DEVELOPING TUBER BASED FUNCTIONAL FOOD TO SUPPORT FOOD SECURITY

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THE GLOBAL FOOD SECURITY INDEX

- Indonesian position for food security increases at 71 of 113 countries in 2016, in 2019 at position of 65.
- It is based on Global Food Security Index (GFSI) that released by The Economist Intelligence Unit.

Developed by Economist Intelligence Unit and The Economist.
Indonesian Food Security and Vulnerability Atlas in 2018
Food Quality and Safety dalam GFSI

Measured across five indicators:
- Diet diversification
- Nutritional standards
- Micronutrient availability
- Protein quality
- Food safety
### Food Accessibility

- Affects the ability to obtain qualified and safe foods
- In food innovation, accessibility should be taken into account
- **Problems:** local food innovation usually produces more expensive procedures that limit the access of the foods
The Challenges

- Increasing food availability
- Diversification
- Developing competitive food products
- Increasing added value

Innovation

Food Independence

Accelerating Diversification of Food Consumption (P2KP)
P2KP
(Presidential Regulation No. 22 Year 2009)

Decreasing rice and wheat consumption

Facilitation of production of non rice and non wheat flours (intermediate products)

Shifting rice and wheat consumption into other carbohydrate based commodities mainly tubers
7 Indicators for P2KP Program

1. Food consumption is more vary and balance, as the sources of carbohydrate, protein, vitamins, and minerals, in daily consumption.

2. Decreasing rice consumption 1.5% annually.

3. Increasing the image of local foods in community.

4. More people use the yard as the sources of foods for family consumption.
5. Increasing the interest of food business to produce local food products

6. Increasing the participation of people in food business including culinary technology to develop local foods

7. Increasing the role of universities to support P2KP based on local food development
Local Food Varieties

- Legumes
- Cereals
- Tubers
- Vegetables
- Fruits
- Rhizomes
- Animal Foods
- Other Foods

Local Wisdom
LOCAL CEREALS
Serealia/Biji-bijian

- Maixe
- Rice
- Millet
- Sorghum
- Sesame
SORGHUM

White Sorghum

Brown Sorghum
Millet (Setaria italica)

Millet plant

Millet seed
Varieties of Millet
Millet as Staple Food in Papua Island
VARIETIES OF TUBERS
Cassava (Manihot utilissima)

Cassava plant
Varieties of Cassava

Adira

Malang

Darul Hudayah

High productivity, high cyanide
Staple Foods from Cassava

• Kasuami from Buton Island
• Kabuto from Muna Island
• Sangko from Kangean Island
• Tiwul from Java
• Rasi from Cireundeu
• Nasi aruk from Bangka
Sweet potato (Ipomoea batatas)
Varieties of Sweet Potato

- White
- Yellow
- Orange
- Purple
- Purple-White
- Cilembu

Rich in Pigment
Taro plant

Tarp (Colocasia esculenta)
Type of Taro Based on Flesh Color
Cana plant

Cana (Cana edulis)
Cocoyam plant

Cocoyam (Xanthosoma saggitifolia)
Bentul Taro

Bentul (Colocasia esculenta)
Suweg (Amorphophallus campanulatus)

Glucomanan

Suweg Paint
Sente Plant

Sente (*Alocasia macrorizha*)
Lesser yam plant

Bioactive Compounds: WSP, Diosgenin, Dioscorin

Lesser yam (Dioscorea esculenta)
Varieties of Lesser Yam from Different Locations at Central and East Java (Herlina, 2011)
Giant Yam

(Giant Yam (Dioscorea bulbifera))

Bioactive Compounds: WSP, Diosgenin, Dioscorin
Greater yam

Bioactive Compounds:
WSP, Diosgenin, Dioscorin, High Amylose - RS

Greater yam (Dioscorea alata)
Wild yam (Dioscorea hispida)

Bioactive Compounds: WSP, Diosgenin, Dioscorin
Konjac

(*Amorphophallus oncophillus*)

Glucomannan – Food Ingredient
Arrowroot (Maranta arundinaceae)

Low GI, 14
Black Potato

Black Potato (Solanum rotundifolius)
Dioscorea Family
(Trimanto and Hapsari, 2003)

Figure 2. Outer morphological features of Dioscorea spp. tubers from Nganjuk
The Problems in Local Foods as Industrial Ingredients

Availability

- Quantity of production is limited
- There is no center of production
- Continuity of production

Characteristics

- Not yet completely explored
- Some tubers contain toxic compounds
- Some contains anti-nutritionals
- Some needs flour or starch modification

Acceptability of consumers – Social Engineering
Availability

Limited production and cultivation

- No market demand
- Some are endangered and no more available and recognized
- Specific location

Central of Production

Mapping

Exploring the Health Benefits

Product Innovation
Cultivation of Wild Yam under the Shade of the Trees in the Forest
Detoxification

**Cyanide**
- Wild yam
- Bitter Cassava

**Oxalate**
- Konjac
- Suweg
- Taro

Innovation

Technology of Detoxification
Characteristics for Industrial Ingredients

- Specific characteristics
- Sorghum – hard, astringent, difficult to polish
- Maize – hard starch granule
- Dioscorea – hard texture of the products
- Flour color – tend to brown
- Mucolage

Innovation

Modification of the starch and flour such as mocaf, mocap, nixtamalization

Processing Technology
Exploring the Excellence of Tuber Bioactive Compounds

- Dioscorin, diosgenin, galactomannan, glucomannan, water soluble polysaccharides lain, pigment (anthocyanin, carotenoid)

Functional characteristics: high amylose, high feedback viscosity, high amylopectin, high glucomannan, low GI
Developing Tuber Based Foods
Substitution

- The most innovation
- To replace wheat flour
- A certain product such as noodle and bread cannot be fully substituted
- A challenge of gluten-free product for autism market
Tuber Based Noodles

- 5 types of tubers
- Without wheat flour
- Wet noodle, dry noodle, instant noodle
- The process is similar to wheat noodle
- Health benefits: lowering blood cholesterol, glucose, hypertension
- Have antioxidant activity and hepatoprotector
Antihypertension Effect of Tuber Based Noodles

Blood Pressure (mmHg)

Week
Blood Glucose Lowering Effect

Blood Glucose Level (mg/dL)

Week

Normal
Standard
Wheat
Lesser Yam
Wild Yam
Greater Yam
Arrowroot
Cocoyam
Hypocholesterolemic Effect

Blood Total Cholesterol (mg/dL)

Week

Normal
Standard
Wheat
Lesser Yam
Wild Yam
Greater Yam
Arrowroot
Cocoyam
Developing of Substitutes for Staple Foods

Staple Foods:

• The highest quantity of consumed food
• The highest contributor for energy intake
• Decreasing rice and wheat consumption

Artificial Rice

• Form the ingredients other than wheat and rice
• Processing technology: extrusion, twin roll machine, etc
Tuber Based Artificial Rice

- Color and texture are not attractive
- Acceptance test: rather like
- Processing technology is still complicated
- Health benefits: lowering blood cholesterol, glucose, hypertension
- Have antioxidant activity and hepatoprotector
Nasi Analog

- It is tasty to consume with side dishes such as rice.
Hypoglycemic Effect

Blood Glucose Level (mg/dL)

Week

Rice
Lesser Yam
Wild Yam
Greater Yam
Arrowroot
Cocoyam
Hypocholesterolaemic Effect

Blood Total Cholesterol (mg/dL)

Week

Normal
Rice
Lesser Yam
Wild Yam
Greater Yam
Arrowroot
Cocoyam
Hypotensive Effect

Blood Pressure (mmHg)

Week
Social Engineering

• Mainly for a new product
• Introduction and promotion should be intensive and attractive
• Change the mind-set of consumers
• Exploring the excellence of tubers: cheaper, have health benefits, more attractive, affordable

• A Challenge
THANK YOU