Chapter 7

General Discussion
The aim of this PhD project was to explore the diet and cardiovascular disease risk among South Asians including Pakistanis and change in diet after migration among South Asian Surinamese with the presumption that there are ethnic differences regarding diet and cardiovascular disease risk among different Asian subgroups living in the Netherlands. The research questions were related to dietary intake / change in diet and cardiovascular related risk factors among Pakistanis and change in dietary intake among the South Asian Surinamese. We also presumed that there are ethnic differences regarding diet and cardiovascular related risk factors among different Asian groups living in the Netherlands, so we compared diet and cardiovascular related risk among two Asian groups namely South Asian Surinamese and Javanese Surinamese living in Amsterdam, the Netherlands.

**Main findings and comparison with existing literature**

We will briefly discuss the results of different studies incorporated as chapters in our thesis to answer the above mentioned research questions.

*Obesity and cardiovascular disease risk among indigenous and immigrant Pakistanis*

Chapter 2 systematically describes the gender and ethnic differences and also comparisons between the indigenous Pakistani population and immigrant Pakistani population regarding the prevalence of general/central obesity and cardiovascular disease (CVD) risk factors such as diabetes mellitus type 2, hypertension, and hypercholesterolemia among the indigenous and immigrant Pakistani communities. The studies in this systematic review included two large scale studies namely National Health Survey of Pakistan (NHSP) and Pakistan National Diabetes Survey (PNDS) which are large scale representative studies of indigenous Pakistani population due to their large sample size, good response rates and clinical measurements along with other relatively small studies based on sample size. Regarding the prevalence of obesity and related CVD risk factors, there was high prevalence of obesity and associated CVD risk factors among the indigenous Pakistani populations. Based on gender stratification, women had higher prevalence of central obesity as compared to men; though there were no consistent differences regarding the prevalence of overweight, obesity, diabetes mellitus 2, hypertension and hypercholesterolemia. Certain ethnicities such as Muhajir and Baluchis showed a higher prevalence of cardiovascular risk factors when compared to other ethnicities in the indigenous Pakistani population. The results also indicated that the prevalence of obesity is 10–20% higher among the immigrant Pakistanis than in the indigenous Pakistanis.
Studies from South Asia have shown burgeoning burden of CVD related risk factors among the indigenous populations [1, 2]. South Asian countries consist of many ethnic groups who have their own distinct language, culture and genetic history. These ethnic groups have shown differences in the prevalence of cardiovascular related risk factors [3]. Regarding the prevalence of cardiovascular related risk factors among the immigrant South Asians living in western countries, migration may worsen their CVD risk profile [4, 5].

**Intake of foods and cardiovascular risk factors among the immigrant Pakistani population living in the Netherlands and their comparison with Amsterdam population**

Chapter 3 aimed to explore the intake of foods relevant for cardiovascular disease and changes in the dietary habits of Pakistani immigrants living in The Netherlands. Data was collected through a cross sectional study conducted in The Netherlands. The study included the completion of a questionnaire about diseases, diet and other lifestyle measures and focused on adults who were 18 years or older. Results showed that there were both favorable and unfavorable dietary changes in relation with cardiovascular disease among the immigrant Pakistanis living in The Netherlands. For example, around half of the participants reported eating 100-200 grams of fruit and 50-100 grams of cooked / raw vegetables daily. Similarly, 61% participants reported drinking fruit juice every day while 18.6% participants reported drinking soft drinks 5-7 days a week. According to the guidelines of World Health Organization, at least 400 grams of fruits and vegetables are recommended everyday [6]. In the Netherlands, at least 2 portions of both fruits and vegetables should be consumed per day [7]. In terms of change in dietary habits, 30% participants reported decreased intake of high fat/fried foods, deserts/candy/sweets and red meat while 35% reported an increased intake of soft drinks and convenience foods after migration. Excessive intake of sugar through the use of sweets and soft drinks increase the risk for being overweight and developing Type 2 diabetes [8]. Majority of the participants reported eating chicken at least once per week and half of the participants reported drinking milk 5-7 days a week. The results in our study for the intake of fruits and vegetables can be compared to a study among the local population in Amsterdam, the Netherlands [9] where almost half of the Dutch population adhered to the recommended amount of fruits while 35% adhered to the recommended amount of vegetables. Similarly the results of our study can be compared to the results of a qualitative study among Pakistani women living in Oslo and a cross-sectional study among the Pakistani immigrants in Oslo [10, 11], where the participants reported decrease in the consumption of
vegetables and lentils and increase in the consumption of white meat, dairy products and convenience foods after migration which is a source of fat. According to a study from inner city Manchester [12] Pakistani men and women had the highest percentage of energy from fat. Fruits and vegetables have a protective effect against the development of cardiovascular disease while excessive use of fat increases the risk for cardiovascular disease [13, 14].

The objective of study conducted in Chapter 4 was to compare the general health status and prevalence of myocardial infarction (MI), diabetes, high blood pressure, overweight, obesity, and fruit and vegetable intake between Pakistani immigrants in The Netherlands and Amsterdam population. For this study, two datasets were compared from two different health surveys conducted in The Netherlands. The first dataset consisted of a health survey (consisting of questions about CVD risk factors and diet) conducted in 2012-13 among 154 Pakistani immigrants in big cities of The Netherlands (Amsterdam, Rotterdam, The Hague) and Almere. The second dataset consisted of a study conducted in 2012 by the Amsterdam Public Health Service among a sample of about 19,000 inhabitants of Amsterdam aged 19 years and over out of which 7,218 completed the questionnaire. The study consisted of completion of a questionnaire about physical health, fruit and vegetable intake and other lifestyle measures.

Results of the study showed that Pakistanis reported a high prevalence of MI (3.3%), diabetes (11.4%), high blood pressure (14.4%), overweight (35.5%) and obesity (18.5%) while Amsterdam population reported the prevalence’s as 2.5% for MI, 6.8% for diabetes, 15.3% for high blood pressure, 28.1% for overweight and 11.1% for obesity. Pakistanis had a significantly higher level of MI (OR=2.71; 95%CI: 1.19-6.14), diabetes (OR=4.41; 95%CI: 2.66-7.33) and obesity (OR=2.51; 95%CI: 1.53-4.12) after controlling for age, sex and educational level with Amsterdam population as the reference group. Pakistanis also showed a higher intake of fruit and fruit juice as compared to Amsterdam population though the latter showed a higher intake of cooked vegetables. If we compare the results of our study with health surveys of England and the Oslo immigrant health study, we see that Pakistani population has shown higher prevalence of CVD, diabetes, high blood pressure, overweight and obesity to the local populations [15-17].
The objective of chapter 5 was to test Koctürk’s model of dietary change among South-Asian Surinamese in the Netherlands. This is a model of dietary change among the immigrants developed by Koctürk [18, 19] and is meant to enhance the understanding of food combination patterns in different cultures and the process of adaptation to new dietary patterns. The model categorizes food into staple, complementary and accessory foods along an axis where identity and taste form the two extreme poles. The model postulates that migrants will continue to consume foods that are strongly tied with their cultural identity. Dietary change is more likely to involve foods which are not very much related to the identity of migrants. This model has been used to structure a qualitative study [11] but to our knowledge, it has never been quantitatively tested. So, we tested this model for South-Asian Surinamese. Cross-sectional baseline data of the HELIUS (Healthy Life in an Urban Setting) study were used and participants aged 18-70 years were included in the study. For the current study, we studied 1456 Dutch and 968 South-Asian Surinamese HELIUS participants, who also had dietary intake data available participated in the study.

Results showed that intake of staple foods like rice, fried rice and noodles is consistently higher among South-Asian Surinamese as compared with Dutch origin participants, irrespective of acculturation strategy, residence duration or migration generation, which is in line with Koctürk’s model. In addition, accessory foods like fruits vary across acculturation strategies which is also consistent with Koctürk’s model. In contrast to our expectations, consumption of complementary foods like chicken and fish was also higher among South-Asian Surinamese than in Dutch participants, regardless of acculturation strategy. Men, second generation and assimilated South-Asian Surinamese were inclined towards Dutch foods such as potato, pasta and red meat. Accessory foods like fruits showed variation across acculturation strategies. A previous study in Oslo used Koctürk’s model qualitatively to gain insight into the traditional eating habits in Pakistan and the new eating trends in Norway [11]. The results of that study gave limited support to the hypothesis that changes occur predominantly among the accessory foods and least among staples. Inconsistent with the Koctürk model, participants reported several changes concerning staple foods, e.g. chapatti, roti or paratha, were replaced by bread with spreads.
Comparison of cardiovascular risk factors and intake of foods among Javanese and South Asian Surinamese

Chapter 6 compared the prevalence of overweight, obesity, waist circumference, waist hip ratio, diabetes, cardiovascular disease, hypertension, hypercholesterolemia, low density lipoprotein (LDL) and high density lipoprotein (HDL) and dietary intakes between two different Asian-origin groups: Javanese Surinamese and South-Asian Surinamese. Cross-sectional baseline data of the HELIUS (Healthy Life in an Urban Setting) study were used. The HELIUS study is a cohort study among the six largest ethnic groups living in Amsterdam, the Netherlands. For the current study, 197 Javanese Surinamese and 2738 South-Asian Surinamese were selected out of which 78 Javanese Surinamese and 1082 South-Asian Surinamese also had extensive dietary intake data.

Results showed that South-Asian Surinamese had significantly higher prevalence of high waist circumference, high waist hip ratio, cardiovascular disease and diabetes as compared with Javanese Surinamese after adjusting for age and sex. South Asian Surinamese men had significantly higher prevalence of high waist hip ratio and high waist circumference as compared to Javanese men; though the same was not true when we compared South Asian Surinamese women with Javanese Surinamese women. Javanese Surinamese had significantly higher intake of red meat and significantly lower intake of both high fat and low fat dairy products as compared to South Asian Surinamese. Javanese Surinamese also had higher intake of vegetables as compared to South Asian Surinamese. In addition both ethnicities showed considerable intake of sugar sweetened beverages and low fiber refined grains. Previous studies among Asian subgroups living as immigrants in Europe and USA have shown diet and disease differences [20, 21]. Studies from within Asia have also shown ethnic differences regarding the prevalence of cardiovascular risk factors [1, 2, 22].

Methodological Considerations

Before reflecting on our results, we have to take into account the methods used in our studies. So, below we will talk about methods used in our studies and implications of the use of these methods for conclusions from our studies. In addition, we will talk about the practical issues encountered during the execution of our methods.
Strengths

The studies included in this thesis are the first ones to explore the cardiovascular disease risk and dietary intakes of Pakistani and Javanese immigrants living in the Netherlands. The studies related to cardiovascular disease risk and dietary intakes on Asian immigrant subgroups living in western countries remain scarce, so our studies have added valuable information to the existing literature. In addition, in chapter 5, we had a large sample size of almost 1000 participants of South Asian Surinamese origin.

Weaknesses

Cross Sectional Design

The studies in our thesis had a cross sectional design which means that we cannot derive causality from our studies. As the major theme of our thesis is based on change in diet of the Asian immigrants after migration to the Netherlands and the exposure to non-communicable after migration, a cross sectional design does not cover the temporal relationship related with the process of migration and the change in diet after migration. However, the use of this design in this PhD thesis did provide us with valuable information about the current status of dietary intake among the Asian immigrants living in the Netherlands which can explain the prevalence of diseases among these Asian subgroups.

Low participation and over representation of men

One of the major practical challenge faced was data collection among immigrant Pakistanis living in the Netherlands on diet and health. We were able to get data from 154 Pakistanis. We contacted prayer leaders and community leaders who not only endorsed the study but also announced it in their community. Additionally, the study was advertised through leaflets and posters at the community centers, shops and mosques. Participants were reached through festivals, mosques and Pakistani shops. We encountered many challenges ranging from convincing people about the benefits of surveys about health to awarding them with small prizes in order to complete the questionnaire. We had no funding to reach people at large for data collection. People we reached for data collection did not have health as a priority, so the principal researcher had to spend a lot of time with them in order to convince them about
filling in the questionnaire about health. Informal discussions with the Pakistani community revealed “hot” topics among the community which included politics mainly in Pakistan and then in the Netherlands, religion, family issues, stress and financial woes and health was not a very “hot” topic. As has been shown by previous researchers, accessing South Asian communities is difficult, and is an impediment to research [23]. Though it must be noted that South Asian communities living in different western countries might have different interest levels in health. The difficulty in accessing South Asian community in western countries could be explained by many factors including perceptions that participation presented no personal benefit to them or their community; language barrier; fear of being exposed if you are an illegal migrant or involved in illegal behaviors; mistrust of the researcher or the host population; cultural beliefs, age and gender. South Asian countries have a very different approach towards medical care and medical research. There is less medical research in South Asian countries, so people are not using to filling in health survey and as far as medical care in South Asia is concerned, patients expect an interpersonal relationship with their doctor. So, developing an interpersonal relationship while doing health surveys among the South Asian communities in western countries could be one of the ways to increase the sample size; it will be laborious but will be potentially fruitful.

Another practical issue encountered by principal researcher during data collection among Pakistani immigrants was the cultural sensitivity related to gender. Overall, there was low response rate and men were over-represented, so one should be cautious about generalizing the results. The principal researcher visited Pakistani mosques, embassy of Pakistan and Pakistani festivals to collect the data. All these places had higher percentage of men than women, e.g., in mosques there were only men and in the embassy there were more men than women and the personal contacts of principal researcher were also mostly men, explaining the higher percentage of men in the present study.

In study among the Pakistani immigrants in the Netherlands, mostly older men (almost 40% of our study population is above the age of 50) filled out the questionnaire who might have more interest in diet and health. As the principal researcher was male, so it was difficult for him to reach women in the Pakistani community which is why we have less women in our study on Pakistanis. The two student assistants helped in getting the questionnaires filled by
fellow students and the female student assistant was also helpful in getting the questionnaire filled by some women from the Pakistani community. The less participation of women in the study on Pakistanis did not give us representative results for women regarding cardiovascular risk factors and dietary habits. Previous studies have shown that women in Pakistan have a very high prevalence of central obesity (42.2%) as compared to men (14.7%). So, it would be interesting to see if Pakistani immigrants persist with gender differences regarding the cardiovascular risk factors in the Netherlands with more representative studies.

Amsterdam population as a comparison Group

In chapter 4, we compared the cardiovascular risk factors (myocardial infarction) of Pakistani immigrant population in the Netherlands with the general Amsterdam population including all groups. We must note that the Amsterdam population is a mix of ethnic backgrounds, about half of them being Dutch. Among the ethnic minorities, Moroccans, Turkish and Surinamese make up the largest ethnic minority groups in Amsterdam followed by other European and non-European nationals; there are around 20,000 Pakistanis living in the Netherlands and a significant number lives in Amsterdam according to central bureau of statistics, the Netherlands. Thus it will be interesting in future studies to look at the dietary and disease prevalence differences between Pakistani immigrants living in the Netherlands with the white Dutch to check for health inequalities and determinants related to those inequalities.

Self-report and social desirability

Self-reporting was the mode of data collection for health, diet and socio-demographic variables in this thesis except for clinical measurements of participants for cardiovascular risk factors in the HELIUS study. Data collected by self-reporting has often raised concerns on its validity. However, self-reported health has been widely reported in the earlier studies. Social desirability bias is one of the problems with the self-reported intake of fruits, vegetables and BMI. It has been reported in an earlier study that people report higher intake of fruits and vegetables as compared to their actual intake to gain appreciation and avoid criticism [24-26]. We might have encountered it in our study. The self reported data for cardiovascular risk factors among Pakistani immigrants may not have given us very accurate measurements as
could have been done by clinical measurements. Similarly, self reporting of dietary habits in our thesis could have led participants to overstate their healthy behavior resulting in inaccurate results. Thus, the conclusions of our studies should be confirmed with future studies considering the limitations posed by the studies in our thesis.

**Generalizability of results**

We should be careful in terms of generalizing the results for the immigrant populations studied in this thesis. The study among Pakistanis did not have a very large and representative sample because of the impediments in data collection described above. The results for Pakistanis may not be applicable to immigrant Pakistanis living in other western countries due to the differences in physical and social environment, cultural context of those countries and economic situation of the Pakistanis living in those countries. For example, statistics from UK show that that 32 percent of Pakistanis live in deprived neighborhood [27], though conversely around 13% of British Pakistanis are in managerial or professional occupations and 51% of British Pakistanis are continuing their education at university level [28, 29] as compared to around 28% of university degree holders of Pakistanis living in the Netherlands (Chapter 3 of this thesis).

Similarly results for Javanese Surinamese living in Amsterdam could possibly be generalized to Javanese living in other cities of the Netherlands presuming the same socio-cultural context but they possibly cannot be generalized to Javanese immigrants living in other western countries due to different socio-cultural and economic environment. The results for South Asian Surinamese could possibly be generalized to non-Western ethnic minority groups residing in countries where language is not a barrier, for example Latin-American residents in Spain [30] as is the case among Surinamese in the Netherlands, where language is not a major barrier.

**Reflection on the results of this thesis**

Our thesis has produced interesting results on indigenous Pakistani population and different Asian groups living in the Netherlands regarding dietary intakes and prevalence of
cardiovascular risk factors. In the following sections we will interpret these results along with their possible causes and implications.

**Cardiovascular risk factors among varied indigenous Asian ethnicities with a focus on Pakistan and possible causes**

The 2nd chapter have shed light onto the prevalence of cardiovascular disease risk factors among the indigenous Pakistanis living in Pakistan and immigrant Pakistanis living in the Netherlands. Pakistan is one of the most populous countries located in South Asia, hosting a population of 170 million and is administratively divided into four provinces, i.e. Punjab, Sindh, Baluchistan, and Khyber Pakhtunkhwa (KP), previously known as North-West Frontier Province (NWFP). There are large ethnic and linguistic divisions among Pakistanis. It must be noted that the variation along ethnic and linguistic lines run all across Asia ranging from South Asia comprising of countries like Pakistan, India, Sri Lanka, Bangladesh and Nepal to Southeast Asia comprising of countries like Indonesia, Malaysia, Cambodia, Laos, Thailand and Philippines. In addition, the geographic boundaries do not necessarily entirely represent the ethnicities living within those geographic boundaries. For example, Punjabi ethnicity is living in both Pakistan and India and Pashtun ethnicity is living in both Afghanistan and Pakistan. The lifestyle of these ethnicities including diet would be similar across the geographic boundaries.

Pakistan ranks sixth globally regarding the number of persons with diabetes [31]. The National health survey of Pakistan (NHSP) has shown high prevalence of cardiovascular risk factors among the indigenous Pakistani population. In addition, NHSP has also shown gender and ethnic differences regarding the prevalence of cardiovascular risk factors among the indigenous Pakistani population; women have higher prevalence of central obesity as compared to men. Studies from South Asia have shown high prevalence of cardiovascular risk factors among indigenous populations and different ethnicities[1-3]. Similarly studies in Southeast Asia have shown differences regarding the prevalence of cardiovascular risk factors among different ethnicities [32, 33] This high prevalence of cardiovascular risk factors among Asians and South Asians including Pakistanis could be attributed to different aspects of lifestyle including diet and physical activity. Pakistan is going through a process of nutrition transition where most of the people are moving from traditional foods towards more convenience foods due to status attached to eating convenience foods along with other factors
like the physical environment which enables the access of masses towards these foods; though one must be careful in generalizing this kind of nutrition transition. According to a nonpartisan fact tank named as Pew research centre, 97.6% of Pakistanis come in the bracket of “poor “or “lower middle class” [34]. Previous studies have shown that higher socio-economic class results in better health and longevity of individuals [35]. It must be noted that the cuisine of different groups varies by region and is influenced by religion, culture, physical environment and socio-cultural norms.

Shift in diet due to migration among Asians and resulting diet related diseases

Migration is a universal phenomenon and many Asian subgroups including Pakistanis, South Asian Surinamese and Javanese Surinamese have migrated to the Netherlands.

Brief history of migration of Asian groups to the Netherlands and their current status

There are 18579 Pakistanis in Netherlands according to the Central bureau of statistics, The Netherlands; 10493 are males while 8086 are females [36]. The beginning of a major Pakistani migration to the Netherlands can be traced back to the 1960s. The early Pakistani migrants can be called as the ‘fortune seekers’ who came into the Netherlands in the 1960’s and early 1970s. The latter wave of Pakistanis consisted of asylum seekers, imported brides or bridegrooms. Javanese Surinamese and South-Asian Surinamese originally migrated from the region of Southeast Asia comprising of countries like Philippines, Malaysia, East Timor, Indonesia, Brunei, and Singapore and South Asia comprises of countries like India, Pakistan, Bangladesh, Sri Lanka and Nepal, respectively, to Surinam and then to the Netherlands. The mass migration of Surinamese to the Netherlands occurred after 1975, when Surinam announced independence from the Netherlands. Most of these Surinamese settled around big cities in the Netherlands including Amsterdam, Rotterdam, Utrecht and Den Haag. According to the recent data by central bureau of statistics (CBS), there are 151,000 South Asian Surinamese and 22,000 Javanese Surinamese living in the Netherlands [37, 38].

We were able to capture the reported change in the dietary habits / change in dietary habits of Pakistanis in this thesis where they mentioned some favorable and some unfavorable dietary changes after migration from Pakistan to the Netherlands. For example, they reported that
they have increased the intake of fruits and vegetables after migration. Although when we compare their intake of fruits and vegetables with the WHO recommendation, they fall quite short of the criteria mentioned by WHO for intake of fruits and vegetables. An important reason for the less use of fruits and vegetables as compared to the WHO recommendations could be related to the taste, which is not be the same as in the home country. Having said this, in cosmopolitan cities, like Amsterdam, more ethnic foods are available. They also reported an increase in the intake of soft drinks / soda, dairy products and convenience foods. The increase in the intake of soft drinks and convenience foods could be related to the status factor in the Pakistani community. Generally the Pakistani immigrants who migrated around 1960 and 1970 were labor migrants who might not be very well off in their country. Foods like soft drinks and convenience foods like pizza are still considered as foods to be eaten by rich and these Pakistani migrants might not have access to these foods on regular basis or not at all, so after migration when these foods became accessible to these migrants, they increased their consumption of convenience foods and soft drinks. Pakistani immigrants reported decrease in the intake of food items like high fat/fried foods, sweets, red meat and they also reported decrease in dining out after migration. Studies among Pakistani immigrants from other western countries have shown that they have increased the consumption of convenience foods and dairy products and reduced the consumption of sweets and deep frying method of cooking [10-12].

Migration and acculturation are associated with changes in chronic disease patterns [39]. The results on Pakistani immigrants living in the Netherlands in 3rd chapter of this thesis have shown that they have high prevalence of cardiovascular risk factors. This high prevalence of cardiovascular risk factors could be attributed to different lifestyle factors including diet, physical activity, smoking and stress. During informal discussions with the Pakistani participants, they brought up the topic of stress as one of the barriers to healthy eating. They said that one of the major reason for this stress was economic turbulence in their lives. When we compared the results of our study for cardiovascular risk factors for Pakistani immigrants living in the Netherlands with that of Amsterdam population, Pakistanis reported higher prevalence of cardiovascular risk factors as compared to the Amsterdam population. Amsterdam population consists of different ethnicities with half of them Dutch. So, we need to be careful when interpreting our results in terms of comparison with the ethnic Dutch population. Nevertheless, other studies from the Netherlands have also shown high prevalence
of cardiovascular risk factors among South Asians as compared to Dutch [40, 41]. Similarly immigrant Pakistanis living in other western countries have also shown higher prevalence of cardiovascular risk factors as compared to the local populations [20].

Results from Chapter 5 show that South-Asian Surinamese men and women are sticking to their traditional diet of rice and chicken which is related to their identity, though some changes were observed for foods like fruits which are more related to the taste aspect and not the identity. South Asian Surinamese have migrated twice, first from India to Surinam and then from Surinam to the Netherlands and it seems that South Asian Surinamese are faithful to their Surinamese traditional dietary patterns but we cannot say the same for their region of origin, i.e., India as we did not study the traditional eating patterns of our population in India. Dietary acculturation is a complex, multidimensional phenomenon as explained by Jessie Satia About a in her proposed model of dietary acculturation (figure 1). Dietary acculturation is influenced by many factors ranging from socio-demographic factors to psychosocial, cultural and environmental factors.
Figure 1 Proposed model of dietary acculturation: The process by which racial/ethnic immigrant groups adopt the eating patterns of their host country. Some of these factors may also be influenced by exposure to host country.
Cardiovascular risk factors and dietary differences among Asian subgroups living in the Netherlands

As discussed earlier, Asia is a large continent divided along ethnic and linguistic lines ranging from South Asia to Southeast Asia. Migration from different Asian countries to the Netherlands has occurred in different phases and at the moment, Netherlands hosts a vast range of Asian immigrants from countries like Surinam, Pakistan, India etc. Surinam is an amalgamation of cultures with immigrants originating from different countries like India and Indonesia who eventually migrated to the Netherlands. These Asian immigrants carry their distinct cultures including dietary habits with them to the Netherlands. The distinct dietary habits of these Asian immigrants from different Asian countries encompassed in their broader approach towards health combined with the process of acculturation may predispose them towards the development of non-communicable diseases.

Chapter 6 of this thesis has shown disease and diet differences between South Asian Surinamese and Javanese Surinamese. Javanese Surinamese had significantly higher intake of red meat and a significantly lower intake of dairy products as compared with South-Asian Surinamese. Dairy is essential part of the Indian cuisine and similarly red meat is an essential part of Indonesian / Java cuisine. As we see in this chapter that South Asian and South east Asians are adhering to their traditional cuisines, this also gives us guidelines / indications for developing dietary lifestyle interventions specific to the cultural needs of the Asian subgroups living in the Netherlands.
Implications for Research, Prevention and Policy

The findings of this thesis have practical implications for research, prevention and policy. The studies in our thesis have shown that Asian subgroups including Pakistanis, South Asian Surinamese and Javanese Surinamese report the intake of favorable and unfavorable dietary items related to the development of cardiovascular disease. For example, the intake of vegetables is well below the recommended intake among these groups especially for the South Asian groups including Pakistanis and South Asian Surinamese. In addition, the intake of sugar sweetened beverages is on the higher side among these groups. Although our study has added valuable knowledge to the existing literature, but we had a cross sectional design which cannot provide us with a causal relationship between the dietary intake and the development of non-communicable diseases. We need good longitudinal studies with causal designs and representative sample sizes in future to ascertain the results of our studies. The future studies should also take into account conventional factors like physical activity and non-conventional factors like C-reactive protein levels related to the development of cardiovascular disease among these Asian immigrant in the Netherlands. A notable large scale prospective cohort study (HELIUS) in Amsterdam is looking into the disease risks through specific risk factors including health-related behavior and explanatory mechanisms such as ethnic identity, migration history and socio-economic status among the largest ethnic groups living in Amsterdam, the Netherlands such as Surinamese, Moroccan, Turkish and Ghanaians [42]. It must be noted that there are substantial number of Pakistanis and Indians living in the Netherlands. In addition, there has been influx of immigrants from different parts of the world and in future, public health researchers need to include these rather smaller immigrant groups in the health related surveys.

From the prevention perspective, we need evidence based lifestyle interventions among these Asian subgroups living in the Netherlands. These lifestyle interventions should be based on the results of sound epidemiological studies. As the results of our thesis have shown high prevalence of cardiovascular disease and related risk factors among Asian subgroups namely, Pakistanis, South Asian Surinamese and Javanese Surinamese living in the Netherlands. The results on dietary intake among these groups have shown favorable and unfavorable trends in relation to the development of cardiovascular disease. For example, South Asian groups like Pakistanis and South Asian Surinamese have shown lesser intake of vegetables as compared to other ethnic groups while Javanese Surinamese have shown higher intake of red meat as
compared to the South Asian Surinamese. Thus the future lifestyle interventions should take into account these dietary behaviors along with other factors like physical activity levels.

The results of our thesis has shown high intake of sugar sweetened beverages and fruit juice among the Asian groups living in the Netherlands. The policy makers and people at the helm of affairs in politics need to make sure that unhealthy choices are not the easy choices. Increase in sugar taxes, information campaign about healthy eating and physical activity targeting the immigrants specifically could be a good start in this direction. Immigrants have different cultural and religious sensitivities as compared to the host populations which need to be taken into account while developing educational campaigns regarding health. For example, among certain Muslim ethnic groups like Pakistanis living in the Netherlands, religion along with culture insists on gender segregation among these communities, thus policy makers can take the issue of gender segregation into account while developing health facilities among these groups. In addition, the socio-economic conditions and the current living conditions also play an important part in determining the choice for healthy foods. Immigrants are usually living in poor neighborhoods as is the case with the Surinamese and Pakistanis who are included in our thesis. Therefore, the policy makers should address the physical environments and income disparities of the migrant groups in order to allow them to make healthy choices.
Conclusion

There is high prevalence of non-communicable diseases including cardiovascular disease and diabetes among the Asian communities including Pakistanis, South Asian Surinamese and Javanese Surinamese living in the Netherlands. Dietary intakes like less intake of vegetables than the recommended amounts, high intake of sugar sweetened beverages and dairy products seem to be the cause for the development of non-communicable diseases among these Asian communities. Javanese Surinamese living in Amsterdam, the Netherlands show high prevalence of non-communicable diseases, though less than their South Asian counterparts living in Amsterdam, the Netherlands. Javanese Surinamese reported higher intakes of red meat and vegetables as compared to South Asian Surinamese. Thus, ethnic differences regarding diet and disease are also evident among different Asian ethnic minorities living in the Netherlands.
Future Recommendations for research

Future studies among ethnic minorities should increase sample size to increase the generalizability. More funding is needed to equip the researchers with tools for data collection. Longitudinal studies, where immigrants from Asian countries are followed in terms of their diet and other lifestyle measures right from their point of entry into a western country can provide us with a very rich data about the dietary transition of an Asian immigrant.

Lifestyle interventions targeting both dietary behaviors and the dietary environment of Asian immigrants could be developed in the Netherlands and elsewhere. These lifestyle interventions should be guided by intervention mapping. Intervention Mapping is a protocol for developing theory-based and evidence-based health promotion programs and describes the process of health promotion program planning in different steps ranging from needs assessment to planning, implementation and evaluation of the process of interventions. Participatory action research could also be a useful tool to tackle the problem of non-communicable diseases among the Asian immigrants living in western countries. Participatory action research (PAR) emphasizes collective inquiry and experimentation grounded in experience and social history. Within a PAR process, "communities of inquiry and action evolve and address questions and issues that are significant for those who participate as co-researchers" [43].
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