second revealed high acidity levels of a pH of 1.3 proving tamarillo in itself is rich in acid like ascorbic acid [5].

### The Demographic Characteristics of Respondents

The total number of parents and teachers who participated in the study were 48 with half being teachers (n=24) who were college graduates. Concerning age groups 12.5% (n=6) were between 25 and 34 years, 54.2% (n=26) between 35 and 44 years and 33.3% (n=16) between 45 and 54 years; 25% (n=12) were male and female were 75% (n=36). The mean weight of all the participants (n=48) was 71.25 kg. The parents consisted of business people, medical practitioners and farmers. Preschoolers were 53.4% (n=55) males and 46.6% (n=48) females and, 47.6% (n=49) four years of age and 52.4% (n=54) were 5 years (Table 2). They had a mean weight of 17.86 kg (ranging 11-30 kg), height of 103.83 cm and Mid Upper Arm Circumference (MUAC) of 15.4 cm.

### Familiarity and appearance of tamarillo honey jam among adults

The study revealed that almost all respondents (85%, n=41) liked the appearance of the tamarillo honey jam. They relied on their memory of previous products that they had bought or seen in the shelves and used some of them like tomato paste, peanut butter, food colour and honey based on the packaging to describe tamarillo

Honey Jam. It was also noted that some of the respondents had not previously interacted with tamarillo fruit and that those who had interacted with it revealed that they did not necessarily like the natural taste of the fruit. Some revealed that it was grown in their homes some time back when they were still children. Below are some descriptions by the respondents attributed to tamarillo:

*"I think sometimes inside the fruit you find it is red, yellow."*

Response from respondent BK (17/6/2022)

*"Yes, I know it, looks like a tomato. And people think it adds blood."*

Response from respondent MK (17/6/2022)

The above statements revealed that the respondents who had prior interacted with the fruit not only knew the fruit but could also describe it. It also revealed they knew the family in which it belongs; the tomato family. The study also found out that those who had eaten the tamarillo fruit preferred sucking it directly in the mouth without cutting it with a knife. It was also eaten leisurely during walks or in the middle of activities without necessarily including it as part of meal times.

### **Evaluation of Taste and texture of Tamarillo Honey Jam**

In this study, Tamarillo Honey Jam was offered to the respondents who were allowed to taste it by licking with their scooping spoons and later on allowed to eat with bread. The results showed that a 75% (n=36) of the respondents appreciated the taste. Findings indicated that taste depended largely on respondents' age. A percentage of those who were ages of 35 and below highly recommended addition of honey to make it sweeter. Those aged above 35 years liked the jam and suggested the taste maintained as it is. A respondent who was keen to cater for all age groups said:

*"I want to tell you that you can have two types of jam. You can specify for those people who cannot take that which is so sweet at all times. That's when you will be catering for all the needs."*

Response from respondent MK (17/6/2022)

### **Evaluation of Smell of Tamarillo Honey Jam**

Findings showed that the jam had a sweet, attractive smell. All the participants accepted it, comparing it to familiar smells that they interacted with, for example: passion fruit, tamarind, orange and honey. The study revealed that smell was a great influence of sensory attributes and most of them indicated that they were attracted to tamarillo honey jam due to its characteristic smell. Several



respondents had varying opinions. Some indicated that the jam smelled like passion fruit, while others described it as an orange-like smell and honey-like smell. This showed the uniqueness of smell characteristics to different individuals, which can influence the choice of tamarillo honey jam.

### **Tamarillo Honey Jam Recommendations**

The respondents gave feedback on areas of improvement and their recommendations. They suggested that the color should be deeper red, the product should have a label that clearly outlines all the contents present and that the jam should be produced in large scale with different sugar content. Below is a statement from a respondent with regard to improvements to be made:

*"I usually buy the fruit, it is somehow red, dark and I also have them in the house. I would easily buy the jam"*

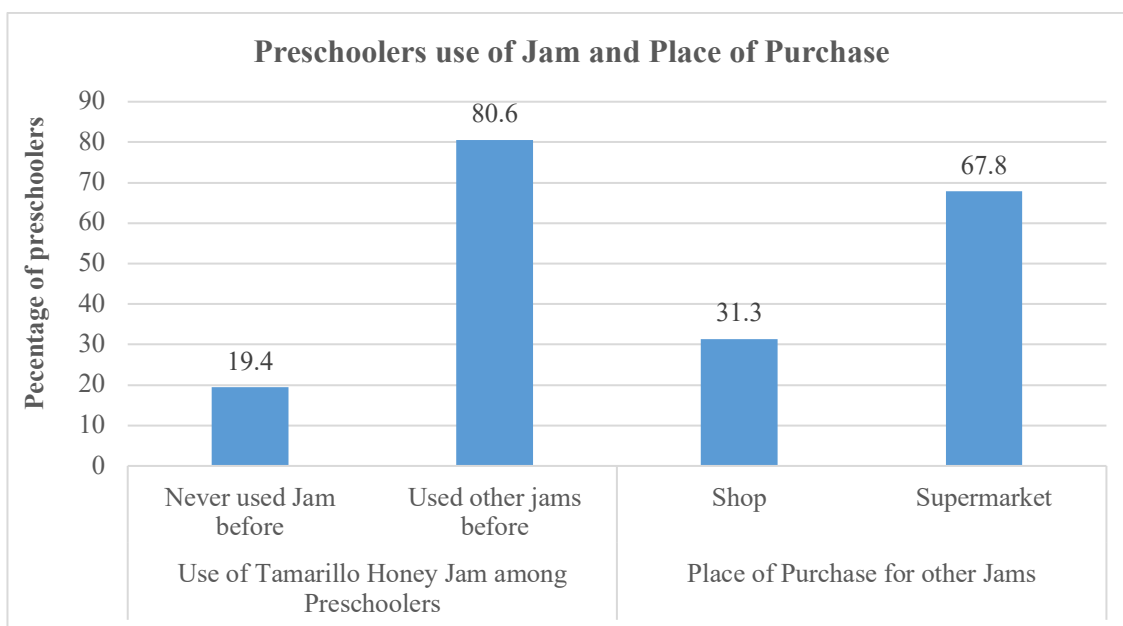
Responses from respondent K (16/6/2022)

Usually, sensory science incorporates use of the five senses: touch, smell, sound, sight and taste to measure and evaluate individuals appeal to products [19]. This study incorporated use of the human senses that is: smelling, tasting and appearance of tamarillo honey jam and it revealed that tamarillo jam is highly acceptable among majority of consumers except those who could not tolerate it based on the prior experience due to its taste. It has a distinctive acidic flavor, an attractive deep skin and flesh as attributed by Schotsmans *et al.* [20]. The study found out that most respondents identified the characteristic flavour and could point it out especially among the adults.

### **Preschoolers use of jam**

Preschoolers were also evaluated on use of jam before and 19.4% (n=20) of the sampled participants had not consumed any jam before while 80.6% (n=83) had interacted and eaten different types of jam before. Out of the 83, 31.3% (n=26) bought their jam from the shop while 67.8% (n=57) bought it from the supermarket. This is illustrated in Figure 3.





**Figure 4: Combined Distribution on Use of Jam and place of purchase for Preschools**

### Acceptability of tamarillo jam among preschoolers

Preschoolers 96.1% (n=99) liked the appearance of the jam very much while 2.9% (n=3) liked it moderately and 1% (n=1) disliked extremely. Each of the participants had a chance to open their samples and smell it and 2.9% liked the smell extremely, 88.3% (n=91) liked it very much, 6.8% (n=7) liked it moderately and 1.9% (n=2) disliked it extremely. On tasting the product, 1% liked it extremely since they could smell it over and over again, 82.5% (n=85) liked the taste of tamarillo honey jam very much, 12.6% (n=13) liked it moderately, 1.9% (n=2) disliked it very much while the remaining 1.9% (n=2) disliked it extremely to the extent they could not eat the jam. Concerning the mouthfeel, fluidity and acceptability of the jam, 83.5% (n=86) liked it very much, 12.6% (n=13) liked it moderately, 1.9% (n=2) disliked very much and the remaining 1.9% (n=2) disliked it extremely. The above data is indicated in Table 3. The acceptable taste levels among preschoolers were higher at 83% liking it very much and extremely which indicated that the jam was acceptable. The appearance and smell were highly acceptable among both the adults and children. There were high sensory values: 96.1% (n=99) liked the appearance of the jam very much while 2.9% (n=3) liked it moderately and 1% (n=1) disliked extremely. Preschoolers 2.9% liked the smell extremely, 88.3% (n=91) liked it very much, 6.8% (n=7) liked it moderately and 1.9% (n=2) disliked it extremely. The above results were qualified by the nine-point hedonic scale and could be linked to the characteristic flavour of tamarillo, its colour and honey incorporated in it [16]. This shows that a tamarillo honey jam could be consumed among majority of the adults and preschoolers and the preference levels were

high. This is compared to high acceptability levels of fruit jams like pineapple, watermelon and banana with high sensory values due to texture, colour and flavour [21]. A few adults and preschoolers who could not tolerate the jam showed that the product was not 100% acceptable.

## CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

Development of tamarillo jam revealed that it is possible to incorporate honey in jams and come up with acceptable and nutritious products for human consumption. This also indicated that the tamarillo fruits could be preserved for longer periods of time when converted into jams to minimize on its spoilage and wastage due to its high levels of perishing. More than 75% of both adults and preschoolers liked the jam with less than 25% having negative taste preferences revealing the possibility of high production of honey-based jams to match the needs of consumers and market. The researchers recommends the following: a longitudinal study should be done to establish the long-term effect of tamarillo honey jam on health and nutrition status of children as well as adults. During any jam processing it is important to evaluate the fruit acidity levels to utilize the natural acidity of fruits instead of additional commercial citric acid.

Table 1: Tamarillo Honey Jam Mixing Ratios

Tamarillo honey jam mixing ratios						
1 <sup>st</sup> trial			2 <sup>nd</sup> trial		3 <sup>rd</sup> trial	
Raw materials	Amount(kg)	(%) Pulp	Amount(kg)	(%) Pulp	Amount(kg)	(%) Pulp
Fruit pulp	4.3	57.01	4.3	58.75	4.3	64.93
Honey	3.23	42.82	2.8	38.29	2.15	32.45
Pectin	0	0	0.215	2.94	0.172	2.59
Citric acid	0.013	0.17	0	0	0	0
Preservatives	0	0	0.002	0.02	0.002	0.03
Total	7.543	100	7.317	100	6.624	100
Parameters	1 <sup>st</sup> Test	2 <sup>nd</sup> Test (before packaging)	1 <sup>st</sup> Test	2 <sup>nd</sup> Test (before packaging)	1 <sup>st</sup> Test	2 <sup>nd</sup> Test (before packaging)
Brix ( <sup>o</sup> Brix)	53	68	63	70	65	73
Acidity		1.2		1.3		3
Temperature ( <sup>o</sup> C )	95	70	98	65	99	50

**Table 2: General Preschoolers and Adults Demographic Data**

DEMOGRAPHIC DATA					
Children			Adults		
Gender					
Frequency		Percentage (%)	Frequency		Percentage (%)
Male	55	53.4	Male	12	25
Female	48	46.6	Female	36	75
Total	103	100	Total	48	100
Age (Years)					
4 years	49	47.6	25 -34	6	12.5
5 years	54	52.4	35-44	26	54.2
Total	103	100	45-54	16	33.3
			55-64	0	
			Total	100	
Mean Weight		17.9 kgs	Mean Weight		71.3 kgs
Mean Height		103.8cm			
Mean MUAC		15.4cm			

**Table 3: Overall Acceptability Test Results for All Preschools**

General Acceptability test												
Hedonics	Parameters											
	Appearance		Smell		Taste		Mouthfeel		Fluidity		Acceptability	
Like extremely			3	2.9%	1	1%						
Like very much	99	96.1%	91	88.3%	85	82.5%	86	83.5%	86	83.5%	86	83.5%
Like moderately	3	2.9%	7	6.8%	13	12.6%	13	12.6%	13	12.6%	13	12.6%
Dislike very much					2	1.9%	2	1.9%	2	1.9%	2	1.9%
Dislike extremely	1	1%	2	1.9%	2	1.9%	2	1.9%	2	1.9%	2	1.9%
Total No.	103		103		103		103		103		103	
Percentage		100		100		100		100		100		100



**Table 4: Proximate and Micronutrient Composition of Tamarillo Honey Jam**

Proximate and Micronutrients Test Results		
Parameters	Amount percentage%	Test method
Moisture content	21.5	ISO 6496
Crude protein	0.1	AOAC 2001.11
Fat content	0.36	AOAC 2003.05
Sugar content	30.32	Lane- Eynon
Crude fibre	0.02	ISO 6541
Total ash	0.22	ISO 936
Carbohydrates	77.8	FAO 2003
Trace elements	mg/100g	
Zinc	0.03	AOAC 999.10
Iron	0.08	AOAC 999.10
Potassium	0.01	AOAC 999.10
Sodium	1.09	AOAC 999.10
Magnesium	2.3	AOAC 999.10
VITAMINS	µg/100g	
Vitamin A	0.3	ISO 20633
Vitamin E	0.2	ISO 20633
Vitamin B	0.16	ISO 21470
Vitamin C	49.63	ISO 20633
Folate	0.00	ISO 21470

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