Targeting persons with low socioeconomic status of different ethnic origins with lifestyle interventions:
opportunities and effectiveness

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General introduction

Lifestyle intervention studies have shown that the development of cardiometabolic diseases can be partly prevented or postponed by the combination of a healthy diet and physical activity [1-3]. In particular, individuals with low socioeconomic status may benefit from lifestyle changes, as such persons are less likely to eat healthily [6, 7] than persons with higher socioeconomic status and are less likely to be physically active during leisure time [8, 9]. Likewise, in the Netherlands, persons of Turkish and Moroccan origin have a relatively high prevalence of physical inactivity compared to persons of Dutch origin [10].

Although individuals with low socioeconomic status and ethnic minorities could potentially benefit from lifestyle interventions, it seems that these groups are often not successfully reached with these interventions. First of all, people with low socioeconomic status and some ethnic minorities are often underrepresented in lifestyle interventions [11-13]. Moreover, when they do participate in these interventions, they seem more likely to drop out [14, 15].

At risk of cardiometabolic diseases

Why is it important to target these groups for lifestyle change? Cardiometabolic diseases, like type 2 diabetes mellitus and cardiovascular diseases, are relatively prevalent among individuals with low socioeconomic status and among some ethnic minorities [16-19]. More specifically, in the case of the Moroccan and Turkish population living in the Netherlands, the onset of type 2 diabetes mellitus occurs at an earlier age compared with Dutch people [20].

Cardiometabolic diseases have a substantial impact on the burden of disease [23, 24]. In the Netherlands, according to the most recent data, life expectancy without chronic diseases is on average 8.4 to 11.3 years (women and men, respectively) shorter among individuals with the lowest socioeconomic status than among individuals with the highest socioeconomic status [25]. The difference in life expectancy in good health is 19.1 and 18.9 years

Low socioeconomic status

Socioeconomic status can be determined at different levels, including the individual, household and neighbourhood level. In practice, as well as in health research, socioeconomic status is often determined by a single variable at a single level [4], such as occupation, education, income or neighbourhood status. In the Netherlands, in 2014, 30% of persons older than 25 years had a low socioeconomic status as defined by highest completed education level (no, primary or lower secondary school) [5].

Ethnic minorities

Following the definition of Statistics Netherlands, persons with at least one parent born in another country are considered to be of foreign origin [21]. In the Netherlands, in 2015, 22% of Dutch citizens had a foreign background [22]. As in several other European countries, people of Turkish and Moroccan origin are the two largest ethnic minority groups in the Netherlands [22].

(women and men, respectively) [25]. Targeting lifestyle interventions at individuals with low socioeconomic status can potentially help to reduce these socioeconomic inequalities in health [26].

Although ethnic minorities often do have a low socioeconomic status, variation in cardiometabolic health among ethnic groups cannot be explained by their socioeconomic status alone [27, 28]. The variation in cardiometabolic health can additionally be explained by variation in obesity [20]. Other hypothesised mechanisms underlying the complex relation between ethnicity, socioeconomic status and health include migration history, access to medical care and genetics [29].

People with metabolic syndrome or prediabetes are at increased risk of developing cardiometabolic diseases [30, 31]. Metabolic syndrome is characterised by having a combination of risk factors for cardiometabolic diseases, usually three or more of the following five: raised fasting blood glucose concentration, central obesity, raised serum triglycerides concentration, lowered serum high-density lipoprotein cholesterol concentration and raised blood pressure [32]. Prediabetes is characterised by glycaemic variables that are higher than normal, but lower than the diabetes thresholds [30].

Underrepresentation of persons with low socioeconomic status and ethnic minorities in lifestyle interventions

> *"People experiencing socioeconomic disadvantage face a range of challenges that can substantially hinder efforts to adopt healthy eating and physical activity behaviours."*
>
> K. Ball [33]

What can explain the underrepresentation of individuals with low socioeconomic status and ethnic minorities in lifestyle interventions? In the case of individuals with low socioeconomic status, reaching them for preventive lifestyle interventions may be difficult as they are less likely to perceive the need for lifestyle advice [34] and less motivated than individuals with higher socioeconomic status to eat healthily in order to prevent diseases [35]. Moreover, individuals with low socioeconomic status may not engage in lifestyle interventions as they are hindered by more immediately pressing struggles in their daily life. Possible struggles like relational problems, physical problems, emotional problems and financial concerns can require all their attention, and therefore deflect their interest in lifestyle change [36]. Likewise, ethnic minorities can be hindered by competing struggles, both emotional and financial, leaving little room for concerns about their own health [37]. In the same way, competing struggles in life can be a reason for individuals with low socioeconomic status of different ethnic origins to drop out of lifestyle interventions [38]. Furthermore, a lack of local language skills has been identified as one of the major barriers in reaching minorities for healthcare services [39].

Because many researchers and health professionals have experienced problems reaching these groups, individuals with low socioeconomic status and ethnic minorities are often labelled as 'hard to reach' [40]. However, are they truly hard to reach, or do we label them that way out of frustration because we are not reaching them? Should we not rather ask ourselves whether our efforts to reach them are appropriate?

Lifestyle interventions: SLIM, SLIMMER, MetSLIM

> *"Although, this study (SLIM) is already promising, better results may be achieved with special tailored programs for subjects with a low socioeconomic status to enable these subjects to change their lifestyle."*
>
> C. Roumen *et al.* [14]

SLIM is an example of a study that showed promising effects of a combined lifestyle intervention on the prevention of type 2 diabetes mellitus. However, in this study also, individuals with low socioeconomic status were more likely to drop out of the study than individuals with higher socioeconomic status [14]. From the beginning of the study, ethnic minorities were probably already missed, as mastery of the Dutch language was necessary in order to participate and non-Caucasians were excluded [41]. The current thesis builds on the experiences of the SLIM study.

SLIM (Study of Lifestyle intervention and Impaired glucose tolerance Maastricht) was a randomised controlled trial that aimed to study whether a combined lifestyle intervention, involving dietary counselling and physical activity lessons, could improve glucose tolerance in participants with prediabetes [41]. The study showed that, after one year of lifestyle intervention, blood glucose tolerance was significantly improved among participants in the intervention group in comparison to participants in the control group [42]. Ultimately, after an intervention period of on average 4.1 years, diabetes risk had declined by 47% among participants in the intervention group in comparison to participants in the control group [14].

Recently, two new studies were set up based on the SLIM study. The first one was the SLIMMER study (SLIM iMplementation Experience Region Noord- en Oost-Gelderland). The aim of SLIMMER was to translate the SLIM lifestyle intervention to practice and to study the effectiveness of the SLIMMER intervention in a real-life setting on cardiometabolic health, quality of life and lifestyle among adults at high risk of type 2 diabetes [43, 44]. The adaptation from SLIM to SLIMMER is described in detail elsewhere [44]. Although the intervention did not target individuals with low socioeconomic status, the majority of participants had a low educational level [45]. The number of participants with no education or only primary school (i.e. lowest educated group) and participants of non-Dutch origin was, however, rather low.

The second study derived from SLIM was the MetSLIM study, the main focus of this thesis. The aim of MetSLIM was to adapt the SLIM lifestyle intervention towards persons with low

socioeconomic status of Dutch, Turkish and Moroccan origin, and to study its effectiveness on waist circumference and other components of metabolic syndrome among adults from this target group with an elevated waist-to-height ratio.

Adapting lifestyle interventions

How can a lifestyle intervention be adapted to a specific target group? From literature regarding health communication, it is known that tailoring is a promising strategy to effectively reach individuals. Tailoring refers to the development of messages or strategies that are intended to reach one specific person, whereby insight into the characteristics that are unique to that person and related to the outcome of interest are taken into account [46]. Tailoring can be achieved in various ways, such as by mentioning the name of the targeted individual in a message or by including personal feedback on an individual's behaviour [47]. Studies have shown that tailored messages are considered more thoughtfully than comparison messages [48] and can stimulate actual health behaviour change [49].

Although a lifestyle intervention is more complex than just one health message, the evidence supports the potential effectiveness of taking into account the target group that one is aiming to reach. However, in a lifestyle intervention, it is not only the message that can be tailored. In addition to the message, the source and channel for health communication should be adapted to the targeted individuals [50, 51].

To make an intervention culturally appropriate, most adaptations take the form of cultural targeting rather than cultural tailoring. Tailoring can be distinguished from targeting, as tailoring refers to the development of messages or strategies that are intended to reach one person specifically, whereas targeting refers to the development of messages or strategies for a defined subgroup that take into account characteristics shared by the subgroup's members [46]. Kreuter and colleagues divide strategies for cultural targeting into five categories: peripheral, evidential, linguistic, constituent-involving and sociocultural [52]. In short:

- *Peripheral strategies* refer to packaging the intervention materials in such a way that their appearance is culturally appropriate in order to appeal to the target group.
- *Evidential strategies* refer to presenting evidence (e.g. epidemiological data) specific to the target group in order to enhance the perceived relevance of a health issue.
- *Linguistic strategies* refer to using the dominant or native language of the target group in order to make intervention materials more accessible.
- *Constituent-involving strategies* refer to the involvement of members of the target group in the planning and decision making of interventions in order to support the linguistic strategies as well as learn from members' insights into the cultural characteristics of the target group.
- *Sociocultural strategies* refer to discussing health behaviour in the context of social and/or cultural characteristics of the target group.

Likewise, Liu and colleagues reviewed and summarised types of adaptation used in health-promoting interventions targeting ethnic minorities. On the basis of their review, they concluded that culturally adapted interventions that take into account the needs of the target group may achieve better engagement and retention among the target group [53].

Therefore, in order to successfully target a lifestyle intervention like SLIM at persons with low socioeconomic status of Dutch, Turkish and Moroccan origin, it is important to get insight into the needs of these groups first. Getting insight into characteristics of the target group is an important and common element in proposed frameworks for adapting effective programmes to new populations [54-56]. Next, these insights can be used in deciding which elements of a programme should be adapted to suit the new target group. Insights into the needs of persons with low socioeconomic status of Dutch, Turkish and Moroccan origin are expected to facilitate the adaptation of the SLIM intervention in such a way that it is more appealing for the target group to participate and complete the intervention.

Aim and outline of this thesis

The overall aim of this thesis was to study opportunities for, and the effectiveness of, lifestyle interventions to reduce the risk of cardiometabolic diseases, targeting individuals with low socioeconomic status of Dutch, Turkish and Moroccan origin. To this end, this thesis describes studies that identified opportunities for adapting lifestyle interventions to the target group's needs *(chapters 2 and 3)*, a study that describes the adaptation process of SLIM to MetSLIM *(chapter 4)* and studies that determined the effectiveness of lifestyle interventions among the target group *(chapters 5 and 6)*.

Chapter 2 describes the perceptions of native Dutch people with low and higher socioeconomic status regarding current lifestyle, lifestyle change and needs regarding support for lifestyle change. *Chapter 3* looks at people of Turkish and Moroccan origin and describes how they prefer to be reached for health checks and lifestyle advice. These two chapters contributed to the development of the MetSLIM study, the design of which is presented in *chapter 4*. Besides the design, this chapter also gives insight into considerations and choices made during the adaptation process from SLIM tot MetSLIM. *Chapter 5* elucidates the influence of socioeconomic status on participation, acceptability, attendance, adherence, drop-out and effectiveness in the SLIMMER diabetes prevention study. Studying the role of socioeconomic status in different phases of the SLIMMER study – from initial participation in the intervention study, active participation during the intervention programme and completing the study – was considered valuable because it could give insight into critical phases and potential opportunities for improvement in order to successfully target a lifestyle intervention at individuals with low socioeconomic status. *Chapter 6* reports on the effectiveness of the MetSLIM intervention in reducing waist circumference and improving other components of metabolic syndrome among individuals with low socioeconomic status of different ethnic origins. In *chapter 7,* the main findings of this thesis are summarised and discussed. The chapter also includes a reflection on the methods used in this thesis, implications for practice and suggestions for future research. The outline of the thesis is schematically presented in Figure 1.1.

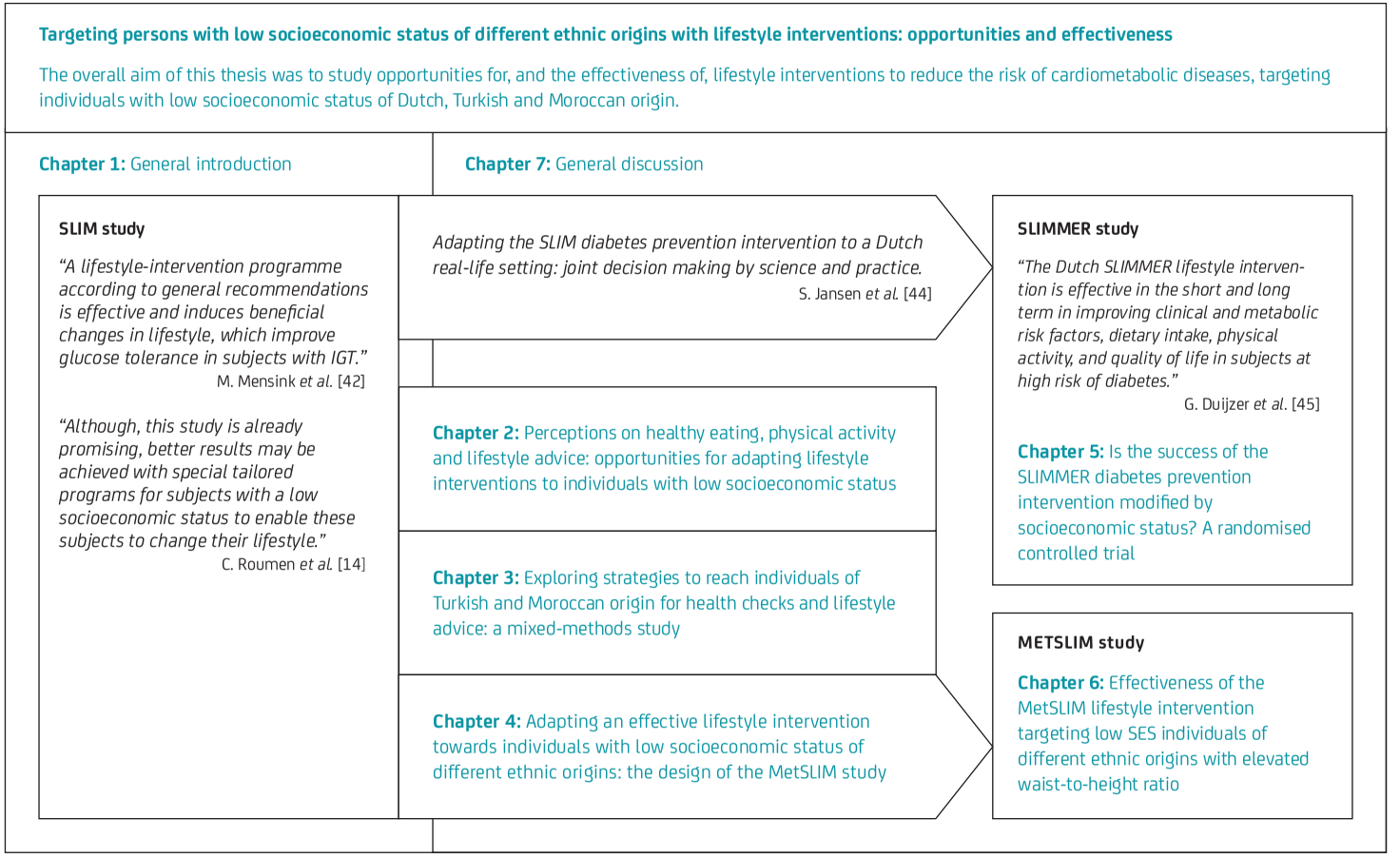

Figure 1.1 Schematic overview of thesis content

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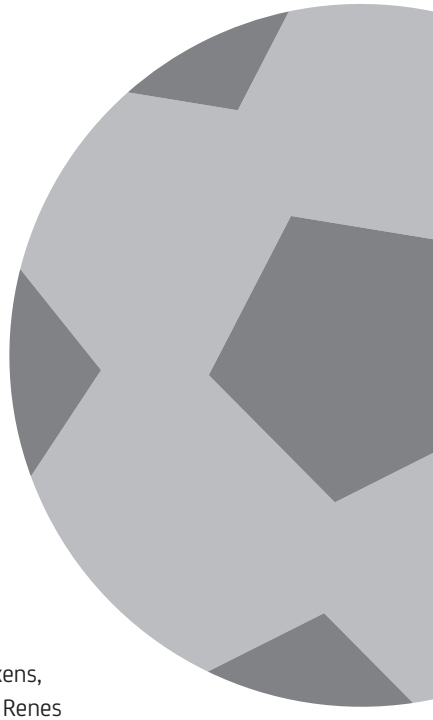
2

Perceptions on healthy eating, physical activity and lifestyle advice: opportunities for adapting lifestyle interventions to individuals with low socioeconomic status



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Abstract

Background: Individuals with low socioeconomic status (SES) are generally less well reached through lifestyle interventions than individuals with higher SES. The aim of this study was to identify opportunities for adapting lifestyle interventions in such a way that they are more appealing for individuals with low SES. To this end, the study provides insight into perspectives of groups with different socioeconomic positions regarding their current eating and physical activity behaviour; triggers for lifestyle change; and ways to support lifestyle change.

Methods: Data were gathered in semi-structured focus group interviews among low SES (four groups) and high SES (five groups) adults. The group size varied between four and nine participants. The main themes discussed were perceptions and experiences of healthy eating, physical activity and lifestyle advice. Interviews were transcribed verbatim and a thematic approach was used to analyse the data.

Results: In general, three key topics were identified, namely: current lifestyle is logical for participants given their personal situation; lifestyle change is prompted by feedback from their body; and support for lifestyle change should include individually tailored advice and could profit from involving others. The perceptions of the low SES participants were generally comparable to the perceptions shared by the high SES participants. Some perceptions were, however, especially shared in the low SES groups. Low SES participants indicated that their current eating behaviour was sometimes affected by cost concerns. They seemed to be especially motivated to change their lifestyle when they experienced health complaints, but were rather hesitant to change their lifestyle for preventive purposes. Regarding support for lifestyle change, low SES participants preferred to receive advice in a group rather than on their own. For physical activities, groups should preferably consist of persons of the same age, gender or physical condition.

Conclusions: To motivate individuals with low SES to change their lifestyle, it may be useful to (visually) raise their awareness of their current weight or health status. Lifestyle interventions targeting individuals with low SES should take possible cost concerns into account and should harness the supportive effect of (peer) groups.

Background

Persons with low socioeconomic status (SES) are more likely to have poorer health and a shorter life expectancy than persons with higher SES [1]. These differences can partly be explained by a less favourable lifestyle [2]. In general, persons with low SES are less likely to eat healthily [3, 4] and are less likely to be physically active during leisure time [5-7]. This makes the low SES group an important target group for lifestyle interventions, given that these interventions are found to be an effective way to improve lifestyle and consequently reduce the risk of chronic diseases [8-11].

Although the effects of such lifestyle interventions are promising, individuals with low SES are less likely to perceive the need for lifestyle advice [12] and participate less often in these lifestyle interventions than individuals with high SES [13, 14]. Moreover, individuals with low SES who initially participate in these interventions might be more likely to drop out than individuals with high SES [11, 15]. Apparently, different approaches are necessary to successfully reach individuals with low SES for lifestyle interventions. For this reason, the focus of this study is on identifying possibilities for making an intervention potentially more applicable to individuals with low SES.

Tailoring a lifestyle intervention to the targeted individuals' needs is a promising strategy for developing effective lifestyle interventions [16]. Tailoring can be effected in various ways, such as by mentioning the name of the targeted individual in a message or by including personal feedback on an individual's behaviour [17]. However, to improve the effectiveness of lifestyle interventions, it is important not only to tailor the message, but also to choose the appropriate source, setting and channel for the health communication [18, 19]. A meta-analysis of interventions that promoted physical activity showed that the mode of delivery is important when socioeconomically disadvantaged women are being targeted. Interventions that included a group element in their intervention achieved better results than interventions with individual or community-based delivery [20].

A tailored intervention should suit the targeted individuals' needs, and it should be realised that these needs may differ from those standardly perceived by health professionals. Several researchers have argued that future health promotion activities should pay more attention to the perceptions of the target group, instead of following the standard principles of health promotion and science-based understandings of a healthy lifestyle [21, 22]. Consumers' definition of a healthy diet, for example, appears to be broader than the scientific definition that focuses on food composition and health outcomes [23].

Likewise, it should be realised that there is a friction between the health-oriented view of researchers and health promoters and the complexity of participants' everyday life [24]. The perceived difficulty of fitting intervention activities into participants' personal life can be an important barrier to engaging in health promoting programmes [25]. In addition, an

accumulation of personal problems can hinder participants from engaging in lifestyle change [26]. Therefore, more attention should be paid to the complexity of participants' everyday life [24]. To make lifestyle interventions better suited to participants' day-to-day practices, it is important to get insight into the target group's perceptions regarding a healthy lifestyle and lifestyle advice.

People's perceptions are to some extent related to socioeconomic position. One study showed socioeconomic differences in the perceived relevance of various food topics and the need for information on these topics [27]. It observed, for example, that high SES participants were more interested in receiving information about food composition than low SES participants. In line with this, another study showed different barriers to physical activity among individuals with different socioeconomic status [28]. It suggested, for example, that, especially among low SES groups, health-promoting activities should take account of neighbourhood safety and negative early life experiences with physical activity. This indicates that different barriers or interests need to be taken into account when lifestyle interventions targeting individuals with either high or low SES are being created or adapted.

The aim of the current study was to identify opportunities for adapting lifestyle interventions in such a way as to make them more appealing and accessible to individuals with low socioeconomic status. To this end, the study provided insights into people's perspectives regarding healthy eating, physical activity and lifestyle advice, with special attention on the following questions:

1. How do low SES participants explain their own eating behaviour and physical activity pattern?
2. What can trigger low SES participants to change their lifestyle?
3. How do low SES participants believe that they can be supported in lifestyle change?

This study addressed perspectives among groups with different socioeconomic positions in order to understand what perspectives exist in general and what perspectives may exist in particular among individuals with low SES that should be taken into account in developing a lifestyle intervention.

Methods

Study design

Nine focus group interviews were conducted in two Dutch provinces, namely, Gelderland and Limburg. In each province, the interviews were carried out among two low SES groups and two or three high SES groups (men and women separately). The reason for separating the focus groups by gender was to create more homogeneous groups, since the flow of an interview was expected to be smoother in more homogenous groups compared to mixed groups [29]. The study was not, however, intended to examine differences between

genders. Beforehand, it was expected that four groups per socioeconomic group would be enough to reach saturation [30]. As a result of convenience sampling, an additional ninth group volunteered to participate in the study. The number of participants per group varied between four and nine, with a total of 56 participants. All participants were born in the Netherlands. The average age of the participants was 57.1 ± 9.0 years (range = 39–75 years). The participants' characteristics are presented in Table 2.1. The study was approved by the medical ethics committee of Maastricht University. All participants gave written informed consent and received a gift voucher of 10 euros for participating in the focus group interviews.

Table 2.1 Characteristics of focus group interview participants (mean ± SD or n (%))

	Participants in low SES groups (n=26)	**Participants in high SES groups (n=30)**
Age (years)	60.3 ± 7.7	54.4 ± 9.2
BMI (kg/m^2)	27.8 ± 3.8	24.7 ± 3.6
Education level[1]:		
Low	16 (61.5)	0 (0.0)
Middle	9 (34.6)	2 (6.7)
High	1 (3.8)	28 (93.3)
Employment status:		
Paid job/own company	9 (34.6)	26 (86.7)
Househusband/housewife	5 (19.2)	1 (3.3)
Retired	9 (34.6)	3 (10.0)
Disabled	3 (11.5)	0 (0.0)
Marital status:		
Married	17 (65.4)	22 (73.3)
Unmarried	3 (11.5)	7 (23.3)
Divorced	2 (7.7)	1 (3.3)
Widow(er)	4 (15.4)	0 (0.0)
Household situation:		
Alone	7 (26.9)	6 (20.0)
Together with partner	16 (61.5)	13 (43.3)
Together with partner and child(ren)	3 (11.5)	11 (36.7)

[1] Participants who had no education, or had primary school or lower secondary education were classified as low education level. High education level was defined as having completed at least a bachelor's degree.

Procedure

The focus group interviews were held with pre-existing groups, specifically groups of persons who already met regularly (for example in a community centre or at an association). Individuals were asked in person to participate in a focus group interview by the researchers or via a member or contact person of the group. In order to reach groups with low SES, persons in community centres or associations in more deprived areas were approached. Higher socio-economic groups were recruited by contacting members of associations in which normally

persons with a higher socioeconomic position are involved (e.g. university setting or rotary club). The time and location of the interviews were determined by the participants themselves, and were often the time and location at which the group regularly met. Several days before the interview, participants received written information about the procedure. The interviews lasted approximately 1.5 to 2.5 hours. Following the interview, a short questionnaire was used to determine age, country of birth, marital status, household situation, employment status, highest completed education, height and weight. Two researchers (AJB and DT) were in charge of recruitment. The researcher who recruited the participants also moderated the focus group interview, and the other researcher observed. The interviews were conducted between May 2011 and November 2011.

Interview guide

This study addressed different perspectives and experiences about healthy eating, physical activity and lifestyle advice. A semi-structured interview guide was developed around these topics based on literature relating to qualitative studies and theory on behaviour change [31]. The interview guide contained open-ended questions about participants' daily eating practice; experiences and perceptions regarding barriers, enablers and social influences for healthy eating and physical activity; and earlier experiences and future needs relating to lifestyle advice (see Additional file 2.1).

Data analysis

The interviews were audiotaped and transcribed verbatim. All transcripts were individually read by two researchers (AJB and DT) and frequently emerging themes were identified. These themes were discussed to create one coding scheme. Data were coded with NVivo 9 (QSR international Pty Ltd, Doncaster, Victoria, Australia). One transcript was coded by both researchers independently and discussed together afterwards. Only a few discrepancies were observed, which were discussed by the two researchers to reach consensus about the coding process. Because of these discrepancies, the researchers chose to slightly adapt the coding scheme by combining themes and renaming themes, to make it more suitable for the coding of the transcripts. The remaining transcripts were finally coded by the first author of this article. Thereafter, the researcher (AJB) went through the themes to identify key topics relating to healthy eating, physical activity and lifestyle advice in order to find out what is important for participants in current lifestyle, lifestyle change and support for lifestyle change. Within the topics, special attention was paid to the perceptions of low SES participants compared to those of high SES participants, to see whether some arguments might have been exclusively mentioned by individuals with either low or high SES. Quotes illustrative of the identified topics were selected.

Results

Three key topics relating to eating behaviour, physical activity and lifestyle advice were identified, namely: current lifestyle is logical for participants given their personal situation; lifestyle change is prompted by feedback from their body; and support for lifestyle change should include individually tailored advice and should take into account the advantages of making lifestyle changes together with others. The perceptions of the low SES participants were in general comparable to the perceptions shared by the high SES participants. Some perceptions were, however, especially shared in the low SES groups. The perceptions regarding the three key topics are summarised in Figure 2.1 and described in more detail below.

Current lifestyle is logical for participants given their personal situation

Frequently, participants indicated that their current lifestyle – healthy or not – worked for them. Physical activity and eating behaviour were explained in both SES groups as logical with regard to their: available time and energy, habits, social influences and physical condition. Especially in the case of some low SES participants, eating behaviour was in addition explained by financial considerations. Some participants stated that they simply did not have the motivation to eat more healthily or to be more physically active.

Time and energy

For those participants motivated to live healthily, having enough time and energy was an important requirement for having a healthy diet. Participants indicated that preparing *a healthy meal* could take more time and effort.

> *"I think it is a disadvantage, or maybe not really a disadvantage, but that it* [eating healthily] *takes more time sometimes. Or you have to prepare it properly, that you peel the potatoes earlier, or something like that."* (Low SES woman, 49 years old)

Participants also indicated that a lack of time or a lack of energy after a long day's work could make it sometimes difficult to be *physically active*. Participants perceived that they had to divide their time and energy. Physical activities, for example, had to compete with other activities.

> *"I should do it* [exercise] *more often, but sometimes the motivation is lacking, and the time. At home the laundry is waiting for me. And then you have to make choices: Will I do the laundry or am I going to exercise? Do I choose to take care of my mother, or am I going to do other things? Choices."* (Low SES woman, 44 years old)

Participants also mentioned that, if they planned their eating behaviour and physical activities, it became easier to do it.

"What I did notice, what does help – not that I always do it, but I do have those periods that I do – is when you plan it. You make up some recipes for a few days and you do the groceries for that." (High SES woman, 48 years old)

"If you, for example, like me, go for a walk with a friend on Tuesday evening, and she knows that, you know, I will be there on Tuesday evening at seven o'clock." (High SES woman, 60 years old)

Habits

Some participants indicated that it was easy for them to live healthily because that was how they grew up or it was what they were used to doing.

"I was raised to eat quite healthily. But if you are not used to that, I think it can be difficult." (Low SES man, 69 years old)

However, other participants indicated that it was difficult for them to live healthily because they were used to the unhealthy behaviour. Likewise, some participants indicated that healthy behaviours should become habitual, but that, at the moment, these healthy behaviours were rather an exception than a rule for them.

"My husband and I often say it; we go walking before we go to bed or around half past nine in the evening. But it should become a habit. It is now rather an exception." (Low SES woman, 61 years old)

Financial cost

Low SES groups in particular discussed the influence of cost on their shopping and *eating behaviour.* They mentioned that they did their grocery shopping at cheap supermarkets and indicated that special offers influenced their food choice. They furthermore considered higher financial cost as a disadvantage of eating healthily.

"As I understand from you, money is a disadvantage for healthy eating. Are there any other disadvantages?" (Interviewer)
"I think money is the most important factor." (Low SES woman, 64 years old)
"That is the most important." (Low SES woman, 56 years old)
"You can't take whatever you want. You have to pay attention to the price. With everything. We first had two incomes, but we don't have my income anymore. (...) Then you really need to pay attention to the things you buy." (Low SES woman, 62 years old)

The high SES groups that discussed the higher cost of healthy foods put this into perspective by saying that a healthy diet might be cheaper in the long run, taking into account the total lifestyle and the long-term health costs.

"It is about your lifestyle as a whole and then I think that eating healthily does not have to be more expensive." (High SES man, 60 years old)
"It could be that it [eating healthily] *is even cheaper."* (High SES man, 47 years old)
"In the end, I am convinced of that. If you take into account the medical cost in the long term, etcetera." (High SES man, 60 years old)

Social influences

All groups indicated that the social environment made it sometimes difficult to *eat healthily*. Enjoying an alcoholic beverage or an unhealthy snack was often associated with sociability. At a party or in a social setting, participants sometimes found it difficult to resist unhealthy foods.

"When you are at a reception or whatever – that happens once, twice or three times a month or something – then I think: 'Oh, no'. I find that difficult, when you want to eat healthily, but you get stuck in a snack situation." (High SES woman, 53 years old)

Another reason why it could be difficult for participants to say no was because they did not want to disappoint the hostess.

"Then you do not want to displease someone, or they have bought a lot of food. Then you think I will eat a little. That is how it goes." (Low SES woman, 44 years old)

At home also, it sometimes became difficult for participants to eat healthily because family members bought unhealthy products or because family members did not want to join them in eating healthy alternatives. At the same time, participants could be stimulated by their family members to eat healthily by improving their eating behaviour together or by following the good example of family members who already ate healthily.

"When the persons in your surrounding eat more healthily, you are going to do that more easily as well. My wife thinks it important to eat healthily, my daughter as well. But especially my wife influences me, because she is always around. I think your surroundings play a decisive role." (High SES man, 61 years old)

Some participants indicated that they ate more healthily by adapting their own eating pattern to the needs or wishes of family members, or that family members adapted their eating patterns to what the participants needed.

"I have to pay attention because of the diabetes as well. So, my husband does that automatically as well. He gets the same [food]*. I am not going to prepare two types of vegetables and two types of potatoes, or whatever. I make all the same. But he doesn't mind."* (Low SES women, 56 years old)

Social influences were also noticeable in participants' perceptions regarding *physical activity*. For some participants, physical activity was a social occasion, associated with the opportunity to meet new people. Being part of a group made it easier for participants to go to exercise sessions, because they felt obligated to go even if they had other things to do or felt no motivation at that moment.

> *"Then you have that appointment. And then you won't cancel it that easily. Then you really first need to have a good excuse."* (Low SES woman, 49 years old)

Family members, especially the partner and children, could also motivate participants to exercise by saying they should be physically active or by joining them. Some participants indicated that their family members could also demotivate them, for example by reminding them of other things that should be done (first). Such competing activities, like household activities or family duties, could inhibit participants from being physically active.

> *"You are getting older, you have kids, and you do not have any time anymore to exercise because you are busy with the kids and so on."* (Low SES man, 54 years old)

Physical condition

Some participants stated that their physical condition made it difficult or impossible for them to be *physically active*.

> "*That your body sometimes can't do it* [being physically active]*, because of certain health complaints."* (High SES woman, 51 years old)

> *"When I was 15* [years old]*, I started working at a building site, so my body is just not functioning anymore. It's finished. Done."* (Low SES man, 62 years old)

However, at the same time, as illustrated in the next section, someone's physical condition could be a motivation to engage in a healthy lifestyle.

Lifestyle change is prompted by feedback from their body

Participants relied strongly on the feedback that their own body gave them. Both low and high SES groups mentioned the negative health consequences of an *unhealthy diet* or a lack of *physical activity*. However, more than the high SES participants, the low SES participants stated that they first needed to get a signal from their own body before they would change their lifestyle.

> *"As long as I feel healthy and I don't suffer from anything, I eat whatever I want."* (Low SES man, 58 years old)

However, some participants mentioned that it might be too late if they were to wait for a signal before improving their lifestyle. Like many high SES participants, some low SES participants stated that a healthy lifestyle was necessary to prevent overweight and health complaints.

> *"But it is also for preventive purposes. To prevent all kind of things. When you eat fatty, you can get cardiovascular complaints."* (Low SES man, 54 years old)

Several participants mentioned that they had already experienced some health complaints and stated that these health complaints were the trigger to change their lifestyle.

> *"I have suffered three heart attacks. That's why I take a little bit of care of what I eat."* (Low SES man, 54 years old)

> *"I have been in the hospital once, because of a heart attack. And then I have been reminded of some things. That is why I have changed my lifestyle."* (High SES man, 61 years old)

Lifestyle change was also prompted by less extreme feedback from participants' bodies, such as a simple change in weight:

> *"What I did notice was that I weighed 106 kilograms at a certain point. I stood naked on my wife's weighing scale. One hundred and six kilogrammes naked, then I scratched my head and started thinking: 'how did it happen'? So, normally when I came home and was watching TV, then I always ate something before I went to bed. And now I consciously stopped doing that and I weigh 102 kilograms again."* (Low SES man, 58 years old)

In the case of lifestyle advice also, several participants from both SES groups believed that their own body could tell them what was healthy for them and saw themselves as the most reliable source of information.

> *"But your body will indicate it, what you can or can't eat. Because when I eat more sauce than normally, I notice it immediately."* (Low SES woman, 62 years old)

When participants discussed the possibility of receiving support for lifestyle change from health professionals, they indicated once more that it was person-specific support that was needed. As illustrated in the next section, participants therefore considered it important for health professionals to take a participant's personal situation into account.

Support for lifestyle change should include individually tailored advice and could profit from involving others

Participants made suggestions about how they could be supported to make lifestyle changes. They required tailored lifestyle advice and discussed the influence of involving significant others. In low SES groups in particular, the advantage of making lifestyle changes together with comparable others was mentioned.

Although some participants were keen to receive support for lifestyle change, others indicated that they were not interested. Some participants mentioned that they already lived healthily and therefore did not need advice. Others indicated that they already knew what was healthy or already received enough advice. Some men considered themselves too old to receive lifestyle advice.

> *"If I was 20, I would say: 'Yes I do need advice'. But not anymore at this time."* (Low SES man, 70 years old)

Furthermore, as with lifestyle change, participants often felt that there needed to be something wrong with their weight or health before they would visit health professionals for lifestyle advice.

> *"You often just don't do it without a reason. You don't just go to someone like that* [nutritionist]*, there must be a reason."* (Low SES woman, 44 years old)

Tailored lifestyle advice

Those participants who were interested in receiving advice mentioned that it was person-specific whether something was good for one. Therefore, they would like to receive tailored *nutrition* advice, preferably based on knowledge about how their own body works. Some high SES participants suggested that such individually tailored information could be given on the basis of the results of health checks.

> *"You can give some general advice – like that is good and that is not good – but not personal advice. Then you first need at least maybe blood and urine tests and whatever more."* (High SES woman, 72 years old)

In the case of *physical activity* guidance also, interested participants mentioned that the person giving the advice should understand the personal situation and physical condition of the participant, so that the advice could be tailored to the individual situation. Some low SES participants in addition mentioned that they wanted to get advice specifically for their age.

> *"You become older. You become stiffer. Tying your shoelaces, that kind of things, all those movements become more difficult. I would like to get more specific physical activity advice about that"* (Low SES man, 65 years old)

Making lifestyle changes together

A change in lifestyle might be more easily accomplished together with others. Support for lifestyle change could make use of that by involving significant others. Some low SES participants in particular indicated that they would like to receive *nutrition* advice in a group. They explained that, in a group, members could stimulate one another by interchanging ideas and experiences and by social control.

> *"In a group, you can accomplish more. At least, you will have more motivation. If I look into your eyes and I say: 'I did not eat any potatoes this week', you can't check it. (...) But he lives next to me, and then he can say 'I have seen you sitting at the table, with potatoes'."* (Low SES man, 58 years old)

In contrast, high SES participants frequently indicated that they preferred to receive nutrition advice individually. They found that advice on an individual level could become more personally relevant or more specific, whereas on a group level it would often remain very general.

> *"In a group, you get the more general* [information]*, what you already know."* (High SES women, 60 years old)

With regard to *physical activity*, participants from both SES groups indicated that they preferred to be physically active in a group rather than on their own. Participants found it more enjoyable to do physical activities with others. Additionally, being part of a group could stimulate them because others in the group would expect them to show up.

> *"You don't cancel it that easily. You made your appointment."* (High SES woman, 58 years old)

The low SES participants in particular mentioned that it would be stimulating to exercise together with persons of the same age, gender, physical activity level or health complaints. One perceived advantage was that they could exercise on the same intensity level.

> *"My daughter regularly exercises a few times a week. But I don't think I will go together with my daughter, because I can't keep up with her. (...) I can't keep up the pace and then I would think 'Sorry, I won't join you'. If you are in a group with persons of the same age, then you have about the same tempo. (...) I would appreciate that."* (Low SES woman, 64 years old)

Another advantage with respect to being physically active with comparable others was that participants expected to be better understood by other participants.

"When you're going to exercise with persons with the same illness, it is easier. (…) If you say that you have to take a break, you feel less awkward." (Low SES woman, 56 years old)

The support of similar peer groups could apparently help to create a safe and accessible setting for facilitating lifestyle change among these low SES participants.

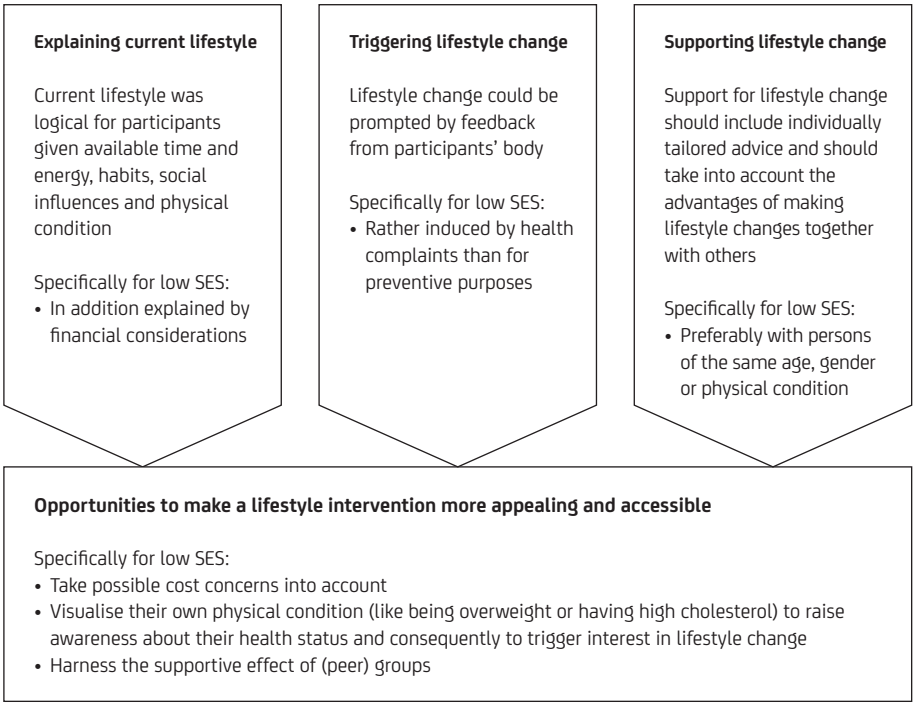

Figure 2.1 Overview study results and identified opportunities for lifestyle interventions targeting individuals with low SES

Discussion

This study addressed perceptions of low and high SES groups regarding healthy eating, physical activity and lifestyle advice and provided insight into the variety of perceptions – which exist either in general or more specifically among low SES groups – that should be taken into account when a lifestyle intervention is being adapted for individuals with low SES. The results showed three striking aspects regarding current lifestyle, lifestyle change and support for lifestyle change. In general, participants described their current lifestyle – healthy or not – as logical for them given their personal situation in terms of their available time and energy, habits, social influences and physical condition. In order to change their lifestyle, participants first had to be prompted by feedback given by their own body. With regard to

supporting this lifestyle change, participants indicated that it was important to tailor lifestyle advice towards their personal situation. The perceptions of the low SES participants were in general quite comparable to the perceptions shared by the high SES participants. However, some perceptions were especially shared among the low SES groups. Low SES participants indicated that their current eating behaviour was sometimes affected by cost concerns. They seemed to be especially motivated to change their lifestyle when they experienced health complaints, but were rather hesitant to change their lifestyle for preventive purposes. Furthermore, they preferred to receive lifestyle advice in groups and to be physically active in a group of persons of the same gender, age or physical condition.

The low SES groups in this study seemed to be more affected by cost in their current lifestyle than the high SES groups. Financial cost was more often mentioned by the low SES groups and more intensively mentioned as making a real difference in their food choices. When high SES participants brought up the topic of cost, they put it more into perspective, for example by mentioning that cost concerns could be an issue for other persons. Financial cost is a recurring theme in research among low SES groups. Cost is often cited as an influence or barrier in food choices among low SES groups [32-35]. For physical activity however, cost concerns were hardly mentioned as a barrier by our groups. This is in accordance with another qualitative study, which showed that financial cost was not perceived as a key barrier for physical activity in any of their SES groups [28]. Some other studies, however, did show that financial cost could be a barrier to starting or continuing physical activity among individuals with low SES [36, 37]. More generally, losing weight is more often experienced as expensive by less educated persons compared to more highly educated persons [38]. Apparently, cost could be an issue for individuals with low SES with respect to lifestyle (change), and therefore participants' possible cost concerns should be taken into account in lifestyle interventions.

The observation that our low SES participants were mostly not prevention oriented is in line with other studies that observed that individuals with lower SES are less likely to think about ways to stay healthy [39], are less likely to control their weight [38] and health status [40] and are in general less interested in screening activities [41-43]. Our participants indicated that they expected their body to warn them when something was wrong with their health. Several participants mentioned that they had already experienced health complaints and cited their health complaints as the trigger to engage in healthy behaviour. Likewise, Van der Waerden and colleagues observed that an increased severity of complaints is associated with a greater willingness to participate in, and keep following, prevention programmes [44]. Apparently, some persons first have to experience health complaints or changes in their physical condition before they become motivated to change their behaviour. Therefore, it can be a challenge to motivate these persons to participate in preventive activities. A possible solution could be to use individuals' own physical condition (like being overweight or having high cholesterol) or the signs that their own body gives as the trigger to make individuals aware of their own current health status and the possible benefits of lifestyle change.

To support this lifestyle change, lifestyle interventions for low SES persons could profit from the supportive effect of (peer) groups. Low SES participants in particular preferred dietary advice and physical activities together with others. Involving friends, families and peers in order to create social support is a strategy that is often suggested in order to promote healthy lifestyles among low SES groups [37, 45, 46]. A review of lifestyle interventions stimulating physical activity among women with low SES showed that lifestyle interventions with a group component were more effective [20]. Being part of a group can help to make these persons feel more accountable and therefore more motivated [47]. Our low SES participants especially preferred to be physically active together with persons of the same age, gender or health complaints. This finding may be bound up with the on-average higher age and BMI of our low SES participants compared to our high SES participants. However, that seems rather a speculative statement given that none of our high SES participants – of whom some were also relatively older and overweight – expressed this preference. Another study among women in deprived neighbourhoods also observed that being physically active together with participants with similar health conditions could be encouraging [36]. Lifestyle change is easier to accomplish together with (the social support of) others, and including a group component in lifestyle interventions might be extremely important for targeting low SES individuals.

Some methodological choices should be taken into consideration in relation to interpreting the results. Although the focus group interviews gave rich and detailed data on the variety of perceptions that may exist among groups with different socioeconomic status, this method is not suitable for arriving at firm conclusions about actual differences between socioeconomic groups. In general, the study does give us a better understanding of the variety of perceptions that exists among groups with different socioeconomic status, which – regardless of whether these perceptions are more common among individuals with either low or high SES – should be considered in developing a lifestyle intervention. Moreover, we observed some perspectives that were exclusively shared by our low SES participants and supported by the existing literature; this finding may further help to make a lifestyle intervention more appealing and accessible to individuals with low SES.

In this research, participants were recruited via pre-existing groups. Participants were already acting in a social group, and therefore it could be that our groups were more focused on social support and group activities. Individuals that are not acting in a social group might have other perceptions regarding lifestyle advice in groups. However, the fact that our participants were acting in a social group would not completely explain why our low SES participants preferred lifestyle advice and physical activities in groups, whereas our high SES groups – also pre-existing groups – were less willing to receive nutrition advice in groups. Likewise, another study demonstrated with the help of survey research and individual interviews that being physically active together with others is an enabler or pre-requisite for individuals with low SES to participate in physical activities [37].

Our study gives valuable information on how individuals in the target group find that a healthy lifestyle fits into their life; what motivates them to participate in lifestyle change; and how this change can be facilitated, according to them. As already mentioned, these perceptions of the target group can differ from the perceptions of health professionals. Therefore, it is interesting to get insight into how the ideas of the target group match with the experiences of health professionals and whether participants' suggestions for supporting lifestyle change actually suit the practicalities. A next step is to study how the revealed insights for adapting lifestyle interventions aimed at individuals with low SES can be realised in a real-life situation.

Conclusions

This study gave important insights into perceptions relating to healthy eating, physical activity and lifestyle advice of individuals with different socioeconomic positions, and reveals some promising opportunities to adapt lifestyle interventions especially for individuals with low SES. To motivate individuals with low SES to participate in a lifestyle intervention, it may be useful to visualise their own physical condition (like being overweight or having high cholesterol) to raise their awareness about their health status and consequently to trigger interest in lifestyle change. Lifestyle interventions targeting individuals with low SES should take possible cost concerns into account and should harness the supportive effect of peer groups.

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Additional file 2.1 Interview questions

Questions with which to start the conversation:	Ask why! Continue with the following questions:
Introduce yourself	
What did you have for dinner last night?	• Do you often eat that type of meal?
Who usually prepares dinner?	
Who usually does the grocery shopping?	
Where do you usually buy your groceries?	
Nutrition	
If I say food, what do you think about?	• How important is food for you?
Do you think that you eat healthily?	• What is healthy? • What is unhealthy?
Is it important for you to eat healthily?	• What do you see as **advantage(s**) of eating healthily? • What do you see as **disadvantage(s)** of eating healthily?
Would you like to eat more healthily?	• What would you like to change about your eating behaviour? Have you ever tried that? How did you try and how did you experience that? • What makes it **difficult** for you to eat healthily? • What makes it **easier** for you to eat healthily?
By whom are you **supported** to eat healthily?	• Which people **discourage** you from eating healthily (disapprove of you eating healthily)? • How do you experience that?
Do you talk with others about what you eat? About what?	• From whom do you take advice? How do you experience that advice? • What are for you trustworthy sources regarding information about healthy nutrition?
Would you like to receive advice about healthy eating?	• From whom? • About what topic would you like to receive advice?
Where and when would you like to receive advice about healthy eating?	• Individually or in a group?

Questions with which to start the conversation:	Ask why! Continue with the following questions:
Physical activity	
How did you get here?	• Is that the way you usually do that?
Do you like to be physically active?	• What do you see as **advantage(s)** of being physically active? • What do you see as **disadvantage(s)** of being physically active?
What kind of physical activities do you usually do during a normal day?	• With whom? Where? Organised? • What is your definition of being physically active?
Do you think you do sufficient physical activity?	• How would you do that?
Would you like to be more physically active?	• Have you ever tried that? How did you try and how did you experience that? • What makes it **difficult** for you to be physically active? • What makes it **easier** for you to be physically active?
By whom are you **supported** to be physically active?	• Which people **discourage** you from being physically active (disapprove of you being physically active)? • How do you experience that?
Do you talk with others about physical activity behaviour? About what?	• From whom do you take advice? How do you experience that advice? • What are for you trustworthy sources regarding information about sufficient physical activity?
Would you like to receive guidance to be (more) physically active?	• From whom? • About what topic would you like to receive advice?
Where and when would you like to receive guidance for physical activity?	• Individually or in a group?
What kind of physical activities would you prefer?	
Where would you like to be physically active?	• Indoors or outdoors? • Sports club? • With whom?
Lifestyle (guidance)	
So far, we mainly talked about eating healthily and being physically active. What else is important for you for a healthy life?	• Are those things more important than eating healthily or doing sufficient physical activity?
How could we help/stimulate you to live healthily?	• If we offered you guidance, what should that guidance look like? • What is important to you regarding (lifestyle) guidance?
Additional topics, if there is enough time: • ***Smoking*** • ***Participating in research***	

3

Exploring strategies to reach individuals of Turkish and Moroccan origin for health checks and lifestyle advice: a mixed-methods study

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Submitted

Abstract

Background: Low participation rates among ethnic minorities in preventive healthcare services are worrisome and not well understood. The objective of this study was to explore how adults of Turkish and Moroccan origin living in the Netherlands, aged 45 years and older, can be reached to participate in health checks for cardiometabolic diseases and follow-up (lifestyle) advice.

Methods: This mixed-methods study used a convergent parallel design, to combine data of one quantitative study and three qualitative studies. Questionnaire data were included of 310 respondents, and interview data from 22 focus groups and four individual interviews. Participants were recruited via a research database, general practitioners and key figures. Quantitative data were analysed descriptively and qualitative data were analysed using a thematic approach.

Results: Regarding health checks, 50% of the Turkish questionnaire respondents and 66% of the Moroccan questionnaire respondents preferred an invitation from their general practitioner. The preferred location to fill out the health check questionnaire was for both ethnic groups the general practitioner's office or at home, on paper. Regarding advice, both groups preferred to receive advice at individual level rather than in a group, via either a physician or a specialised healthcare professional. It was emphasised that the person who gives lifestyle advice should be familiar with the (eating) habits of the targeted individual. Sixty-one percent of the Turkish respondents preferred to receive information in their native language compared to 37% of the Moroccan respondents. Several participants mentioned a low proficiency in the local language as an explanation for their preference to fill out the health check questionnaire at home, to receive advice from an ethnic-matched professional, and to receive information in their native language.

Conclusions: The general practitioner is considered as a promising contact to reach adults of Turkish and Moroccan origin for health checks or (lifestyle) advice. It might be necessary to provide information in individuals' native language to overcome language barriers. In addition, (lifestyle) advice must be tailored. The obtained insight into preferences of adults of Turkish and Moroccan origin regarding reach for preventive healthcare services could help professionals to successfully target these groups.

Background

Cardiometabolic diseases, like cardiovascular diseases and diabetes mellitus, have a substantial impact on the global burden of disease [1, 2]. The risk for developing cardiometabolic diseases seems to be especially high among some ethnic minorities [3-5].

In the Netherlands, as in several other European countries, individuals of Turkish and Moroccan origin are the two largest non-Western ethnic minority groups [6]. Among these ethnic minorities, the prevalence of type 2 diabetes is relatively high compared to the host population [7-9]. There is also evidence for relatively unfavourable HDL cholesterol levels among people of Turkish origin [8].

An increased risk of cardiometabolic diseases can be due partly to modifiable risk factors, such as an unhealthy lifestyle and overweight [10, 11]. In the Netherlands, individuals of Turkish and Moroccan origin have a relatively high prevalence of physical inactivity and overweight compared to individuals of Dutch origin [12, 13]. Given their elevated risk, these groups in particular could benefit from preventive health services.

However, it seems difficult to reach ethnic minorities for preventive health services. The lack of reach hinders both the identification of individuals at high risk and the subsequent uptake of health promoting activities. Firstly, concerning identification, ethnic minorities are often not reached for health screening services [14-17]. This poses a problem, as early detection of individuals at risk for metabolic diseases is of utmost importance in order to prevent health complications and to offer lifestyle advice to those who need it. Secondly, ethnic minorities are less likely to be reached by health promoting activities [18, 19]. However, the problem does not seem to be that ethnic minorities do not have access to healthcare, as in the Netherlands they often visit their GP [20]. Still, there is a lack of specific strategies to reach individuals of Turkish and Moroccan origin for preventive health services.

Recently, a health check for cardiometabolic diseases was developed in the Netherlands. This health check consists of a two-stage approach. In the first stage, people fill out a short questionnaire (risk estimation). In the second stage, people with a high risk score are advised to plan two consultations with their GP or practice nurse for further examination of their risk profile and to discuss follow-up actions [21]. Along with the development of this health check, the issue was raised how to reach individuals of Turkish and Moroccan origin for this initiative and how to provide suitable follow-up lifestyle advice. To solve this issue, several studies were initiated. The ambition of this paper was to combine insights of these independent studies, which included one quantitative study and three qualitative studies.

The overall aim of the current study was to get insight into the perceptions of adults of Turkish and Moroccan origin living in the Netherlands regarding how they could successfully be reached for both a health check for cardiometabolic diseases and follow-up (lifestyle)

advice. To this end, this study provided answers to the following questions among the two ethnic groups:

- By whom do they prefer to be invited for a health check, and why?
- Where do they prefer to fill out a health check questionnaire, and why?
- By whom do they want to receive (lifestyle)advice, and why?
- What is the preferred way of communicating (lifestyle)advice, and why?
- What is their preference regarding language, and why?

Methods

The current study is a secondary analysis, using data from four related studies (one quantitative study and three qualitative studies), among adults of Turkish and Moroccan origin living in the Netherlands. To answer the research questions of the current study, a selection of data of the four studies were used. The relation between the original studies and the data used in the current study is presented in Table 3.1. The studies were conducted independently of one another and all provided data regarding either participating in a health check or receiving (lifestyle) advice, or both. A mixed-methods approach – "in which elements of quantitative and qualitative research approaches are combined" [22] – was used in order to get a better understanding of the quantitative results regarding the research questions of the current study, with the help of the narratives from the qualitative studies.

Study population and data collection

The demographic characteristics of the study population included in the current mixed method study are presented in Table 3.2. Study population, study procedure, and the data collection methods for each original study are described below. Additionally, for each study, it is described which data is used in the current mixed methods study.

Quantitative study

Study population

The target group of the original study consisted of adults of Turkish and Moroccan origin aged 18 years and older.

Procedure

A representative sample design was composed, based on the background characteristics of the target group (for each ethnic group: by region, gender, age, education) by using data from Statistics Netherlands. On the basis of this design, 600 persons were selected from the TNS NIPObase, which is a database for market research. Selected persons received an invitation by e-mail to fill out a web-based questionnaire. A reminder was sent after one and a half weeks. The response rate was 52%. An additional sample was recruited for face-to-face interviews (n=586). These interviews were conducted in Dutch, using a structured questionnaire similar to the web-based questionnaire. The web-based questionnaire was

Table 3.1 Overview of objectives and methods of the original studies and data used in current study

	Original study objective	Original study population	Data collection	Recruitment strategy	Data included in secondary analysis	Relevant topics for secondary analysis
Quantitative study	To get insight into knowledge and perceptions of adults of Turkish and Moroccan origin regarding cardiovascular diseases and its risk factors, and their preferences in order to reach them with health communication.	Individuals of Turkish and Moroccan origin (18 years and older)	Web-based questionnaire	Via TNS NIPObase (database for market research)	310 respondents, aged 45 and older: • 167 Turks • 143 Moroccans	Health check: • by whom? • where? CVD information: • by whom? • preferred way? • preferred language?
			Face-to-face interviews, using a structured questionnaire	Via research assistants in own network		
Qualitative study I	To explore determinants influencing vulnerable groups regarding (non-) participation in the Dutch two-stage cardiometabolic health check, comprising a health risk asseswsment and prevention consultations for high-risk individuals.	Non-Western immigrants and Dutch individuals with low socioeconomic status (45–70 years old)	Focus groups, using a semi-structured interview guide	Via key persons within the community, e.g. educational coordinators or employees of cultural/community organisations	4 focus groups: • 2 Turkish groups • 2 Moroccan groups	Health check: • by whom? • where? • preferred language?
		Adult children of the non-Western immigrants (18–45 years old)	Focus groups, using a semi-structured interview guide		5 focus groups: • 3 Turkish groups • 2 Moroccan groups	
Qualitative study II	To explore factors that play a key role in the uptake and maintenance of behavioural changes in individuals from non-western immigrant populations with a high risk for cardiometabolic disease. Furthermore to get insight in what kind of support is needed to increase the uptake and maintenance of healthy behaviours.	Non-Western immigrants at risk for cardiometabolic diseases (45–70 years old)	Face-to-face interviews, using a semi-structured interview guide	Via their GP	4 face-to-face interviews: • 2 Turks • 2 Moroccans	Lifestyle advice: • by whom? • preferred way? • preferred language?
		Adult children of the non-Western immigrants (18–45 years old)	Focus groups, using a semi-structured interview guide	Via community workers and neighbourhood centres	3 focus groups: • 1 Turkish group • 2 Moroccan groups	
Qualitative study III	To explore perceptions on healthy eating and physical activity of individuals with lower socioeconomic status of different ethnic origin, in order to identify opportunities to make a lifestyle intervention more applicable to the target groups' realities.	Individuals of Turkish, Moroccan and Dutch origin with low socioeconomic status (45 years and older)	Focus groups, using a semi-structured interview guide	Via local community workers, chairmen of mosques and persons of the target population	10 focus groups: • 6 Turkish groups • 4 Moroccan groups	Lifestyle advice: • by whom? • preferred way? • preferred language?

distributed in March 2010 and the face-to-face interviews were conducted between April and June 2010. The research team assessed that, according to the Dutch regulations, no ethical permission was required for this type of research [23].

Questionnaire

The questionnaire consisted of 74 questions divided over four topics, namely, questions regarding participants': 1) general characteristics, 2) health and lifestyle, 3) knowledge and attitude towards cardiovascular diseases (CVD) and health checks, and 4) preferences regarding information provision concerning CVD. The questionnaire was self-constructed by a market research agency specialised in the target population. The questionnaire was pre-tested for duration and clarity among eight subjects and was adjusted based on the findings of the pre-test.

Data used in secondary analysis

For the mixed methods study, data were used of respondents aged 45 years and older, of whom 167 were of Turkish origin and 143 were of Moroccan origin. Data were only used from those questions related to reach for a health check or related to information provision concerning CVD (Table 3.3). It should be noted that questions regarding a health check were examined only among those respondents that were either 'maybe' or 'definitely' interested in participating in a health check (85% of the Turkish respondents and 71% of the Moroccan respondents).

Qualitative study I

Study population

The target group of this study consisted of non-Western immigrants and native Dutch participants with a low socioeconomic status (45–70 years old). Although the target group consisted of persons aged 45–70 years, adult children of the non-Western immigrants (18–45 years old) were also invited for this study. This was done to overcome language barriers and because these children often help their parents to find their way around the Dutch healthcare system. Adult children were interviewed about the needs and preferences of their parents. The methods used in this study are presented in detail elsewhere [24].

Procedure

Participants were recruited through key persons within the community, e.g. educational coordinators or employees of cultural/community organisations. Focus groups were conducted between February and June 2010. They were held separately for males and females. The focus groups were held in Dutch by the researcher (IG), who was accompanied by an ethnicity-matched research assistant who took notes and helped the interviewer, if the mastery of the Dutch language of participants was low. The study was approved by the medical ethics committee of Leiden University Medical Center. Participants' verbal informed consent was audio-taped. The interviews were recorded and transcribed verbatim. Interviews transcripts were coded with Atlas.ti 6.2.

Table 3.2 Characteristics of the participants in the four individual studies in this mixed methods study

	Quantitative study		Qualitative study I		Qualitative study II		Qualitative study III	
	Turks	**Moroccans**	**Turks**	**Moroccans**	**Turks**	**Moroccans**	**Turks**	**Moroccans**
Target group	n=167	n=143	n=15	n=18	n=2	n=2	n=33	n=33
Gender								
Males	51%	73%	1 group	1 group	–	–	3 groups	2 groups
Females	49%	27%	1 group	1 group	2 interviews	2 interviews	3 groups	2 groups
Age (mean years ± SD)	53 ± 8.1	55 ± 8.7	52 ± 8.5	54 ± 6.8	55 ± 3.5	48 ± 2.8	49 ± 8.5	47 ± 11.8
Overweight (BMI > 25 kg/m^2)	82%	73%	–	–	–	–	85%	87%
Adult children			n=22	n=10	n=6	n=13		
Gender								
Males	–	–	1 group	–	–	1 group	–	–
Females	–	–	2 groups	2 groups	–	1 group	–	–
Mixed	–	–	–	–	1 group	–	–	–
Age (mean years ± SD)	–	–	34 ± 13.4	19 ± 3.6	31 ± 12.2	28 ± 7.7	–	–

Table 3.3 Selected questions from quantitative study

A health check:

- In the future, a new health check will be provided that is scientifically tested. The check starts with a questionnaire. From your answers, it may emerge, for example, that you have an elevated risk of getting diabetes and/or cardiovascular diseases. If so, then you will be advised to visit your GP for further investigation. Would you like to participate in this new health check?
  - ☐ *Yes, definitely*
  - ☐ *Yes, maybe*
  - ☐ *No, probably not*
  - ☐ *No, definitely not*

If *'Yes, definitely'* or *'Yes, maybe'*:

- By whom would you prefer to be invited for this check?
  - ☐ *GP*
  - ☐ *Specialist/hospital*
  - ☐ *Municipal institution/Community health service*
  - ☐ *Other*
  - ☐ *Don't know*

- Where would you like to fill out this questionnaire?
  - ☐ *At GP's office*
  - ☐ *At the specialist's/in the hospital*
  - ☐ *At community health service*
  - ☐ *At other medical healthcare provider*
  - ☐ *In the community centre*
  - ☐ *In the mosque*
  - ☐ *At home, with pen and paper*
  - ☐ *Via internet*
  - ☐ *Other*
  - ☐ *No preference*

Information concerning CVD:

- Suppose that you are interested in information about CVD, where would you get that information? Mention two most important information sources.
  - ☐ *GP*
  - ☐ *Specialist/hospital*
  - ☐ *Community health service*
  - ☐ *Dutch Heart Foundation*
  - ☐ *Internet*
  - ☐ *Library*
  - ☐ *Other*

- What is the preferred way of communicating information about CVD?
  - ☐ *Written via brochure/paper*
  - ☐ *Internet*
  - ☐ *Oral in a group*
  - ☐ *Oral in person*
  - ☐ *Television*
  - ☐ *Other*

- Do you want to receive the information about CVD in Dutch or your native language?
  - ☐ *Prefer Dutch*
  - ☐ *Prefer native language*
  - ☐ *Does not matter*

- Suppose that a person provides information about CVD. Do you consider it important that this person:
  ...is a physician/doctor?
  ...is of the same ethnic origin?
  ...is of the same gender?
  - ☐ *Very important*
  - ☐ *A little important*
  - ☐ *Not important*
  - ☐ *Not important at all*

Interview guideline
A semi-structured interview guide was used, with questions regarding invitation strategies, risk communication and determinants influencing participation in health checks.

Data used for secondary analysis
For the mixed methods study, data were used from four focus groups with the target group (2 Turkish groups; 2 Moroccan groups) and five focus groups with the adult children of the target group (3 Turkish groups; 2 Moroccan groups).

Qualitative study II
Study population
The target group of this study consisted of non-Western immigrants (45–70 years old) at risk for cardiometabolic diseases. Like in qualitative study I, adult children of non-Western immigrants (18–45 years old) were also included in the study.

Procedure
The older adults were recruited via their GP, and adult children were recruited via community workers and neighbourhood centres. Focus groups and interviews were conducted between February 2011 and January 2012. The (focus group) interviews were held in Dutch by the researcher (JBM). Focus groups were organised for men and women separately, if the participants preferred that over a mixed group. During the focus groups, the researcher was accompanied by a research assistant who took notes and who was ethnically matched if translating was needed. Likewise, if necessary, a translator was present during the interviews. The study was approved by the medical ethics committee of Leiden University Medical Center. Participants signed an informed consent form. The (focus group) interviews were recorded and transcribed verbatim. Interviews transcripts were coded with Atlas.ti 6.2.

Interview guideline
A semi-structured interview guide was used, with questions regarding culture and health, the uptake and maintenance of healthy behaviours, and preferences regarding lifestyle guidance.

Data used for secondary analysis
For the mixed methods study, data were available from four individual interviews with the target group (2 Turks; 2 Moroccans) and three focus groups with the adult children of the target group (1 Turkish group; 2 Moroccan groups).

Qualitative study III
Study population
The target group of this study consisted of native Dutch participants and participants of Turkish and Moroccan origin, aged 45 years and older. The methods used in the original study are presented in detail elsewhere [25, 26].

Procedure

Focus groups were conducted between May and November 2011 and were held separately for males and females. Participants were recruited via local community workers, chairmen of mosques and persons of the target population in mostly disadvantaged neighbourhoods. The focus groups were held in Dutch by one of the two researchers (AJB and DT) and the other researcher took notes. If participants could not express their feelings in Dutch, they expressed themselves in their native language and others translated for the researchers. The study was approved by the medical ethics committee of academic hospital Maastricht and Maastricht University (METC azM/UM). Participants gave either written or audio-taped informed consent. The interviews were recorded and transcribed verbatim. Interviews transcripts were coded with Nvivo 9.2.

Interview guideline

A semi-structured interview guide was used with questions regarding determinants of a healthy diet and physical activity, and experiences and preferences regarding lifestyle guidance.

Data used for secondary analysis

For the mixed methods study, data were used from ten focus groups with the target group (6 Turkish groups; 4 Moroccan groups).

Mixed-methods analysis

For the secondary data analyses, a mixed-methods approach was used with a convergent parallel design. This mixed-methods study had a quantitative priority, meaning that greater emphasis was placed on the quantitative findings for answering the study question. The qualitative data were used to explain and elaborate on the quantitative findings.

Firstly, the data of the four studies were prepared (e.g. transcribed, coded) independently by each research team that conducted the original study. Secondly, the first author (AJB) studied the quantitative data. SPSS Statistics 19 was used to create frequency tables and calculate descriptives. Thirdly, the three research teams of the qualitative studies I, II & III used their qualitative data to explain the findings of the quantitative data. Finally, the first two authors (AJB and DT) compared and combined the results of the previous step. During this process, the original data were consulted when necessary. The final results were checked by all research teams to ensure that no information was missed or misinterpreted.

Results

Health check

Regarding reach for a health check, the following topics were examined: preferred source of invitation and preferred location to fill out a health check questionnaire.

Source of invitation

As described in Table 3.4, most of the questionnaire respondents would prefer to be invited for a health check by their GP (50% of the Turkish respondents and 66% of the Moroccan respondents). Several participants in the qualitative studies explained that they trust their GP and take it seriously when a GP sends them something. They indicated that, if they were invited by the GP, they would participate.

> *"If you receive it from the GP, you will fill it out, I'm sure of that. Because if it is from the GP, they will think: Yes."* (Turkish female adult child)

However, not everyone trusts their GP. Some participants indicated that they do not have the feeling that their health complaints are taken seriously.

> *"When you are at the GP, she already starts writing: paracetamol, while you're telling your story."* (Turkish male)

> "*They send us home with a paracetamol, while it* [the complaint] *is really more severe. They* [my parents] *won't be taken seriously."* (Moroccan female adult child)

Forty-one percent of the respondents of Turkish origin indicated medical specialists/the hospital as their preferred source to invite them for a health check, compared to 18% of the respondents of Moroccan origin. An invitation by a specialist or hospital was not extensively discussed in the qualitative studies. If the invitation was from the hospital, some participants stated that it would be important that they were familiar with that hospital.

> "*They have to be familiar with it. If it comes from a hospital that they don't know, I would also say: 'What do you want from me'. You put it* [the invitation] *away and you forget about it."* (Turkish female adult child)

Preferred location to fill out the health check questionnaire

Most respondents in the quantitative study indicated that they would prefer to fill out a health check questionnaire at the GP's office (40% of the Turkish respondents and 39% of the Moroccan respondents). Participants in the qualitative studies explained that, at the GP's office, the GP could tell them about the test and give more information when necessary. Another reason to fill out the questionnaire at the GP's office is because they have time anyway, while waiting for their appointment.

> *"In the waiting room, persons are bored anyway. The GP can provide the questionnaires in the waiting room. Those persons can fill out the questionnaire on site."* (Turkish female adult child)

Table 3.4 Preferences regarding source of invitation and location to fill out a health check questionnaire

The table presents the percentage of participants that chose that option; one option should be chosen.

	Turks (n=142)	Moroccans (n=102)
By whom would participants like to be invited for a health check		
GP	50%	66%
Specialist/hospital	41%	18%
Municipal institution/Community health service	2%	7%
Other	0%	5%
Don't know	7%	5%
Preferred location to fill out a health check questionnaire		
At GP's office	40%	39%
At home, with pen and paper	23%	23%
At the specialist's/in the hospital	20%	13%
Via internet	8%	9%
In the mosque	2%	2%
In the community centre	1%	0%
At community health service	0%	4%
At other medical healthcare provider	0%	0%
Other	1%	2%
No preference	5%	9%

The preference for filling out the health check questionnaire at home, on paper, was mentioned by 23% of the Turkish questionnaire respondents and 23% of the Moroccan respondents. Participants in the qualitative studies explained that the advantage of receiving a letter at home was that they could take the time to read and understand the letter, or they could ask someone else to translate it for them.

> *"Personally I prefer a letter. It is better for people who do not speak Dutch. Why? Because if they receive a letter, they will think: 'Oh, I received a letter so I will go to my cousin who does speak Dutch and he can read and translate the letter for me'. They will understand the message better."* (Turkish male adult child)

Some participants in the qualitative studies suggested providing the questionnaire in their mother tongue – possibly in addition to the Dutch version – to be able to understand it themselves and not to be dependent on others for a translation. However, even if the questionnaire is provided in the person's mother tongue, some persons might not be able to read it.

> *"When I look at my own situation, it does not add any value if it is in Arabic, because my mother is illiterate."* (Moroccan female adult child)

Advice

Regarding reach for follow-up (lifestyle) advice, the following topics were examined: preferred way to receive advice, source of advice and language. It should be noted that the quantitative findings refer to advice regarding CVD in general, whereas the qualitative findings refer to advice regarding lifestyle specifically.

Preferred way to receive advice

As mentioned by 65% of the Turkish respondents and 51% of the Moroccan respondents, the preferred way to receive information about CVD was in person, on an individual level (see Table 3.5). In one of the qualitative studies, it was asked how participants would prefer to receive nutrition and physical activity advice. The answers depended on the type of information that would be expected; in the case of personal information, some participants in the qualitative studies expressed a preference for advice on an individual level because not everyone should know about their personal eating habits:

> *"If you talk about my lifestyle in particular, yes, then it is nice of course* [to discuss it on an individual level]. *Otherwise, everyone knows 'oh, he has such a belly, because he eats that and that'. That is not pleasant of course. That advice, when it is about changing my lifestyle for example, then not everyone has to know that."* (Moroccan male)

However, in the case of general information, group meetings were appreciated. Participants indicated that receiving general advice in group meetings was better because they could stimulate and support one another.

Source of advice

When asked for the two most important sources for information about CVD, most of the respondents indicated that they would get their information from their GP (78% of the Turkish respondents and 76% of the Moroccan respondents) or a medical specialist/hospital (44% and 40%, respectively) (see Table 3.5). To most of the respondents, it is a little to very important that the person who gives advice is a physician/doctor (90% and 83% for Turks and Moroccans, respectively) (see Figure 3.1). For the participants in the qualitative studies, it was especially important that the person giving advice was competent. Specialised health professionals were suggested, such as a dietician for nutrition advice.

> *"Preferably someone who knows a lot about that, someone who's professional in that field."* (Turkish female)

Furthermore, it was emphasised that the person who gives lifestyle advice should be familiar with the eating habits of the targeted individual.

"But the person has to have knowledge about our dietary habits, what we eat and so on. Because if the advice is like a plate cut in thirds with potatoes, meat and vegetables [typical Dutch meal]*, then it won't be successful. Not in our culture."* (Turkish male)

Preferences regarding the advisor's ethnicity varied among respondents in the quantitative study. About half of the Turkish respondents (55%) and of the Moroccan respondents (46%) found it a little to very important that the person that provides information has the same ethnicity as the recipient (see Figure 3.1). An advantage of ethnicity-matched professionals is, as stated in the qualitative data, that a person speaks the same language.

"Of Turkish origin is easier, right? Then you understand more, so you will know more. You get more information, right?" (Turkish female)

Some participants in the qualitative studies were, however, sceptical towards a person from their own cultural background, because they were afraid of gossip within the community.

"At the end of the day, they rather prefer not to have a Moroccan counsellor, because they don't want to air their dirty laundry in public." (Moroccan male)

Twenty-three percent of the Turkish respondents and 29% of the Moroccan respondents found it a little to very important that the information provider was of the same gender. In particular, some female participants in the qualitative studies explained why gender-matching is important. The following quotes illustrate that some women would be hesitant to talk with a male advisor and would feel better understood by a female advisor.

Woman 1: "We think women are always better. Women are also more sociable."
Woman 2: "Being embarrassed for men. Can't say everything."
Woman 1: "Women do understand each other better than men." (Turkish females)

Language

Twenty-nine percent of the Turkish respondents and 25% of the Moroccan respondents did not have a preference about receiving information materials in either the local language or their native language. The majority of Turkish respondents, however, wanted to receive information in Turkish (61%). Among the Moroccan respondents, the preferred language was rather divided: 37% preferred their native language, whereas 38% preferred the local language. In the qualitative data, many Turkish and Moroccan participants often stated that they would prefer to get the advice in their mother tongue. A reason why they preferred advice in their mother tongue was that they needed it in order to understand the advice better, as they might be less fluent in the local language than in their mother tongue.

Woman 1: "In their own language it is easier, yes."
Woman 2: "They will also take it more seriously, because they hear it themselves, not via another, no, directly." (Moroccan female adult children)

Table 3.5 Preferences regarding way of communicating CVD advice

The table presents the percentage of participants that chose that option; multiple options were possible.

	Turks (n=167)	Moroccans (n=143)
Where would you get information		
GP	78%	76%
Specialist/hospital	44%	40%
Internet	23%	17%
Dutch Heart Foundation	11%	8%
Community health service	7%	6%
Library	1%	1%
Other	4%	14%
Preferred way of receiving information		
Oral in person	65%	51%
Written via brochure/paper	39%	43%
Oral in a group	21%	12%
Internet	19%	23%
Television	13%	12%
Other	1%	5%

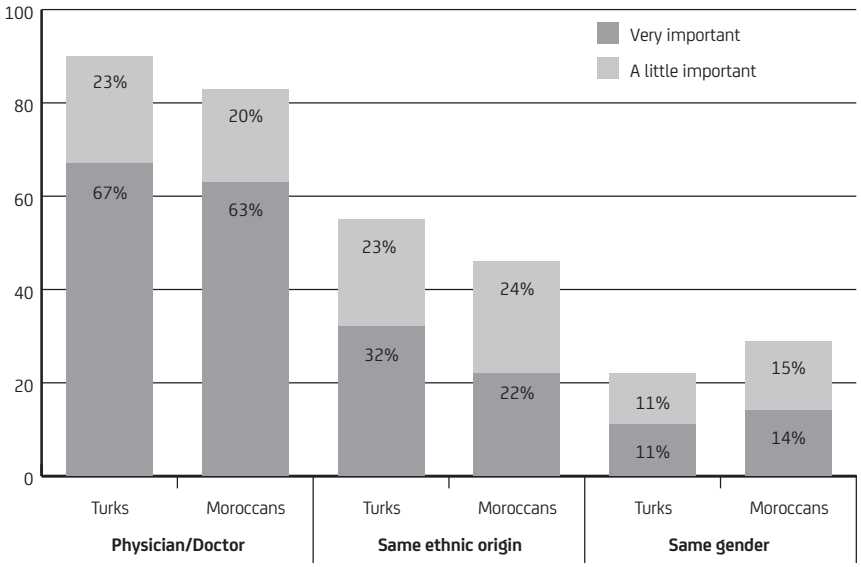

Figure 3.1 Preferences regarding profession, ethnicity and gender of the person that provides information about CVD

The figure presents the percentage of Turkish and Moroccan participants that considered it either 'very important' or 'a little important' that the person that provides information is a physician/doctor, of the same ethnic origin and of the same gender. The rest of the participants considered these characteristics of the advisor 'not important' or 'not important at all'.

Discussion

This current mixed-methods study gave valuable insights into what might be needed in order to reach individuals of Turkish and Moroccan origin in the Netherlands for two different activities: a health check and (lifestyle) advice. Although health checks and lifestyle advice are different activities, some common strategies could be identified to increase the reach among Turkish and Moroccan immigrants for preventive health services. The results of this study suggest that the GP may be a promising contact in order to reach these groups and that possible language barriers should be addressed. Figure 3.2 gives an overview of the strategies identified specifically for health checks and lifestyle advice.

The GP was indicated as the most preferred source for both the invitation for the health check and advice about CVD. Involving the GP may be a promising strategy to reach individuals of Turkish and Moroccan origin given that these groups often visit their GP [20], and GPs in the Netherlands, in general, have a positive attitude towards primary prevention of cardiometabolic diseases [27]. However, providing preventive care might not be self-evident in all general practices, and some GPs might consider it a task for other health professionals [28].

A low proficiency in the local language was often used to explain the target groups' preference. A lack of local language skills has been identified as one of the major barriers in reaching minorities for healthcare services [29]. The participants in this mixed-methods study discussed several strategies to overcome language barriers, like offering translated information materials or involving ethnically matched professionals. Although the involvement of ethnically matched professionals can help to overcome language barriers, our participants explained, as also reported in the literature [30], that fear of gossip can be a reason to prefer Dutch professionals over ethnically matched professionals.

In general, the Turkish and Moroccan respondents shared similar preferences. However, it was the respondents of Turkish origin rather than those of Moroccan origin that preferred to be invited for a health check by a medical specialist/hospital. Another notable difference between the two ethnic groups could be seen for preferred language. The preference for information materials in their mother tongue was more prominent among the Turkish respondents than among the Moroccan respondents. This could possibly be explained by differences in proficiency in the local language. Persons with a lower proficiency in the local language find it rather important that leaflets are provided in their mother tongue [31]. In the Netherlands, persons of Turkish origin more often have difficulties with reading Dutch than persons of Moroccan origin [32].

Overall, the findings of this study are in line with previously suggested strategies to reach ethnic minorities for preventive health services [33-35]. Bell and colleagues, for example, concluded that translated information materials and a GP endorsement letter were beneficial in recruiting ethnic minorities for breast screening [33]. An added value of our study is that

a mixed-methods approach was used to research how the target groups want to be reached for preventive health services. It was therefore possible not only to quantitatively identify the target groups' preferences, but also to qualitatively explain their preferences, and this helps us to better understand why these specific strategies are necessary. This study identified promising strategies for health professionals how to reach an underrepresented group for preventive healthcare services. It is, however, important to find out how feasible it is to meet the target groups' preferences in practice, as for example time and financial constraints could play a role in the implementation of these strategies.

The current study focused mainly on the preferred source, location and language required to reach the target groups. However, in relation to health checks or lifestyle advice, as stated by some participants in this study, it is also important that the content suits the needs and behaviours of the targeted individuals. Therefore, in our efforts to effectively reach these groups, it is also necessary to get insight into the target groups' preferences regarding the content of health checks or lifestyle advice.

Some methodological concerns should be taken into consideration regarding the interpretation of the results. Although a representative sample design was used to recruit respondents for the quantitative study, more Moroccan men than women participated in it. Therefore, it could be argued that the answers are not representative of the general 45+ Moroccan population in the Netherlands. However, differences between the answers of the Moroccan men and women were small and weighing the data for gender did not change the results substantially (data not shown).

The current study used existing data, which is an advantage, as mixed methods research can be expensive and time consuming. A disadvantage is that the four studies were not designed for answering the research questions of the current study. As a consequence, the topics and study population of the four original studies were not completely comparable. For example regarding advice, the quantitative study focused mainly on advice regarding CVD, whereas the qualitative studies focused on advice regarding healthy eating and physical activity. CVD is a medical condition, and this might explain why the quantitative data merely showed that the GP should give the advice. It could be that, for lifestyle advice specifically, other information sources are preferred. From the qualitative data, it appeared that it is at least important that the information source for lifestyle advice is someone professional or specialised.

The persons in the quantitative study were partly selected via a database consisting of persons who participate in research fairly regularly. It can be speculated that persons who are used to participating in research, especially in the case of questionnaires, are more likely to have higher literacy skills in the local language. As a consequence, in the quantitative study, the preference for information materials in one's native language and the importance of ethnicity matching in order to overcome language barriers might be under-recognised.

In the mixed-methods approach, it was chosen to give a quantitative priority, meaning that greater emphasis was placed on the quantitative findings for answering the study question. The qualitative data were used to explain and elaborate on the quantitative findings. As the quantitative data were leading in the analysis, one might have missed valuable qualitative data along the way. In the quantitative study, participants were limited to the given answer categories. As a consequence, it could be, for example, that other sources beside the GP are important for the target group, but were missed in the current study as they were not present in the posed answer categories of the quantitative study.

Health check

- ☐ *By whom*: Invitation by GP or – mainly in case of Turkish migrants – by a medical specialist
- ☐ *Where*: At the GP's office or at home, on paper
- ☐ *Language*: Provide invitation and questionnaire in both the local language and mother tongue

Lifestyle advice

- ☐ *How:* Consider whether the topic is suitable to discuss in a group or should be discussed one-on-one
- ☐ *By whom:* A physician/doctor or someone professional in that field, who is also familiar with the target groups' (eating) behaviour
- ☐ *Language:* Provide information in both the local language and mother tongue

Figure 3.2 Overview of explored strategies to reach Turkish and Moroccan immigrants for preventive health services

Conclusions

This study gave important insights into preferences of adults of Turkish and Moroccan origin relating to health checks and lifestyle advice, and reveals some promising strategies to reach these ethnic minorities for preventive healthcare services. The GP is considered as a promising contact to reach Turkish and Moroccan adults in the Netherlands for health checks and lifestyle advice. It might be necessary to provide information in individuals' native language to overcome language barriers. In addition, the content of (lifestyle) advice must be tailored. The obtained insight into the preferences of Turkish and Moroccan adults regarding reach for preventive healthcare services could help professionals to successfully target these groups. It is important to find out how feasible it is to meet the target groups' preferences in practice.

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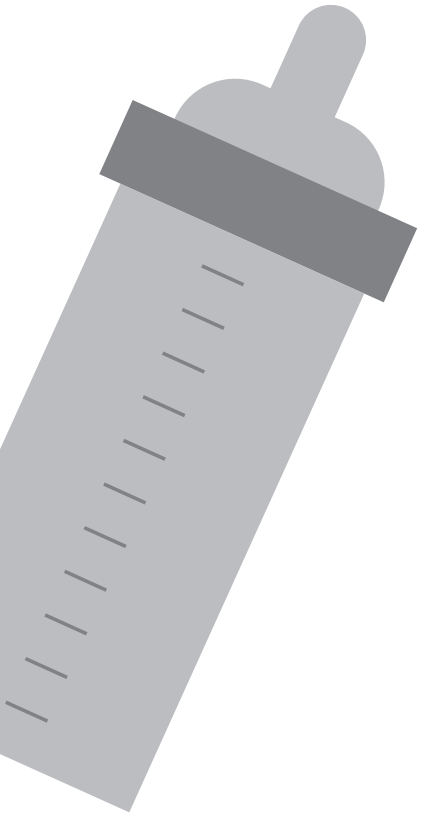

4

Adapting an effective lifestyle intervention towards individuals with low socioeconomic status of different ethnic origins: the design of the MetSLIM study

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Abstract

Background: People with low socioeconomic status (SES) and some ethnic minorities are often underrepresented in lifestyle programmes. Therefore, a lifestyle programme was developed especially targeting these groups. Developing this lifestyle programme and designing an intervention study to test the effectiveness of this programme was an informative process in which several obstacles were encountered and choices had to be made. Study protocols, however, rarely describe these obstacles encountered in the protocol design process, and it is not always clear why researchers made certain choices. Therefore, the aim of this article is to describe both the final MetSLIM study protocol and the considerations and choices made in designing this study protocol.

Methods/Design: The developed MetSLIM study has a quasi-experimental design, targeting 30- to 70-year-old adults with an elevated waist circumference, living in deprived neighbourhoods, of Dutch, Turkish or Moroccan descent. The intervention group participates in a 12-month lifestyle programme consisting of individual dietary advice, four group sessions and weekly sports lessons. The control group receives written information about a healthy lifestyle and one group session provided by a dietician. The study contains an elaborate effect, process and economic evaluation. Outcome measures are, among other things, change in waist circumference and the other components of the metabolic syndrome.

Discussion: Matching the preferences of the target group, such as their preferred setting, has implications for the entire study protocol. The process evaluation of the MetSLIM study will provide insight into the consequences of the choices made in the MetSLIM study protocol in terms of reach, acceptability and delivery of the programme, and the effect and economic evaluation will provide insight into the (cost)effectiveness of the lifestyle programme in order to reduce waist circumference among individuals with low SES of different ethnic origins.

Background

Lifestyle intervention studies have shown that the development of cardiometabolic diseases such as type 2 diabetes mellitus (T2DM) can be prevented or postponed by the combination of a healthy diet and increased physical activity [1, 2]. Furthermore, it has been established that certain lifestyle interventions can be cost-effective ways to decrease the burden of cardiometabolic diseases [3]. However, people with low socioeconomic status (SES) and some ethnic minorities are often underrepresented in lifestyle interventions [4-6]. This low level of participation is alarming, since the prevalence of cardiometabolic diseases is especially high in these groups [7-9].

In order to decrease the burden of lifestyle-related morbidity, effective lifestyle interventions are needed for low SES individuals and ethnic minorities. Therefore, a research project was started with the aim of developing a lifestyle intervention study especially targeted at these groups. The project focuses on the adaptation of a lifestyle intervention study named SLIM (Study of Lifestyle intervention and Impaired glucose tolerance Maastricht). The SLIM study was a randomized controlled trial, designed to study in a university setting the effectiveness of a diet and physical activity intervention on glucose tolerance in persons with impaired glucose tolerance [10]. The intervention programme consisted of one hour of individual dietary advice from a dietician every three months; annually, a 90-minute group session from a dietician; and free supervised aerobic and resistance training at the university fitness centre. The SLIM study showed that participants with impaired glucose tolerance improved their glucose tolerance and decreased their diabetes risk by participating in this diet and physical activity intervention [11, 12]. Although the effects of the SLIM lifestyle programme were promising, and the programme seemed cost-effective [13], participants with lower SES dropped out earlier than participants with higher SES [12]. Furthermore, as in other studies in the Netherlands, participants had to be fairly fluent in spoken Dutch to be able to participate in the study because all the lifestyle intervention activities and measurements were provided in Dutch only, making it difficult for some ethnic minorities to participate.

The adaptation of the SLIM study protocol into the new study protocol, called MetSLIM, was an informative process in which several choices were made. Study protocols rarely describe obstacles encountered in the protocol design process, and it is not always clear why researchers make certain choices. Transparency, by sharing considerations and choices made, can, however, help other researchers to design their study protocol. Therefore, the aim of this article is to describe the design of the MetSLIM study and the considerations and choices made in adapting the SLIM study protocol to the needs of individuals with low SES of different ethnic origins.

Methods/Design

The protocol design process was supported by gathering information on the current health status and preferences of the target group; consulting health professionals, researchers and a communications expert; and assessing possibilities in the local community setting. The elements of the original SLIM study protocol and the considerations about maintaining or changing those elements for the MetSLIM study protocol are described in more detail in Tables 4.1 and 4.2.

Objective

The objective of the MetSLIM study is to evaluate the (cost-)effectiveness of the adapted lifestyle programme to reduce elevated waist circumference and improve other components of the metabolic syndrome (MetS) in individuals with low socioeconomic status of Dutch, Turkish and Moroccan origin. It was decided to focus on these groups as they are three of the largest ethnic groups in the Netherlands [16]. Change in waist circumference was chosen as the primary outcome for the study because waist circumference is one of the components of the metabolic syndrome, a risk factor for cardiometabolic diseases [21] and easy to communicate to participants. Secondary outcomes are changes in the other components of MetS (i.e. triglycerides, HDL cholesterol, blood pressure and fasting glucose).

Study design

The MetSLIM study is a quasi-experimental 12-month intervention study. The intervention study is designed for execution in a community setting. In order to prevent spill-over and to have the opportunity to recruit enough participants, the study will be executed in two cities. Two Dutch cities with sufficient potential to recruit the target population have been identified on the basis of the location of the two involved universities, the presence of low SES neighbourhoods and the number of Turkish and Moroccan citizens [31]. Intervention group participants will be recruited in different neighbourhoods than control group participants. Participants will be measured at baseline and after 12 month. Turkish and Moroccan research assistants will assist in recruitment and data collection for the intervention study. The MetSLIM study is registered in the Dutch Trial Register (NTR3721) since November 27, 2012. The medical ethical committee of Wageningen University approved the study protocol. All participants will give their written informed consent before participating in the study.

Sample size calculation

The sample size calculation was estimated based on the change in waist circumference as an outcome of SLIM after one year (mean difference between intervention and control group 2.1cm) [11], and the expectation that we would be able to reach 50% of this effect in a real-life setting among this group. Taking into account a relatively high drop-out rate of 25% compared to the 10% in SLIM [11], we estimated that 252 participants (126 per group) would be required to show this effect with an alpha < 0.05 and $1 - \text{beta} > 0.8$. The aim is to include equal numbers of male and female participants, equally distributed over the three ethnicities.

Table 4.1 From SLIM to MetSLIM: overview of considerations and choices regarding the inclusion and exclusion criteria

Criteria	Original study protocol: SLIM [10]	Considerations	Adapted study protocol: MetSLIM
Inclusion criteria	Mean 2-h blood glucose ≥ 7.8 and ≤12.5 mmol/l Mean fasting blood glucose ≤ 7.8 mmol/l	Primary outcome measure of MetSLIM will be waist circumference (see considerations Table 4.2). There is an on-going discussion about the use of different waist cut-off points for different ethnicities. In order to take height differences between ethnic groups into account, waist-to-height-ratio (WHtR) was chosen as selection criterion [14]. In order to observe a change in waist circumference, only persons with an elevated WHtR will be included [15].	WHtR ≥ 0.5
	Caucasian	The adapted intervention is aimed at individuals of Dutch, Moroccan or Turkish ethnic origin. Moroccans and Turks are the two largest non-Western ethnic minority groups in the Netherlands [16].	Persons of Dutch, Moroccan or Turkish descent
	Age 40–70 years	In the Netherlands, life expectancy without chronic diseases is 8.9 years lower in women and 10.9 years lower in men among the least educated group compared to the most educated group [17]. Also, the onset of T2DM among the Moroccan and Turkish population living in the Netherlands occurs at an earlier age compared with Dutch people [9]. Apparently, prevention of chronic diseases should start at an earlier age among our target group.	Age 30–70 years
	No additional inclusion criteria	As the adapted intervention study is aimed at low SES individuals, the researchers had to investigate where and how they would ideally reach this target group. Commonly used indicators for SES are income, education level and occupation. However, these are individual level indicators and this could create recruitment difficulties. It might be uncommon and illogical for the target group to be selected for lifestyle programmes on the basis of their individual education level, income or occupation. Furthermore, it is more practical to recruit in specific areas and use the postal code as indicator for SES [18]. A disadvantage of using the postal code is that more highly educated persons will also be able to participate in the intervention study. However, the advantage of recruiting in neighbourhoods is that participants will live in the same neighbourhood. This offers us the opportunity to provide all activities close to the participants' home and to focus on group cohesion and social support in the community.	Living in deprived neighbourhood

Criteria	Original study protocol: SLIM [10]	Considerations	Adapted study protocol: MetSLIM
Exclusion criteria	Known diabetes mellitus	See consideration WHtR as inclusion criterion.	WHtR ≤ 0.5
	Mean 2-h blood glucose > 12.5 mmol/l		
	Mean fasting blood glucose > 7.8 mmol/l		
	Any chronic disease that makes 5-year survival improbable or that interferes with glucose tolerance, or that makes participation in a lifestyle intervention impossible	Participants must be able to follow a lifestyle programme for one year.	Any mental or physical disability that makes participation in a lifestyle intervention impossible
	Medication know to interfere with glucose tolerance	Since the adapted lifestyle programme aims to decrease waist circumference and improve other factors of metabolic syndrome, persons taking medication for CVD and/or T2DM will be excluded.	Medication for hypertension, hypercholesterolemia, cardiovascular diseases, diabetes mellitus or/and renal failure
	Participants in a regular vigorous exercise programme	In order to measure the effectiveness of the lifestyle programme, participants should not already be participating in other lifestyle programmes.	Participation in another regular vigorous exercise and/or diet programme targeting weight loss
	No additional exclusion criteria	Since the minimum age of participants was decreased to women's fertile years, pregnant or lactating were added as exclusion criteria, as these have an influence on the main outcomes of the MetSLIM study.	Pregnant or lactating

Table 4.2 From SLIM to MetSLIM: an overview of considerations and choices in the protocol design process

Protocol elements	Original study protocol: SLIM [10, 12, 19]	Considerations	Adapted study protocol: MetSLIM
Objective	To study whether a diet/physical activity intervention programme can improve glucose tolerance in subjects at high risk of developing type 2 diabetes mellitus. *Primary outcome*: Change in glucose tolerance (2-h plasma glucose)	Because of the overlapping risk factors, the initial idea of the MetSLIM study was to focus on persons with metabolic syndrome (MetS), which is associated with an increased risk both of T2DM and of CVD [20]. However, screening for MetS might impose too high a burden on low SES individuals to participate in the study because of: • unfamiliarity with MetS • time-consuming screening necessary before potential participants know whether they can actually participate (waiting for laboratory results). Waist circumference was considered because it is: • visible for potential participants and therefore easy to communicate • one of the components of the metabolic syndrome and a risk factor for cardiometabolic diseases [21].	To evaluate the effectiveness of an adapted version of the SLIM lifestyle programme to reduce elevated waist circumference and improve other components of the metabolic syndrome in individuals with low socioeconomic status of different ethnic origins. *Primary outcome*: Change in waist circumference
Study design	*Setting*: At the university	Distance can be a barrier to participation; target group prefers nearby location, possibly a familiar place. The two universities involved in this study are not located in deprived neighbourhoods. Besides, the number of ethnic minorities living in the cities where the two universities are located is relatively small.	*Setting*: In the community
	Design: Randomized controlled trial (RCT)	RCT design does not seem appropriate because: • target group is probably unfamiliar with randomization, which could easily provoke dissatisfaction if participants were randomly allocated to intervention and control group within one community • participants are allowed to bring a friend or family member to different intervention activities (for social support), which could result in spill-over.	*Design*: Quasi-experimental study
	Duration: 4.1 year (range 3–6years)	The duration of MetSLIM should be shorter given the limited time and budget.	*Duration*: 12 months

Protocol elements	Original study protocol: SLIM [10, 12, 19]	Considerations	Adapted study protocol: MetSLIM
Study population	*Inclusion/exclusion criteria:* See Table 4.1	See Table 4.1	*Inclusion/exclusion criteria:* See Table 4.1
	Recruitment strategies: • Potentially eligible persons from a large existing cohort monitoring health and disease in the general population were approached to participate • Through advertisements in the local newspaper	Recruitment strategies should be adapted to needs of target group, taking into account that: • GP is indicated as trustworthy and valued person for the target group [22, 23] • a personal approach seems to be appreciated • letterbox drops do not seem to work for this group [24].	*Recruitment strategies*: • Invitation letter from own GP • Personal approach in community centres
Intervention group	*Nutrition advice*: • One group meeting a year • Four 1-hour sessions of individual advice in one year	Target group preferred group delivery of nutrition advice [25]; therefore group meetings should be added. The topics of the extra group meetings should be related to identified barriers, like financial costs and social occasions [25, 26]. The spreading of the four hours of individual advice should be flexible. The involved professionals indicated that they preferred to vary the number and length of consultations to the individual needs of the client. This is in accordance with daily practice.	*Nutrition advice*: • Four group meetings a year, of which one is an introduction/kick-off meeting • Four hours of nutrition advice spread over the year, with regard to the needs of the individual
	Physical activity lessons: • Once or twice a week • Provided at the gym on the grounds of the university • In special SLIM groups	Target group indicated that they preferred to be physically active with persons of the same gender [25, 27], age and physical condition [25]. Target group indicated that creating a supportive environment can encourage lifestyle change [26].	*Physical activity lessons:* • Once or twice a week • Provided in the community • In special MetSLIM groups • Men and women separately • Possibility to bring friend or family member
	No participation fee	Some local health professionals preferred a participation fee for participating in the lifestyle programme. Their experience was that persons get used to getting everything for free and will switch to other free programmes once a programme is not free anymore. This could be a problem for the maintenance of programmes. At the same time, the target group indicated that financial cost can be a barrier to a healthy lifestyle, and researchers were concerned about not recruiting enough participants.	No participation fee

Protocol elements	Original study protocol: SLIM [10, 12, 19]	Considerations	Adapted study protocol: MetSLIM
Control group	*Activities control programme*: • No additional appointments are scheduled, apart from the annual visits for follow-up measurements • Participants received oral and written information about the beneficial effects of a healthy diet, weight loss and increased physical activity at the appointment for baseline measurements	Because of possible low literacy level of the target group, an information meeting instead of only written materials should be considered.	*Activities control programme*: • One group meeting with a dietician about nutrition • Participants will receive oral and written information about the beneficial effects of a healthy diet, weight loss and increased physical activity (where possible, in their mother tongue)
Measurements	*Physical measurements:* • Anthropometric measurements • Blood sampling • Blood pressure • Oral Glucose Tolerance Test (OGGT) • 12-lead resting ECG • Incremental exhaustive exercise test on an electronically braked bicycle ergometer	The measurements were reconsidered taking into account: • practical feasibility of doing the measurements at different locations, in the community • possibility of relocating measurements equipment • participants' unfamiliarity with different measurements.	*Physical measurements:* • Anthropometric measurements • Blood and urine sampling • Blood pressure
	Physical activity: • SQUASH • 3-day PA record	Difficulties were expected with filling in diaries because of illiteracy. Additional information should be gathered about determinants of behaviour.	*Physical activity:* • SQUASH • Accelerometers • Questionnaire on determinants of physical activity
	Dietary habits: • FFQ • 3-day food record	Difficulties were expected with filling in diaries because of illiteracy. Additional information should be gathered about determinants of behaviour.	*Dietary habits:* • Ethnicity-matched FFQ • Questionnaire on determinants of healthy diet
	Quality of life: SF-36 questionnaire	The SF-36 is considered as acceptable to measure quality of life among these populations [28, 29].	*Quality of life:* • SF-36 questionnaire
	Economic evaluation: Cost-effectiveness analysis was conducted from a healthcare perspective only [13].	The economic evaluation of a lifestyle programme is important in the context of possible future implementation of the programme. Because it is not known who might be willing to pay for the programme, it is important to consider the costs and effects from different perspectives.	*Economic evaluation:* Cost-effectiveness analysis and cost-utility analysis will be done from a societal perspective and a healthcare perspective.

Protocol elements	Original study protocol: SLIM [10, 12, 19]	Considerations	Adapted study protocol: MetSLIM
Measurements	*Process evaluation:* Limited data available	Adherence to the nutrition and exercise part of to the lifestyle programme was reported in SLIM [30]. An elaborate process evaluation was lacking however. MetSLIM should include an elaborate process evaluation.	*Process evaluation:* Elaborate process evaluation by means of: • Researchers' logbooks • Registration forms including an attendance list • Non-response survey • Drop-out questionnaire • Participants' questionnaire
Additional considerations	*Involved staff*: • Dutch researcher • Dutch dietician • Sports instructor not gender matched	Staffing should be matched with either ethnicity or gender of the participants, depending on the availability of staff and the needs of participants: • fluency of participants' Dutch language might be low • dietician should be able to tailor dietary advice to individuals' (possibly traditional) eating habits and should be familiar with traditions bound to Islam • gender-matched sports instructors are preferred by some Turkish and Moroccan females.	*Involved staff*: • Dutch researcher(s) • Ethnicity-matched research assistants • Ethnicity-matched dieticians • Gender-matched sports instructors
	Language of information material and questionnaires: Dutch	The information materials and questionnaires should be translated because of possible problems with fluency in the Dutch language.	Participants can opt for information in one or more of the following *languages*: • Dutch • Standard Arabic • Turkish
	Receiving results of measurements: Yes	Participation in health checks seemed to be popular among the target group according to various health professionals; receiving results could help to motivate control group participants to participate in the study's baseline and final measurements. Apart from the motivational aspect, it is common in healthcare practice that patients are informed about the results of regular blood tests.	*Receiving results of measurements:* Yes

Study population

Inclusion and exclusion criteria

Applicants are eligible to participate if they fulfil the following criteria (see Table 4.1): (1) waist-to-height ratio (WHtR) > 0.5; (2) aged between 30 and 70 years; (3) no medication for high cholesterol, cardiovascular diseases (CVD), T2DM or renal failure; (4) living in a deprived neighbourhood; (5) Dutch, Turkish or Moroccan ethnic origin. Following the definitions of Statistics Netherlands, persons with both parents born in the Netherlands are considered to be Dutch [32], and persons who have at least one parent born in Morocco/Turkey are considered to be Moroccan/Turkish [33]. Applicants are excluded if they have any mental or physical disability that makes participation in a lifestyle intervention impossible, already participate in a regular vigorous exercise programme, or are pregnant or lactating.

Recruitment

Potential participants will be selected by GPs located in disadvantaged neighbourhoods or GPs who have many Turkish or Moroccan patients. GPs will make a selection of eligible patients in their database on the basis of the inclusion criteria regarding postal codes of deprived neighbourhoods [18], age and medication use. In addition, GPs will be asked to select the targeted ethnicities and to exclude those individuals who are unable to participate in the intervention because of their mental or physical condition. GPs will send an invitation to the selected patients to participate in the intervention study. The invitation will contain a brief screening questionnaire/registration form, an information booklet about the study, a tape measure and a return envelope. Participants of Turkish and Moroccan origin will receive the information materials in both Dutch and Turkish or Arabic, respectively.

In addition, multiple other recruitment strategies will be used. The intervention study will be promoted in the local community by researchers with the help and involvement of community health workers (e.g. social workers), local health professionals and other local contacts. Recruited participants will also be asked to inform friends or family members about the study and to ask them to participate in the study, if they meet the study criteria. Potential participants will fill in a screening questionnaire to check for the inclusion and exclusion criteria.

Intervention group

The lifestyle programme will last for 12 months. It will consist of four group meetings, four hours of individual dietary advice and weekly sports lessons provided in the neighbourhood. The first group meeting is an introduction/kick-off meeting, guided by the researcher, in which participants get to know the dietician, the sports instructor and other study participants. The other three group meetings are about nutrition and are guided by the dietician. The topics of these meetings include comparing products/reading labels, dealing with social occasions and making affordable choices in the supermarket. The four hours of individual dietary advice will be divided over a flexible number of consultations in order to suit the needs of the participants. Participants will receive dietary advice from an ethnicity-matched dietician and information leaflets from the Netherlands Heart Foundation and the Netherlands Nutrition

Centre on the benefits of healthy nutrition and increased physical activity. If these information leaflets are available in Turkish or Arabic, participants will be provided with leaflets in the language of their choice.

The physical activity lessons will be set up especially for the study participants. The lessons will be offered for men and women separately. Female and male sports instructors will be involved to provide gender-matched physical activity lessons. Participants will also be allowed to bring a friend or family member to increase social support.

Participants will receive the results of their anthropometric measurements, blood glucose and total cholesterol concentrations, and their physical activity levels after the baseline measurements as well as after the end measurements. The participants' GPs will receive anthropometric values, blood values and urine values.

Control group

At one group meeting, guided by a dietician, control group participants will receive general advice about a healthy diet. At the end of this meeting, participants will receive information leaflets on the benefits of healthy nutrition and increased physical activity. If these information leaflets are available in Turkish or Arabic, participants will be provided with leaflets in the language of their choice. Like in the intervention group, control group participants and their GPs will receive the results of the measurements.

Measurements

The researcher will make an appointment with (potential) participants at a location close to their home to measure their anthropometrics and blood pressure. Subsequently, the participant will receive a referral letter for the medical laboratory in their neighbourhood to hand in a urine sample and to have blood taken for testing. In addition, participants will be asked to fill in several questionnaires. Participants can choose to complete these questionnaires in Dutch or in their mother tongue. They will be asked whether they prefer to fill in the questionnaires themselves at home or with a research assistant speaking their mother tongue. All measurements, except the process evaluation measures, will be performed at baseline and after 12 months.

Physical measurements

Blood samples will be taken after at least 10 hours of fasting to measure fasting glucose, HLD cholesterol, LDL cholesterol, total cholesterol, triglycerides, HbA1c, fasting insulin, liver function enzymes, creatinine and uric acid. Fasting spot urine samples will be collected to measure creatinine and microalbumin. Blood pressure will be measured six times, with two minutes rest in-between, in a seated position, with the Omron 705CP. The mean will be calculated from the last five measurements. Anthropometric measurements will be taken, including body weight, waist circumference, hip circumference, body fat percentage and height. Height will be measured to the nearest 0.1 cm. Waist circumference will be determined midway between the lowest rib and the iliac crest, and measured to the nearest

0.5 cm. Hip circumference will be measured to the nearest 0.5 cm at the widest portion of the buttocks. Waist and hip circumference will both be measured twice. Body weight and body fat percentage will be measured with the Tanita BC-418 (Tanita Corporation, Tokyo, Japan).

Physical activity

To evaluate changes in physical activity level, participants will fill in the validated Short QUestionaire to Assess Health enhancing physical activity (SQUASH) [34]. A question on sedentary behaviour was added based on the Activity Questionnaire for Adults and Adolescents (AQuAA) [35]. Participants will additionally wear an activity monitor (GT3X+ Actigraph, Pensacola, FL, USA) for seven days in order to measure physical activity.

Dietary intake

To evaluate changes in diet, an ethnic-specific Food Frequency Questionnaire (FFQ) will be administered [36].

Determinants of behaviour

A questionnaire has been developed to gain insight into determinants of behaviour. Questions to measure barriers to, and reasons for, healthy eating and physical activity are based on questions used in the Pan-EU Survey [37]. Items to measure perceived social influence are based on scales described by Schulz *et al.* [38]. The extent to which participants intend to be physically active and eat healthily will be assessed by the means of a Stages of Change Scale based on Prochaska and DiClemente's Transtheoretical Model [39]. To assess knowledge with regard to nutrition, participants will be asked to select the healthiest choice from 10 pairs of products [40].

Quality of life

Quality of life will be assessed with the SF-36 questionnaire [41].

Process evaluation

A process evaluation guide has been developed on the basis of items described in the literature [42-46], including process evaluation measures to evaluate recruitment, reach, dose delivered, implementation integrity and programme acceptability. Data will be gathered by means of logbooks, registration forms, participants' questionnaires, non-response survey, drop-out survey and individual interviews with the dieticians and sports instructors.

Economic evaluation

Costs and effects of the intervention programme will be compared with costs and effects of the control programme. The economic evaluation consists of a cost-effectiveness analysis and cost-utility analysis, and will be done from a societal and a healthcare perspective. A time horizon of 12 months will be used. Change in waist circumference will be used as clinical outcome for the cost-effectiveness analysis, and quality-adjusted life years (QALYs) for the cost-utility analysis. QALYs will be assessed with the EuroQoL instrument (EQ-5D-5L)

[47, 48]. Healthcare costs, patient costs and participants' productivity losses will be assessed with a questionnaire. The intervention costs, including both staffing and materials, will be assessed on the basis of the attendance lists, registration forms and project logbooks of the health professionals and/or researchers. The Dutch guidelines for costing research within health economic evaluations will be used to value costs [49].

Statistical analyses

For the effect evaluation, the intention-to-treat method will be followed. Changes in effect outcomes will be compared between the intervention and the control group. Analyses will be adjusted for age, gender, ethnicity and other possible confounders. For the process evaluation, both quantitative and qualitative data will be collected. Interviews will be analysed using a thematic approach. Quantitative data will be described by means and frequencies. Characteristics of the responders versus non-responders, and of the completers versus drop-outs, will be analysed by means of an independent sample t-test or chi-squared test. For the economic evaluation, the incremental cost-effectiveness ratio will be calculated on the basis of the differences in costs and effects between the intervention and the control programme. Bootstrapping will be used to calculate confidence intervals around costs and effects. A cost-effectiveness acceptability curve will be constructed from which it can be judged whether the intervention is cost-effective given a range of cost-effectiveness thresholds. The cost-effectiveness analyses will be complemented with sensitivity analyses for critical assumptions.

Discussion

This article provides a detailed description of the MetSLIM study protocol, which is based on the SLIM study protocol. Furthermore, this article gives insight into the obstacles encountered in developing the MetSLIM study targeting low SES individuals of different ethnic origins. Adaptations to the original SLIM study protocol were considered necessary in order to overcome practical barriers that hinder the target group's participation; to suit the (cultural) needs of the target group; and to make it feasible to perform the study in a local (community) setting. The main adaptations regarding the lifestyle programme, which will be offered to the intervention group, are: 1) additional group meetings about price concerns and social occasions with regard to a healthy diet; 2) ethnicity-matched dietician; 3) gender-matched sports instructor; 4) all activities in the participants' own neighbourhood; and 5) activities for women and men separately. These adaptations are expected to be relevant for both the recruitment and retention of participants and for the successful delivery of the lifestyle programme [50].

A strict comparison between the effects of the adapted and the original lifestyle programme will be difficult. The target groups of SLIM and MetSLIM vary more than just in socioeconomic status and ethnicity. MetSLIM will include persons at a younger age and with an elevated waist circumference instead of impaired glucose tolerance, and excludes persons who use medication for cardiometabolic diseases. Consequently, the study population of the two

studies could differ in health status, and this might influence both the interest in participating in a lifestyle programme, either positively or negatively [5, 51], and the possible health gains from participating in a lifestyle programme [52].

A strength of the adaptation from the SLIM study protocol to the MetSLIM study protocol is that we involved the target group, (health) professionals and other researchers, and checked possibilities in the local setting while designing the MetSLIM study protocol. This enabled the creation of a study protocol that takes into account both the needs of the target group and what is actually possible in the local setting. In the end, however, researchers made the final decisions in the design of the MetSLIM study protocol. Although practically challenging, it could have been useful to involve the target group and health professionals in this decision making as well, in order to take into account the balance between evidence-based concerns and the acceptability or applicability of the intervention [50, 53]. The multidisciplinary backgrounds of the research team, however, contributed to a careful consideration of the advantages and disadvantages of various choices in the study protocol. In addition, to check the applicability of several intervention materials, the materials were assessed by local health professionals and a communications expert.

The current article illustrates, next to a detailed description of the MetSLIM study protocol, several considerations that should be taken into account when a study protocol is being adapted or developed for individuals with low SES of different ethnic origins. Transparency, by sharing these considerations and choices made in the development of a study protocol, can help other researchers and health professionals to create appropriate strategies for (testing the effectiveness of) lifestyle interventions for this target group. Recruitment for the MetSLIM study started in January 2013 and data collection is expected to finish in June 2015. The process evaluation of the MetSLIM study will provide insight into the consequences of the choices made in the adapted study protocol in terms of reach, acceptability and delivery of the programme, and the effect and economic evaluation will provide insight into the (cost) effectiveness of the adapted lifestyle programme to reduce waist circumference among individuals with low SES of different ethnic origins.

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5

Is the success of the SLIMMER diabetes prevention intervention modified by socioeconomic status? A randomised controlled trial

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Submitted

Abstract

Background: Intensive lifestyle interventions involving healthy diet and exercise promotion can help to prevent type 2 diabetes. It is often argued that individuals with low socioeconomic status (SES) are difficult to reach and retain for such interventions. The aim of the current study is to explore the role of SES in willingness to participate, programme attendance, programme acceptability, adherence to lifestyle guidelines, drop-out and effectiveness in the SLIMMER diabetes prevention intervention.

Methods: SLIMMER was a randomised controlled intervention, carried out in a real-world setting, targeting 40- to 70-year-old adults at increased risk of developing type 2 diabetes (n=316). The intervention group participated in a 10-month combined dietary and physical activity programme. Measurements were carried out at baseline, at 12 months and at 18 months (six months after the active intervention period ended). SES was determined by highest completed educational level. Educational level was divided into two categories: low (no, primary, or lower secondary school) and higher. Effectiveness was determined for fasting insulin, HbA1c, weight, BMI, waist circumference and waist-to-height-ratio. Differences between the low and higher SES group were tested using logistic regression and ANCOVA.

Results: Fifty-two percent of the SLIMMER participants had a low SES. No differences in willingness to participate were observed between the low and the higher SES group. Reasons for non-participation differed. The most important reason for non-participation in the low SES group was 'lack of interest' (32%), whereas in the higher SES group this was 'I already exercise enough' (31%). Attendance, acceptability, adherence, drop-out and effectiveness after 12 months were similar in the low and the higher SES group. After 18 months, the low SES group seemed to maintain slightly better effects for fasting insulin, HbA1c and waist circumference than the higher SES group.

Conclusions: The current study showed that participation, attendance, acceptability, adherence, drop-out and effectiveness of the SLIMMER intervention were in general not modified by socioeconomic status. The SLIMMER intervention can therefore contribute to health promotion for individuals in both low and higher socioeconomic groups. Future studies should give insight into possible differences between low and higher SES groups after a longer follow-up period.

Background

Type 2 diabetes mellitus is a major public health problem because of its associated co-morbidities [1] and premature mortality [2]. The prevalence of type 2 diabetes is especially high among individuals with low socioeconomic status (SES) [3]. Lifestyle interventions involving healthy diet and exercise promotion can be an effective way to prevent type 2 diabetes [4, 5].

However, it is often argued that individuals with low SES are hard to reach for lifestyle interventions [6, 7]. Moreover, if they do participate, they seem less likely to complete the intervention [8, 9]. In contrast, low SES participants seem at least as successful as higher SES participants in attending intervention sessions and adhering to intervention goals [10-12]. Also, several studies have shown that the effectiveness of these lifestyle interventions may not depend on the socioeconomic position of the participants [13, 14]. Apparently, SES can modify the success of an intervention, especially by selective participation and selective drop-out.

The aim of the current study is to explore the role of SES in willingness to participate, programme attendance, programme acceptability, adherence to lifestyle guidelines, drop-out and effectiveness in the SLIMMER diabetes prevention intervention. SLIMMER investigated the effect of a 10-month combined dietary and physical activity intervention, according to general public health recommendations, in persons at increased risk of developing type 2 diabetes. SLIMMER was based on the evidence-based SLIM intervention (Study on Lifestyle intervention and Impaired glucose tolerance Maastricht) [9, 15], which was translated to the Dutch public health and primary healthcare setting [16], pilot-tested [17], and thereafter implemented and evaluated on a large scale [18]. The SLIMMER study showed beneficial effects on anthropometry and glucose metabolism [19]. Studying the role of SES in different phases of the SLIMMER study – initial participation in the intervention study, active participation during the intervention programme and completion of the intervention study – is valuable because it gives insight into critical phases and potential opportunities for improvement in order to successfully target low SES individuals with a lifestyle intervention.

Methods

Study design

SLIMMER was a randomised controlled intervention study, carried out in two middle-sized cities located in the eastern part of the Netherlands between 2011 and 2014. The intervention study was implemented in the public health and primary healthcare setting, involving local general practitioners (GPs) and practice nurses, dieticians, physiotherapists and sports clubs. After baseline measurements, participants were randomly allocated to the intervention or the control group, using block randomisation on the GP level and stratification for gender. The intervention group participated in an intensive lifestyle programme, and the control group

received written information about a healthy lifestyle and usual healthcare as provided by their GPs and practice nurses. Participants joined the intervention study in three consecutive phases for logistical reasons. Participants were measured at baseline, at 12 months and at 18 months (six months after the active intervention period ended). The study is registered with ClinicalTrials.gov (Identifier NCT02094911) and was approved by the medical ethics committee of Wageningen University. All participants gave written informed consent before the start of the study. The design of the intervention study is described in detail elsewhere [18].

Study population

Participants were recruited via GPs and practice nurses from patient registration databases, using either a laboratory glucose test or the Dutch Diabetes Risk Test [20]. Persons were eligible to participate if they fulfilled the following criteria: (1) aged between 40 and 70 years at screening; (2) impaired fasting glucose (IFG; 6.1–6.9 mmol/l [14]) or an elevated/high risk of type 2 diabetes (a Diabetes Risk Test score of ≥7 points [15]); (3) willing and able to participate in the study for at least 1.5 years, and (4) able to speak and understand the Dutch language. Individuals with known diabetes or any severe cardiovascular or psychiatric disease were excluded. Eligible persons were invited for the SLIMMER study by their GP. In total, 590 persons met the study criteria, of whom 316 (54%) were willing to participate in the SLIMMER study. One participant was excluded from the current analyses because of missing data for SES.

Intervention programme

The intensive intervention programme lasted 10 months and consisted of a dietary and a physical activity (PA) component. Participants were supported to achieve a healthy diet according to the Dutch dietary guidelines [21] and an active lifestyle including moderate-intensity PA for at least 30 minutes a day at least five days a week. It was aimed to help participants to achieve 5–10% weight loss. A dietician provided participants with dietary advice during 5–8 individual consultations and one group session. Participants were encouraged to participate in weekly physical activity training sessions, which were provided in groups of SLIMMER participants and guided by a physiotherapist. The training sessions contained both aerobic and resistance training and were in line with the Dutch guidelines for physical activity and type 2 diabetes [22]. To guide participants in the process of maintaining lifestyle behaviour change, a maintenance programme was offered in the last phase of the intervention, consisting of sports clinics at local sports clubs, final interviews with dietician and physiotherapist and a return visit three months after the active intervention ended [23]. Case management was provided by the practice nurse, who was the contact person for both participants and healthcare professionals.

Data collection and outcomes

Identical examinations were performed at baseline, at 12 months and at 18 months. Participants filled in questionnaires, blood samples were taken by trained nurses and anthropometric measurements were performed by trained research assistants according to

standardised procedures. The measurement procedures are described in detail elsewhere [18]. Methods specifically for the current analyses are described below.

Socioeconomic status – Socioeconomic status was determined by highest completed educational level, ascertained by means of a questionnaire. Educational level was divided into two categories: low (no, primary, or lower secondary school) and middle/high (higher secondary education, pre-university education, intermediate vocational school, higher professional education, or university level).

Willingness to participate – In total, 316 of the 590 eligible and invited persons were willing to participate in the SLIMMER study. A short telephonic non-response survey was conducted by practice nurses if patients were not willing to participate, including questions regarding the main reason for non-participation and highest completed educational level. The reason for non-participation was known for 207 individuals (76%) and educational level for 96 individuals (35%) of the 274 non-responders. Missing data for non-responders could mostly be attributed to practice nurses' lack of time or to the fact that participants could not be reached.

Programme attendance – Attendance was defined as the total duration of the attended dietary consultations and presence at sports lessons, dietary group meeting, sports clinics and return visit, as recorded by healthcare professionals during the intervention.

Programme acceptability – Participants' acceptability of the total SLIMMER intervention programme was assessed on a scale from 1–10 by means of a questionnaire.

Adherence to lifestyle guidelines – Adherence to a healthy diet was assessed by the Dutch Healthy Diet index (DHD-index) [24, 25]. The original DHD-index consists of 10 components, of which two were not measured in the SLIMMER study (sodium intake and acidic drinks and foods). For the remaining eight components (physical activity, vegetables, fruit, fibre, fish, saturated fatty acids, transfatty acids and alcohol), participants could score between 0 and 10 points, resulting in a total maximum score of 80 points (meaning complete adherence). Dietary intake was assessed by a validated Food Frequency Questionnaire (FFQ) [26, 27] and calculated with the 2011 Dutch food composition table [28]. Adherence to the physical activity guidelines was assessed by determining which participants were moderately physical active for at least 30 minutes at least five times a week. Physical activity was measured using the validated Short QUestionnaire to ASsess Health-enhancing physical activity (SQUASH) [29, 30].

Drop-out – It was preferred to choose an indicator for drop-out that was applicable to both the intervention and the control group. Therefore, drop-out was defined as not attending measurements of the intervention study. As fasting insulin and body mass index (BMI) were the two most important study outcomes, participants were considered drop-outs at 12 months or at 18 months if data on fasting insulin or BMI were missing at the respective time point [19].

Effectiveness – Effectiveness was assessed by changes in blood markers and anthropometric measures, including fasting insulin, HbA1c, weight, BMI, waist circumference and waist-to-height ratio. Blood samples were taken after at least 10 hours of fasting. For fasting serum insulin, all blood samples were analysed within one run after 18 months. BMI was calculated as the ratio of weight and height squared (kg/m^2). Waist circumference was measured

midway between the lowest rib and the iliac crest. Waist-to-height-ratio was calculated as the ratio of waist circumference and height.
Other socio-demographics – Data on age, gender, ethnicity, job status, marital status, smoking and medication use were collected by participant questionnaires, using standardised questions according to national health surveillance in the Netherlands [31] and earlier research [32].

Statistical analyses

Data were analysed with IBM SPSS Statistics version 22. Non-normally distributed variables were natural log transformed (BMI, fasting insulin). Significance level was set to 0.05. For interaction terms specifically, a *p*-value of 0.20 was considered relevant [33]. Continuous variables are presented as mean ± SD and categorical variables as percentages.

Socio-demographic baseline characteristics were compared between participants with low and higher SES with Chi-Square tests and independent samples t-tests. Because of differences in age and gender distribution between the SES groups, baseline characteristics for anthropometric measures, blood markers and lifestyle guidelines were compared with either ANCOVA or logistic regression, adjusted for age and gender.

Willingness to participate was compared between individuals with low and higher SES using logistic regression, adjusted for age and gender. Attendance, acceptability, adherence and drop-out were compared between SES groups with either logistic regression or ANCOVA, adjusted for age, gender and recruitment phase. Attendance, acceptability and adherence were determined for the treatment group only. Effectiveness of the intervention programme was compared between SES groups using an ANCOVA model, adjusted for baseline value, age, gender and recruitment phase, and for medication use if applicable. An interaction term was included in the ANCOVA model to test whether the association between treatment and outcome measures differed between SES groups. For analyses regarding effectiveness after 12 and 18 months, only data of participants who did not drop out earlier were used (12 months: n=275; 18 months: n=240). Analyses were performed according to the intention-to-treat principle, i.e. participants were analysed in the groups to which they were randomised. Stratified analyses were conducted for gender.

Results

Willingness to participate

No differences in willingness to participate were observed between the low and higher SES group (Table 5.1). However, reasons for non-participation differed between the groups. The most important reason for non-participation in the low SES group was 'lack of interest' (32%), whereas in the higher SES group this was 'I already exercise enough' (31%). Other frequently mentioned reasons for non-participation in both groups were 'lack of time' and 'it is of no importance to me' (Table 5.1).

The baseline characteristics of persons who participated in the SLIMMER study, by SES, are described in Table 5.2. SES did not differ between the intervention and the control group (54% vs. 51% with low SES, respectively). Compared to participants with higher SES, participants with low SES were more often female (60% vs. 37%), slightly older (62 ± 6 years vs. 60 ± 6 years), had less often a fulltime job (15% vs. 40%) and more often no paid job (30% vs. 11%), and had higher HbA1c levels at baseline (40.8 ± 3.7 mmol/mol vs. 39.2 ± 3.9 mmol/mol). These differences between low and higher SES participants were similar in the intervention and the control group (Additional file 5.1).

Table 5.1 Participation and reasons for non-participation by socioeconomic status*

	Low SES	Middle/high SES	*p*[1]
Participation			0.98
Non-responder[2]	50 (52)	46 (48)	
Responder	165 (52)	150 (48)	
Main reason for non-participation			0.003
Lack of time	13 (26)	8 (18)	
Lack of interest	16 (32)	6 (13)	
'I already exercise enough'	2 (4)	14 (31)	
'It is of no importance to me'	8 (16)	7 (16)	
Not being able due to illness or handicap	5 (10)	1 (2)	
Other reasons	6 (12)	9 (20)	

* Values are expressed as n (%).

[1] *p*-value is adjusted for age and gender.

[2] Total number of non-responders was 274. Education data were available for only 96 non-responders. Reason for non-participation was known for 95 of these non-responders.

Programme attendance

There were no differences in attendance between participants with low and with higher SES (Table 5.3). During the intervention programme, the low and higher SES group attended a similar number of physical activity lessons (38 ± 22 vs. 37 ± 20) and individual consultations with the dietician (204 ± 53 vs. 208 ± 36 min). Neither was attendance at the group meeting with the dietician significantly different between the low and the higher SES group (66% vs. 68%). During the maintenance programme, there were no differences in number of sports clinics attended (2.1 ± 1.8 vs. 2.5 ± 2.0) and attendance at the return visit (55% vs. 61%). The return visit was, however, significantly less often attended by males with a low SES than males with a higher SES (35% vs. 62%; p=0.01) (Additional file 5.2).

Programme acceptability

The total SLIMMER intervention programme was not differently scored by low and higher SES participants (8.2 ± 1.1 vs. 8.0 ± 1.1) (Table 5.3).

Adherence to lifestyle guidelines

After 12 months, when adjusted for age, gender and recruitment phase, intervention participants with a higher SES complied better with the Dutch guidelines for a healthy diet than intervention participants with low SES (DHD-index scores: 61.1 ± 9.7 vs. 63.4 ± 7.7; p=0.04). When the analysis was additionally adjusted for baseline values of the DHD-index scores, this difference was no longer statistically significant (p=0.15). Adherence to the guidelines for a healthy diet at 18 months and adherence to the physical activity guideline at both 12 and 18 months were not significantly different between the low and higher SES groups (Table 5.3).

Drop-out

Drop-out did not differ significantly between the SES groups at 12 and at 18 months (Table 5.4). However, when the data were stratified for treatment group, drop-out was relatively high among low SES participants compared with higher SES participants at 18 months in the intervention group specifically (28% versus 17%; p=0.11).

Effectiveness

Effectiveness of the intervention after 12 months was not modified by SES for fasting insulin, weight, BMI, waist circumference and waist-to-height ratio (Table 5.5). Only for HbA1c was the intervention effect among participants with low SES slightly better compared to the higher SES group directly after the intervention (p=0.07). After 18 months, the improvements in HbA1c were still larger in the low SES group (p=0.03). In addition, at that time, effectiveness on fasting insulin (p=0.14) and waist circumference (p=0.16) seemed somewhat better among the low SES group than among the higher SES group.

Analyses stratified for gender showed that the effectiveness of the intervention was similar for low and higher SES female participants. However, among male participants, some differences in effectiveness were observed (Additional file 5.2). An interaction between SES and treatment for changes in HbA1c was observed at 12 months (p=0.02) and at 18 months (p=0.12), where the low SES men achieved relatively greater improvements in HbA1c than the higher SES men. In addition, at 18 months, somewhat better improvements were achieved for weight (p=0.18) and BMI (p=0.16).

Table 5.2 Baseline characteristics of SLIMMER participants (n=315) by socioeconomic status*

	Low SES (n=165)	Middle/high SES (n=150)	*p*
Treatment group			0.68
Intervention group	83 (50)	72 (48)	
Control group	82 (50)	78 (52)	
Socio-demographics			
Gender			<0.001
Male	66 (40)	95 (63)	
Female	99 (60)	55 (37)	
Age (years)	62.0 ± 6.3	59.6 ± 6.4	0.001
Ethnicity			0.37
Dutch	143 (87)	137 (91)	
Western non-Dutch	17 (10)	9 (6)	
Non-western non-Dutch	5 (3)	4 (3)	
Employment status			<0.001
Retired	58 (35)	43 (29)	
No paid job	50 (30)	16 (11)	
Part-time job (<32 hours/week)	32 (19)	31 (21)	
Fulltime job (≥32 hours/week)	25 (15)	60 (40)	
Educational level			
No education	7 (4)	–	
Lowest education (primary)	24 (15)	–	
Low education (lower secondary)	134 (81)	–	
Middle education	–	75 (50)	
High education	–	75 (50)	
Smoking status			0.99
Current	31 (19)	29 (19)	
Former	96 (58)	87 (58)	
Never	38 (23)	34 (23)	
Anthropometric measurements[1,2]			
Weight (kg)	87.4 ± 17.2	90.7 ± 15.9	0.74
BMI (kg/m^2)	30.5 ± 5.0	29.9 ± 4.4	0.29[3]
Waist circumference (cm), total	104.7 ± 13.4	104.9 ± 12.2	0.28
Male	109.8 ± 12.3	107.7 ± 10.9	
Female	101.5 ± 13.0	99.9 ± 12.8	
Waist-to-height ratio	0.620 ± 0.072	0.603 ± 0.067	0.10
Blood markers[2]			
Fasting insulin (pmol/l)	87.3 ± 46.5	88.5 ± 68.2	0.52[3]
HbA1c (mmol/mol)	40.8 ± 3.7	39.2 ± 3.9	0.007
Lifestyle guidelines[2]			
Adherence healthy diet (score 0–80)[1]	58.3 ± 9.4	59.5 ± 9.5	0.15
Adherence physical activity	139 (84)	115 (77)	0.53

* Values are expressed as n (%) or mean ± SD.

[1] Data are missing for 1 participant with low SES.

[2] *p*-value is adjusted for age and gender.

[3] Log-transformed data were used.

Table 5.3 Programme attendance, programme acceptability and guideline adherence by socioeconomic status*

	n	Low SES	n	Middle/ high SES	p^1	p^2
Attendance	83		72			
Number of physical activity lessons		38 ± 22		37 ± 20	0.99	
Individual consultations dietician (min)		204 ± 53		208 ± 36	0.21	
Group meeting dietician		55 (66)		49 (68)	0.53	
Return visit		46 (55)		44 (61)	0.11	
Number of sports clinics		2.1 ± 1.8		2.5 ± 2.0	0.17	
Acceptability (score 1–10)	74	8.2 ± 1.1	67	8.0 ± 1.1	0.23	
Adherence healthy diet (score 0–80)						
At 12 months	75	61.1 ± 9.7	67	63.4 ± 7.7	0.04	0.15
At 18 months	66	61.5 ± 8.7	65	62.7 ± 8.2	0.30	0.71
Adherence physical activity						
At 12 months	76	64 (84)	68	56 (82)	0.39	0.34
At 18 months	67	61 (91)	65	53 (82)	0.77	0.61

* Determined for participants of the intervention group only. Values are expressed as n (%) or mean ± SD.
[1] *p*-value is adjusted for age, gender and recruitment phase.
[2] *p*-value is adjusted for age, gender, recruitment phase and baseline adherence.

Table 5.4 Drop-out by socioeconomic status*

	n	Low SES	n	Middle/ high SES	p^1
Drop-outs at 12 months, total	165	18 (11)	150	22 (15)	0.36
Intervention group		9 (11)		7 (10)	0.92
Control group		9 (11)		15 (19)	0.25
Drop-outs at 18 months, total	165	37 (22)	150	31 (21)	0.38
Intervention group		23 (28)		12 (17)	0.11
Control group		14 (17)		19 (24)	0.57

* Values are expressed as n (%).
[1] *p*-value is adjusted for age, gender and recruitment phase.

Table 5.5 Effectiveness at 12/18 months by socioeconomic status: changes in blood markers and anthropometric measures*

	Low SES		Middle/high SES		*p*[1]
At 12 months	**INT (n=74)**	**CON (n=73)**	**INT (n=65)**	**CON (n=63)**	
Fasting insulin (pmol/l)[2, 3]	-9.52	0.82	-9.96	-0.52	0.78
HbA1c (mmol/mol)[2]	-1.85 ± 2.09	-0.58 ± 2.87	-1.46 ± 2.50	-0.92 ± 1.96	0.07
Weight (kg)	-3.07 ± 5.55	-0.62 ± 3.25	-2.99 ± 4.31	0.15 ± 3.88	0.87
BMI (kg/m^2)[3]	-1.06	-0.20	-0.94	0.04	0.99
Waist circumference (cm)	-5.89 ± 6.17	-1.88 ± 4.24	-4.68 ± 4.53	-0.86 ± 4.79	0.76
Waist-to-height-ratio	-0.034 ± 0.037	-0.011 ± 0.025	-0.026 ± 0.026	-0.004 ± 0.028	0.81
At 18 months	**INT (n=60)**	**CON (n=66)**	**INT (n=58)**	**CON (n=56)**	
Fasting insulin (pmol/l)[2, 3]	-18.54	-6.70	-15.73	-10.56	0.14
HbA1c (mmol/mol)[2]	-2.03 ± 2.38	0.06 ± 6.39	-1.67 ± 2.25	-1.43 ± 2.11	0.03[4]
Weight (kg)	-3.30 ± 5.78	-0.56 ± 3.26	-2.46 ± 4.31	-0.09 ± 4.07	0.37
BMI (kg/m^2)[3]	-1.16	-0.21	-0.78	-0.03	0.28
Waist circumference (cm)	-5.15 ± 6.77	-1.30 ± 4.48	-3.61 ± 5.35	-1.21 ± 6.30	0.16
Waist-to-height-ratio	-0.029 ± 0.040	-0.006 ± 0.027	-0.019 ± 0.031	-0.005 ± 0.037	0.20

* Values are expressed mean ± SD.

[1] *p*-value for interaction between treatment group and SES in ANCOVA test, adjusted for respective baseline variable, age, gender and recruitment phase.

[2] Adjusted for diabetes medication at 12 months or at 18 months.

[3] Log-transformed data were used. Data were back-transformed; hence SD cannot be presented.

[4] There was one extreme outlier in the low SES control group. Excluding this participant from the analysis resulted in a *p*-value for interaction of 0.08.

Discussion

The current study assessed the impact of socioeconomic status on willingness to participate, programme attendance, programme acceptability, adherence to lifestyle guidelines, drop-out and effectiveness in the SLIMMER diabetes prevention intervention. Persons with low SES were as likely as persons with higher SES to participate in the SLIMMER study, to attend the intervention programme and to complete the SLIMMER study. Adherence to the lifestyle guidelines and effectiveness of the intervention after 12 months were also mostly independent of SES. At 18 months, after 6 months of follow-up, the low SES participants seemed to maintain some effects better than the higher SES participants.

It has been hypothesised that individuals with low SES are less likely to participate in lifestyle programmes than individuals with higher SES [6, 7]. In the SLIMMER study, there was no difference in SES between responders and non-responders. Also, the percentage of participants with low SES in the SLIMMER study was relatively high (52%) compared with

the general Dutch population between 45 and 75 years old in 2012 (38%) [34], Apparently, the SLIMMER study was successful in reaching individuals with low SES. However, among non-responders, differences were observed in reasons for non-participation between the SES groups. Whereas the higher SES non-responders were more likely to report that they already exercised enough, the low SES non-responders were more likely to express a lack of interest in participating. It could be speculated that a different approach is necessary to motivate low and higher SES groups to participate in lifestyle programmes. Unfortunately, it is not known what motivated the current SLIMMER participants.

Once they were participating in the SLIMMER study, low SES participants attended the programme as well as the higher SES participants and showed similar adherence to the lifestyle guidelines; this is in line with earlier findings [10-12]. Furthermore, SLIMMER was also successful in retaining low SES as well as higher SES participants until the end of the intervention study, as drop-out rates were not different between SES groups. This is surprising, as comparable studies observed that individuals with low SES were less likely to complete an intervention study [8, 9] and its follow-up measurements [35]. One of these studies is SLIM [9, 15], which formed the basis of the SLIMMER study. In the SLIMMER study, the SLIM intervention was translated from an experimental setting to a primary care setting [16]. The finding that SES groups did not differ in drop-out in the SLIMMER study whereas they did differ in SLIM may suggest that the intervention is more successful in retaining low SES participants in a real-world setting than in an experimental setting. However, it should be noted that the SLIM programme had an average duration of 4.2 years with measurements up to 10 years after baseline [35], whereas the SLIMMER programme had a duration of 10 months with measurements up to 18 months after baseline. It could be that a longer period of follow-up is needed to observe differences between socioeconomic groups. It would be interesting to study the impact of SES in the SLIMMER study after a longer period of follow-up.

Our findings that effectiveness after 12 months – directly after the end of the intervention programme – was in general not modified by SES is in line with results from the Finnish Diabetes Prevention Study, where, after one year, effectiveness regarding several clinical markers and diabetes incidence was mostly independent of educational attainment [14]. Remarkably, after 18 months – after a period of follow-up – effectiveness for some outcomes in the SLIMMER study seemed better among the low SES group than among the higher SES group. However, it should be realised that drop-out at 18 months was relatively high compared with drop-out at 12 months in the low SES intervention group. It could be that a selective group, possibly consisting of the more successful participants, was willing to participate in the follow-up measurements, resulting in biased results.

Although the success of the SLIMMER study was in general not modified by SES, the current study could not exclude the possibility that some socioeconomic differences may be present in men or women only. Analyses stratified for gender showed some differences for

programme attendance and effectiveness among men in particular. To our knowledge, little is known about the impact of gender on socioeconomic differences in lifestyle interventions. This impact should be further explored in future studies.

A strength of this study is that the intervention was carried out in a real-world setting and involved professionals from local healthcare. The study therefore shows the actual effect of the intervention in the Dutch healthcare setting, rather than its potential in a more controlled setting. Another strength is that this study investigated differences between low and higher SES groups in multiple stages of the intervention: from initial participation in the intervention study, through active participation during the intervention programme, to completing the intervention study.

A limitation of this study is that it lacked some data to conduct these analyses optimally. For analyses regarding participation, educational level was missing for a large number of non-responders; therefore, the analysis could be subject to selection bias. Furthermore, reasons for participation and drop-out were not known. Additionally, the sample size may not have been sufficient for the stratified analyses for gender or treatment group. With a larger sample size, differences within the low SES group could have been studied, for example comparing the low vs. the least educated or comparing ethnic groups. Another limitation is that SES was determined by educational level only. It would be interesting to study other indicators of socioeconomic status, like employment, income, or neighbourhood socioeconomic characteristics, as different SES indicators are not interchangeable and can influence health outcomes differently, through different causal pathways [36, 37]. In the current study, it was not possible to study these SES indicators because of the high number of retired participants, the small differences in neighbourhood deprivation in the two middle-sized cities where the study was carried out [38] and the fact that participants' income was unknown.

Conclusions

This study showed that participation, programme attendance, programme acceptability, adherence to lifestyle guidelines, drop-out and effectiveness of the SLIMMER diabetes prevention intervention were in general not modified by socioeconomic status. In Dutch primary healthcare, the SLIMMER study was able to reach the low SES group as effectively as the higher SES group from the beginning to the end of the intervention study, resulting in at least similar health benefits. The SLIMMER intervention can therefore contribute to health promotion of individuals in both low and higher socioeconomic groups. Future studies should give insight into possible differences between low and higher SES groups after a longer period of follow-up. In addition, attention should be paid to the influence of gender in relation to socioeconomic differences and differences between specific subgroups within the low SES group.

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Additional file 5.1 Baseline characteristics of SLIMMER intervention participants (n=315) by socioeconomic status and treatment group*

	Low SES			Middle/high SES			
	INT (n=83)	**CON (n=82)**	***p*[1]**	**INT (n=72)**	**CON (n=78)**	***p*[1]**	***p*[2]**
Socio-demographics							
Gender			0.48			0.14	0.12
Male	31 (37)	35 (43)		50 (69)	45 (58)		
Female	52 (63)	47 (57)		22 (31)	33 (42)		
Age (years)	61.7 ± 6.1	62.2 ± 6.4	0.59	59.6 ± 6.5	59.6 ± 6.3	0.99	0.75
Employment status			0.91			0.23	
Retired	29 (35)	29 (35)		21 (29)	22 (28)		
No paid job	26 (31)	24 (29)		8 (11)	8 (10)		
Part-time job (<32 hours/week)	17 (20)	15 (18)		10 (14)	21 (27)		
Fulltime job (≥32 hours/week)	11 (13)	14 (17)		33 (46)	27 (35)		
Anthropometric measurements[3]							
Weight (kg)	86.7 ± 18.1	88.1 ± 16.3	0.74	93.4 ± 15.8	88.2 ± 15.6	0.11	0.19
BMI (kg/m^2)	30.6 ± 5.1	30.5 ± 4.9	0.97[4]	30.3 ± 4.3	29.5 ± 4.6	0.21[4]	0.38[4]
Waist circumference (cm)	104.9 ± 14.6	104.6 ± 12.1	0.69	106.5 ± 11.6	103.3 ± 12.7	0.23	0.60
Waist-to-height ratio	0.624 ± 0.077	0.616 ± 0.068	0.50	0.608 ± 0.062	0.599 ± 0.072	0.43	0.96
Blood markers							
Fasting insulin (pmol/l)	89.2 ± 51.0	85.2 ± 41.7	0.85[4]	97.9 ± 76.9	79.9 ± 58.3	0.06[4]	0.18[4]
HbA1c (mmol/mol)	41.0 ± 3.9	40.6 ± 3.5	0.47	39.3 ± 3.7	39.2 ± 4.2	0.89	0.69
Lifestyle guidelines							
Adherence healthy diet (score 0–80)[3]	57.6 ± 9.9	59.1 ± 8.8	0.25	60.0 ± 9.2	59.1 ± 9.8	0.51	0.21
Adherence physical activity	65 (78)	74 (90)	0.04	53 (74)	62 (79)	0.46	0.27

* Values are expressed as n (%) or mean ± SD.

[1] *p*-value for difference between treatment groups. Tests for anthropometric measures, blood markers and lifestyle guidelines are adjusted for age and gender.

[2] *p*-value for interaction between treatment group and SES, adjusted for age and gender.

[3] Data are missing for one participant with low SES in the intervention group.

[4] Log-transformed data were used.

Additional file 5.2 Stratified analyses for gender

Table A Participation by socioeconomic status*

	Low SES	Middle/high SES	*p*[1]
Males			
Participation			0.65
Non-responder[2]	20 (38)	33 (62)	
Responder	66 (41)	95 (59)	
Females			
Participation			0.60
Non-responder[2]	29 (71)	12 (29)	
Responder	99 (64)	55 (36)	

* Values are expressed as n (%).

[1] *p*-value is adjusted for age.

[2] Total number of non-responders was 274. Education and gender data were available for only 94 non-responders.

Table B Programme attendance, programme acceptability and guideline adherence, by socioeconomic status*

	n	Low SES	n	Middle/high SES	p^1	p^2
Males						
Attendance	31		50			
Number of physical activity lessons		38 ± 24		37 ± 19	0.76	
Individual consultations dietician (min)		205 ± 48		209 ± 33	0.16	
Group meeting dietician		20 (65)		33 (66)	0.68	
Return visit		11 (35)		31 (62)	0.01	
Number of sports clinics		2.0 ± 2.1		2.5 ± 2.1	0.26	
Acceptability (score 1–10)	29	8.3 ± 1.0	48	8.0 ± 1.1	0.31	
Adherence healthy diet (score 0–80)						
At 12 months	30	58.7 ± 11.1	48	63.1 ± 7.8	0.07	0.43
At 18 months	25	60.2 ± 9.4	47	62.9 ± 8.6	0.29	0.84
Adherence physical activity						
At 12 months	30	22 (73)	49	40 (82)	0.21	0.16
At 18 months	25	21 (84)	47	37 (79)	0.88	0.99
Females						
Attendance	52		22			
Number of physical activity lessons		38 ± 21		37 ± 22	0.85	
Individual consultations dietician (min)		204 ± 56		206 ± 41	0.72	
Group meeting dietician		35 (67)		16 (73)	0.62	
Return visit		35 (67)		13 (59)	0.57	
Number of sports clinics		2.2 ± 1.7		2.6 ± 1.8	0.31	
Acceptability (score 1–10)	45	8.2 ± 1.2	19	8.1 ± 1.2	0.42	
Adherence healthy diet (score 0–80)						
At 12 months	45	62.7 ± 8.3	19	64.2 ± 7.7	0.49	0.20
At 18 months	41	62.4 ± 8.2	18	62.2 ± 7.2	0.95	0.92
Adherence physical activity						
At 12 months	46	42 (91)	19	16 (84)	0.62	0.67
At 18 months	42	40 (95)	18	16 (89)	0.46	0.46

* Values are expressed as n (%) or mean ± SD. Determined for intervention programme participants only.
[1] *p*-value is adjusted for age and recruitment phase.
[2] *p*-value is adjusted for age, recruitment phase and baseline adherence.

Table C Drop-out by socioeconomic status*

	Low SES	Middle/high SES	p^1
Males	**(n=66)**	**(n=95)**	
Drop-outs at 12 months	7 (11)	10 (11)	0.65
Drop-outs at 18 months	16 (24)	17 (18)	0.09
Females	**(n=99)**	**(n=55)**	
Drop-outs at 12 months	11 (11)	12 (22)	0.13
Drop-outs at 18 months	21 (21)	14 (25)	0.74

* Values are expressed as n (%).
[1] *p*-value is adjusted for age and recruitment phase.

Table D Effectiveness at 12/18 months by socioeconomic status: changes in blood markers and anthropometric measures*

	Low SES		Middle/high SES		*p*[1]
At 12 months					
Males	**INT (n=28)**	**CON (n=31)**	**INT (n=47)**	**INT (n=38)**	
Fasting insulin (pmol/l)[2, 3]	-13.75	0.92	-8.87	-1.76	0.52
HbA1c (mmol/mol)[2]	-1.61 ± 2.53	0.03 ± 3.74	-1.38 ± 2.52	-1.29 ± 2.10	0.02
Weight (kg)	-3.69 ± 6.47	-0.75 ± 3.17	-3.17 ± 4.60	-0.69 ± 3.64	0.68
BMI (kg/m^2)[3]	-1.21	-0.21	-0.94	-0.21	0.55
Waist circumference (cm)	-6.61 ± 5.63	-2.16 ± 4.72	-4.70 ± 4.61	-1.91 ± 4.83	0.52
Waist-to-height-ratio	-0.037 ± 0.031	-0.011 ± 0.026	-0.025 ± 0.025	-0.010 ± 0.026	0.51
Females	**INT (n=46)**	**CON (n=42)**	**INT (n=18)**	**CON (n=25)**	
Fasting insulin (pmol/l)[2, 3]	-7.36	0.74	-12.75	1.23	0.87
HbA1c (mmol/mol)[2]	-2.00 ± 1.79	-1.02 ± 1.93	-1.67 ± 2.52	-0.36 ± 1.60	0.51
Weight (kg)	-2.69 ± 4.95	-0.51 ± 3.33	-2.54 ± 3.51	1.43 ± 3.96	0.41
BMI (kg/m^2)[3]	-0.97	-0.18	-0.93	0.44	0.43
Waist circumference (cm)	-5.46 ± 6.49	-1.67 ± 3.88	-4.64 ± 4.42	0.73 ± 4.35	0.57
Waist-to-height-ratio	-0.033 ± 0.040	-0.010 ± 0.024	-0.027 ± 0.027	0.005 ± 0.027	0.52
At 18 months					
Males	**INT (n=23)**	**CON (n=26)**	**INT (n=42)**	**CON (n=33)**	
Fasting insulin (pmol/l)[2, 3]	-31.89	-6.33	-17.14	-9.59	0.22
HbA1c (mmol/mol)[2]	-1.91 ± 2.21	-0.35 ± 2.38	-1.48 ± 2.17	-1.55 ± 2.37	0.12
Weight (kg)	-4.57 ± 5.05	-0.82 ± 2.58	-2.76 ± 4.72	-0.91 ± 3.26	0.18
BMI (kg/m^2)[3]	-1.49	-0.27	-0.85	-0.29	0.16
Waist circumference (cm)	-6.60 ± 5.06	-2.40 ± 3.71	-3.95 ± 5.77	-2.32 ± 6.88	0.26
Waist-to-height-ratio	-0.035 ± 0.028	-0.012 ± 0.021	-0.021 ± 0.033	-0.011 ± 0.039	0.30
Females	**INT (n=37)**	**CON (n=40)**	**INT (n=16)**	**CON (n=23)**	
Fasting insulin (pmol/l)[2, 3]	-12.17	-6.94	-11.78	-11.59	0.19
HbA1c (mmol/mol)[2]	-2.11 ± 2.50	0.32 ± 8.02	-2.19 ± 2.46	-1.26 ± 1.68	0.06[4]
Weight (kg)	-2.52 ± 6.12	-0.39 ± 3.65	-1.69 ± 2.98	1.09 ± 4.85	0.95
BMI (kg/m^2)[3]	-0.95	-0.17	-0.58	0.35	0.95
Waist circumference (cm)	-4.25 ± 7.57	-0.59 ± 4.82	-2.70 ± 4.08	0.37 ± 5.08	0.61
Waist-to-height-ratio	-0.025 ± 0.046	-0.003 ± 0.030	-0.014 ± 0.025	0.005 ± 0.030	0.69

* Values are expressed mean ± SD.

1 *p*-value for interaction between treatment group and SES in ANCOVA test, adjusted for respective baseline variable, age and recruitment phase.

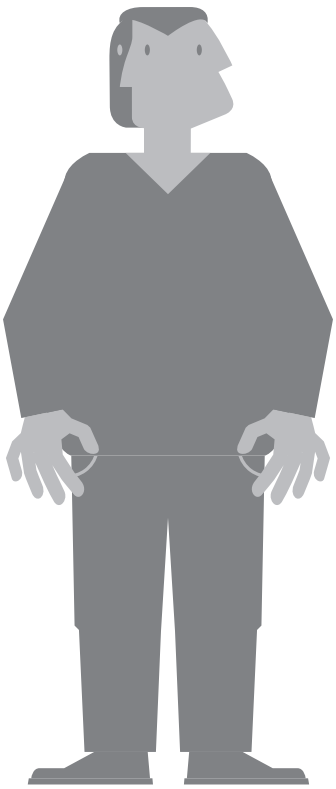
2 Adjusted for diabetes medication at 12 months or at 18 months.

3 Log-transformed data were used. Data were back-transformed; hence SD cannot be presented.

4 There was one extreme outlier in the low SES control group. Excluding this participant from the analysis resulted in a *p*-value for interaction of 0.30.

6

Effectiveness of the MetSLIM lifestyle intervention targeting low SES individuals of different ethnic origins with elevated waist-to-height ratio



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Submitted

Abstract

Background: Lifestyle interventions can have beneficial effects on risk factors for cardiometabolic diseases. We aimed to evaluate whether the lifestyle intervention MetSLIM targeting low socioeconomic status individuals of different ethnic origins was successful in improving waist circumference and other cardiometabolic risk factors, lifestyle behaviour and quality of life.

Methods: MetSLIM was a quasi-experimental intervention study, carried out in deprived neighbourhoods, involving ethnicity-matched and gender-matched research assistants, dieticians and sports instructors. Two hundred and twenty subjects aged 30–70 years with an elevated waist-to-height ratio were recruited: 117 participated in the intervention group (12-month dietary and physical activity programme) and 103 in the control group. Drop-out was 31%. All subjects underwent anthropometric measurements and blood withdrawal, and completed questionnaires on dietary intake, physical activity and quality of life. Examinations were performed at baseline and after 12 months.

Results: Most participants were of Dutch (40%) or Turkish origin (48%). Mean age was 47.5 ± 9.2 years. Eighty-three percent of the participants were female, and 38% had completed no education or primary school only. At 12 months, the intervention group showed significantly greater improvements than the control group in waist circumference (ß=-3.3cm, 95% CI -4.7;-1.8, p<0.001) and other obesity measures. Additionally, greater reductions were observed for total cholesterol (ß= -0.33 mmol/l, 95%CI -0.56;-0.10, p=0.005) and LDL cholesterol (ß= -0.35 mmol/l, 95%CI -0.56;-0.14, p=0.001). Dietary changes were significant for fibre intake (ß=1.5 g/1000kcal, 95%CI 0.3;2.7, p=0.016). Compared with the control group, the intervention group reported a decrease in total minutes of physical activity (ß= -573 min/wk, 95%CI -1126;-21, p=0.042) and showed improvements in the quality of life domains 'health transition' and 'general health'.

Conclusions: This study showed that MetSLIM is effective in improving waist circumference, total and LDL cholesterol, and quality of life among individuals with low socioeconomic status of different ethnic origins.

Background

Lifestyle intervention studies such as the Diabetes Prevention Program (DPP) and the Diabetes Prevention Study have shown that lifestyle interventions have beneficial effects on risk factors for cardiometabolic diseases and reduce the development of type 2 diabetes mellitus [1-3]. The success of these studies has led to the adaptation of these lifestyle interventions towards several different target groups and settings [4-9].

In the Netherlands, the Study of Lifestyle intervention and Impaired glucose tolerance Maastricht (SLIM) also showed that a combined diet and physical activity intervention reduces diabetes risk [10]. The SLIM study was a randomised controlled trial studying the effectiveness of a lifestyle intervention on glucose tolerance in persons with impaired glucose tolerance. Participants in the lifestyle intervention received one hour of individual dietary advice every three months and one 90-minute group session per year led by a dietician. In addition, they could participate in a weekly free supervised aerobic and resistance training programme at the university fitness centre [11]. In this trial, individuals with low socioeconomic status (SES) dropped out earlier than individuals with higher SES [12]. This is unfortunate, as in general the prevalence of cardiovascular disease and type 2 diabetes mellitus is relatively high among individuals with low SES [13]. Others have also shown that this group is less likely to participate in lifestyle interventions and more likely to drop out early [14-16]. Similar patterns have been observed in ethnic minorities living in the Netherlands [17-20]. Therefore, this group forms an important target group for lifestyle interventions.

In order to tackle the underrepresentation of socioeconomically disadvantaged individuals and ethnic minorities in health promotion activities, adapted methods are expected to be necessary to reach and retain this group effectively [21-23]. For this reason, we adapted the SLIM study to the needs and preferences of low SES individuals of different ethnic origins based on findings of preceding research [22, 24, 25]. This adapted study was named MetSLIM.

Following the preferences of the target group, adaptations included additional group meetings about topics relevant for the target group; involving ethnicity- and gender-matched research assistants, dieticians and sports instructors; activities provided for women and men separately; and all activities provided in participants' own neighbourhood. Study design, setting and measurements were chosen to minimise the burden of participation [25]. The aim of this study was to evaluate whether the adapted lifestyle intervention was successful in improving waist circumference and other cardiometabolic risk factors, lifestyle behaviour and quality of life among low SES individuals of different ethnic origins.

Methods

Study design

MetSLIM was a quasi-experimental study running from January 2013 until June 2015 in two cities in the Netherlands. The study was approved by the medical ethical committee of Wageningen University and registered at the Netherlands Trial Register as NTR3721. All subjects gave their written informed consent before the start of the study. The design of the MetSLIM study has been published in more detail previously [25].

Recruitment

Individuals of Dutch, Moroccan and Turkish origin, aged 30–70, were recruited in deprived neighbourhoods. Intervention group participants were recruited in different neighbourhoods than control group participants to avoid dissatisfaction and spill-over. The aim was to achieve similar numbers of participants for each ethnicity (frequency matching) in the intervention and control group. Two recruitment strategies were used. Firstly, participants were recruited via general practitioners (GPs) either situated in deprived neighbourhoods or having a broad spectrum of low SES patients or ethnic minority patients. GPs made a selection of potential participants in their database on the basis of the inclusion criteria that were available in their registry, e.g. age, medication use and postal code (as indicator for neighbourhood). GPs were asked to select only patients from Dutch, Turkish and Moroccan origin who were physically and mentally able to participate in the intervention. Secondly, participants were recruited in community centres involving community health workers (e.g. social workers), local health professionals and other local contacts. Interested persons were asked to fill out a screening questionnaire to check whether they fulfilled the inclusion or the exclusion criteria.

The inclusion criteria were (1) waist-to-height ratio (WHtR) > 0.5; (2) aged between 30 and 70 years; (3) no medication for hypertension, hypercholesterolemia, cardiovascular diseases, diabetes mellitus or/and renal failure at baseline; (4) living in a deprived neighbourhood; (5) Dutch, Turkish or Moroccan ethnic origin. Following the definitions of Statistics Netherlands, persons with both parents born in the Netherlands are considered to be Dutch [26], and persons who have at least one parent born in Morocco/Turkey are considered to be Moroccan/Turkish [27]. However, if persons signed up for the study from neighbourhoods close by or of another ethnic background, they were also accepted for participation in the study, as it was considered unethical and undesirable (for social cohesion) to exclude them. Exclusion criteria were: (1) having a mental or physical disability that made participation in a lifestyle intervention impossible; (2) already participating in a lifestyle programme targeting weight loss; (3) pregnant or lactating.

During the inclusion period (January 2013 to June 2014), 220 participants with elevated WHtR enrolled in the study, of which 117 participated in the intervention group and 103 in the control group.

Intervention and control group

The intervention group participated in a 12-month lifestyle intervention that promoted lifestyle change and weight loss through increased physical activity and changes in dietary habits following the general Dutch public health recommendations [28]. The lifestyle intervention was provided in a community setting and consisted of three components: four group meetings, four hours of individual dietary advice and weekly sports lessons. All group meetings on nutrition were provided separately for Dutch, Turkish and Moroccan participants. The dietary advice (maximum four hours) was divided over a flexible number of consultations and was given by a dietician who was ethnicity-matched to the Dutch, Turkish and Moroccan participants. Dieticians tailored their advice, based on the national guidelines on healthy nutrition [28], to the needs of each participant. Additionally, participants were invited to join the four group meetings (90 minutes). The first was an introductory meeting, guided by the researcher, in which participants got to know the dietician, the sports instructor and other study participants. The other three group meetings were about nutrition and were guided by the dietician. The group meeting focused on label reading, social occasions and price concerns (supermarket tour). Because of a lack of interest or other thematic priorities, the meeting on price concerns was in some cases replaced by a meeting about 'Staying motivated' or 'Ramadan'. The physical activity lessons (60 minutes) were set up especially for the study participants and were tailored to the needs and preferences of the sports groups. Sports instructors provided a variety of activities such as basketball, circuit training, core stability, zumba and walking. The physical activity classes for ethnicities other than Dutch were provided separately for women and men with gender-matched sports instructors. Participants were allowed to bring friends and family along to the physical activity lessons if that was feasible given the space of the physical activity location.

The participants in the control group received only one group meeting (90 minutes) guided by a dietician, together with, if necessary, a language assistant with a dietetic background. The dietician provided the group with general information about a healthy diet. Additionally, participants received information leaflets on the benefits of healthy nutrition and increased physical activity.

The intervention programme was promoted as 'TogetherLongerHealthy' and the control programme as 'Health check'. Both groups participated in the same measurements. All participants received the results of their own measurements. Measurement results were also sent to the GPs.

Outcome measures

To evaluate the effectiveness of the lifestyle intervention programme, data were collected at baseline and after 12 months. Participants underwent physical examinations and were asked to fill in questionnaires, either alone or together with a research assistant speaking their native language. Height was measured without shoes to the nearest millimetre. Body weight and body fat percentage were measured with a Tanita BC-418 bioimpedance scale (Tanita

Corporation, Tokyo, Japan). Waist circumference was determined midway between the lowest rib and the iliac crest, and hip circumference was measured at the widest portion of the buttocks. Both were measured twice to the nearest 0.5cm and averaged. Blood pressure was measured six times (with two minutes rest in-between) in a seated position with an Omron 705CP (Omron Healthcare Co., Kyoto, Japan) after at least two minutes rest. The mean was calculated from the last five measurements. Blood samples were taken after at least 10 hours of fasting to measure fasting glucose, HDL cholesterol, total cholesterol, triglycerides, HbA1c, fasting insulin, liver function enzymes, creatinine and uric acid. A fasting spot urine sample was collected to measure albumin and creatinine. Analyses were performed either at SHO laboratory in Velp or Maxima Medisch Centrum laboratory in Veldhoven, the Netherlands, depending on the location of the blood sampling. For fasting insulin, all blood samples were analysed at SHO laboratory in Velp.

Albuminuria was determined by the ratio between urinary concentrations of albumin and creatinine, with cuf-offs >2.5mg/mmol for men and >3.5mg/mmol for women [29]. LDL cholesterol was calculated using the Friedewald formula [30]. Metabolic syndrome was defined by the revised NCEP-ADT III criteria as the presence of ≥3 of the following five cardiometabolic risk factors: increased waist circumference (men ≥102cm, women ≥88cm), low HDL cholesterol (men <1.03 mmol/l, women <1.29 mmol/l or on drug treatment for reduced HDL cholesterol), high triglyceride levels (≥1.69 mmol/l or on drug treatment for elevated triglycerides), increased blood pressure (systolic ≥130 mmHg and/or diastolic ≥85 mmHg or on antihypertensive drug treatment) and impaired fasting glucose (≥5.6 mmol/l or on drug treatment for elevated glucose) [31]. For participants with both parents born in Asia (except for countries in the Middle-East), cut-off values of 90cm (men) and 80cm (women) for waist circumference were used [31].

Physical activity was measured with the Short Questionnaire to Assess Health enhancing physical activity (SQUASH) [32]. Dietary intake was assessed with ethnic-specific Food Frequency Questionnaires (FFQ) [33] and calculated using the 2013 Dutch food composition database [34]. Adherence to a healthy diet was assessed by the Dutch Healthy Diet index (DHD-index) [35, 36]. The original DHD-index consists of 10 components, representing the Dutch Guidelines for a Healthy Diet [28]. Eight of the ten components were measured in the MetSLIM study (physical activity, vegetables, fruit, fibre, fish, saturated fatty acids, trans fatty acids and alcohol). Participants could score between 0 and 10 points, resulting in a total maximum score of 80 points. A higher score represents better adherence to the Dutch Guidelines for a Healthy Diet. Quality of life was assessed in different health domains with the SF-36 questionnaire [37].

Statistical analysis

It was calculated that a sample size of 252 subjects would be required to detect a change in waist circumference of 1.1cm, assuming an alpha of 0.05, power of 80% and a drop-out rate of 25% [25]. Eventually, 220 participants could be enrolled in the MetSLIM study during an intensive recruitment period of 17 month (see Figure 6.1).

Participants who became pregnant during the study (n=5) were excluded from the analyses. Furthermore, participants with missing data on waist circumference at 12 months were considered drop-outs and excluded from the analyses (n=66). As a result, data collected from 149 participants were used for statistical analysis. Participants with a CRP concentration >10 mg/L were excluded from the analysis regarding CRP, because these concentrations reflect acute rather than chronic inflammation [38, 39]. Participants who skipped whole sections of the food frequency questionnaire or reported a consumption of less than 500kcal/day or 800kcal/day, for women and men respectively, were excluded from the analyses for dietary intake (n=5) [40]. Excessive alcohol consumption was classified as more than 21 consumptions/week for men and more than 14 consumptions/week for women.

Data were analysed with IBM SPSS Statistics version 22. Significance level was set at 0.05. All analyses were performed according to the intention-to-treat principle, where participants were analysed in the groups for which they were recruited, regardless of whether they actively participated in that group. Continuous variables are presented as mean ± SD and categorical variables as percentages. Baseline characteristics were compared between participants in the intervention and the control group, and between completers and drop-outs with Chi-Square tests, independent samples t-tests or Mann-Whitney tests. For each outcome variable, baseline results are described for those participants who had data for that variable at baseline and after 12 months. Changes in prevalence of metabolic syndrome and albuminuria were compared within the intervention and the control group with McNemar's tests. Changes in continuous effect outcomes over time were compared between the intervention and the control group by ANCOVA, with change after 12 month as outcome variable, adjusted for the average of baseline and 12 months of the variable [41] and ethnicity. Non-normally distributed variables were log transformed. Although GPs and researchers screened for relevant medication during recruitment, a few medication users were enrolled in the study. Excluding users of medication for glucose (n=2), cholesterol (n=5) or blood pressure (n=2) from those analyses that could be influenced by medication use resulted in similar results, except for HbA1c. Medication users were therefore included in the analyses.

The effect of the treatment was compared between participants of Dutch and Turkish origin (the two largest ethnic groups in this study). To test the interaction between treatment and ethnicity, an interaction term was added to the model. For the interaction term between treatment and ethnicity, a *p*-value of 0.20 was considered relevant [42]. The effect of the treatment on dietary intake was not compared between Dutch and Turkish participants, because dietary intake was known for only a small number of Turkish participants in the control group (n=6).

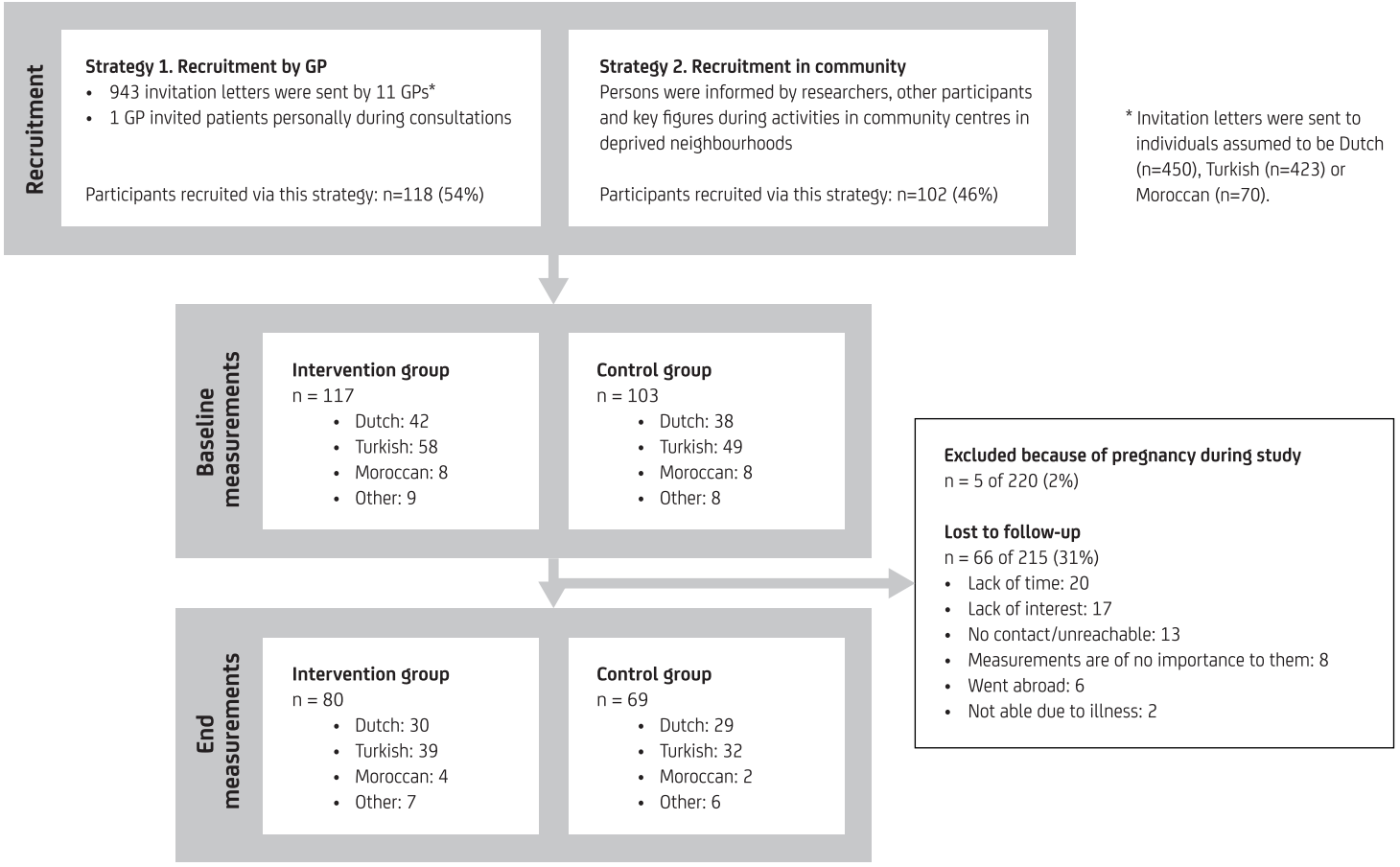

Figure 6.1 Flow diagram of the MetSLIM study

Results

Baseline characteristics

Participants who dropped out (n=66, 31%) did not differ in baseline characteristics from the completers, except that they were more often smokers and had more often been recruited via their GP (Table 6.1). The most important reasons for drop-out were lack of time (30%), lack of interest (26%) and lost contact (20%) (Figure 6.1).

The baseline characteristics and changes therein of the 149 participants that completed the study are presented in Tables 6.2–6.5. In general, baseline characteristics were similar between the intervention and the control group. On average, the completing participants were 47.5 ± 9.2 years old. Most of them were of Dutch (40%) or Turkish origin (48%) and female (83%). Thirty-eight percent of them had completed no education or primary school only, and 56% had no paid job. The latter were mostly househusband/housewife (35%), disabled (18%), or unemployed/looking for a job (15%).

Intervention effects on cardiometabolic risk factors

After 12 months, beneficial intervention effects were observed for cardiometabolic risk factors (Table 6.3). Mean difference in change in waist circumference was -3.3cm (95%CI -4.7;-1.8) between the two groups. Also, greater reductions were observed in weight (ß=-2.2 kg, 95%CI -3.7;-0.8), BMI (ß=-0.8 kg/m^2, 95%CI -1.3;-0.3), WHtR (ß=-0.020, 95%CI -0.028;-0.011) and fat percentage (ß=-0.9 %, 95%CI -1.8;-0.1) in the intervention group compared to the control group.

Apart from waist circumference, no significant improvements were observed for the other components of metabolic syndrome. Metabolic syndrome prevalence did not change significantly in either the intervention group (from 18/68 to 18/68 after 12 months; *p*=1.00) or the control group (16/60 to 20/60 after 12 months; *p*=0.29). The intervention group had greater improvements in total cholesterol (ß= -0.33 mmol/L, 95%CI -0.56;-0.10) and LDL cholesterol (ß= -0.35 mmol/l, 95%CI -0.56;-0.14) compared with the control group. Albuminuria was rare in both the intervention group (from 1/73 to 3/71 after 12 months; *p*=0.50) and the control group (from 1/58 to 2/58 after 12 months; *p*=1.00).

Intervention effects on dietary intake and physical activity

After 12 months, fibre intake had increased in the intervention group compared to the control group (ß= 1.5 g/1000 kcal, 95%CI 0.3;2.7) (Table 6.4). The intervention group also showed a reduction in energy intake (*p*=0.12) (ß= -325 kcal, 95%CI -736;87). Additionally, the intervention group reported a decrease in total minutes of physical activity compared to the control group (ß= -573 min/wk, 95%CI -1126;-21).

Table 6.1 Comparison of baseline characteristics between completers and drop-outs in the MetSLIM study*

	Completers (n=149)[1]	Drop-outs (n=66)[1]	*p*[2]
Treatment group			0.93
Intervention group	80 (54)	35 (53)	
Control group	69 (46)	31 (47)	
Recruitment strategy			0.047
Invited by GP	73 (49)	42 (64)	
Invited in community centre	76 (51)	24 (36)	
Gender			0.13
Male	25 (17)	17 (26)	
Female	124 (83)	49 (74)	
Age (years)	47.5 ± 9.2	45.4 ± 10.1	0.14
Ethnicity			0.17
Dutch	59 (40)	20 (30)	
Turkish	71 (48)	35 (53)	
Moroccan	6 (4)	7 (11)	
Other	13 (9)	4 (6)	
Educational level			0.18
No education	16 (11)	14 (21)	
Lowest education (primary)	41 (28)	15 (23)	
Low education (lower secondary)	35 (23)	19 (29)	
Middle education	38 (26)	13 (20)	
High education	19 (13)	5 (8)	
Employment status			0.47
No paid job	83 (56)	37 (64)	
Part-time job (<32 hours/week)	40 (27)	11 (19)	
Full-time job (≥32 hours/week)	25 (17)	10 (17)	
Household situation			0.19
Single occupant	30 (20)	10 (18)	
Living with partner	27 (18)	12 (21)	
Living with partner and children	67 (46)	32 (56)	
Single parent living with children	23 (16)	3 (5)	
Smoking status			0.031
Current	30 (20)	22 (38)	
Former	39 (26)	11 (19)	
Never	79 (53)	25 (43)	
Alcohol consumption			0.22
No consumption	76 (60)	39 (74)	
Low to moderate consumption	42 (33)	11 (21)	
Excessive consumption	8 (6)	3 (6)	
Metabolic syndrome			0.60
No	102 (72)	37 (69)	
Yes	39 (28)	17 (31)	
Family history of type 2 diabetes in first degree			0.88
No	89 (61)	36 (62)	
Yes	57 (39)	22 (38)	

* Values are expressed as n (%) or mean ± SD.

[1] Employment status: Completer *n*=148, Drop-out *n*=58; Household situation: Completer *n*=147, Drop-out *n*=57; Smoking status: Completer *n*=148, Drop-out *n*=58; Alcohol consumption: Completer *n*=126, Drop-out *n*=53; Metabolic syndrome: Completer *n*=141; Drop-out *n*=54; Family history of type 2 diabetes in first degree: Completer *n*=146, Drop-out *n*=58.

[2] *p*-value of Chi-Square tests or independent samples t-tests.

Table 6.2 Baseline characteristics of participants in the MetSLIM study (n=149)*

	INT (n=80)[1]	CON (n=69)[1]	*p*[2]
Recruitment strategy			0.29
Invited by GP	36 (45)	37 (54)	
Invited in community centre	44 (55)	32 (46)	
Gender			0.29
Male	11 (14)	14 (20)	
Female	69 (86)	55 (80)	
Age (years)	47.9 ± 7.9	47.0 ± 10.6	0.57
Ethnicity			0.89
Dutch	30 (38)	29 (42)	
Turkish	39 (49)	32 (46)	
Moroccan	4 (5)	2 (3)	
Other	7 (9)	6 (9)	
Educational level			0.10
No education	12 (15)	4 (6)	
Lowest education (primary)	24 (30)	17 (25)	
Low education (lower secondary)	20 (25)	15 (22)	
Middle education	18 (23)	20 (29)	
High education	6 (8)	13 (19)	
Employment status			0.11
No paid job	45 (57)	38 (55)	
Part-time job (<32 hours/week)	25 (32)	15 (22)	
Full-time job (≥32 hours/week)	9 (11)	16 (23)	
Household situation			0.13
Alone	17 (22)	13 (19)	
Together with partner	16 (21)	11 (16)	
Together with partner and child(ren)	38 (49)	29 (42)	
Single parent living with children	7 (9)	16 (23)	
Smoking status			0.92
Current	15 (19)	15 (22)	
Former	21 (27)	18 (26)	
Never	43 (54)	36 (52)	
Alcohol consumption			
No consumption	41 (65)	35 (56)	0.28
Low to moderate consumption	20 (32)	22 (35)	
Excessive consumption	2 (3)	6 (10)	
Metabolic syndrome			0.56
No	52 (70)	50 (75)	
Yes	22 (30)	17 (25)	
Metabolic syndrome components			0.43
0	8 (11)	11 (16)	
1	16 (22)	20 (30)	
2	28 (38)	19 (28)	
3	14 (19)	7 (10)	
4	7 (9)	9 (13)	
5	1 (1)	1 (1)	

Family history of type 2 diabetes in first degree			0.39
No	45 (58)	44 (65)	
Yes	33 (42)	24 (35)	
History of hyperglycaemia			0.55
No	71 (90)	63 (93)	
Yes	8 (10)	5 (7)	
History of hypercholesterolemia			0.54
No	65 (82)	54 (78)	
Yes	14 (18)	15 (22)	
History of hypertension			0.37
No	66 (88)	62 (93)	
Yes	9 (12)	5 (7)	

* Values are expressed as n (%) or mean ± SD.

[1] Employment status: INT *n*=79, CON *n*=69; Household situation: INT *n*=78, CON *n*=69; Smoking status: INT *n*=79, CON *n*=69; Alcohol consumption: INT *n*=63, CON *n*=63; Metabolic syndrome: INT *n*=74, CON *n*=67; Metabolic syndrome components: INT *n*=74, CON *n*=67; Family history of type 2 diabetes in first degree: INT *n*=78, CON *n*=68; History of hypercholesterolemia: INT *n*=79, CON *n*=69; History of hypertension: INT *n*=75, CON *n*=67.

[2] *p*-value of Chi-Square tests or independent samples t-tests.

Intervention effects on quality of life

The intervention group after 12 months showed greater improvement in the domains 'health transition' (i.e. self-rated health compared with one year ago) and 'general health' (i.e. their own self-reported health and their self-rated health compared with that of others) compared with the control group ($p<0.001$). Other changes within domains of quality of life were not different between the groups (Table 6.5).

Intervention effects among different ethnic groups

In general, the intervention effects were more beneficial among participants of Dutch origin than among participants of Turkish origin, especially for the different measures of obesity (see Additional file 6.1). Intervention effect on waist circumference (p for interaction=0.14) among participants of Dutch origin was -4.8cm (95%CI -7.7;-2.0) compared with -2.7cm (95%CI -4.2;-1.2) among participants of Turkish origin. For total physical activity (p for interaction=0.018) and light-intensity physical activity (p for interaction=0.006), the intervention effect was disadvantageous for participants of Turkish origin only (ß= -1215 min/wk, 95%CI -2039;-390 for total amount of physical activity; ß= -1030 min/wk, 95%CI -1761;-299 for light intensity physical activity).

Table 6.3 Changes in cardiometabolic risk factors from baseline to 12 months*

	INT[1]	CON[1]	Differences between groups	*p*[2]
Anthropometric measures	**n=80**	**n=69**		
Waist circumference (cm)				
Baseline	99.1 ± 11.2	97.6 ± 11.2		
Change after 12 month	-3.4 ± 4.7	-0.2 ± 4.3	-3.3 (-4.7; -1.8)	<0.001
Weight (kg)				
Baseline	83.7 ± 14.7	82.7 ± 14.1		
Change after 12 month	-2.2 ± 5.4	-0.1 ± 3.6	-2.2 (-3.7; -0.8)	0.003
BMI (kg/m^2)				
Baseline	31.7 ± 4.7	30.5 ± 5.0		
Change after 12 month	-0.8 ± 1.9	-0.1 ± 1.3	-0.8 (-1.3; -0.3)	0.003
Waist-to-height ratio				
Baseline	0.610 ± 0.061	0.593 ± 0.070		
Change after 12 month	-0.021 ± 0.028	-0.001 ± 0.026	-0.020 (-0.028; -0.011)	<0.001
Body fat (%)				
Baseline	37.5 ± 6.8	35.9 ± 7.9		
Change after 12 month	-0.7 ± 2.6	0.2 ± 2.6	-0.9 (-1.8; -0.1)	0.033
Blood pressure	**n=75**	**n=69**		
Systolic blood pressure (mmHg)				
Baseline	117.3 ± 20.0	116.6 ± 15.0		
Change after 12 month	-0.3 ± 10.4	-1.0 ± 11.2	0.6 (-2.9; 4.1)	0.73
Diastolic blood pressure (mmHg)				
Baseline	77.1 ± 10.7	74.7 ± 9.5		
Change after 12 month	-1.3 ± 6.9	-0.3 ± 7.8	-0.9 (-3.4; 1.5)	0.46
Blood markers	**n=72**	**n=61**		
Fasting glucose (mmol/l)				
Baseline	5.38 ± 0.91	5.30 ± 1.34		
Change after 12 month	-0.22 ± 0.57	-0.17 ± 0.51	-0.06 (-0.23; 0.12)	0.53
Fasting insulin (pmol/l)				
Baseline	66.73 ± 38.71	71.27 ± 30.89		
Change after 12 month	-1.94 ± 39.05	-0.84 ± 44.73	-0.57 (-15.28; 14.14)	0.94
HbA1c (mmol/mol)				
Baseline	37.23 ± 5.81	36.83 ± 9.30		
Change after 12 month	1.09 ± 3.43	0.28 ± 2.63	0.84 (-0.23; 1.91)	0.12[3]
HOMA-IR				
Baseline	2.67 ± 1.68	2.86 ± 1.65		
Change after 12 month	-0.19 ± 1.69	-0.13 ± 1.63	-0.09 (-0.68; 0.50)	0.76
Total cholesterol (mmol/l)				
Baseline	5.56 ± 0.95	5.28 ± 0.87		
Change after 12 month	-0.26 ± 0.61	0.03 ± 0.71	-0.33 (-0.56; -0.10)	0.005
HDL cholesterol (mmol/l)				
Baseline	1.41 ± 0.32	1.44 ± 0.39		
Change after 12 month	0.04 ± 0.19	0.00 ± 0.21	0.05 (-0.02; 0.12)	0.14

LDL cholesterol (mmol/l)				
Baseline	3.48 ± 0.87	3.20 ± 0.82		
Change after 12 month	-0.28 ± 0.58	0.04 ± 0.64	-0.35 (-0.56; -0.14)	0.001
Triglycerides (mmol/l)				
Baseline	1.45 ± 0.77	1.40 ± 0.67		
Change after 12 month	-0.06 ± 0.50	-0.02 ± 0.53	-0.05 (-0.23; 0.13)	0.57
ALAT (U/l)				
Baseline	21.75 ± 8.65	24.62 ± 13.59		
Change after 12 month	-1.07 ± 7.4	1.43 ± 12.94	-2.50 (-6.19; 1.19)	0.18
ASAT (U/l)				
Baseline	23.01 ± 4.96	22.95 ± 6.03		
Change after 12 month	-1.83 ± 4.65	-0.25 ± 7.12	-1.43 (-3.53; 0.66)	0.18
Gamma GT (U/l)				
Baseline	24.51 ± 17.96	25.75 ± 23.16		
Change after 12 month	-2.59 ± 11.99	1.07 ± 16.66	-3.65 (-8.70; 1.39)	0.15
Creatinine (umol/l)				
Baseline	66.14 ± 9.20	65.59 ± 12.62		
Change after 12 month	0.72 ± 5.32	2.48 ± 6.56	-1.75 (-3.78; 0.27)	0.09
Uric acid (mmol/l)				
Baseline	0.29 ± 0.07	0.27 ± 0.07		
Change after 12 month	-0.014 ± 0.035	0.000 ± 0.047	-0.014 (-0.028; 0.001)	0.07
CRP (mg/l)				
Baseline	3.07 ± 2.37	2.73 ± 2.38		
Change after 12 month	0.09 ± 2.00	0.17 ± 2.32	-0.19 (-0.99; 0.62)	0.65

* Values are expressed as mean ± SD or β (95% CI).

[1] Body fat: INT *n*=76, CON *n*=69; Fasting insulin: INT *n*=71, CON *n*=61; HbA1c: INT *n*=70, CON *n*=60; HOMA-IR: INT *n*=71, CON *n*=61; Triglycerides: INT *n*=72, CON *n*=60; ALAT: INT *n*=71, CON *n*=61; ASAT: INT *n*=71, CON *n*=60; Gamma GT: INT *n*=71, CON *n*=61; Uric acid: INT *n*=71, CON *n*=61; CRP ≤10 mg/l: INT *n*=61, CON *n*=56.

[2] *p*-value for difference between treatment groups in ANCOVA test, adjusted for ethnicity and individuals' mean value at baseline and 12 month for the respective variable.

[3] Excluding participants using relevant medication (*n=2*) from the analysis resulted in a *p*-value of 0.044.

Table 6.4 Changes in dietary intake and physical activity from baseline to 12 months*

	INT[1]	CON[1]	Differences between groups	*p*[2]
Dietary intake	**n=61**	**n=37**		
Energy intake (kcal/d)				
Baseline	2460 ± 1134	2238 ± 878		
Change after 12 month	-425 ± 1112	-138 ± 620	-325 (-736; 87)	0.12
Total protein (en%)				
Baseline	16.1 ± 2.7	16.2 ± 2.3		
Change after 12 month	0.8 ± 3.0	0.3 ± 2.2	0.7 (-0.5; 1.8)	0.25
Total fat (en%)				
Baseline	34.5 ± 6.2	34.8 ± 5.4		
Change after 12 month	-0.1 ± 8.1	-0.3 ± 3.9	-0.9 (-3.8; 2.0)	0.55
Saturated fat (en%)				
Baseline	12.6 ± 3.0	12.5 ± 2.9		
Change after 12 month	-0.3 ± 3.7	-0.0 ± 2.3	-0.8 (-2.2; 0.5)	0.22
Total carbohydrates (en%)				
Baseline	43.3 ± 7.1[3]	40.3 ± 6.7[3]		
Change after 12 month	-0.8 ± 8.2	0.1 ± 4.5	0.3 (-2.7; 3.3)	0.85
Fibre (g/1000 kcal)				
Baseline	10.9 ± 3.1	10.8 ± 2.8		
Change after 12 month	0.8 ± 3.3	-0.2 ± 2.1	1.5 (0.3; 2.7)	0.016
Fruit intake (g/d)				
Baseline	205 ± 258	201 ± 249		
Change after 12 month	-5 ± 261	-32 ± 201	54 (-36; 144)	0.23
Vegetable intake (g/d)				
Baseline	148 ± 123	159 ± 133		
Change after 12 month	-3 ± 122	-21 ± 98	20 (-30; 70)	0.43
Dutch Healthy Diet index (0–80 scale)				
Baseline	57.0 ± 9.9	57.6 ± 9.8		
Change after 12 month	0.3 ± 9.3	-0.1 ± 6.8	1.5 (-2.2; 5.2)	0.42
Physical activity	**n=62**	**n=63**		
Total PA (min/week)				
Baseline	2372 ± 1784	2274 ± 1301		
Change after 12 month	-362 ± 1447	211 ± 1611	-573 (-1126; -21)	0.042
Light PA (min/week)				
Baseline	1608 ± 1106	1677 ± 1067		
Change after 12 month	-243 ± 1071	248 ± 1344	-434 (-873; 5)	0.053
Moderate PA (min/week)				
Baseline	643 ± 1098	457 ± 525		
Change after 12 month	-79 ± 894	-9 ± 657	-54 (-333; 225)	0.70
Vigorous PA (min/week)				
Baseline	120 ± 239	141 ± 423		
Change after 12 month	-40 ±193	-28 ± 327	-27 (-118; 64)	0.56

* Values are expressed as mean ± SD or β (95% CI).

[1] Dutch Healthy Diet index: INT *n*=60, CON *n*=36.

[2] *p*-value for difference between treatment groups in ANCOVA test, adjusted for ethnicity and individuals' mean value at baseline and 12 month for the respective variable.

[3] Significantly different between intervention group and control group at baseline.

Table 6.5 Changes in quality of life from baseline to 12 months*

	INT (n=64)[1]	CON (n=65)[1]	Differences between groups	*p*[2]
Health transition				
Baseline	43.7 ± 20.6	50.4 ± 23.2		
Change after 12 month	22.2 ± 32.7	-0.4 ± 28.5	21.6 (10.7; 32.5)	<0.001
General health				
Baseline	58.4 ± 21.4	60.6 ± 17.9		
Change after 12 month	8.2 ± 16.8	-1.5 ± 12.3	9.2 (3.9; 14.5)	<0.001
Physical functioning				
Baseline	74.8 ± 23.2	78.5 ± 20.2		
Change after 12 month	5.0 ± 20.8	2.9 ± 17.0	1.5 (-5.1; 8.1)	0.65
Role physical				
Baseline	70.0 ± 40.6	71.8 ± 38.8		
Change after 12 month	-7.5 ± 36.0	-3.2 ± 46.3	-4.7 (-19.9; 10.5)	0.54
Role emotional				
Baseline	72.5 ± 41.4	78.5 ± 39.2		
Change after 12 month	-2.9 ± 43.3	7.0 ± 41.4	-9.7 (-25.5; 6.1)	0.22
Social functioning				
Baseline	78.5 ± 25.3	76.9 ± 27.0		
Change after 12 month	-3.5 ± 32.8	4.2 ± 23.6	-7.5 (-17.5; 2.5)	0.14
Bodily pain				
Baseline	65.6 ± 28.9	69.7 ± 26.0		
Change after 12 month	-0.2 ± 27.3	-3.5 ± 23.5	3.9 (-5.0; 12.9)	0.39
Vitality				
Baseline	53.0 ± 20.1	56.4 ± 22.8		
Change after 12 month	4.5 ± 22.4	-1.0 ± 17.3	5.0 (-2.0; 12.1)	0.16
Mental health				
Baseline	66.7 ± 18.4	66.6 ± 17.6		
Change after 12 month	2.6 ± 17.1	0.4 ± 17.5	2.1 (-4.0; 8.1)	0.50

* Values are expressed as mean ± SD or β (95% CI).

[1] Health transition: INT *n*=63, CON *n*=65; General health: INT *n*=62, CON *n*=63; Physical functioning: INT *n*=61, CON *n*=65; Role physical: INT *n*=60, CON *n*=62; Role emotional: INT *n*=57, CON *n*=62; Bodily pain: INT *n*=63, CON *n*=65; Vitality: INT *n*=62, CON *n*=65; Mental health: INT *n*=62, CON *n*=65.

[2] *p*-value for difference between treatment groups in ANCOVA test, adjusted for ethnicity and individuals' mean value at baseline and 12 month for the respective variable.

Discussion

The results of this one-year intervention study, targeting low SES individuals of different ethnic origins, are promising and show that a lifestyle intervention carried out in deprived neighbourhoods can be successful. The lifestyle intervention significantly improved obesity-related measures such as waist circumference, WHtR, body weight, fat percentage and BMI. The lifestyle intervention did not affect prevalence of metabolic syndrome or components of metabolic syndrome, apart from waist circumference, within 12 months. However, total cholesterol and LDL cholesterol did improve significantly. Significant changes in lifestyle were observed for fibre intake (relative intake increased in the intervention group) and total minutes of self-reported physical activity (reduced in the intervention group) only. The intervention group also showed, although not significantly, a reduction in energy intake. With regard to quality of life, participants in the intervention showed improvements in 'general health' and 'health transition'. Overall, our data support an improvement in cardiometabolic risk and quality of life in the intervention group compared to the control group.

Our study, an adapted version of the SLIM study, was targeted at persons with low SES of different ethnic origins [25]. In the SLIM study, weight loss and reduction in waist circumference was significantly different after 12 month between the intervention and the control group (-2.7kg, -3.5cm in the intervention group and -0.2kg, -1.4cm in the control group) [10]. This is comparable with our findings. The achieved reduction of waist circumference in our intervention group is also comparable to the results of a primary-care-based intervention study based on the DPP by Ma *et al*. [43] among participants with predominantly high SES. Our findings of reduction in weight and total cholesterol are comparable with another effect study of the DPP intervention translated to a community setting, i.e. the YMCA [44]. We did not reproduce the beneficial results with regard to blood pressure, HDL cholesterol, triglycerides and fasting glucose after 12 month reported in other studies based on the DPP [5, 7, 45], or the reduction in fasting insulin levels after 12 month in the SLIM study [10]. However, in those studies, participants were selected on the basis of having pre-diabetes, metabolic syndrome or impaired glucose tolerance or on the basis of being at high risk of developing diabetes (risk score tool), whereas participants in our study were included on the basis of elevated WHtR only. Because medication users were excluded during recruitment, a relatively healthy population was enrolled in our study. This might explain why we found no significant changes in blood pressure, HDL cholesterol, triglycerides and fasting glucose. Only 28% of the participants in the MetSLIM study had metabolic syndrome; this is comparable to data on the general Dutch population aged 30–70 years (34% of men and 24% of women) [46].

Despite the beneficial changes in obesity measures, the intervention group did not report significant improvements in energy intake and physical activity. One would expect improvements in obesity measures to result from positive lifestyle changes. As obesity measures are expected to be more objective than self-reported lifestyle data, one could

debate whether the self-reported lifestyle data in this study were completely reliable. Questionnaire data can be subject to socially desirable answers and depend on participants' literacy skills, which might be relatively low in our target group.

In general, intervention effects were more beneficial among participants of Dutch origin than among participants of Turkish origin. However, these two groups were not completely comparable in this study as they differed in, among other things, age, education level and intervention location (see Additional file 6.1). Therefore, the results cannot be attributed to ethnicity only. Anyhow, the results imply that the intervention was less effective in the Turkish group that was reached in this study and, in order to achieve greater effects, further adaptations for this group should be considered.

The drop-out rate in MetSLIM (31%) was relatively high compared with SLIM (10% after the first year), but comparable to drop-out rates in similar studies among low SES populations [47] or ethnic minorities [20, 48]. It can be questioned whether drop-out can be reduced by further adaptations to the intervention study protocol. Reasons for drop-out that were quite often mentioned were 'no time' and 'no interest'. Participants elaborated on this by mentioning that they had conflicting issues to worry about in life, for example sick relatives. Other researchers have reported that 'life stressors' can interfere with participation in a lifestyle intervention [47]. Such drop-out is hard to prevent in a lifestyle intervention focusing exclusively on diet and physical activity. Furthermore, some of the reasons for drop-out (e.g. moving to another area) or exclusion from the analyses (e.g. pregnancy) cannot to be prevented by adaptation measures.

A limitation of our study was that some participants did not fill in the questionnaires or did not go for their blood test at the medical laboratory. Another limitation is the low number (19%) of male participants in the MetSLIM study. Other lifestyle intervention studies also report low participation rates among men [4, 49]. The MetSLIM study focused on individuals of Dutch, Turkish and Moroccan origin. However, we did not succeed in recruiting many participants of Moroccan origin. This could have possibly been because we especially found good contact persons within the Dutch and Turkish communities, e.g. ethnicity-matched GPs and a Turkish research assistant with contacts at the intervention locations. Other researchers have concluded that ethnicity-matched recruiters result in better reach to the target group [50]. We will further investigate this issue in the process evaluation of this study (forthcoming).

In conclusion, this study showed that the adapted SLIM lifestyle intervention targeting low SES individuals of different ethnic origins is effective in improving waist circumference, total and LDL cholesterol, and quality of life after 12 month. Future research is required to investigate whether further adaptations to the lifestyle intervention may be necessary to enhance its effectiveness among different ethnic minorities and to investigate how men and persons of Moroccan origin can be more successfully reached for this lifestyle intervention.

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Additional file 6.1 Stratified analyses for participants of Dutch and Turkish origin

Table A Baseline characteristics of participants in MetSLIM study, stratified for participants of Dutch and Turkish origin and for treatment*

	Dutch[1]			Turkish[1]		
	INT (n=30)	CON (n=29)	*p*[2]	INT (n=39)	CON (n=32)	*p*[2]
Recruitment strategy			0.008			<0.001
Invited by GP	26 (87)	16 (55)		5 (13)	16 (50)	
Invited in community centre	4 (13)	13 (45)		34 (87)	16 (50)	
Gender			0.38			0.16
Male	8 (27)	5 (17)		3 (8)	6 (19)	
Female	22 (73)	24 (83)		36 (92)	26 (81)	
Age (years)	51.3 ± 8.7	53.5 ± 10.8	0.38	44.5 ± 5.0	41.9 ± 7.5	0.10
Educational level			0.49			0.48
No education	4 (13)	1 (3)		5 (13)	1 (3)	
Lowest education (primary)	4 (13)	2 (7)		18 (46)	15 (47)	
Low education (lower secondary)	8 (27)	7 (24)		9 (23)	6 (19)	
Middle education	9 (30)	11 (38)		6 (15)	8 (25)	
High education	5 (17)	8 (28)		1 (3)	2 (6)	
Employment status			0.06			0.28
No paid job	10 (33)	14 (48)		28 (74)	19 (60)	
Part-time job (<32 hours/week)	15 (50)	6 (21)		8 (21)	8 (25)	
Full-time job (≥32 hours/week)	5 (17)	9 (31)		2 (5)	5 (16)	
Household situation			0.18			0.39
Alone	11 (37)	7 (24)		3 (8)	3 (9)	
Together with partner	11 (37)	10 (34)		3 (8)	1 (3)	
Together with partner and child(ren)	8 (27)	8 (28)		27 (71)	19 (59)	
Single parent living with children	0 (0)	4 (14)		5 (13)	9 (28)	
Smoking status			0.91			0.81
Current	7 (23)	7 (24)		6 (16)	5 (16)	
Former	14 (47)	12 (41)		5 (13)	6 (19)	
Never	9 (30)	10 (34)		27 (71)	21 (66)	
Alcohol consumption			0.14			1.00[3]
No consumption	9 (31)	4 (15)		24 (100)	27 (96)	
Low to moderate consumption	18 (62)	17 (63)		0 (0)	1 (4)	
Excessive consumption	2 (7)	6 (22)		0 (0)	0 (0)	
Metabolic syndrome			0.78			0.33
No	19 (66)	20 (69)		26 (70)	25 (81)	
Yes	10 (34)	9 (31)		11 (30)	6 (19)	
Family history of type 2 diabetes in first degree[1]			0.72			0.27
No	19 (63)	19 (68)		20 (53)	21 (67)	
Yes	11 (37)	9 (32)		18 (47)	11 (34)	

* Values are expressed as n (%) or mean ± SD.

[1] Employment status: Dutch *n*=59, Turkish *n*=70; Household situation: Dutch *n*=59, Turkish *n*=70; Smoking status: Dutch *n*=59, Turkish *n*=70; Alcohol consumption: Dutch *n*=56, Turkish *n*=52; Metabolic syndrome: Dutch *n*=58, Turkish *n*=68; Family history of type 2 diabetes in first degree: Dutch *n*=58, Turkish *n*=70.

[2] *p*-value of Chi-Square tests or independent samples t-tests.

[3] *p*-value of Fisher's Exact Test.

Table B Changes in cardiometabolic risk factors from baseline to 12 months, stratified for participants of Dutch and Turkish origin*

	Dutch			Turkish			
	INT[1]	**CON[1]**	**Differences between groups[2]**	**INT[1]**	**CON[1]**	**Differences between groups[2]**	***p*-value for interaction[3]**
Anthropometric measures	**n=30**	**n=29**		**n=39**	**n=32**		
Waist circumference (cm)							
Baseline	105.3 ± 11.7	100.0 ± 11.5		94.6 ± 9.2	93.8 ± 9.8		
Change after 12 month	-5.7 ± 5.5	-0.7 ± 5.2	-4.8 (-7.7; -2.0)	-2.1 ± 3.2	0.7 ± 3.2	-2.7 (-4.2; -1.2)	0.14
Weight (kg)							
Baseline	90.0 ± 14.3	83.5 ± 14.7		79.3 ± 12.7	79.9 ± 10.9		
Change after 12 month	-4.6 ± 5.9	-0.2 ± 3.8	-4.1 (-6.8; -1.5)	-1.4 ± 4.0	0.4 ± 3.1	-1.7 (-3.5; 0.0)	0.10
BMI (kg/m^2)							
Baseline	31.5 ± 5.3	29.7 ± 4.9		31.8 ± 4.2	30.7 ± 4.3		
Change after 12 month	-1.6 ± 2.0	-0.1 ± 1.3	-1.4 (-2.3; -0.5)	-0.6 ± 1.6	0.1 ± 1.2	-0.7 (-1.4; 0.0)	0.17
Waist-to-height ratio							
Baseline	0.623 ± 0.073	0.597 ± 0.069		0.599 ± 0.050	0.582 ± 0.066		
Change after 12 month	-0.033 ± 0.031	-0.004 ± 0.031	-0.028 (-0.045; -0.012)	-0.013 ± 0.020	0.004 ± 0.20	-0.018 (-0.027; -0.008)	0.20
Body fat (%)							
Baseline	37.0 ± 8.8	36.8 ± 7.1		37.3 ± 5.6	35.3 ± 8.1		
Change after 12 month	-1.7 ± 2.8	0.2 ± 2.4	-1.8 (-3.2; -0.4)	-0.2 ± 2.3	0.5 ± 2.8	-0.5 (-1.7; 0.7)	0.18
Blood pressure	**n=29**	**n=29**		**n=38**	**n=32**		
Systolic blood pressure (mmHg)							
Baseline	131.9 ± 21.8[4]	120.1 ± 14.9[4]		109.1 ± 12.3	113.1 ± 14.3		
Change after 12 month	-4.9 ± 9.6	-0.8 ± 9.2	-2.5 (-7.5; 2.5)	3.0 ± 10.4	-1.6 ± 9.7	4.7 (-0.9; 9.6)	0.03
Diastolic blood pressure (mmHg)							
Baseline	82.9 ± 11.3[4]	76.0 ± 9.7[4]		74.5 ± 8.4	73.0 ± 8.8		
Change after 12 month	-2.6 ± 7.3	-0.1 ± 6.8	-1.2 (-4.9; 2.6)	-0.5 ± 7.0	-0.9 ± 6.6	-0.3 (-3.0; 3.6)	0.27

	Dutch			Turkish			
	INT[1]	CON[1]	Differences between groups[2]	INT[1]	CON[1]	Differences between groups[2]	*p*-value for interaction[3]
Blood markers	**n=26**	**n=28**		**n=35**	**n=27**		
Fasting glucose (mmol/l)							
Baseline	5.78 ± 1.25[4]	5.24 ± 0.55[4]		5.06 ± 0.43	5.42 ± 1.93		
Change after 12 month	-0.49 ± 0.67	-0.15 ± 0.55	-0.25 (-0.57; 0.08)	-0.10 ± 0.32	-0.17 ± 0.49	-0.02 (-0.16; 0.21)	0.12
Fasting insulin (pmol/l)							
Baseline	69.61 ± 33.79	64.54 ± 20.58		67.55 ± 46.44	75.10 ± 35.55		
Change after 12 month	-10.46 ± 38.16	4.68 ± 56.88	-13.15 (-37.40; 11.11)	-1.34 ± 37.74	-3.40 ± 29.02	0.39 (-16.79; 17.57)	0.26
HbA1c (mmol/mol)							
Baseline	35.68 ± 7.92[4]	37.67 ± 4.24[4]		38.24 ± 3.32[4]	36.00 ± 13.28[4]		
Change after 12 month	-0.12 ± 4.63	0.59 ± 2.69	-1.55 (-3.44; 0.33)	1.59 ± 2.28	0.52 ± 1.91	1.14 (0.24; 2.25)	0.04[5]
HOMA-IR							
Baseline	2.92 ± 1.43	2.53 ± 0.95		2.60 ± 2.02	3.11 ± 2.11		
Change after 12 month	-0.63 ± 1.72	0.09 ± 1.99	-0.73 (-1.72; 0.26)	-0.15 ± 1.54	-0.23 ± 1.16	-0.04 (-0.73; 0.64)	0.22
Total cholesterol (mmol/l)							
Baseline	5.96 ± 0.83	5.70 ± 0.98		5.27 ± 0.91	4.92 ± 0.61		
Change after 12 month	-0.51 ± 0.56	-0.04 ± 0.86	-0.47 (-0.87; -0.07)	-0.10 ± 0.62	0.06 ± 0.52	-0.17 (-0.47; 0.13)	0.24
HDL cholesterol (mmol/l)							
Baseline	1.57 ± 0.36	1.43 ± 0.42		1.29 ± 0.28[4]	1.46 ± 0.36[4]		
Change after 12 month	0.10 ± 0.22	0.05 ± 0.24	0.03 (-0.10; 0.15)	0.03 ± 0.18	-0.07 ± 0.17	0.11 (-0.02; 0.20)	0.25
LDL cholesterol (mmol/l)							
Baseline	3.78 ± 0.78	3.57 ± 0.83		3.22 ± 0.85	2.89 ± 0.69		
Change after 12 month	-0.53 ± 0.60	-0.08 ± 0.80	-0.45 (-0.83; -0.06)	-0.10 ± 0.54	0.11 ± 0.40	-0.19 (-0.44; 0.06)	0.30
Triglycerides (mmol/l)							
Baseline	1.33 ± 0.49	1.51 ± 0.53		1.64 ± 0.96[4]	1.24 ± 0.75[4]		
Change after 12 month	-0.17 ± 0.35	-0.03 ± 0.54	-0.10 (-0.36; 0.15)	-0.06 ± 0.56	0.03 ± 0.55	-0.02 (-0.30; 0.27)	0.57

	Dutch			Turkish			
	INT[1]	CON[1]	Differences between groups[2]	INT[1]	CON[1]	Differences between groups[2]	*p*-value for interaction[3]
ALAT (U/l)							
Baseline	21.00 ± 8.72[4]	29.57 ± 12.79[4]		22.91 ± 9.49[4]	19.04 ± 10.73[4]		
Change after 12 month	-0.64 ± 9.68	-1.11 ± 8.96	-0.19 (-5.84; 5.47)	-2.29 ± 5.70	5.22 ± 14.27	-7.55 (-12.48; -2.63)	0.01
ASAT (U/l)							
Baseline	22.48 ± 4.81	24.68 ± 6.07		23.31 ± 5.27[4]	21.00 ± 5.14[4]		
Change after 12 month	-1.04 ± 5.36	-0.36 ± 6.70	-0.67 (-4.21; 2.87)	-2.23 ± 4.11	0.12 ± 5.38	-2.56 (-4.97; -0.15)	0.31
Gamma GT (U/l)							
Baseline	28.00 ± 15.89	34.14 ± 29.28		22.74 ± 21.01	18.59 ± 13.92		
Change after 12 month	-4.08 ± 9.58	3.00 ± 23.68	-5.31 (-15.50; 4.88)	-3.37 ± 13.83	-0.70 ± 6.39	-1.62 (-6.69; 3.45)	0.46
Creatinine (umol/l)							
Baseline	69.73 ± 9.86	71.21 ± 11.73		65.09 ± 7.99	59.89 ± 9.58		
Change after 12 month	1.08 ± 5.47	2.46 ± 7.44	-1.00 (-4.47; 2.46)	0.31 ± 5.16	3.00 ± 6.20	-3.26 (-6.15; -0.36)	0.31
Uric acid (mmol/l)							
Baseline	0.31 ± 0.07	0.29 ± 0.07		0.27 ± 0.06	0.25 ± 0.06		
Change after 12 month	-0.02 ± 0.04	0.00 ± 0.05	-0.019 (-0.046; 0.007)	-0.01 ± 0.03	0.00 ± 0.04	-0.010 (-0.030; 0.009)	0.64
CRP (mg/l)							
Baseline	3.39 ± 2.76	3.11 ± 2.60		3.03 ± 2.31	2.15 ± 1.89		
Change after 12 month	-0.56 ± 2.02	0.09 ± 2.73	-0.64 (-2.09; 0.81)	0.48 ± 1.99	0.46 ± 1.99	-0.17 (-1.28; 0.94)	0.53

* Values are expressed as mean ± SD or β (95% CI).

1 Body fat: Dutch INT *n*=28 Dutch CON *n*=29 Turkish INT *n*=39 Turkish CON *n*=32; Fasting insulin: Dutch INT *n*=25 Dutch CON *n*=28 Turkish INT *n*=35 Turkish CON *n*=27; HbA1c: Dutch INT *n*=25 Dutch CON *n*=27 Turkish INT *n*=34 Turkish CON *n*=27; HOMA-IR: Dutch INT *n*=25 Dutch CON *n*=28 Turkish INT *n*=35 Turkish CON *n*=27; Triglycerides: Dutch INT *n*=26 Dutch CON *n*=28 Turkish INT *n*=35 Turkish CON *n*=26; ALAT: Dutch INT *n*=25 Dutch CON *n*=28 Turkish INT *n*=35 Turkish CON *n*=27; ASAT: Dutch INT *n*=25 Dutch CON *n*=28 Turkish INT *n*=35 Turkish CON *n*=26; Gamma GT: Dutch INT *n*=25 Dutch CON *n*=28 Turkish INT *n*=35 Turkish CON *n*=27; Uric acid: Dutch INT *n*=25 Dutch CON *n*=28 Turkish INT *n*=35 Turkish CON *n*=27; CRP ≤10 mg/l: Dutch INT *n*=21 Dutch CON *n*=27 Turkish INT *n*=31 Turkish CON *n*=23.

2 β (95% CI) from ANCOVA test, stratified for participants of Dutch and Turkish origin, adjusted for individuals' mean value at baseline and 12 month for the respective variable.

3 *p*-value for interaction between treatment group and ethnicity in ANCOVA test, adjusted for individuals' mean value at baseline and 12 month for the respective variable.

4 Significantly different between intervention group and control group at baseline.

5 Excluding participants using relevant medication (*n*=2) from the analysis resulted in a *p*-value for interaction of 0.74.

Table C Changes in physical activity and quality of life from baseline to 12 months, stratified for participants of Dutch and Turkish origin*

	Dutch			Turkish			
	INT[1]	CON[1]	Differences between groups[2]	INT[1]	CON[1]	Differences between groups[2]	*p*-value for interaction[3]
Physical activity	**n=28**	**n=27**		**n=26**	**n=29**		
Total PA (min/week)							
Baseline	2144 ± 979	2315 ± 1252		2541 ± 2412	2147 ± 1406		
Change after 12 month	47 ± 1182	-159 ± 1557	230 (-492; 953)	-642 ± 1528	508 ± 1662	-1215 (-2039; -390)	0.018
Light PA (min/week)							
Baseline	1547 ± 1002	1626 ± 941		1624 ± 1140	1618 ± 1175		
Change after 12 month	35 ± 997	-228 ± 1016	255 (-290; 799)	-380 ± 989	657 ± 1510	-1030 (-1761; 299)	0.006
Moderate PA (min/week)							
Baseline	497 ± 519	416 ± 336		820 ± 1585	481 ± 632		
Change after 12 month	27 ± 634	125 ± 581	-119 (-390; 152)	-192 ± 1202	-136 ± 735	82 (-417; 582)	0.79
Vigorous PA (min/week)							
Baseline	100 ± 188	274 ± 621		97 ± 226	48 ± 87		
Change after 12 month	-15 ± 180	-55 ± 473	-23 (-205; 159)	-70 ± 216	-13 ± 164	-42 (139; 54)	0.84
Quality of life	**n=28**	**n=28**		**n=28**	**n=30**		
Health transition							
Baseline	41.1 ± 18.3[4]	53.6 ± 18.9[4]		44.4 ± 22.3	48.3 ± 27.8		
Change after 12 month	32.1 ± 31.8	-3.6 ± 22.3	34.1 (19.2; 49.0)	16.7 ± 32.5	-0.8 ± 30.4	17.4 (0.4; 34.4)	0.11
General health							
Baseline	64.3 ± 19.4	67.7 ± 17.7		51.8 ± 22.7	53.0 ± 16.5		
Change after 12 month	9.5 ± 17.9	-2.0 ± 11.9	11.7 (3.4; 20.1)	7.5 ± 16.6	-1.2 ± 11.8	8.1 (0.6; 15.7)	0.61
Physical functioning							
Baseline	79.6 ± 23.3	81.1 ± 18.3		71.6 ± 23.1	73.8 ± 22.7		
Change after 12 month	10.6 ± 19.9	6.8 ± 9.8	4.1 (-2.4; 10.5)	-1.7 ± 20.3	0.1 ± 22.5	-1.3 (-12.9; 10.3)	0.41
Role physical							
Baseline	80.4 ± 33.6	83.3 ± 30.2		60.4 ± 44.8	55.4 ± 43.8		
Change after 12 month	-0.9 ± 31.5	-2.8 ± 39.4	-2.1 (-17.3; 21.5)	-15.6 ± 44.7	-1.8 ± 54.4	-13.9 (-42.2; 14.4)	0.35

	Dutch			Turkish			
	INT[1]	CON[1]	Differences between groups[2]	INT[1]	CON[1]	Differences between groups[2]	*p*-value for interaction[3]
Role emotional							
Baseline	78.6 ± 36.5	88.9 ± 32.0		66.7 ± 47.1	67.9 ± 44.0		
Change after 12 month	-8.3 ± 43.2	0.0 ± 46.2	-6.4 (-31.5; 18.8)	3.0 ± 49.2	14.3 ± 41.0	-12.2 (-38.1; 13.7)	0.88
Social functioning							
Baseline	86.2 ± 20.8	86.2 ± 17.5		68.3 ± 28.6	65.8 ± 32.0		
Change after 12 month	-8.0 ± 34.9	-1.8 ± 18.9	-4.6 (-18.8; 9.6)	-2.7 ± 33.7	11.3 ± 27.9	-14.7 (-31.0; 1.6)	0.50
Bodily pain							
Baseline	75.5 ± 25.8	78.3 ± 20.0		51.7 ± 26.5	57.4 ± 27.8		
Change after 12 month	0.5 ± 31.0	-3.7 ± 26.6	4.3 (-11.3; 19.9)	2.7 ± 25.4	-1.0 ± 21.8	3.9 (-8.8; 16.6)	0.98
Vitality							
Baseline	54.6 ± 15.8[4]	66.1 ± 17.6[4]		50.7 ± 23.2	45.7 ± 22.6		
Change after 12 month	6.3 ± 24.0	-3.4 ± 15.9	12.5 (2.1; 22.9)	0.4 ± 20.8	1.6 ± 18.8	-0.3 (-11.0; 10.3)	0.12
Mental health							
Baseline	69.7 ± 18.9	74.3 ± 14.5		62.2 ± 17.7	58.0 ± 17.8		
Change after 12 month	0.7 ± 21.6	-1.4 ± 11.4	3.1 (-5.8; 12.2)	3.7 ± 13.2	1.3 ± 22.3	1.8 (-8.4; 12.0)	0.81

* Values are expressed as mean ± SD or β (95% CI).

[1] Health transition: Dutch INT *n*=28 Dutch CON *n*=28 Turkish INT *n*=27 Turkish CON *n*=30; General health: Dutch INT *n*=28 Dutch CON *n*=27 Turkish INT *n*=26 Turkish CON *n*=29; Physical functioning: Dutch INT *n*=28 Dutch CON *n*=28 Turkish INT *n*=26 Turkish CON *n*=30; Role physical: Dutch INT *n*=28 Dutch CON *n*=27 Turkish INT *n*=24 Turkish CON *n*=28; Role emotional: Dutch INT *n*=28 Dutch CON *n*=27 Turkish INT *n*=22 Turkish CON *n*=28; Bodily pain: Dutch INT *n*=28 Dutch CON *n*=28 Turkish INT *n*=27 Turkish CON *n*=30; Vitality: Dutch INT *n*=28 Dutch CON *n*=28 Turkish INT *n*=26 Turkish CON *n*=30; Mental health: Dutch INT *n*=28 Dutch CON *n*=28 Turkish INT *n*=26 Turkish CON *n*=30.

[2] β (95% CI) from ANCOVA test, stratified for participants of Dutch and Turkish origin, adjusted for individuals' mean value at baseline and 12 month for the respective variable.

[3] *p*-value for interaction between treatment group and ethnicity in ANCOVA test, adjusted for individuals' mean value at baseline and 12 month for the respective variable.

[4] Significantly different between intervention group and control group at baseline.

7

General discussion

The overall aim of this thesis was to study opportunities for, and the effectiveness of, lifestyle interventions to reduce the risk of cardiometabolic diseases, targeting individuals with low socioeconomic status (SES) of Dutch, Turkish and Moroccan origin. To this end, this thesis reports two studies that identified opportunities for adapting lifestyle interventions for the target group (*chapters 2 and 3*), one study describing the process of adapting an effective lifestyle intervention (SLIM) into a new lifestyle intervention targeting individuals with low SES of different ethnic origins (MetSLIM) (*chapter 4*) and two studies that determined the effectiveness of lifestyle interventions among the target group (*chapters 5 and 6*). In this chapter, the main results of this thesis are summarised, followed by a discussion of methodological considerations, public health implications, suggestions for future research and the general conclusion.

Main findings

Opportunities to reach low SES populations and ethnic minorities

This thesis provides insight into opportunities to adapt a lifestyle intervention towards individuals with low SES of Dutch, Turkish and Moroccan origin. On the basis of our findings from focus group interviews among low and high SES groups *(chapter 2)*, it is suggested that, to motivate individuals with low SES to change their lifestyle, it may be useful to raise their awareness of their current weight or health status. Lifestyle interventions targeting individuals with low SES should take possible cost concerns of the target group into account and should harness the supportive effect of (peer) groups. On the basis of our findings from a mixed-methods study among individuals of Turkish and Moroccan origin *(chapter 3)*, it seems that the general practitioner may be a promising contact to reach adults of Turkish and Moroccan origin for health checks or (lifestyle) advice. Furthermore, we suggest that it is necessary to provide information in individuals' native language to overcome language barriers and that (lifestyle) advice should be tailored to the needs of the targeted individuals. These identified strategies to reach individuals with low SES of different ethnic origins are based on the target groups' perceptions. However, it is important to find out how feasible it is to meet the target groups' preferences in practice.

Adapting a lifestyle intervention towards the new target group

The insights gained into opportunities to reach individuals with low SES of different ethnic origins with preventive healthcare services were used to adapt the SLIM study protocol to the MetSLIM study protocol *(chapter 4)*. The MetSLIM study targeted individuals with low SES of Dutch, Turkish and Moroccan origin. In addition to the opportunities identified in the studies in this thesis, experiences of healthcare professionals and researchers and other studies among the target group were taken into consideration to adapt the SLIM study protocol towards the new target group. Adaptations to the original SLIM study protocol were considered necessary in particular to overcome practical barriers that hinder the target group's participation; to suit the target group's (cultural) needs; and to make it feasible to perform the study in a local (community) setting.

Adapting SLIM to the target group had implications for the entire study protocol, including both the lifestyle intervention itself and elements of the study design to test the effectiveness of the lifestyle intervention. The new elements regarding the lifestyle intervention were: 1) additional group meetings about price concerns and social occasions with regard to a healthy diet; 2) ethnicity-matched dietician; 3) gender-matched sports instructor; 4) all activities in the participants' own neighbourhood; and 5) activities for women and men separately. The new elements regarding the study design included: 1) from an university setting to a community setting; 2) from a randomised controlled trial to a quasi-experimental study; 3) waist circumference – as a visible cardiometabolic risk factor – as main study outcome; 4) recruitment via GPs and in community centres; 5) translated study materials and ethnicity-matched research assistants involved in the measurements; and 6) fewer measurements and measurements that could take place at different locations.

Effectiveness of intervention among low SES populations

Besides describing opportunities to reach low SES populations with lifestyle interventions, the aim of this thesis was to test the effectiveness of lifestyle interventions among such populations. In this thesis, the effectiveness of two studies are reported, the SLIMMER *(chapter 5)* and MetSLIM study *(chapter 6)*.

The SLIMMER study did not specifically target individuals with low SES; however, 52% of the SLIMMER participants had a low education level. As we were interested in the effectiveness of lifestyle interventions for low SES populations, we compared the success of the SLIMMER lifestyle intervention between low and higher SES participants. The SLIMMER study showed that socioeconomic status in general did not modify participation, attendance, acceptability, adherence, drop-out and effectiveness in that study. The SLIMMER study was able to reach the low SES group as effectively as the higher SES group from the beginning to the end of the intervention study, resulting in at least similar health benefits. Unfortunately, the SLIMMER sample size was too small to study differences within the low SES group, e.g. comparing the low vs. the least educated or comparing ethnic groups. Ten percent of the SLIMMER participants had completed only the lowest educational levels (no education or primary education) and 11% had a foreign background.

In the MetSLIM study, 220 individuals living in deprived neighbourhoods participated, of whom 40% had no education or only primary education, and 64% had a foreign background. The study showed that the adapted lifestyle intervention was effective in reducing waist circumference among individuals with an elevated waist-to-height ratio. Other metabolic syndrome components did not improve. However, the intervention had beneficial effects on measures of obesity, total and LDL cholesterol, and quality of life. Drop-out rate was higher than in SLIM and SLIMMER [1, 2], and comparable to drop-out rates in similar studies among low SES populations or ethnic minorities [3-5].

Methodological considerations

Several methodological choices had to be made in the studies reported in this thesis. In this section, these choices are reflected upon. The methodological considerations of each individual study are described in detail in the individual chapters. This section focuses on the methodological considerations that were faced throughout the different studies.

The central question throughout this thesis was how persons with low SES of Dutch, Turkish and Moroccan origin could be successfully reached with lifestyle interventions in order to prevent cardiometabolic diseases, with a main focus on the possibilities for adapting the existing SLIM intervention towards this target group (from SLIM to MetSLIM). The main overall challenges of the studies reported in this thesis therefore included: how to adapt an existing lifestyle intervention, how to define and select persons with low socioeconomic status and of different ethnic origins, and who should be targeted to prevent cardiometabolic diseases. Therefore, first of all, the adaptation process from SLIM to MetSLIM is discussed, including a reflection on the decision to use SLIM as a starting point and the decision to target three different ethnic groups at the same time. Secondly, difficulties in defining and selecting persons with low socioeconomic status and specific ethnic groups within research are addressed. Thirdly, it is discussed whether an at-risk group was reached with the MetSLIM effect study. Lastly, the generalisability of the results of this thesis is discussed.

Adapting an existing intervention

In the adaptation from SLIM to MetSLIM, input was used from different methods and experiences regarding intervention development and intervention adaptation [6-8]. Chen *et al.* [9] report that adaptation models in general follow the same stages:

1. A needs assessment among the new target group
2. Deciding which evidence-based intervention should be adapted
3. Identifying differences between the intervention's original population and the new target population
4. Making changes to the intervention in response to these differences
5. Involving diverse stakeholder in the pilot testing of the adapted intervention (e.g. prospective participants, practitioners and community partners).

The adaptation of SLIM to MetSLIM involved all these stages, although some stages could be optimised, as discussed step-by-step below.

In this thesis, the decision about which evidence-based intervention to adopt (stage 2) was already made before the needs assessment (stage 1). The intervention that was adapted in the current thesis was the intervention programme delivered in the SLIM study. It was decided beforehand to focus on this intervention programme as it showed the beneficial effects of nutrition advice and physical activity promotion on the prevention type 2 diabetes, but drop-out was relatively high among low SES participants [10]. According to methods for

intervention adaptation, an evidence-based intervention programme should be chosen with goals that are relevant for the target group [8]. Because the SLIM intervention was selected before conducting a needs assessment, the goals of the SLIM intervention may not be in line with the needs of the target group. The need to focus on the prevention on metabolic diseases and on improving lifestyle among the target group, however, was confirmed by the needs assessment. The needs assessment gave us insight into the relatively high prevalence of cardiometabolic diseases and their risk factors among the target group. The solution – to focus mainly on nutrition and physical activity behaviour as in SLIM – may, however, not completely suit the target group's needs. Individuals with low SES and ethnic minorities often struggle with other issues in daily life, like relational, physical and emotional problems and financial concerns [11-13]. These struggles can hinder lifestyle changes, as they can require most of their attention and energy. Consequently, these struggles leave little room for concerns about their own health and can diminish their interest in lifestyle changes [12, 13]. Therefore, the exclusive focus on nutrition and physical activity in SLIM could have been relatively unsuitable for this target group. An intervention that deals in addition with negative issues in daily life (either by psychological counselling or offering assistance in solving these issues) might have been more appropriate for our target group. However, to our knowledge, such an evidence-based intervention was not available in the Netherlands.

The third and fourth stages as described by Chen *et al.* [9] – i.e. identifying differences between the intervention's original population and the new target population, and making changes to the intervention in response to these differences – in the adaptation from SLIM to MetSLIM are extensively discussed in chapter 4 of this thesis. The adaptation from the SLIM study protocol to the MetSLIM study protocol involved the target group, (health) professionals and other researchers. Moreover, the feasibility of carrying out the intervention study (e.g. the measurements and the intervention activities) in the community setting was taken into consideration in the protocol's design stage. This enabled the creation of a study protocol that took into account both the needs of the target group and what was actually possible in the local setting. Although different stakeholders – i.e. the target group, (health) professionals and other researchers – were involved in different stages of the adaptation from SLIM to MetSLIM, researchers made the final decisions about the design of the MetSLIM study protocol. Although practically challenging, it might have been useful to involve the target group and health professionals in this decision making as well, in order to take into account the balance between evidence-based concerns and the acceptability and feasibility of the intervention protocol among the target group and health professionals [6, 14]. The multidisciplinary backgrounds of the research team, however, contributed to a careful consideration of the advantages and disadvantages of various choices in the study protocol.

The last stage, pilot testing, was not extensively done in the MetSLIM study and not among all stakeholders. To check the applicability of several intervention materials, the materials were assessed by local health professionals and a communications expert. The adaptation process might have benefited from a more complete pilot test, to gain input regarding process (e.g.

success of recruitment strategy), resources (e.g. duration of measurements), management (e.g. capacity of research locations) and scientific outcomes (e.g. estimate of intervention effect) [15, 16]. Experiences from the SLIMMER study, which was pilot-tested [17], helped to prepare for some practical issues in the intervention study, e.g. with organising measurements and intervention activities. Issues relating specifically to the target group, however, had to be experienced and solved during the MetSLIM intervention. A pilot test could have helped for example to foresee that recruitment would take longer than expected at first or that the number of measurements might have been too extensive for participants in the intervention study. A pilot test was not done because of time constraints.

A difficulty that arose during all steps of the adaptation was that the 'new target population' for which the intervention was adapted was rather diverse. The current thesis focused on three ethnic groups at the same time, namely, persons of Dutch, Turkish and Moroccan origin. However, the advantage of targeting multiple groups at the same time was that one intervention plan was created that suited multiple target groups. The practical advantage of suiting multiple target groups is rather contradictory to the aim of tailoring or targeting, in which the specific needs of a targeted individual or targeted group are taken into account [18]. It can, however, be debated whether targeting one ethnic group is desirable in the heterogeneity of current Dutch society. Different needs exist in any population, in which migration status is just one aspect explaining heterogeneity [19]. Because of that, Razum and Spallek recommend the creation of diversity-sensitive interventions rather than migrant-specific interventions [19]. For future implementation, it is more practical if there is one intervention programme that suits multiple target groups. I believe that it is good to strive for diversity-sensitive interventions because of the diversity in society. However, I would like to add that, in line with diversity, it should be possible for health professionals that offer such a diversity-sensitive intervention to make small adaptations in the intervention in order to make it more applicable to the specific individual targeted by them (i.e. tailoring). For that purpose, in MetSLIM, the healthcare professionals had some flexibility to tailor the intervention programme, e.g. in relation to deciding how the hours of individual dietary advice should be spread for each participant.

Targeting persons with low socioeconomic status and ethnic minorities

In most of the studies included in this thesis, it was intended to study persons with low SES of different ethnic origins. Targeting low SES populations or specific ethnic groups can induce stigmatisation of that group, especially when it is publically mentioned that persons are selected for that reason [20]. Other ways of selecting the target population could be considered without labelling the population as 'low SES' or 'from a specific ethnic group' [21]. To overcome the problem of stigmatisation, in recruiting participants for the studies reported in this thesis, we often chose pragmatic solutions that did not require the selection criteria of low socioeconomic status or specific ethnic origins to be emphasised or even mentioned. In this section, these choices are reflected upon.

With respect to socioeconomic status, for the focus group interviews and for the MetSLIM effect study, it was chosen to recruit in deprived neighbourhoods and to use postal code as an inclusion criterion [22]. A person's neighbourhood is one of the levels on which socioeconomic status can be determined. Other levels include the individual level and the household level. In practice, as well as in health research, socioeconomic status is often determined by a single variable (e.g. education level or income) at a single level (i.e. individual, household or neighbourhood) [23]. For the recruitment for both the focus group interviews and the intervention study, we expected that it would be uncommon and illogical for the target group to be selected on the basis of their individual education level or income. It was considered more practical to recruit in specific areas and to use the postal code as indicator for socioeconomic status. In that way, it was not necessary to emphasise selection based on socioeconomic status or to exclude people because of their socioeconomic status. For the MetSLIM study, it seemed a good solution. However, selecting persons with low socioeconomic status by postal code is not always feasible, as small differences in deprivation can exist in middle-sized cities, like the cities in which SLIMMER was carried out [22]. In the SLIMMER study, socioeconomic status was determined by educational level. It should be realised that different socioeconomic status indicators are not interchangeable and can influence health outcomes differently, through different causal pathways [23, 24].

Regarding the selection of specific ethnic groups, it was decided not to actively recruit persons with other ethnic backgrounds, but also not to exclude them because of their ethnic origin once they expressed their interest in participating. We considered this a very practical solution to prevent stigmatisation or even discrimination. The solution of including other ethnic minorities as well, however, also caused some difficulties in the execution of the MetSLIM intervention study. Food-frequency questionnaires were not developed for most of these other ethnic groups [25] and the involved research assistants spoke only Dutch, Turkish, Berber and Arabic. This made it difficult to collect questionnaire data among the participants of other ethnic origins. Moreover, in the lifestyle intervention, it was intended that dietary advice would be received from an ethnicity-matched dietician, but this was not possible for these other ethnic groups because only dieticians of Dutch, Turkish and Moroccan origin were involved. However, diversity in our society is real and this should be taken into account when studies are being designed.

Reaching an at-risk group

The lifestyle interventions SLIM, SLIMMER and MetSLIM aimed to reach a population at risk of developing metabolic diseases. However, it can be debated whether an at-risk group was reached in MetSLIM. In SLIM and SLIMMER, participants were selected on the basis of having impaired glucose metabolism or an elevated/high risk of type 2 diabetes. In MetSLIM, it was chosen to select individuals on the basis of elevated waist-to-height ratio only. Moreover, using medication for hypertension, hypercholesterolemia, cardiovascular diseases, diabetes mellitus or/and renal failure was chosen as an exclusion criterion. Because of the exclusion of medication users and the screening on central obesity only, a relatively healthy population

was reached compared to the SLIM and SLIMMER populations. However, a recent meta-analysis showed that, although metabolically healthy obese adults are at lower risk of developing type 2 diabetes compared to unhealthy obese adults, the healthy obese are still at increased risk of developing type 2 diabetes compared to metabolically healthy normal-weight adults [26]. Therefore, we did reach a group at risk of developing cardiometabolic diseases in the long run.

The targeted at-risk group in this thesis consisted of persons with low SES of Dutch, Turkish and Moroccan origin. Although several other at-risk groups could have been considered (e.g. people of Asian origin [27, 28]), one 'missed' group in particular should be mentioned, namely, ethnic minorities with higher socioeconomic status. The current thesis focused only on persons with low socioeconomic status. However, it is suggested that, among ethnic minorities, both low and higher SES groups should be targeted in order to reduce ethnic inequalities in health, and not exclusively ethnic minorities with low SES [29].

Generalisability of findings

The current thesis focused on targeting the three largest ethnic groups in the Netherlands, namely, those with low SES of Dutch, Turkish and Moroccan origin. The results cannot be generalised to other ethnic populations. The opportunities identified to adapt lifestyle interventions and the effectiveness of SLIMMER and MetSLIM may be different for other ethnic groups, as different (ethnic) groups are expected to have different preferences and needs to which an intervention programme should be adapted [9]. In this thesis, for example, it was seen that the preference for information in one's native language was more prominent among persons of Turkish origin than among persons of Moroccan origin *(chapter 3).* Some preferences and needs, however, will be common among different ethnic groups. With respect to participating in health research, for example, some common barriers identified among different ethnic groups include competing demands and mistrust or fear of participation [30]. Besides generalisability to other ethnic groups, generalisability to other geographic areas is difficult. Low SES groups living in non-deprived neighbourhoods, for example, can have different needs than low SES groups living in deprived neighbourhoods. Moreover, other locations might offer different possibilities or difficulties for executing the lifestyle intervention; for example, offering all activities in the neighbourhood, as done within MetSLIM, will be difficult in some geographic areas.

Public health implications

The results of this thesis could have important public health implications. To date, the effect of most interventions in the Netherlands targeting low SES populations and ethnic minorities is limited or unknown [31, 32]. It is promising that SLIMMER and MetSLIM have proved that low SES populations can be successfully reached and that their health can be improved with lifestyle interventions. Further implementation should be considered. In this section, it is discussed what is necessary in order to implement the MetSLIM intervention. The possibility of implementing the SLIMMER intervention has been discussed in detail elsewhere [33].

The SLIMMER study – for which the SLIM intervention was adapted from a research setting to a real-life setting [6] – already showed the feasibility of implementing the intervention in Dutch primary healthcare [17, 34]. In MetSLIM, additional changes were made in order to suit the needs of the target group. However, some of these additional changes can be difficult to implement in reality. One of these changes includes the involvement of ethnicity-matched dieticians, who provided the dietary counselling in MetSLIM. It probably is not always possible to involve ethnicity-matched dieticians, as these dieticians may not always exist or be available. Likewise, it may not always be possible to organise a supermarket tour and to provide all activities in the neighbourhood. Solutions should be found for those adaptations that are relatively difficult to realise when the intervention is being implemented, but that are essential in order to reach, inspire and retain the target group.

Care should be taken not to omit essential elements when the intervention is being implemented. It is argued that intervention planners may leave out elements that are less appealing to them or more difficult to realise [35]. To support proper implementation, insight is first needed into what elements of MetSLIM are truly essential in order to successfully reach, retain and improve the health of the target group. These insights could, to some extent, be gained by means of a process evaluation. The process evaluation of MetSLIM is planned but not yet completed. In addition to an evaluation of MetSLIM, it would be helpful to get insight into effective elements of comparable interventions. Combining our findings with insights from comparable interventions, like SLIMMER, DHIAAN [4] and DiAlert [36], could help to provide a complete picture of essential elements for lifestyle interventions to be effective for individuals with low SES and ethnic minorities in the Netherlands.

Future studies

The aim of the current thesis was to get insight into opportunities for, and the effectiveness of, lifestyle interventions targeting persons with low socioeconomic status of different ethnic origins. The studies in this thesis did identify opportunities (*chapters 2 and 3*) and showed interventions' effectiveness (*chapters 5 and 6*). However, a few questions remain unanswered and new questions arise. Some as yet unanswered questions could be answered with research that is already planned: a process evaluation and an economic evaluation. Based on what we have learned, additional research is recommended regarding knowing more specifically what adaptations work for which groups and regarding the long-term effects of lifestyle interventions among the target group. Both the planned future research and the recommended future research are discussed below. This is followed by a discussion of the factors that future research targeting persons with low SES of different ethnic origins should take into account based on the lessons learned from this thesis.

Process and economic evaluation

The planned process evaluation of the MetSLIM study will give insight into the importance of the adaptations in the MetSLIM study to successfully target individuals with low SES of

different ethnic origins. The aim of the process evaluation will be to evaluate whether the MetSLIM study was carried out as planned; which changes were made to the intervention and why; how the intervention programme was perceived by participants and professionals; and whether the intended target group was actually reached.

The planned economic evaluation of the MetSLIM study will give insight into the cost-effectiveness of the lifestyle intervention. A recent review showed that combined diet and physical activity promotion interventions to prevent type 2 diabetes are cost-effective among persons at increased risk [37]. More specifically, the SLIM intervention proved to be cost-effective from a healthcare perspective [38]. The SLIMMER study showed a moderate probability of being cost-effective from a healthcare perspective [39]. However, to our knowledge, information about the cost-effectiveness of combined lifestyle interventions targeting individuals with low SES is lacking; this makes the economic evaluation of MetSLIM rather important.

What works for whom and for how long?

In order to guide implementation of lifestyle interventions, without omitting any of their essential elements, more insight should be gained into the 'black box' of lifestyle interventions. We should get insight into what works, and for whom. In order to achieve this, more fundamental – though applied – research should be considered. For example, it would be valuable to compare the recruitment and retention rates of different recruitment strategies, instead of applying multiple strategies concurrently. Furthermore, we could compare the effectiveness of interventions that vary in duration or intensity, in order to study the ideal duration or intensity of a lifestyle intervention. Moreover, the effectiveness could be compared of interventions that either do or do not involve ethnicity-matched dieticians. Combining insights from other studies could also help to get insight into what is specifically necessary for whom when persons with low SES of different ethnic origins are being targeted with lifestyle interventions.

In addition, it would be valuable to study whether effects of lifestyle interventions can be maintained among the target group. The effects of SLIMMER and MetSLIM were measured after a time span of 18 and 12 months, respectively. It remains unknown whether the effects of SLIMMER and MetSLIM will be maintained among the low SES populations in the long term. However, it might be rather difficult to study this, as drop-out was already high in MetSLIM and increasing in SLIMMER among individuals with low socioeconomic status. A high drop-out can be expected when this group is targeted with intervention studies [3-5], and this will make it difficult to draw firm conclusions about the long-term effectiveness of the interventions among low SES populations.

Studying individuals with low socioeconomic status and ethnic minorities

Persons with low socioeconomic status and ethnic minorities are often labelled as 'hard-to-reach' [40]. I believe we should turn that around and rather ask ourselves whether we are

doing the right thing to reach them. Our insights into opportunities to reach these groups (*chapters 2 and 3*) were applied and described in the development of the MetSLIM study protocol *(chapter 4*). Additional insights, based on our experiences while we were studying this target group, are discussed here, in order to help future researchers who are targeting this group.

In general, flexibility is required in study protocols targeting individuals with low socioeconomic status and ethnic minorities. Traditional approaches regarding study design, recruitment and measurements may not suit these target groups' preferences and possibilities. For example, traditionally, intervention studies like SLIM, SLIMMER and MetSLIM include a lot of measurements, for which participants are expected to fill in questionnaires for one or more hours. However, as these target groups are often not familiar with participating in research, they may not see the need of these long questionnaires. Moreover, low literacy is a relatively large problem among these groups [41]. Involving ethnicity-matched research assistants and providing information in individuals' native language may help to overcome some language barriers. However, still, long questionnaires may scare them away and consequently decrease participation rates or increase drop-out. It should be questioned whether the benefits of collecting large amounts of data outweigh the chance of low participation or retention rates and of reaching a rather selective group of participants with low socioeconomic status (e.g. with relatively good literacy).

Decreasing the participant burden may help to prevent some of the drop-out. However, some drop-out among this target group is difficult to prevent, and it may be important for a researcher targeting this group with intervention studies not to have too high expectations regarding retention. The MetSLIM study showed that, although some important barriers among the target group (e.g. language and distance) were removed, the drop-out rate was still rather high compared to SLIM and SLIMMER. Some reasons for drop-out were rather specific for that target group and difficult to overcome, e.g. a lack of time or interest due to conflicting concerns, and immigration. This, for sure, does not mean that high drop-out rates should be accepted; rather, it calls for a more pragmatic and creative approach.

General conclusion

This thesis has shown that intensive combined lifestyle interventions can be effective in low SES populations and identified possible adaptations to make the lifestyle intervention more suitable for individuals with low socioeconomic status of Dutch, Turkish and Moroccan origin. The question is not whether a lifestyle intervention can be effective, but how diverse groups can be reached, inspired and retained. For this purpose, further insight into the success of different adaptations for different target groups should be obtained to reveal the effective elements to reach, retain and improve the health of low SES populations and ethnic minorities with lifestyle interventions.

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Summary

Lifestyle intervention studies have shown that the development of cardiometabolic diseases can be partly prevented or postponed by the combination of a healthy diet and physical activity. Cardiometabolic diseases and their risk factors are particularly prevalent among individuals with low socioeconomic status and some ethnic minorities, and therefore these groups especially may benefit from participating in lifestyle interventions. Although individuals with low socioeconomic status and ethnic minorities could potentially benefit from lifestyle interventions, it seems that these groups are often not successfully reached for such interventions. Moreover, when they do participate in these interventions, they seem more likely to quit. The overall aim of this thesis was therefore to study opportunities for, and the effectiveness of, lifestyle interventions to reduce the risk of cardiometabolic diseases, targeting individuals with low socioeconomic status of different ethnic origins. To this end, this thesis reports two studies that identified opportunities for adapting lifestyle interventions to the target group's needs, one study describing the process of adapting an effective lifestyle intervention (SLIM) into a new lifestyle intervention targeting individuals with low SES of different ethnic origins (MetSLIM) and two studies that determined the effectiveness of lifestyle interventions among the target group.

The aim of the study described in **chapter 2** was to identify opportunities for adapting lifestyle interventions in such a way as to be more appealing for individuals with low socioeconomic status. The study provided insight into perspectives of groups with different socioeconomic positions regarding their current eating and physical activity behaviour; triggers for lifestyle change; and preferred ways to support lifestyle change. Data were gathered in semi-structured focus group interviews with adults with low socioeconomic status (four groups) and with adults with high socioeconomic status (five groups). In general, three key topics were identified, namely: current lifestyle is logical for participants given their personal situation; lifestyle change is prompted by feedback from their body; and support for lifestyle change should include individually tailored advice and could profit from involving others. The perceptions of the participants with low socioeconomic status were generally comparable to the perceptions shared by the participants with high socioeconomic status. Some perceptions were, however, especially mentioned in the low socioeconomic status groups. Participants with low socioeconomic status indicated that their current eating behaviour was sometimes affected by cost concerns. They seemed to be especially motivated to change their lifestyle when they experienced health complaints but were rather hesitant to change their lifestyle for preventive purposes. Regarding support for lifestyle change, participants with low socioeconomic status preferred to receive advice in a group rather than on their own. For physical activities, groups should preferably consist of persons of the same age, gender or physical condition.

The aim of the study described in **chapter 3** was to identify how Turkish and Moroccan adults living in the Netherlands, aged 45 years and older, could be reached to participate in health checks for cardiometabolic diseases and follow-up (lifestyle) advice. In this study, questionnaire data were combined with interview data. This was done in order to use the

narratives from the interviews to get a better understanding of the numbers that resulted from the questionnaire data. It turned out that both ethnic groups preferred an invitation from their general practitioner (GP) for a health check and preferred to fill out the health check questionnaire at the GP's office or at home, on paper. They preferred to receive advice at individual level in relation to personal matters via either a physician or a specialised healthcare professional. Sixty-one percent of the Turkish respondents preferred to receive information in their native language, compared to 37% of the Moroccan respondents. Several participants mentioned a low proficiency in the local language as an explanation for their preference to fill out the health check questionnaire at home, to receive advice from an ethnicity-matched professional and to receive information in their native language. The results of this study suggested that the GP would be a promising contact to reach adults of Turkish and Moroccan origin for health checks or (lifestyle) advice. Furthermore, the findings suggested that it would be necessary to provide information in individuals' native language to overcome language barriers and that (lifestyle) advice should be tailored towards the needs of the targeted individuals.

The insights gained into the needs and preferences of the target group – as described in chapter 2 and chapter 3 – were taken into account in the design of the MetSLIM intervention study. The MetSLIM study targeted individuals with low socioeconomic status of Dutch, Turkish and Moroccan origin. The MetSLIM study protocol was based on the SLIM study protocol. The SLIM study showed the beneficial effects of nutrition advice and physical activity promotion on the prevention type 2 diabetes, but drop-out was relatively high among low SES participants. **Chapter 4** provides a detailed description of the development from the SLIM study protocol to the MetSLIM study protocol. Furthermore, this chapter gives insight into the obstacles encountered in developing the MetSLIM study to target individuals with low socioeconomic status of different ethnic origins. The new elements regarding the lifestyle intervention programme were: 1) additional group meetings about price concerns and social occasions with regard to a healthy diet; 2) ethnicity-matched dieticians; 3) gender-matched sports instructors; 4) all activities in the participants' own neighbourhood; and 5) activities for women and men separately. The new elements regarding the study design, in order to study the effectiveness of the MetSLIM intervention programme, included: 1) from an university stetting to a community setting; 2) from a randomised controlled trial to a quasi-experimental study; 3) waist circumference – as a visible cardiometabolic risk factor – as main study outcome; 4) recruitment via GPs and in community centres; 5) translated study materials and ethnicity-matched research assistants involved in measuring; and 6) fewer measurements and measurements that could take place at different locations. Adaptations to the original SLIM study protocol were considered necessary in order to overcome practical barriers that hinder the target group's participation; to suit the target group's (cultural) needs; and to make it feasible to perform the study in a local (community) setting.

MetSLIM was not the only study set up based on the SLIM study. The SLIMMER study translated SLIM from a university setting to a real-world setting. The intervention was implemented

in the public health and primary healthcare setting involving local GPs, practice nurses, dieticians, physiotherapists and sports clubs. The SLIMMER study did not target individuals with low socioeconomic status in particular; however, 52% of the study participants did have a low socioeconomic status, as determined by highest completed educational level. **Chapter 5** describes how we explored the role of socioeconomic status in willingness to participate, programme attendance, programme acceptability, adherence to lifestyle guidelines, drop-out and effectiveness in the SLIMMER diabetes prevention intervention. The SLIMMER study was a randomised controlled trial, targeting 40- to 70-year-old adults at increased risk of type 2 diabetes, carried out in Apeldoorn and Doetinchem. The intervention group participated in a 10-month lifestyle programme: weekly training sessions were guided by a physiotherapist, and dietary advice was given by a dietician during 5–8 individual consultations and one group session. Measurements were carried out at baseline, after 12 months and six months after the active intervention period ended. The study showed that participation, attendance, acceptability, adherence, drop-out and effect of the SLIMMER study were mostly not affected by socioeconomic status. The SLIMMER study was able to reach the low socioeconomic status group as effectively as the higher socioeconomic status group, resulting in at least similar health benefits. The SLIMMER sample size was too small to study differences within the low socioeconomic status group, e.g. comparing the low vs. the least educated or comparing ethnic groups. Only 10% of the 316 SLIMMER participants had the lowest educational levels (no education or primary education) and only 11% had a foreign background.

The aim of the study described in **chapter 6** was to measure the effectiveness of the MetSLIM intervention on waist circumference and other cardiometabolic risk factors, lifestyle and quality of life among 30- to 70-year-old adults with an elevated waist-to-height ratio. In the MetSLIM study, 220 individuals participated, of whom 40% had no education or only primary education and of whom 64% had a foreign background. MetSLIM had a quasi-experimental design with measurements at baseline and after 12 months. Participants were recruited in deprived neighbourhoods of Arnhem and Eindhoven via either their GP or in community centres. The intervention group participated in a 12-month lifestyle programme: an introductory group meeting was guided by the researcher, weekly physical activity lessons were guided by a sports instructor and dietary advice was given by an ethnicity-matched dietician (in total four hours of individual consultations and three group sessions). The study showed that the MetSLIM lifestyle intervention was effective in reducing waist circumference, other measures of obesity, total and LDL cholesterol, and quality of life. MetSLIM had a drop-out of 31%, which was higher than at 12 months in the SLIM study (10%) and SLIMMER study (13%), but comparable to drop-out in similar studies among ethnic minorities or low socioeconomic status populations.

Finally, in **chapter 7**, the main results of this thesis are described, followed by a discussion of methodological considerations, public health implications, suggestions for future research and the general conclusion. The adaptation process from SLIM to MetSLIM is discussed, including a reflection on the decision to use SLIM as a starting point and the decision to

target three different ethnic groups at the same time. Moreover, difficulties in defining and selecting persons with low socioeconomic status and specific ethnic groups within research are addressed. As SLIMMER and MetSLIM proved that low socioeconomic status populations can be reached, and that their health can be improved when they participate in lifestyle interventions, it is suggested that further implementation should be considered. Insight should be gained into the 'black box' of lifestyle interventions; i.e. we should get to know what works for whom. Planned future research includes a process and economic evaluation of MetSLIM.

This thesis has shown that intensive combined lifestyle interventions can be effective in low socioeconomic status populations and identified possible adaptations to make lifestyle interventions more suitable for individuals with low socioeconomic status of Dutch, Turkish and Moroccan origin. The question is not whether a lifestyle intervention can be effective, but how diverse groups can be reached and benefit from it. For this purpose, further insight into the success of different adaptations for different target groups should be obtained to reveal the effective elements to reach, inspire and retain different low socioeconomic status populations and ethnic minorities with lifestyle interventions.

Samenvatting

Onderzoek naar leefstijlinterventies heeft aangetoond dat cardiometabole ziekten, zoals diabetes en hart- en vaatziekten, deels kunnen worden voorkomen of uitgesteld door een gezond voedingspatroon en voldoende beweging. Cardiometabole ziekten en hun risicofactoren komen relatief vaak voor bij mensen met een lage sociaaleconomische status en bepaalde etnische minderheden. Daarom zouden juist deze groepen baat hebben bij deelname aan een leefstijlinterventie. Echter lijkt het erop dat deze groepen vaak niet goed bereikt worden met leefstijlinterventies. Het doel van de studies in dit proefschrift was daarom allereerst om te bestuderen wat er nodig is om leefstijlinterventies beter aan te laten sluiten bij personen met een lage sociaaleconomische status met een Nederlands, Turkse en Marokkaanse achtergrond. Daarnaast is er gekeken naar de effectiviteit van leefstijlinterventies op het verminderen van het risico op cardiometabole ziekten bij de doelgroep. Dit proefschrift beschrijft vijf studies: twee studies beschrijven de mogelijkheden hoe we leefstijlinterventies beter kunnen laten aansluiten bij de doelgroep, één studie beschrijft hoe we een bestaande leefstijlinterventie (genaamd SLIM) hebben aangepast naar een leefstijlinterventie voor de doelgroep (genaamd MetSLIM) en twee studies beschrijven de effectiviteit van leefstijlinterventies onder de doelgroep.

Het doel van de studie in **hoofdstuk 2** was om mogelijkheden te achterhalen om leefstijlinterventies beter aan te laten sluiten bij de wensen van mensen met een lage sociaaleconomische status. De studie onderzocht daarom opvattingen betreffende hun huidige voedings- en beweeggedrag, 'triggers' voor leefstijlverandering en de manier waarop ze ondersteund zouden willen worden bij leefstijlverandering. De opvattingen van volwassenen met een lage sociaaleconomische status werden vergeleken met de opvattingen van volwassenen met een hogere sociaaleconomische status. Data werd verzameld door middel van groepsinterviews (vier groepen met lage sociaaleconomische status en vijf groepen met een hoge sociaaleconomische status). In zowel de lage als hoge sociaaleconomische status groepen zagen we de volgende drie thema's terug: huidige leefstijl sluit aan bij de persoonlijke situatie van deelnemers, leefstijlverandering wordt gestimuleerd door de signalen die hun eigen lichaam geeft en om van leefstijl te veranderen zouden ze graag advies ontvangen dat aansluit bij hun persoonlijke situatie. Ook gaven deelnemers aan dat het zou kunnen helpen als mensen in hun omgeving ook van leefstijl zouden willen veranderen. Sommige opvattingen kwamen in het bijzonder voor in de groepen met een lage sociaaleconomische status. Personen met een lage sociaaleconomische status gaven aan dat hun huidige voedingsgedrag soms beïnvloed wordt door financiële overwegingen. Verder leek het dat deze groep vooral gemotiveerd is om hun leefstijl te veranderen wanneer ze gezondheidsklachten ervaren, maar minder gemotiveerd zijn om hun leefstijl te veranderen om preventieve redenen. Wat betreft de steun bij leefstijlverandering werd door de groepen met een lage sociaaleconomische status de voorkeur gegeven aan advies in groepen in plaats van individueel. Wat betreft sportactiviteiten willen ze bij voorkeur bewegen met personen van dezelfde leeftijd, hetzelfde geslacht of dezelfde fysieke conditie.

Het doel van de studie in **hoofdstuk 3** was om te bestuderen hoe personen van 45 jaar en ouder, die een Turkse of Marokkaanse achtergrond hebben en in Nederland leven, bereikt kunnen worden voor gezondheidschecks gericht op cardiometabole ziekten en voor follow-up (leefstijl)advies. In deze studie is vragenlijstdata gecombineerd met interviewdata. De verhalen uit de interviews zijn gebruikt om de kwantitatieve resultaten van de vragenlijsten beter te begrijpen. Het bleek dat beide etnische groepen bij voorkeur door hun huisarts uitgenodigd worden voor een gezondheidscheck. Verder gaven deelnemers er de voorkeur aan om in de huisartsenpraktijk of thuis op papier een risicovragenlijst in te vullen van een gezondheidscheck. In het geval van (leefstijl)advies, gaven ze er de voorkeur aan om op een individueel niveau advies te ontvangen als het ging om persoonlijke zaken. Advies ontvangen ze bij voorkeur via een arts of een gespecialiseerde gezondheidsprofessional. Eenenzestig procent van de vragenlijstrespondenten met een Turkse achtergrond gaf aan bij voorkeur informatie in hun moedertaal te ontvangen. Bij de respondenten met een Marokkaanse achtergrond was dit 37%. Deelnemers gaven aan dat een lage taalvaardigheid van de Nederlandse taal een reden was om een vragenlijst thuis in te vullen, om advies te ontvangen van iemand met dezelfde etnische achtergrond en om informatie in eigen taal te ontvangen. De resultaten van deze studie suggereren dat de huisarts een veelbelovend contactpersoon is om volwassenen met een Turkse of Marokkaanse achtergrond te bereiken voor gezondheidschecks of (leefstijl)advies. Verder wijzen de resultaten erop dat het nodig is om informatie ook in de moedertaal aan te bieden in verband met taalbarrières en dat de inhoud van (leefstijl)advies aangepast moet worden naar wat een individu nodig heeft.

De inzichten van de studies uit hoofdstuk 2 en 3 zijn meegenomen in de ontwikkeling van de MetSLIM interventiestudie. De MetSLIM studie was gericht op personen met een lage sociaaleconomische status met een Nederlandse, Turkse en Marokkaanse achtergrond. Het studieprotocol van MetSLIM was gebaseerd op het SLIM studieprotocol. De SLIM studie liet de voordelen zien van voedingsadvies en het promoten van beweging op de preventie van diabetes type 2, maar deelnemers van een lage sociaaleconomische status stopten relatief vaak met de studie. **Hoofdstuk 4** geeft een gedetailleerde omschrijving van de aanpassing van het SLIM studieprotocol naar het MetSLIM studieprotocol. Verder geeft het hoofdstuk een beschrijving van de obstakels die we tegen zijn gekomen in de ontwikkeling van het MetSLIM studieprotocol. De belangrijkste nieuwe elementen in de leefstijlinterventie waren: 1) extra groepsbijeenkomsten over gezonde voeding in relatie tot financiële overwegingen en sociale gelegenheden; 2) diëtisten met dezelfde etnische achtergrond als deelnemers; 3) sportbegeleiders van hetzelfde geslacht als deelnemers; 4) alle interventieactiviteiten in de eigen wijk aangeboden; 5) interventieactiviteiten voor mannen en vrouwen apart. In de MetSLIM onderzoeksopzet waren de belangrijkste nieuwe elementen: 1) van een universiteitsomgeving naar de leefomgeving van deelnemers; 2) van een gerandomiseerd onderzoek naar een quasi-experimenteel onderzoek; 3) buikomvang als belangrijkste uitkomstmaat, omdat het een zichtbare risicofactor voor cardiometabole ziekten is; 4) werving via huisartsen en in buurthuizen; 5) studiematerialen in eigen taal en onderzoeksassistenten met dezelfde etnische achtergrond bij de metingen; 6) minder metingen en metingen die gemakkelijk plaats kunnen

vinden op verschillende locaties. Aanpassingen in het oorspronkelijk SLIM studieprotocol waren om verschillende redenen nodig: om praktische barrières op te lossen die deelname van de doelgroep konden verhinderen, om aan te sluiten bij de voorkeuren van de doelgroep en om het mogelijk te maken om de studie uit te voeren in de leefomgeving van de deelnemers.

De MetSLIM studie was niet de enige studie die was opgezet op basis van de SLIM studie. De SLIMMER studie heeft SLIM vertaald van een universiteitssetting naar een real-life setting. De leefstijlinterventie van SLIMMER is uitgevoerd in samenwerking met lokale huisartsen, praktijkondersteuners, diëtisten, fysiotherapeuten en sportverenigingen. De SLIMMER studie had niet specifiek als doel om mensen met een lage sociaaleconomische status te bereiken. Toch had 52% van de deelnemers een lage sociaaleconomische status, wat was bepaald aan de hand van het hoogst afgeronde opleidingsniveau. **Hoofdstuk 5** beschrijft hoe is bekeken of sociaaleconomische status een rol heeft gespeeld in deelname aan de SLIMMER studie. Er is gekeken naar aanwezigheid bij interventieactiviteiten, tevredenheid met het interventie programma, het naleven van leefstijlrichtlijnen van de interventie, drop-out in de studie en effectiviteit van de SLIMMER diabetes preventie interventie. De SLIMMER studie was een gerandomiseerd onderzoek, uitgevoerd in Apeldoorn en Doetinchem. Het onderzoek was gericht op personen van 40 tot 70 jaar met een verhoogd risico op diabetes type 2. De interventiegroep nam deel aan een 10 maanden durende leefstijlinterventie: wekelijkse trainingssessies onder leiding van een fysiotherapeut en voedingsadvies gegeven door een diëtist tijdens 5-8 individuele consulten en één groepsbijeenkomst. Metingen zijn uitgevoerd aan het begin van de studie, na 12 maanden en zes maanden nadat de interventie was afgelopen. De studie liet zien dat deelname, aanwezigheid, tevredenheid, opvolgen van richtlijnen, drop-out en effectiviteit in de SLIMMER studie over het algemeen niet afhankelijk was van sociaaleconomische status. De SLIMMER studie heeft personen met een lage sociaaleconomische status net zo effectief bereikt als personen met een hogere sociaaleconomische status en heeft geresulteerd in een minstens zo goede gezondheidswinst. Het aantal SLIMMER deelnemers was te klein om vergelijkingen te maken tussen de laag en laagst opgeleiden en tussen verschillende etnische groepen. Maar 10% van de 316 SLIMMER deelnemers had één van de laagste opleidingsniveaus (ofwel geen afgeronde opleiding of alleen basisschool) en maar 11% had een niet-Nederlandse achtergrond.

Het doel van de studie in **hoofdstuk 6** was om de effectiviteit van de MetSLIM interventie te bepalen op buikomvang en andere cardiometabole risicofactoren, leefstijl en kwaliteit van leven bij personen tussen de 30 en 70 jaar oud met een vergrote buikomvang. In de MetSLIM studie deden 220 deelnemers mee, van wie 40% geen opleiding had of alleen basisschool en 64% een niet-Nederlandse achtergrond had. MetSLIM had een quasi-experimentele onderzoeksopzet met metingen bij de start en na 12 maanden. Deelnemers werden geworven in achterstandswijken in Arnhem en Eindhoven via hun eigen huisarts en in buurthuizen. De interventiegroep nam deel aan een 12 maanden durende leefstijlinterventie. Deze bestond uit een introductiebijeenkomst geleid door de onderzoeker, wekelijkse beweeglessen onder leiding van een sportinstructeur en voedingsadvies gegeven door een diëtist met dezelfde

etnische achtergrond als deelnemers. Het voedingsadvies werd gegeven tijdens 4 uur aan individuele consulten en drie groepsbijeenkomsten. De MetSLIM studie liet zien dat de leefstijlinterventie effectief was in het verminderen van buikomvang en andere maten van overgewicht, totaal en LDL cholesterol, en kwaliteit van leven. MetSLIM had een drop-out van 31%, wat meer is dan na 12 maanden in SLIM (10%) en SLIMMER (13%), maar te vergelijken met drop-out in soortgelijke studies gericht op mensen met een lage sociaaleconomische status en etnische minderheden.

Tot slot zijn de belangrijkste onderzoeksresultaten in **hoofdstuk 7** samengevat, gevolgd door een discussie van de methodologische overwegingen, mogelijke toepassingen van de onderzoeksresultaten, suggesties voor toekomstig onderzoek en de algehele conclusie. Het aanpassingsproces van SLIM naar MetSLIM is bediscussieerd, inclusief een reflectie op de keuze om SLIM te gebruiken als uitgangspositie voor MetSLIM en de keuze om ons op drie verschillende etnische groepen tegelijkertijd te richten. Verder beschrijft het hoofdstuk de keuzes en consequenties in het werven van personen met een lage sociaaleconomische status en specifieke etnische groepen voor onderzoek. Omdat zowel SLIMMER als MetSLIM lieten zien dat personen met een lage sociaaleconomische status bereikt kunnen worden en gunstige gezondheidseffecten kunnen behalen door hun deelname aan de interventie, is er gesuggereerd dat er over mogelijkheden voor implementatie nagedacht moet worden. Daarvoor moet er meer inzicht verkregen worden in factoren die de effectiviteit van de leefstijlinterventie bepalen; we moeten kijken wat er werkt en voor wie. Een procesevaluatie en kosteneffectiviteitsevaluatie van MetSLIM staan nog op de planning.

De studies in dit proefschrift hebben laten zien dat intensieve, gecombineerde leefstijlinterventies effectief kunnen zijn bij personen met een lage sociaaleconomische status. Bovendien hebben ze laten zien welke aanpassingen mogelijk zijn om een leefstijlinterventie te laten aansluiten bij personen met een lage sociaaleconomische status met een Nederlands, Turkse en Marokkaanse achtergrond. Het is niet de vraag óf leefstijlinterventies effectief kunnen zijn, maar hoe verschillende groepen bereikt kunnen worden en ervan kunnen profiteren. Het is daarom wenselijk om meer inzicht te verkrijgen in het succes van verschillende aanpassingen bij verschillende doelgroepen, zodat duidelijk wordt welke elementen in leefstijlinterventies daadwerkelijk bepalend zijn voor het effectief bereiken, behouden en inspireren van groepen met een lage sociaaleconomische status van verschillende etnische achtergronden.

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"When eating a fruit, think of the person who planted the tree."

(Vietnamese saying)

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About the author

Curriculum Vitae

Andrea Johanna Bukman (Sandra) was born on November 2nd, 1987 in Leiden, The Netherlands. In 2005, she received her secondary school diploma from Ichthus College in Kampen. Shortly thereafter, she moved to Wageningen to pursue her post-secondary education in 'Nutrition and Health'. During her MSc, she completed two theses. For the first thesis, she compared micro-eating behaviours (e.g. eating rate, bite size) between overweight and normal weight people. For the second thesis, she investigated weight loss maintenance after participation in different weight loss programmes. She completed her internship at the Community Health Service in Zwolle, where she investigated how the EPODE methodology – which aims to reduce childhood obesity – was applied in practice, using the municipality of Raalte as an example. In 2010, Sandra started her PhD. Her project focussed on adapting an existing lifestyle intervention to reduce waist circumference and improve other components of the metabolic syndrome in individuals with low socioeconomic status of different ethnic origins. The project was funded by LekkerLangLeven, which is a joint collaboration between the Dutch Diabetes Research Foundation, the Dutch Kidney Foundation and the Dutch Heart Foundation. During her PhD, she joined the educational programme of the Graduate School VLAG and helped organise an academic excursion for fellow PhD candidates to Mexico and the Southwestern United States. She has co-taught both bachelor and master level courses in the 'Nutrition and Health' programme, and supervised thesis students from various study programmes. Sandra currently works for the research group Cross-Media Communication in the Public Domain at HU University of Applied Sciences, in Utrecht.

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Duijzer G, Bukman AJ, Meints-Groenveld A, Haveman-Nies A, Jansen SC, Heinrich J, Hiddink GJ, Feskens EJM, de Wit GA: Cost-effectiveness of the SLIMMER diabetes prevention intervention in Dutch primary health care.

Overview of completed training activities

Discipline specific activities	Organiser and location	Year
Courses		
Masterclass 'Public health interventions in real-life settings: the AGORA experience'	VLAG, Wageningen	2010
Masterclass 'Health food innovation: research, development and claim substantiation'	Maastricht University/UM Campus Venlo, Maastricht	2010
Masterclass 'Public health intervention in real-life settings - how to develop effective interventions in public health practice'	VLAG, Wageningen	2012
Masterclass 'Longitudinal data analysis (mixed models)'	VLAG, Wageningen	2013
Methodology in health economic evaluation	UMC Utrecht/Julius Centre, Utrecht	2013
Masterclass 'Confounding'	VLAG, Wageningen	2014
Conferences and meetings		
Voeding in 2020: een gezamenlijke toekomstverkenning	Voedingscentrum, Rotterdam	2010
Nationaal congres gezondheidsbevordering en preventie	NIGZ/NSPOH, Wageningen	2011
Tolken in de zorg	Utrecht University/Erasmus MC/ Mikado, Rotterdam	2011
Nederlands congres volksgezondheid	Amsterdam	2011
ASPO symposium 'Long term psychology'	TIBER, Tilburg	2011
ASPO symposium 'Behavior change'	Maastricht University, Maastricht	2011
Nederlandse gezondheidsvaardigheden in internationaal perspectief	Alliantie Gezondheidsvaardigheden/ RIVM/NIVEL/NIGZ, Woerden	2012
European public health conference	EUPHA, Malta	2012
Nederlands congres volksgezondheid	Ede	2013
Conference for international society of behavioral nutrition and physical activity	ISBNPA, Gent	2013
Nationale diabetes dag	NDF, Den Haag	2014
Nederlands congres volksgezondheid	Rotterdam	2014
Nederlands congres volksgezondheid	Rotterdam	2015
Conference for international society of behavioral nutrition and physical activity	ISBNPA, Edinburgh	2015
Mini-symposia of learned societies		2011-2015

General courses and workshops	Organiser and location	Year
VLAG PhD week	VLAG, Baarlo	2011
PhD competence assessment	WGS, Wageningen	2011
Information literacy including EndNote introduction	WGS, Wageningen	2011
How to write a world-class paper	Wageningen UR Library, Wageningen	2011
Techniques for writing and presenting scientific papers	WGS, Wageningen	2011
Successful presenting	Mennen Training & Consultancy, Wageningen	2011
Teaching and supervising thesis students	Educational Staff Development, Wageningen	2012
Philosophy and ethics of food science and technology	WGS, Wageningen	2013
Reviewing a scientific paper	WGS, Wageningen	2015
ISBNPA early career researcher	ISBNPA, Edinburgh	2015
Career perspectives	WGS, Wageningen	2015
Orientation on teaching for PhD students	Educational Staff Development, Wageningen	2015
Optional courses and activities	**Organiser and location**	**Year**
Interviewing techniques	YRM, Wageningen	2011
PhD study tour organising committee 2011	HNE/VLAG, Wageningen	2011
PhD study tour 2011	HNE/VLAG, Wageningen	2011
PhD study tour 2013	HNE/VLAG, Wageningen	2013
Literature and discussion groups: 'Epi-research club' 'Rothman Lunches' 'Paperclip club'	HNE, Wageningen	2011-2015

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