Utilization of Vegetable Waste Powder in Formulation Some Egyptian Common Foods

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ABSTRACT

The trimming wastes of some vegetables such as external leaves of lettuce, alcapucci, cabbage, cauliflower (stem & leaves) and artichoke (leaves and outside bracts) were utilized to prepare vegetable - waste powder (VWP). Gross chemical composition, dietary fiber, mineral content, bioactive components, antioxidant activity and antimicrobial activity were studied. Also the utilization of this powder in preparing some Egyptian common foods, such as *Falafel*, Jew's mallow stew (*Mulukhiya*), lentil soup and *Bessara* as well as some bakery products such as cake and biscuits (*Menain*) was studied and evaluated from the organoleptic point of view.

The results showed that the VWP contained higher amount of protein, dietary fiber, carotenoids, ascorbic acid and flavonoids. The methanolic extract of powder had antioxidant and antimicrobial activities. The results also showed that all the prepared products containing the different percentages of VWP were well accepted by the panelists.

Keywords: Agro-industrial wastes, vegetable wastes, Egyptian common food products

INTRODUCTION

Food industries produced large amounts of food wastes especially vegetable wastes or by-products. The demand to recover the value through converting these wastes to new products is increased (Helkar *et al*., 2016, Salim *et al*., 2017).

Vegetable wastes are good sources of phytonutrients having pharmacological activity. These nutrients include antitumor, antiviral, antibacterial, cardio-protective and antimutagenic (Gupta *et al*., 2015).

As consumers become incrementally aware of the relation between food and health, their attitude towards healthy food is promising development and the scope of functional foods is increasing all over the world markets (Helkar *et al*., 2016).

Vegetable wastes can be considered good sources of dietary fiber, antioxidants which may play an important role in food industry and human health (Nawal *et al*., 2008, Sharoba *et al*., 2013a).

Antioxidants have an important role in preventing undesirable changes in food flavour and nutritional quality. Also, protect the cells from tissue damage (Nawal *et al*., 2008). On the other hand, dietary fiber act as protective agent against diverticulitis, constipation, colon cancer, diabetes and cardio vascular diseases (Rodriguez *et al*., 2006, Sharoba *et al*., 2013b).

Fruits and vegetables processing, packaging, distribution and consumption generate a huge quantity of fruit and vegetable wastes and most of these wastes are being disposed in the landfills causing environment pollutions. Outer leaves of lettuce, alcapucci, cabbage, in addition to stems and leaves of cauliflowers as well as leaves and outside bracts of artichoke are example of wastes which are removed during the trimming process their done by green grocers before selling these products. These unconventional wastes can act as an excellent source of nutrients capable of inhibiting the activity of some pathogenic microorganisms. In addition, these wastes contain bioactive compounds which can be used as natural antioxidants as well as act as an anticarcinogenic effect. No attention has been done to utilize these wastes in some common food products consumed in Egypt. Thus, the present study aimed to evaluate the composition of these wastes which can help to suggest enormous potentiality for producing value- added products.

MATERIALS AND METHODS

Materials:

Lettuce leaves (*Lactucasativa*), alacapucci-lettuce leaves, cabbage leaves(*Brassica oleracea var. ocpitota*), cauliflower stems and leaves (*Brassica oleraceavar. botrytis*) and artichoke (*Cynarascotymus*) leaves and outside bracts, were obtained from different local markets in Alexandria, Egypt. Wheat flour (72% extraction ratio), baking ingredients (including milk, sugar, oil, eggs, vanillin, baking powder, instant yeast, salt, dry milk), dehulled faba beans, lentil, onion, garlic, fresh and dry coriander ,parsley, carrot, tomato and dry Jew'smallow (*Mulukhiya*) were obtained from local market in Alexandria, Egypt.

Bacterial and fungal strains including: *Staphylocoousaerus* 29123, *Escherichia coli* 3518, *Rhizopusspp* and *Aspergillusniger* CAIM 147 were utilized. They were obtained from Food technology Department Arid Lands Caltivation Research institute City for Scientific Research and Technological Applications, Alexandria, Egypt.

Preparation of vegetable waste powder (VWP)

All the waste samples were shredded into small pieces, washed with tap water, drained and then dehydrated at 40°C in an air circulating oven for approximately 6 hr. The dehydrated samples were ground and sieved through 60 mesh sieve. Equal amounts of each powder were mixed and the obtained flour was stored frozen at $-18^{o}C$ in tightly closed kilner jars until used.

Technological processes

Preparation of *Falafel*, *Bessara* and lentil soup

The traditional methods for preparing *Falafel* and *Bessara* were followed as shown in Fig. (1) and described by Youssef *et al* .(1987).

Traditional method for preparing lentil soup was followed as described by Gafar (1971).

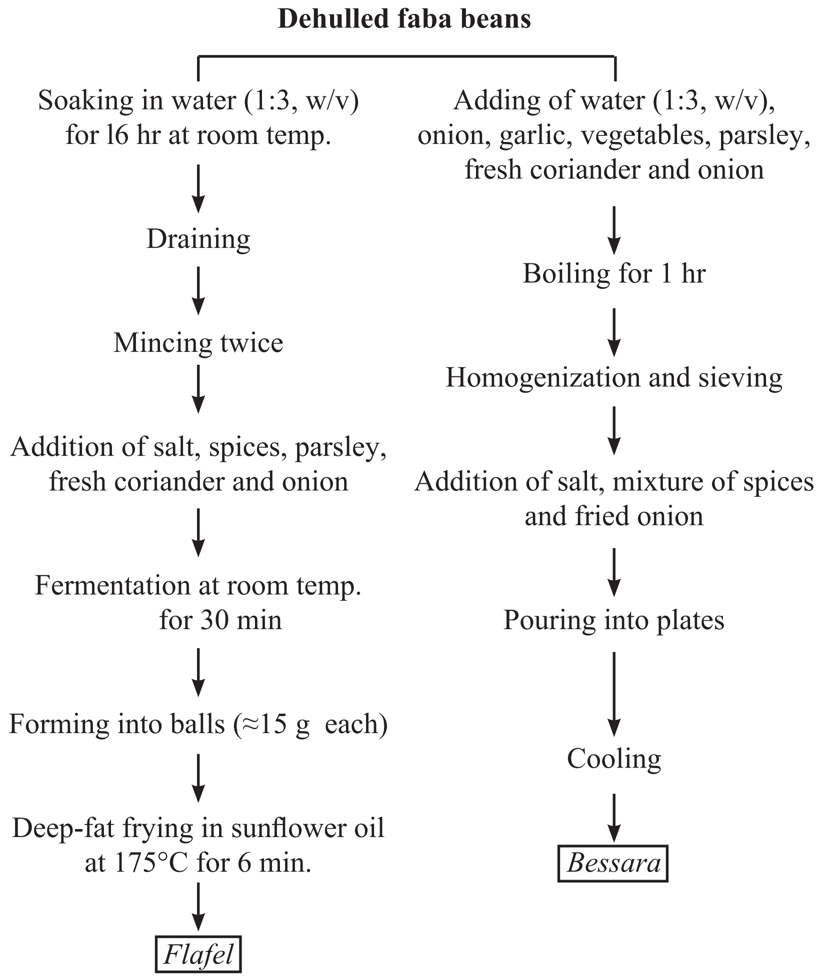


Fig. 1: Preparation of *Falafel* and *Bessara*

Preparation of Jew's mallow stew (*Mulukhiya*)

The procedure of Muna *et al* . (2016) was followed with some modifications in which dehydrated *Mulukhiya* was used instead of the fresh ones. Garlic sauce was prepared by heating small amount of butter, garlic and coriander. This sauce was poured immediately into the *Mulukhiya*.

Preparation of cake and biscuits (*Menain*).

Cake preparation was done according to Sharoba *et al.* (2013a). On the other hand, ingredients and procedure for preparing biscuits (*Menain*) was followed according to the method described by Abdel-Nabey *et al*. (2013).

The VWP was added to the previous products as follows:

Bessara (1.25, 2.5, 3.75 and 5.0%).
Falafel (6.25, 12.5 and 25%).
Lentil soup (0.25, 0.5, 0.75 and 1%)
Jew's mallow stew (*Mulukhiya*) (20, 40, 60 and 80%).
Cake (0.5, 1.0 and 1.5%).
Biscuts (*Menain*) (0.05, 1.0 and 1.5%)

Analytical methods

Chemical composition.

Moisture, crude protein, crude ether extract and total ash of VWP were determined according to AOAC (2003) unless otherwise stated. Carbohydrate were calculated by difference .Crude fiber, acid detergent fiber (ADF) and neutral detergent fiber (NDF) were determined using ANKOM 200 Fiber Analysis ANKOM Technology corporation, NY,USA) according to AOAC (2006). Ascorbic acid was determined according to the AOAC method (2003).

Chlorophylls and carotenoids

Chlorophylls and carotenoids were determined according to Sumanta *et al*. (2014). The sample (0.5 g of VWP) was homogenized in homogenizer with 10 ml of acetone 80%. Homogenized sample was centrifuged at 13416 xg for 15 min. The supernatant was separated and 0.5 ml was mixed with 4.5 ml of the solvent. The mixture was analyzed for chlorophyll-a , b and carotenoid content in Optizen pop uv- vis spectrophotometer. The equation used for the quantification of chlorophyll-a , b and carotenoids were as follows:

$$\text{Ch-a} = 12.25\ A_{663.2} - 279 A_{646.8}$$

$$\text{Ch-b} = 21.5\ A_{646.8} - 5.1\ A_{663.2}$$

$$\text{Cx+c} = (1000\ A_{470} - 1.82\ \text{Ca} - 85.02\ \text{cb}) / 198$$

Where:

A: Absorbance.

Ch-a: chlorophyll a.

Ch-b: chlorophyll b.

Cx+c : carotenoids.

Extraction of total phenolic compounds from VWP

The VWP was extracted using the method of Vongsak *et al*. (2013). The dehydrated powder was separately macerated with 70% ethanol (1:40, w/v) for 72 hr at room temperature with occasional shaking. The extract was filtered and the precipitate was re-extracted by the same process and solvent until the extraction was exhausted. The combined extracts were separately filtered through Whatman No.1 filter paper. The extract was dried under reduced pressure at 50°C using a rotary vacuum evaporator. The crude extract was weighed and kept in a tightly closed container protected from light.

Determination of total phenolic compounds

Total phenolic content

Total phenolic content of VWP extract was determined by the method of Moyo *et al*. (2012) using Folin-Ciocalteu reagent. The extract was mixed with 5 ml Folin – Ciocalteu reagent (previously diluted with distilled water 1:10 v/v) and 4 ml of sodium carbonate (75 g/l). The mixture was vortexed for 15 sec and allowed to stand for 30 min at 40°C for colour development. Absorbance was measured at 765 nm using Optizen pop uv- visspectrohpotometer. Total phenolic content was expressed as mg gallic acid equivalent /g.

Total flavonoid content

Total flavonoid content of VWP extract was determined by the method of Zarina & Tan(2013). Firstly, 2 ml of the sample solution was accurately transferred into 10 ml volumetric flask and 0.6 ml of 5% sodium nitrite ($NaNO_2$) was added. The mixture was shaken and left for 6 min Secondly, 0.5 ml of 10% aluminum nitrate ($Al(NO_3)_3$ solution was added to the volumetric flask, shaken, and left to stand for 6 min. Finally, 3.0 ml of 4.3 sodium hydroxide (NaOH) solution was added to the volumetric flask, followed by addition of water up to the scale, shaken, and left to stand for 15 min before determination. Absorbance was measured at 500 nm using Optizen pop uv- vis spectrohpotometer. Total flavonoid content was calculated as mg rutin equivalent /g.

Total proanthocyanidin content

Total proanthocyanidin content of VWPextract was determined by the method of Moyo*et al*. (2012). Aliqouts of 0.5 ml of 1 mg/ ml of the extract was mixed with 3 ml of 4 % vanillin-acetone solution and 1.5 ml concentrated hydrochloric acid. The absorbance was measured at 500 nm after the mixture was allowed to stand for 15 min. Total proanthocyanidin content was expressed as mg catechin equivalent /g.

Mineral contents

Minerals including calcium, magnesium, iron, zinc, manganese, chromium, cadmium, copper, nickel and lead were measured as described in AOAC method (2000) using Perkin Elmer 2380 Atomic Absorption spectrophotometer. On the other hand, sodium and potassium were determined using flame photometer (model PFP7, England).

Antioxidant activity

The DPPH radical scavenging assay

The effect of VWP extract on 1, 1- diphenyl 1-2 picrylhydrazyl (DPPH) radical was estimated using the method described by Moyo *et al*. (2012). A solution of DPPH (0.135 mM) was prepared and 1 ml of this solution was mixed with 1 ml of the extract. The reaction mixture was vortexed thoroughly and left in the dark at room temperature for 30 min. The absorbance of the mixture was measured at 517 nm using butylatedhydroxyanisole (BHA) as a control. The radical scavenging activity was calculated from the equation:

Percentage of radical scavenging activity= $(Abs_{control} – Abs_{sample}) / Abs_{control} \times 100$

Where Abs control is the absorbance of DPPH, Abs sample is the absorbance of DPPH radical + sample extract / standard.

The half maximal inhibitory concentration (IC_{50}) values denoted the concentration of sample required to scavenge 50% of DPPH free radicals is calculated.

Antimicrobial activity

The antimicrobial activity was performed by agar well diffusion method according to El Sohaimy *et al*. (2015). A well was prepared in the plates with the help of a cork-borer (0.85cm). One hundred µl of the extract (500 mg/ml) was introduced into the well. The plates were incubated overnight at 37^0C for bacteria and 25 ^{0}C for fungal. Microbial growth was determined by measuring the diameter of zone of inhibition. The result was obtained by measuring the zone diameter (mm). The experiment was dome three times and the mean values were expressed. *Staphylocoous aerus* 29123, Escherichia *coli*3518,*Rhizopus spp* and *Aspergillus niger* CAIM 147were used.

Sensory evaluation

Colour, taste, odour, texture, (consistency) and overall acceptability of all the products prepared containing the different percentages of VWP were assessed using 15 panelists from Food Science and Technology Department, Faculty of Agriculture, Alexandria university. The panelists were asked to score the above attributes according to a standard hedonic rating score from 9 (like extremely) to 1(dislike extremely) as described by Kramer &Twigg (1973).

Statistical analysis

Statistical package for social science software (SPSS) Version 21using2 factor factorial analysis of variance (ANOVA) was followed. The differences, among means were determined for significance at $p \leq 0.05$ using Duncan's multiple range test.

RESULTSAND DISCUSSION

Gross chemical composition and fiber content of VWP

Nowadays, human is being more aware of food related health troubles and interest in using raw materials for producing dietary fiber powder from inexpensive sources such as agro-food industrial wastes such as vegetable wastes. The data in Table (1) shows the proximate chemical composition as well as dietary fiber content of VWP.

It can be noted that the moisture content was 10.79%. On the other hand, the result declared that this powder was a good source of crude protein being 21.52%. Crude ether extract of VWP was very low being 3.19%, while the total ash was 15.4% and total carbohydrate was 59.89 %. In accordance, Esteban *et al.* (2007) found that the fruit and vegetable wastes contained 65% nitrogen free extract, 13% crude fiber, 12% crude protein, 8% total ash

Table 1: Chemical composition and fiber content of VWP

Component	Value**
Moisture	10.79 ± 0.38
Crude protein	21.52 ± 0.14
Crude ether extract	3.19 ± 0.18
Total ash	15.40 ± 0.43
Carbohydrate*	59.89 ± 0.24
Neutral detergent fiber	32.04 ± 0.43
Acid detergent fiber	21.57 ± 0.36
Crude fiber	15.43 ± 0.32

* Calculated by difference

** Mean value ± S.D. on dry weight basis

and 2% ether extract. On the other hand, Muna *et al*. (2016) found that Jew's mallow and mallow which are similar to the agro-waste utilized in the present study contained high crude protein in the range of 36.73 – 44.77%, crude fiber (9.81 – 12.73%) and total ash content (9.30 – 16.85%), but low in crude ether extract (1.05 – 3.39%).

From the results in Table (1). Also, it can be noted that neutral detergent fiber and acid detergent fiber were 32.09 % and 21.58%, respectively. In accordance with the results obtained in the present study, Sharoba *et al*. (2013a) utilized some vegetable waste including green pea peels as a source of dietary fiber powder in the production of cakes prepared for people suffering from obesity or over weight and diabetes. They found that total dietary fiber, insoluble fiber and soluble fiber were 71.3, 51.48 and 19.82%, respectively. Also, Muna *et al*. (2016) found that the raw leaves of Jaw's mallow and mallow had high content of total dietary fiber, insoluble dietary fiber and soluble dietary fiber The neutral detergent fiber were in the range of (20.94 to 28.98%) and acid detergent fiber (16.97 – 25.61%).

Mineral contents of VWP

Mineral contents of VWP are given in Table (2). The results indicated that K, Ca, Mg and Na were the major minerals. In addition, microelements such as Fe, Zn and Cu were found in small concentrations.

The data obtained in the present study are more or less in agreement with those reported by Abdel-Nabey *et al.* (2015) and Muna *et al*. (2016). Generally, VWP may be considered a good source of K, Ca, Mg and Na.

Table 2: Mineral content of VWP

Mineral*	Value (mg/100g)
K	5390.02
Ca	2935.31
Fe	51.66
Cd	ND
Mg	1799.89
Zn	32.27
Mn	1.97
Cu	11.55
Na	2273.71
Ni	0.72
Cr	0.92
Pb	ND

* On dry weight basis ND: Not detected

Bioactive components and antioxidant activity of VWP

The data in Table (3) show the bioactive components as well as the antioxidant activity of VWP.

It can be noted that VWP contained 59.09 mg/100 g ascorbic acid. The total carotenoid content, chloronhyll a and b were 35.91, 119.49 and 40.18 mg/100g, respectively (Table 3). The results in Table (3) also showed that VWP contained 77.87 mg/100 g total phenolics as gallic acid equivalent, 1.26 mg/100 g flavonoids as rutin equivalent and 0.18 mg/100 g proanthocyanidins as catechin

Table 3: Bioactive components and antioxidant activity of VWP

Parameter	Value±
Ascorbic acid*	59.09 ± 0.46
Carotenoids*	35.91 ± 1.42
Chlorophyll a*	119.49 ± 1.27
Chlorophyll b*	40.18 ± 1.55
Total phenolics**	77.87 ± 0.14
Flavonoids***	1.26 ± 0.15
Proanthocyanidins±±	0.18 ± 0.05
DPPH inhibition %	59.42 ± 2.96
IC_{50} (mg/ml)	17.03 ± 0.23

± Mean ± S.D. on dry weight basis

* mg/100g ** Gallic acid equivalent

*** Rutin equivalent ±±Catechin equivalent

equivalent. These results are in agrement with Campas–Baypoli *et al*. (2009) who found that the stalks of broccoli had nutritional components such as ascorbic acid, β-carotenoids and phenolic. Gupta *et al*. (2015) reported that cauliflower wastes including leaves and stems revealed the presence of some flavonoids which could be a feasible strategy to develop functional foods and at the same time would contribute to valorize these wastes. Jimenez–Escrig*et al*. (2003) mentioned that stems and the external bracts of artichoke which are not suitable for human consumption could be used as a source of inulin, phenolics and should be considered as a raw material for the production of food additives and nutraceuticals.

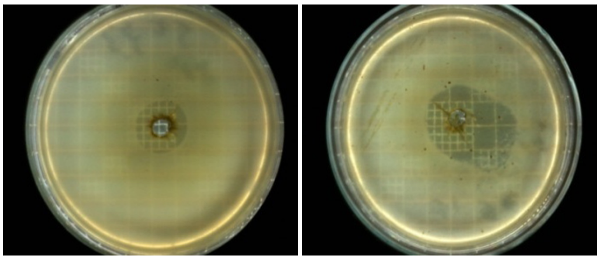
The antioxidant activity (DPPH inhibition %) as well as IC_{50} (mg/ml) of VWP are shown also in Table (3). These values were 59.42% and 17.03 mg/ml, respectively. These values are mainly due to its high content of phenolic and flavonoids. El-Houfi (2015) and Boriy (2016) extracted and identified phenolic compounds from agro-industrial wastes including pea pod, purslane leaves and stems and studied their antioxidant efficiency on oxidative stability of sun flower oil. They included that the agro as industrial wastes can be considered a natural source of antioxidants which can be exploded to keep the quality of vegetable oils against the rancidity. In addition, Khadiga (2016) found that agro-food industrial wastes including empty pea pods and artichoke bracts showed antioxidant activity comparing with BHT. Also Mabrouk(2017) found that *moringa oleifera* leaves had an antioxidant activity in which the IC_{50} of the ethanolic extract was 67.77 mg/ml.

Antimicrobial activity of VWP extract

The methanolic extract of VWP had an antimicrobial activity against all tested bacterial strains (Fig. 2 and Table 4). The diameter of inhibition zone was 25.1 mm for *E. coli* 3518, and 35.47 mm for *Staphylococcus aureus* 29123.

On the other hand, the results in Table (4) and Fig. (3) showed that the diameter of inhibition zones were 30 mm for *Rhizopus*spp and 32.17 mm for *Aspergillusniger* CATM 147.

Data presented here agree with the results obtained in the study of Abdel-Nabey *et al.* (2015), El-Sohaimy *et al*. (2015) and Mabrouk (2017) who found that the leaf powder of *Moringa oleifera* had



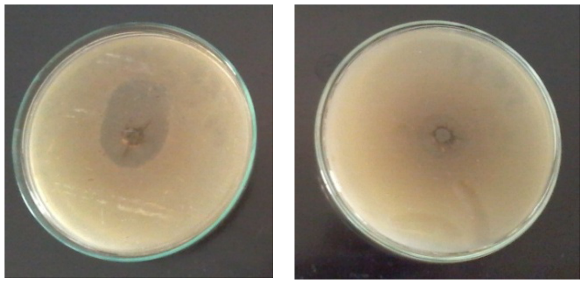
E. coli 3518 *Staphylococcus aureus* 29123

Fig. 2: Antimicrobial activity of VWP extract

Table 4: Antimicrobial activity of VWP extract

Pathogenic microbe	Inhibition zone mm*
Staphylococcus aureus 29123	35.48 ± 0.25
Esherichia coli 3518	25.14 ± 0.36
Rhizopusspp	30.00 ±0.46
Aspergillusniger CATM 147	32.17 ± 0.21

* Average of triplicate determinations



Aspergillusniger CATM 147 *Rhizopus* spp.

Fig. 3: Antimicrobial activity of VWP extract

a noticeable antimicrobial effect on growth of some pathogenic bacteria, molds and yeasts. On the other hand, Khadiga (2016) found that agro-industrial wastes including empty pea pods and artichoke bracts showed antimicrobial activity against some strains of pathogenic microorganisms.

Sensory evaluation of some common food products containing VWP

The data in Table (5) show sensory attributes of some common food products such as *Falafel*, *Mulukhiya*, lentil soup and *Bessara* containing different ratios of VWP.

As it can be shown from Table (5), no significant differences were noted in the organoleptic contributes of *Falafel* containing the different ra-

Table 5: Sensory evaluation of *Flafel*, *Mulukhiya*, lentil soup and *Bessara* containing VWP

Product		%VWP	Sensory attributes				
			colour	Taste	Odour	Texture	overall Acceptability
Flafel	Control	-	8.06 ±0.77a	7.94±0.851a	7.88±0.89 a	7.75±0.86a	7.86±0.81 a
	1	6.25	0.62± 7.88 a	7.75±0.68a	7.81±0.75a	7.81±0.75a	7.81±0.75a
	2	12.50	7.63±0.72a	7.75±0.77a	7.81±0.83a	7.81±0.83a	7.75±0.77a
	3	25.00	7.56±0.73 a	±0.73 a7.56	7.63±0.89 a	7.5±0.63a	7.56±0.63a
Mulukhiya	Control	-	8.81±0.40 a	8.50±0.52 a	8.81±0.40 a	8.81±0.40 a	8.81±0.40 a
	1	20	8.00±0.89b	0.70 b ±7.69	8.06±0.85 b	8.81±0.81b	8.81±0.77b
	2	40	7.62±0.62c	7.44±0.63 b	7.63±0.62 c	7.75±0.68c	0.60c ±7.69
	3	60	7.38±0.72c	7.31±0.70 b	7.50±0.73 c	7.63±0.81 c	0.63c ±7.56
	4	80	7.38±0.72 c	7.44±0.81 b	7.63±0.81c	7.44±0.73c	7.63±0.81c
Lentil soup	Control	-	8.44±0.73 a	8.56±0.63 a	8.50±0.63a	8.69±0.60 a	8.56±0.63 a
	1	0.25	7.63±0.62 b	7.56±0.81 b	7.81±0.83 b	7.69±0.70 b	7.69±0.60 b
	2	0.50	7.63±0. 50 b	7.62±0.61 b	7.81±0.54 b	7.50±0.52b	7.63±0.50 b
	3	0.75	7.56±0.63 b	7.56±0.73 b	7.75±0.77 b	7.50±0.82b	7.56±0.63 b
	4	1.00	7.68±0.60 b	7.63±0.96b	8.00±0.73 b	7.81±0.91 b	7.56±0.63 b
Bessara	Control	-	8.81±0.40 a	8.81±0.40 a	8.75±0.45 a	8.69±0.48 a	8.18±0.40 a
	1	1.25	8.19±0.75 b	8.13±0.62 b	7.94±0.68bc	8.06±0.86bc	8.06±0.68 b c
	2	2.50	8.06±0.44 b	8.13±0.34 b	8.06±0.57 b	8.19±0.54 b	8.19±0.54 b
	3	3.75	8.38±0.72 b	8.06±0.57bc	7.94±0.68bc	8.13±0.72 b	8.13±0.72 b
	4	5.00	7.63±0.62 c	7.81±0.40 c	7.63±0.50 c	7.75±0.58 c	7.75±0.45 c

Means within a column not sharing the same letter are significantly different at $P \leq 0.05$

tios of VWP comparing with the control sample. In case of *Mulukhiya*, it can be noted that the percentages of VWP added were significantly affected all the sensory attributes in comparison with the control sample. The scores of organoleptic attributes given for *Mulukhiya* decreased with increasing the % of VWP. In general, all the organoleptic attributes were still over 7.0 which mean that all the *Mulukhiya* samples prepared containing up to 80% VWP are still accepted by the panelists.

In case of lentil soup, there were significant differences between the control sample and the other samples containing the different % of VWP from the organoleptic point of view. However, there were no any differences between samples containing the different % of VWP. It was obvious that the panelists accepted lentil soup containing the different % of VWP up to 1% (Table 5).

In case of *Bessara*, there were significant differences on the sensory attributes between the control sample and those containing VWP up to 5%. According to the data obtained (Table 4), the scores of organoleptic attributes slightly decreased with increasing the % of VWP added. However all the samples containing VWP were well accepted by the panelists in which all the scores were above 7.5.

The sensory attributes of some food products such as cake and biscuits (*Menain*) containing different % of VWP are shown in Table (6)

In case of cake, there were significant differences between the control sample and cakes containing different % of VWP. It can be noted with elevating the % of VWP, the organoleptic acceptance declined. This was also true for biscuits (*Menain*). The data obtained regarding these two products declared that there were slight significant differences between the products containing the different levels (%) of VWP. In general both products were still well accepted by the panelists even at the highest % of VWP added (1.0%).

Table 6: Sensory evaluation of cake and biscuits "*Menain*" containing VWP

Product		%VWP	Sensory attributes				
			colour	Taste	Odour	Texture	Overall Acceptability
Cake	Control	-	8.69±0.48 a	8.75±0.44 a	8.56±0.73 a	8.63±0.72 a	8.69±0.48 a
	1	0.5	8.19±0.40 b	8.13±0.50 b	8.06±0.44 b	8.19±0.54 a b	8.19±0.54 b
	2	1.00	7.69±0.79 c	7.63±0.81 c	7.75±0.77 b	7.69±0.95 b	7.69±0.87 c
	3	1.5	8.19±0.54 b	8.13±0.34 b	8.78±0.50 b	8.13±0.62 a b	7.12±0.50 c
Biscuits	Control	-	8.69±0.48 a	8.56±0.51 a	8.44±0.51 a	8.63±0.50 a	8.50±0.52 a
	1	0.5	8.19±0.66 b	8.13±0.50 b	7.75±0.45 b	8.06±0.86 b	7.94±0.44 b
	2	1.00	7.63±0.50 c	7.75±0.58 c	7.75±0.51 b	7.63±0.50 c	7.81±0.54 b
	3	1.5	7.94±0.57 cb	7.94±0.44 b c	7.81±0.54 b	8.00±0.63 cb	7.50±0.52 b

Means within a column not sharing the same letter are significantly different at $P \leq 0.05$

Sharoba *et al*. (2013 a, b) reported that fruit and vegetable wastes including green pea peels can serve as a good source of dietary fiber in cake manufacture. Salim *et al*. (2017) mentioned that dried products from fruit and vegetable wastes are used as confectionary products, flours, and flakes, granulated, powder, additional ingredient of ready-to-eat soup, salads, energy bars, and cereals, as well as snack products.

As a conclusion, VWP prepared from trimming wastes of some vegetables can be used as a functional ingredient in preparing some common food products such as *Falafel*, *Mulukhiya*, lentil soup and *Bessara* as well as some bakery products such as cake and biscuits (*Menain*). This is because the VWP can be considered as a source of bioactive components, dietary fiber, antioxidant and antimicrobial agents.

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الاستفادة من مسحوق مخلفات بعض الخضروات في تحضير بعض الأغذية الشعبية المصرية

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استخدمت في هذه الدراسة نواتج عملية تشذيب بعض الخضروات مثل الأوراق الخارجية لكل من الخس والكابوتشى والكرنب بالإضافة إلى الأوراق الخارجية وسيقان القرنبيط والخرشوف وذلك لتحضير مسحوق من هذه المخلفات. هذا وقد تم تقييم هذا المسحوق من حيث التركيب الكيماوي الإجمالي والألياف الغذائية والمعادن ومحتواها من المركبات الحيوية وتأثيرها كمضاد للنشاط التأكسدى وكمضاد لبعض الميكروبات وكذا الإستفادة من هذا المسحوق بإدخاله بنسب مختلفة فى بعض الأغذية الشائعة فى مصر مثل الفلافل والملوخية وشوربة العدس والبصارة وبعض المخبوزات مثل الكيك والبسكويت (المنين)

ولقد أوضحت الدراسة أن مسحوق هذه المخلفات غني فى محتواه من كل من البروتين والألياف الغذائية والكاروتينويدات، حامض الأسكوربيك والفتلافونويدات. كما أن المستخلص الميثانولي لهذا المسحوق له نشاط مضاد لبعض الميكروبات وكذلك مضاد للأكسدة.

كما أثبتت الدراسة أن جميع المنتجات المحضرة المحتوية على هذا المسحوق وبالنسب المختلفة كانت مقبولة بدرجة جيدة من الناحية الحسية.