

Trends in Nutrition Transition: Pakistan in Focus

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Introduction

The world 'is experiencing an accelerated epidemic of diet-related non-communicable diseases. Unbalanced and excessive food and nutrient intakes, often closely associated with other changes in lifestyle that include less physical activity, stress, tobacco smoking and excessive alcohol consumption, underlie a range of these diseases. These include coronary heart disease, hypertension and stroke, various cancers, non-insulin dependent diabetes mellitus, obesity, dental caries, gall bladder disease and osteoporosis¹.

Obesity has emerged as a world wide epidemic not only prevalent in the affluent and developed countries, but is also appearing rapidly in less wealthy and developing countries. One of the explanations for obesity and other non-communicable diseases is the 'Barker's Hypothesis', the basic concept of which is that factors affecting the fetus and the young have long lasting effects and are important causes of diseases later on in life². Under-nutrition in utero and in infancy may cause 'programming' of the body in such a way that it may lead to a number of diseases in adulthood, including obesity. Popkin and other researchers have presented another hypothesis of the Developmental and Nutrition Transition. Various papers from the developing world describe the concept of the nutrition transition, which is a sequence of characteristic dietary and nutritional patterns resulting from large shifts in the overall structure of the diet, correlated with changing economic, social, demographic and health factors³. These changes are associated with a high prevalence of obesity, particularly childhood obesity⁴.

Pakistan is still in the early stages of the nutrition transition. High rates of intra—uterine growth retardation. low birth weight and subsequent malnutrition are seen. Most work done on children has concentrated on malnutrition, and obesity has not been studied adequately. However. the National Health Survey data set clearly shows the double burden of under—nutrition and over-weight in adolescents and adults. More adolescents are under weight than overweight, while the opposite is true for adults⁵. With the high prevalence of stunting in children and a shift in dietary and lifestyle patterns, countries like Pakistan may experience a larger burden of stunted-obese individuals in the next few decades.

There is a great need to conduct representative surveys of the population to study the changing trends in the dietary and life style pattern of Pakistani families and their consequences on the health of the population. It is essential to analyse whether obesity is more closely associated with stunted children in Pakistan: to see whether these trends follow into adulthood: to assess whether there is evidence to prove the hypotheses mentioned earlier. This paper is a review of the relevant literature. The main focus is on the developmental transition and its impact on the developing countries. A number of people have studied these changes in various countries. The present paper analyses the situation in Pakistan. in the light of the international literature and the limited local data that are available. The paper further assesses Pakistan's stage of development and discusses the implications of this transition on health. Some recommendations are made especially in terms of directions for policy makers.

Discussion

Obesity is becoming an increasingly important public health issue. It is not just restricted to affluent countries, but the prevalence is increasing in developing countries as well. In some of the Latin American and Asian countries, not only is adult obesity seen, but childhood obesity is also an emerging

problem. Obesity is very closely related to a number of non-communicable and chronic diseases.

Barker's Hypothesis

'The child is father to man', is the principal on which this hypothesis is built. The concept is that factors affecting the foetus and the young have long lasting effects and are important causes of diseases later on in life. During growth associations have been found for glucose intolerance in spurts, which are periods of sensitive and critical growth in fetal life and infancy, the actual 'programming' of the body takes place². The timing of these critical periods of development differs for different tissues⁶⁻⁸. As growth depends on nutrition, the foetus responds to a lack of nutrients by adapting a slow rate of cell division. Hence each brief period of under-nutrition may permanently reduce the number of cells in a particular organ. In this way under—nutrition in utero can have lasting memories on the body⁶. Barker's group of researchers also showed that it is the disproportionately short, thin or small baby that is associated with diseases and risk factors, and not the proportionately small babies. These have a slow growth trajectory. an adaptation to continuous under—nutrition, which evenly reduces the demand for nutrients in fetal life^{6,9}.

Coronary heart diseases and associated conditions such as hypertension, insulin response to glucose, cholesterol metabolism, blood coagulation and hormonal settings have been shown to be associated with foetal origins in England^{7,10} Sweden¹¹ and South India¹². Similar adults exposed to famine in Netherlands⁸. for ischaemic heart disease in Sweden¹¹, for non-insulin diabetes and obesity¹⁴.

Animal studies show that rats that are malnourished in utero or in early childhood become overweight adults when put on unrestricted In humans, exposure to famine in early pregnancy and low birth weight have been associated with adult obesity and greater waist to hip ratio, respectively. Improvement in the socio-economic status and diet subsequent to childhood malnutrition are thought to strengthen these associations^{8,17}.

Critique of Barker's Hypothesis

Barker's hypothesis is in line with the body of research of the past fifty years on the deferred effects of fetal exposure to underweight, famine, viral infections, atomic bombs, hormonal treatment during pregnancy and smoking¹⁸. None of the studies done actually measure the nutritional intake of the mother or the baby. Early malnutrition is inferred indirectly from fetal and infant growth¹⁸. The studies mostly use conveniently available cohorts, mostly from developed countries, where malnutrition is relatively less common. Little attention has been paid to issues like selection bias and confounding, inconsistencies in evidence, the fact that the hypothesis is not rigorously tested and is usually broadly stated^{18,19}. Also the fact that twins who have restricted fetal growth, do not suffer from a greater risk of mortality than the general population^{18,20}. It is not that the hypothesis has been rejected. but it requires more careful testing before it can form the basis for national policy¹⁸.

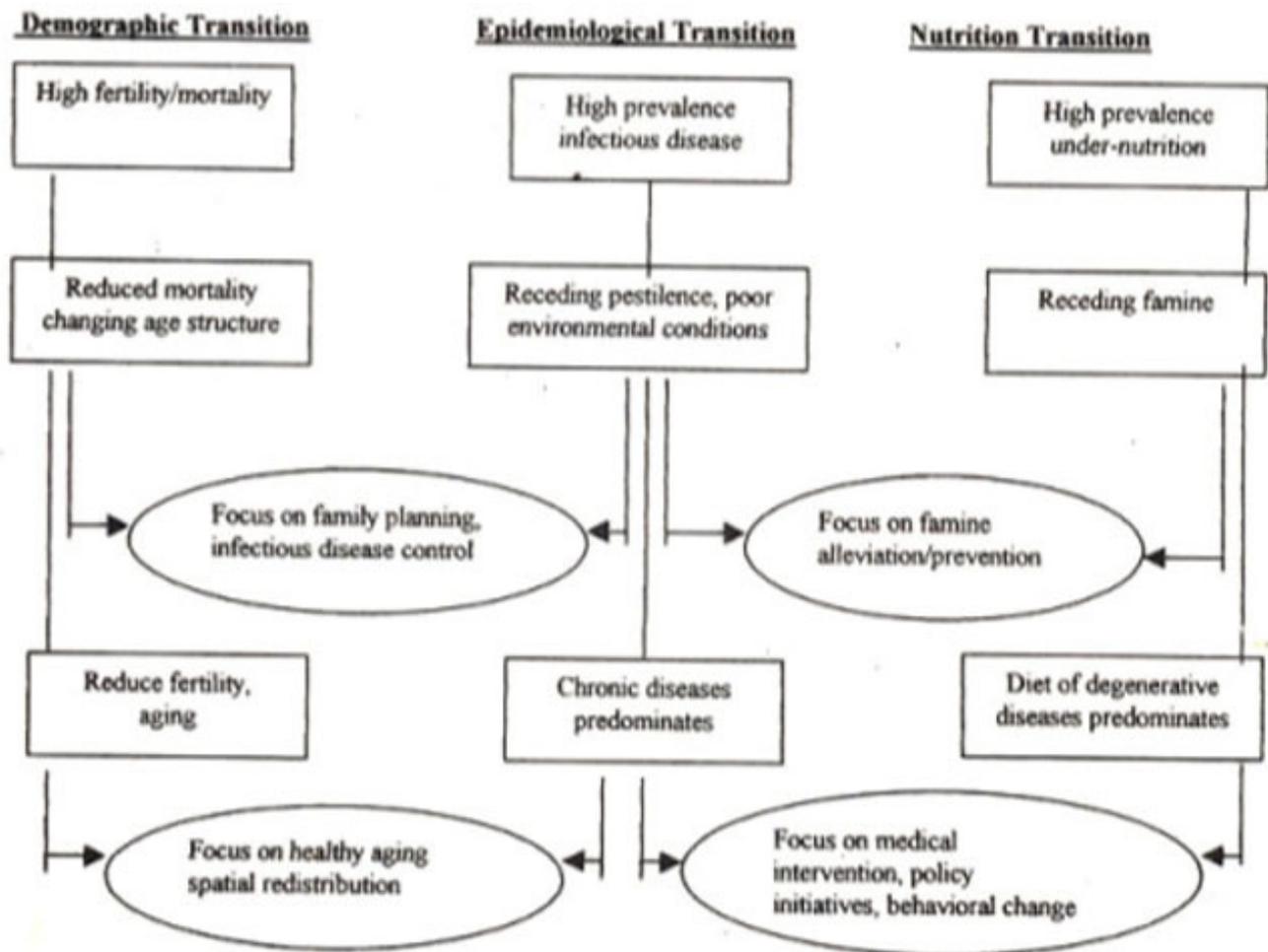
Development and Nutrition Transition

As opposed to the above work on the 'programming hypothesis'. there is research that suggests that socio-economic, epidemiological, demographic and nutritional factors may be responsible for the emergence of a considerable excess of obesity in the developing countries.

The prevalence of under-nutrition is very high in Pakistan and has not reduced much over the years. The prevalence of stunting in children under five years has reduced very slightly from 43 per cent in 1977²¹, to 42 percent in 1986²² and 36 per cent in 1992⁵. Whereas wasting in the under five year olds has remained almost static being 9 percent in 1977²¹, 10.8 per cent in 1986²³ and 9 per cent in 1992⁵. In spite of the fact that a large burden of malnutrition persists in the country, the problem of obesity has started to emerge⁵. Unfortunately, trends on obesity are not available.

Although the surveys done in the 70s and 80s^{21,22} were specifically nutrition surveys, they did not report on obesity. The main thrust of both the Micronutrient Survey of Pakistan 1976-77 and the

National Nutrition Survey 1985-87 was on studying under-nutrition other aspects such as dietary pattern, infant and child feeding practices, etc. were also studied^{21,22}. The later survey does look at overweight and obesity in pregnant and lactating women, but the indicator used is body mass index (BMI), which is not useful in determining the health status of the pregnant mothers. As pregnancy and lactation have been reported together, the prevalence of obesity cannot be determined for lactating mothers either. It is possible that these surveys did not aim to look at obesity, even though the problem was there. On the other hand it is more likely that during the 70s and 80s, obesity was not perceived as a public health issue and hence not studied. Even in other countries of the South Asian region, mostly under-nutrition has received attention and it is only recently that over-nutrition has been looked at²³. The National Health Survey 1990-94 (NHS), does report on obesity⁵. About 1 percent of the population was reported to be obese and 5 percent overweight in the 15-24 years age group. In the older age group i.e., 25-44 years, the prevalence increased to 6 and 15 percent for obese and overweight, respectively⁵. Along with obesity, figures for other degenerative diseases are also high⁵. A comparison with two cross sectional surveys in Brazil supports the findings that underweight has decreased over 5 years in both children and adults, whereas obesity has increased in adults but not in children²⁴. Pakistan like many other third world countries is experiencing a double burden of health problems. This double burden is typical for countries passing through the developmental transition, whereby poverty is slowly being eradicated and varying proportions of the populations achieving affluence²³. The developmental transition encompasses a number of transitions within it. It involves demographic and epidemiological transitions as well as health and nutrition transitions, which occur simultaneously.



(Popkin B. M., 1994).

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Figure. Stages of Health, Nutritional and Epidemiological Change.

Figure presents these changes, which have long since been recognised in the developed world. The developing countries are now passing through the same process. However, the important difference is that the transition in the developing countries is much more rapid than in the developed countries and along with it the technological advancement is not as rapid. Therefore the developing countries are in for a greater impact, such as China is already experiencing²³. In China the nutritional problems have become bipolar—problems of deficit among the poor and problems of excess in the rich. Brazil, on the other hand is experiencing an increase in the problems of dietary excess, and because food security is not a problem, a decrease in under-nutrition²⁵. The enormity of the task at hand is not yet fully recognised by most countries²³.

Demographic Changes

The third world countries are at various stages of struggle to achieve socio-economic development. The demographic transition grows out of this struggle. It is characterised by a progressively aging population, which is a consequence of a rapid decline in fertility, a decline in mortality—whether modest or significant. China is a classic example of these changes. The under fifteen population has significantly decreased, whereas the 15-64 year old group has increased, It is projected that the over 65 years age group will increase in the next decade³. This rapid process in China has grown out of the

adaptation and enforcement of a 'one-child policy', because of which the total fertility rate (TFR)-----

studied these changes in some South-East Asian countries and found that as the population moved up the socioeconomic scale, the dietary pattern changed. Coarse grains were substituted with prestigious cereals (wheat and rice), that result in a significant decrease in the amount of fibre intake. The consumption of green leafy vegetables remained low, but the fat intake increased, so did the animal food and sugar. Overall the energy consumption increased in relation to the energy expenditure. The beneficial change that Gopalan found was an increase in the use of legumes, fruits and vegetables^{23,35}.

Table. Comparison of Food Consumption Patterns in Pakistan and China.

Food Groups	Average Grams Per Person Per Day			
	Pakistan		China ⁺	
	1978*	1988**	1978	1987
Total cereals	532.0	502.0	534.2	684.9
Wheat	448.2	439.0	NA	NA
Rice	74.6	61.0	NA	NA
Other cereals	19.2	NA	NA	NA
Pulses	24.0	43.0	NA	NA
Fats & oils	54.9	33.0	4.7	15.3
Eggs	5.3	7.0	5.5	15.3
Fish	6.3	6.0	9.6	15.1
Meat	24.8	39.0	23.3	49.3
Roots	26.6	40.0	NA	NA
Leafy vegetables	33.1	10.0	205.53	372.6
Other vegetables	16.4	81.0		
Fruits	10.0	8.0	17.5	35.6
Milk products	363.4	161.0	3.0	9.6
Sugar	64.6	39.0	9.6	18.4

* = G.O.P., 1978

** = G.O.P., 1988

+ = Popkin B. M., et al, 1993

NA = Not available

Table shows a comparison of trends in the consumption of food in Pakistan and in China. interestingly, the data from Pakistan over the decade from 1978 to 1988 shows a tremendous decrease in the consumption of sugar, fats and oils. in spite of this, the number of grams used per person per day

is still very high. Similar is the case of milk products. These is, however, an increase in the consumption of meat, vegetables, roots and pulses. There is a dire need to conduct up to date surveys to assess the trends now. Health professionals need to probe further into the issue and assess the causes and the implications of these dietary changes. There is evidence suggesting that diet composition has an association with the development of obesity³⁶⁻³⁷. This would suggest that as a consequence of consuming large amounts of fats, oils and sugars, the population could suffer from obesity.

The Western industrialised nations are spending money on programs to convince their citizens to replace dietary fat with simpler diets based on grains, vegetables and fruits and at the same time the developing nations use their meagre income increases to replace their traditional diets, rich in fibre and grains, with 'Western diets' rich in fats and caloric sweeteners⁴. This is perhaps because the Western fat rich diet has always been regarded as a sign of prosperity. The Chinese diet was generally assumed to be low in fat, and was thought to be a reflection of poverty, rather than concerns for nutrition and health⁴. Hence as income becomes better, the diet diversifies and people consume more of foodstuff that was not previously accessible to them. Jointly, this dietary shift and lowered physical activity are a leading cause of increased obesity in many low-income countries and in sub-populations in others^{4,38}.

Association of Stunting and Overweight

Researchers have found that there is an association between stunting and obesity. In Brazil, Sawaya et al found that in both younger children and adolescents, obesity associated with stunting was more common than obesity without stunting, in both sexes³⁹. In Guatemalan children, born in deprived communities, poor linear growth or stunting in childhood was associated with increased abdominal fatness (increased waist to hip ratio)¹⁷. These findings are the same reported from the Netherlands in 1976 by Ravel I i8 Recent work further strengthens this association. It was observed that a slight improvement in food availability in a low—income population, with high prevalence of malnutrition and stunting, might very easily lead to obesity³⁹. In Brazil like Pakistan, stunting is the most frequently seen nutritional disorder. In their study Sichieri R. et al (1996)⁴⁰ found that high weight-for height was mainly dependent on the low stature reached by children. But researchers have asked why the pattern of stunting and obesity did not exist in earlier periods, when rates of stunting were similarly high?⁴¹ A possible explanation is that due to poor socio-economic conditions, obesity was not a physical possibility. A study in Chile correlates the level of poverty to prevalence of low height-for-age in children³⁴. With the development and nutrition transitions now, the income of people is increasing. With this is the corresponding change in lifestyle and diet that makes the situation conducive for obesity i This would explain at least part of the increasing burden of obesity in developing nations. Migrant studies have shown that given the opportunity to grow to genetic potential, people from developing countries show the same pattern of chronic diseases, as people from developed countries. McKeigue (1997)⁴² concluded that migrant South Asian populations develop high rates of coronary heart diseases and diabetes in association with central obesity. These patterns of susceptibility probably result from past adaptation to survival under adverse conditions. The ability to deposit fat in visceral depositions, for instance, may be advantageous under conditions of unreliable food supply and physically demanding work. The experience of migrant populations provides a window to predict the pattern of morbidity and mortality that will emerge in the countries of migrant origin⁴².

The Transition Stages and Pakistan's Position

Popkin has presented his views on how the developmental transition progresses in five stages. It would be beneficial to see where Pakistan fits into it. A brief description of these stages is given below. The first stage is 'the food collection stage'. People move from one place to another to hunt for food. Their diets are varied, with large amounts of carbohydrates and fibre. Nutritional deficiencies are few and the fertility rate is low. The main killers are infectious diseases, because of which mortality is high and life expectancy is low²⁵. Before Europeans colonised Australia in 1788, the Aborigines were hunter

gatherers and had this kind of lifestyle.⁴³

The second stage of transition, 'famine', is characterised by a less varied diet, with periods of famine. Social stratification begins and people start taking up occupations such as animal husbandry and agriculture. Nutritional deficiencies emerge, from which women and children suffer most. Fertility is naturally high, life expectancy low due to starvation and epidemics and consequently mortality—both infant and maternal—is high. In general, most countries are beyond this stage, but in some African countries famine is still seen²⁵. In Pakistan, there are pockets such as the Tharparkar desert area, where there is little to eat and generally the features are similar to this stage. But Pakistan mainly falls between the third and the fourth stages of this transition.

Stages three and four are the 'receding famine' and 'degenerative diseases' stages. With the limited data that are available, it can be assessed that Pakistan has some features of both the stages. Crop rotation and use of fertilisers has been in Pakistan for sometime now. Women have joined the labour force, although not in equal numbers and status as men. More recently mechanisation and technological revolution has started, which are features of stage four.

Similar is the case of diet. The country has characteristics of stage three and is adopting those of stage four. People use few starchy staple and more animal protein. Food variety continues to be low. In the high socioeconomic strata, changes towards more fat especially: from animal sources, more sugar, processed foods and consequently less fibre can be seen. These changes are alongside a shift towards a sedentary life style²⁵. The trends towards eating out, especially fast food is increasing at a tremendous rate. The available fast foods are mostly high in fat, mainly from animal sources. These changes are typical of stage four, but to be able to actually assess exact changes in the dietary pattern more information is required, but is presently not available.

Stage three is characterised by a decrease in mortality, static fertility at first and then a decline, with a cumulative population growth²⁵. The trends in both infant and maternal mortality show that although the decline in death rates is not very significant yet, there is a reduction in mortality. In 1978 the infant mortality rate (IMR) was 120/1000 births and the maternal mortality rate (MMR) was 700/100,000 live births. This has declined to 95 and 500, respectively in 1997²⁷. The crude death rate has declined from 14 to 9.1 in these years. The cumulative population growth rate is 2.6127. The TFR has been fluctuating between 6.0 and 6.9 in the 70s and 80s. In the 90s it has been reported to have reduced to 5.426, while Pakistan has not reached stage four as far as fertility is concerned, which is expected to be low and fluctuating in stage four, it has the life expectancy of this stage. Male life expectancy at birth has risen from 54 in 1978 to 61 in 1993 and that of females from 53 to 60 years²⁷. Pakistan also shows the stage four feature of growth in income and in income disparities.

On the health side the third stage is characterised by infectious diseases, parasitic diseases, polio, growth retardation and diarrhoea, which first expand and then decline. For most of these, Pakistan has seen the increase but the decline is yet to come. For example, the number of wasted children under five years has remained static over a 15-year period and stunting has reduced only by 7 percent⁵. Anemia was reported in 45 percent of the pregnant and lactating women in 1986 and 42 percent for all child-bearing age women in 1992⁵. The two figures are not comparable, but if anything it shows that the prevalence of anemia may have increased.

Pakistan has also started to show signs of stage four health changes. Chronic diseases such as heart diseases and cancers are manifesting themselves in substantial numbers. Cardio-vascular diseases affect about 18 percent of the population fifteen years and above. The prevalence of these diseases increases with age and is more common in high socio-economic classes and in urban areas⁵. It is not possible to say much about trends in chronic diseases, because of a lack of information. There are no regular health and dietary surveys to show how disease patterns are changing and what the causes are. Using the emergence of obesity and other diet-related chronic diseases of affluence as a crude indicator, it can be

suggested that the traditional Pakistani diet is giving way to the Western diet. Hence, although malnutrition and deficiency diseases are still prevalent in the low socio-economic strata, obesity is emerging at the other end of the spectrum.

Stage five 'the behavioural change stage' is recognised by high industrialised robotization and mechanisation, leisure exercise grows to offset sedentary jobs: less fat processing and increased use of carbohydrates, fruits and vegetables: reduces body fat and obesity and improves bone health. A life expectancy of 70 and 80 years, with an increase in disability free life is had. Improved health promotion, both preventive and therapeutic, leads to a decline in coronary heart disease, improved in age-specific cancer risk and consequently an increased proportion of elderly over 75 years²⁶. The developed countries are at this stage. If the developing countries learn from the lessons of the developed world and enact policies in the right direction earlier on in the transition, it may be possible to reduce the damage that stages three and four can do to the health of the population.

Implications of Developmental Transition: Future Directives

The Government of Pakistan rightfully recognises the importance of nutrition on the health of people^{27,44,46}. Improving the nutritional status of people has been an objective for planning in its own right. A whole range of policies and programs have been suggested²⁷⁻⁴⁵ and separate funds allocated to it⁴⁶. Under the umbrella of nutrition importance is given to the prevention of malnutrition (underweight), low birth weight and deficiency diseases^{27,44}.

The thrust of the discussion on developmental transition is that as nations undergo transition, the demographic make-up of the country changes. It is essential that countries recognise this change and cater for the new problems that emerge with the changing population⁴⁷. Hence policy recommendations in this direction are imperative. At this stage the requirements would be of a preventive nature, while in the future the requirement would be for effective treatment programs^{23,47}. Preventing obesity and chronic diseases would require much less money than that required for treatment programs^{3,23}. Hence keeping in view Pakistan's position in the transition pattern and the experience of other countries, obesity and other chronic diseases are problems in which failure to articulate primary prevention measures and health awareness programs now, will lead to a waste of precious monetary resources being allocated to its treatment later. Also that prevention is the only possible way out with problems like obesity and chronic diseases. Treatment is only marginally effective and mostly leads to weight cycling (cycles of weight gain and loss). This is more harmful than the original problem.

In no way is this arguing against the importance of programs directed towards under-nutrition¹⁷. But the fact is that a major cause of under-nutrition in Pakistan is the maldistribution of food and is therefore preventable⁴⁶. What is needed is a shift in the resource allocation formula: to bring about a balance in the money spent on under-nutrition and over-nutrition³.

Experience from China^{3,25}, Thailand²⁵, India²³, Latin America²⁵ and African countries²⁴ suggests that the traditional focus of developing countries on poverty and deficiencies leads to resource allocation in this direction only. It is important not to magnify the problem of deficit or distort resource allocation, which might actually hurt the poor who then start to suffer from problems of dietary excess. The promotion of one unified, balanced diet is required, instead of special diets for the two groups²⁵. It is important to emphasize the relationship of nutrition to the development of chronic diseases and obesity. Chronic diseases related interventions must not be entirely focused on medical interventions but should also include food and nutrition guidelines and other educational interventions related to nutrition²⁴. Yet no isolated nutrition program can effectively deal with this problem alone²³, what is required is an integrated food and nutrition policy. This demands inter sectoral collaboration. Not just the health sector policy, but all sectors need to be aware of the impact policies have on the health of the population. Health is a by-product of decisions that are being made in agriculture, politics, economics,

public works and the like⁴⁸. Hence all policies should be “healthy public policies”. The Government of Pakistan recognises this in the Ninth Five Year Plan⁴⁵, but needs to take steps to implement it. Norway is one country that has effectively been able to develop an integrated policy⁴⁹ and the effects on the health of its people can be clearly seen^{4,25}.

There is a lot to be done, before Pakistan can reach the goal of developing an effective nutrition and health policy. Information on dietary trends and changes taking place over time need to be assessed. There is a dire need for a central data collection unit, which collects information on an on-going basis, analyses it and gives feedback to the Government and the people. Such information would form the basis of appropriate guidelines for the population. It must be remembered that great caution needs to be exercised when suggesting guidelines for the general population⁴⁷. There need to be National goals, strategies and recommendations for children, adolescents, pregnant and lactating women⁴⁸. To be effective, these strategies should be culturally sensitive, grounded in tradition and values that promote health and well-being³³.

In general the recommendations should include the following:

- Moderation in food, to maintain appropriate energy intake and body weight⁴⁷.
- Recognize energy needs decline with age and decreased activity¹⁷.
- Avoid excessive intakes of fat, especially saturated fats and cholesterol⁴⁸.
- Increase the intake of complex carbohydrates and dietary fibre and limit the sugar intake to moderate levels⁴⁸.
- Combat the use of alcohol and tobacco⁴⁸.
- Moderation in salt use⁴⁷.
- Eat plenty of fresh fruit and vegetables⁴⁸.
- Promotion of healthy lifestyles, such as physical activity⁴⁸.
- Reduce stresses⁴⁸.
- Improvement in the working conditions⁴⁸.

Educating the public is very essential. Educational programs should start very early in schools and be reemphasized through other programs such as community awareness campaigns, mass media and health professionals⁴⁵. Children in schools can be reached through nutrition education curricula, fitness programs and modification of school meals to meet the suggested dietary guidelines^{27,45}.

Mass media is a good way to reach a large number of people. The recent campaigns for family planning and use of iodised salt have been fairly successful in raising awareness. Television, radio, cinema, press and other sources cover almost the whole population^{27,46}.

The lady health workers' (LHW) program also has a great outreach. A lot can be achieved in terms of educating the public through lady health workers. As education is the only thing that works out and goes a long way, investing in it is the most efficient use of funds^{23,27}.

The role of Non-Governmental Organizations (NGO) and Community Based Organizations (CBO) cannot be emphasized enough. Such organizations work at the grass root level, with the people and know the actual limitations and problems of the people. They can effectively help develop workable guidelines. Developing partnerships between the public and private sectors, involving industries, shopkeepers association, consumer groups, health and medical associations in educating the public and providing healthy food stuff help build the spirit of good nutrition²⁷.

Monitoring and surveillance systems need to be strengthened at local, provincial and national levels³³. No program can succeed if monitoring, evaluation or feedback is inadequate. These systems must have links back into the community, otherwise the exercise is fruitless. The timeliness of the feedback and

action is of the essence²³.

To develop a coherent policy, it is imperative that governments focus on the whole, and not part of the picture. Running supplementary feeding programs can only work as a trigger for improving the health status of the people, as India has experienced²³. They are costly and cannot be sustained. The change has to be in income and food affordability, in production and availability of foodstuffs, and in the social structure of our societies, in order to reinforce women's health along with that of their families.

Accessibility to good quality and appropriate health services and improved literacy and awareness of health issues, such as family planning must play central roles.

Developing countries like Pakistan are at a cross road, where the issues of deficit and the issues of excess exist together. It is time the world realises that obesity, cardiovascular diseases, diabetes and other diseases of 'affluence' are not issues on the agenda for only the developed world, they are being plagued with them at an even faster rate. It is not enough to reduce mortality and increase life expectancy; it is also essential to improve the quality of life of the people.

Conclusion

This paper has reviewed two possible explanations of the emergence of the obesity epidemic in the developing countries. These countries are now face-to-face with a dual burden of under-nutrition and over-nutrition. Barker's group of researchers has shown that it is periods of under-nutrition in utero and in early infancy that programs the body in such a way, that it leads to obesity and chronic diseases later on in adult life. The work of Popkin and other researchers has been on the development and nutrition transition, which involves an improvement in income, a change in the demography of the country and a control over infectious diseases. Along with this dietary and nutritional shifts from a high fiber, less varied diet to a more varied, high calorie diet, reduced physical activity and other lifestyle factors are the cause of obesity in people from the under developed world.

Irrespective of whichever hypothesis one assumes to be true, the importance of a balanced and nutritious diet throughout life cannot be over emphasized. If it is the nutrition transition hypothesis—the importance lies in avoiding excessive intakes of fats and sugars and increasing the amount of fiber, coarse cereals and vegetables. If it is the Baker's hypothesis then poor dietary intake during pregnancy and in early infancy are crucial. The focus therefore needs to be good nutrition throughout life, for optimal health.

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