SCREENING FOR HIGH BROMELAIN CONTENT IN DIFFERENT SPECIES OF PINEAPPLE IN MALAYSIA.

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The importance of the study:

- Bromelain in pineapple is known for its medical properties such as:
  - Anti-inflammatory agent
    - Effective in relieving inflammation associated with infection and physical injuries. [9]
  - Help to promote and maintain proper digestion
    - Relieve symptom of stomach upset or heartburn [9]
In order to promote the benefit of eating fresh pineapple, it is important to screen for the highest bromelain concentration in various pineapple grown in Malaysia.
SCOPES

- Identify pineapple species grown in Malaysia and potentially grown in Malaysia.
- Screen for bromelain and total protein content in flesh and stem of each species.
METHODOLOGY

- Analyses four (4) types of pineapple that can be easily found in Malaysia. They are:
  - Josapine
  - Gandul
  - Maspine
  - N 36

- Analysis that had been done are Gelatin Digestion Unit (GDU) test for bromelain concentration and Buireset Protein Assay for total protein.
PINEAPPLES

- Scientifically known as *Ananas Comosus M.*
- Contain: 81.2 – 86.2% moisture,
  13 – 19% total solid
  (glucose, sucrose, fructose)
TYPES OF PINEAPPLES FOUND IN MALAYSIA

- **CANNING**
  - N 36
  - GANDUL
  - MORIS

- **FRESH**
  - JOSAPINE
  - JOHOR 1
  - SARAWAK
  - CRYSTAL HONEY
  - MASPINE

- **OTHER SPECIES OF PINEAPPLE**
  - Nanas hijau
  - Moris gajah
  - Yan Kee
  - Giant India
  - Hana
  - Sleeping beauty
COMMERCIALY GROWN PINEAPPLE

JOSAPINE

GANDUL

MASPINE

N 36
# GENERAL NUTRITIONAL FACTS

Pineapple is a well known tropical fruit. It contains an enzyme called **bromelain**.

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>EVERY 100g/ edible parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>45.0 calories</td>
</tr>
<tr>
<td>Moisture</td>
<td>87.8 g</td>
</tr>
<tr>
<td>Protein</td>
<td>0.5 g</td>
</tr>
<tr>
<td>Fat</td>
<td>0.1 g</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>10.6 g</td>
</tr>
<tr>
<td>Fiber</td>
<td>0.6 g</td>
</tr>
<tr>
<td>Ash</td>
<td>0.4 g</td>
</tr>
<tr>
<td>Calcium</td>
<td>24.0 mg</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>6.0 mg</td>
</tr>
<tr>
<td>Beta carotene</td>
<td>270.0 µg</td>
</tr>
<tr>
<td>Vitamin B1</td>
<td>0.7 mg</td>
</tr>
<tr>
<td>Vitamin B2</td>
<td>0.8 mg</td>
</tr>
<tr>
<td>Niacin</td>
<td>0.1 mg</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>15.2 mg</td>
</tr>
</tbody>
</table>

*Source: Malaysian Food Nutrition Composition, IMR 1982*
WHAT IS BROMELAIN?

- A complex mixture of sulfur-containing protein-digesting enzymes called PROTEOLYTIC ENZYMES or PROTEINASES. [9]

- It is a crude, aqueous extract from the STEMS and IMMATURE FRUITS OF PINEAPPLES. [1]

- Contain small amount of: peroxidase, acid phosphatase, protease inhibitors and calcium. [9]
WHERE BROMELAIN CAN BE FOUND?

- Usually found in ALL PARTS of the PINEAPPLE plant. [9]
- Mostly concentrated in the STEM. [9]
- Types of Bromelain found in pineapple:
  - From pineapple stem = stem bromelain, ananain, comosain.
  - From pineapple fruit = fruit bromelain. [1]
CLINICAL AND OTHER USES

- Most common uses: MEAT TENDERIZER and used in DIGESTIVE PROBLEM.
- Therapeutic benefits:
  - Reversible inhibition of platelet aggregation.
  - As an anti-inflammatory agent.
  - Bronchitis
  - Sinusitis
  - Surgical trauma

[1,2,3,4,9]
SIDE EFFECT

- Nausea
- Vomiting
- Diarrhea
- Menorraghia (excessively heavy menstrual flow)
- Possible allergic reaction
- Possible to increased heart rate (with doses up to 1840 mg)
- May interact with medications (antibiotic: tetracycline and blood thinning medications: aspirin and warfarin)

[1,2,3,4,9]
PRECAUTION

- Those who are allergic to pineapple should avoid consuming it because skin reactions and/or asthma-like symptom may occur.
- Bromelain supplement should only be taken under supervision of medical practitioners for those who are:
  - Pregnant
  - Individuals with bleeding disorders
  - Individuals with high blood pressure
  - Liver or kidney disease

[1,2,3,4,9]
METHODOLOGY

A) GELATIN DIGESTION UNIT (GDU) ANALYSIS

- Conducted in order to determine the enzyme activity [5]
- Pineapple juice will cause the gelatin to stay in liquid state.
B) BUIRET PROTEIN ASSAY

- The principle Buiret assay is to determine the protein content of an unknown.
- The quantity measured in a protein assay is absorbance of light.
- Sample with known amounts of protein and comparing their absorbance with the unknown sample. [11]
RESULT

COMPARISON OF BROMELAIN CONCENTRATION IN FLESH AND STEM OF INDEX 2 PINEAPPLE

Bromelain Concentration (GDU/g)

Sampling: $n = 2$
From the chart,

- It is obvious that *Gandul* and *N 36* have high bromelain concentration in stem at index 2.

However,

- *Josapine* and *Maspine* have almost the same concentration of bromelain either in flesh or stem.
COMPARISON OF BROMELAIN CONCENTRATION IN FLESH AND STEM OF INDEX 4 PINEAPPLE

Sampling: n = 2
From the observation,

- It is clear that at index 4, bromelain concentration is higher in the flesh compared to the stem.

- Bromelain concentration in Josapine, Maspine and N36 are found to be \( \approx 50\% \text{ less} \) in the stem.

- While in Gandul, the bromelain concentration is \( \approx 20\% \text{ higher in flesh} \).
INFLUENCE OF FRUIT INDEX ON BROMELAIN CONCENTRATION

Sampling: n = 2
From the graph,

- Fruit index does influence the concentration of bromelain in pineapples.

- There is a very significant increase of bromelain concentration in flesh from index 2 to index 4.

- In stem, bromelain concentration is insignificant between index 2 and index 4.

- Only the increased of bromelain concentration in gandul’s stem are significant from index 2 to index 4.
PROTEIN CONTENT IN VARIOUS PINEAPPLE GROWN COMMERCIALY IN MALAYSIA

<table>
<thead>
<tr>
<th></th>
<th>FLESH INDEX 2</th>
<th>STEM INDEX 4</th>
<th>FLESH INDEX 2</th>
<th>STEM INDEX 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>JOSAPINE</td>
<td>0.189</td>
<td>0.202</td>
<td>0.239</td>
<td>0.236</td>
</tr>
<tr>
<td>GANDUL</td>
<td>0.201</td>
<td>0.202</td>
<td>0.204</td>
<td>0.214</td>
</tr>
<tr>
<td>MASPINE</td>
<td>0.201</td>
<td>0.202</td>
<td>0.217</td>
<td>0.230</td>
</tr>
<tr>
<td>N 36</td>
<td>0.216</td>
<td>0.202</td>
<td>0.214</td>
<td>0.235</td>
</tr>
</tbody>
</table>

Sampling: n = 2
Referring to the graph,

- Total protein for both index 2 and index 4 are approximately similar.
- Except for Josapine at index 4, the total protein is higher compared to the others.
- In index 2, the total protein for stem are equal for all variety of pineapple.
- A small increases can be spotted for total protein in flesh and stem of maspine and N 36 in index 4.
CONCLUSION

- Bromelain concentration change with the index.
- Different variety of pineapple have different bromelain concentration.
- Josapine and Maspine in index 2 are relatively having the same bromelain concentration.
  - Could be due the hybridization of Maspine and Josapine.
CONCLUSION

- The concentration of bromelain is found to be higher in the flesh for index 4.
- Gandul has the highest bromelain concentration either in flesh or stem for index 4.
- Different index did not influence the total protein of pineapples.
- Josapine at index 4 has the highest total protein content compare to the other variety.
RECOMMENDATION

- Extract bromelain from cooled pineapple juice by centrifugation, ultrafiltration and lyophilization. [1]
- The bromelain concentration in pineapple juice can precisely calculated by using high performance liquid chromatography (HPLC).
- It is suggested to eat the fresh or frozen (not canned) pineapple to obtain any potential health benefits from proteolytic enzymes in pineapples. [2]
REFERENCES

1. H.R. Maurer, *Bromelain: biochemistry, pharmacology and medical used*, CMLS Cellular and Molecular Life Sciences, 2001


4. Karen Howard, Donna Krupa, *Pineapple plant extract found to reduce asthma in mice*, 2004
5. *Gelatin Digestion Unit Analytical Method (GDU)*, Enzyme Development Corporation.


THANK YOU...
MY SPECIAL THANKS TO....

😊 Assoc. Prof. Dr Fadzilah Adibah
😊 Puan Siti Zalita
😊 Encik Muhammad El-Qarni
😊 Encik Malik
😊 Encik Yaakub
😊 Cik Rozilawati
😊 Cik Madihah
😊 Not to forget friends and family......