PENYEDIAAN SERBUK SERABUT DIET DARIPADA KULIT PISANG DAN UBI KELEDEK

TEY CHEW LAN

LATIHAN ILMIAH INI DIKEMUKAKAN UNTUK MEMENUHI SYARAT MEMPEROLEHI IJAZAH SARJANA MUDA SAINS MAKANAN DENGAN KEPUJIAN DALAM BIDANG TEKNOLOGI MAKANAN DAN BIOPROSES

SEKOLAH SAINS MAKANAN DAN PEMAKANAN
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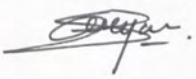

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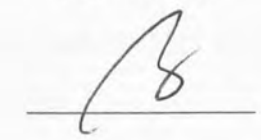

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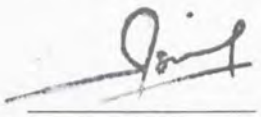

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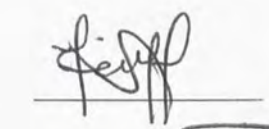

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PENGHARGAAN

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ABSTRAK

PENYEDIAAN SERBUK SERABUT DIET DARIPADA KULIT PISANG DAN UBI KELEDEK

Kajian ini dijalankan untuk mengkaji kesan saiz partikel (5 mm, 10 mm, 15 mm, dan 20 mm) dan masa penceluran (5 min, 10 min, dan 15 min) ke atas kandungan serabut diet, kandungan proksimat, warna, aktiviti air (a_w), kapasiti membendung air (WHC), kapasiti membendung minyak (OHC), dan keupayaan mengembang (SWC) ke atas serbuk serabut diet yang dihasilkan daripada kulit pisang Saba dan kulit ubi keledek. Kulit pisang Saba dan kulit ubi keledek yang bersaiz 15 mm dapat menghasilkan serbuk serabut diet dengan peratus perolehan yang lebih tinggi, iaitu masing-masing 12% dan 19% ($p<0.05$). Kesemua sampel dihasilkan mempunyai nilai a_w yang kurang daripada 0.7, maka adalah stabil dari segi penyimpanan. Warna serbuk serabut diet kulit pisang Saba adalah lebih gelap dan kurang menarik berbanding dengan sampel serbuk serabut diet kulit ubi keledek. Kandungan lembapan dan kandungan protein antara kedua-dua sampel tidak menunjukkan perbezaan yang nyata ($p>0.05$). Namun, kandungan abu serbuk serabut diet kulit pisang Saba didapati lebih tinggi berbanding dengan serbuk serabut diet kulit ubi keledek. Kandungan lemak serbuk serabut diet kulit pisang Saba didapati sepuluh kali ganda lebih tinggi daripada kandungan lemak serbuk serabut diet kulit ubi keledek ($p<0.05$). Didapati jumlah serabut diet (TDF), nisbah IDF/SDF, WHC, OHC dan SWC serbuk serabut diet kulit pisang Saba adalah lebih tinggi berbanding dengan serbuk serabut diet kulit ubi keledek ($p<0.05$). Akan tetapi, serabut diet larut air (SDF) serbuk serabut diet kulit ubi keledek (11.9%) adalah lebih tinggi daripada SDF serbuk serabut diet kulit pisang Saba (5.3%) ($p<0.05$). Selain itu, nilai WHC dan OHC bagi kedua-dua sampel tidak menunjukkan perbezaan signifikan ($p>0.05$). Nilai OHC bagi kedua-dua sampel adalah kira-kira empat kali ganda lebih rendah daripada nilai WHC. Kajian ini mendapati saiz partikel dan masa penceluran telah mempengaruhi TDF, SDF, nisbah IDF/SDF dan SWC kedua-dua sampel serbuk serabut diet dengan ketara ($p<0.05$). Selain itu, kesan interaksi antara saiz partikel dan masa penceluran didapati turut mempengaruhi SDF, nisbah IDF/SDF dan SWC kedua-dua sampel serbuk serabut diet ($p<0.05$). Kesimpulannya, serbuk serabut diet kulit ubi keledek yang mengandungi kandungan abu dan kandungan lemak yang rendah serta kandungan SDF yang tinggi merupakan sumber serabut diet sisa sampingan yang lebih baik berbanding dengan serbuk serabut diet kulit pisang Saba.

ABSTRACT

PREPARATION OF HIGH DIETARY FIBRE POWDER FROM BANANA PEELS AND SWEET POTATO PEELS

This study was conducted to investigate the effect of particle size (5 mm, 10 mm, 15 mm and 20 mm) and blanching time (5 min, 10 min and 15 min) on the content of dietary fibre, proximate analysis, colour, water activity (a_w), water holding capacity (WHC), oil holding capacity (OHC), as well as swelling (SWC) of the dietary fibre powder prepared from banana peels and sweet potato peels. Banana and sweet potato peels with 15 mm particle sized could produce highest recovery, namely 12% and 19% respectively ($p<0.05$). It was found that all the samples had a_w value less than 0.7, thus were stable in terms of storage. The dietary fibre powder of the banana peels was found darker and less attractive compared to the dietary fibre powder of sweet potato peels. There were no significant differences for moisture content and protein content between the dietary fibre powder of banana peels and sweet potato peels ($p<0.05$). However, ash content of dietary fibre powder from banana peels was found higher compared to the sweet potato counterpart. The fat content of the dietary fibre powder of banana peels was found ten times higher than the fat content of dietary fibre powder of sweet potato peels ($p<0.05$). The study found that total dietary fibre (TDF), ratio of IDF/SDF, WHC, OHC, and SWC of the dietary fibre powder of banana peels was higher compared to the dietary fibre powder of sweet potato peels ($p<0.05$). Nonetheless, soluble dietary fibre (SDF) of dietary fibre powder of sweet potato peels (11.9%) was higher than the SDF of dietary fibre powder of banana peels (5.3%) ($p<0.05$). No significant difference was detected for WHC and OHC of both dietary fibre powders ($p>0.05$). OHC of both the dietary fibre powders was found four times lower than the WHC. This study found that the particle size and blanching time influenced the TDF, SDF, ratio of IDF/SDF and SWC of both the dietary fibre powders significantly ($p<0.05$). Interaction effect between particle size and blanching time also affected the SDF, ratio of IDF/SDF and SWC of both dietary fibre powders ($p<0.05$). In conclusion, dietary fibre powder of sweet potato peels is a good source of dietary fibre waste product as it contained higher SDF content and lower ash and fat as compared to dietary fibre powder of banana peels.

SENARAI KANDUNGAN Halaman

SENARAI RAJAH

SENARAI JADUAL

SENARAI FORMULA

SENARAI SINGKATAN NAMA

ANOVA	Analisis Sisihan Piawai
$CuSO_4$	Kuprum sulfat
DP	Darjah Percantuman Polimer
GALT	Rangkaian Limfoid
HCl	Asid Hidroklorik
H_2SO_4	Asid Sulfurik
K_2SO_4	Potassium Sulfat
NaOH	Natrium Hidroksida

SENARAI SIMBOL DAN UNIT

%	Peratus
cm	Centimeter
g	Gram
mg	Miligram
mm	Milimeter
µL	Mikroliter
ml	Mililiter
°C	Darjah Celsius
±	Campur Tolak
N	Normality

SENARAI LAMPIRAN

BAB 1

PENDAHULUAN

1.1 Pengenalan

Pengguna-pengguna pada zaman moden ini lebih mengambil berat terhadap kesihatan badan. Pengguna-pengguna bukan sahaja mengharapkan makanan yang sedap dan menarik, malahan makanan tersebut haruslah selamat dimakan serta baik untuk kesihatan. Oleh sebab kepentingan diet dan kesihatan, kebanyakan pengguna telah memilih cara hidup yang sihat dengan memakan makanan yang telah sengaja diperkaya dengan nutrien (Qiang *et al.*, 2009). Menurut Fuentes-Alventosa *et al.* (2009), kadar jangkitan pelbagai penyakit usus seperti barah duodenum, apendisitis, penyakit sembelit, buasir, tumor barah usus, diabetis melitus, obesiti, dan penyakit kardiovaskular di negara maju adalah rendah di kalangan masyarakat yang mengambil jumlah kuantiti serabut diet yang tinggi.

Mengikut Codex (2009), serabut diet bermaksud polimer karbohidrat yang mengandungi 10 atau lebih unit monomer di mana serabut diet tidak boleh dihidrolisiskan oleh enzim endogen dalam usus kecil manusia. Serabut diet ini telah digolongkan dalam tiga kategori: 1) polimer karhohidrat yang boleh dimakan yang wujud secara semulajadi dalam makanan, 2) polimer karbohidrat yang boleh didapati dari bahan makanan mentah secara fisiologi, enzim atau bahan kimia yang mempunyai kesan fisiologi yang bermanfaat kepada kesihatan manusia seperti yang ditunjukkan oleh bukti saintifik yang diterima umum oleh pihak berkuasa, 3) polimer karbohidrat sintetik yang terbukti kesan fisiologinya yang bermanfaat kepada kesihatan manusia seperti yang ditunjukkan oleh bukti saintifik yang diterima umum oleh pihak berkuasa. *Federation of American Societies of Experimental Biology*

(FASEB) mengesyorkan bahawa pengambilan serabut diet sebanyak 35g sehari dengan memakan pelbagai jenis makanan (Andres, 1987).

Mengikut Shaw *et al.* (2010), obesiti akan menjadi satu masalah besar di Malaysia serta peningkatan penyakit diabetis yang berterusan merupakan satu bebanan kepada penyakit diabetis terutamanya di negara yang sedang membangun. Mengikut penyelidikan Kendall *et al.* (2010), obesiti dan diabetis melitus jenis dua merupakan faktor risiko kepada penyakit sakit jantung.

Manfaat serabut diet terhadap usus telah diakui secara meluas dan ia boleh dipertimbangkan sebagai satu jenis nutrien (FDA & Human Services, 1993). Serabut diet memainkan peranan yang penting dalam pencegahan karsinogenesis, arterioskerosis (Raghavendra *et al.*, 2006) dan pengurusan penyakit kronik seperti diabetis melitus jenis dua, penyakit sakit jantung dan kanser (Kendall *et al.*, 2010). Selain itu, penyelidikan telah menunjukkan bahawa pengambilan makanan serabut diet yang tinggi dengan diet indeks glisemik yang rendah, bukan sahaja dapat memperbaiki kawalan glisemik, malahan bermanfaat untuk pengurusan berat badan.

Amnya, kultivar pisang dibahagikan kepada dua kategori utama: (i) *dessert bananas* atau pisang manis dan (ii) *cooking bananas* atau plantain (Turner, 1994). Pisang Saba yang tergolong dalam spesis M. *Balbisiana* (Ploetz *et al.*, 2007) merupakan salah satu jenis plantain. Pisang Saba adalah lebih pejal daripada pisang manis dan kurang diambil sebagai produk segar walaupun telah matang kerana ia masih mengandungi kanji yang tinggi iaitu 31.7% (Lustre *et al.*, 1975). Di Malaysia, pisang Saba lazimnya digunakan untuk menghasilkan pisang goreng dan kerepek pisang (Masdek *et al.*, 2005). Anggaran juga telah dibuat di mana 50% daripada plantain digunakan untuk menghasilkan pisang goreng manakala yang selebihnya adalah untuk penghasilan kerepek pisang (Masdek *et al.*, 2005). Menurut laporan

González-Montelongo *et al.* (2010), sebanyak 30% daripada keseluruhan pisang adalah sisa kulit pisang. Sisa tersebut mengandungi kuantiti nitrogen dan fosforus yang tinggi menyebabkan pencemaran nitrat dalam air tanah, eutrofikasi tasik dan kolam, ubin merah di wilayah pesisir, dan meningkatkan pelepasan nitrik oksida. Menurut Tchobanoglous *et al.* (1993), sebanyak 40% daripada jumlah berat pisang manis dan plantain segar adalah sisa kulit. Zhang *et al.*, (2005) turut melaporkan bahawa kuantiti sisa kulit pisang manis atau plantain yang banyak ini telah membawa masalah kepada pembuangan. Laporan telah menunjukkan sisa kulit pisang manis dan plantain tidak boleh dianggap sebagai "sampah" (Happi Emaga *et al.*, 2008) kerana jumlah kandungan serabut diet pada sisa kulit pisang manis dan plantain adalah lebih kurang 50% berdasarkan asas kering (Happi Emaga *et al.*, 2007) dan mengandungi serabut diet yang sama atau lebih tinggi daripada sisa kulit buah-buahan lain. Lebih-lebih lagi, tahap kematangan pisang manis atau plantain tidak menjejaskan kandungan serabut diet secara konsisten (Happi Emaga *et al.*, 2008).

Menurut kamus Dewan Bahasa (2002), ubi keledek (*Impomoea batatas* L.) juga digelar sebagai ubi jalar, ubi jawa, ubi ketela atau ubi rambutan. Ubi keledek merupakan tanaman kelima penting selepas beras (padi), gandum, ubi kayu dan jagung di negara-negara sedang membangun (Rumbaoa *et al.*, 2009; Horton 1988). Telah dilaporkan bahawa ubi keledek adalah kaya dengan serabut diet, mineral, vitamin dan antioxidan seperti asid fenolik, antosianin, tokoferol, dan beta-karotin (Woolfe, 1993; Ishida *et al.*, 2000). Ubi keledek biasanya diproseskan kepada produk biskut, capati, kerepek, ugali, roti, kek dan sebagainya (Omosa, 1997). Menurut laporan Balagopalan *et al.* (1991), sisa kulit ubi keledek didapati semasa proses penyediaan kerepek ubi keledek dan jem. Beliau melaporkan bahawa satu per tiga daripada ubi keledek adalah sisa kulit. Beliau turut melaporkan bahawa satu kilogram sisa kulit mentah dapat menghasilkan 180-200g sisa kulit kering selepas dikeringkan. Tambahan pula, sisa kulit ubi keledek adalah sisa utama bagi pemprosesan ubi keledek (National Research Council, 1983). Walau bagaimanapun, ubi keledek telah

disyorkan sebagai tanaman yang berpotensi diproses kepada produk bernilai serta unik kerana kandungan nutrisinya yang bermanfaat kepada kesihatan manusia (Balagopalan *et al.*, 1991) serta peratusan degredasi sisa kulit ubi keledek adalah tinggi iaitu sebanyak 95% (Wilson dan Azeb, 1989).

Telah dilaporkan bahawa saiz partikel dan masa penceluran didapati mempengaruhi kandungan serabut diet dalam serbuk kulit mangga (Larrauri *et al.*, 1996). Mengikut Larrauri (1999), saiz partikel yang terlalu kecil akan membawa keburukan kepada proses pengeringan. Sebaliknya, saiz partikel yang terlampau besar akan menyusahkan pengasingan komponen yang tidak diingini seperti gula. Langkah penceluran pula merupakan satu langkah yang mampu memberi kesan kepada kualiti bahan mentah yang ingin dikaji (Larrauri, 1999). Menurut penyelidikan Larrauri *et al.* (1996), sebahagian sifat-sifat fizika-kimia sisa-sisa kulit mangga telah berubah selepas dicuci pada jangka masa serta saiz partikel yang berlainan.

Pembuangan sisa kulit pisang Saba dipercayai akan membawa kesan negatif kepada masyarakat terutamanya pencemaran persekitaran pada masa akan datang. Penggunaan sisa kulit pisang Saba dan kulit ubi keledek merupakan satu idea baru yang bernas memandangkan sisa kulit tersebut bukan sahaja mempunyai kandungan serabut diet yang tinggi yang bermanfaat terhadap kesihatan masyarakat. Malahan sisa ini merupakan sumber umum yang murah tetapi dengan keberkesanan yang tinggi, iaitu dapat menyumbang satu saluran yang lebih berguna dan menguntungkan bagi produk sampingan pisang Saba dan ubi keledek. Amnya, usaha membangunkan sisa kulit pisang Saba dan kulit ubi keledek sebagai sumber serabut diet menjadikan kajian ini penting kerana ini membantu mengurangkan pencemaran dan pembaziran dengan memperbanyakkan penggunaan sisa-sisa kulit tersebut.

Memandangkan masa penceluran dan saiz partikel adalah sangat penting untuk memastikan kandungan serabut diet dalam serbuk serabut diet, kajian ini akan memfokuskan terhadap kandungan serabut diet dan ciri-ciri kefungsian serbuk serabut diet yang dihasilkan daripada saiz partikel dan masa penceluran yang berbeza. Secara tidak langsung, data kajian ini dapat dijadikan sebagai rujukan kepada pengusaha berasaskan serabut diet untuk memahami kandungan serabut diet dan ciri-ciri kefungsian serabut diet yang dipengaruhi oleh pelbagai saiz partikel dan masa penceluran. Hasil kajian ini turut memaklumkan saiz partikel dan masa penceluran yang sesuai untuk menghasilkan serbuk sisa pisang Saba dan ubi keledek dengan kandungan serabut diet yang tinggi. Ini membolehkan serbuk serabut diet yang dihasilkan dapat digunakan dan diaplikasikan mengikut kesesuaian produk.

1.2 Objektif Kajian:

i. Mengkaji kesan pembolehubah saiz partikel dan masa penceluran ke atas kandungan serabut diet dalam kulit pisang Saba dan kulit ubi keledek.

ii. Menentukan kandungan serabut diet, kandungan proksimat dan ciri-ciri fizikal seperti warna, aktiviti air, kapasiti membendung air, kapasiti membendung minyak dan keupayaan mengembang dalam serbuk serabut diet yang dihasilkan.

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