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EFFECT OF ADDITION OYSTER MUSHROOM AND RED BEET ROOT BY-PRODUCTS ON QUALITY OF PAN BREAD

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ABSTRACT

Mushroom stalk powder (MSP) and red beet root powder (RBP) are rich source of valuable biochemical such as polyphenols, flavonoids (antioxidants) and dietary fiber .The properties of various physochemical compounds and utililization of the MSP and RBP in the production of pan bread were carried out. Pan bread was made by replacing wheat flour with 5, 10 and 15% of MSP or RBP separately. The obtained pan bread was compared with control sample "which made by 100% wheat flour (WF)" for their chemical and sensory evaluation. Water absorption (WA) was increased significantly ($p \leq 0.05$) as MSP or RBP level increased in all dough .Dough stability was significantly ($p \leq 0.05$) increased as MSP or RBP level increased except (MSP% 10). Replacement of WF with (MSP and RBP) up to15%, increased the crude protein content from 9.45 to 12.35%, crude fiber from 0.66 to7.06% and ash from 1.02 to 3.00% while, caloric value decreased. Baking properties, colour and sensory evaluation showed that WF could be replaced with 5% (MSP or RBP) for preparing a good quality of pan bread. While at 10% MSP or RBP exhibited low difference in sensory evaluation. The results of the appearance, taste and colour were highly significant difference. The results of sensory evaluation indicated that 5% and 10%mushroom stalk and red beet root pomace powder can be successfully used in replacement of wheat flour pan bread. It can be referred to the possibility of using mushroom stalks powder or red beets as a source of dietary fiber and protein in the production of pan bread good nutrition and technology.

Key word: Mushroom stalk, red beet root, replacement, pan bread, sensory evaluation.

INTRODUCTION

Mushrooms are simple forms of plants life which have lack of chlorophyll and hence cannot produce their own food. It depends on dead plants and organic matter. Mushrooms are rich source of proteins, vitamins and minerals. Their low content of carbohydrate and fat makes them an ideal food for diabetes and persons who wish to shed excess fat. They are also good source of energy about 454 g of fresh mushrooms providing 120 kilo calories. The production of mushrooms is increasing every year in the world. There are about 14000 different species of mushrooms of which at least 1450 are reported to be edible and 25 accepted widely as food (Chong and Miles, 2004; Reis *et al.*, 2012).

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Mushrooms are good source of iron, copper, calcium potassium, zinc and vitamin D and folic acid. Selected strains of dried mushrooms are used to produce mushroom capsules and extracts. Commercial mushrooms are popular in the USA and Europe. They are used in various sausages, minsed meat, vegetables soups, pastes and bakery products and many other dietary menus specially for flavoring purposes (Mahamud *et al.*, 2012). Nowadays, mushroom is being relised through out the world as food and medicine. Researcher reports revealed that mushrooms are rich food values being food source, and out of 100 g. It contains proteins (3.6 g), minerals, vitamins B_{12} (0. 26 mg), fats (0.39 g), carbohydrates (1.5 g), dietary fibers (2.5 g) and ash (5.0 g) and the vitamins contains are exceptionally high (Alam and Roza, 2001).

Oyster mushroom (*Pleurotus ostreatus*), have a great potenitial due to their high (24-35%) and good quality-protein, (higher lysine and soluble dietary fiber), but mushrooms have soluble and insoluble dietary fiber especially β-glucan (Abou-Zaid *el al.,* 2012). Another very cheap by-product are mushroom stalks from the mushroom industry. After harvesting the main upper parts, the lower parts are usually discarded or sometimes mixed with other feeds and fed to animals such as cattle and swine. If produced in very large quantities some might end up thrown in land fills and can cause environmental pollution (Muin *et al.*, 2013; Muin *et al.*, 2015).

Red beet root (*Beta vulgaris*) is botanically classified as an herbaceous biennal from Chenopodiaceae family and has several varieties with bulb colours ranging from yellow to red. Deep red-coloured beet roots are the most popular for human consumption, both cooked and raw as salad or juice. There are growing interest in the use of natural food colours to improve the red colour of tomato pastes, sauces, soups, dessert, jams, jellies, ice creams sweets and breakfast cereals (Koul *et al.,* 2002; Roy *et al.,* 2004). It also contributes to consumer`s health and betalain, mainly comprise of red-violet-coloured betacyanins (betanin, isobetanins, porbetanin and neobelanin), and yellow - orange - coloured, betaxanthyns, (Kaur and Kapoor 2002; Singh and Hanthan, 2014). Processing of fruits and vegetables results in high amounts of waste materials (by-products) which are economical and ecological deficit problem. Residues from the processing of fruits and vegetables, traditionally considered as an environmental problem, are being increasingly recognized as sources for obtaining high valuable products, such as phenolics and betalains. Though still rich in betalains and phenols the beet root pomace from the juice industry (15-30%) is disposed as feed and manure (Vulic *et al.,* 2012). Beet root by products still contain high content of beneficial substance, especially bioactive compounds with antioxidants activity. These photochemical from waste materials deriving from agro-industrial production may be used as functional food ingredients as natural antioxidants to replace their synthetic equivalents that have experienced growing rejection. They could be used as additives in food, pharmaceutical and cosmetic industry (Clifford *et al*., 2015).

Bread is one of the most widely consumed as human meal in the world. Bread making technological is one of the oldest technology know (Selomulyo and Zhou, 2007). It is an important staple food forming countries. The product is basically made of (hard and/or soft) wheat flour, yeast, fat, sugar, salt and water (Badifu *et al.,* 2005). It is a cereal product that is naturally low in protein and nutritionally not a balance diet because it is low in lysine, as essential amino acid (Gimai *et al.,* 2003 ; Agu *et al.,* 2010). Bakery products, particularly bread, take a significant share in the food guide pyramid for daily as recommended by US Department of Health and Human Services. Therefore, the development of enriched bread with high fibers content is one of the efficient ways to increase fibers intake (Goesaert *et al.,* 2005).

The aim of this work was to study the effect of this replacement on the physiochemical, nutritional, sensory properties and over all acceptability.

MATERIALS AND METHODS

Materials

Mushroom stalk *(Pleurotus ostreatus*) was obtained from Agricultural Research Center, Giza, Egypt.

Wheat flour of (72% extraction) and red beet root (*Beta vulgaris*) were purchased from Zagazig local market, Zagazig City, Sharkia Governorate, Egypt.

Preparation of Mushroom Powder

The mushroom stalk were washed, cut and dried in thermostatically controlled oven with air fan at 40-45°C for 48 hrs., then milled using a laboratory disc to pass through a 40 mesh/inch sieve, stored at 3-4°C until used for technogical studies.

Preparation of Red Beet Root Powder

Red beet root was washed and cut. Then, it was extracted by juicer Blender National, (Model: MJ: 160N) made in japan. Red beet root

pomace were dried in thermostatically controlled oven with air fan at 40-45°C for 48 hrs., then milled using a laboratory disc mill to pass through 40 mesh/insh sieve, stored at 3-4°C until used for technological studies.

Baking Techniques

Pan bread preparation

The straight dough method for pan bread production was carried out according to the method described by (AACC, 2002)

Physical analyses of pan bread

Weight

The average weight (g) of pan bread was determined individually within one hour after baking .

Volume

The volume of loaf (cm^3) of different types of produced pan bread was determined by Tex vol Instrumets AB Box 45,260 40 Viken, Sweden (Chematic international, 6 October, Giza, Egypt).

Specific volume

Specific volume was calculated according to the method of AACC (2002) using the following equation: specific volume = volume (cm^3)/ weight (g)

Chemical analyses and calories value of pan bread

Moisture, protein, ash, fat, crude fiber were determined according to the methods described in (AOAC, 2005). Total carbohydrates were calculated by difference. The gross energy of substance is the amount of heat measured in calories that is released when the substance completely oxidized in a bomb calorimeter. Calories value of the pan bread samples was determined using oxygen Bomb Calorimeter (Werke I KAC2000) according to Krishna and Ranjhan (1981)

Determination of total phenolic compounds

The concentration of total phenolic in all extracts were measured by UV spectrophotometer (Jenway-UV-vis spectrophotometer), based on a colorimetric oxidation/reduction reaction, as described by Skerget *et al.* (2005).

Determination of total flavonoids compounds

Total flavonoid contents was determined by the method of Ordon *et al.* (2006).

Antioxidant activity

Free radical scavenging activity of mushroom stalk and red beet root pomace powders were determined according to the DPPH (1,1diphenyl -2- picryIhydrazyl radical) method as described by Lee *et al.* (2003)

Rheological properties

Dough rheological was performed using Mixolab (Chopin, tripettet Renaud, Paris, France) according to the method of (AACC, 2002). Sample of 50 grams was placed into the Mixolab bowl and mixed. After tempering the solids, the water required for optimum consistency was added. Special attention was carried to the determination of the water absorption; in order to ensure the complete hydration of all the components (Bonet and Rosell, 2006). The running parameters of the Mixolab device during the tests are: mixing rate 80 rpm, temperature of the first plateau 30ºC, duration of the first plateau 8 min., temperature of the second plateau 90 ºC, first temperature gradient 4 ºC/min, duration of the second plateau 7 min , second temperature gradient 4 ºC /min., temperature of the third plateau 5 ºC and duration of third plateau 5min as described by Simona *et al.* (2013) (Chematic international, 6 October, Giza, Egypt).

Colour Measurement

Colour attribute of wheat flour pan bread (L*,a* and b*) was performed using Hunter lab colour analyzer (Hunter lab colour Flex Ez, USA) according to Roa *et al.* (2011). The L* value (lightness index scale) ranges from 0(black) to 100(white) while a* value indicates the redness (+a) or greenness (-a*) and the b* value refers to the yellowness (+b) or blue l (-b). Samples were placed in petri dishes and filled to the top. The petri dish was placed directly on the colorimeter sensor. The colour intensity (C), hue angle (h_{ab}) and total colour difference ΔE was calculated in comparison to untreated (control) sample: where h_{ab} 0ºC for red hue and h_{ab}= 90ºC for yellow hue. The results were expressed as:

$C^* = (a^{*2} + b^{*2})^{0.5}$

$h_{ab} = \tan^{-1} (b^*/a^*)$

$WI = 100 – [(100-L^*)^2 + a^{*2} + b^{*2}]^{0.5}$

$\Delta E = [(L-L_O)^2 + (a-a_0)^2 + (b-b_0)^2]^{0.5}$

Where L_o, a_0 and b_0 were the L ,a, and b values of the control sample

Sensory Evaluation

Well trained panelists from the staff members of the Food Science Department, Zagazig University, were asked to evaluate the prepared pan bread. Panelists were asked to rate each sensory attribute of the pan bread (Aroma, taste, crust colour, crumb colour, crumb texture and over all acceptability) using 9-point hedonic scale according to the following scoring system; 1 dislike extremely, 5, neither like nor dislike, and 9, like extremely (Hooda and Jood, 2005)

Statistical Analysis

All the data of the present study were subjected to analysis of variance (ANOVA) using SAS Software (SAS Institute, 1990) Difference between means were calculated by the least significant difference (LSD) at $p<0.05$ All measurements were carried out in triplicate.

RESULTS AND DISCUSSION

Some Chemical Properties of Mushroom Stalk and Red Beet Root Powders

Proximate composition, total phenolic, total flavonoids and antioxidants activity of mushroom stalk and red beet root powders were determined. Data in Table 1 show that the mushroom stalk powder had higher moisture, crude protein, and crude fiber (9.41%, 16.74% and 21.12%, respectively) as compared to red beet root powder. On the other hand, the red beet root had higher content of ash, crude fat and total carbohydrates (4.60%, 2.40% and 62.53%, respectively). The crude fiber content in mushroom stalk and red beet root powder were higher than navel orange peels (13.38%), mandarin peels (7.14%) and water melon rinds (17.28%) as reported by (Magda *et al.*, 2008 ; Al-Sayed and Rahmed, 2013). It means that the utilization of mushroom stalk and red beet root powder in some bakery products increase their content of fiber. Protein and total flavonoid of mushroom stalk were higher than those of red beet root being (34.92 mg/g and 32.74 mg/g phenolic and 6.18 mg/g and 1.68 mg/g flavonoid, respectively, indicting that the higher phenolic and flavonid compounds in mushroom stalk. While, red beet root significantly greater free radical scavenging activity expressed as DPPH% than mushroom stalk .It could be observed that the red beet root is more effective as an antioxidant than mushroom stalk powders .These data are in agreement with that obtained by Al-Sayed and Rahmed (2013).

Mixolab Measurements

Table 2 presents the primary parameters from the rheological profile: water absorption (WA, %), stability (St, min), mechanical weakening (C1, Nm), minimum torque (C2, Nm) peak torque (C3, Nm), cooking stability (C4, Nm) dough cooling (C5, Nm) and set back. Mixolab characteristics of flour replacement with different levels of mushroom stalk and red beet root powder are presented in Table 3 .Water absorption and dough stability were increased with replacement of wheat flour by mushroom stalk and red beet root powder. C1 and C2 values were slightly affected by replacement flour with mushroom stalk and red beet root powders. C3 values were decreased by replacement flour with mushroom stalk and red beet root powder. C4 values were decreased by replacement flour with 10% (mushroom stalk and red beet root powders) but in levels (5, 15%), C4 values of mushroom and red beet root powder were increased compared with 10% level. C5 values were decreased by replacement flour with mushroom stalk and red beet root powders, (Simona *et al.*, 2013; Pastukhov and Dogan, 2014).

Proximate Composition of Pan Bread Samples

From Table 3 it could be noticed that fiber content of pan bread samples were significantly affected by substituting the flour with mushroom stalk or red beet root powders.

Meanwhile, a gradual increase in protein, ash and fat contents of pan bread samples containing mushroom stalk or red beet powders was observed with raising replacement level.

Table 1. Proximate composition, total phenolic, total flavonoid and antioxidant activity of mushroom stalk and red beet root powders

Characteristic	Mushroom stalk	Red beet root
Moisture (%)	9.41[a]	7.88[b]
Ash (%)	2.30[b]	4.60[a]
Crude fat (%)	1.00[b]	2.40[a]
Crude protein (%)	16.74[a]	15.36[b]
Crude fiber (%)	21.12[a]	18.11[b]
Total carbohydrate (%)	59.84[b]	62.53[a]
Total phenolic (mg/g)	34.92[a]	32.74[b]
Total flavonoid (mg/g)	6.18[a]	1.68[b]
Antioxidant activity DPPH (%)	46.02[b]	77.68[a]

Different letters with the same raw means highly significant differences.

Table 2. Mixolab measurement properties of flour replacement with mushroom stalk and red beet root powders

Mixolab parameter / Sample	Flour moisture (%)	Water absorption (%)	Dough stability (min)	C1 (Nm)	C2 (Nm)	C3 (Nm)	C4 (Nm)	C5 (Nm)	Setback (Nm)
Flower (72%)	14.00[Aa]	58.30[Dd]	5.60[Dc]	1.10A[b]	0.43[Aa]	1.80[Aa]	1.43[Aa]	2.11[Aa]	0.10[Ab]
Mushroom stalk (5%)	13.80[a]	60.10[c]	5.92[b]	1.06[d]	0.20[c]	1.30[b]	1.14[b]	1.91[b]	0.08[b]
10%	13.50[a]	62.00[b]	5.38[d]	1.08[c]	0.21[c]	1.25[d]	1.04[d]	1.63[c]	0.09[ab]
15%	13.30[a]	63.80[a]	6.83[a]	1.13[a]	0.25[b]	1.28[c]	1.06[c]	1.62[c]	0.13[a]
Red beet root (5%)	13.60[a]	59.50[c]	10.15[c]	1.09[a]	0.41[b]	1.47[b]	1.15[c]	1.80[b]	0.10[a]
10%	13.50[a]	61.56[b]	10.92[b]	1.09[a]	0.41[b]	1.42[d]	1.07[d]	1.79[b]	0.10[a]
15%	13.30[a]	63.50[a]	11.53[a]	1.09[a]	0.41[b]	1.43[c]	1.18[b]	1.75[c]	0.08[b]

The same letters in the column means insignificant deferences.

Table 3. Proximate analysis and caloric value of pan bread containing substituted flour with different levels of mushroom stalk or red beet root powders

Chemical composition / Sample	Moisture (%)	Ash (%)	Fat (%)	Protein (%)	Fiber (%)	Carbohydrate (%)	Caloric value (K.cal./100g)
Flower (72%)	37.64^{Aa}	1.02^{Cd}	0.20^{Dd}	9.54^{Dd}	0.66^{Dd}	51.60^{Aa}	394.28^{Aa}
Mushroom stalk (5%)	37.62^{a}	1.83^{c}	1.07^{c}	11.83^{c}	2.45^{c}	47.65^{c}	388.23^{b}
10%	34.09^{b}	2.03^{b}	1.24^{b}	12.01^{b}	4.94^{b}	50.63^{b}	378.37^{c}
15%	37.88^{a}	2.52^{a}	1.53^{a}	12.35^{a}	7.06^{a}	45.72^{d}	369.33^{d}
Red beet root (5%)	36.08^{d}	1.73^{b}c	0.50^{c}	10.69^{c}	0.73^{c}	51.00^{a}	392.66^{b}
10%	37.46^{b}	2.20^{ab}	0.83^{b}	11.46^{b}	3.52^{b}	48.45^{b}	381.27^{c}
15%	37.01^{c}	3.00^{a}	1.53^{a}	11.86^{a}	3.57^{a}	46.60^{c}	380.47^{d}

The same letters in the column means insignificant deferences.

It could be also noticed that the utilization of mushroom stalk and red beet root powders in pan bread resulted in gradual decreased in its content of carbohydrates and caloric value with increasing the level of substitution. The increase in protein, ash and fiber content in utilized pan bread were due to their higher content in mushroom stalk and red beet powders than in flour. The decrease in carbohydrates and caloric value in samples of pan bread were due to the highest fiber value in mushroom stalk and red beet root powders .These results are in agreement with Okafor *et al*. (2012).

Physical Characteristics of Pan Bread

Physical characteristics (volume, weight and specific volume) of pan bread were affected by increase the level of mushroom stalk or beet root powders Table 4. It was found that by increasing of mushroom stalk powder to 10% and the red beet root powder to 15% the loaf volume increased to 987.3 cm^3 in mushroom stalk powder and 660 cm^3 in red beet root powder compared to 517.5 cm^3 in the control. It may be due to that 10% mushroom stalk and 15% red beet root powder the gluten network loss some of its strength but still keep air in the dough (Abou-Zaid *el al.*, 2012).

Colour Characteristics

Pan bread colour

Colour analysis of processed food is an important field, always related strongly to market and consumers acceptability as it controls the first impression of any food product. L*a*b*values are how colour is measured to describe the colour differences between control pan bread and modified formula, data of colour values are presented in Table 5 shows Hunter values of whiteness (L), redness (a), and yellowness (b) measured for crumb and crust colours. All replacement samples had slightly lower L values for crust than the control and therefore, a slightly darker crumb colour .All breads containing mushroom stalk and red beet root powders, had lower crust L values than the control, indicating darker colour, its due to dietary fiber level increased .There results are in coincidence and confirmed with that obtained by (Sariconban and Imaz, 2010; Abou-Zaid *et al.*, 2012). Increasing the percentage of added mushroom stalk and red beet root powders to wheat flours led the values of whitness (L), redness (a) yellowness (b), Chroma (C*) and hue angle (H*) to be slightly decreased in all fortified samples. Subjective evaluation confirmed that the mushroom stalk and red beet root powder bread samples were darker, more red (a-values) than control samples. The results showed that the a- values (redness) increased in the fortified pan dread with the increased of mushroom stalk powder and red beet root powders 5% in crust and increasing in all supplemented in crumb samples. These, results are consistent with those obtained by Ahamed (1999) and Kenny *et al.* (2000).

Table 4. Effect of replacement mushroom stalk and red beet root powders on physicals properties of produced pan bread

Physicals composition / Sample	Weight (g)	Volume (cm^3)	SP.V (cm^3)/g
Flower (72%)	265.1^{Bbc}	517.5^{Dd}	1.9519^{Ad}
Mushroom stalk (5%)	267.0^{a}	819.7^{c}	3.0701^{c}
10%	264.5^{c}	987.3^{a}	3.7328^{a}
15%	265.8^{bc}	925.1^{b}	3.4803^{b}
Red beet root (5%)	261.3^{c}	543.7^{b}	2.0809^{c}
10%	256.2^{d}	543.2^{c}	2.0956^{b}
15%	267.8^{a}	660.4^{a}	2.4659^{a}

The same letters in the column means insignificant deferences.

Table 5. Colour characteristics of pan bread crust and crumb samples

Colour parameter / Sample	L*	a*	b*	C*	h_{ab}	WI	Differences ΔE	b/a
				Crust samples				
Flower (72%)	49.81^{Ab}	9.95^{Ab}	20.99^{Aa}	23.23^{Aa}	64.64^{Ab}	44.72^{Ab}	0.00^{Dd}	2.11^{Ab}
Mushroom stalk (5%)	54.81^{a}	8.50^{d}	18.43^{b}	20.30^{c}	65.26^{a}	50.46^{a}	5.78^{b}	2.17^{a}
10%	44.79^{c}	8.97^{c}	18.44^{b}	20.51^{b}	64.11^{c}	41.10^{c}	5.74^{c}	2.06^{c}
15%	42.37^{d}	10.10^{a}	17.29^{c}	20.02^{d}	59.68^{d}	38.99^{d}	8.34^{a}	1.71^{d}
Red beet root 5%	34.22^{b}	7.82^{b}	11.25^{b}	13.70^{b}	55.22^{b}	32.81^{b}	18.53^{c}	1.44^{b}
10%	31.94^{c}	7.60^{c}	9.55^{c}	$12.\ 21^{c}$	51.65^{c}	30.85^{c}	21.37^{b}	1.26^{c}
15%	28.67^{d}	6.72^{d}	7.25^{d}	9.89^{d}	47.20^{d}	27.99^{d}	25.45^{a}	1.08^{d}
				Crumb samples				
Flower (72%)	81.24^{Aa}	6.00^{Ca}	21.60^{Aa}	21.61^{Ab}	74.46^{Aa}	71.38^{Aa}	0.00^{Dc}	3.60^{Aa}
Mushroom stalk (5%)	53.00^{b}	6.10^{a}	19.60^{c}	20.53^{c}	72.70^{b}	48.71^{c}	29.09^{b}	3.21^{b}
10%	53.02^{b}	6.17^{a}	19.46^{d}	20.41^{d}	72.39^{c}	48.78^{b}	29.10^{b}	3.15^{c}
15%	52.85^{b}	6.94^{a}	20.90^{b}	22.02^{a}	71.62^{d}	47.96^{d}	29.38^{a}	3.01^{d}
Red beet root (5%)	44.62^{b}	7.79^{a}	15.23^{b}	17.11^{b}	62.97^{c}	42.04^{b}	38.11^{c}	1.96^{c}
10%	36.56^{c}	6.69^{bc}	13.73^{c}	15.27^{c}	64.00^{b}	34.75^{c}	45.95^{b}	2.04^{b}
15%	34.51^{d}	71.38^{ab}	13.07^{d}	15.01^{d}	60.53^{d}	32.81^{d}	48.17^{a}	1.77^{d}

The same letters in the column means insignificant deferences.

Sensory Evaluation

The effect of mushroom stalk or red beet root powders fortification on sensory characteristic (Aroma, taste, crust colour, crumb colour, crumb texture and over all acceptability) of wheat flour pan bread are shown in Table 6. Pan bread replacement with 5% mushrooms stalk and red beet root powders had the highest scores in the (Aroma, taste, crust colour, crumb colour, crumb texture and overall acceptability). It 's were (7.35, 6.72, 6.35, 6.71, 6.06 and 6.78, respectively while in 5% red beet root, 7.65, 6.94, 6.12 ,6.35, 7.24 and 7.41, respectively). On the other hand, pan bread replacement with 15% (mushroom stalk and red beet root powders) were not acceptable. The results of sensory evaluation indicated that 5% mushroom stalk or red beet root can be successfully used in replacement of wheat flour pan bread. From Table 6 it was no significant difference in the aroma of pan bread in all mushroom substitution. The same results were noticed in crust colour while, it was highly significant difference in all sensory properties in case of red beet root compared to control samples.

Conclusion

Mushroom production is on of the most eco-friendly methods of recycling agro-wastes. The present studies is a successful and novel formulation of pan bread production with mushroom stalk and red beet root powders were developed. Mushroom stalk and red beet root powders are good sources of phenolic compounds, protein and dietary fiber. Mushroom stalk and red beet root powder were good in antioxidant activity and dietary fiber of pan bread. Substitution of wheat flour at 10% is recommended to produce an acceptable pan bread. Over all, it could be recommended that the technology of using mushroom stalk and red beet root powders should be encouraged among food industries to make economic use of local/raw materials to incorporate into pan bread and provide pan bread with more functional components and more effective antioxidant activity and to make zero waste technology.

Table 6. Sensory evaluation of pan bread made from wheat flour 72% replacement with mushroom stalk and red beet root powders

Sensory evaluation / Sample	Aroma (9)	Taste (9)	Crust color (9)	Crumb color (9)	Crumb texture (9)	Overall acceptability (9)
Flower (72%)	8.29^{Aa}	7.65^{Aa}	7.76^{Aa}	7.71^{Aa}	7.47^{Aa}	7.41^{Aa}
Mushroom stalk						
5%	7.35^{b}	6.72^{b}	6.35^{b}	6.71^{b}	6.06^{b}	6.78^{b}
10%	7.35^{b}	6.12^{c}	6.00^{b}	6.47^{c}	6.00^{c}	6.47^{c}
15%	7.35^{b}	5.94^{d}	5.82^{b}	6.41^{d}	5.82^{d}	6.24^{d}
Red beet root						
5%	7.65^{b}	6.94^{b}	6.12^{b}	6.35^{b}	7.24^{b}	7.41^{a}
10%	7.29^{c}	6.24^{c}	5.65^{c}	5.82^{c}	7.06^{c}	7.12^{b}
15%	7.00^{d}	5.82^{d}	4.94^{c}	4.94^{d}	6.24^{d}	5.65^{c}

The same letters in the column means insignificant deferences.

REFERENCE

AACC (2002). Approved Methods of Analysis, Methods 10-50D, 44-15 and 4612.AACC. Int., St. poul, MN.

Abou-Zaid, A.A.M., M.A.S. El-Bandy and H. Ismaeil (2012). Rheological properties and quality evaluation of pan bread and biscuits supplemented with mushroom micelles flours. Aust. J. Basic and Appl. Sci., 6 (6): 237- 245.

Agu, H.O., J.A. Ukonze and K.A. Paul (2010). Quality characteristics of bread, made from wheat and fluted pumpkin seed flour. Nig. Food. J., 28 : 188- 198.

Ahamed, Z.S. (1999). Effect of hydrocolloids in Egyptian balady bread ц. Baking quality, J. Agric. Sci., Mansoura Univ., 24 : 3535-3544.

Alam, D.S.M. and M.S. Roza (2001). Importance of mushrooms.NIA, Tando Jam, Pakistan.

AL-Sayed, H.M.A. and A. Rahmed (2013). Utilization of watermelon rinds and sharlyn melon peels as a natural source of dietary fiber and antioxidants in cake. Annals Agric. Sci., 58 (1): 83-95.

AOAC (2005). Official Methods of Analysis of the Association of official Analytical Chemists, 18th Ed., AOAC Int., Arlington, Virginia, USA.

Badifu, S.O., C.E. Chima, Y.I. Aayi and A.F. Ogori (2005). Influence of mango mesocare flour supplement to micronutrient, Physical and organoleptic qualities of wheat- based-bread. Nig. Food J., 23 : 59- 68.

Bonet, B. and C.M. Rosell (2006). Formation of homopolymeters and heteropolymeters between 1 wheat flour and several protein sources by 2 trans glutaminase catalyzed cross linking , Cereal Chemi.

Chong, S.T. and P.G. Miles (2004). Mushroom Cultivation, Nutritional Value, Medicinal Effect and Environmental Impact 2nd Ed., CRS Press, LLC, 27-37.

Clifford, T., G. Howaston, D.L.J. West and E.J. Stevenson (2015). The potential benefits of red beet root supplementation in health and disease. Nutrients, 7 : 2801- 2822; doi: 10, 3390/ nu 7042801.

Gimai, S.Y., D.B. Mepha, K. Kabari and S.D. Achienewhn (2003). Evaluation of the nutritional quality of breads prepared from wheat- fluted pumpkin (*Telferia occidentis* Hooks) seed flour blends. Plant Food Health. Nutr., 58:1-8.

Goesaert, H., K.W.S. Brijs, V. Beke, C.M. Courtin, K. Gebruers and J.A. Delcour (2005). Wheat Flour Constituent: how they impact bread and how to impact their functionality. Trends in Food Sci. and Technol., 16:12- 30.

Hooda, S. and Jood (2005). Organoleptic and nutritional evaluation of wheat biscuits supplemented with untreated and treated fenugreek flour. Food Chem., 90(3):427-435.

Kaur, C. and H.C. Kapoor (2002). Anti- Oxidant activity and total phenolic content of some Asian vegetables, Int. J. Food Sci., Technol., 37 : 153- 161.

Kenny, S., W. Karina, S. Catherine and A. Elke (2000). Incorporation of dairy ingredients into wheat bread : Effects on dough rheology and bread quality. Eur Food Res. Technol., 210 : 391-396.

Koul, V.K.J., M.P. Koul, S. Sharma, V.K. Tikoo and S.M. Jaln (2002). Spray drying of beet root juice using different carries, Indian J. Chem. Technol., 9 (5) : 442-445.

Krishna, G. and S.K. Ranjhan (1981). Gross energy value of herbage, faeces, Urine milk, meat and silage .Laboratory Manual for Nut. Res. Vikas Publishing House (Pvt) Ltd. Delhi

Lee, S.C., J.H. Jeng, S.M. Kim and D.R. Nam (2003). Effect of far infrared radiation on the antioxidants activity of rice hulls, J. Agric. and Food Chemi., 51 : 4400-4403.

Magda, R.A., A.M. Awad and K.A.S. Selim (2008). Evaluation of mandarin and navel peel as natural sources of antioxidant in biscuit, Alex. J. Food .Sci. and Technol., 75-82

Mahamud, M.M., M. Rezaul, I. Shirshir and M.R. Hasan (2012). Fortification of wheat bread using mushroom powder. Bangladesh

Res. Pub. J. 7(1) :60-68 Retrieve from http :// WWW. Bd Res. Publi. Com. / admin / J./ Upload / 09 314.pdf

Muin, H., N. Mohd., T. Fek, R.A. Abiodun, H.M. Yusof and S. Abdul- Razak (2015). Effect of partial and complete replacement of fishmeal with mushroom stalk meal and soybean meal on growth performance of Nile Tiapia *Oreochromis niloticus* fingerlings. Sains Malay Siena, 44(4): 511-516 .

Muin, H., N.N. Abdulfatah, M.H.M. Nor and S. Abdul-Razak (2013). Rice bran replacement in *Clarias gariepinus* fingerlings diets with *Pleurotus Florida* stalk. Sains Malay Siana, 42 (8) : 1109-1114

Okafor, J.N.C., G.I. Okafor, A.U. Ozumba and G.N. Elemo (2012).Quality characteristics of bread made from wheat and Nigerian oyster mushroom (*Pleurotus plumonarius*) powder. Pakistan J. Nutr., 11(1) : 5-10.

Ordon, T.D., M.A. Gomez and M.L.V. Huone (2006). Antioxidant activities of sechium edule (Jacq). Swartz extracts. Food Chem., 97: 452-458.

Pastukhov, A. and H. Dogan (2014). Studying of mixing speed and temperature impacts on rheological properties of wheat flour dough using mixolab. Agron. Res., 12 (3):779-786.

Reis, F.S., L. Barros, A. Martins and Ferreira (2012). Food Chem., Toxical., 50 : 191-197 .

Roa, L.H., L.Y. Khizar, E. Karangwa, S.Q. Xia, C.S Jia and X.M. Zhang (2011). Effect of ultrafilration adsorbents on the clarification of green tea. J. Food Engin., 102 : 321-326

Roy, k., S.Gullapall, U.R. Chaudhuri and R. Chakraborty (2004). The use of a natural colorant based on betalainl in the manufacture of sweet products in India, "Int. J. Food Sci. Technol., 39 (10): 1087- 1091.

Sariconban, C. and M.T.Y. Imaz (2010). Modeling the effect of processing factors on the changes in color parameters of cooked meat ball using response surface methodology .World Appl. Sci. J., 9 (1): 14-22.

SAS Institute Inc. (1990). SAS/STAT User's Guide volume 2, Version 6,Fourth edition, Cary, NC : SAS Institute Inc.

Selomulyo, V.O. and W. Zhou (2007). Frozen bread dough: effects of freezing storage and dough improvers. J. Cereal Sci., 45:1-17.

Simona, A., A. Ersilia, N. Monica, G. Emilia and A. Lazureanu (2013). Studies regarding rheological properties of tritical, wheat and rye flours, J. Hort., Forestry and Biotechnol., 17 (1): 345-349.

Singh, B. and B.S. Hanthan (2014). Chemical composition, functional properties and processing of beet root-a review. Int. J. Sci. and Eng. Res., 5 : 2229- 2233.

Skerget, M., M. Kotnik, M. Hadolin, A. Rizner, M. Simonic and Z. Knez (2005). Phenols proanthocyanidins, flavones and flavnols in some materials and their antioxidants activities. Food Chem., 89:191-198

Vulic, J., J. C. Brunet, G. Cetkovic, S. Dilas, V. Tumbas, S. Savatovic and D.C. Simin (2012). Betalains from beet pomace- good source of food colorants and antioxidants, Fac. Technol., Uni. Novi Sad, Serbia Relalive from e-mail: Jvulic @un s.a.c.rs.

تأثير إضافة مخلف عيش الغراب المحارى والبنجر الأحمـــر على جودة خبــز القالب

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صممت هذه الدراسة بغرض استبدال ٥%، ١٠%، ١٥%، من دقيق القمح استخلاص ٧٢% بسيقان عيش غراب المحاري أو البنجر الأحمر بعد تجهيزها فى صور مسحوق كمصدر لمضادات الأكسدة والألياف والبروتين عند تصنيع خبز القالب، وقد تم دراسة تأثير نسب الإضافة على التركيب الكيماوى للخبز الناتج، أوضحت النتائج أن الخبز المستبدل بمسحوق عيش الغراب المحاري والبنجر الأحمر مرتفع فى البروتين والألياف والرماد بينما كان منخفضا في الكربوهيدرات والطاقة وذلك مقارنة بعينة الكنترول، كما تم دراسة تأثير نسب الاستبدال على الصفات الريولوجية باستخدام جهاز Mixolab حيث أن إضافة مسحوق عيش الغراب المحاري والبنجر الأحمر إلى عجائن دقيق استخلاص ٧٢% أدى إلى زيادة نسبة الماء الممتص ومعدل ثبات العجينة وذلك مقارنة بالكنترول وبإجراء أختبارات اللون للخبز الناتج باستخدام جهاز هانتر لقياس الألوان أظهرت النتائج إلى انخفاض طفيف لقيم L,a,b اللبابة والقصرة للخبز مقارنة بالكنترول، ولوحظ من الدراسة زيادة الحجم (سم^3) للخبز المستبدل مقارنة بالكنترول، وبإجراء التقييم الحسى أشارت النتائج أن أفضل العينات المستبدلة بنسبة ٥%، ١٠% من مسحوقي عيش الغراب المحاري أو البنجر الأحمر، وبذلك يمكن الإشارة إلى إمكانية استخدام مسحوقي سيقان عيش الغراب المحاري أو البنجر الأحمر كمصدر للألياف الغذائية والبروتين في إنتاج خبز جيد غذائيا وتكنولوجيا.

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