CASHEW APPLE

BY

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CERTIFICATION

This is to certify that this research project has been read and approved as meeting the part of the for the award of National Diploma (ND) of the department of Nutrition and Dietetics Institute of Finance and Management Studies, Kwara State Polytechnic, Ilorin.

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DEDICATION

This research is dedicated to the glory of Almighty God the source of my wisdom, knowledge and understanding for giving me the privilege strength and a great opportunity and power to carry out and complete this research study.

ACKNOWLEDGEMENT

Firstly, I would like to give glory and thanks to God the Almighty for everything for the opportunity given to write this project.
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CHAPTER ONE

1.0 INTRODUCTION TO CASHEW APPLE

The cashew apple is the fresh part of the cashew fruit that is attached to the cashew nut. It is a rich source of ascorble acide, polyphenola, minerals, vitamins and sugars. Its phytochemical profile reveals a complex source of natural carotenoida what makes fruits an excellent source of antiyoxidants that can scavenge free radical on reactive oxygen species, inhibit free radical formation, and prevent damage of cellular components, as well as cellular death (Mello-Cavalcante et al 2008).

The cashew apple is a pseudofuit produced by the cashew tree (Anacardium Occidentale), a tropical evergreen tree native to Brazil and widely cultivated in tropical regions. The cashew apple is the swollen stem or receptacle that supports the cashew nut. It is bright and flashy varying in color from yellow to red and has a juicy and slightly astringent taste rich in vitamin c and other nutrients.

The cashew apples are highly perishable not exceeding four days at room tempppratin, its availability is seasonal and even when in season a large quantity of these fruits are wasted due to lacks of adequate storage facility [oduwole et all 2001]. The seasonal nature of the production of the perishable cashew apple the poor storability and the lack of information on an appropriate processing technology are the reasons lundaring the full utillisation of the fruit [bidaisee and badrie 2001].

TYPES OF CASHEW APPLE

Cashew apples are typically classified based on their sizes, shape, color, and flavor some common types include;

1. Red Cashew Apple

Bright red in color, these apples land to have a more fibrous texture and a sweeter taste. They are often used for juice production and fermentiation .

2. Yellow Cashew Apple

Light yellow to golden in color these apple are typically juice and less fibrous than red cashew apples. They are popular for direct consumption and for making jams and beverages.

3. Bio-colored Cashew Apple

A combination of red and yellow. These apples share characteristic of both types and are primarily used for processing [oliveira Ld\carvalho mvd,melo L [2014]

HARVESTATION OF CASHEW APPLE

Harvesting cashew apples requires careful timing and harvesting to ensure the fruit remain intact. The key steps are;

1. Timing

Cashew apples are harvested when they are fully mature, indicated by their color and the natural detachment of the cashew nut from the apple.

2. Collection

Harvesters pick the apples by hand to prevent bruising, as the flesh is delicate. The nuts are separated from the apples immediately after collection.

3. Post Harvest Handling

The apples are transpinted in crates on baskets to processing faculties to avoid damage. Since they are perishable they must be processed or consumed quickly after harvest.

[Hartley L, igbinedion E, Thorogoodm, clarkia, stranges et al [2012]

1.3 PEST AND DISEASES OF CASHEW APPLE

Cashew trees and their fruits are susceptible to various best and disease that can affect productivity. Common ones include;

1.31 PEST OF CASHEW APPLE

1. Tea mosquito bug[helopettis cintonii]

Attack young shoot, flowers and fruit causing lesions on the cashew apple and reducing it's quality.

2. Stem and root borers

These pests damage the tree by boring into the stem causing witing and reduced fruit production.

3. Thrips

Cause discoloration and scaring of the cashew apple surface

4. Aphids

Small, soft bodies insects is that feed on sap , causing culed districted leaves

5. Whiteflies

Tiny winged insects that feed on sap , transmitting diseases like yellow mosaic virus .

6. Fruit flies

Small, winged insects that lay eggs in cashew apples, causing fruit drop and damage

7. Mealy Bugs:

Small, white cotton insects that feed on sap, casuisng stunted growth

[Habibi E, Shokrzadah M, Ahmadi A, Chabra A, Naghshua F et al (2018)]

DISEASES OF CASHEW APPLE

1. Powdey Mildew

   A fungal disease that affects flowers and fruits leading to poor fruit set and smaller cashew apples.

2. Anthracnose

   Cause dark spots and lesions on the cashew apples reducing marketability and quality.

3. Dieback

   Affects branches and may lead to reduced fruit yield and overall tree health

4. Yellow Mosaic Virus

   A viral disease causing yellowing of leases stunted growth and reduced yields.

5. Root Rot

   A fungal disease causing roots to rot, leading to plant death.

[Ahmadi A, Shadbotstan A. (20216)]

1.4 RED YELLOW CASHEW APPLE

The red yellow cashew apples are the most prominent varieties of this pseudofruit. Here a comparison

Table 1.1

Aspect	Red, Yellow Cashew Apple
Color	Bright red, light yellow to golden
Texture	Slight yellow fibrous juice and smooth
Taste	Sweet and slightly tangy mildly sweet with lower acidity
Uses	Juices jam and fermeted product direct consumption, beverages
Shelf life	Slightly longer due to firms skin shorter, as it bruises more

Both type are lightly nutritious, rich in vitamin C, and are valued for their diverse uses. They are also gaining popularity in industries like wine and juice production due to their unique flavor profiles (Arinzechulawu and Nkama 2019)

DRYING OF CASHEW APPLE

1. SOLAR DRYING

   Method: cashew apples are exposed to sunlight often an raised platforms or trays covered with netting to prevent contamination.

   Advantage; cost effective and environmental friendly;

   Challenges; dependent on weather conditions may result in uneven drying.

2. Freeze Drying

Method; Cashew apples are fozen and alen subjected to a vacuum that causes the water content to sublimate [change directly from solid to gas]

Advantage; preserve nutrients, texture and flower, long shelf life.

Disadvantage; High energy costs expensive equipment and may not suitable for small scale production.

3. CABINET DRYING

Mrthod ; Cashew apple are dried in a controlled environment using a cabinet dryer with regulated heat and flow.

Advantage; Uniform drying ,faster process and higher quality retention

Challenges; moderate cost and requires specific equipment.[Galano A [2015]

4 .SUN DRYING

Method; similar to solar but without controlled condition often done on open surfaces.

Advantage; Simple and requires no special equipment.

Challenges; Higher risk of contamination slower process and potential loss of nutrient due to exposure.

5 .OSMOTIC DRYING

Method; The fruit is pretreated with a concentrated sugar or salt solution to draw out water from drying.

Advantage; retains flaws and texture while reducing drying time.

Challenges; Added sugar and sugar may attertle nutrition profile. [Galano A [2015]

NUTRITIONAL COMPOSITION OF RED, YELLOW OF CASHEW APPLE

Red and yellow cashew apples are highly nutritious and are considered an excellent source of vitamins, minerals and other beneficial compounds. Below is the typical nutritional composition per 100grams of fresh cashew apple

Nutrient	Content

Energy	40-50lacal
Water	80-90g
Carbohydrates	10-13g
Sugars	8-10g
Protein	0.9-1.1g
Fat	0-1-0.2g
Vitamin c high]	200-300mg [very]
Vitamin A	Trace amounts
calcium	10-12mg
iron	0-5-1.1mg
potassium	120-150mg
fiber	1.5-2g

[ROSE, LC Tapsell, sabete] 2010

Vitamin c; The cashew apple contains more vitamin c than oranges ,contributing to its strong cintioneident properties.

Low colones; it is a low colories fruit making it ideal for health conscious consumers.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Sample procurement

Matured red yellow cashew apple was plucked from ara village, Ilorin, kwara state.

3.2 Equipment and Materials

Materials such as bowls, water knives, hand gloves, ziplock bag, foil, paper, tissue paper, trays with mesh, nets, electric blenders, solar dryer, weighing balance, thermometer were used.

3.3 Sun Drying

Mechanical Drying

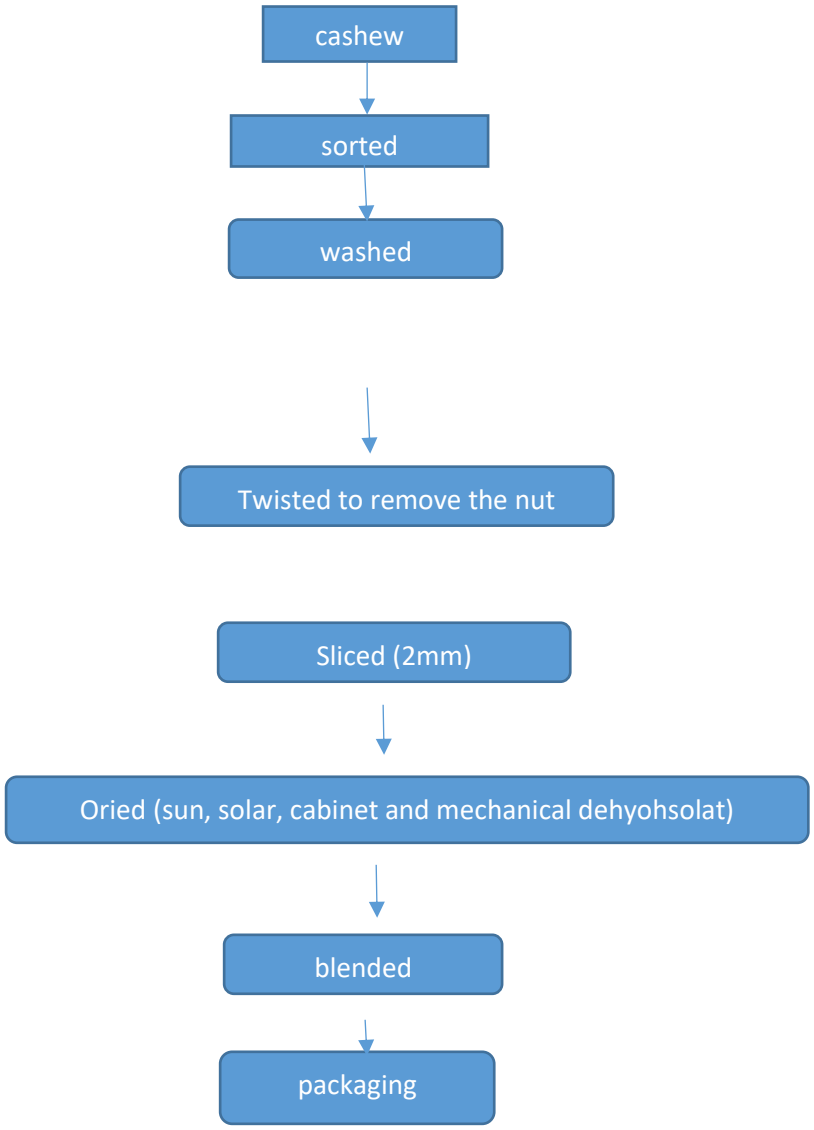
cashew
sorted
washed
Twisted to remove the nut
Sliced (2mm)
Oried (sun, solar, cabinet and mechanical dehyohsolat)
blended
packaging

Fig 3.1

Flow diagram for dried cashew (red yellow) apple fruit.

Reference Ogunjobi and Ogunwolu (2010)

3.3.1 Solar Drying

The cashew apple were sorted, washed and the nuts were removed. The cashew apples were sliced and spread in three trays, the covered with nets and placed in a solar dryer for 72hrs. After the red yellow cashew apple was dried electric blender was used to blend it into powder.

The cashew powder was packed into 2 plocks bags

3.4 Sample Preparation

The cashew apple was taken to the lab for analysis, firstly extract the samples. The solvent to be used is called METHANOL. We use the weighing balance to measure the solvent (1gm) we added 10cm of methanol to the solvent and shake thoroughly so that it can mix together.

Chemical Analysis

3.4.1 Proximate Analysis

3.4.1 Determination of moisture content

This method is based on moisture content radion. Here the aluminium dishes were washed dried in oven and is desicators for cooling. The weight of each dish was taken

of ground samples of were weighted into a sterile aluminium dish, weight of the dish and weight of undried. Sample (in duplicate) were taken.

This was transferred into an oven set at 80^0c for 2 hours and 100^0c for 3 hours respectively. This was removed and cooled in desiccators. Then the weight was measured using a measuring scaler balance. It was transferred back into the oven for another one hour and then reweighted the process continued until a constant weight was obtained.

The differences in weight between the initial weight and the constant weight gained represents the moisture content.

Calculation: the loss in weight multiplied by 100 over the original weight is percentage moisture content.

Moisture content (g/100g)

A loss in weight [(w2-w3)/ (w2-w1)] * 100

Where w1= initial weight of empty crucible,

W2= weight of crucible + sample before drying-w3= find weight of crucible + sample after drying.

%Total solid (dry matter) (%) = 100 moisture

3.4.1.2 ASH CONTENT

The ash represents the inorganic component (minerals) of the sample after all moisture has been removed as well as the organic material. The method is a destructive approach based on the decomposition of all organic matter such that the mineral elements may be lost in the process twenty grains (20g) of each of the sample were weighted into a clean dried and cooled platinum crucible. It was put into a furnance

set of 55^0c and allowed to blast for 3hrs. It was then brought out and allowed to cool in desiccators and weighed again.

Calculations: percentage weight is calculated as weight of ash multiplied by 100 over original weight of the sample used.

Ash content= (weight of ash/weight of original sample used)*100

Loss of weight [(W3-W1/W2-W1)] * 100

Where w1= weight of empty crucible

W2= weight of crucible + sample before drying and or ashing

W3= weight of crucible + ash

3.4.1.3 Crude Fiber Determination

The bulk of roughages in sample is referred to as fiber and is estimated as crude fiber. Twenty grains (20g) of the different samples were defatted with diethyl either for 8hrs and boiled under reflex for exactly 30min with 200ml of 1.25% H_2S0_4 it was then filtered through cheese cloth on a flutter funnel. This was later washed with boiling water to completely remove the acid. The residual was then boiled in a round bottoned flask with 200ml of 1.25% sodium hydroxide (NaOH) for another 30 mins and filtered through previously weighted couch crucible. The crucible was then dried with sample in an oven at 100^0c, left to cool in a desiccator and later weighed. This was later incinerated in a muffle finance at 600^0c for 2 to 3hrs and later allowed to cool in a desiccator and weighed

Calculations= weight of fiber = (c2-c3)

% fiber = c2-c3 * 100/wt, of original sample

Reference for proximate analysis chemists association of official analyticak chemists (2019). Official method of analysis 21st edition vol1, AOAC international, suite 300, 275 Research Blud Rockville, Maryland USA.

3.4.1.4 Determination of vitamin C (Ascorbic Acid)

0.1g of the sample was taken into a 15ml test tube. This was extracted with 1ml of 4% trichloro acetic acid (TCA). This was stirred with vortex mixer and allowed to stay for 15minutes the component was centrifuged at 2000pm for 5minute. 500 micro liter of vitamin C color reagent (Dichlorphenolindophenol) was added to 250 micro liters of the supernatant. The orange color that developed was measured at 700mm blank was prepared the same way as sample but TCA used in place of sample supermotant. The standard was prepared by using ascorbic acid at various concentration. The vitamin C content in each sample was calculated from the standard curve prepared using the standard.

CHAPTER FOUR

4.0 Result and Discussion

4.1 Proximate Composition

The proximate composition of SD, SOD, CD, and FD are shown in table 4.1

4.1.1 Moisture Content

The moisture content for table 4.1 shows that the range were between 5.22-11.27%. thr CD had 5.22%, which is the lowest moisture content while the highest moisture content is SD(11.27%). The result also shows that there's significant different $p<0.05$ among all the samples. It also show that CD, which had the lowest moisture content, will have higher shelf life then all other samples follow by SD (9.64%). The result is similar

4.1.2 Crude Ash

The crude Ash is from the range of 2.06-2.88%. The CD had 2.06, which is the lowest crude Ash while the highest Crude Ash is SD (2.88%). The result shows that there's significant different $P<0.05$ among all the samples. Its also show that SD with the highest range has high mineral advantage. The benefit of SD having the highest range in the sample is that it will supports bone health, promote healthy metabolism, help regulate blood pressure and it will contribute to overall nutrition.

4.1.3 Carbohydrate

The carbohydrate is from the range of 63.04-79.52%. The SOD has 63.04 which is the lowest carbohydrate among all the sample while the highest carbohydrate is CD (79.52%). The result show that there's significant different $6<0.05$ among all the samples. The SOD which have the lowest management blood sugar control. Low

carbohydrate in cashew apples might be suitable for specific diets or preferences Ayanwale et al (2010).

4.1.4 Crude Fat

The crude fat is from the range of 0.88 to 1.19. The CD has 0.88% which is the lowest crude fat among all the sample, while SD has the highest crude fat (1.19%). The CD (0.80%) which is the lowest it help in energy provision, absorption of vitamins cell membrane structure while SD(1.19&) which is the highest crude fat has a effect of adding to weight, it increasr calories intake. The crude fat content of cashew apples can have both positive and negative effects depending on individual circumstances and dietary needs. Neema Kassim (2020).

4.1.5 Crude Fiber

The crude fiber is from the range of 8.05-12.21. The FO is the lowest while the SOD (12.21%) is the highest crude fiber among all the samples. The SOD (12.21%) which is the highest help in improving digestive health, increased satiety and potential benefit is cause during the drying process, some nutrient has been loss during the drying processing crude fiber in cashew apples after various health benefits, while high fiber content can promote digestive health and satiety. Journal al-Eizhar et al (2019).

4.2 Vitamin C

The vitamin C is from the table 4.2 show that the range were between 7.53%.32.16%. is the highest vitamin C among all the samples. The result shows that there's significant different 6<0.05 among all the samples the SOD (32.16%) which is the highest vitamin help in immune function, enhanced antioxidant activity and help

in healthy skin and bones. Vitamin C in cashew apples is essential for immune function, autioxid ant activity, and coollen production. A balance intake of vitamin C is crucid to reap its benefits while minimizing potential drawbacks (Mare et al 2012).

CHAPTER FIVE

SUMMARY, RECOMMENDATION AND CONCLUSION

5.1 SUMMARY

The cashew apple is a nutrient rich that offers various health benefits due to its high content of vitamin, minerals, antioxidant and fiber cashew apple is very useful in fresh consumption enjoy cashew apples fresh or use in salads, juice and beverages, jams and preserves and functional foods. Cashew apples are a nutritious and versatile fruit that can be enjoyed in various ways. Their potential health benefits and uses make them a valuable addition to a balanced diet.

5.2 RECOMMENDATION

Considering the availability and nutritional potential of cashew apple in Tanzania, it is recommended that tremendous efforts needs to be invested in order to efficiently explort the potential of cashew apples, farmers should be given education and training on the importance of cashew apples and various quality processing technologies in order to increase awareness and avail this opportunity into the farmers and processors hands. Furthermore, the government should equally encourage the establishment of processing industries and fund researches related to cashew apples value addition and marketing.

5.3 CONCLUSION

cashew apple fruit are important source of nutrient and bioactive compounds beneficial to consumer “health , farmers income and the economy of the country .cashew apple in the selected area are found to be underutilized and the small utilized proportion is highly consumed in there raw state with the frequency and number of

fruit consumed by an individual being high . In addition processing of cashew into valuable product apart from eating the cashew apple directly was found to be a major concerned .the study also attempted to develop dried cashew apple with good acceptability as an approach to utilize the potential of this fruit . It was revealed that mechanical drying and solar dried fruit has Almost the same nutrient retention after processing and storage . Furthermore both drying method had similar overall acceptability.mechanical drying method is superior to solar drying method as less time is required for drying , hence reduced risk and spoilage . Sun drying is abundant in nature , thus solar drying could be use as an alternative to mechanical drying and other sophisticated drying which may be expensive and inaccessible to the low resources setting .therefore dried form of cashew apple could be regarded as nutritious product and that could be processed in a large scale and solid wide range market segment for both income , nutrition and food security . This will ultimately reduced the post - harvesting losses of cashew apple encountered at the moment . In addition the cashew apple as highlight the nutritional and potential health benefit of this often overlooked fruit , rich in vitamin , mineral , antioxidants and other bio active compounds, cashew apple offer a range of advantages like nutritional value ,optimize cultivation and processing , explore new products and application , and promoting awareness and consumption.

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