Study on Nutritional and Immunological Status of adult human

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Abstract: This study was carried on 40 demonstrators assist let were (males & females), 20-50 years old from Faculty of Specific Education, Menufiya University to through light on the relationship between nutritional status and immune system. It was found that while mean BMI indicated (29.45 & 27.44kg/cm2 in males & females) respectively that subjects overweight of females were 52.38 % and 47.375% males were obese. females intake of calcium (49.45%of RDA) was low besides Vit. B6 intake (89.49%). Regardless of gender intakes of Vit A &D were low, and Vit.B6 intake was low in females. Laboratory analyses revealed that Eosinopls count was less than Ref. Range, while Segmented and lymphocytes higher than Ref. Range. Serum fat fractions levels were unsets factory, in particular the low levels of omega -6 and omega -3 essential fatty acids; being less than RDA. Fractionation of fatty acids(FA) indicated the low levels of mono- and poly - unsaturated FA. Amino acids analysis revealed that biological value of protein was relatively low for females (94.11%), being evidently low for males protein (65.66%).Conciliation coefficients indicated that macronutrients and micronutrients may play an important effect on the immune function. The result suggested that nutritional education programs should be carried out to increase the awareness of males & females of the faculty of Specific Education Menufiya university so as to avoid overweight and obesity as well as to pay much attention to the balance of nutrients in food.

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1. Introduction

Diet is a critical factor in the maintenance of human cellular defense systems, immunity, inflammation, redox regulation, metabolism, and DNA repair that ensure optimal health and reduce disease risk ***(Janice,2012***)

Optimal functioning of the immune system is crucial to human health, and nutrition is one of the major exogenous factors modulating different aspects of immune function (***ALBERS ET AL., 2013*)**.

Recent research links nutritional exposures early in life with alterations in functional immunity that persist beyond childhood(***MOORE ET AL.,* 2012).**

Immune function can be modulated by multiple physiological factors, including nutrition and reproductive state. Because these factors can vary throughout an individual's lifetime due to environmental conditions (e.g. nutrition) or life-history stage (e.g. adult reproduction), we must carefully examine the degree to which developmental versus adult conditions shape performance of the immune system **(BUTLER& MCGRAW,2013).**

Immune system is key to providing good defense against pathogenic organisms and to providing tolerance to non-threatening organisms, to food components and to self. The immune system works by providing an exclusion barrier, by identifying and eliminating pathogens and by identifying and tolerating non-threatening sources of antigens, and by maintaining a memory of immunological encounters.

The immune system is complex involving many different cell types distributed throughout the body and many different chemical mediators some of which are involved directly in defense while others have a regulatory role**(Calder,2013).**

An optimal nutritional status contributes to health maintenance and prevention of the infection, as the function of healthy cells is maintained by the provision of adequate nutrition. When nutrient availability disrupted, a cascade of adverse metabolic events occurs that can compromise the immune system and impair the body's ability to adapt, recover, and survive ***(*Landete *et al.,* 2002).**

Nutrient status is an important factor contributing to the immune competence, and the adequate nutritional support has a major role in the prevention of infection, multiple organ failure, and sepsis **(Flebinger, 2003).**

L-Arginine (L-Arg) availability is crucial in the regulation of immune response. Indeed, L-Arg deficiency induces T-cell dysfunction and could modulate the properties of natural killer (NK) cells involved in the early host defense against infections and tumors**(Lamas *et al.*,2012**).

Polyunsaturated fatty acids (PUFAs) are essential dietary nutrients; they are indispensable as

structural components of cell membranes and as precursors for eicosanoids, signaling molecules which act on reproduction and immunity **(Schlotz, *et al.*,2013).**

The relationship between metabolism and immunity, and in particular, how eicosapentaenoic acid EPA and docosahexaenoic acid DHA work with both systems to modulate immunometabolic complications and chronic disease (**Flock *et al.*, 2013).**

Fatty acid composition of cells involved in the inflammatory response influences their function; the contents of arachidonic acid, EPA and DHA appear to be especially important. The anti-inflammatory effects of marine n-3 PUFAs suggest that they may be useful as therapeutic agents in disorders with an inflammatory component **(Calder, 2010).**

Obesity is associated with low-grade inflammation and impaired immune response. Caloric restriction (CR) has been shown to inhibit inflammatory response and enhance cell-mediated immune function. Curcumin, the bioactive phenolic component of turmeric spice, is proposed to have anti-obesity and anti-inflammation properties while piperine, another bioactive phenolic compound **(Wang *et al.*, 2013).**

Diet and body fatness, among others. Measuring the concentration of inflammatory markers in the bloodstream under basal conditions is probably less informative compared with data related to the concentration change in response to a challenge (**Calder *et al.*,2013)**

NDC have emerged as a promising nutritional concept to modulate immune function as well. In the world of immunology non-digestible carbohydrates are recognized now as key immunomodulating molecules **(Nauta & Garssen,2013).**

Malnutrition consistently impairs innate and adaptive defenses of the human body being an important determinants of morbidity and mortality. Malnutrition can intensify the serverity of infections, and may lead to their evolution into life- threatening diseases (**Enwonwu *et al.*, 2002).**

CD8αα+ T-cell receptor (TCR) αβ+ intestinal intraepithelial lymphocytes (IELs) were found to have a regulatory function in the mucosal immune system (**Tung *et al.*, 2013).**

Because of the complexity of the relationship between the nutritional status and the immune system more research is required concerning the effect of diet on immune response.

Therefore this study was aimed to find the possible relation between anthropometric measurements, food intake (macronurients micronurients, fatty acids and amino acids) and immune response.

2.Subjects and Methods

A- Subjects

This study was carried out on a sample of 40 demonstrators, assist lecturers (males and females). The age of the sample ranged between 25-50 years chosen randomly from Faculty of Specific Education Menoufia University.

Information about daily diet dietary intake either at home were collected during the study period through interviews using the 24 hours recall sheet. A questionnaire was used for collecting data about diet history. Evaluation of food intake included assessments the meals served at home.

Determination of daily nutrient intake:

Daily nutrient intake was obtained for three different days, and nutritional values of consumed food were calculated using the Computer Program for Ready to Eat Egyptian Foods, Faculty of Home Economics, Menoufiya University ***(Diet Analysis Program, 1996)***. Total fat (g), saturated fatty acid SFA (g), monounsaturated MFA (g) and polyunsaturated PFA (g) were calculated. The adequacy of diets evaluated with regard to references intake ***(DRI, 2002)*.** And Dietary Allowances ***(RDA, 1989)*** was calculated.

Amino acids scores (A.A.S%) were calculated as follow: A.A.S% = g/16g N of test protein ÷ g/16g N of the FAO pattern. The pattern used was the ***DRI (2002)***.

The values of the EAA as g/100g protein were used to calculate the essential amino acids index (EAAI) and biological value (BV) of protein which were calculated in relation to egg protein According to ***Oser (1959),*** while protein efficiency ratios (PER) were calculated according to ***Alsmeyer et al., (1974)*** using 3 equations.

PER_1= -0.684 +0.456 Leucine – 0.047 Proline.

PER_2= -0.468 +0.454 Leycine – 0.105Tyrosine.

PER_3= -1.816+ 0.435 Methionine + 0.78 Leucine + 0.211

Histidine- 0.944 Tyrosine.

Anthropometric measurements:

Antropometric measurements:

1.Weight measurement: Weight was measured by the help of digital electronic scale. Weight was recorded to the nearest 0.1 kg.

2.Height measurement: Height was measured by the help of a metal or nylon tape without shoes. Height Measurement was taken to nearest 0.1 cm.

3. Body mass index (BMI) was calculated {weight (kg) height (m) ^{2}} and used to determine the nutritional status of women according to **Garrow, (1988)** who reported that BMI value < 20 indicates under weight, 20-24.9 desirable weight, 25-30 overweight and >30 obesity (all as kg/M^2).

Laboratory analysis:

1- Haematology:

WBC count: Total white cells.
Basophils percentage.
Eosinophils percentage.
Staff percentage.
Segmented percentage.
Lumphocyted percentage.
Monocytes percentage.

2- Immunophenolog

Absolute Lymphocyte.
CD_4 percentage.
CD_8 percentage.
CD_4: CD_8 percentage.

Laboratory analysis were performed in Al-Borg Laboratory.

Statistical analysis has been achieved using IMB-p-C computer by SPSS(V.16).2008)

3.Results And Discussion

1- Anthropometric Measurements:

Table (1) shows the comparison between mean ± SD of age and anthropometric measurements of studied sample according to sex groups. Means for age was higher in males than females. On the other hand mean of anthropometric measurements for males were higher than females. According to mean BMI values both males and females were overweight.

Table (2): Show the percentage distribution of studied sample according to body mass index (kg/m^2); 47.37 % in male group were in range BMI> 30 (obese) while 52.38 % in female group were in range BMI 25-29.9 (overweight), 36.84% in male at range of BMI 25-29.9 (overweight), and 14.29 % of females were in range of BMI >30 were on kg15.79% and 19.04% of males and females respectively were at the BMI range 20-24 desirable weight. From the results it was noticed that the higher studied sample for male and female were obese and overweight. on the other hand obesity is known to increase risk for postoperative wound infections. These results agreed with **Lew and Grafinkel (1979)** who suggested that body weight of BMI 20-24 "desirable weight " was associated with lowest mortality rates, and moderate degrees of "overweight" (BMI < 30) might enhance immunity. On the other hand these results agreed with **(Lee *et al.*, 2013)** who reported that Obesity is thus an underlying condition for inflammatory and metabolic diseases.

2-Dietary intake:

Data of table (3 and 4) show the mean daily nutrients intake (calories & total protein) for males and total protein for females, compared to (DRI) daily requirement. While mean calories intake for male was higher than 100% of (DRI), mean calories intake for females was lower than 100% of (DRI). On the other side total protein intake for males (201.26%) and females(183.33%) were higher than 100% of (DRI) The mean intake of all macronutrients intake for males were higher than females (calories, total protein, protein- A protein- P, total fat, fat- A, Fat – P and carbohydrates).

The male percentage of intake was higher from the essential macronutrients. Also, minerals intake (Table 4) of males and females were higher than 100% of RDA except for calcium which consumed at lower than 100% of RDA, it was nearly half requirements for female.

Mean vitamins intake(Table 4) of males was higher than 100% of RDA except for some vitamins being less than 100% of EDA. Mean vitamins intake of females was higher than 100% of RDA except for vitamin A, D,C and B_6. From the result of same table it was noticed the higher vitamins intakes of males than females, and the lower vitamins A and D for males and females and being less than 100% of RDA specially for Vit. D. These results agreed with **Calder, 2013** who reported also Micronutrient deficiencies impair immune function. Here, vitamins A, D and E, and Zn, Fe and Se are discussed. The gut-associated lymphoid tissue is especially important in health and well-being because of its close proximity to a large and diverse population of organisms in the gastrointestinal tract and its exposure to food constituents.

Esposito *et al.*, 2013 reported that that vitamin D plays an important role in host defenses, inflammation and immunity.

Baum *et al., (1995)* suggested that deficiency of vitamins A and B_{12} was associated with a decline in CD_4 cell counts, while normalization of vitamin A, B_{12} and zinc was associated with higher CD_4 cell counts, and suggested also that micronutrient deficiencies are associated with HIV-1 disease. These results (Table 4) agreed with that of ***Padbidri (2002)*** who reported that several micronutrient such as vitamin A, beta- carotene, folic acid, vitamin $B_{12,}$ C, riboflavinas well as iron, zinc and selenium have immunomodulating functions.

Ahmad et al., 2009 suggested that increasing vitamin A stores above the level that maintains normal vision enhances some measures of T-cell-mediated immunity, suggesting difference in requirements for maintaining vision and immune function.

Finally in the present study the mean intake of macro and micro nutrients were nearly higher than 100% of (DRI and RDA) with deficiencies in calories, calcium, Vit.A, D and C. And it was noticed that the mean intake of macro and micro nutrients of male were higher than female possibly increasing immune system for males than females.

3- Laboratory analysis

Data of tables (5 and 6) show the complete blood counts (W.B.C) and immunological parameters for studied sample. It noticed that complete blood counts (W.B.C) for males and females were in the normal range except in Basophils the value was upper range the value were (0.50% and 0.81%) for males and females respectively. On the others hand the mean all immunological parameters for studied sample were in the normal range. These results disagreed with ***Trushina et al.,2012*** who finding that immune system was statistically authentic decrease in an immunoregulatory index of CD4/CD8 (in women- -0,89 +/- 0,08, in men--0,77 +/- 0,11; $p < 0,05$)

4- Dietary Fat:

Table (7) shows the mean daily intake of fatty acids fraction and their percentages of the total fat daily intakes (Table 3) according to different sex groups. For males group mean± SD of total saturated fatty acids was 34.75± 6.09 (gm) with percent 40.76% from total fat, while the mean±SD of total saturated fatty acids were 22.97±11.78gm with percent 36.78% for females, it is noticed that the total saturated fatty acids was higher for males than females. For total monounsaturated fatty acids the mean ±SD was 20.55±5.73 and 11.99±6.41 in males and females respectively, while the mean ±SD value of total polyunsaturated and total unsaturated fatty acids were 26.32±6.52, 29.33±5.19, 38.31±12.93 and 49.88±10.92 for females and males respectively. It is noticed that the values for percent total poly saturated and total unsaturated fatty acids for females were higher than males. While mean the percent of Omega-6 and omega-3 of females were high than males (18.9, 22.8 & 14.88 and 19.5%) respectively. Also the percent of T.unsat FA/ t.sat FA of females was higher than males (2.65 and 1.44%) respectively. While the percent of P/s of females was higher than males (1.84 and 0.99%) respectively.

Calder(,2013) reported that fatty acid composition of cells involved in the inflammatory response influences their function

Chavali and Forse (1994), Taraszewski and Jensen (1994) reported that essential fatty acid deficiencies diminish the number and variety of polyunsaturated fatty acids located in cell walls throughout the body. ***Waitzberg et al., (2002)*** reported that fatty acids may have different impacts on phagocytic cells according to their structure. ***Sackc et al., (2003)*** reported that specific nutrients such as omega-3 fatty acids have been shown to influence infectious morbidity, antibiotic use and has become known as immune – enhancing diets. ***Singh et al., (2002)*** reported that nutrients like omega-3 fatty acids and mucleotides enhance cellular immunity, modulate tumor cell metabolism and improve clinical outcome in stress situations.

Table (8) Shows the value of mean daily consumption of saturated and total unsaturated fatty acids, as presented for the different sex groups. For males capric, $C_{10:0}$ Palmitic $C_{16:0}$ and stearic $C_{18:0}$ fatty acids had the highest percent intake among other saturated fatty acids (11.45%, 47.17% and 15.65) respectively, The first were higher than females. In the present study oleic $C_{18:0}$ fatty acid were with mean ±SD (15.51±3.93 and 8.29±4.69 gm) for males and females respectively, nevertheless the mean ±SD of daily consumption of polyunsaturated fatty acid and their percentage according to sex for all studied sample (Linoleic $C_{18:2}$ and linolenic $C_{18:3}$ fatty acid) had the higher intakes among other polyundaturated fatty acid, while arachidonic $C_{20:4}$ fatty acid had the lowest intake among other polyunsaturated fatty acids. These results agreed with ***Hagenlocher et al., (2001)*** who studied that correlation between dietary fatty acid intake, (linoleic acid and oleic acid) in serum and finding that linoleic acid intake depend on the ratio Omega.6 polyunsaturated fatty acid other fatty acid and antioxidant consumed in the diet.

5- Dietary amino acid:

Table (9) results show the protein quality and value of protein intake for sex groups. The E.A.A.I and B.V value of females were higher than males (97.1, 94.11 &71, and 65.66 (G/16gN) respectively. While the protein efficiency ratio (PER) value of males were lower than females (2.63, 2.82, 2.55&2.8, 2.99 and 2.72(G/16gN) respectively. **Baltar *et al.*, 2013** who suggest that a greater role of the methionine-homocysteine metabolism and immune activation. **Wang *et al.*, 2013** reported that Glycine plays an important role in metabolic regulation, anti-oxidative reactions, and neurological function. Thus, this nutrient has been used to) improve immunity

Correlation coefficients:

Table (10) present the correlation between macronutrients & micronutrients intake and immunological parameters for males of studied sample. as shown in the table it was significantly positive control -ve between calories and CD_4: CD_8, and fat animal with eosinophils (0.573 and 0.545) respectively. Also they were significant correlations between (zinc, Vit. B_1 and vit.B_2) with CD_4:CD_8 (0.579, 0.618 and 0.558) respectively. Also high significant correlations between Vit. D with segmented. While there were high significant negative correlations between Vit.B_1 and Vit.B_2 with CD_8 (0.679 and 0.719) respectively. Moreover decreased significant negative correlations recorded between protein-p and carbohydrates with monocytes (0.576 and 0.595) respectively. The negative significant correlation between protein –p with basophils, and

negative decreased significant correlation between zinc with CD_8 were also recorded it could be concluded that the increase of macronutrients and micronutrients accom by the increase of immunological parameters, while decreased macronutrients and micronutrients intakes decreased such parameters.

Table (1): Comparison between mean ± SD of age and anthropometric measurements of studied sample according to sex group

Six group Parameters	Male (N= 19)	Female (n=21)
	Mean± SD	Mean± SD
Age (years)	39.86±7.76	33.31±6.06
Weight (Kg)	86.00±18.11	71.06±18.69
Height (Cm)	171.21±8.56	161.44±6.50
BMI (Kg/m^2)	29.45±2.47	27.44±4.42

Table (2): Percentage distribution of studied sample according to body mass index

BMI Sex group	Sample size	<20undersweight		20-24 Desirable weight		25-29-9 over weight		>30 obese		Total	
		No	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	%
Male	19	-		3	15.79	7	36.84	9	47.37	19	100
Female	21	3	14.29	4	19.04	11	52.38	3	14.29	21	100

Table (3): Mean ± SD of macro-nutrients intake and their percentage% of daily requirements for studied sample according to sex

Sex group MacroNutrients	Male (n=19)		Female (n=21)	
	Mean ±sSD	% of RDI	Mean ±SD	% of RDI
Calories (Kcal)	3032.96±586.64	106.64	2095.88±959.21	95.26
Total protein (g)	126.79±46.37	201.26	84.33±46.14	183.33
Protein –A (g)	72.79±52.84		45.69±30.46	
Protein-P (g)	53.95±15.66		38.63±19.36	
Total Fat (g)	85.25±40.31		62.45±43.43	
Fat- A (g)	53.28±39.10		39.57±27.68	
Fat- P (g)	31.97±15.60		22.89±20.80	
Carbohydrate (g)	440.48±87.46		300.14±113.45	
Fiber (mg)	30.21±8.01		22.54±10.61	
Cholesterol (mg)	533.29±352.04		337.17±414.96	

Table (4): Mean ± SD of micro-nutrients intake and its percentage of (DRA) for studied sample according to sex.

Sex group Micro- Nutrients	Male (n=19)		Female (n=21)	
	Mean ±SD	% of RDI	Mean ±SD	% of RDI
1- Minerals				
Calcium (mg)	797.14±223.00	99.64	495.67±422.29	49.54
Phosphorus (mg)	2052.38±687.25	256.54	1375.14±622.56	114.61
Total iron (mg)	30.11±8.69	243.43	12.24±9.17	108.34
Animal Iron (mg)	10.25±8.15		5.45±4.34	
Plant Iron (mg)	19.14±7.64		10.80±5.94	
Zinc (mg)	20.35±6.07	135.64	13.79±7.69	114.92
Magnesium (mg)	615.71±97.83	175.41	438.09±184.39	156.46
2- Vitamins				
Vitamins A (ug)	862.77±768.66	86.28	487.14±474.37	60.89
Vitamin D (mg)	1.43±1.12	28.51	1.92±3.38	19.13
Vitamin C (mg)	160.56±109.63	267.61	57.56±41.54	95.31
Vitamin E (mg)	17.72±8.37	177.21	11.69±6.78	146.18
Vitamin B_1 (mg)	1.96±0.45	133.29	1.19±0.61	108.79
Vitamin B_2 (mg)	4.31±1.14	258.77	2.98±1.67	229.18
Niacin (mg)	26.08±13.76	139.88	18.37±12.09	122.43
Folate (mg)	586.43±329.04	293.22	289.07±133.02	160.54
Vitamin $–B_6$ (mg)	2.47±0.76	123.43	1.43±0.81	89.49
Vitamin – B_{12} (mg)	13.11±32.06	655.68	3.85±4.78	192.75

Table (5): Complete blood counts (W.B.C) for studied Sample

Sex group parameters	Male (n=19)	Female (n=21)	Ref. Range
	Mean ±SD	Mean SD	
Leucocytic Count	6.29±1.30	6.26±1.67	4-11
Basophils	0.50±0.52	0.81±0.40	0-100
Eosinophils	5.86±3.67	4.66±3.80	40-400
Staff	4.00±1.24	3.94±1.18	2.5-7.5
Segmented	40.14±8.17	48.44±10.48	2.5-7.5
Lymphocytes	36.43±8.35	30.00±8.09	1.5-4.5
Monocytes	6.07±2.40	4.68±2.41	2.00-8.00

Table (6): Immunological parameters for studied Sample

Sex group parameters	Male (n=19)	Female (n=21)	Ref. Range
	Mean ±SD	Mean ±SD	
Lymphocyte Count	24.35±636.5	23.02±50.70	10.5-33
CD_4	40.36±4.55	41.69±3.96	32-50
CD_3	18.43±5.71	23.56±6.49	13-50
CD_4:CD_8	2.27±0.62	1.84±0.50	1.0-3.5

Table (7): Mean ± SD of fatty acids and percentage of essential FA intake of (RNI) according to different sex group

Sex group Macro- Nutrients	Male (n=19)		Female (n=21)	
	Mean ±SD	% of RDI	Mean ±SD	% of RDI
Total saturated fatty acid	34.75±6.09	40.76	22.97±11.78	36.78
Total monounsaturated fatty acid	20.55±5.73	24.11	11.99±6.41	19.19
Total polyunsaturated fatty acid	29.33±5.19	34.40	26.32±6.52	42.14
Total unsaturated fatty acid	44.88±10.92	58.51	38.31±12.93	61.35
Omega-6 FA (RNI=1.1)	12.69	14.88	11.86	18.9
Omega-3 FA (RNI= 1.83)	16.64	19.5	14.3	22.8
T.unsat FA/T.sat.FA 1.24	1.29	1.5	11.66	2.65
P/S	0.84±0.85	0.99	1.15±0.55	1.84

P/S: T.Polyunsat. FA/T. Sat. FA

Table (8): Mean and SC of Daily Consumption of Saturated and Unsaturated Fatty Acids their percentage of Total FA group According to different sex Groups

Sex group	Male (n=14)		Female (n=16)	
saturated fatty acid	Mean ±SD	% of RDI	Mean ±SD	% of RDI
Capric $C_{10:0}$	3.39±0.34	11.45	2.31±0.45	10.06
Lauric $C_{13:0}$	3.12±0.10	8.98	2.09±0.15	9.09
Myristic $C_{14:0}$	5.75±0.66	16.55	2.13±0.94	20.59
Palmitic $C_{16:0}$	16.39±2.55	47.17	10.26±6.56	44.66
Stearic $C_{18:0}$	5.44±0.76	15.65	2.14±1.46	9.32
Lignoceric $C_{24:0}$	0.66±1.68	1.89	1.44±2.22	6.29
Total	34.75±6.09	100	22.97±11.78	100
Monounsaturated:	Mean±SD	%of T. mono	Mean±SD	% of T.Mono
Polmitoliec $C_{16:1}$	4.45±0.27	21.65	3.24±0.34	27.02
Oleic $C_{18:1}$	15.51±3.93	15.47	8.29±4.69	69.14
Eicosenoic $C_{20:1}$	0.02±0.04	0.09	0.03±0.06	0.25
Erucic $C_{22:1}$	0.57±1.49	2.11	0.43±1.32	3.5
Total monounsatred	20.55±5.73	100	11.99±6.41	100
Linoleic $C_{18:2}$	16.64±3.40	56.74	14.38±4.18	54.64
Linoleic $C_{18:3}$	12.56±1.68	42.82	11.78±2.22	44.75
Arachidonic C20:4	0.13±0.11	0.44	0.16±0.12	0.61
Total polyunsaturated:	29.33±5.19	100	26.32±6.52	100

Table (9): Protein quality and value of protein intake for sex groups

Sex group	Male (N=14						Female (N= 16)					
Amino acids	M.L g/day	D.R/day	%of D.R	G/16gN	DRI2002	A.A.S	M.L g/day	D.R/day	%of D.R	G/16gN	DRI2002	A.A.S
Isolencine	4.16	.72	5.77	3.28	1.3	2.52	4.81	0.59	815	5.7	1.3	
Leucine	8.17	4.57	1.78	6.44	1.9	3.39	4.13	0.87	4.74	4.89	1.9	
Lyaine	6.59	0.89	7.40	5.19	1.6	3.24	6.87	0.73	9.41	8.15	1.6	
Methionine	2.33			1.84			2.35			2.79		
Cystine	1.65			1.3			1.49			1.77		
Phynilainlne	5.55			4.38			5.28			6.26		
Tyrosnine	4.02			3.17			4.01			4.76		
Threanine	4.42	0.49	902.	3.49	0.89	3.92	4.25	0.40	1062	5.04	0.89	
Tryptophan	1.39	0.28	496	1.09	0.5	2.18	1.34	0.23	5821	1.59	0.5	
Vailine	6.09	0.72	845	4.8	1.3	3.69	5.93	0.59	1005	7.03	1.3	
Elistidine	3.65	0.89	410	2.88	1.6	1.8	3.01	0.73	412	3.57	1.6	
Arginine	6.38			5.03			6.06			7.18		
Alamine	5.48			4.32			4.22			5		
Aspartic	8.86			6.99			8.56			10.15		
Glytamm	2.34			1.85			2.16			2.56		
Glycine	4.88			3.85			4.56			5.4		
Proline	8.64			6.82			8.40			10.03		
Serine	5.07			4			4.84			5.74		
Methomine &Cystine	3.98	0.95	418	3.14	1.7	1.85	3.84	0.78	492	4.55	1.7	2.68
Phynilalanine &Tyroaine	9.27	1.06	8.74	7.55	1.9	3.97	9.29	0.87	1067	11.02	1.9	5.8
E.A.A.I				71						97.1		
B.V				65.66						94.11		
PER_1				2.63						2.8		
PER_2				2.82						2.99		
PER_3				2.55						2.72		

MI: Mean intake. DRI: Dietary reference intake. B.V.: Biological Value. DR: Daily Requirement. EAAI: Essential amino acid index. PER: Protein efficiency ratio.

Table (10): Correlation coefficients between macrinutrients& micronutrients intake and immunological parameters for males of studied sample

Immunological Variables	Leucocytic count	Basophils	Eosinophils	Staff	Segmented	Lymphocytes	Monocytes	Lymphocte count	CD_4	CD_8	CD_4:CD_8
Calories (Kcal)	-0.397	-0.287	0.320	-0.279	-0.065	-0.034	-0.100	-0.222	-0.214	-0.478	0.573*
Protein-P (g)	-0.062	-0.551	-0.440	0.115	-0.058	0.238	-0.576*	0.364	0.066	-0.061	0.151
Fat. A (g)	-0.348	0.070	0.542*	-0.377	-0.015	-0.078	-0.375	-0.364	-0.192	-0.396	-0.445
Carbohydrates (g)	-.236	-0.520	-0.109	0.071	-0.262	0.037	-0.595*	0.054	-0.307	-0.277	0.215
Zinc	-0.341	-0.111	0.354	-0.381	-0.068	0.011	0.269	-0.178	-0.152	-0.569*	0.579*
Vit.b (mg)	0.155	0.228	0.176	0.080	0.612*	-0.512	0.174	-0.334	0.265	0.061	0.084
Vit.B_1(mg)	-0.572*	-0.394	-0.018	-0.039	-0.234	0.223	-0.181	0.035	-0.090	-0.679**	0.618*
Vit.B_2(mg)	-0.277	-0.436	-0.136	-0.071	-0.001	0.020	0.066	0.047	-0.233	-0.719**	0.558*

* significant

Table (11): Correlation coefficients between macrinutrients & micronutrients intakes and immunological parameters for females of studied sample

Immunological Variables	Leucocytic count	Basophils	Eosinophils	Staff	Segmented	Lymphocytes	Monocytes	Lymphocte count	CD_4	CD_8	CD_4:CD_8
Protein-P (g)	0.276*	0.521	-0.388	-0.375	0.086	0.069	0.487	0.294	-0.098	0.528*	-0.553*
Carbohydrates (g)	0.452	0.510*	-0.391	-0.295	0.217	-0.042	0.545*	0.385	-0.108	0.461	-0.491
Fiber (mg)	0.436	0.481	-0.77*	-0.385	0.184	-0.124	0.510*	0.385	-0.218	0.561*	-0.645**
Iron. P (mg)	0.171	0.510*	-0.378	-0.429	-0.002	0.117	0.394	0.209	-0.091	0.533*	-0.540*
Magnesium (mg)	0.407	0.516*	-0.536*	-0.349	0.285	-0.064	0.574*	0.298	-0.051	0.522*	-0.579*
Vit.B_1 (mg)	0.223	0.446	-0.442	-0.379	0.105	0.133	0.528*	0.290	-0.081	0.448	-0.486

Table (11) show the correlations between macronutrient& micronutrients intakes and immunological parameters for females. It is shown that it was high significant positive correlation between fiber and CD_4: CD_8. Also it was significant correlation between protein-P with leucocytic count. While they were significant positive correlation between carbohydrate, iron.p and magnesium with basophiles (0.510,0.510and 0.516) respectively. Also there were significantly positive correlations between carbohydrate, fiber, magnesium and Vit.B_1 with monocytes (0.545, 0.510, 0.575 and 0.528.) respectively. They were significant positive correlation between protein. P, fiber, iron. p and magnesium with CD_8 (0.528, 0.561, 0.533 and 0.522) respectively. While they were significant negative correlation between protein-P, iron. P and magnesium with CD_4: CD_8 (0.553, 0.540 and 0.579) respectively. Also they were significant negative correlations between fiber and magnesium with eosinophils (0. 77 and 0.536) respectively.

Recommendations

The present study suggests that lifestyle factors i.e. avoidance of obesity and maintaining ideal weight, nutritional balance (macronutrients & Micronutrients intake especially iron, zinc, Vit. (A,C,D,B_1,B_6, B_{12} and E), fiber and plant protein and fat may exert an important effect on WBC count and immune function.

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1/25/2014