

The Relationship of Wheat Flour Mix with Maizena and Sodium Carbonate to the Quality of Crispy Potatoes

Rahma Wahyuni Hsbn

Fakultas Pertanian, Universitas Sumatera Utara, Medan, Indonesia

Article Info

Article history:

Received : May 5, 2022

Revised : Jun 16, 2022

Accepted : Jul 30, 2022

Keywords:

Crispy Potatoes;
Grist Flour;
Corn Starch;
Sodium Carbonate.

ABSTRACT

The aim of this research was to find the effect of mixture grist flour and corn starch with sodium carbonate on the quality of potatoes crispy. The research had been performed using completely randomized design (CRD) with 2 factors, i.e: sum of grist flour and corn starch (3:1) (C) (25%, 30%, 35%, and 40%) and percentage of sodium carbonate (P) (0.10%, 0.15%, 0.20% and 0.25%). Parameters analysed were lipid content (%), free fatty acid (%), water content (%), and organoleptic values (colour, taste, and crispiness). The result showed that sum mixture of grist flour and corn starch had highly significant effect on free fatty acid, water content, organoleptic values (colour, taste and crispiness) and had no significant effect on lipid content. Percentage of sodium carbonate had highly significant effect on free fatty acid and organoleptic value of crispiness, had significant effect on water content, and had no significant effect on lipid content and organoleptic values (colour and taste). Interaction of sum mixture grist and corn starch with percentage of sodium carbonate had significant effect on free fatty acid and water content and had no significant effect on lipid content and organoleptic values (colour, taste, and crispiness). To yield crispy potatoes which have crispiness and taste delicious with using the sum of mixture grist and corn starch 25%, and sodium carbonate 40%.

This is an open access article under the [CC BY-NC](#) license.



Corresponding Author:

Rona J. Nainggolan

Fakultas Pertanian, Universitas Sumatera Utara, Medan, Indonesia

Jalan Dr. T. Mansur No.9, Padang Bulan, Kec. Medan Baru, Kota Medan, Sumatera Utara 20222

Email: ronanainggolan@gmail.com

1. INTRODUCTION

One of the horticultural commodities that have high economic value is potato. Although potatoes are not the staple food of the Indonesian people, their consumption tends to increase. Moreover, with the proliferation of fast food restaurants and potato processing factories, the demand for potatoes is increasing.

The demand for potatoes in the market tends to increase significantly. This is not only caused by population growth alone, but also because of the wider market segment. Currently the demand for potatoes for snacks and fast food is increasing sharply. Fast food restaurants such as McDonald's, Kentucky Fried Chicken and California Fried Chicken are mushrooming everywhere. PT. Indofood as one of the producers of "Chitato" potato chips has always experienced a shortage of raw materials for potatoes.

Until now, North Sumatra is the third potato-producing area in Indonesia after West Java and Central Java, and almost all provinces in Indonesia produce potatoes. Potato is a commodity that is in great demand by domestic and foreign consumers and is now widely used for developers and as a binder in tablet making, but the most popular is potato as a food ingredient. Apart from being a

source of carbohydrates, potatoes are prominent in providing nutrients, especially minerals (Fe, P and K), vitamins C, B6 and K, sources of folic acid and potassium. Considering the above, potato starch is a commodity that has the potential to be developed, especially in North Sumatra.

In fact, although potato farmers in North Sumatra do not experience difficulties in marketing because the potatoes produced are of good quality, farmers often have to sell their crops at very low prices compared to the production costs that have been incurred. The main obstacle faced is difficulty in storage.

The above causes a lack of appropriate technology in the area that can process these potatoes into other products, so the potatoes must be marketed outside the region in fresh form.

One way that can be taken to solve the problems mentioned above is to change the potato into a form that has a higher economic value, which is longer in storage and easier to market. One suitable form is to turn the potatoes into flour.

Basically the quality of domestically made potato chips in general has not been able to compete with foreign products in the domestic market. The quality of domestically-made potato chips, especially the non-uniform shape, size and appearance, has not been able to match the quality of imported potato chips. So, so that potato chips can provide added value to potato-producing producers, stimulated potato chips can be made in the addition of some flour called crispy potatoes.

The addition of wheat flour can improve the properties of the resulting dough, one of the compositions contained in wheat flour is protein, namely gluten so that it can soften and expand the dough so that the resulting crispy potatoes are crispier. The addition of cornstarch in the manufacture of crispy potatoes aims to increase the crispness of the product, so that it can improve the quality of the crispy potatoes produced.

In the case of making crispy potatoes, the resulting product must have a crunchy (crispy) texture. The function of the leavening agent is to produce gas in the mixture or dough and make the dough light and hollow. Carbon dioxide is the main gas used in chemically fermented bakery products. The source of carbon dioxide is sodium carbonate.

2. METHOD

2.1 Place and time of research

This research is planned to be conducted in July 2008 at the Food Technology Laboratory of the Department of Agricultural Technology, Faculty of Agriculture, University of North Sumatra, Medan.

2.2 Materials and tools

The material used in this study was potatoes obtained from the afternoon tax on Jalan Jamin Ginting Medan. Carrageenan and dextrin were obtained from the Food Technology Laboratory and other additives were coconut oil, wheat flour, cornstarch, salt, sugar, chili powder obtained from Carrefour Medan. nChemicals: Sodium metabisulfite; Alcohol; Natrium carbonate; Hexan; NaOH; Phenoltalein Indicator. Research Tools: Oven; Measuring cup; Aluminum foil; Drop pipette; Vacuum frying; Spatula; Scales; sealers; Beaker glass; Soxhlet; desiccator; Erlenmeyer.

2.3 Research methods

This research was conducted using a completely randomized design (CRD), with two factorials, consisting of: Factor I : Mixture of Wheat Flour and Maizena Flour 3 : 1 (C) consisting of 4 levels, namely: C1 = 25%; C2 = 30%; C3 = 35%; C4 = 40%. Factor II : Percentage of Sodium Carbonate (P) which consists of 4 levels, namely: P1 = 0.10%; P2 = 0.15 %; P3 = 0.20%; P4 = 0.25%. The combination of treatments (Tc) = 4 x 4 = 16, to obtain accuracy, it was repeated 2 times.

2.4 Analysis Method

The design used was a two-factorial Completely Randomized Design (CRD) with the following model:

$$Y_{ijk} = \mu + i + j + (\alpha\beta)_{ij} + ijk \quad (1)$$

Y_{ijk} = Observations of factor C at the i-level and P factor at the j-th level with the k-th replication

μ = Middle value effect

i = Effect of factor C at the i-th level

j = P factor effect at j level

$(\alpha\beta)_{ij}$ = The interaction effect of factor C at level i and factor P at level j

ijk = Error effect of factor C at level i and factor P at level j with k-th replication

2.5 Research Implementation

Potatoes are sorted, peeled, washed and thinly sliced; Soaked in 2% metabisulfite solution for 10 minutes; Washed and drained; dried at 600 C for 3 hours; Puree in a blender and sieve through a 50 mesh sieve; Potato flour was added with a mixture of wheat flour and cornstarch in a ratio (3:1) of 25%, 30%, 35% and 40%, respectively; Added 0.1% dextrin, 0.1% carrageenan, 2% salt and sodium carbonate with a percentage of 0.10%, 0.15%, 0.20% and 0.25%, respectively; Knead with the addition of water until smooth; Milled and molded using a mould; Fry in coconut oil, using a vacuum fryer; Added external spices consisting of a mixture of wheat flour, sugar, red abe powder and MSG; Packaged by using aluminum foil packaging; Stored for 7 days;

2.6 Observation Parameter

Observation and measurement of data is done by analyzing the parameters: Fat content; Free Fatty Acid Number (ALB); Water content; Organoleptic Test (Color, Taste and Crispy).

3. RESULTS AND DISCUSSION

3.1 Research result

3.1.1 Effect of Mixed Amount of Wheat Flour and Cornstarch on Observed Parameters

From the results of research that has been carried out, it is known that a mixture of wheat flour and cornstarch has an effect on fat content, free fatty acid content, water content, color and taste organoleptic tests and crispness organoleptic tests as shown in Table 1 below:

Table 1. Effect of the Amount of Mixed Wheat Flour with Maizena on the Observed Parameters

Amount of Flour Mix	Fat level (%)	Free Fatty Acids (%)	Water content (%)	Color and Taste (Numeric)	Crispy (numeric)
C1= 25%	17.21	0.80	1.25	3.75	3.03
C2 = 30%	17.38	0.94	1.00	3.71	3.13
C3= 35%	17.51	1.04	0.96	3.69	3.29
C4= 40%	17.83	1.16	0.91	3.64	3.36

Table 1 shows that the amount of mixture of wheat flour and cornstarch has an effect on the observed parameters. The highest fat content was obtained in the C4 treatment (40%) which was 17.83% and the lowest was in the C1 treatment (25%) which was 17.21%. The highest free fatty acids were obtained in the C4 treatment (40%) which was 1.16% and the lowest was in the C1 treatment (25%) which was 0.80%. The highest moisture content was obtained in treatment C1 (25%) which was 1.25% and the lowest was in treatment C4 (40%) which was 0.91%. The highest color and taste organoleptic test was obtained in the C1 treatment (25%) which was 3.75 and the lowest was in the C4 treatment (40%) which was 3.64. The organoleptic test of the highest crispness was obtained in the C4 treatment (40%) which was 3.36 and the lowest was in the C1 treatment (25%) which was 3.03.

3.1.2 Effect of Na₂CO₃ Percentage on Observed Parameters

From the results of research that has been done, it is known that the percentage of Na₂CO₃ has an effect on the following parameters:

Table 2. Effect of Na₂CO₃ Percentage on Observed Parameters

Percentage of Na ₂ CO ₃	Fat level (%)	Free Fatty Acids (%)	Water content (%)	Color and Taste (Numeric)	Crisp (Numeric)
P1 = 0.10%	17.32	0.80	1.14	3.73	3.10
P2 = 0.15%	17.44	0.94	1.07	3.69	3.18
P3 = 0.20%	17.56	1.04	0.99	3.69	3.22
P4 = 0.25%	17.61	1.16	0.91	3.68	3.31

Table 2 shows that the percentage of Na₂CO₃ has an effect on the observed parameters. The highest fat content was obtained in treatment P4 (0.25%) which was 17.61% and the lowest was in treatment P1 (0.10%) which was 17.32%. The highest free fatty acids were obtained in treatment P4 (0.25%) which was 1.16% and the lowest was in treatment P1 (0.10%) which was 0.80%. The highest moisture content was obtained in treatment P1 (0.10%) which was 1.14% and the lowest was in treatment P4 (0.25%) which was 0.91%. The highest color and taste organoleptic test was obtained in treatment P1 (0.10%) which was 3.73 and the lowest was in treatment P4 (0.25%) which was 3.68. The organoleptic test of the highest crispness was obtained in treatment P4 (0.25%) which was 3.31 and the lowest was in treatment P1 (0.10%) which was 3.10.

3.1.3 Fat level (%)

From the results of the study, it was found that the amount of the mixture of wheat flour with cornstarch gave no significant effect ($P>0.05$) on the fat content of crispy potatoes so that the LSR test was not continued. The percentage of Na_2CO_3 had a significantly different effect ($P>0.05$) on the fat content of crispy potatoes so that the LSR test was not continued. The interaction between the amount of the mixture of wheat flour and cornstarch and the percentage of Na_2CO_3 gave no significant effect ($P>0.05$) on the fat content of crispy potatoes so that the LSR test was not continued.

3.1.4 Free Fatty Acid Content (%)

The amount of the mixture of wheat flour and cornstarch had a very significant effect ($P<0.01$) on the free fatty acid content of crispy potatoes. The results of the LSR test showing the effect of the mixture of wheat flour and cornstarch on the free fatty acid content of crispy potatoes from each treatment can be seen in Table 3 below:

Table 3. LSR Test Effect of Amount of Mixed Wheat Flour with Maizena on Free Fatty Acid Content of Potato Crisps (%)

Distance	LSR		Flour Mix (C)	Average	Notation	
	0.05	0.01			0.05	0.01
-	-	-	C1 = 25%	0.80	D	D
2	0.0106	0.0146	C2 = 30%	0.94	C	C
3	0.0111	0.0153	C3 = 35%	1.04	B	B
4	0.0114	0.0157	C4 = 40%	1.16	A	A

Notes: Different letter notations show a significant difference at the 5% level (lowercase) and a very significant difference at the 1% level (uppercase).

The higher the amount of the mixture of wheat flour with cornstarch, the free fatty acid content of crispy potatoes increases. This is because at the time of frying there is a breakdown of fat into free fatty acids (ALB). ALB is bound by protein substances contained in wheat or carbohydrates contained in potato starch and cornstarch. This is in accordance with the opinion of Ketaren (1986) which states that the decomposition of fat into its constituent components during frying is due to the presence of protein or carbohydrate molecular substances. So that with the addition of wheat flour and cornstarch, there will be a breakdown of fat into ALB when fried, so that the ALB of crispy potatoes increases.

The percentage of Na_2CO_3 gave a very significant effect ($P<0.01$) on the free fatty acid content of crispy potatoes. The results of the LSR test showing the effect of the percentage of Na_2CO_3 on the free fatty acid levels of each treatment can be seen in Table 4 below:

Table 4. LSR Test Effect of Na_2CO_3 Percentage on Free Fatty Acid Levels of Potato Crisps (%)

Distance	LSR		Percentage of Na_2CO_3 (P)	Average	Notation	
	0.05	0.01			0.05	0.01
-	-	-	P1 = 0.10%	0.80	d	D
2	0.0106	0.0146	P2 = 0.15%	0.94	c	C
3	0.0111	0.0153	P3 = 0.20%	1.04	b	B
4	0.0114	0.0157	P4 = 0.25%	1.16	a	A

Notes: Different letter notations show a significant difference at the 5% level (lowercase) and a very significant difference at the 1% level (uppercase).

The higher the percentage of Na_2CO_3 , the free fatty acid levels will increase. This is because Na_2CO_3 is alkaline in the dough, thereby accelerating the decomposition of fat into free fatty acids and this is in accordance with the literature from Desrosier (1988) which says that Na_2CO_3 is an alkaline compound so that there is a decomposition of fat into free fatty acids. In addition, heating will also increase the formation of free fatty acids.

The interaction between the amount of the mixture of wheat flour and cornstarch and the percentage of Na_2CO_3 gave a significantly different effect ($P<0.05$) on the free fatty acid content of crispy potatoes. The results of the LSR test showing the interaction between the amount of the mixture of wheat flour and cornstarch and the percentage of Na_2CO_3 on the free fatty acid levels of crispy potatoes from each treatment can be seen in Table 5 below:

Table 5. LSR Test Effect of Interaction between Amount of Wheat Flour Mix with Maizena and Na_2CO_3 Percentage on Free Fatty Acid Content of Potato Crispy (%)

Distance	LSR		Treatment	Average	Notation	
	0.05	0.01			0.05	0.01
-	-	-	C1P1	0.77	o	J
2	0.021	0.029	C1P2	0.79	no	IJ

3	0.022	0.031	C1P3	0.82	M N	HI
4	0.023	0.031	C1P4	0.84	m	H
5	0.023	0.032	C2P1	0.88	l	G
6	0.024	0.033	C2P2	0.91	k	G
7	0.024	0.033	C2P3	0.97	j	F
8	0.024	0.033	C2P4	1.00	ghi	E
9	0.024	0.034	C3P1	1.00	gh	E
10	0.024	0.034	C3P2	1.02	g	E
11	0.024	0.034	C3P3	1.06	f	D
12	0.024	0.034	C3P4	1.10	de	C
13	0.024	0.034	C4P1	1.12	d	C
14	0.024	0.035	C4P2	1.16	bc	B
15	0.024	0.035	C4P3	1.17	B	B
16	0.024	0.035	C4P4	1.22	a	A

Notes: Different letter notations show a significant difference at the 5% level (lowercase) and a very significant difference at the 1% level (uppercase).

The highest free fatty acid content of crispy potatoes was found in the C4P4 treatment, which was 1.22% and the lowest was in the C1P1 treatment, which was 0.77%. The interaction of the two shows a real influence. This shows that the higher the amount of the mixture of wheat flour with cornstarch and the higher the percentage of Na₂CO₃ gives higher free fatty acid (ALB) levels in crispy potatoes. The addition of a mixture of wheat flour with cornstarch causes the breakdown of fat into ALB, where fat is easily bound to protein in wheat, so that fat bound to wheat will be converted into ALB. This is in accordance with the statement of Ketaren (1986), and the presence of alkaline Na₂CO₃ will also accelerate the decomposition of fat into free fatty acids. This is in accordance with Desrosier's (1988) statement,

3.1.5 Water content (%)

The amount of mixture of wheat flour and cornstarch has a very significant effect ($P < 0.01$) on the moisture content of crispy potatoes. The results of the LSR test which show the effect of the amount of mixture of wheat flour and cornstarch on the moisture content of crispy potatoes from each treatment can be seen in Table 6 the following:

Table 6. LSR Test Effect of Amount of Mixed Wheat Flour with Maizena on Potato Crispy Moisture Content (%)

Distance	LSR		Flour Mix (C)	Average	Notation	
	0.05	0.01			0.05	0.01
-	-	-	C1 = 25%	1.25	a	A
2	0.114	0.157	C2 = 30%	1.00	b	B
3	0.120	0.165	C3 = 35%	0.96	b	B
4	0.123	0.170	C4 = 40%	0.91	b	B

Notes: Different letter notations show significant differences at the 5% level (lowercase letters) and very significant differences at the 1% level (uppercase letters)

The higher the amount of the mixture of wheat flour with cornstarch, the water content of crispy potatoes will decrease. Wheat flour and cornstarch have high starch content. Because starch is a hydrophilic compound that will bind water strongly and with increasing wheat flour with cornstarch, the water content of the resulting crispy potatoes will also decrease because the starch content also increases.

The percentage of Na₂CO₃ had a significant effect ($P < 0.05$) on the moisture content of crispy potatoes. The results of the LSR test showing the effect of the percentage of Na₂CO₃ on the water content of crispy potatoes from each treatment can be seen in Table 7 below:

Table 7. LSR Test Effect of Na₂CO₃ Percentage on Potato Crispy Moisture Content (%)

Distance	LSR		Percentage of Na ₂ CO ₃ (P)	Average	Notation	
	0.05	0.01			0.05	0.01
-	-	-	P1 = 0.10%	1.13	a	A
2	0.114	0.157	P2 = 0.15%	1.07	ab	AB
3	0.120	0.165	P3 = 0.20%	0.99	bc	BC
4	0.123	0.170	P4 = 0.25%	0.91	c	C

Notes: Different letter notations show significant differences at the 5% level (lowercase letters) and very significant differences at the 1% level (uppercase letters)

The higher the percentage of Na₂CO₃, the lower the moisture content of the crispy potatoes. Na₂CO₃ is a compound that is easily soluble in water and will decompose to form Na²⁺ and CO₃²⁻ which will then react to form H₂CO₃ from a water molecule H₂ donor (H₂O), thus when a higher percentage of Na₂CO₃ is added to the dough, the water is physically bound in the water. Crispy potatoes are decreasing so that they are difficult to physically separate through the oven

and are said to be physically decreasing. Kadri, (2000) said that compounds from the formation of ionic bonds and salts, when dissolved in water, will decompose into their constituent components and if analyzed, the content of free water and physically bound water will also decrease with the increasing number of compounds added.

The interaction between the amount of the mixture of wheat flour and cornstarch and the percentage of Na_2CO_3 gave no significant effect ($P>0.05$) on the moisture content of the resulting crispy potatoes so that the LSR test was not continued.

3.1.6 Organoleptic Color and Taste (Numeric)

The amount of the mixture of wheat flour and cornstarch had a very significant effect ($P<0.01$) on the organoleptic value of the color and taste of crispy potatoes. The results of the LSR test showing the effect of the amount of mixture of wheat flour and cornstarch on the organoleptic values of the color and taste of crispy potatoes from each treatment can be seen in Table 8 below:

Table 8 . LSR Test Effect of Amount of Mixed Wheat Flour with Corn on the Organoleptic Value of Color and Taste

Distance	LSR		C Flour mix C	Average	Notation	
	0.05	0.01			0.05	0.01
-	-	-	C1 = 25%	3.75	A	A
2	0.054	0.074	C2 = 30%	3.71	Ab	AB
3	0.056	0.078	C3 = 35%	3.69	Bc	BC
4	0.058	0.080	C4 = 40%	3.64	C	C

Notes: Different letter notations show significant differences at the 5% level (lowercase letters) and very significant differences at the 1% level (uppercase letters)

The higher the amount of mixture of wheat flour and cornstarch, the organoleptic value of color and taste decreases. Starch contains a reducing sugar component and is a small granule of various sizes (de Man, 1997). One of the properties of reducing sugars when heated at high temperatures is that a nonenzymatic browning reaction occurs. Due to the increasing amount of a mixture of wheat flour and cornstarch that is added to the dough, the amount of reducing sugar will also increase so that eventually the color of the crispy potatoes will also decrease as a result of non-enzymatic browning which causes the color and taste of the organoleptic to decrease.

3.2 Discussion

Na_2CO_3 is a compound that dissolves easily in water and will decompose to form Na_2^+ and CO_3^{2-} which will then react to form H_2CO_3 from the donor H_2 water molecule (H_2O), thus when more percentage of Na_2CO_3 is added to the dough, the water that is physically bound in in crispy potatoes decreases so that it is difficult to separate physically through the oven and is said to decrease physically. Kadri, (2000) said that compounds from the formation of ionic bonds and salts, when dissolved in water will decompose into its constituent components and if analyzed, the free water content and physically bound water will also decrease as more compounds are added.

The higher the amount of the mixture of wheat flour and cornstarch, the organoleptic value of color and taste decreases. Starch contains a reducing sugar component and is a small grain with various sizes (de Man, 1997). One of the properties of reducing sugars when heated at high temperatures will be a non-enzymatic browning reaction. Because more and more of the mixture of wheat flour and cornstarch is added to the dough, the amount of reducing sugar will also increase so that finally the color of the crispy potatoes will also be lower as a result of non-enzymatic browning which causes the organoleptic color and taste to decrease.

The higher the amount of the mixture of wheat flour and cornstarch, the organoleptic value of the crispiness increases. This is because the protein in wheat flour can produce CO_2 gas which is trapped in the dough, the dough forms cavities and during frying the heat penetration is faster so that the water in the dough evaporates faster and the moisture content of the crispy potatoes gets lower, resulting in crispy crispy potatoes.

The higher the percentage of Na_2CO_3 , the crunchier the potato chips will be. This is because the presence of Na_2CO_3 will cause crispy potatoes to become hollow and crunchy. This is in accordance with the statement (Desrosier, 1988). This crispness is due to the presence of CO_2 gas trapped in the dough, making the dough hollow and accelerating the penetration of heat during frying which makes it easier for the water content in the crispy potatoes to decrease, so that the crispy potatoes become more crunchy. Due to the presence of protein in wheat flour and the presence of Na_2CO_3 will trapping CO_2 and forming cavities in the dough, so that when fried the heat penetration is faster, so that the water content in the ingredients easy to evaporate. So the resulting crispy potatoes will be even crunchier.

4. CONCLUSION

From the results of the research that has been done, the following conclusions can be drawn: The amount of the mixture of wheat flour and cornstarch had an insignificant effect on fat content and had a very significant effect on free fatty acids, moisture content, organoleptic color and taste and organoleptic crunch of the resulting crispy potatoes; The percentage of Na₂CO₃ had an insignificant effect on fat content and organoleptic color and taste, had a very significant effect on free fatty acids and crispness, and had a significant effect on the moisture content of crispy potatoes; The interaction of the mixture of wheat flour and cornstarch with the percentage of Na₂CO₃ gave a significant effect on the organoleptic crunch and free fatty acids of crispy potatoes.

ACKNOWLEDGEMENTS

The authors would like to thank parents, supervisors, heads of study programs and friends who have helped the author in supporting the completion of this research both materially and morally.

REFERENCES

- Al arif, 2008. Cara Mudah Untuk Membuat Keripik Buah dan Sayur, dan Menjadi Pengusaha Makanan Ringan, Yang Bisa Dilakukan Siapa Saja, di Seluruh Indonesia. <http://www.Mesin produksi.com> [12 Februari 2008].
- Baliwati, Y.F ., A. Khomsan dan C.M. Dwiriani, 2004. Pengantar Pangan dan Gizi. Penebar Swadaya, Jakarta.
- Bangun, M.K., 1991. Perancangan Percobaan. Fakultas Pertanian USU-Press, Medan.
- Cahyadi, W., 2006 Analisis dan Aspek Kesehatan Bahan Tambahan Pangan. Bumi Aksara, Jakarta.
- Chichester, C. E. and F.W. Tanner, 1975. Antimicrobia Food Additives. Chemical Rubber Co., Amsterdam.
- Departemen Kesehatan, R.I., 1989. Daftar Komposisi Bahan Makanan. Bhratara, Jakarta.
- De Man, J.M., 1997. Kimia Makanan. Penerjemah K.Padmawinata. ITB-Press, Bandung.
- Desrosier, N.W., 1988. Teknologi Pengawetan Pangan. Terjemahan M. Muljohardjo. UI Press, Jakarta.
- Evawati, A.A., 1997. Mempelajari Proses Pembuatan Keripik Ubi Kayu Kajian Lama Gelatinisasi Serta Analisa Finansial. Fakultas Pertanian Universitas Brawijaya, Malang.
- Fardiaz, 1986. Hidrokoloid dalam Industri Pangan. Jurusan Tekhnologi Pangan dan Gizi, IPB-Press, Bogor.
- Harsono., U. Budiharti dan Suparlan, 2006. Pengembangan Alsin Pengolahan Tepung Maizena Cara Basah (Corn Wet Milling System) Skala Kecil. <http://ntb.litbang.deptan.go.id>. [25 Februari 2008].
- Iptek, 2008. Kentang Family Solanaceae. <http://www.iptek.net.id>. [12 April 2008].
- Istiningsih, N., 2003. Pengaruh Arah Irisan dan Konsentrasi Larutan Natrium Metabisulfit (Na₂S₂O₅) Terhadap Mutu Keripik Kentang (Solanum Tuberosum L.). <http://www.asiamaya.co.id>. [12 Februari 2008].
- Kadri, A., 2000. Penuntun Praktikum Analisa Kuantitatif, Titrasi Organik dan Gravimetri. Fakultas kedokteran USU, Medan
- Ketaren, S., 1986. Pengantar Tekonologi Minyak dan Lemak Pangan. UI-Press, Jakarta.
- Maryati, H.S., 2000. Tata Laksana Makanan. Rineka Cipta, Jakarta.
- Novary, E.W., 1997. Penanganan dan Pengolahan Sayuran Segar. Penebar Swadaya, Jakarta.
- Pantastico, ER. B., 1993. Fisiologi Pasca Panen Penanganan dan Pemanfaatan Buah-Buahan dan Sayur-Sayuran Tropika dan Subtropika. Terjemahan Kamariyani. UGM-Press, Yogyakarta.
- Purba, A dan H. Rusmarilin, 1985. Dasar Teknologi Pengolahan Pangan. FP-USU, Medan.
- PT. Bogasari Flor Mills Indonesia, 1994. Rahasia dalam Pembuatan Roti, Jakarta.
- Raditya, A., 2008. Cabe Merah Ternyata Bukan Asli Indonesia. <http://ww.SitusHijau.co.id> [16 Juni 2008].
- Rubatzky, V. E. and M. Yamaghuci, 1988. Sayuran Dunia 2, Prinsip, Produksi dan gizi. Terjemahan C. Herison. ITB – Press, Bandung.
- Satuhu, S., 1996. Penanganan dan Pengolahan Buah. Penebar Swadaya, Jakarta. Setiadi dan S.F. Nurulhuda, 2000. Kentang: Varietas dan Pembudidayaan. Penebar Swadaya, Jakarta.
- Smith, O., 1968. Potatoes: Production, Storing, Processing. The AVI Publishing Company, Inc. Westport, Connecticut.
- Soekarto, S.T., 1985. Penilaian Organoleptik. Pusat Pengembangan Teknologi Pangan. IPB, Bogor.
- Sudarmadji, S., B. Haryono, dan Suhardi, 1984. Analisa Bahan Makanan dan Pertanian. Liberty, Yogyakarta.
- Sulistiyowati, A., 2004. Membuat Keripik Buah dan Sayur. Puspa Swara, Jakarta. Suptijah, P., 2002. Rumput Laut Prospek dan Tantangannya. <http://www. Rumputlaut.htm>. (20 februari 2008).

- Susanto, T dan B. Saneto, 1994. Teknologi Pengolahan Hasil Pertanian. Bina Ilmu, Surabaya.
- Sustrinisniati, D. , D. Mahdan, H. Wiriano dan M. Ridwan, 1995. Pengaruh Pencampuran Tepung dan Penambahan Carboxyl Methyl Cellulose (CMC) Pada Pembuatan Tepung Campuran Siap Pakai Untuk Penggorengan, Warta Industri Hasil Pertanian Vol-2 No 1-2, BBPIHP, Jakarta.
- Syarief, R. dan A. Irawati, 1988. Pengetahuan Bahan untuk Industri Pertanian. Mediyatama Sarana Perkasa, Jakarta.
- Tarwotjo, C. S., 1998. Dasar-Dasar Gizi Kuliner. Gramedia Widiasarana Indonesia, Jakarta.
- Talbur, W.F. and O. Smith, 1987. Potato Processing. AVI Publishing by Van Nostrand Reinhold Co., New York.
- Winarno, F.G., 1993. Gizi, Teknologi, dan Konsumen. Gramedia Pustaka Utama, Jakarta..
- Winarno, F.G dan T.S. Rahayu., 1994. Bahan Tambahan untuk Makanan dan Kontaminasi. Pustaka Sinar Harapan, Jakarta.
- Winarno, F.G ., S. Fardiaz dan D. Fardiaz, 1980. Pengantar Teknologi Pangan. Gramedia Pustaka Utama, Jakarta.