Preparation of food products rich in vitamin D, zinc and selenium to raise Immunity to face Covid-19

Prof. Dr.

Fatma Elzahraa Amin Elshrief

Prof. of Nutrition and Food Science
Ex-Dean of Faculty of Home Economics
Menoufia University

Prof. Dr.

Ali Badawy Rosas

Prof. of Nutrition and Food Science
Ex-Dean Of Faculty of Specific Education
Menoufia University

Prof. Dr.

Mona Ibrahim Mohamed

Prof. of Nutrition and Food Science
Faculty of Specific Education
Menoufia University

Esraa Mohamed Ismail El-Nayad

Postgraduate Researcher
Faculty Of Specific Education
Menoufia University

Abstract

The novel coronavirus (COVID-19) has spread rapidly to many countries and has been declared a pandemic by the World Health Organization. People with weakened immunity are mostly affected by the coronavirus. However, plant foods increase beneficial intestinal bacteria that help a lot in increasing people's immunity by 85% using different minerals such as zinc, selenium and other foods rich in Vitamins C and D. So the aim of the study was to produce food products (date bar, chocolate bar, oat bar) rich in zinc, selenium and vitamin D to raise the body's immunity to confront the coronavirus. The results of the study showed that the newly processed date , chocolate and oats are higher in vitamin D3, C, zinc and selenium, and therefore more valuable in preventing COVID-19 when compared to the control bar .The results also showed a significant increase in protein in the newly processed date bar compared to the control bar, as well as it also increased other nutrients (fats, fibers, carbohydrates and calories), and in the newly processed chocolate bar, the protein, carbohydrates and fibers increased significantly, while calories and fats decreased, which indicates for a healthier product. Moreover the newly processed oat bar has more protein and fat but less fiber, carbohydrates , and calories than regular oat bars. Finally, the new formulation of the newly processed date bar showed an increase of n-3 FA, n-9 FA and MUFA, while it revealed a decrease in UFA , n-6 FA, PUFA and P/S. While the newly processed chocolate bar increased UFA, n-3 , n-6, n-9, MUFA and PUFA and less than in SFA and also P/S, as well as n-3, n-9 , MUFA and SFA levels increased, while UFA, n-6, PUFA, FA and P values decreased / S unsaturated / saturated in newly processed oat bar. The study recommends that the new foods obtained (new chocolates, dates and oats bars) be used in their applications and produced on a commercial scale to benefit the public in raising their immunity, and this is necessary for all diseases, not just COVID-19.

Key words:- COVID-19- immunity- VD- VC- Zn- Se.

Introduction:

The Novel Coronavirus disease-2019 (COVID-19) is a contagious disease characterized by a several acute respiratory syndrome of coronavirus 2 (SARS-CoV-2). This disease has wreaked havoc worldwide, claiming more than 5.5 million lives and infecting close to 323 million people by 16 January 2022 The virus that is reported to have originated from Wuhan, China has spread to over 200 countries in a span of just 6 months. People with certain prior ailments like diabetes, cancer, hypertension, cardiovascular illness, neurological disorder, and respiratory issues are at a higher danger of having COVID-19 complexities. However, persons with more youthful age, vigorous resistance, nil fundamental sicknesses and no habit of smoking or vaping, are likely to battle the surge of the infection, since in that case, COVID-19 can only bring about a minor viral infection **(Vishwakarma et al.,2022).**

Infections with Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2) can be asymptomatic (40 % of the cases) or cause a mild illness (40 %), but in about 15 % of the cases, the several disease develops, characterized by clinical signs of pneumonia (fever, cough and dyspnoea) plus one of the following: Respiratory rate > 30 breaths/ min; severe respiratory distress or SpO2 < 90 % on room air as defined by the WHO **(Wessels et al.,2022).** To date no widely available drugs or biologics for worldwide use have been shown to be effective in the prevention of COVID-19 **(Bhatta et al.,2022).**

In the wake of the COVID-19 pandemic, improving immunity assumes a significant job in keeping up optimum health. As a well-known saying ―prevention is better than cure. While there is no medicine yet discovered for COVID-19, it will be acceptable to take preventive measures which help our immunity during circumstances such as the present. Food plays a key role in deciding generally health and immunity. Eating a low-fat, plant-based eating habit may help give the immune system a boost. The immune system depends on WBCs which produce antibodies to battle against microbes, viruses,etc **(Ojha,2020).**

The immune system is complex and sophisticated, consisting of many interacting components, which protect the body from pathogens, as well as other harmful intrinsic and extrinsic factors such as cancerous cells (**Lockyer,2020).** The immune system protects the body against disease or other potentially harmful foreign bodies. When functioning

properly, the immune system identifies and attacks a variety of threats, including viruses, bacteria and parasites, while distinguishing them from the body's own healthy tissue **(Reddy،2020 & Ahmed et al., 2021).**

In order to develop the physical and mental health of individuals concerning the COVID-19 pandemic, vitamin rich food is essential. Noteworthy, there is a link between food and immunity. In fact, existing evidence highlights that food has a profound effect on people's immune system and disease vulnerability. It is also mentioned that nutrients may change immunity through the activation of cells, amendment in the creation of signaling molecules, and gene expression . An adequate intake of minerals like iron, zinc, selenium and vitamins C, D and E are predominantly vital for the maintenance of immune function **(de Almeida Brasiel, 2020).**

Vitamin C is an important aspect of improving immunity, for kids, adults, or even elderly people. Fruits like oranges, papaya, kiwi, and guava are rich in vitamin C and should be included in the diet. **(Arshad et al.,2020).** This is a strong antioxidant that can boost your blood antioxidant levels. It is recommended that vitamin C supplements is essential to boost immunity, as vitamin C is involved in many parts of the immune system **(Darbar et al.,2021).**

Vitamin D is involved in innate and adaptative immune responses **(François et al.,2020).** The physiological role of vitamin D in fighting against infections and diseases has been widely studied. Recently, vitamin D was found to reduce the risk of the common cold and other similar viral infections **(Junaid et al.,2020).**

Zinc is an essential nutrient that plays a vital role in immune system response, wound healing, synthesizing proteins and DNA, and many other bodily functions. It is used in DNA synthesis and cell propagation. Moreover, it is involved in the regulation of innate and adaptive immune responses, cell signaling, and the production of immune cells **(de Almeida Brasiel,2020).**

Selenium is a significant part of the body's antioxidant system, ensuring the body against oxidative pressure, a natural by-product of the body's metabolism. There is currently extensive proof that selenium assumes a key role in the functioning of the immune system (**Ojha،2020**).

This work was conducted to process some functional foods that enhance immunity to fight against COVID-19 disease.

Material and method

Materials:

Dark chocolate, oats, dates, peanut butter, wheat germ, almond, walnuts, cashew and mushroom were purchased from the local market Mmenofia Govorate, Ashmoun, Egypt. Dried mango, goji berries and pecan were purchased from Abu Auf Food Industries, Cairo, Egypt. Dried guava, dried apricot and honey were purchased from Shana Company for Natural Healthy Food, Cairo, Egypt. Cod liver oil was obtained from IHerb for Health and Natural Products (St Lous, USA).

Methods

Date bar preparation

A control date bar was prepared according to **(Ansari et al.,2021).**

A new formulation date bar: (sample weight- breaking the nuts 100g of both pecan and cashew nuts into small pieces- cut dried fruits 100g guava into small pieces- wash, peel and chop 100g of mushroom and season them in 5g butter over a low heat- add 150g of date palm- add 50g cod liver oil to the date palm and rub it well- add mushroom to the date palm- add nuts and dried fruits while continuing to rub and stir well- put the mixture in small molds- then it placed in the refrigerator).

Chocolate bar preparation

A control chocolate bar was prepared according to **(Dian and Dedy,2015).**

A new formulation of chocolate bar: (weight of nuts 100g almond and 100g cashew- breaking nuts into small pieces- weight of dried fruits 20g guava and 130g goji berries- cut dried fruits into small pieces- melt 150g of dark chocolate 100% cocoa on a water bath- add 55g honey to chocolate- add 55g cod liver oil while stirring- add nuts and dried fruits to the mixture and mix well- the mixture is placed in small molds- then it is placed in the refrigerator).

Oat bar preparation

A control oat bar was prepared according to **(Tiwari et al.,2017).**

A new formulation oat bar: (sample weight- nuts cracker 100g each of walnuts and almond- melt 60g of peanut butter over low heat- cut the dried fruits 100g of mango and 60g of apricot into small pieces- add 40g of honey- add 60g cod liver oil stirring- add 130g of oats and 50g of wheat germ to the previous mixture and keep stirring- add nuts and dried fruits and stir well so that the mixture sticks together- put the mixture in small molds- then it is placed in the refrigerator).

Analytical methods

Chemical composition:

Moisture, protein (N x 6.25), lipids (ether extract), ash and crude fiber contents were determined according to **AOAC (2000)**. Total carbohydrates calculated by difference. The determination of minerals (Zn and Se) was carried out by the Atomic Absorption Spectrum.

Dietary fiber:

Total dietary fibers are determined using the enzymatic-gravimetric method (Total dietary fiber assay kit, Product Codes TDF-100A) according to **(AOAC, 2000).**

Determination of Fatty acid composition:

The fatty acid composition was determined by the transmethylation of the fatty chains to fatty acid methyl esters (FAMEs) according to the modified method by **Zahran and Tawfeuk (2019).**

Mineral contents:

Mineral quantification was carried out by Atomic Absorption Spectrophotometer (type AAnalyst 400, Perkin– Elmer, Waltham, MA, USA) after sample digestion with HCl as described by **AOAC (2000)**.

Amino acids pattern:

Amino acids were determined after hydrolyzing the defatted samples as well as newly formulated samples with 6 N HCl at 110 ℃ for 22 h in a nitrogen atmosphere using a Beckman amino acid analyzer **(**Model 118/119 CL) according to the method described by **Moore and Stein (1963)**. Tryptophan was determined after alkaline hydrolysis **Moore and Stein (1963)**.

Determination of vitamin C:

Ascorbic acid content was determined using the 2, 6-dichlorophenol-indophenol titration method described in **AOAC (2000)**. Extracts for vitamin C analysis were obtained by homogenizing one gram sample in a 20 ml cold solution of 3% (w/v) oxalic acid, and 8% glacial acetic acid (v/v) in water until uniform consistency was achieved using the Ultra-Turrax homogenizer. The homogenates were centrifuged at 10,000 rpm at 4°C for 10 minutes. The supernatant was recovered and measured for vitamin C immediately by 2,6 dichlorophenol dye.

Determination of Vitamin C by HPLC:

Preparation of Extraction Solutions

Extraction solution was made by mixing 50 mL of ace-tonitrile with 10 mL of glacial acetic acid and the volume was finally made up to 1000 mL with double distilled water.

Determination of vitamin D by HPLC-FLD

Analytical HPLC

An Agilent 1100 chromatographic system (Agilent Ltd., South Queensferry, UK) was used for the analysis and quantitation of tocopherols. The ChemStation software controlled the whole chromatographic system. Reversed phase HPLC with fluorescence detection (excitation 292 nm, emission 325 nm) was used. Tocopherols were separated on Agilent Exlipse XDB-C18 column (5 μm, 150 mm × 4.6 mm i.d.) using isocratic elution with a mobile phase consisting of acetonitrile : methanol (70:30). The flow rate was adjusted to 1 mL/min. Column temperature was kept constant at 30◦C.

Sensory evaluation:

Control (date, chocolate and oat) were organoleptically evaluated for their external and internal properties by 20 staff members of Home Economic Dept.Faculty Of Specific Education. Menofia University, Ashmoon scores were as follow: Very good:8<9 - Good:7<8 - Fair:6<7- Weak:5<6 -Rejected: 4<5**(Watts et al.,1989).**

Statistical analysis:

Analysis of variance was conducted for the data in accordance with procedures described by **Steel and Torrie (1980).** L.S.D. at a 5% level of significance was used to compare between means.

Results and discussion

No drug or ultimate cure for COVID-19 is yet found. Even vaccines are allocating at 70-90% only, whence the hope is to get stronger immunity. Accordingly this work was conducted to enhance immunity via newly processed foods that contain pronounced levels of Vit.D, Vit.C ,zinc and selenium known to support the immunity system, e.g functional foods. Analyses of newly processed foods revealed the following:

A. Date bars:

Newly suggested date bars raised the protein level % of DRI **(Table 1)** to 23.16%, 28.19% and 68.26% when consumed by males, females and children respectively, values for control bars were 4.82%, 5.86% and 14.21% respectively indicating the high nutritional value of newly formulated date bars, which undoubtedly able more to fight infectious disease due to high protein level. This was also receded for fat and other

nutrients, showing the benefit of newly suggested date bars to enhance immunity and struggle against COVID-19.

Table (1): Chemical composition for date bar

Chemical compositions of date bar	Control						New formulation											
	Male (31-50 year)		Female (31-50 year)		Child (4-8 year)		Male (31-50 year)			Female (31-50 year)				Child (4-8 year)				
	Content	%Of DRI	Content	% Of DRI	Content	%Of DRI	Content	% Of control	DRI	% Of DRI	Content	% Of control	DRI	% Of DRI	Content	% Of control	DRI	% Of DRI
Moisture	8.86		8.86		8.86		10.21	115.24			10.21	115.24			10.21	115.24		
Fat	0.09	0.1	0.09	0.13	0.09	0.155	16.35	18166.66	89	18.37	16.35	18166.66	67	24.40	16.35	18166.66	58	28.18
Ash	2.18		2.18		2.18		2.66	122			2.66	122			2.66	122		
Crude fibre	2.73	7.18	2.73	10.92	2.73	10.92	7.29	267	38	19.18	7.29	267	25	29.16	7.29	267	25	29.16
Crude protein	2.70	4.82	2.70	5.86	2.70	14.21	12.97	480.37	56	23.16	12.97	480.37	46	28.19	12.97	480.37	19	68.26
Total carbohydrates	83.44	17.79	83.44	23.63	83.44	25.59	50.52	60.55	469	10.77	50.52	60.55	353	14.31	50.52	60.55	326	15.49
Total Calories	345.37	11.90	345.37	15.69	345.37	18.17	401.11	116.14	2900	13.83	401.11	116.14	2200	18.23	401.11	116.14	1900	21.11

Data of **(Table 2)** show the levels of Vit.D3, Vit. C, Se and Zn in unsupplemented and supplemented date bars as consumed by males, females, childern, with reference to the DRI. It is evident that levels of vitamins and minerals were raised in bars due to supplementation. Accordingly, the values calculated for males, females and children, as % of DRI raised appreciably by mentioned practice.

As reported by **(Rondanelli et al.,2018 and Arshad et al.,2020)** vitamin C is useful for cold patients, children and adults and is improving immunity even for elderly people. The administration of 15 g of vitamin C per day decreased the mortality rate in COVID-19 patients **(Thirumdas et al., 2021).** The government now officially recommends high-dose vitamin C therapy in their guidelines for the treatment of COVID-19 **(Grober and Holick, 2021).**

Vitamin D fortification of foods, particularly for older people is useful, specifically for older people with high vulnerability to COVID-19 **(Hashemifesharaki and Gharibzahedi,2020).** Zinc has the nature of anti-viral properties and could reduce the intensity of COVID-19 infection **(Ramaiah et al., 2020).** The use of selenium may be of particular significance in terms of resistance to COVID-19 processive. The use of selenium supplements could help in the treatment of COVID-19. As reported by **(Ayad et al.,2020)** dates are rich in selenium and zinc.

Finally, data from **(Table 2)** indicated that newly formulated date bars are actually rich in vitamin D, vitamin C, selenium and zinc.

Table (2): Vitamins and minerals of new date formulation considering the age and sex consumed

Vitamins and minerals of date bar	Control						New formulation											
	Male (31-50 year)		Female (31-50 year)		Child (4-8 year)		Male (31-50 year)				Female (31-50 year)				Child (4-8 year)			
	Content	%Of DRI	Content	% Of DRI	Content	%Of DRI	Content	% Of control	DRI	% Of DRI	Content	% Of control	DRI	% Of DRI	Content	% Of control	DRI	% Of DRI
Vitamin D3 (ug /100 g)	0	0	0	0	0	0	19.34	0	15	128.93	19.34	0	15	128.93	19.34	0	10	193.4
Vitamin C (mg /100 g)	0	0	0	0	0	0	76.98	0	90	85.53	76.98	0	75	102.64	76.98	0	25	307.92
Selenium (ug /100 g)	3	5.45	3	5.45	3	10	20.01	667	55	36.38	20.01	667	55	36.38	20.01	667	30	66.7
Zinc (mg /100 g)	0.44	4	0.44	5.5	0.44	8.8	4.18	950	11	38	4.18	950	8	52.25	4.18	950	5	83.6

When the EAA content was calculated as g/100 g product **(Table 3)** it could be observed that values as % of DRI were higher for newly formulated data bars then that of the ordinary bars. Nothing could be observed for changes in isoleucine and lysine (deficiencies in the protein of newly processed bars) **(Table 3)**, as their contents in the new product were higher plan that of ordinary bars. It should be recommended that new bars were not processed only of dates, where many other ingredients of nutritive value were added (mushroom, cashew, pecan, dried guava and cod liver oil).

Table (3): Essential amino acid profile (g/100g product) for date bar according to age and sex of consumed

Amino acid profile (g/100g product) Essential AA	Control						New formulation											
	Male (31-50 year)		Female (31-50 year)		Child (4-8 year)		Male (31-50 year)				Female (31-50 year)				Child (4-8 year)			
	Content	% Of DRI	Content	% Of DRI	Content	% Of DRI	Content	% Of DRI	DRI	% Of DRI	Content	% Of DRI	DRI	% Of DRI	Content	% Of DRI	DRI	% Of DRI
Histidine	0.026	2.58	0.026	3.14	0.026	7.60	0.339	1303.85	1.008	33.63	0.339	1303.85	0.828	40.94	0.339	1303.85	0.342	99.12
Iso leucine	0.044	3.14	0.044	3.83	0.044	9.26	0.064	145.45	1.4	4.57	0.064	145.45	1.15	5.57	0.064	145.45	0.475	13.47
Leucine	0.057	2	0.057	2.43	0.057	5.88	1.025	1798.24	2.856	35.89	1.025	1798.24	2.346	43.69	1.025	1798.24	0.969	105.78
Lysine	0.073	2.37	0.073	2.89	0.073	6.99	0.526	720.55	3.08	17.1	0.526	720.55	2.53	20.79	0.526	720.55	1.045	50.33
Threonine	0.053	3.51	0.053	4.27	0.053	10.33	0.603	1137.73	1.512	39.88	0.603	1137.73	1.242	48.55	0.603	1137.73	0.513	117.54
Tryptophan	0.044	11.2	0.044	13.66	0.044	33.1	0.370	840.91	0.392	94.39	0.370	840.91	0.322	114.91	0.370	840.91	0.133	278.20
Valine	0.065	3.63	0.065	4.42	0.065	10.69	0.515	792.31	1.792	28.74	0.515	792.31	1.472	34.99	0.515	792.31	0.608	84.70
Methionine + cysteine	0.027	1.93	0.027	2.35	0.027	5.68	0.541	2003.7	1.4	38.64	0.541	2003.7	1.15	47	0.541	2003.7	0.475	113.89
Phenylalanine + tyrosine	0.045	1.71	0.045	2.1	0.045	5	1.06	2355.55	2.632	40.27	1.06	2355.55	2.162	49	1.06	2355.55	0.893	118.70

Fatty acids composition of original and new date bars is given in **(Table 4).**

Table (4): Fatty acid profile of date bar

Fatty acids profile (%)	Control	New formulation	
	Content	Content	% of control
C14:0		1.00	
C16:0	6.75	8.57	126.96
C16:1		1.38	
C18:0	3.98	4.58	115.1
C18:1	52.34	55.02	105.12
C18:2	38.56	24.48	79.84
C18:3		0.88	
C20:0	0.65	1.80	276.92
C22:0		1.31	
C24:0		1.02	
C28:1	0.92		
UFA (unsaturated fatty acids)	83.82	81.68	97.45
SFA (saturated fatty acids)	11.38	18.28	160.63
Omega - 3		0.88	
Omega - 6	38.56	24.4	79.84
Omega - 9	52.34	56.4	107.76
MUFA (mono unsaturated fatty acid)	52.34	56.4	107.76
PUFA (poly unsaturated fatty acid)	38.56	25.28	82.72
Unsaturated saturated	7.37	4.47	60.65
P S (poly unsaturated saturated)	2.69	1.38	51.38

It could be observed **(Table 4)** that the new formulation date bars fat was more unsaturated that the control bars. New formulation bars had higher SFA, n-3FA, n-9FA and MUFA, while revealing lower UFA, n-6FA, PUFA and P/S. Therefore, the new formulation indicated more health aspects due to less fat saturation.

B. Chocolate bar:

Data of **(Table 5)** show the gross chemical composition of control and new formulation chocolate bars. It is evident that the new chocolate bar formulation had somewhat more moisture content. This may be avoided during processing steps, such as dehydration practice.

Table (5): Gross chemical composition for chocolate bar

Chemical compositions of chocolate bar	Control						New formulation											
	Male (31-50 year)		Female (31-50 year)		Child (4-8 year)		Male (31-50 year)				Female (31-50 year)				Child (4-8 year)			
	Content	%of DRI	Content	% of DRI	Content	%of DRI	Content	% of control	DRI	% of DRI	Content	% of control	DRI	% of DRI	Content	% of control	DRI	% of DRI
Moisture	1.36		1.36		1.36		7.88	579.41			7.88	579.41			7.88	579.41		
Fat	46	51.68	46	68.65	46	79.31	24.19	52.59	89	27.17	24.19	52.59	67	36.10	24.19	52.59	58	41.70
Ash	3.6		3.6		3.6		3.52	97.78			3.52	97.78			3.52	97.78		
Crude fibre	16.3	42.89	16.3	65.2	16.3	65.2	9.53	58.47	38	25	9.53	58.47	25	38.12	9.53	58.47	25	38.12
Crude protein	12.5	22.32	12.5	27.17	12.5	65.78	18.34	146.72	56	32.75	18.34	146.72	46	39.86	18.34	146.72	19	96.52
Total carbohydrates	20.24	4.31	20.24	5.73	20.24	6.20	36.54	180.53	469	7.79	36.54	180.53	353	10.35	36.54	180.53	326	11.20
Total Calories	544.96	18.79	544.96	24.77	544.96	28.68	437.23	80.23	2900	15	437.23	80.23	2200	19.87	437.23	80.23	1900	23.01

Evaluation of the gross chemical composition was carried out via calculation of different nutrients as % of DRI considering sex and age. As for the fat, it could be noticed that the new formulation contained appreciably less content which reduced from 46 to 24.19 g/100 g. This may mean a healthier product because of less fat. It is clear that 100 g of chocolate bars of new formulation by a child will cover about 2.2% only of DRI in fat ,v.s 53% of DRI when control bars are consumed, this may aid in avoiding obesity in children. The ash decreased slightly (3.52 % ash) in the new formulation in comparison with the control (3.6 % ash) .

The new chocolate formulation revealed more fibre content (18.32 %) as compared with the control (16.3 %) only. The fibers were reported to show desirable effects in figuring diabetes, cardiac disease and obesity

(Kerimi and Williamson,2015). Therefore the increase of fibres is desirable, provided that the eating qualities do not deteriorate.

In a study by **(Agarwal,2013)** ,chocolate consumption was associated with a reduction of cardiovascular disease by 37% ,diabetes by 31% and stroke by 29% . As reported by **(Haritha et al.,2014 & Patel et al.,2019)** the various health benefits of dark chocolate includes, stroke prevention, alleviation of hypertension, regulation of blood sugar and insulin dependence, reduced risk of type II diabetes, antioxidant protection, alleviation of cold and cough, reduced cancer risk, reduced risk of colon cancer, slowing aging, increased immune function, slowing the progression of AIDS, DNA repair and protection, Alzheimer's protection and alleviation of premenstrual syndrome. Also **(Dala-Paula et al.,2021)** have high levels of bioactive compounds, including flavonoids, and phenolic acids.

It could be noticed **(Table 5)** that in the new chocolate formulation protein content raised from (12.5% control sample) to 18.34% (above 47% increase). One hundred grams of dark chocolate of the new formulation covers 96.52% of DRI for children compared to 22.32% only considering the control product.

Total carbohydrate raised from 4.31% (control product) to 7.79% in new formulated bars (about an 84.88% increase). Nevertheless (regardless of protein and total carbohydrates) increases, due to fat decrease, the total calorie content decreased from 544.96 to 437.23 (calories/100g) indicating the health benefit of processing of new chocolate formulation.

The results of **(Table 6)** show the vitamins and minerals contents of the dark chocolate new formulation considering the age and sex of the categories.

Table (6): Vitamins and minerals of new dark chocolate formulation considering the age and sex of consumed

Vitamins and minerals of chocolate bar	Control						New formulation											
	Male (31-50 year)		Female (31-50 year)		Child (4-8 year)		Male (31-50 year)				Female (31-50 year)				Child (4-8 year)			
	Content	%of DRI	Content	% of DRI	Content	%of DRI	Content	% of control	DRI	% of DRI	Content	% of control	DRI	% of DRI	Content	% of control	DRI	% of DRI
Vitamin D3 (ug /100 g)	0	0	0	0	0	0	23.77	0	15	158.46	23.77	0	15	158.46	23.77	0	10	237.7
Vitamin C (mg /100 g)	0	0	0	0	0	0	66.86	0	90	74.28	66.86	0	75	89.14	66.86	0	25	267.44
Selenium (ug /100 g)	6.8	12.36	6.8	12.36	6.8	22.66	22.19	326.32	55	40.34	22.19	326.32	55	40.34	22.19	326.32	30	73.96
Zinc (mg /100 g)	3.31	30	3.31	41.37	3.31	66.2	5.36	161.93	11	48.72	5.36	161.93	8	67	5.36	161.93	5	107.2

It is clear **(Table 6)** that control dark chocolate bars were totally free of vitamin D3 and vitamin C, meanwhile due to the incorporation of different ingredients (cashew, almond, honey bee, dried goji berries, dried guava and possibly cod liver oil), the product showed 23.77 ug/100g of Vit.D3 and 66.86 mg/100g of Vit. C. Therefore, the newly formulated product is of more immunological action and more able to fight COVID-19 disease and also similar respiratory diseases **(Alagawany et al., 2021).** For instance, a new dark chocolate product (100 g) revealed calculated 159, 159 and 238% of DRI for males, females, and children in Vits D3 and 74.28, 89.14 and 267.44 in vit. C, control product was free of both vitamins.

Selenium content was increased to 12.36 ug/100g in the control sample, while in the newly formulated product it was 22.19 ug/100g (79.53% increase). Similarly, zinc increased from 3.31 mg/100g to 5.36 mg/100g (61.93% increase). This makes the newly formulated dark chocolate bars are with more immunological properties. Selenium has an important effect on both innate and acquired immunity as reported by **(Alexander et al.,2020).** Zinc is an important mineral having a crucial role in the immune system **(Joachimiak,2021),** especially for COVID-19 disease **(Mahwish et al.,2022).**

Results of **(Table 7)** indicated also the merit of newly formulated chocolate bars over control when reviewing the data of EAA when bars were consumed by males, females, and children. Whil the exception of isoleucine, in the case of all other 8 EAA values as % of DRI for the newly formulated product was pronouncedly more than that of control bars regardless of age and sex, indicating that bars were better for the former theme in the latter case.

Table (7): Essential amino Acid profile (gm/100g product) for chocolate bar according to age and sex of consumed

Amino acid profile (g/100 g product)	Control						New formulation											
	Male (31-50 year)		Female (31-50 year)		Child (4-8 year)		Male (31-50 year)				Female (31-50 year)				Child (4-8 year)			
Essential AA	Content	%of DRI	Content	% of DRI	Content	%of DRI	Content	% of control	DRI	% of DRI	Content	% of control	DRI	% of DRI	Content	% of control	DRI	% of DRI
Histidine	0.187	18.55	0.187	22.58	0.187	54.68	0.583	311.76	1.008	57.84	0.583	311.76	0.828	70.41	0.583	311.76	0.342	170.47
Iso leucine	0.375	26.79	0.375	32.61	0.375	78.95	0.090	24	1.4	6.43	0.090	24	1.15	7.83	0.090	24	0.475	18.95
Leucine	0.787	27.56	0.787	33.55	0.787	81.22	1.338	170	2.856	46.85	1.338	170	2.346	57	1.338	170	0.969	138.1
Lysine	0.563	18.28	0.563	22.25	0.563	53.88	0.874	155.24	3.08	28.38	0.874	155.24	2.53	34.55	0.874	155.24	1.045	83.64
Threonine	0.513	33.93	0.513	41.30	0.513	100	0.837	163.16	1.512	55.36	0.837	163.16	1.242	67.39	0.837	163.16	0.513	163.16
Tryptophan	0.275	70.15	0.275	85.40	0.275	206.77	0.388	141.1	0.392	98.98	0.388	141.1	0.322	120.50	0.388	141.1	0.133	291.73
Valine	0.612	34.15	0.612	41.58	0.612	100.66	1.024	167.32	1.792	57.14	1.024	167.32	1.472	69.57	1.024	167.32	0.608	168.42
Methionine + cysteine	0.15	10.71	0.15	13	0.15	31.58	0.92	613.33	1.4	65.71	0.92	613.33	1.15	80	0.92	613.33	0.475	193.68
Phenylalanine + tyrosine	0.5	19	0.5	23.13	0.5	56	1.714	342.8	2.632	65.12	1.714	342.8	2.162	79.28	1.714	342.8	0.893	191.94

Data presented in **(Table 8)** revealed that newly formulated chocolate bars contained fat that was more unsaturated than that of the control product, indicating healthier chocolate in the former case that the latter one. Newly formulated chocolate bars had more UFA, n-3, n-6, n-9, MUFA, unsaturated/saturated FA and PUFA, but less SFA and also higher P/S than the control chocolate bars.

Table (8): Fatty acid profile of chocolate bar

Fatty acids profile (%)	Control	New formulation	
	Content	Content	% of control
C14:0	0.051	0.73	1431.37
C16:0	25.87	18.40	71.12
C16:1	0.1	2.08	2080
C18:0	32.55	15.98	49.1
C18:1	32.850	47.85	145.66
C18:2	7.15	9.66	135.10
C18:3	0.379	0.89	234.83
C20:0	0.618	1.36	219.35
C22:0	0.158	1.86	1177.21
C24:0	0.073	1.21	1657.53
C17:0	0.144		
C20:1	0.853		
UFA (unsaturated fatty acids)	40.53	60.48	149.22
SFA (saturated fatty acids)	59.46	39.48	66.40
Omega - 3	0.379	0.89	234.83
Omega - 6	7.15	9.66	135.10
Omega - 9	33	49.93	151.30
MUFA (mono unsaturated fatty acid)	33	49.93	151.30
PUFA (poly unsaturated fatty acid)	7.529	10.55	140.12
Unsaturated saturated	0.682	1.53	224.34
P S (poly unsaturated saturated)	0.127	0.267	210.24

C. Oat bars

Data presented in **(Table 9)** show the gross chemical composition of control and newly formulated oat bars. It is clear that the newly formulated oat bars had 2.71% increase in moisture. Also new oat bars had higher fat (+106.8% increase), ash (+5.82% increase) and protein (+23.46% increase), but less crude fibre (- 40.59%), T. carbohydrates (-44.04%) and calories (-15.85%). As reported by **(Sangwan et al.,2014)** oats are characterised to constitute large amounts of T. protein, carbohydrate, fat, and fibers. Therefore the decrease in fibres, T. carbohydrates and T. calories indicate the T. sum effect of added ingredients during processing the newly formulated oat bars (wheat germ, honey bee, peanut butter, walnuts, almond, dried mango, dried apricot and cod liver oil).

The increase of fat (106.80%) and protein (+ 23.46%) attracts the attention. **(Paudel et al., 2021)** found that protein in oats ranges 13 to 20%. Oat flour received increased attention due to its health effects. Oat reduced serum cholesterol, cardiovascular disease (CVD), and prevent, cancer, diabetes and gastrointestinal disorders **(Martinez-Villaluenga and Penas, 2017)**. Oat have high nutritional value and lacking of allergenicity **(Sterna et al., 2016).** Accordingly, oat bars selected in present work to support immunity and fight COVID-19.

Newly formulated oat bars had higher fat content (106.80% increase). This oat fat however, is mainly unsaturated. According to **(Sterna et al., 2016)** oat lipids contain 78-85% unsaturated FA associated with reduction of serum cholesterol, prevents several important diseases including cardiovascular diseases. Oat characterised by unique antioxidants **(Sangwan et al.,2014).**

As % of DRI, highest values were found **(Table 9)** when bars consumed by children (fat, fibres, T. carbohydrates). As reported by **(Sterna et al.,2016)** oats are a major component of infant foods due to high nutritional profile, palatable flavour, good shelf-life, stability and low cost, which are mainly used for breakfast cereals, porridge, bread and mainly biscuits and infant food.

Table (9): Chemical composition for oat bar

Chemical compositions of oat bar	Control						New formulation											
	Male (31-50 year)		Female (31-50 year)		Child (4-8 year)		Male (31-50 year)				Female (31-50 year)				Child (4-8 year)			
	Content	%of DRI	Content	% of DRI	Content	%of DRI	Content	% of control	DRI	% of DRI	Content	% of control	DRI	% of DRI	Content	% of control	DRI	% of DRI
Moisture	9.42		9.42		9.42		12.13	128.77			12.13	128.77			12.13	128.77		
Fat	6.91	7.76	6.91	10.31	6.91	11.91	14.29	206.8	89	16	14.29	206.8	67	21.32	14.29	206.8	58	24.63
Ash	2.06		2.06		2.06		2.18	105.83			2.18	105.83			2.18	105.83		
Crude fibre	13.65	35.92	13.65	54.6	13.65	54.6	8.11	59.41	38	21.34	8.11	59.41	25	32.44	8.11	59.41	25	32.44
Crude protein	12.62	22.53	12.62	27.43	12.62	66.42	15.58	123.45	56	27.82	15.58	123.45	46	33.86	15.58	123.45	19	82
Total carbohydrates	85.25	18.18	85.25	24.15	85.25	26.15	47.71	55.96	469	10.17	47.71	55.96	353	13.51	47.71	55.96	326	14.63
Total Calories	453.67	15.64	453.67	20.62	453.67	23.88	381.77	84.15	2900	13.16	381.77	84.15	2200	17.35	381.77	84.15	1900	20.09

The results of **(Table 10)** show the vitamins and minerals of oat bars. It is obvious that newly formulated oat bars revealed more levels of Vit.D3, Vit. C, Se and zinc. According to **(Sangwan et al.,2014).** Oats are characterised by large amounts of vitamins and minerals. Moreover, the higher D3, Vit. C, Se and zinc were found to be effective in COVID-19 relieving of prevention COVID-19 **(Alexander et al., 2020; Junaid et al., 2020; Ojha, 2020; Hashemifesharaki and Gharibzahedi, 2020 and Mahwish et al., 2022).**

Table (10): Vitamins and minerals of new oat formulation considering the age and sex of consumed

Vitamins and minerals of oat bar	Control						New formulation											
	Male (31-50 year)		Female (31-50 year)		Child (4-8 year)		Male (31-50 year)				Female (31-50 year)				Child (4-8 year)			
	Content	%of DRI	Content	% of DRI	Content	%of DRI	Content	% of control	DRI	% of DRI	Content	% of control	DRI	% of DRI	Content	% of control	DRI	% of DRI
Vitamin D3 (ug /100 g)	0	0	0	0	0	0	20.06	0	15	133.73	20.06	0	15	133.73	20.06	0	10	200.6
Vitamin C (mg /100 g)	0.9	1	0.9	1.2	0.9	3.6	71.87	7985.55	90	79.85	71.87	7985.55	75	95.82	71.87	7985.55	25	287.48
Selenium (ug /100 g)	25	45.45	25	45.45	25	83.33	30.1	120.4	55	54.72	30.1	120.4	55	54.72	30.1	120.4	30	100.33
Zinc (mg /100 g)	3.97	36	3.97	49.62	3.97	79.4	4.77	120.15	11	43.36	4.77	120.15	8	59.62	4.77	120.15	5	95.4

When EAA calculated as g/100g protein decline in EAA due to new formulation of oat bars, decreased from 3 EAA (when calculated as g/100g protein) to only one (isoleucine) considering male, female and child **(Table 11)** while all other EAA increased in 100g product, confirming the improvement of newly formulated protein compared to control.

Table (11): Essential amino acids profile (gm/100g product) for oat bar according to age and sex of consumed

Amino acid profile (g/100 g product)	Control						New formulation									
	Male (31-50 year)		Female (31-50 year)		Child (4-8 year)		Male (31-50 year)				Female (31-50 year)				Child (4-8 year)			
Essential AA	Content	%of DRI	Content	% of DRI	Content	%of DRI	Content	% of control	DRI	% of DRI	Content	% of control	DRI	% of DRI	Content	% of control	DRI	% of DRI
Histidine	0.464	46	0.464	56	0.464	135.67	0.642	138.36	1.008	63.69	0.642	138.36	0.828	77.54	0.642	138.36	0.342	187.72
Iso leucine	0.516	36.86	0.516	44.87	0.516	108.63	0.083	16.1	1.4	5.93	0.083	16.1	1.15	7.22	0.083	16.1	0.475	17.47
Leucine	1.01	35.36	1.01	43.1	1.01	104.23	1.043	103.27	2.856	36.52	1.043	103.27	2.346	44.46	1.043	103.27	0.969	107.64
Lysine	0.516	16.75	0.516	20.40	0.516	49.38	0.745	144.38	3.08	24.19	0.745	144.38	2.53	29.45	0.745	144.38	1.045	71.29
Threonine	0.431	28.51	0.431	34.70	0.431	84	0.691	160.32	1.512	45.70	0.691	160.32	1.242	55.64	0.691	160.32	0.513	134.70
Tryptophan	0.126	32.14	0.126	39.13	0.126	94.74	0.235	186.51	0.392	59.95	0.235	186.51	0.322	72.98	0.235	186.51	0.133	176.69
Valine	0.662	36.94	0.662	44.97	0.662	108.88	0.708	106.95	1.792	39.51	0.708	106.95	1.472	48.1	0.708	106.95	0.608	116.45
Methionine + cysteine	0.218	15.57	0.218	18.96	0.218	45.89	0.556	255	1.4	39.71	0.556	255	1.15	48.35	0.556	255	0.475	117.1
Phenylalanine + tyrosine	0.810	30.78	0.810	37.47	0.810	90.71	1.42	175.31	2.632	53.95	1.42	175.31	2.162	65.68	1.42	175.31	0.893	159

Data of **(Table 12)** show the levels of FA and their evaluation compared to DRI. It was found that both control and new formulated oat bars contained unsaturated fat showing 78 and 77% unsaturated FA. The effect of additives to oat was higher and unsaturation characterised the bars fat.

Due to formulation of new oat bars n-3, n-9, MUFA and SFA increased while UFA, n-6, PUFA, unsaturated/saturated FA and P/S decreased.

Table (12): Fatty acid profile of oat bar

Fatty acids profile (%)	Control	New formulation	
	Content	Content	% of control
C14:0	0.36	1.05	291.66
C16:0	16.63	9.35	56.22
C16:1	0.19	1.77	931.58
C18:0	1.70	4.35	255.88
C18:1	35.74	42.46	118.80
C18:2	36.25	30.27	83.50
C18:3	1.46	2.33	159.59
C20:0		2.24	
C22:0		4.12	
C24:0		1.99	
C18:1	0.89		
C20:1	0.82		
C22:1	[illegible]		
C22:1	0.70		
C24:2	1.13		
UFA (unsaturated fatty acids)	78.29	76.83	98.13
SFA (saturated fatty acids)	18.86	23.12	122.5
Omega - 3	1.46	2.33	159.59
Omega - 6	36.25	30.27	83.50
Omega - 9	35.93	44.23	123.10
MUFA (mono unsaturated fatty acid)	35.93	44.23	123.1
PUFA (poly unsaturated fatty acid)	38.84	32.6	86.45
Unsaturated saturated	4.15	3.32	80.0
P S (poly unsaturated saturated)	2.06	1.41	68.45

Data collected from sensory evaluation that carried out by panelists and statistically analyzed showed that (date bar, chocolate bar and oat bar)had good scores in all investigated sensory attributes (aroma, taste, color, texture and overall acceptability) as given in **(Tables 13, 14 &15).**

Table (13): sensory evaluation of control and new formulation for date bar

Groups	Aroma Mean ±SD	Taste Mean ±SD	Color Mean ±SD	Texture Mean ±SD	Overall acceptability Mean ± SD
Control	7.89 ^{b} ±0.58	7.99 ^{b} ±0.26	7.71 ^{b} ±0.55	7.9 ^{b} ±0.53	7.88 ^{b} ±0.21
New formulation	8.7 ^{a} ±0.47	8.95 ^{a} ±0.22	8.95 ^{a} ±0.22	8.85^{a}±0.37	8.86 ^{a} ±0.15
LSD	0.34	0.16	0.27	0.29	0.12

Table (14): Sensory evaluation of control and new formulation chocolate bar

Groups	Aroma Mean ±SD	Taste Mean ±SD	Color Mean ±SD	Texture Mean ±SD	Overall acceptability Mean ± SD
Control	7.85 ^{b} ±0.45	7.33 ^{b} ±0.47	8.16 ^{b} ±0.51	8.1^{b} ±0.37	7.85 ^{b} ±0.23
New formulation	8.9 ^{a} ±0.31	8.7 ^{a} ±0.47	8.95 ^{a} ±0.22	8.9 ^{a} ±0.45	8.86 ^{a} ±0.15
LSD	0.25	0.30	0.25	0.26	0.13

Table (15): Sensory evaluation of control and new formulation oat bar

Groups	Aroma Mean ±SD	Taste Mean ±SD	Color Mean ±SD	Texture Mean ±SD	Overall acceptability Mean ± SD
Control	7.9 ^{b} ±0.39	7.96 ^{b} ±0.45	8.1^{b} ±0.31	7.7 ^{b} ±0.58	7.93 ^{b} ±0.20
New formulation	8.9 ^{a} ±0.31	8.95 ^{a} ±0.22	9 ^{a} ±0	8.75^{a}±0.44	8.9 ^{a} ±0.15
LSD	0.23	0.23	0.14	0.33	0.11

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إعداد بعض المنتجات الغذائية الغنية بفيتامين د والزنك والسيلينيوم لرفع مناعه الجسم لمواجهة فيروس كرونا

أ.د/ فاطمة الزهراء أمين الشريف
أستاذ التغذية وعلوم الأطعمة وعميد كلية الاقتصاد المنزلى جامعة المنوفية (سابقا)

أ.د/ على بدوى رصاص
أستاذ التغذية وعلوم الأطعمة والعميد الأسبق لكلية التربية النوعية جامعة المنوفية

أ.د/ منى إبراهيم محمد
أستاذ التغذية وعلوم الأطعمة
كلية التربية النوعية جامعة المنوفية

إسراء محمد إسماعيل النياد
باحثه دراسات عليا
كليه التربيه النوعيه جامعه المنوفيه

المستخلص العربي :

انتشر فيروس كورونا الجديد (COVID-19) بسرعة في العديد من البلدان وأعلنت منظمة الصحة العالمية أنه جائحة. وقد وجد أن الأشخاص الذين يعانون من ضعف المناعة هم في الغالب الأكثر عرضة للتأثر بفيروس كورونا. ومن الممكن للأطعمة النباتية ان تزيد من البكتيريا المعوية النافعه مما تعمل علي رفع المناعه الطبيعية للجسم بنسبة 85٪ وذلك باستخدام معادن مختلفة مثل الزنك والسيلينيوم وغيرها من الأطعمة الغنية بفيتامين C و D ، لذلك كان الهدف من الدراسة هو إنتاج منتجات غذائية (بار التمر والشيكولاته والشوفان) الغنيه بالزنك والسيلينيوم وفيتامين د لرفع مناعه الجسم لمواجهه فيروس كرونا . أظهرت نتائج الدراسة ان المنتجات الغذائيه المعالجة (بار التمر و الشيكولاته والشوفان) أعلى في محتواها في فيتامين (د 3)، (ج) ، والزنك والسيلينيوم مما يجعلها أكثر تأثيراً في رفع مناعه الجسم وأكثر وقايه من فيروس كرونا ومقارناتها بالكنترول. كما أظهرت النتائج حدوث زياده في البروتين بنسبه كبيره في بار التمر المعالج حديثا مقارنه بالبار الكنترول مع زياده في نسبه العناصر الغذائية الأخرى ، (الدهون والألياف والكربوهيدرات والسعرات الحرارية) ، كما وجد زياده ملحوظه في نسبه البروتين والكربوهيدرات والألياف في بار الشيكولاته المعالج حديثا بينما قلت السعرات الحرارية والدهون مما يجعله منتج صحي، بينما في بار الشوفان المصنعه حديثًا زادت نسبة البروتينات والدهون وقلت نسبه الألياف ، والكربوهيدرات ، والسعرات الحرارية مقارنة بالبار الكنترول. واخيرا أظهرت التركيبة الجديدة لبار التمر المعالج حديثا ارتفاع n-3 FA و n-9 FA و MUFA ، بينما كشفت عن انخفاض UFA و PUFAو P / S. بينما ف بار الشيكولاته زاد UFA و n-3 و n-6 و n-9 و MUFA وغير المشبعة / المشبعة PUFA وأقل في SFA وأيضًا P / S ، وكذلك زادت مستويات n-3 و n-9 و SFA ، بينما انخفضت قيم UFA و n-6 و PUFA وقيم FA و P / S غير المشبعة / المشبعة في بار الشوفان . وتوصي الدراسة باستخدام المنتجات الجديدة التي تم الحصول عليها (بارالشوكولاتة ، التمر والشوفان) في رفع مناعه الجسم وأن يتم إنتاجها على نطاق تجاري للإفادة في رفع مناعه الجسم لدي الأفراد ، وهذا ضروري لجميع الأمراض ، وليس فقط الوقاية أو العلاج من COVID-19.

الكلمات المفتاحية:- فيروس كرونا – المناعه – فيتامين د – فيتامين ج – الزنك – السيلينيوم.