Scholars Academic Journal of Biosciences
Abbreviated Key Title: Sch Acad J Biosci
ISSN 2347-9515 (Print) | ISSN 2321-6883 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Pathology

A Requisition to Fortify *Unani* Supplements with Omega-3 Fats for Mother and Child to Prevent Cardiovascular Diseases

Dr. Shabana Noor[1], Dr. Md. Tanwir Alam[2*], Dr. Afeefa Kazmi[3], Dr. Mariyam Jameel[4]

[1]P.G. Scholar, Dept. of Mahiyatul Amraz (Pathology)
[2]Associate Professor cum HoD- Tahaffuzi wa Samaji Tib (PSM) 511-PG Block, Dept. of PSM, GTCH, Patna
[3]P.G Scholar, Dept. of Moalajat (Medicine)
[4]P.G Scholar, Dept. PSM, Govt. Tibbi College and Hospital, Patna, Bihar, India

DOI: https://doi.org/10.36347/sajb.2025.v13i05.004 | **Received:** 04.04.2025 | **Accepted:** 10.05.2025 | **Published:** 15.05.2025

***Corresponding author:** Dr. Md. Tanwir Alam
Associate Professor cum HoD- Tahaffuzi wa Samaji Tib (PSM) 511-PG Block, Dept. of PSM, GTCH, Patna

Abstract **Review Article**

Background: Sustainable and holistic food policy is nowadays an essential requisite to promote health and prevent diseases. Lack of knowledge regarding dietary recommendation in pregnancy contributes to neonatal conditions/illness as well as in developing CVDs in later years of life. ***Objective:*** The main aim of this study is to highlight the importance of omega-3-fats in relation to mother and child health and also its link in the primary prevention of CVD and to recognise, enlist and fortify *Unani* medicines/drugs with omega-3-fats. ***Conclusion:*** Considering the scientific importance of role of omega-3 fatty acids in primary prevention of cardiovascular diseases and in maintaining and enhancing mother & infant health development, Omega-3 enriched *Unani* formulations and food should be advocated to be used extensively during entire pregnancy period.

Keywords: *Unani* medicine; CVDs; MCH; Omega-3; DHA; food supplements.

INTRODUCTION

Diet has always served as the most important link between disease and mortality. Most of the chronic illnesses and mortality are due to diet induced diseases, especially the cardiovascular diseases. Sustainable and holistic food policy is nowadays an essential requisite to promote health and prevent diseases. Throughout history the dearth of knowledge about human nutritional requirements specially the dietary recommendations for pregnant women have worked as a catalyst in promoting diet induced disease. Omega-3 fats are important dietary requirement which helps in improving health conditions of pregnant and lactating women which further leads to improvement in infant health conditions and also in avoiding CVD in subsequent years of life. Fatty acids fall into one of three major categories; saturated fatty acids, mono-unsaturated fatty acids and polyunsaturated fatty acids (PUFAs). Essential PUFAs are required by all mammals but they are not produced within the body and must come from the diet. There are two types of essential fatty acids (EFAs) in body, ω-6, derived from cis-linoleic acid (LA, 18:2) and ω-3 originated from α-linolenic acid (ALA, 18:3). α -linolenic acid (ALA) is the precursor to Docosahexaenoic acid (DHA) and Eicosapentaenoic acid (EPA). This paper primarily focusses on the importance of Omega-3-fats in mother and child and as a prophylaxis for CVDs.

OBJECTIVE

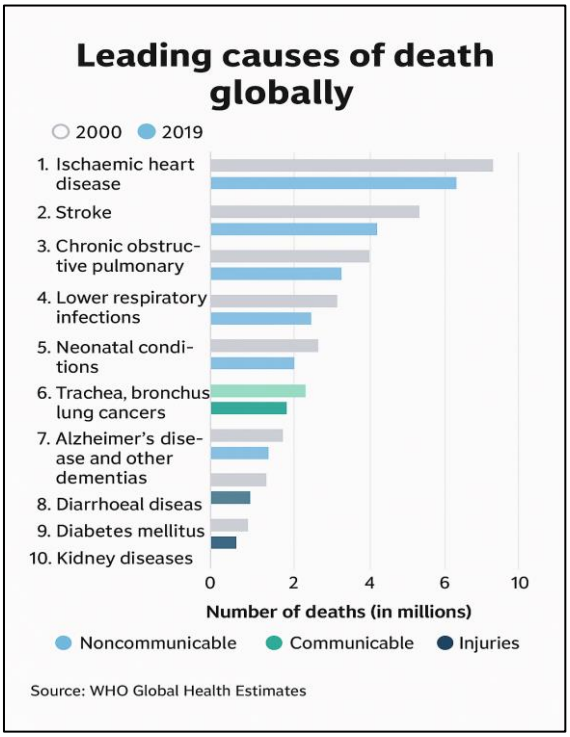
There are 3 main objectives of this research paper. Firstly, to understand the magnitude of the problem of diet induced disease especially in cardiovascular illness. Secondly to highlight the importance of Omega-3 Fatty acids (DHA & EPA) in pregnancy and newborns to prevent CVS diseases. Lastly and most importantly to recognize & enlist *Unani* medicines specifically for pregnancy & lactating women and to fortify the same with Omega-3 fatty acids.

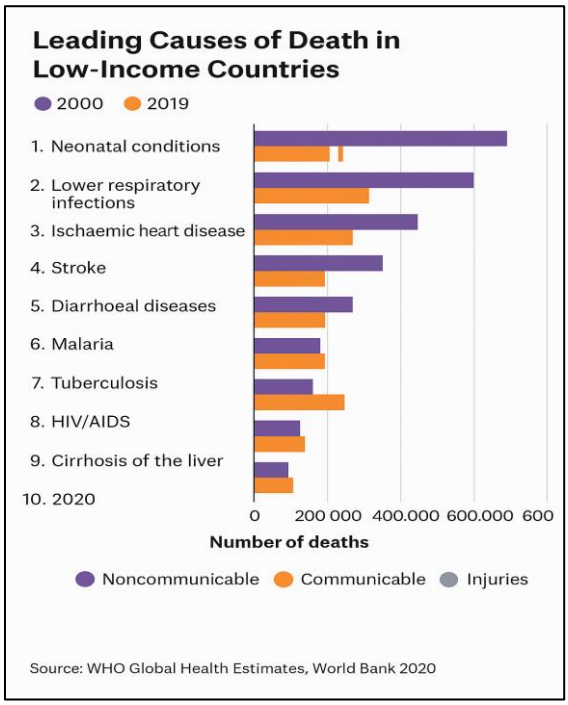
DISCUSSION

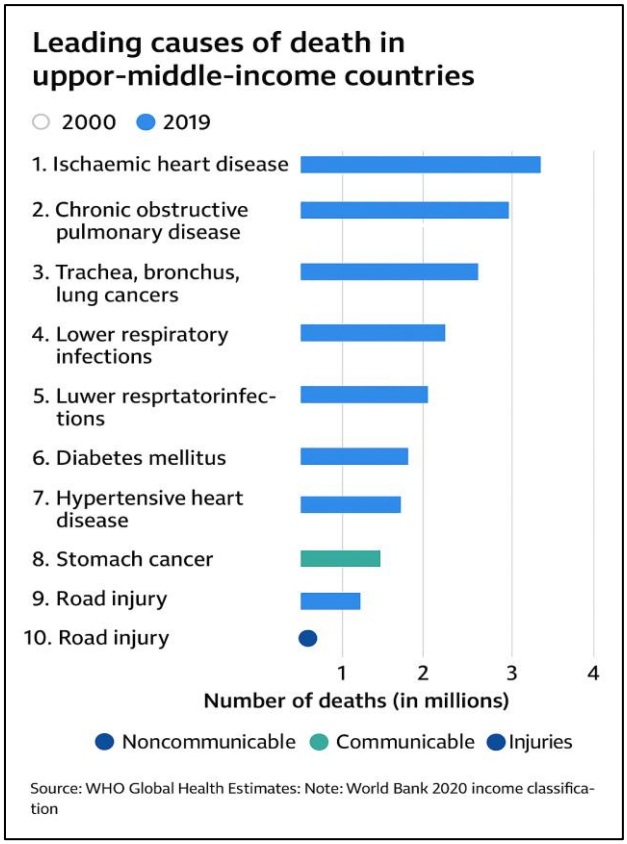
Cardiovascular disease (CVD) is a broad expression of various linked pathologies, commonly described as coronary heart disease (CHD), peripheral arterial disease, cerebrovascular disease, rheumatic fever & rheumatic heart diseases along with congenital heart diseases and venous thromboembolism [1]. According to WHO, in 2019, the top 10 causes of mortality accounted for 55% of the total 55.4 million deaths worldwide, wherein 7 of the 10 leading causes of deaths were noncommunicable diseases accountable for 74% of worldwide death. The topmost universal reasons of

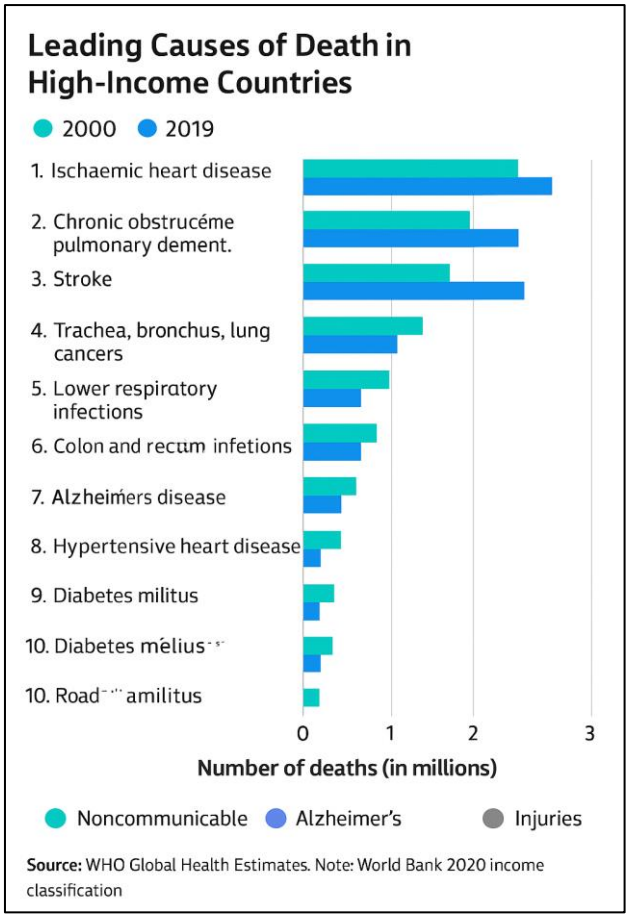
death, are associated firstly with cardiovascular (ischaemic heart disease i.e IHD and stroke), secondly with respiration (COPD, lower respiratory infections), thirdly the neonatal conditions which include neonatal sepsis, birth trauma, birth asphyxia and preterm birth complications. The world's massive killer is IHD, owing for 16% of the world's mortality [2].

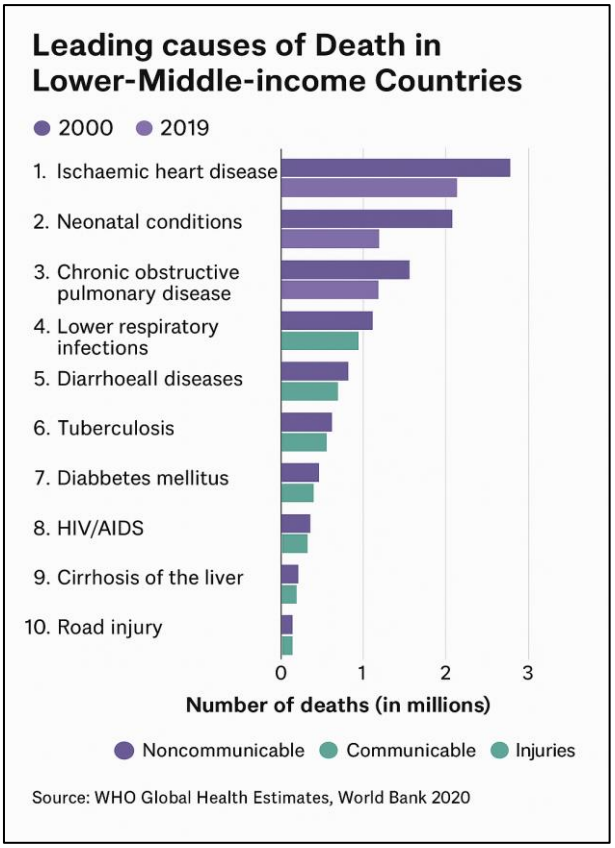
According to the World economic groups, the top 3 leading mortality cause (rank wise) in low-income countries are neonatal conditions, respiratory infections and IHD. And in lower-middle-income group (which includes India [3]), the top 2 causes of death are cardiovascular diseases (IHD, stroke) and neonatal conditions are placed at third place. The same goes for upper-middle-income group where top 2 causes of mortality are the cardiovascular diseases (IHD, stroke). Even in high-income countries, ischaemic heart disease tops the list of mortality cause [2].






Leading causes of death in uppor-middle-income countries
2000
2019
1. Ischaemic heart disease
2. Chronic obstructive pulmonary disease
3. Trachea, bronchus, lung cancers
4. Lower respiratory infections
5. Luwer resprtatorinfec-tions
6. Diabetes mellitus
7. Hypertensive heart disease
8. Stomach cancer
9. Road injury
10. Road injury
1
2
3
4
Number of deaths (in millions)
Noncommunicable
Communicable
Injuries
Source: WHO Global Health Estimates: Note: World Bank 2020 income classifica-tion


Leading Causes of Death in High-Income Countries
2000
2019
1. Ischaemic heart disease
2. Chronic obstrucéme pulmonary dement.
3. Stroke
4. Trachea, bronchus, lung cancers
5. Lower respiratory infections
6. Colon and rectum infetions
7. Alzheimers disease
8. Hypertensive heart disease
9. Diabetes militus
10. Diabetes mélius
10. Road amilitus
0
1
2
3
Number of deaths (in millions)
Noncommunicable
Alzheimer's
Injuries
Source: WHO Global Health Estimates. Note: World Bank 2020 income classification



According to the above-mentioned data its quite clear how important it is to work on the Prevention strategies for CVDs and to some extent the neonatal conditions as well.

WHO estimated that about 75% of premature CVD is avertable and risk factor (high blood pressure, high low-density lipoprotein (LDL) cholesterol, diabetes, smoking and second-hand smoke exposure, obesity, unhealthy diet, and physical inactivity [4].) Modulations can help diminish the ever-growing strain of CVD on individuals as well as healthcare providers. Albeit, age is a well-recognised risk factor of CVD, autopsy evidence has suggested that the course of gradual development of CVD in later years is almost/not inevitable[1], hence reduction of risk is crucial.

Consumption of unhealthy diet, lack of healthy diet is one of the risk factors leading to cardiac diseases. Omega -3-fats are most crucial nutrition requirements as a prophylaxis in CVD. Ideally, preventive measures should be initiated early in life to reduce the ultimate burden of CVD in both young and old. The slow gradual progressive injury to human tissues eventually becomes CVD and premature death becomes irreversible over time. It could be avoided and managed by imparting nutrition education, but these days medical efforts emphasizes more on treatment for older people rather than preventing principal causes and factors that leads to diseases in young people. Most of the risk factors can simply be avoided by incorporating two dietary modulation or intervention; firstly, by increasing the intake of omega-3 and decreasing the omega-6 fats consumption, so that the tissues have reduced level of intense n-6 eicosanoid action, and secondly eating less quantity of food at each meal to decrease the vascular postprandial oxidant stress [6]. Secondary prevention of CVD using DHA/EPA dietary interventions may not repair all the damage already done to human tissues by the lack of DHA and EPA and other factors in the diet earlier in life. Hence it is of prime concern to incorporate DHA and EPA in diet of young people especially women in reproductive age group. The true significance of DHA (docosahexaenoic acid) and EPA (eicosapentaenoic acid) in the primary prevention of CVD critically begins with adequate maternal consumption of DHA and EPA omega-3-fats and their cofactors (folic acid, vitamin B12, vitamin B6, vitamin C, tetrahydrobiopterin (H4B), calcium, magnesium, L-arginine, zinc and trace of selenium and vitamin-E [7]) before the inception of pregnancy and continues with adequate intake of it during pregnancy and throughout the life of the new born child [5].

DHA is a vital component of human retinal and brain membranes and has been shown to have a part in the cognitive development of infants [8]. Poor maternal health and nutrition before and during pregnancy disadvantages fetal development with permanent mental and cognitive deficits and behavioural dysfunction, [9,10] with a risk of diabetes, heart diseases and stroke in later life. Studies have shown that low-birthweight is associated with increased incidence of CHD and its related disorders (hypertension, non-insulin-dependent

diabetes, stroke) [11]. The association between low birthweight and coronary heart disease has been confirmed in longitudinal studies of men and women around the world [12].

Food Supplement having both DHA and EPA (or consumption of aquatic-based foods) is likely to be more effective than use of either alone [5].

Dietary intake of omega-3-fats not only helps in improving maternal, fetal and infant health conditions but also aids in preventing CVD in elderly. Hence, dietary recommendation of omega-3-fats should be advocated in all age groups with special attention to pregnant and breastfeeding women. This is where *Unani* System of Medicine comes into play. In *Unani* System of Medicine, a great emphasis is given on curing certain ailments by the administration of specific diets and also by modifying the food in term of quality and quantity, a term known as *Ilaj-bil-ghiza* (dietotherapy). The comprehensive explanation of antenatal care is known as "*Tadabeer-e- Haamla*". The primary motive of antenatal care is to prevent and impede birth, neural defects, preterm labour to achieve a healthful mother and healthy baby at the completion of pregnancy. There is a detailed description about presumptive and definitive signs of pregnancy, dietary regimens and lifestyle during pregnancy. *Unani* literature archives various single and compound *Unani* formulations for general health & wellbeing and for management of commonly occurring complaints during the pregnancy. Throughout the pregnancy period, a woman needs special attention and care as numbers of ailments are associated with pregnancy like *Gathāyan* (nausea), *Qai* (vomiting), *Sud'a* (headache), flatulence, excessive salivation, *Du'f al Ishtiha* (anorexia) etc. due to collection of *Fuzlat* (waste product) in the body during pregnancy [13].

During pregnancy, calorie and energy requirement shoots up for better development of foetus and maternal tissues. Increased calorie need is also essential metabolic rate as well. So, a nutrient high in calories, proteins, minerals, essential fats and light and easily digestible *(Jayyed al Kaimoos)* is recommended. *Unani* drugs are mostly administered according to the symptoms or complaints. The authors have carefully compiled the single and compound drugs that are administered during pregnancy. Most of the drugs already contains Omega-3-fats (which needs recognition) and other few are administered in pregnancy but they lack omega-3-fats which needs to be fortified with the same. Also, there are some special *Unani* diets that are recommended for pregnant women and are enriched with Omega-3-fats. USM has everything as a requisition for the sustenance of healthy pregnancy, but what lacks is the proper recognition and enlistment of the same. Effective and strategic marketing needs to be implemented for promotion of *Unani* fortified supplements.

Following is a list of *Unani* drugs according to ailments and symptoms.

General weakness: *Majun hamal ambari alwi khan, khameera marwareed, Jawarish loluwi, jawarish mastagi* [13,14,15,16,17].

Loss of appetite & pica

Gulqand, sharbate angoor, anaardana, Zarawand, Jawarishe ood tursh, sikanjabeen tufahi, arqe kewra, Rayee, Mastagi, Sudab [13-17].

Nausea

Sikanjabeen leemoni, gulqand, murabba leemokagzi, aabe nana (mint), Sharbat Angoor, behi, Murabba lemuni, Sikanjbeen Sada, Jawarish Anarain, jawarish amla [13-17]

Fever

khaksi, sheera tukhme khayarain, sheera tukhme kasni, arqe badyan, sharbat buzoori, gulqand [13-17].

Palpitation

Majun hafiz ul Janeen, Sharbat Tuffah, Dawa al-Misk and Khamira Marwareed, khameera abresham, khameera gaozaban, Arq-e-gauzaban sada ambari, Arq-e- badranjboya, arq mundi [13-17].

Flatulence

Jawarish kamooni, jawarish mastagi, safoof muqliyasa, tiryaqe arba [13-17].

Pain abdomen

Rogane gul (massage) [13-17].

Cough

Laooqe sapistan, sharbat aijaz, sharbate khashkhash [14].

Vulvar itching

Lu'ab khatmi, murdar sang (local application), [14].

Edema of legs

Barge kirnab (massage), *Rogane gul* (Local application) [14].

Per vaginal bleeding

Sitz bath/ abzan with poast gulnar, mazu, baloot, Qishoor Rumman, *Gulnar*

Syncope

Aab Anar (pomegranate juice), *Arq Gulab* (Rose distillate), *Arq Badiyan* (fennel extract), *Arq Gauzaban*, *Dawa al-Misk Motadil, Jawarish Amla*

Anaemia: *Sharbat Anarain, Sharbat Deenar, Sharbat Faulad, dates, gud (jaggery), chukandar*

Following is a list of few pregnancies indicated drugs having omega-3-fats.

S. No	*Unani* Single Drugs	Common Name	Scientific Name	Omega-3 Content (ALA/ EPA/ DHA)
1.	*Alsi*	Flaxseed	*Linum usitatissimum*	*50-60%* [18,19]
2.	*Amla*	Indian gooseberry	*Phyllanthus emblica*	*8-11.8%* [20-22]
3.	*Unnab*	Jujube / red date	*Ziziphus jujuba*	*42%* [23,24]
4.	*Anjeer*	Fig	*Ficus carica*	*32-50%* [25,26]
5.	*Behi*	Quince	*Cydonia oblonga*	*63.55%)* [27]
6.	*Gul-e-Gaozaban*	Borage flower	*Borago officinalis*	*7.91-27.36%* [28]
7.	*Chukandar*	Beetroot	*Beta vulgaris*	*2.33-48.23%* [29]
8.	*Moongphali*	Peanuts	*Arachis hypogaea*	*26.96%* [30]
9.	*Shajna/ saijna*	Drumstick / moringa	*Moringa oleifera*	33.00%- 54.27% [31]
10.	*Rumman*	Pomegranate	*Punica granatum*	0.40±0.05 [32]
11.	*Kaddu beej*	Pumpkin seed	*Cucurbita pepo*	0.69±0.13 [32]
12.	*Qaranfal*	Clove	*Syzygium aromaticum*	8.21% [33]
13.	*Afis*	Gall oak / oak gall	Quercus infectoria	1.31 % [34]
14.	*Kundur*	Indian frankincense	Boswellia serrata	1.61% [35]
15.	*Shahdana*	Sweet cherry (oil)	*Prunus avium*	Trace [32]
16.	*Khubani*	Apricot (oil)	*Prunus armeniaca*	0.2 ± 0.0 [36]
17.	*Aarhu*	Peach (oil)	*Prunus persica*	0.5 ± 0.1 [36]
19	*Aloo bukhara*	Plum (oil)	*Prunus domestica*	0.2 ± 0.0 [36]
20.	*Asl*	Honey	-	4.50–7.34 [37]

SUGGESTIONS/RECOMMENDATIONS

Most of the drugs administered during pregnancy has Omega-3-fats, but the lack of recognition makes it difficult to reach the pregnant masses. However, all *Unani* formulations do not have Omega-3-fats which also may be fortified with the same. *Unani* has come a long way since ages and has been continuously doing efforts for the betterment of the society. And with time certain new implications and changes may benefit our USM. *Unani* does have a module for pregnancy management and treatment but still there is no exclusive range of medicines for pregnant and lactating mass. The need of the hour is to collab with the research and development wings for production of a range only for pregnant women. For this the marketing strategy also needs to be modified. The supplements should also be labelled as 'enriched with Omega-3-fats', reason being today's world is self-educated, especially when it's related to pregnancy. Couples plan well in advance for family planning considering all the do's and dont's. *Unani* formulations will differ from current market pregnancy supplements as it will be free of chemical additives. *Unani* fortified supplements (relevant) will attract the pregnant mass more and will provide safe health benefits to mother and child. Social awareness, campaigning and advertising our fortified Range may add up to the reach of our product to the relevant population. And as per the research studies a healthy mother and healthy child is at a lower risk for the development of CVD's in later year of life. It's a cycle of events and are interconnected. A simple change of fortifying *Unani* formulations with Omega-3-fats is not just beneficial for mother and child but is also a proven nutrient as a prophylaxis for primary prevention of CVDs. Although, clinical trials (large sample size & multicentric) need to be conducted in *Unani* field to explore the efficacy of Omega-3-fats.

CONCLUSION

Considering the scientific importance of role of omega-3 fatty acids in primary prevention of cardiovascular diseases and in maintaining and enhancing mother & infant health development, Omega-3 enriched *Unani* formulations and food should be advocated to be used extensively during entire pregnancy period. Special *Unani* pregnancy kits (fortified with required nutrient like Omega-3-fats esp. DHA & EPA) should be formulated exclusively for pregnant-lactating women. Incorporation of the above-mentioned suggestions may increase the market value of *Unani* medicines as it will be safe and chemical free. Fortification may help in promoting *Unani* women and child health care services, which in turn may lead to *Unani* contribution towards the ongoing government programs for mother & child health care.

REFERENCES

1. Stewart J, Manmathan G, Wilkinson P. Primary prevention of cardiovascular disease: A review of contemporary guidance and literature. JRSM cardiovascular disease. 2017 Jan; 6:2048004016687211.doi: 10.1177/2048004016687211.
2. https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death{cited :1.3.2023}
3. https://data.worldbank.org/?locations=IN-XN {cited :1.3.2023}
4. https://www.cdc.gov/chronicdisease/resources/publications/factsheets/heart-disease-

stroke.htm#:~:text=Leading%20risk%20factors%20for%20heart,unhealthy%20diet%2C%20and%20physical%20inactivity. {cited: 30.06.2023}
5. Robson AA. Preventing diet induced disease: bioavailable nutrient-rich, low-energy-dense diets. Nutrition and Health. 2009;20(2):135-66.
6. Lands WE. Dietary fat and health: the evidence and the politics of prevention: careful use of dietary fats can improve life and prevent disease. Annals of the New York Academy of Sciences. 2005;1055(1):179-92.
7. Das UN. Essential fatty acids: biochemistry, physiology and pathology. Biotechnology Journal: Healthcare Nutrition Technology. 2006;1(4):420-39.
8. Willatts P, Forsyth JS. The role of long-chain polyunsaturated fatty acids in infant cognitive development. Prostaglandins, Leukotrienes and Essential Fatty Acids (PLEFA). 2000;63(1-2):95-100.
9. Litt J, Taylor HG, Klein N, Hack M. Learning disabilities in children with very low birthweight: prevalence, neuropsychological correlates, and educational interventions. Journal of learning disabilities. 2005;38(2):130-41.
10. McNamara RK, Carlson SE. Role of omega-3 fatty acids in brain development and function: potential implications for the pathogenesis and prevention of psychopathology. Prostaglandins, Leukotrienes and Essential Fatty Acids. 2006;75(4-5):329-49.
11. Barker DJ. The developmental origins of chronic adult disease. Acta paediatrica. 2004;93: 26-33.
12. Barker DJ. The origins of the developmental origin's theory. Journal of internal medicine. 2007;261(5):412-7.
13. Bashir F, Akhtar J, Anjum N, Alam S, Khan AA. Tadabeer-e-Haamla (Antenatal Care) An approach through *Unani* System of Medicine. International Journal of Scientific Research and Review. 2019; 8:40-7.
14. Shakoor F, Begum W, Khan AA. Antenatal care: an approach through Unani system of medicine. IJMPR. 2016;4(5):301-2.
15. HMA Khan. Akseerazam. New Delhi: Idara Kitabus Shifa; 2011; 813,823,824
16. HA Khan. Haziq. Karanchi: Madina Publishing Company; 1983; 488,492,493
17. Razi Z. Kitabul Mansoori New Delhi: Central Council for Research in *Unani* Medicine, 1991;105,109,120,132,137,139,222,390,391
18. Goyal A, Sharma V, Sihag MK, Tomar SK, Arora S, Sabikhi L *et al*. Development and physico-chemical characterization of microencapsulated flaxseed oil powder: A functional ingredient for omega-3 fortification. Powder Technology. 2015;286:527-37.
19. Rodriguez-Leyva D, Bassett CM, McCullough R, Pierce GN. The cardiovascular effects of flaxseed and its omega-3 fatty acid, alpha-linolenic acid. Canadian Journal of Cardiology. 2010;26(9):489-96.
20. Choudhary M, Grover K. Amla (Emblica officinalis L.) Oil. Fruit Oils: Chemistry and Functionality. 2019:875-82.
21. Arora A, Kumar I, Sen R, Singh J. Emblica officinalis (amla): Physico-chemical and fatty acid analysis from arid zone of Rajasthan. International Journal of Basic and Applied Chemical Sciences. 2011;1(1):89-92.
22. Mishra P, Mahanta CL. Comparative analysis of functional and nutritive values of amla (Emblica officinalis) fruit, seed and seed coat powder. American Journal of Food Technology. 2014;9(3):151-61
23. Maia M, Ferreira AE, Laureano G, Marques AP, Torres VM, Silva AB, Matos AR, Cordeiro C, Figueiredo A, Silva MS. Vitis vinifera 'Pinot noir'leaves as a source of bioactive nutraceutical compounds. Food & function. 2019;10(7):3822-7.
24. Martin ME, Grao-Cruces E, Millan-Linares MC, Montserrat-De la Paz S. Grape (Vitis vinifera L.) seed oil: A functional food from the winemaking industry. Foods. 2020;9(10):1360.
25. Baygeldi N, Küçükerdönmez Ö, Akder RN, Çağındı Ö. Medicinal and nutritional analysis of fig (Ficus carica) seed oil; a new gamma tocopherol and omega-3 source. Progress in Nutrition. 2021;23(2):1-6.
26. Güven N, Gökyer A, Koç A, Temiz NN, Selvi S, Koparal B, Dedeoglu DB, Öztürk BS, Büyükhelvacigil HF, Büyükhelvacigil R, Erman C. Physiochemical composition of fig seed oil from Turkey. Journal of pharmacy and pharmacology 2019;7:541-5.
27. Hamedi A, Sohrabpour M, Zarshenas MM, Pasdaran A. Phytochemical investigation and quantitative analysis of the fatty acids and sterol compounds of seven pharmaceutical valuable seeds. Current Pharmaceutical Analysis. 2018;14(5):475-82.
28. Borowy A, Chwil M, Kapłan M. Biologically active compounds and antioxidant activity of borage (Borago officinalis L.) flowers and leaves. Acta Scientiarum Polonorum Hortorum Cultus. 2017;16(5):169-80.
29. Biondo PB, Boeing JS, Barizão ÉO, Souza NE, Matsushita M, Oliveira CC *et al*. Evaluation of beetroot (Beta vulgaris L.) leaves during its developmental stages: a chemical composition study. Food Science and Technology. 2014;34:94-101.
30. Bonku R, Yu J. Health aspects of peanuts as an outcome of its chemical composition. Food Science and Human Wellness. 2020;9(1):21-30.
31. Oyeyinka SA, Abiodun OA, Oyeyinka AT, Dauda AO, Grassby T, Ade-Omowaye BI. Role of Moringa oleifera in nutraceuticals and functional foods. InHerbs, Spices and Their Roles in Nutraceuticals and Functional Foods 2023:69-94. Academic Press.

32. Siano F, Straccia MC, Paolucci M, Fasulo G, Boscaino F, Volpe MG. Physico-chemical properties and fatty acid composition of pomegranate, cherry and pumpkin seed oils. Journal of the Science of Food and Agriculture. 2016;96(5):1730-5.
33. Xue Q, Xiang Z, Wang S, Cong Z, Gao P, Liu X. Recent advances in nutritional composition, phytochemistry, bioactive, and potential applications of Syzygium aromaticum L. (Myrtaceae). Frontiers in Nutrition 2022;9:1002147.
34. El-Agbar ZA, Naik RR, Shakya AK. Fatty acids analysis and antioxidant activity of fixed oil of Quercus infectoria grown in Jordan. Oriental Journal of Chemistry. 2018;34(3):1368.
35. Ahmed HH, Abd-Rabou AA, Hassan AZ, Kotob SE. Phytochemical analysis and anti-cancer investigation of Boswellia serrata bioactive constituents in vitro. Asian Pacific Journal of Cancer Prevention 2015;16(16):7179-88.
36. Fratianni F, d'Acierno A, Ombra MN, Amato G, De Feo V, Ayala-Zavala JF *et al*. Fatty acid composition, antioxidant, and in vitro anti-inflammatory activity of five cold-pressed prunus seed oils, and their anti-biofilm effect against pathogenic bacteria. Frontiers in Nutrition. 2021;8:775751.
37. Manning R. Fatty acids in pollen: a review of their importance for honey bees. Bee world. 2001;82(2):60-75.