

## CONSUMERS' PERCEPTIONS AND KNOWLEDGE ABOUT HEALTH BENEFITS OF FUNCTIONAL FOODS. A STUDY OF PUNJAB PROVINCE, PAKISTAN

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Though the concept of Functional Foods (FFs) did exist thousands of years ago hence research on its beneficial effects on human beings started in Japan in 1980. It has been globally recognized that FFs have promising effect on human health. The research studies empirically supported the idea that FFs provide protection against certain cancer, cardiovascular, hypertension, bowel movement, constipation, diabetes, improved brain, metabolic and eye health etc. It is worth mentioning that Pakistan has 216.57 million people and the 6<sup>th</sup> most populous country of the world. No significant effort has planned to explore the peoples' knowledge and perceptions about the health benefits of different categories of FFs, such high anti-oxidant, green high fiber, pro-biotic, pre-biotic, omega 3, nuts & seeds, teas, herbs and spices. Keeping in view the promising health benefits of this food, a qualitative study with 50 participants/shoppers from the super stores situated in Faisalabad, Pakistan was conducted. Conservation analysis (CA) based on views of participants demonstrates that majority respondents were of the opinion that FFs have beneficial health impacts and provide the protection against many chronic diseases. As analysis indicates, there is no other opinion that fruits, vegetables, dry fruits, legumes, whole grain, herbs & spices which are used by the peoples of this region from centuries are the best for the healthy life of the people. Organic foods, protein from grass fed animals and cage free poultry and river fish are the best FFs for protecting and maintaining human health. It is suggested that the use of sweet, sweeten dairy products and beverages with added sugar and processed food which is poor in nutrients, vitamins and minerals may be avoided to develop immune system for providing protection against chronic diseases. Bulk of FFs of different varieties with different health benefits are available in the supermarkets, Government should frame policy of logo for those FFs which have promising health benefits.

**Keywords:** Functional Food, Health Benefits, Consumer Knowledge, Punjab, Pakistan.

### INTRODUCTION

The functional foods (FFs) are an important area that has been investigated in the discipline of Foods and Nutritional Sciences globally. A number of scientists have depicted and advocated that FFs provide best protection to human beings against many chronic diseases such as cardiovascular disease, cancer, diabetes, strokes, bowel health, hypertension and many more (Milner, 1999; Crowe *et al.*, 2013; Cheng *et al.*, 2017).

Functional foods also help in maintaining skin and membranes. These are good for the formulation of red blood cells, building and repairing body issues and building antibodies; because FFs, whether natural foods or fortified/enriched, have sufficient minerals calcium, phosphorous, magnesium, potassium, vitamins and fiber that is essential for maintaining human body health. For example, the whole grains have bran, germ and endosperm and also have niacin, folate, riboflavin and thiamin along with number

of minerals like iron, magnesium and zinc. These nutritional ingredients are found in the out layers of the grains required for fighting against type-II diabetes, cardiovascular disease, stroke, obesity and cancer (Kotilainen *et al.*, 2006; Spence, 2006; Litwin *et al.*, 2018; Zhang *et al.*, 2018).

The concept of FF is not new one it can be traced back to thousands of years, given by the father of medicine Hippocrates at around 2500 years ago (Singh *et al.*, 2018). Much clear and profound concept of FFs was introduced in 1980 when the Government of Japan provided funding for the empirical and scientific investigation to find the ability of foods for psychological health benefits and in minimizing the risk of morbidity and helping against different chronic diseases. In lieu of the findings of these scientific studies, Government of Japan framed regulation and law in 1991 about this specialized category of food for human beings (Hardy, 2000). Almost at the same time, the European Commission also approved to establish a scientific-based approach for defining the concept of FFs (Litwin *et al.*, 2018).

Thus, such empirical and scientific work has assisted in defining the concept of FFs. Though there are different definitions of FFs based on, either whole or enriched or fortified, hence with the objectivity that this food ensures better human health. The Academy of Nutrition and Dietetics, Institution of Food Technologies and International Life Search Institute have given definitions of FF primarily focusing on fortified, enriched or enhanced foods that have ability to improve human health through having psychological active foods ingredients (Gibson and Williams, 2000). However, the modified foods enriched through fortification, enrichment or agricultural chemicals and those focusing on isolated or synthesized food ingredients.

It would be pivotal to notice that different organizations claim health benefits of FFs and their ability to fight against chronic diseases, have common practice to add additional nutrients to the processed foods for convincing and winning trust of consumers but the element of maximizing the economic benefits is also the marketing strategy of these organizations. They bring such products in the market and do huge investment on advertisement to get convinced the consumers to ensure monetary benefits (Sutar *et al.*, 2010). A very little has been brought into the knowledge of the people about the numerous health benefits of conventional and unmodified foods like whole fruits, grains, nuts, vegetables, seeds, fish, meat, dairy and many more (Miano, 2016). Credit goes to scientists who have unfolded and explored the numerous health benefits of these natural FFs.

The qualitative study was planned to explore consumers' perceptions and knowledge about the health benefits of the FFs and how these foods are helping to fight against chronic diseases. Protecting against different diseases in human beings through proper food is unique, distinctive and diligent approach instead of relaying merely on chemical medicines; the former approach strengthens the human immune system and ensures the growth of good bacteria in the body that consequently control the function of free radical.

Awareness about FFs in developing countries is increasing as days pass on. Several forces are propelling the demand for FFs. Increasing health consciousness, growing health cost and awareness about the value of FF are the primary drivers now (Ali and Rahut, 2019). In Pakistan, the morbidity rates of different chronic diseases are alarming. Non-communicable diseases are estimated to account for 58 percent of all deaths in Pakistan of which 29 percent are patients of cardiovascular diseases (WHO, 2018). About 35.5 million people are suffering from diabetics making Pakistan the 7<sup>th</sup> country with high number diabetic patients; every sixth person is diabetic (GOP, 2018). Regarding cancer, every year 0.3 million new cases are diagnosed (GOP, 2018). Among male and female cancer patients the lung and breast cancer are common (The Nation, 2018). Daily Times of Pakistan in 2018 reported that Pakistan's 50 percent population is obese reflecting an alarming situation of obesity-basis for many communicable

and non-communicable diseases. The prevalence of such diseases is growing quite rapidly because Pakistan is the 6<sup>th</sup> most populous country of the world having 216.57 million populations in 2019 (UN, 2019). According to Securities and Exchange Commission of Pakistan (SECP), the total number of food and beverages companies registered with SECP till the end of June 2015 that took the figures at around 2500. Out of 2500 registered food and beverages companies, 145 were registered in FY15 only (Dawn, 2017). The daily Dawn reported that food sector in Pakistan has showing a lot of progress and identified the growing demand of processed/FFs that resulted rise in income level. In Pakistan negligible research has been conducted on consumers' knowledge, attitude and business opportunities along with health benefits of functional benefits reflecting a promising area for research.

## MATERIALS AND METHODS

Different mythologies are used for data collection with an objective to gather reliable data for having meaningful research findings that forced the researcher to draw conclusion and recommendations. Some studies were based on quantitative approach while some on qualitative. Both the approaches have their own merits and demerits and are adopted for data collection keeping in view the research objectives and time & resources available to researcher. Different national and international surveys and censuses are based on quantitative approaches to describe respondents' or shoppers' socio-economic, demographic profiles and characteristics. As the demand for explaining and understanding FF phenomenon in terms of behavior, attitude and preferences enhanced, the significance of qualitative studies was well understood and rationalized. The qualitative approaches are based on unstructured questions (guidelines only). The non-directive and open-ended questions allow individuals to respond without setting boundaries, also to explain and share experiences and attitudes in contrast to the structured and directive interview (Krueger, 1988).

In depth interviews are one of the qualitative approaches developed by private sector and widely used for promotional activities (Stycos, 1981). The qualitative techniques attract the attention of a broad spectrum of social scientists working in academic fields in their research to evaluate socially oriented programs and program managers (Folch-Lyon *et al.*, 1981). Social scientists working in the discipline of business management emphasize the significance of qualitative techniques for better understanding of people's views and preferences about FFs, their evaluation and advancement, consumers' attitude, knowledge and acceptance which mainly rely on knowledge attitude and practice studies (Folch-Lyon *et al.*, 1981; Knodel *et al.*, 1984). No doubt, quantitative methods give the answer to "how" individuals behave in certain circumstances, especially in-depth interviews or focus

group discussion intelligently respond to the diagnostic question of "why" (Folch-Lyon *et al.*, 1981).

Well-planned in-depth interviews or focus group discussions enable researchers to obtain perceptions on particular issues of interest in a permissive, non-threatening environment. The session involves small numbers of people, usually in the range of 8 to 10 (Krueger, 1988). The present study was planned to explore consumers' views and their knowledge about the health benefits of FF. For this purpose, in-depth interviews were conducted with 50 participants/ shoppers 10 from each superstore situated in Faisalabad, Pakistan city namely Metro cash and carry, Al-Fatah Shopping Mall, Imtiaz Super Market, Bambino Departmental Store and SB Departmental Store during the months of March and April 2019. Faisalabad is an industrial city with third biggest district of Pakistan with regard to population (GOP, 2017).

**Table 1. Family and demographic characteristics of the shoppers.**

Characteristics	Frequency	Percentage
<b>Gender</b>		
Male	26	52
Female	24	48
Total	50	100
<b>Family Structure</b>		
Nuclear	21	42
Joint	22	44
Extended	7	14
Total	50	100
<b>Marital Status</b>		
Married	35	70
Unmarried/separated/ divorced/widowed	15	30
Total	50	100

After taking the consent of shopper, who came in store for shopping, the study objectives were explained to the respondents. The in-depth interview was conducted with the participant at separate place in the store and it took, on an average, 45 minutes for each interview. After conducting and completing the interview with the shopper then consent was taken from the second one and so on. The interviews were conducted from 3.00 pm to 7.00 pm. In the same way, the in-depth interviews were conducted with the 50 participants. Conversation analysis (CA) was used to analyze the qualitative data of 50 participants. It seeks to pursue that aim through an extremely close scrutiny of the way we converse with one another; open coding is the part of analysis that pertains specially to the naming and categorizing of views of participants on FFs through close examination of qualitative data. During open coding the data were broken into discrete parts, carefully examined, compared for similarities and differences, summarized and then transcribed (Strauss and Corbin, 1990).

**Table 2. Socio-economic characteristics of the shoppers.**

Characteristics	Min.	Max.	Mean	SD
Household size (No. of persons)	3	15	6.8	2.74
Age(in years)	20	65	36.4	11.89
Income(million Pak rupees monthly)	0.01	0.2	0.049	0.035
Years of schooling	8	22	13.76	3.36

Min. = Minimum, Max. = Maximum, SD = Standard deviation

The socio-economic and demographic characteristics are presented in table 1. The education of participants varied from middle (8 years of schooling) to the highest degree that is PhD, with mean years of schooling about 13.76, standard deviation 3.36 years while income from PKR. 0.01 million to 0.2 million with mean income PKR. 0.049 million per month and standard deviation PKR. 0.035 million. The minimum and maximum age of participants were 20 years and 65 years with mean age 36.4 years and standard deviation 11.89 years while the household size varied from 3 to 15 persons with mean household size 6.8 persons and standard deviation 2.74 persons. Male and female shoppers were almost equal in number, 58 percent were living in joint and extended family systems reflecting presence of traditional family system while a substantial percent of shoppers i.e. 42 had the nuclear family arrangement. Overwhelming majority of shoppers were married i.e. 70 percent.

It was depicted that respondents identified a number of food items as FF using for the cooking like fruits, vegetable, flour of wheat, maize, grams and barley. Among spices, they pointed out ginger, garlic, onion, turmeric, cardamom, cumin seeds, basil, cinnamon, red pepper, white and black pepper, cloves, star anise, coriander seed, mint.

## RESULT AND DISCUSSION

Functional foods have of different categories like high anti-oxidant, green high fiber, pro-biotic, omega 3. There are nuts & seeds, teas, herbs and spices. These food categories have impact on human health. The respondents were asked in the in-depth interview; do you know that FF has health benefits? Most of the participants responded in YES. They explained that FFs have the multi-dimensional health impacts. Now-a-days people are much worried about cardiovascular diseases and hypertension; these diseases are growing rapidly in the society resulting in socio-economic implications on individuals, families and rapidly growing public expenditure. The participants of the study were of the opinion that the peoples are quite health conscious, searching information about foods that have curing effects on human health from the social media and interpersonal relations. They expressed that the foods with high anti-oxidant have beneficial health effects and regular use these foods improve quality of human health. The studies on FFs have advocated FFs categories' promising

health effects and those minimize the risk of cardiovascular diseases (Diplock *et al.*, 1999). When it was asked, which were those items that have anti-oxidant characteristics? A number of the participants replied that there are wide variety of the vegetables and foods that have anti-oxidant characters. They mentioned leafy-green vegetables are rich in anti-oxidant ingredients and were very useful for human health.

Studies indicated that vegetables have promising health benefits and provide a source of many nutrients, including potassium, fiber, folate (folic acid) and vitamins A, E and C. Options like broccoli, spinach, tomatoes and garlic provide additional benefits, known as super-food. Potassium maintains blood pressure. Dietary fiber helps to reduce blood cholesterol levels and fight against heart disease. Folate (folic acid) helps the body forming healthy red blood cells. Pregnant women in the first trimester of pregnancy need adequate folate to reduce the risk of neural tube defects and spine bifida during fetal development (USDA, 2015). Eating vegetables in abundance does help in minimizing such health problems.

They also stated broccoli, sweet potato, carrot, garlic, spinach, baronial (baygen), beats, red onion, beans and red cabbage being useful for human health. These vegetables are very rich in anti-oxidant are frequently used by us in our daily life. They provided very interesting information that from decades these vegetables are in their use without knowing their anti-oxidant characteristics and beneficial effects on human health. The credit goes to researchers who conducted researches on such foods and their characteristics like vitamins, minerals, etc., and the impact on human health. Modern information technology has played a vital role in defusing information globally about the uses of FFs. One of the participants expressed that:

“We frequently eat carrot, garlic, spinach and baronial (baygen) without knowing that these vegetables are good for heart health, Thanks to social media for providing useful information to us.”

When it was asked to the participants that if they had knowledge about the fruits which are good for health and rich in anti-oxidant? Without any reservation, they all replied that all the fruits are very useful for human health, there was no other opinion – they reiterated. The participants viewed fruits like oranges, papaya, apples, blackberry, strawberry, Kiev, grapes, tomatoes are the worth mentioning fruits that have rich characteristics of anti-oxidant and beneficial effects in improving heart health.

A common phrase prevails globally “An apple a day, keeps the doctor away” because apples are rich in dietary fiber, carbohydrate, vitamins C, K, B6, riboflavin, minerals, potassium, manganese, calcium and iron. Apples help in weight lost, digestions, gut health, save the colon mucous membrane from exposure to toxic substances, prevent cancer, improve eye sight, useful in treating anemia, control blood

sugar level, and keeps the cholesterol level lower (Koutsos *et al.*, 2015; Elliott, 2019).

It is also emerged from the participants’ discussion that Allah had mentioned six names of fruits in the Holly Book, The Quran. These fruits are olive (olive oil), figs, grapes, pomegranate, banana and dates (Ahmad *et al.*, 2009; Marwat *et al.*, 2009; Farhangi *et al.*, 2014; Desk, 2017), all these fruits are rich in anti-oxidant, fiber, vitamins minerals (Chobotova *et al.*, 2010; Müller *et al.*, 2016) not only good for heart health but also help to fight against other diseases like cancer, diabetes, gut problems, constipation, kidney stones and many more (Basu *et al.*, 2006; Yoneyama *et al.*, 2007). The Holly Prophet Muhammad (PBUH) also liked to eat these fruits along with barley, mushroom, honey, milk and for drinking water (Akgün and Öztürk, 2017; Raza, 2017; Anwaar, 2017, 2018). The participant’s discussion demonstrated that vegetables and fruits are best source of anti-oxidant and minimized the cardiovascular diseases and do improve human health. These fruits and vegetables not only regulate the heart health but many other diseases along with helping to fight against cancer (Miano, 2016).

As mentioned earlier, all fruits are good for human health; some are discussed in this paragraph. Studies on fruits advocated their health benefits. Olives are good source of vitamin E, iron, copper, and calcium prevent heart diseases and liver damage and also have anti-inflammatory effects (Boskou *et al.*, 2006; Di Benedetto *et al.*, 2007). Oranges are rich in vitamin C, potassium, vitamin B such as thiamine and folate (Elliott, 2019) and reduce the risk of kidney stones (Wabner and Pak, 1993) increase iron absorption and prevent anemia (Ballot *et al.*, 1987; Péneau *et al.*, 2008). Bananas are rich in vitamins, minerals, and very high in potassium improve blood sugar control and digestive health (Schwartz *et al.*, 1988; Bird *et al.*, 2000; Topping and Clifton, 2001). Red and purple grapes have high antioxidant contents reduce inflammatory, protect heart, eyes, joints and brain (Seymour *et al.*, 2010; Tomé-Carneiro *et al.*, 2013; Ha *et al.*, 2014; Mossalayi *et al.*, 2014; Reinisalo *et al.*, 2015). Papaya is rich in vitamin C, A, potassium and folate also has antioxidants character (Gajowik and Dobrzyńska, 2014) minimizes the risk of cancer and improves digestion (Muss *et al.*, 2013; Schweiggert *et al.*, 2014).

The participants had shown great concerns about the un-planned use of pesticide on fruits and vegetables to control insects. Such intensive and excessive use of pesticides on vegetables and fruits spoil their anti-oxidant character and cause serious health implications. The un-planned use of pesticide also damages the growth of good bacteria in the body (pro-biotic), resulting in the active function of free-radicals. This entire mechanism spoils the human immune system resulting in victim of many diseases.

The participants expressed that the policy framed for pesticide use must be implemented in the letter and spirit to safeguard the human health. It is heard that in the western countries the

people are shifting from inorganic food to organic food which is free from the use of chemical fertilizer and pesticide and rely upon natural fertilizer to ensure the soil as well as human health. One of the participants presented very horrible picture how the vegetable growers use pesticide on vegetable.

"I have seen a vegetable farmer mixed up the pesticide with water in a big container and washing up the cabbage for killing insects, such cabbage instead of having beneficial effect will have serious health implications."

People do not bother about other people's health, even the farmers, knowing the serious impact of their action which may seriously damage human health. They maximize their profit at the cost of human health. There is need to change the mind set of people for building healthy society. It was asked to the participants how organic vegetable can be taken for family. They have given the example of kitchen gardening. Now this technology is well developed to grow vegetable in pots if land is not available but some efforts are required. One of the respondents reported that:

"we grow vegetables like chilies, cucumber, carrot, radish, radish pods, fenugreek, baronial, tomatoes, spinach, green leaf of mustard, turnip and many more at our home. These organic vegetables are rich in aroma and taste and good for human health."

Vegetables help to minimize the risk of chronic diseases and have the beneficial effects on human health. Brightly colored red and oranges vegetables such as carrots and peppers are rich in beta-carotene that protects skin. Keeping in view the significance of beneficial effects of vegetable in improving human health, the characteristics of some vegetables are described: Spinach is an important source of vitamin A and K (Link, 2017), antioxidant, in beta-carotene and lutein reduces the risk of chronic diseases and lowers the blood pressure (Yang *et al.*, 1996), helps in cancer prevention (Mdiziniso *et al.*, 2006) minimizes prostate cancer (Xu *et al.*, 2014) and reduces lung cancer (Pisani *et al.*, 1986). Carrots are rich in vitamin C, K and potassium (Anderson *et al.*, 2009). Green peas are incredibly, nutritious contain fiber, protein, vitamin A, C, and K, riboflavin, thiamin, niacin and folate (Link, 2017) improve digestive health, help in the growth of beneficial bacteria in gut and regulate bowel movements (Moses *et al.*, 2014). Due to the richness in sapiens, it has anti-cancer effects (Moses *et al.*, 2014) by reducing tumor growth. Sweet potatoes contain fiber, protein, vitamin C, B, potassium, and magnesium (Link, 2017), also rich in beta-carotene that reduces the risk of cancer including breast cancer, due to having anti-diabetic character reduce blood sugar and blood cholesterol (Ludvik *et al.*, 2004).

It has been also asked to the respondents about the foods which were rich in fiber. Most of the participants, without any confusion, reported that vegetables and fruits, pluses and grains are rich in fiber and such foods are also useful for digestive/gut health. They had given the example of coconuts, fruits, legumes whole grains, nuts and seeds. These fruits and

grains are rich in fiber ensures human health. Foods which have good in fiber should be part of your diet that ensure your heart health and regularities in bowel movement, address the problem of gastrointestinal and constipation. Regarding constipation there is consensus among the Hakims that it is mother of all diseases. One of the participants viewed that the use of white flour for bread making at home creates many health problems like gastro, indigestion, acidity and constipation. One of our family friends guided us to use whole wheat flour for bread (chapati), with the use of whole grain flour our gastrointestinal problems are reduced significantly. When it was asked about the processed food, all the participants reported that this food had on the rising trend in the market, individuals and families ate this processed food like pizza, chicken shawarma, ice cream and sweets. Everyone eats this food despite knowing that this is not good for health. Although having information about harmful effects of junk food, people are of the opinion that homemade food is healthy for health, but children force their parents for the junk food. There is no doubt having such information are essentially important for making or food taking decisions. It is established social fact that human attitude and behavior takes a longer time to be changed. The knowledge of such information about the benefits of food rich in fiber surely safeguards individual, family and community health.

One of the participants has given the example of chapatti (bread) made of white flour as discussed earlier: "she reported that, this bread difficult to chew and eat. It takes quite longer time to digest and having health implications".

The FF has indicated have many categories; one is known as omega-3 foods. No doubt there is emerging tendency to advertise the health benefits of this food by the food-industry. They have launched many products in market rich in omega-3 and claimed different health benefits.

It was asked to participants whether they had knowledge about omega-3, rich foods and their health benefits. Most of the participants of qualitative study, those are highly educated and belongs to well off families, were very health conscious and they reported that food rich in omega-3 was very good for heart health. Decide beneficial effects for heart health and also good for decreasing incidences of depression, joint pain and improve cognitive brain function.

When it is asked what are the major sources/food for omega-3, some of the participants had poor knowledge about the foods rich in omega-3 while a substantial number of participants had the knowledge of food/sources for omega-3. They had pointed out that wild caught fish like salmon and sardines are rich in omega-3 but these fish are very expensive and were beyond the purchasing power of majority population. There is common perception prevailing in society that fish is good for cardiovascular diseases. There were days, people prefer to eat chicken and mutton instead of fish to address their dietary protein requirements. Due to the information technology there is flow of information that how

to improve heart health and what are suitable foods for it. Now in the market the fish sale is on the rise and that is good change occurring in society. One of the participants reported that “No doubt fried boneless fish was good one but no comparison with baked smoked fish available in market. It is good in taste, texture and fragrance. When we eat with family really enjoy”. When it is asked what were other sources for getting omega-3. They reported that walnuts, chia seeds and flax seeds are also rich in omega-3. People are well aware of the benefits of the walnuts but have poor knowledge of chia and flax seeds. One of the participants reported that it is the contribution of investment of science and technology that provided such useful and authentic and empirically based evidences about the health benefits of different vegetables, grains, fruits, meat and legumes. Now the milk shake of flax seed is available in the market. One of the participants said that flax seeds were used by our forefathers from decades, keeping in view its health beneficial effects. The specific health impacts have come in their knowledge after conducting empirical research by the food scientists. The participants pointed out the importance of animal protein like eggs, meat, poultry and fish, the essential ingredients for the keeping human body healthy. Balanced nutrients diet is required to maintain human healthy, active and energetic life. As it is emerged from the participants’ discussion that as far as mutton is concerned that is out of the reach of people purchasing power, well off families can afford it. The poultry is available to people in Pakistan which is raised in poultry farms and given hormonal feed, adversely affecting human health. Participants viewed that there was no other alternative just to rely on hormonal feed poultry and eggs. Regarding fish, people do not normally eat in the months of April, May, June July and August because these months are hot ones in Pakistan. There is common saying attached with eating fish that fish should not be eaten in the months which have the word “RAAY” in Urdu and “R” in English. The fish eaten in these months are dangerous for human health through damaging the health of liver, the participants viewed. One participant expressed that:

“The fish that was available in the market was raised in the fish farms given hormonal feeds for rapid growth for commercialization marketing. Wild-caught fish from river and ocean is rarely available in the market”.

Regarding eating of chicken, feelings are growing in the society that it is better to eat vegetable and pulses instead of cage-raised poultry. One respondent explained it in very interesting words:

“Chicken meat available in the market is causing many diseases, disordering the female’s period time and skin problems. It is better to eat pulses which are more safe and healthier”. Respondents also pointed out all those modernizations that had brought many comforts but at the same time responsible for many draw backs as the unhygienic, unhealthy raising chicken and fish at farms. There was time when family raised own cage free poultry

providing them healthy meat and eggs. One participant said I belong to rural areas where my other relatives lived and had back yard poultry. She expressed that in the following words: “We are raising chicken in our back yard and we are getting healthy eggs and chicken meat. It is great blessing of Almighty ALLAH.”

Participants also pointed out that in early days in rural areas almost every family had buffalos, cows and goats and got fresh milk, butter, buttermilk and meat. She further said, “Now such healthy food is a dream. It is entirely due to shift from traditional lifestyle to modern mechanized lifestyle”.

There is another category of nuts and seeds known in Pakistani culture as dry fruits. In the early days, different perception and understanding were prevailing in society about the benefits and misunderstanding of eating dry fruits. Thanks to the scientist who provided empirical support and evidence about the beneficiary effect of dry fruits or nuts and seeds.

When it was asked to the participants about the benefits of eating nuts and seeds for improving human health they had clearly viewed that dry fruits like almonds, cashew, chia, and walnuts are rich in anti-oxidant contents, due to having required essential minerals for human body are extremely useful for human health and are important source for obtaining healthy fats and fibers. The dry fruits also provide protection to heart and brain. One of the participants pointed out that olive and olive oil are very useful for regulating heart function and lowering the bad cholesterol and increasing the good cholesterol. The use of extra virgin olive oil improves the heart health because it is rich in anti-oxidant contents.

The studies provide support that dry fruits and nuts have unimaginable health benefits. Dry fruits and nuts are good source of protein, rich in calcium, source of potassium, vitamin B, antioxidant character, good for muscular health, prevent arthritics, improve heart health, prevent stroke, maintain brain concentration, strengthen bones and teeth, improve digestion, prevent chronic diseases, having elements of anticancer, nourish skin, rich in iron and calories (Retakristiani, 2018). This food category also contains important minerals such as phosphorous, potassium, zinc, selenium and copper in large quantities essential for fetal development (Retakristiani, 2018).

Spices, teas and herbs are an important category of functional food and have been in use of people from decades in the subcontinent. There is possibility people used herbs and spices for enhancing the taste of food, now the research has provided empirical support about charismatic health effects of this food category and this food category is also rich in anti-oxidant contents. The participants reported that spices and herbs like onion, ginger, garlic, turmeric, cinnamon, coriander, mint and many more are in their use for food preparation from centuries in this region. One participant said beautiful words about the spices and herbs (“without these spices and herbs there will be no taste of food, these foods are

also rich in anti-oxidant without adding any calorie additional benefits of these herbs and spices”).

Garlic is a medicinal plant with roots traced back to ancient China and Egypt (Petrovska and Cekovska, 2010) having many health benefits (Bayan *et al.*, 2014). It regulates blood sugar, improves heart health and insulin sensitivity (Liu *et al.*, 2005) reduces blood and LDL cholesterol while increases HDL cholesterol (Bordia, 1981) minimizes the risk of cancer along with liver cancer cell (Chu *et al.*, 2012). Ginger minimizes the risk of nausea (Viljoen *et al.*, 2014), inflammatory related disorder like arthritis and lupus (Grzanna *et al.*, 2005) reduce knee pain (Altman and Marcussen, 2001) and regulate blood sugar (Khandouzi *et al.*, 2015).

Herbs have beneficial effects on human health. This food category boosts psychological health, reduces the cancer, regulates bowel movement, have inflammatory properties, rich in antioxidants, improves cardiovascular health, anti-bacterial and anti-fungal, gives relief to cold and cough, improves hair, bones and skin health, and also helps fighting against infection (Jessimy, 2019).

It is also emerged from the participant's discussion that black tea, salt grass, coffee, were not frequently used in the early days in this region. When British government established in this region then the concept of black tea and coffee emerged. Now-a-days this food category is intensively used by all segments of society. They reported that they also attained this knowledge from media, friends and relative about the health benefits of this category of FF having contents of anti-oxidant, anti-inflammatory and anti-microbial properties. Properly grown, harvested and roasted coffee, black and green tea minimizes the risk of liver cancer, type 2 diabetes, and heart health (Lupkin, 2015; Postuma *et al.*, 2012).

It was asked to the respondents about Pre-biotic and Pro-biotic foods. The participants conceived it new concept. After explaining this concept of food, they expressed that pro-biotic foods are essential for protecting the linings of gastrointestinal, intestinal tract, assisting in absorption of nutrition addressing the digestive problem and also help in fighting against infection. When it was asked what are those foods which are pro-biotic. Mostly said yogurt is good as pro-biotic food. It is fermented and cultural food and it is used in Indian sub-continent from centuries. One of the participants said that:

“Dahi (yogurt) is best for digestive problems and keep the stomach and heart healthy”

Some of the participants pointed out buttermilk (lassi) is also pro-biotic. The pro-biotic is good or friendly bacteria which strengthens immune system and fights against almost all diseases at the same time there is a bad bacterium like fungi, viruses which kills good bacteria and helps the functioning of free-radicals. The participants asked how the good bacteria can be multiplied in other words how the growth of good bacteria is ensured. As it is emerged from the participants'

discussion the pre-biotic helps to multiply pro-biotic bacteria. Major source of pre-biotic bacteria is raw onion, garlic, apple cider, vinegar, rava, green beans, barley, banana, tomato, potatoes, grains and oat meal. The best way to obtain pre-biotic bacteria is to eat raw plant foods which also have digestive enzymes that help nutrients absorption. One of the participants asked question how the good bacteria are reduced or killed causing multiple health problems, as emerged from discussion that anti-biotic, intensive un-planned use of pesticide, anti-bacterial products like soap are the major sources that damage or kill good bacteria.

**Conclusion and Recommendations:** The study findings demonstrate that colored, brightly vegetables and fruits like oranges, berries, papaya, sweet-potatoes, carrots, broccoli are the important sources of anti-oxidant, ensures health and help in fighting against many diseases like cardiovascular, cancer, diabetes, gut health, movement of bowel, skin, bones, muscles, stress and many more. The food rich in fiber like coconuts, fish, fresh fruits avocado, whole grains like wheat and barley, legume ensures digestive/gut health along with minimizing the risk of cardiovascular diseases and regulates appetite. The human health is regulated by good and bad bacteria. The good bacteria controls or minimizes the function of free-radicals, improves immune system and minimizes the risk of all diseases while the bad bacteria in human body causes many diseases. The good bacteria are known as pre-biotic. Their growth is ensured taking/eating onions, garlic, potatoes, banana, beans and grains, yogurt and buttermilk. Pre-biotic foods protect the lines of gastrointestinal tract and minimize the occurrence of digestive problem. It is stressed upon eating fish, walnuts, flax seed which are rich in omega 3, addresses health problem like joint pain, depression and improve brain health. All types of seeds and nuts known as dry fruits are extremely useful and effective in protecting against many diseases should be a part of regular food. The spices, herbs and teas which are rich in anti-oxidant contents should also be a part of daily food. The study findings highlighted its importance in improving human health. If it is possible the animal proteins taken from animals, those are grass fed and cage free, useful for human health along with minimizing poultry given hormonal growth feed. It should be kept in mind to minimize the intake of sweets and sweeten dairy products and beverages added sugar products like syrup, fractions. Briefly, avoid eating such foods in which sugar is added. There is empirical support that highly processed food are low in nutrients, vitamins, minerals rich in refined sugar, saturated fat and sodium damaging effect on human health. Such food should also be avoided. In nut shells all kind of vegetables, fruits, grains, seeds, dry fruits and animal protein should be taken in moderation to keep the body healthy for enjoyment in life as we cannot enjoy our lives without having extremely healthy body. Bulk of FFs of different varieties with different health benefits are available in the

supermarkets, Government should frame policy of logo for those FFs which have promising health benefits.

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## REFERENCES

- Ahmad, M., A. Khan, K. Marwat, M. Zafar, M.A. Khan, U. Hassan and S. Sultana. 2009. Useful Medicinal Flora Enlisted in Holy Quran and Ahadith. *J. Agric. Environ. Sci.* 5:126-140.
- Akgün, S.D. and L. Öztürk. 2017. Cuisine and Dishes in Use During the Prophet Muhammed Era (A.D. 569-632). *Eur. J. Interdiscip. Stud.* 9:81-85.
- Ali, A. and D.B. Rahut. 2019. Healthy foods as proxy for functional foods: Consumers’ awareness, perception and demand for natural functional foods in Pakistan. *Int. J. Food Sci.* 19:1-12.
- Altman, R.D. and K.C. Marcussen. 2001. Effects of a ginger extract on knee pain in patients with osteoarthritis. *Arthritis Rheum.* 44:2531-2538.
- Anderson, J.W., P. Baird, R.H. Davis, S. Ferreri, M. Knudtson, A. Koraym, V. Waters and C.L. Williams. 2009. Health benefits of dietary fiber. *Nutr. Rev.* 67:188-205.
- Anwaar, A. 2018. 10 Favorite Foods of the Prophet to Improve Your Diet, About Islam. <https://aboutislam.net/reading-islam/about-muhammad/10-favorite-foods-of-the-prophet-to-improve-your-diet>.
- Ballot, D., R.D. Baynes, T.H. Bothwell, M. Gillooly, J. Macfarlane, A.P. Macphail, G. Lyons, D.P. Derman, W.R. Bezwoda, J.D. Torrance and J.E. Bothwell. 1987. The effects of fruit juices and fruits on the absorption of iron from a rice meal. *Br. J. Nutr.* 57:331-343.
- Basu, A., S. Devaraj and I. Jialal. 2006. Dietary factors that promote or retard inflammation. *Arterioscler. Thromb. Vasc. Biol.* 26:995-1001.
- Bayan, L., P.H. Koulivand and A. Gorji. 2014. Garlic: a review of potential therapeutic effects. *Avicenna J. phytomedicine* 4:1-14.
- Bird, A.R., I.L. Brown and D.L. Topping. 2000. Starches, resistant starches, the gut microflora and human health. *Curr. Issues Intest. Microbiol.* 1:25-37.
- Bordia, A. 1981. Effect of garlic on blood lipids in patients with coronary heart disease. *Am. J. Clin. Nutr.* 34:2100-2103.
- Boskou, G., F.N. Salta, S. Chrysostomou, A. Mylona, A. Chiou and N.K. Andrikopoulos. 2006. Antioxidant capacity and phenolic profile of table olives from the Greek market. *Food Chem.* 94:558-564.
- Cheng, H.M., G. Koutsidis, J.K. Lodge, A. Ashor, M. Siervo and J. Lara. 2017. Tomato and lycopene supplementation and cardiovascular risk factors: A systematic review and meta-analysis. *Atherosclerosis* 257:100-108.
- Chobotova, K., A.B. Vernallis and F.A.A. Majid. 2010. Bromelain’s activity and potential as an anti-cancer agent: Current evidence and perspectives. *Cancer Lett.* 290:148-156.
- Chu, Y.L., C.T. Ho, J.G. Chung, R. Rajasekaran and L.Y. Sheen. 2012. Allicin induces p53-mediated autophagy in Hep G2 human liver cancer cells. *J. Agric. Food Chem.* 60:8363-8371.
- Crowe, K.M. and C. Francis. 2013. Position of the academy of nutrition and dietetics: functional foods. *J. Acad. Nutr. Diet.* 113:1096-1103.
- Dawn. 2017. Diverse food business surges, Dawn. 10 April 2017.
- Desk, S. 2017. 6 Fruits According to Quran and Sunnah That Every One Should Eat. Islamic Information All about Islam. <https://theislamicinformation.com/fruits-quran-sunnah>.
- Di Benedetto, R., R. Vari, B. Scazzocchio, C. Filesi, C. Santangelo, C. Giovannini, P. Matarrese, M. D’Archivio and R. Masella. 2007. Tyrosol, the major extra virgin olive oil compound, restored intracellular antioxidant defences in spite of its weak antioxidative effectiveness. *Nutr. Metab. Cardiovasc. Dis.* 17:535-545.
- Diplock, A.T., P.J. Aggett, M. Ashwell, F. Bornet, E.B. Fern and M.B. Roberfroid. 1999. Scientific Concepts of Functional Foods in Europe Consensus Document. *Br. J. Nutr.* 81:1-27.
- Elliott, B. 2019. The 20 Healthiest Fruits on the Planet, Healthline media. 3 October 2016. Pp 1-19.
- Farhangi, H., M. Ajilian, M. Saeidi and G.H. Khodaei. 2014. Medicinal fruits in Holy Quran. *Int. J. Pediatr.* 2:89-102.
- Folch-Lyon, E., L. de la Macorra and S.B. Schearer. 1981. Focus group and survey research on family planning in Mexico. *Stud. Fam. Plann.* 12:409-432.
- Gajowik, A. and M.M. Dobrzyńska. 2014. Lycopene - antioxidant with radioprotective and anticancer properties. A review. *Rocz. Państwowego Zakładu Hig.* 65:263-271.
- Gibson, G and C. Williams. 2000. Functional foods: Concept to product, Woodhead Publishing Series in Food Science, Technology and Nutrition. 205:640.
- GOP. 2017. Pakistan Bureau of Statistics, Province wise provisional results of census. Government of Pakistan.
- GOP. 2018. The Diabetic Prevalence survey of Pakistan, Islamabad, Pakistan.
- Grzanna, R., L. Lindmark and C.G. Frondoza. 2005. Ginger - An herbal medicinal product with broad anti-inflammatory actions. *J. Med. Food.* 8:125-132.
- Ha, J.-H., P.K. Shil, P. Zhu, L. Gu, Q. Li and S. Chung. 2014.



- Ocular Inflammation and Endoplasmic Reticulum Stress are Attenuated by Supplementation with Grape Polyphenols in Human Retinal Pigmented Epithelium Cells and in C57BL/6 Mice. *J. Nutr.* 144:799-806.
- Hardy, G. 2000. Nutraceuticals and functional foods: Introduction and meaning. *Nutrition* 16:688-697.
- Jessimy, M. 2019. 15 Impressive Health Benefits of Herbs - Natural Food Series. <https://www.naturalfoodseries.com/15-health-benefits-herbs>.
- Khandouzi, N., F. Shidfar, A. Rajab, T. Rahideh, P. Hosseini and M.M. Taheri. 2015. The effects of ginger on fasting blood sugar, hemoglobin A1c, apolipoprotein B, apolipoprotein A-I and malondialdehyde in type 2 diabetic patients. *Iran. J. Pharm. Res.* 14:131-140.
- Knodel, J., N. Havanon and A. Pramualratana. 1984. Fertility transition in Thailand: a qualitative analysis. *Popul. Dev. Rev.* 10:297-328.
- Kotilainen, L. 2006. Health Enhancing Foods: Opportunities for Strengthening the Sector in Developing Countries. International Bank for Reconstruction and Development: The World Bank.
- Koutsos, A., K.M. Tuohy and J.A. Lovegrove. 2015. Apples and cardiovascular health-is the gut microbiota a core consideration. *Nutrients.* 7:3959-3998.
- Krueger, R.A. 1988. Focus Groups: A Practical Guide for Applied Research. Sage Publications, London.
- Link, R. 2017. The 14 Healthiest Vegetables on Earth, Health line. <https://www.healthline.com/nutrition/14-healthiest-vegetables-on-earth>.
- Litwin, N., J. Clifford and S. Johnson. 2018. Function Food for Health. Extension. Colorado State University.
- Liu, C.T., H. Hse, C.K. Lii, P.S. Chen and L.Y. Sheen. 2005. Effects of garlic oil and diallyl trisulfide on glycemic control in diabetic rats. *Eur. J. Pharmacol.* 516:165-173.
- Ludvik, B., B. Neuffer and G. Pacini. 2004. Efficacy of Ipomoea batatas (Caiapo) on Diabetes Control in Type 2 Diabetic Subjects Treated with Diet. *Diabetes Care.* 27:436-440.
- Lupkin, S. 2015. Up to 5 Cups of Coffee a Day OK, Gov't Advisory Committee Says. ABC News. <https://abcnews.go.com/Health/cups-coffee-day-govt-advisory-committee/story?id=29085259>.
- Marwat, S.K., M.A. Khan, M.A. Khan, M. Ahmad, M. Zafar, F. Rehman and S. Sultana. 2009. Fruit plant species mentioned in The Holy Qura'n and Ahadith and their ethnomedicinal importance. *J. Agric. Environ. Sci.* 5:284-295.
- Mdziniso, P., H.J. Hinds, D.D. Bellmer, B. Brown and M.E. Payton. 2006. Physical quality and carotene content of solar-dried green leafy and yellow succulent vegetables. *Plant Foods Hum. Nutr.* 61:3-21.
- Miano, T.F. 2016. Functional Food-A Review. *Eur. Acad. Res.* 4:5695-5702.
- Milner, J.A. 1999. Functional Foods and Health Promotion. *J. Nutr.* 129:1395-1397.
- Moses, T., K.K. Papadopoulou and A. Osbourn. 2014. Metabolic and functional diversity of saponins, biosynthetic intermediates and semi-synthetic derivatives. *Crit. Rev. Biochem. Mol. Biol.* 49:39-462.
- Mossalayi, M.D., J. Rambert, E. Renouf, M. Micouleau and J.M. Mérillon. 2014. Grape polyphenols and propolis mixture inhibits inflammatory mediator release from human leukocytes and reduces clinical scores in experimental arthritis. *Phytomedicine.* 21:290-297.
- Müller, A., S. Barat, X. Chen, K.C. Bui, P. Bozko, N.P. Malek and R.R. Plentz. 2016. Comparative study of antitumor effects of bromelain and papain in human cholangiocarcinoma cell lines. *Int. J. Oncol.* 48:2025-2034.
- Muss, C., W. Mosgoeller and T. Endler. 2013. Papaya preparation (Caricol®) in digestive disorders. *Neuro Endocrinol. Lett.* 34:38-46.
- Péneau, S., L. Dauchet, A.C. Vergnaud, C. Estaquio, E. Kesse-Guyot, S. Bertrais, P. Latino-Martel, S. Hercberg and P. Galan. 2008. Relationship between iron status and dietary fruit and vegetables based on their vitamin C and fiber content. *Am. J. Clin. Nutr.* 87:1298-1305.
- Petrovska, B. and S. Cekovska. 2010. Extracts from the history and medical properties of garlic. *Pharmacogn. Rev.* 4:106-110.
- Pisani, P., F. Berrino, M. Macaluso, U. Pastorino, P. Crosignani and A. Baldasseroni. 1986. Carrots, green vegetables and lung cancer: A case-control study. *Int. J. Epidemiol.* 15:463-468.
- Postuma, R.B., A.E. Lang, R.P. Munhoz, K. Charland, A. Pelletier, M. Moscovich, L. Filla, D. Zanatta, S.R. Romenets, R. Altman, R. Chuang and B. Shah. 2012. Caffeine for treatment of Parkinson disease: A randomized controlled trial. *Neurology.* 79:651-658.
- Raza, T. 2017. It's time for us to start eating like Prophet Muhammad. The Muslim Vibe. <https://themuslimvibe.com/faith-islam/its-time-for-us-to-start-eating-like-prophet-muhammad>.
- Reinisalo, M., A. Kärland, A. Koskela, K. Kaarniranta and R.O. Karjalainen. 2015. Polyphenol stilbenes: Molecular mechanisms of defence against oxidative stress and aging-related diseases. *Oxid. Med. Cell. Longev.* 15:1-24.
- Retakristiani, 2018. 25 Unimaginable Health Benefits of Nuts and Dried Fruit. [drhealthbenefits.com. https://drhealthbenefits.com/food-beverages/nuts/health-benefits-of-nuts-and-dried-fruit](https://drhealthbenefits.com/food-beverages/nuts/health-benefits-of-nuts-and-dried-fruit).
- Schwartz, S.E., R.A. Levine, R.S. Weinstock, S. Petokas, C.A. Mills and F.D. Thomas. 1988. Sustained pectin ingestion: Effect on gastric emptying and glucose tolerance in non-insulin-dependent diabetic patients. *Am. J. Clin. Nutr.* 48:1413-1417.

- Schweiggert, R.M., R.E. Kopec, M.G. Villalobos-Gutierrez, J. Högel, S. Quesada, P. Esquivel, S.J. Schwartz and R. Carle. 2014. Carotenoids are more bioavailable from papaya than from tomato and carrot in humans: A randomised cross-over study. *Br. J. Nutr.* 111:490-498.
- Seymour, E.M., M.R. Bennink, S.W. Watts and S.F. Bolling. 2010. Whole grape intake impacts cardiac peroxisome proliferator-activated receptor and nuclear factor kb activity and cytokine expression in rats with diastolic dysfunction. *Hypertension.* 55:1179-1185.
- Singh, A.K., A.K. Chaturvedani, N.P. Singh and A. Baranawal, 2018. Nutraceuticals: Meaning and regulatory scenario. *Pharma Innov. J.* 7:448-445.
- Spence, J.T. 2006. Challenges related to the composition of functional foods. *J. Food Compos. Anal.* 19:4-6.
- Strauss, A. and J. Corbin. 1990. *Basics of Qualitative Research: Grounded Theory Procedure and Techniques.* Newbury Park, CA. Sage Publications.
- Stycos, J.M. 1981. A Critique of Focus Group and Survey Research: The Machismo Case. *Stud. Fam. Plann.* 12:450.
- Sutar, N., P.P. Sutar and D. Mohapatra. 2010. New Horizons In Functional Food Sector: An Indian Perspective. *J. Dairying, Foods H.S.* 29:166-172.
- The Nation. 2018. Over 148,000 Pakistanis diagnosed with cancer annually. 4 Febuary 2018.
- Tomé-Carneiro, J., M. González, M. Larrosa, M.J. Yáñez-Gascón, F.J. García-Almagro, J.A. Ruiz-Ros, F.A. Tomás-Barberán, M.T. García-Conesa and J.C. Espín. 2013. Grape resveratrol increases serum adiponectin and downregulates inflammatory genes in peripheral blood mononuclear cells: A triple-blind, placebo-controlled, one-year clinical trial in patients with stable coronary artery disease. *Cardiovasc. Drugs Ther.* 27:37-48.
- Topping, D.L. and P.M. Clifton. 2001. Short-chain fatty acids and human colonic function: Roles of resistant starch and nonstarch polysaccharides. *Physiol. Rev.* 81:1031-1064.
- UN. 2019. *Pakistan Population 2019*, Department of Economics and Social Affairs, Population Division, United Nation, USA. Worldometers. <https://www.worldometers.info/world-population/pakistan-population>.
- USDA. 2015. *Health Benefits of Vegetables: Vitamins, Nutrients, Fiber.* U.S. Department of Agriculture. Washington, DC. <https://www.healthyeating.org/Healthy-Eating/All-Star-Foods/Vegetables>.
- Viljoen, E., J. Visser, N. Koen and A. Musekiwa. 2014. A systematic review and meta-analysis of the effect and safety of ginger in the treatment of pregnancy-associated nausea and vomiting. *Nutr. J.* 13.1:20.
- Wabner, C.L. and C.Y.C. Pak. 1993. Effect of orange juice consumption on urinary stone risk factors. *J. Urol.* 149:1405-1408.
- WHO, 2018. *Pakistan, Non-Communication Disease, Country Profile.* 2018.
- Xu, Xin, Y. Cheng, S. Li, Y. Zhu, Xu, Xianglai, X. Zheng, Q. Mao and L. Xie. 2014. Dietary carrot consumption and the risk of prostate cancer. *Eur. J. Nutr.* 53:1615-1623.
- Yang, Y., C.Y. Huang, S.S. Peng and J. Li. 1996. Carotenoid analysis of several dark-green leafy vegetables associated with a lower risk of cancers. *Biomed. Environ. Sci.* 9:386-392.
- Yoneyama, S., K. Miura, S. Sasaki, K. Yoshita, Y. Morikawa, M. Ishizaki, T. Kido, Y. Naruse and H. Nakagawa. 2007. Dietary intake of fatty acids and serum C-reactive protein in Japanese. *J. Epidemiol.* 17:86-92.
- Zhang, B., Q. Zhao, W. Guo, W. Bao and X. Wang. 2018. Association of whole grain intake with all-cause, cardiovascular and cancer mortality: A systematic review and dose-response meta-analysis from prospective cohort studies. *Eur. J. Clin. Nutr.* 72:57-65.

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