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Tackling overweight and obesity among Kenyan mothers in Nairobi – the Nutrition Club model

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1 Introduction

Kenya is a country located in Eastern Africa, lying astraddle the equator. The country extends from Indian ocean and Somalia in the east to Lake Victoria and Uganda in the west, and from South Sudan and Ethiopia in the north to the United Republic of Tanzania in the south. Of the land area 80 % is semi-arid and merely 20 % is arable. The altitude and proximity of the Indian ocean affects the rainfall and temperatures, and thus, the climate in the coastal region is tropical, having through the year both higher temperatures and rainfall than the rest of the country. The country is divided into eight provinces or regions (Eastern, North-Eastern, Rift Valley, Western, Nyanza, Central, Coast and Nairobi), and further administratively into 47 counties. The capital of Kenya, Nairobi, is located in the south-central part of country, in the county of Nairobi (former province of Nairobi) (FAO, 2015; Kenya National Bureau of Statistics (KNBS) et al., 2014). The population of Kenya is scattered by various ethnic, economic and ecological backgrounds (Oniang'o & Komokoti, 1999).

Kenya is experiencing **rapid urbanization**, with an annual urban population growth rate of 4.3%; while in the year 2000 circa 19% of Kenya's residents were living in urban areas the percentage had risen to 31% by 2010 (Peters et al., 2019). Of Kenya's 47 counties Nairobi, Mombasa, Kisumu, Machakos, Kiambu, Uasin Gishu, Nakuru, and Kajiado, considered "urban counties", account for 70 % of the urban population, and in these 68 people out of 100 live in an urban area (Macharia et al., 2021). The rural-to-urban migration seems to be driven by poverty and the lack of development as well as job opportunities in the rural areas. It has been considered that this movement of people from rural to urban areas, in both low- and middle-income countries, may have an impact on the prevalence of overweight and obesity, as the urban food environments in these countries have been thought as being obesogenic (Peters et al., 2019). Through urbanization people seem to be exposed to a diet differing from that of their traditional one, as it contains a high intake of e.g., saturated fat, sodium and added sugar, combined with a low intake of dietary fibre (Mbochi et al., 2012).

Generally unhealthy eating habits are associated with **sedentary lifestyle** (Steyn et al., 2011). However, for example the results of a study conducted in the urban slum of Kibera in Nairobi reveal that the participants actually demonstrated a high level of physical activity, mainly travel and work related. A notably high level of total physical activity in both genders was discovered, as 80.2% recorded high (>3000) and 17.5% moderate (600–3000) level of total physical activity in metabolic equivalent minutes per week (Joshi et al., 2014). Still, around 6.5% of Kenyans altogether seem to not engage in the WHO recommended level of physical activity (Ministry of Health, 2017).

According to Asiki et al. (2020) the rapid urbanization in Kenya is as well associated with increasing levels of **nutrition related noncommunicable diseases** (NCDs), with higher levels among urban residents, especially women, and indeed between the years 2003 and 2012 a four-fold increase in mortality due to NCDs was observed in urban Kenya. NCDs, as well known as chronic diseases, are the result of a combination of genetic, physiological, environmental, and behavioural factors, and largely are preventable diseases. Diet as a behavioural factor is well

known to play a key role as a risk factor for NCDs. In addition to unhealthy diet, modifiable behaviours that increase the risk of NCDs include tobacco use, physical inactivity, and the harmful use of alcohol. The before mentioned can further lead to metabolic/physiological changes, metabolic risk factors increasing the risk of NCDs, which include raised blood pressure, overweight or obesity, hypoglycaemia (high blood glucose levels), and hyperlipidaemia (high levels of fat in the blood) (WHO, 2021). The Joint WHO/FAO Expert Consultation on Diet, Nutrition and the Prevention of Chronic Disease have recognized that the noticeable growing epidemic of NCDs in both developed and developing countries is linked to dietary and lifestyle changes. In developing countries, and countries in transition in particular, the rapid changes in diets and lifestyles that have occurred with industrialization, urbanization, economic development, and market globalization, and accelerated in recent decades, appear to be having a significant impact on the health and nutritional status of the populations (WHO/FAO, 2002).

In 2019 seven out of the ten leading causes of death globally were NCDs, and deaths from NCDs are on the rise (WHO, 2020b). NCDs account for 71% of deaths at a global level, i.e., kill 41 million people a year. Based on gross national income Kenya is classified as a lower-middle-income economy, and NCDs disproportionately affect people in low- and middle-income countries as 77% of all NCD deaths occur in these (WHO, 2021; The World Bank, 2022). In 2019 in lower-middle-income countries five out of ten leading causes of death were NCDs (ischaemic heart disease, stroke, chronic obstructive pulmonary disease, cirrhosis of the liver and diabetes mellitus), and the incidence of each of these has increased since 2000. The most significant increase in absolute deaths is observed in ischemic heart disease, which was the leading cause of death in 2019 in lower-middle-income countries, as this has risen by over one million to 3.1 million since year 2000. As well the number of deaths from diabetes has almost doubled since 2000. In the case of communicable diseases, the situation appears to be the opposite of that for NCDs in this income group; number of deaths due to these appear to be in decline (WHO, 2020b).

In 2016 NCDs were estimated to account for 27% of all deaths in Kenya (WHO, 2018). The proportional mortality was 8% cardiovascular diseases; 10% cancers; 1% chronic respiratory diseases; 1% diabetes; 8% other NCDs; 63% communicable, maternal, perinatal and nutritional conditions; and 10% injuries. The risk of premature death due to NCDs has slightly decreased from the year 2000 to 2016 for both genders. There have been some changes in the prevalence's of NDC risk factors in Kenya over the last few decades, and especially the **prevalence of overweight and obesity** among the Kenyan people has undergone a particularly worrying change. In 1990 the prevalence of overweight among adults (BMI (body mass index) ≥ 25 kg/m2, age-standardized estimate) was 8.7% among men and 17.4% among women, while in 2016 the prevalence's had already increased to 16.1% and 34.3% respectively. Prevalence of obesity among adults (BMI ≥ 30 kg/m2, age-standardized estimate) in turn has increased more moderately from 1990 (men: 0.6%, women: 3.2%) to 2014 (men: 2.8%, women: 11.1%). Of some other risk factors prevalence of raised blood pressure (systolic blood pressure ≥ 140 OR diastolic blood pressure ≥ 90, age-standardised estimate) among the adult (over 18 years) population slightly increased from 1990 (men: 25.6%, women: 24.1%) to 2014 (men: 26.4%, women: 26.6%) and prevalence of raised fasting blood glucose (≥ 7.0 mmol/L or on medication, age-

standardised estimate) even more noticeably from the year 1990 (men: 3%, women: 3.5%) to 2014 (men: 5.8%, women: 6.2%). Prevalence of insufficient physical activity among adults (over18 years, age-standardized estimate) in 2016 was relatively low, just 13.93% in men and 16.93% in women, when compared to that among school going adolescents (aged 11-17 years, crude estimate) which was 84.85% among boys and 88.86% among girls. The latter has stayed relatively constant for the past few decades, as the figures were 85.32% for boys and 88.58% for girls in 2001 (WHO, 2022).

However, death rate alone does not provide a complete picture of the disease burden of individuals in different population groups, and thus, the overall burden of disease is assessed using the **Disability-Corrected Life Year (DALY),** one DALY representing the loss of the equivalent of one-year full health (WHO, n.d.). In Kenya there seems to be a decrease in DALYs due to all causes from the year 2000 to 2019, which is significant in itself, but even more so given that Kenya's population has grown over the period from almost 32 million in 2000 to over 52 million in 2019 (Figure 1.). The overall decrease in estimated DALYs appears to be because of decrease in DALYs due to communicable, maternal, perinatal, and nutritional conditions. More closely observing the DALYs due to nutritional deficiencies, which overall appear to have decreased over the period from 2000 to 2019, the DALYs due to protein-energy malnutrition, vitamin A deficiency and other nutritional deficiencies (not further specified) seem to be dropping, but those due to iodine deficiency and iron-deficiency anaemia appear to be increasing slightly (Figure 2.). DALYs due to both NCDs and injuries however appear to be on the rise in Kenya (WHO, 2020a). The country is especially facing an increasing burden of NCDs, including cardiovascular disease, cancer, diabetes, chronic respiratory diseases, and mental illness (Ministry of Health, 2020). Rousham et al. (2020) point out that generally in African countries the risk of nutrition related NCDs is increasing at a lower economic threshold and at a faster rate than in high-income countries, and this increased disease risk could be, at least in part, explained by changes in dietary behaviours. In addition, although the crude death rate has dramatically decreased from 1950 to 2010 in Kenya, the life expectancy remains low, below 60 years (Mattei et al., 2015).

In 2019 the leading ten risk factors contributing to total number of DALYs in Kenya were malnutrition (% change, 2009–2019: -28.8%), unsafe sex (% change, 2009–2019: -38.3%), WaSH (Water, sanitation and hygiene) (% change, 2009–2019: -36.9%), air pollution (% change, 2009–2019: -14.9%), high blood pressure (% change, 2009–2019: 34.4%), alcohol use (% change, 2009–2019: 15.0%), high body-mass index (% change, 2009–2019: 66.2%), high fasting plasma glucose (% change, 2009–2019: 39.8%), dietary risks (% change, 2009–2019: 32.5%) and tobacco (% change, 2009–2019: -1.8%) (IHME, 2022). Thus, the most significant increase in the effect on total number of DALYs over the previous decade is observed for high body-mass index, high fasting plasma glucose, high blood pressure and dietary risks, all of these risk factors having a clear connection to diet and lifestyle.

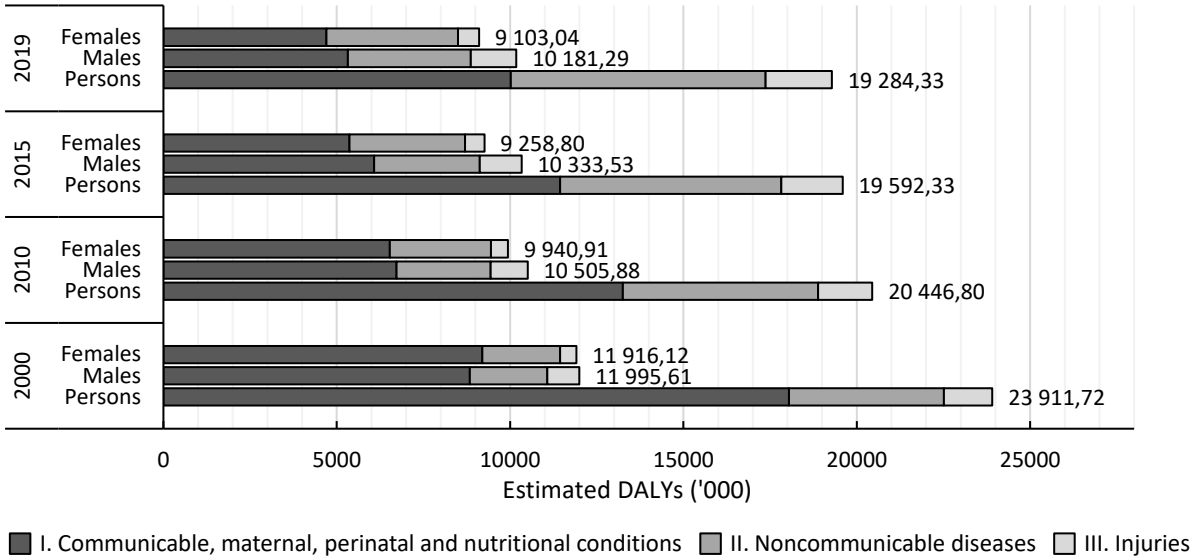

Figure 1. Estimated Disability-Adjusted Life Years (DALYs) ('000), by communicable, maternal, perinatal and nutritional conditions (I.); noncommunicable diseases (II.) and injuries (III.), all persons and by gender, concerning all ages in Kenya, in the years 2000 (population c. 31965000), 2010 (population c. 42031000), 2015 (population c. 47878000) and 2019 (population c. 52574000). The numerical value given is the point estimate for DALYs due to all causes, rounded to two decimal places (WHO, 2020a).

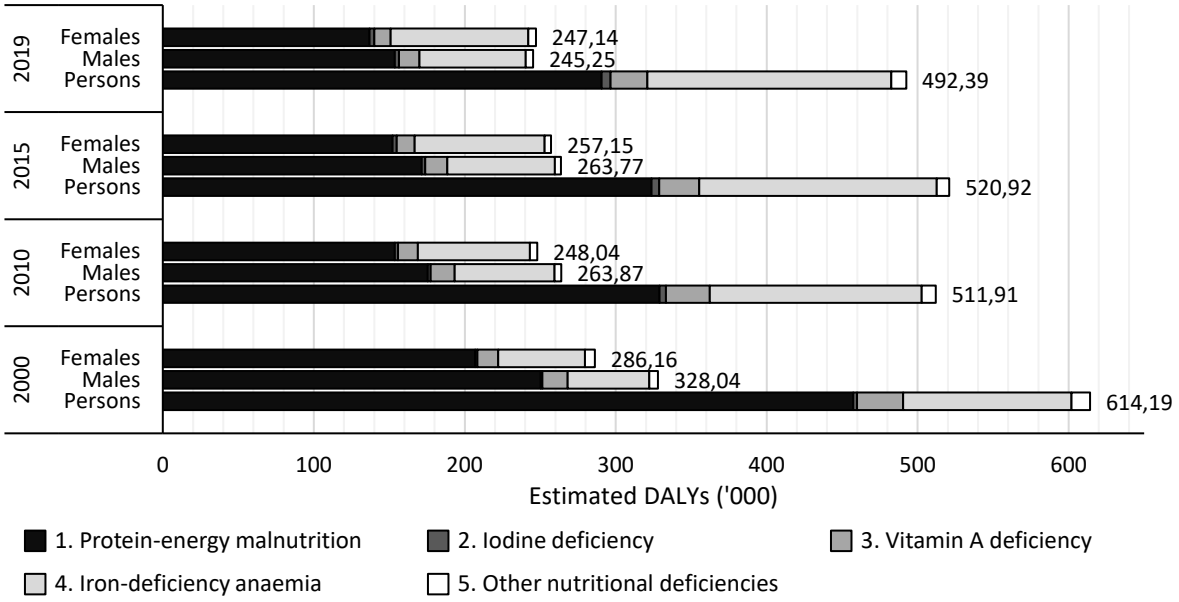

Figure 2. Estimated Disability-Adjusted Life Years (DALYs) ('000), by protein-energy malnutrition (1.), iodine deficiency (2.), vitamin A deficiency (3.), Iron-deficiency anaemia (4.) and other nutritional deficiencies (5.) all persons and by gender, concerning all ages in Kenya, in the years 2000 (population c. 31965000), 2010 (population c. 42031000), 2015 (population c. 47878000) and 2019 (population c. 52574000). The numerical value given is the point estimate for DALYs due to all nutritional deficiencies combined, rounded to two decimal places (WHO, 2020a).

In Kenya, therefore, there seems to be a particularly worrying trend in the prevalence of overweight and obesity. As an association between overweight and obesity and an increased risk of several NCDs has been discovered both more generally in the world and in Kenya as well, these truly are a clear public health challenge. The likelihood of overweight or obesity has previously

been found to be highest in Kenya among women, urban residents, and individuals with high education and wealth (Mkuu et al., 2021). Mbochi et al. (2012) noticed in their study, that among adult women in Nairobi Province, Kenya, there seems to be significantly higher prevalence of overweight and obesity among women as the socio-economic status, age and parity increases. The results of the study seem to indicate, that in the sample of women studied in the high socio-economic groups, both urbanisation and nutrition transition were well established. The women in the high socio-economic groups were found to be living a sedentary lifestyle as well as to consume a diet high in energy, protein, fat, cholesterol, and alcohol and lower in fibre and carbohydrate compared with those in the low socio-economic groups.

Further for example the results of a study by Steyn et al. (2011) give reason to believe, that urbanisation with its associated economic advancement as well as consequent changes in dietary habits are among the most important determinants of overweight and obesity in Kenyan women, as e.g., obesity was found to be more prevalent in urban areas and in higher-income women. The researchers point out, that both the dietary as well as the anthropometric results showed that the nutrition transition was clearly underway in the Kenyan women studied. This can be inferred from the fact that significantly higher levels of overweight and obesity were observed in urban women, combined with the observation of significant differences in dietary intake and distribution of macronutrients, namely increased intake of energy, fat, and saturated fat in the urban group.

The term **nutrition transition** is often considered to include changes in diets (both quantitative and qualitative), patterns of work and leisure, these all seen as causal factors underlying NCDs (WHO/FAO, 2002). The changes in both dietary patterns as well as nutrient intakes are noticed as populations go through social and economic development. In addition to an increase in nutrition related NCDs, nutrition transition has been associated with concomitant increases in obesity (Rousham et al., 2020). The dietary changes associated with nutrition transition in low- and medium-income countries include, for example, reduced consumption of legumes, coarse grains, and vegetables and a shift towards higher consumption of refined carbohydrates, added sugars, oils, and animal-source foods, often called Western diet. This trend can be seen especially in urban areas, but increasingly in rural areas as well (Popkin et al., 2012). It has been considered that Kenya is in an early stage of nutrition transition (Mattei et al., 2015).

Oniang’o and Komoti (1999) pointed out already over two decades ago that there was a transition between traditional and modern lifestyles in process in Kenya. As well the traditional food habits in Kenya have been changing rapidly with social development and modern lifestyle. Kenya has a number of traditional foods and drinks, and one nationally eaten traditional food is called ugali in Kiswahili. Ugali is a boiled or steamed mash made from maize flour, or in some communities in Western Kenya from millet and sorghum flour, and is eaten typically with animal flesh, fish, vegetables, or milk. On the other hand, one modern and foreign beverage consumed by the majority of the people nowadays is tea. Overall, it has been generally thought that the diet Kenyans have traditionally consumed has been more nutritious than what most consume today, unless the current stable foods have not been fortified (Oniang'o & Komokoti, 1999; Mattei et al., 2015). Besides traditional ugali (made from coarse maize, millet, or

sorghum flour) some traditional staple foods that contribute to carbohydrate intake of the Kenyan people include beans, cassava, and sweet potato. Recently there has been a shift noticed from these foods towards more rice and wheat consumption, and the current low-quality staple foods include ugali made from refined maize, refined cereals, and breads, as well as white rice and wheat products (Mattei et al., 2015). Within Kenya there are different food habits, and for example fish, although a stable food at the Coast and in the Lake Basin, has been noticed as being viewed with significant suspicion in both eastern and central Kenya. There are also some food-related taboos in Kenya, with different reasons behind these, and these might have an effect on the nutritional status of people. For example, among the traditional ethnic group of Maasai pregnant women have been advised to avoid fatty foods, and rather drink sour milk, cow's blood, and lots of water, and as well vomit after a heavy meal. The rationale behind this is that this way the baby stays small, and thus a safe birth for both mother and baby is ensured (Oniang'o & Komokoti, 1999).

Mbochi et al. (2012) have stated, that in developing countries overweight and obesity have been neglected because most of the attention has been focused on famine and under- or malnutrition in children. Further they present a warning that if no preventive measures are put in place, the problem will escalate in the future and overburden the health care system. Thus, in addition to the fact that overweight and obesity can be detrimental to an individual's health and well-being, these can also pose challenges at the societal level. Indeed, Kenya has made significant progress in improving the nutritional status of children nationally. When comparing the data from Kenya Demographic and Health Surveys (KDHS) from years 1998 and 2014 it can be seen that the prevalence of underweight in children under five years of age has decreased from 18 to 11%, overweight from 6 to 4%, wasting from 7 to 4%, and the prevalence of stunting has declined particularly significantly from 38 to 26%. Changes in the nutritional status of women over time, on the other hand, do not seem as promising. Although the proportion of underweight (BMI < 18.5 kg/m2) women (age 15–49-years) in Kenya has slightly decreased from around 12 to 9% when comparing the data from 2003 KDHS and 2014 KDHS, the prevalence of overweight (BMI 25–29.9 kg/m2) has increased from 17 to 23%, and obesity (BMI ≥ 30 kg/m2) from 6 to 10% (Central Bureau of Statistics (CBS) et al., 2004; Kenya National Bureau of Statistics (KNBS) et al., 2014). Thus, it seems that the effort that has been seen over the years to promote especially the nutritional status and overall health of children in Kenya has paid off. However, there seems to be a new challenge for the health of women, the mothers of children, possibly emerging at least partly due to the nutrition transition, for there are indications of a shift in malnutrition from under- to overnutrition. This challenge, in particular, we are trying to meet with this health promotion program, still keeping in mind the multiple burdens of malnutrition coexisting.

General description of this intervention program plan

In this health promotion program, we focused on improving the nutritional status and health of the population of Kenya, especially with a view to the Nairobi City County and the villages: Kahawa West, Maziwa, Njathaini, Soweto, Tanners and Pickens there, focusing on mothers of small children. Of the villages, Kahawa West and Maziwa are clearly middle to higher income

areas, Njathaini a low-income area (very poor area), Soweto an informal settlement (slum) area (even poorer area than Njathaini), Tanners a low-middle, middle-income area and Pickens a diverse area including both high- and low-income areas (Kanerva, 2022a).

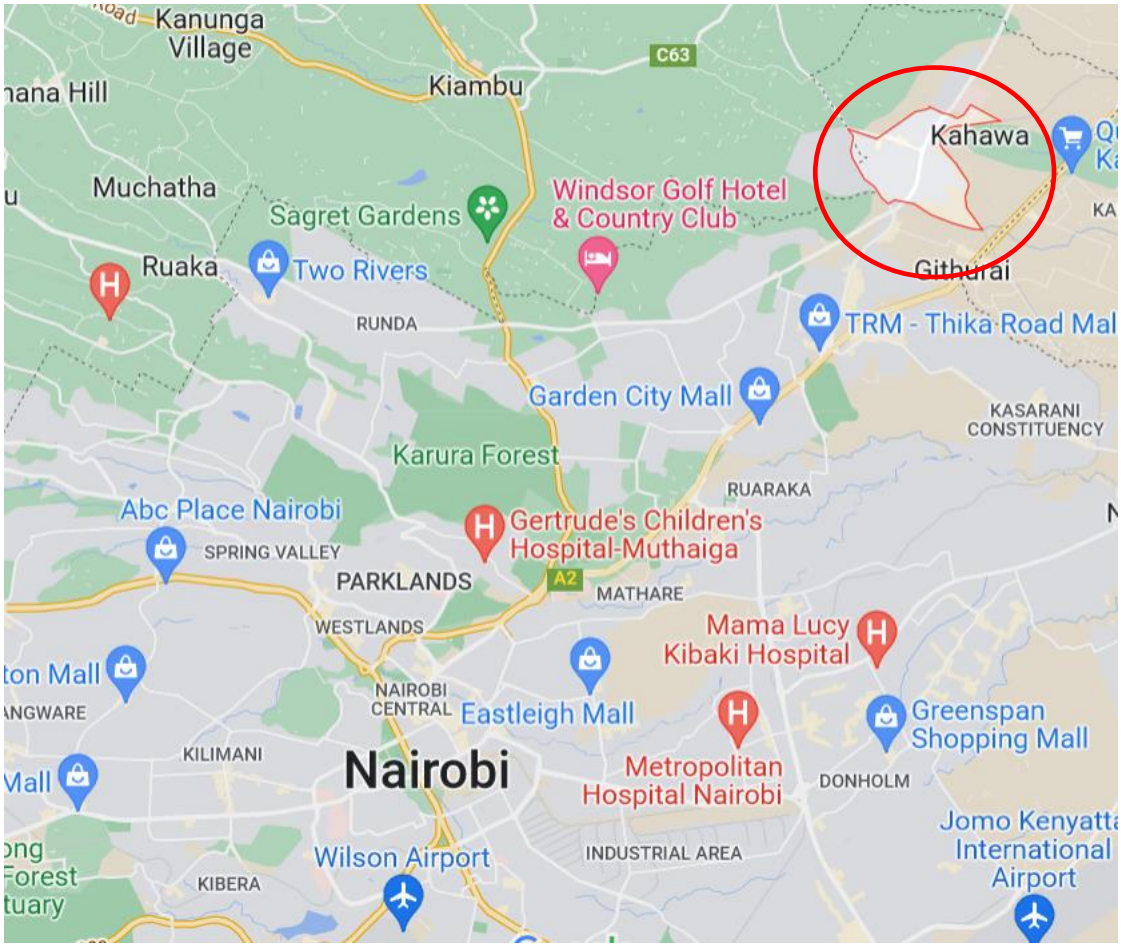

Figure 3. Map of the intervention program target area.

In planning the health promotion program, the intervention mapping steps described by Bartholomew Eldredge et al. (2016) were followed. In the first part of this intervention planning, the needs assessment, the data gathered in the InnoFood Africa Food Consumption Survey in Kenya was utilized. This survey is a part of the work package two (WP2) of the InnoFoodAfrica project, which aims to contribute to improve African diets in prevention of all forms of malnutrition by new diet models and applying nutritional recommendations to develop healthy food. InnoFoodAfrica project is a is a very large-scale project as a whole and explores indigenous climate-smart African crops in Ethiopia, Kenya, South Africa and Uganda, demonstrating the potential of these as healthy food ingredients in combating malnutrition. The focus is on vulnerable groups, including malnourished children, pregnant women and adults struggling with the risk of obesity, and the project will enhance the adoption of nutritionally balanced food consumption in urban Africa. Among other things, it also aims to create new value chains to produce and distribute healthy foods and bio-packaging's from farms to local and export markets (InnoFoodAFrica, 2020).

Although the present health promotion program focuses in particular on promoting the health of mothers of young children through nutrition, it as well aims to involve other family members, such as fathers and grandparents. In addition to the fact that the participation of family members could have a positive effect on their own state of health, it is hoped, among other things, that this will create a supportive environment for the practice of nutrition-related behaviours beneficial to health.

2 Needs assessment

2.1 Social Assessment, participatory planning, and solution analysis

Our social assessment is summarized based on our interview with the mentors from InnoFoodAfrica where we focused on the following areas – food system and accessibility, food environment, nutritional and health promotion programs, and the community's view on possible factors and obstacles related to health outcomes.

Locals do not have their own farms, but rather buy food from open markets dotted around Kahawa West. A central market is present in central Nairobi from which fresh foods and produce are transported to the open markets in Kahawa West. Thus, food accessibility is not seen as an issue. However, concerns are mostly related to food costs which vary depending on food group and environmental factors, including transportation, distance, seasons, and climate. For instance, the price of fish is fairly high due to transportation costs. The most common food items and ingredients include maize, rice, potatoes, and sweet potatoes. In addition, fruits and vegetables are regularly consumed, although the latter is usually eaten cooked as part of a meal. Dairy products, such as skimmed or whole milk, are widely sold in shops or kiosks, and are consumed as is or in sugared chai tea. Chips, fries, and soy-based sausages are considered as junk food and are widely sold in street food carts around Kahawa West. Sugary juice, sodas, and sweets targeted towards children are also sold in kiosks and are frequently purchased and consumed because they are inexpensive. On the other hand, more "Western-type" junk food, such as hamburgers and pizzas, are only sold in restaurants or shopping malls and are not widely available or consumed due to their high prices and inaccessibility.

Some programs to tackle malnutrition in Nairobi already exist. In Kahawa West, some children opt for the school feeding programs in which lunch is provided for the children and usually consist of maize, beans, rice, and vegetables, while other children bring their own meals from home. Current nutritional programs are aimed at children who are facing severe malnutrition, whereby malnourished children are referred to nutritionists and provided with supplementation in the form of fortified porridge. In addition, breastfeeding mothers can also get a referral to a nutritionist where they are offered nutrition counselling for taking care of their young children. However, there have been no programs that specifically targets the mother's nutritional status and health, as well as no programs or intervention plans for overweight and obesity which has been steadily prevalent in the country.

A main characteristic of the intervention mapping approach is participatory planning, which is conducted to understand the needs of the society and the determinants of a health problem. It is recommended that health promotion program planners create partnerships with community members to grasp a clear picture of their needs, behavioural and environmental conditions as well as to determine their strengths and ability to plan and/or conduct an intervention (Bartholomew Eldredge et al., 2016). We have already included participatory planning into our plan by discussing with members of InnoFoodAfrica about the current food environment and nutrition programs in Nairobi. To further strengthen our partnerships with the community, we plan on carrying out the following activities:

- Collecting a program planning team, involving at least Community Health Volunteers, Village Chiefs, and baby health clinic leaders.
- Focus group discussion sessions with community dwellers on their opinions on the growing obesity rate within their community to help us understand their awareness on the topic and establish a baseline to start from.
- Series of workshops with stakeholders to strengthen their knowledge on the health consequences of obesity and methods to tackle the issue, as well as to ensure the feasibility and practicality of the program.

2.2 Epidemiological assessments

The health concerns on which the program will focus on were mainly identified utilizing the data collected in the InnoFood Africa Food Consumption Survey in Kenya. This was a cross-sectional study carried out in Kahawa West area (Nairobi City County) and in Chuka Town, Tharaka-Nithi Country, and in the present project work we concentrated on the data collected in Nairobi City County. In the InnoFood Africa Food Consumption Survey in Kenya, the dietary intake of mothers (aged 29.7 years on average) and their 6–23 months-of-age children were assessed using the Food Atlas, and anthropometrics measured. Also, questions on family's socioeconomic background, food security and food preferences were included in the study (Kanerva, 2022b).

2.2.1 Anthropometric measures

Of the anthropometric measures the height (in cm, nearest 0.1 cm) of mothers was measured with Seca 214 Portable Stadiometer and of children by using a measuring board. Weight (kg nearest 0.1) was measured utilising Seca 877 portable weighing scale with mother/child function, and mid-upper-arm circumferences (MUAC, in cm, nearest 0.1 cm) a non-elastic anthropometric tape (Kanerva, 2022b).

Mothers, Body mass index (BMI)

Body mass index (BMI) is a measure for indicating nutritional status (underweight, overweight and obesity) in adults. It is defined as the weight of a person in kilograms divided by the square of the person's height in metres (kg/m^2) (WHO, 2000). The WHO classification of nutritional status according to BMI is presented in table 1. Even though BMI might not correspond to the

same degree of fatness in different populations, it is nevertheless considered that to achieve optimum health individuals should aim to maintain BMI in the range 18.5–24.9 kg/m^2 (WHO/FAO, 2002). The Ministry of Health (2017) of the Republic of Kenya also instructs the use of the given WHO international classification of BMI when screening for weight categories possibly leading to health problems. In addition, the categories given are pointed out to be suitable for both men and women of all body types and ages (Ministry of Health, 2017).

Table 1. The WHO Body mass index (BMI) cut-off points for defining malnutrition in adults (WHO, 2000, 2004).

Classification	**Body mass index (kg/m^2)**
Obese class III	≥40
Obese class II	35.0–39.9
Obese class I	30.0–34.9
Obesity	≥ 30
Pre-obese	25.0–29.9
Overweight	≥ 25
Normal range	18.5–24.9
Mild underweight	17.0–18.49
Moderate underweight	16.0–16.9
Severe underweight	< 16.0

According to the data, the mothers in the study were on average overweight (pre-obese) in all the other villages examined, except in Soweto, where the mothers were on average normal weight, based on the WHO Classification of adults according to BMI. Looking at income categories (levels), mothers were, on average, overweight in all of these, and the value of the BMI appears to increase as income rises (Figure 4). In total, circa 3% of the participating mothers were underweight (BMI < 18.5 kg/m^2), 65% overweight (BMI > 24.9 kg/m^2) and 30% obese (BMI > 29.9 kg/m^2), according to BMI. Of the villages, the highest prevalence of underweight was observed in Soweto (c. 11%), overweight in Tanners (c. 83%) and obesity in both Maziwa and Tanners (c. 40%). Of the income levels, the highest prevalence of underweight was observed in the lowest income level of < 10 000 ksh (c. 8%), overweight in the highest income level of ≥ 50 000 ksh (c. 74%) and obesity in the income level of 30 000 - 49 999 ksh (c. 41%) (Appendix 1).

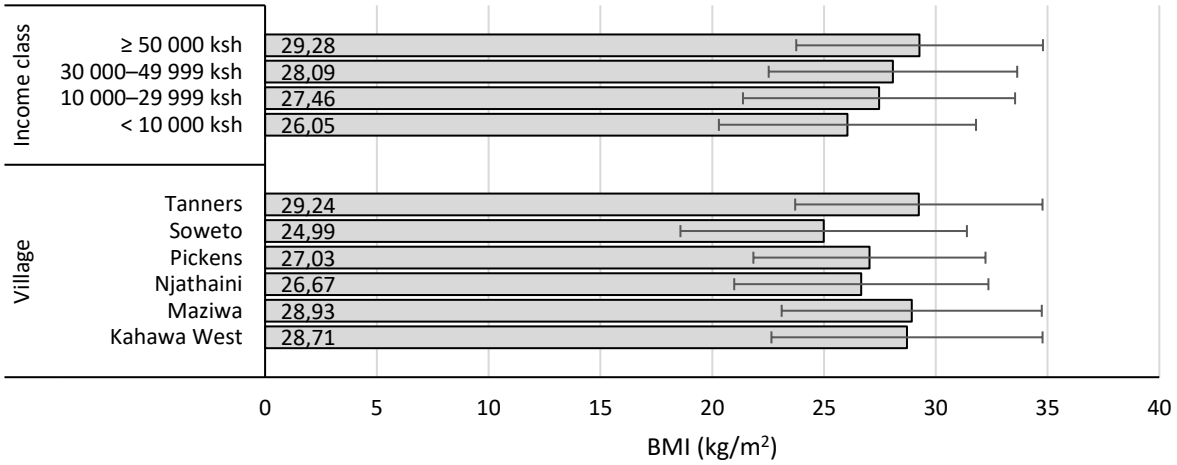

Figure 4. Mean Body mass index (BMI) (kg/m^2) ± SD of mothers (n=211) by village, in alphabetical order, ((Kahawa West, (n=35); Maziwa, (n=35); Njathaini, (n=35); Soweto, (n=35); Tanners, (n=35); Pickens, (n=36)) and the income level (Kenyan shilling, KSh) (< 10 000 ksh, (n=25); 10 000–29 999 ksh, (n=129); 30 000–49 999 ksh, (n=34); ≥ 50 000 ksh, (n=23)).

Similar results concerning the connection between wealth and women's nutritional status have previously been discovered in the 2014 Kenya Demographic and Health Survey (2014 KDHS). There they observed that in Kenya among women aged 15–49-years (n=13 143) underweight seemed to be inversely related to wealth, it being more common among women in the lowest wealth quintile. The proportion of overweight or obese women in turn seemed to increase with increasing wealth, the women in the highest wealth quintile being more likely to be overweight or obese compared to those in the lowest wealth quintile.

Prevalence of underweight (BMI < 18.5 kg/m^2) was higher among rural women (11.2%) than urban (5.5%), and the prevalence of overweight or obesity (BMI ≥ 25.0 kg/m^2), on the contrary, greater among urban women (43.3%) than rural (25.8%). However, in 2014 KNBS, the proportion of women in the county of Nairobi (age 15–49, n=1 517) with BMI less than 18.5 kg/m^2 was found of being 2.8% and proportion of women with BMI equal to or over 25 kg/m^2 47.6%, and according to the data gathered in the InnoFood Africa Food Consumption Survey in Kenya the proportions were 3.3% and 64.9% respectively, looking at the entire sample of Nairobi (average age of the women 28.6 ± 6.3 years, n=211) (Appendix 1.).

Thus, in addition to the fact that the findings on the nutritional status of mothers in this survey are in themselves worrying, they are perhaps even more so when compared to previous findings on the nutritional status of women in the Nairobi County (Kenya National Bureau of Statistics (KNBS) et al., 2014). The finding that the prevalence of overweight and obesity are higher in the higher income classes might partly be explained by the fact that currently only those in the higher income groups may be able to afford food items considered Western. People have only recently been exposed to a Western diet in Kenya and the demand and status of Western foods is still high and affordable mainly to those of higher income (Steyn et al., 2011). However, the fact that in the present InnoFood Africa Food Consumption Survey women were found to be on average overweight in all income classes and most villages, even in the low-income area of Njathaini, is very worrying. In addition, in an even poorer region of Soweto, where the

prevalence of overweight and obesity was lowest of the villages surveyed, the proportion of overweight women was still over 50% (Appendix 1.). **Thus, it seems that overweight and obesity can now be seen in all income classes, not only the higher ones**. This raises doubts as to whether nutrition transition, already considered well established among women of high socioeconomic status, based on previous research, will start to show more in women of lower socioeconomic status as well in the future, as it seems it might have already begun to show (Mbochi et al., 2012).

Mothers, Mid-Upper Arm Circumference (MUAC)

MUAC is easier to implement than BMI and has been used in nutritional evaluation as an indicator of persons protein and energy reserves. MUAC has decent sensitivity and specificity for detecting underweight and it has been as well suggested that MUAC could be used as an alternative to BMI in the diagnosis of obesity and in early detection of overweight in adults (Amegovu et al., 2020). As references Amegovu et al. (2020) have proposed MUAC of greater than 31.1 cm to indicate obesity, MUAC of 29.9 cm to less than or equal to 31.1 cm to indicate overweight, MUAC of 25.4 cm to less than 29.9 cm to indicate normal weight and MUAC of less than 25.4 cm to indicate underweight.

According to MUAC and the classification provided by Amegovu et al. (2020) of the villages in Kahawa West and Tanners the participating mothers could on average be classified as obese, in Maziwa and Pickens overweight, and in Njathaini and Soweto normal weight. Concerning the income levels, the mothers were on average obese in the income level of ≥ 50 000 ksh, overweight in the income level of 30 000–49 999 ksh and in the two lowest income levels normal weight. As with BMI, MUAC also appears to increase slightly as incomes rise (Figure 5).

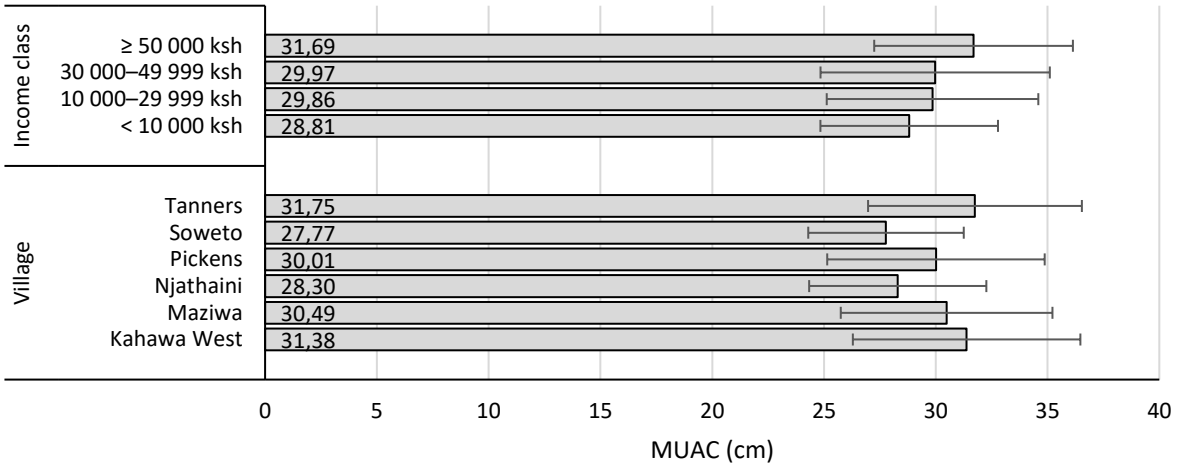

Figure 5. Mean Mid-Upper Arm Circumference (MUAC) (cm) ± SD of mothers (n=211) by village, in alphabetical order, (Kahawa West, (n=35); Maziwa, (n=35); Njathaini, (n=35); Soweto, (n=35); Tanners, (n=35); Pickens, (n=36)) and the income level (Kenyan shilling, KSh) (< 10 000 ksh, (n=25); 10 000–29 999 ksh, (n=129); 30 000–49 999 ksh, (n=34); ≥ 50 000 ksh, (n=23)).

Children, Growth indicators

Growth indicators, such as height-for-age, weight-for-age, and weight-for-height, are used to assess growth and nutritional status considering a child's age and anthropometric measurements together. Height-for-age reflects attained growth in height (or length) at the child's age and can be used to identify children who are stunted due to prolonged undernutrition or repeated illness. Weight-for-age in turn reflects body weight relative to the child's age and can be used to assess if a child is underweight or severely underweight. Weight-for-height on the other hand reflects child's body weight in proportion to attained growth in height (or length) and can be used to identify individuals who may be wasted or severely wasted, and as well those at risk of becoming overweight or obese. These indicators can be expressed as Z-scores, or standard deviation (SD) scores, which are used to describe how far a measurement is from the median (average). A summary of definitions of growth problems in terms of z-scores, as classified by WHO, is provided in table 2 (WHO, 2008).

Table 2. WHO classification of growth and nutritional status based on weight and height indices (WHO, 2008).

Growth indicators and cut off points	Nutritional conditions
Height-for-age <–2SD to –3SD	Stunted
Height-for-age <–3SD	Severely stunted
Weight-for-age <–2SD to –3SD	Underweight
Weight-for-age <–3SD	Severely underweight
Weight-for-height > +3SD	Obese
Weight-for-height > +2SD to +3DS	Overweight
Weight-for-height > +1SD to + 2SD	Possible risk of overweigh
Weight-for-height <–2SD to –3SD	Wasted
Weight-for-height <–3SD	Severely wasted

WHO recommends cut-off values of ± 2 Z-scores to identify individuals with unhealthy growth.

According to the data, the measurements of the children fall on average in the normal range concerning all the growth indicators examined, in both all the villages as well as the income categories inspected (Figures 6, 7, and 8). However, concerning all indicators the standard deviation was partly quite significant and thus, there are indeed individuals among the children participating in the survey with indications of unhealthy growth. In total, according to height-for-age and WHO classification, circa 15% of the participating children could be classified as being stunted, according to weight-for-age 9% underweight and 1% severely underweight, according to weight-for-height 7% wasted, 2% severely wasted, 7% overweight and 1% obese.

Of the villages, the incidence of stunted growth was highest in Soweto (40%), underweight in Njathaini and Soweto (c. 11%), severe under-weight in Maziwa and Soweto (c. 3%), wasting in Soweto (c. 11%), severe wasting in Tanners (c. 6%), overweight in Soweto (c. 17%) and obesity as well in Soweto (c. 6%). Of the income levels, the incidence of all: stunted growth (20%), underweight (16%), severe underweight (4%), wasting (20%) and severe wasting (4%)

were the highest in the lowest income level of <10 000 ksh, overweight in the highest income level of ≥ 50 000 ksh (c. 9%) and obesity in the income level of 10 000–29 999 ksh (c. 2%) (Appendix 1). Thus, it seems that according to the data overall the greatest prevalence of unhealthy growth among the participating children is of the villages in Soweto and of the income levels in the lowest one, i.e., < 10 000 ksh.

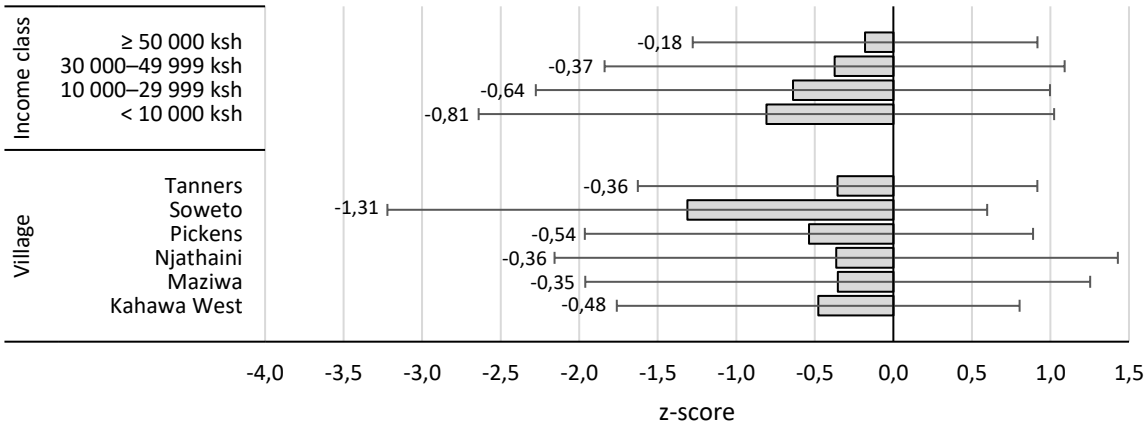

Figure 6. Mean height-for-age z-scores ± SD of children (n=211) by village, in alphabetical order, (Kahawa West, (n=35); Maziwa, (n=35); Njathaini, (n=35); Soweto, (n=35); Tanners, (n=35); Pickens, (n=36)) and the income level (Kenyan shilling, KSh) (< 10 000 ksh, (n=25); 10 000–29 999 ksh, (n=129); 30 000–49 999 ksh, (n=34); ≥ 50 000 ksh, (n=23)).

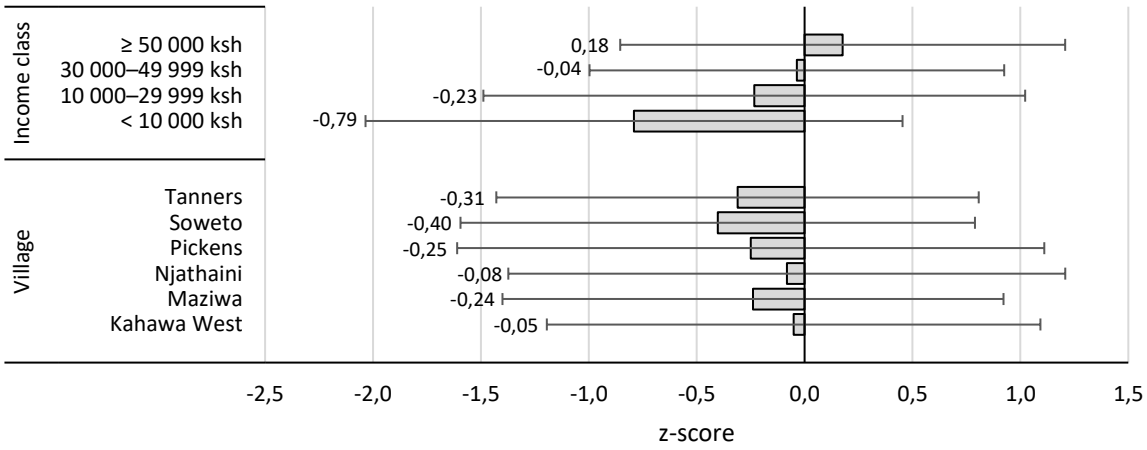

Figure 7. Mean weight-for-age z-scores ± SD of children (n=211) by village, in alphabetical order, (Kahawa West, (n=35); Maziwa, (n=35); Njathaini, (n=35); Soweto, (n=35); Tanners, (n=35); Pickens, (n=36)) and the income level (Kenyan shilling, KSh) (< 10 000 ksh, (n=25); 10 000–29 999 ksh, (n=129); 30 000–49 999 ksh, (n=34); ≥ 50 000 ksh, (n=23)).

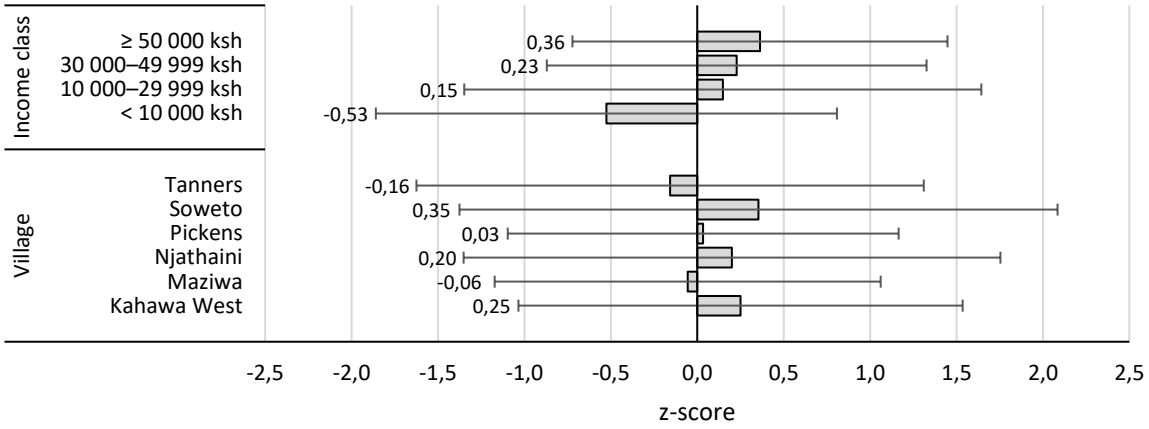

Figure 8. Mean weight-for-height z-scores ± SD of children (n=211) by village, in alphabetical order, (Kahawa West, (n=35); Maziwa, (n=35); Njathaini, (n=35); Soweto, (n=35); Tanners, (n=35); Pickens, (n=36)) and the income level (Kenyan shilling, KSh) (< 10 000 ksh, (n=25); 10 000–29 999 ksh, (n=129); 30 000–49 999 ksh, (n=34); ≥ 50 000 ksh, (n=23)).

When observing the connection between wealth and malnutrition in children according to these three anthropometric indices of nutritional status, it has been previously discovered in 2014 KDHS that stunting and wasting in children, as well as the proportion of underweight children in Kenya (age under 5 years, n=18 986) seemed to decrease as household wealth increases. On the other hand, the opposite was noticed concerning overweight or obesity in children, which seemed to increase with increasing wealth. These results are partly in line with the results from the present survey. In 2014 KDHS in the county of Nairobi it was observed that the proportions of children (under 5 years of age, n=1 643) that could be classified as severely stunted or stunted was 17.2%, severely underweight 1.2%, underweight 3.8%, severely wasted 0.8%, wasted 2.5% and overweight or obese 5.3%, the proportions discovered in the present survey (average age of children 1.2 ± 0.4 years, n = 211) being 14.7%, 0.95%, 8.53%, 1.9%, 6.64% and 7.11% respectively (Kenya National Bureau of Statistics (KNBS) et al., 2014) (Appendix 1.).

Thus, the prevalence of malnutrition in children in this study would appear to be in part somewhat higher than in the previous study, e.g., concerning overweight and obesity, however, bearing in mind that the ages of children in these two studies concerning Nairobi do not exactly match. The prevalence of stunting among Kenyan children remains prominent and it should be noted that this may have an impact on the health of individuals well into the future, as stunting has e.g., been shown to be an independent risk factor for increased BMI with age (Steyn et al., 2011). This combined with e.g., the possible unfavourable effects of urbanization and nutrition transition on people's food behaviour and nutritional status, further raises concerns about whether the prevalence of adult overweight and obesity in Kenya will increase further in the future unless preventive and remedial actions are taken.

2.2.2 Energy and nutrient intakes (24h dietary recall interviews)

The information on dietary intake of both mothers and children was collected by using 24h recall. In the 24h dietary recall interviews (à c. 30 min.) the Photographic food atlas for Kenyan adolescents (9–14 years) was used to aid portion size estimation (Anono et al., 2018). This

includes the most common Kenyan dishes and foods for adults and preadolescents and was validated prior to the main data collection (Kanerva, 2022b). A single day's 24-hour recall was used, and it is considered that this might be adequate providing if the research aim is to identify average consumption in a population, keeping in mind that a single day of intake is not representative of usual individual intake (Willett, 2013). The focus is on the absolute nutrient intakes, but energy-adjusted values are also considered. Adjusting for total energy intake may control for confounding, remove extraneous variation as well as simulate a dietary intervention (Willett et al., 1997). The intake of energy and nutrients were compared mainly with the recommended daily intakes given in the Kenya clinical nutrition and dietetics manual (first and second edition) but if no recommendation was found for a particular nutrient, the Nordic Nutrition Recommendations 2012 were utilized (Ministry of Health2010; Ministry of Health2020; Nordic Council of Ministers2014).

Mothers, Energy and nutrient intakes

The daily energy requirement of an adult may vary between 2100–2950 kcal (to maintain an adequate BMI) and the energy requirement of a lactating woman is 505 kcal / day higher than normal as most of the mothers still were breastfeeding (Ministry of Health2010; Ministry of Health2020). Energy intake was slightly lower (in total on average c. 2097 kcal/day) than recommended for lactating women in all villages and income levels examined (Figure 9). However, the standard deviation in energy intake is considerable, and in addition to the fact that energy intake may be very much too low concerning some individuals, some mothers may exceed the energy intake required to maintain the individual BMI between the limits of 18,5 kg/m^2 to 24,9 kg/m^2 (normal range). In addition, according to Willett (2013) 24-hour recalls have been noticed to underestimate energy intake by circa 10% when compared with observed intake, and underreporting seems to be greater among women and obese persons.

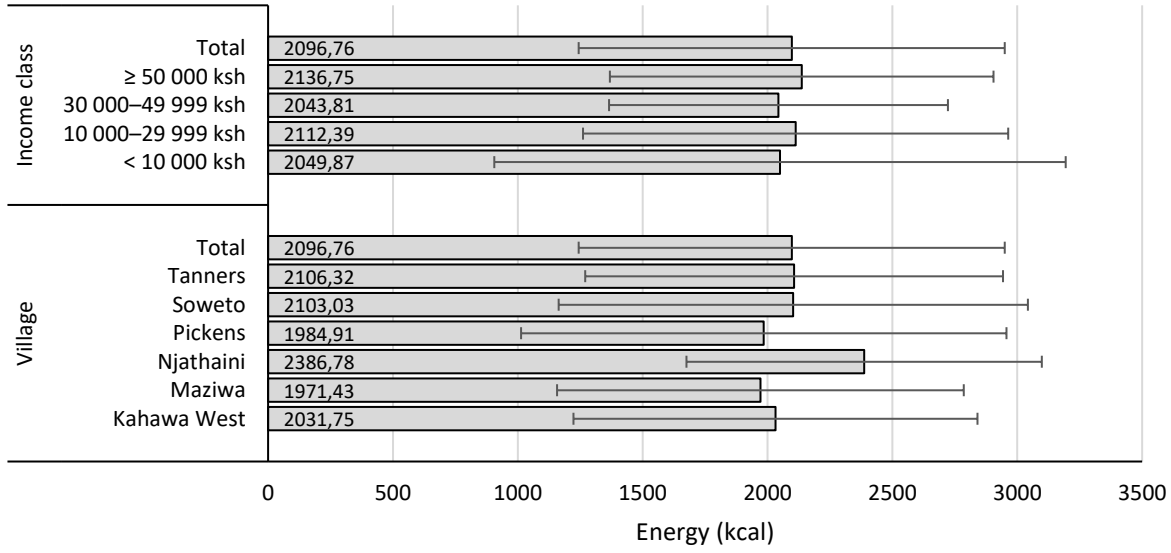

Figure 9. Mean energy intake (kcal/day) ± SD of mothers (n=209) by village, in alphabetical order, (Kahawa West, (n=35); Maziwa, (n=35); Njathaini, (n=35); Soweto, (n=34); Tanners, (n=34); Pickens, (n=36)) and the income level (Kenyan shilling, KSh) (< 10 000 ksh, (n=25); 10 000–29 999 ksh, (n=128); 30 000–49 999 ksh, (n=33); ≥ 50 000 ksh, (n=23)).

When examining the intake of macronutrients as a percentage of total energy intake (E%), it is found that these intakes are, on average, in line with the recommendations in each village and income class (acceptable macronutrient distribution ranges for adults are 45–65% for carbohydrates, 10–35% for protein and 20–35% for fat) (Figure 10). However, the recommended dietary allowance for protein intake (lactation 6–12 months) is 62 g/day, and when comparing to this, according to the research data, the average daily protein intake of mothers is too low, especially when looking at energy adjusted intake (Ministry of Health2020) (Appendix 2). Thus, special attention should be paid to improving protein intake in women. Of the villages, protein intake seems to be insufficient in Kahawa West, Maziwa, Soweto and Pickens, and of the income classes in the two lowest ones (< 10 000 ksh (Kenyan shilling) and 10 000–29 999 ksh).

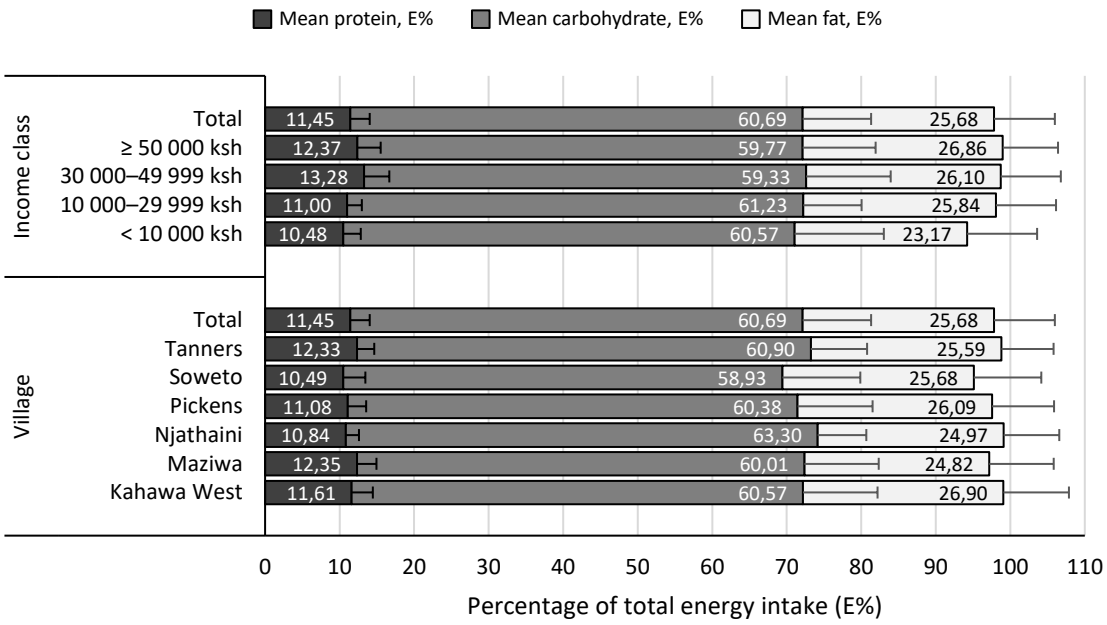

Figure 10. Mean protein, carbohydrate and fat intake (percentage of total energy intake (E%)) ± SD of mothers (n=209) by village, in alphabetical order, (Kahawa West, (n=35); Maziwa, (n=35); Njathaini, (n=35); Soweto, (n=34); Tanners, (n=34); Pickens, (n=36)) and the income level (Kenyan shilling, KSh) (< 10 000 ksh, (n=25); 10 000–29 999 ksh, (n=128); 30 000–49 999 ksh, (n=33); ≥ 50 000 ksh, (n=23)).

Of the maternal micronutrient intakes, both the absolute and energy adjusted intakes in total on average of vitamin A, thiamine, riboflavin, niacin, vitamin B_{12}, vitamin C, calcium, potassium, zinc, and selenium, as well as the energy-adjusted intakes of dietary folate and magnesium were below the recommended intake values for lactating mothers (Appendix 3.). For the other vitamins and minerals considered, the average maternal intake in total would appear to be in line with the recommendations based on the data. However, the standard deviation was particularly high for some nutrients. The low average intake of mothers compared to the recommendations for several nutrients, as well as the fact that the energy intake was on average lower than the recommended, would suggest that perhaps more attention should be paid to the quality of women's diet rather than the quantity of food eaten.

Children, Energy and nutrient intakes

The recommended daily energy intake for children 1–3 years is 1300 kcal (Ministry of Health2020). Energy intake was lower (in total on average c. 1135 kcal/day) than recommended for 1–3-year-old children of the villages in Kahawa West, Njathaini, Soweto and Pickens, and in all the income levels examined (Figure 11). On the other hand, the average energy intake of children in the villages of Tanners and Maziwa seems to be just slightly higher than recommended. It should as well be noted that the standard deviation in energy intake is considerable, and thus, among the children who participated in the survey, there were individuals whose energy intake has been either too low or too high compared to the recommendations.

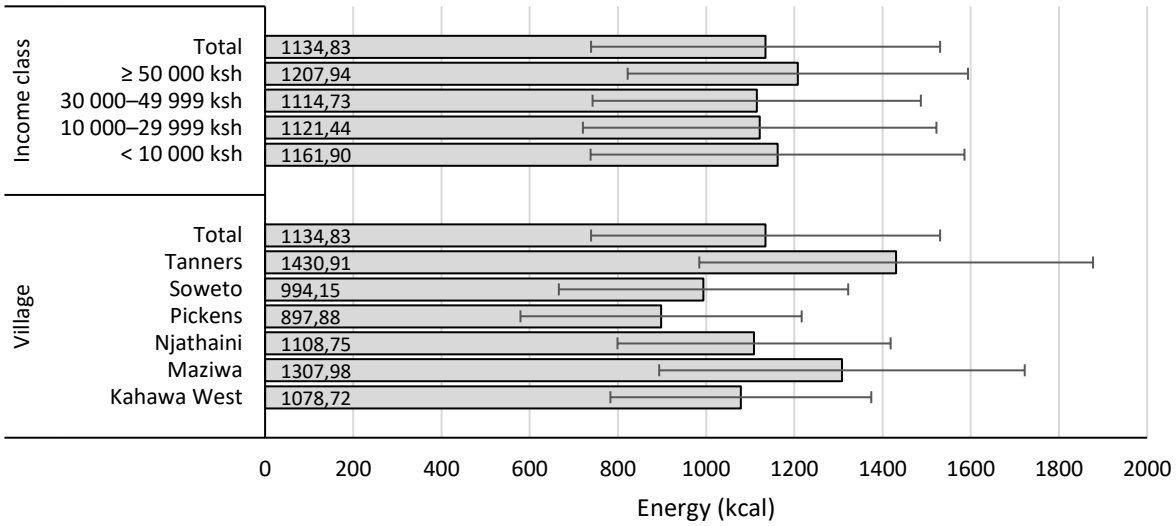

Figure 11. Mean energy intake (kcal) ± SD of children (n=207) by village, in alphabetical order, (Kahawa West, (n=35); Maziwa, (n=34); Njathaini, (n=35); Soweto, (n=34); Tanners, (n=34); Pickens, (n=35)) and the income level (< 10 000 ksh, (n=25); 10 000–29 999 ksh, (n=125); 30 000–49 999 ksh, (n=34); ≥ 50 000 ksh, (n=23)).

When examining the intake of macronutrients as a percentage of total energy intake (E%), it can be seen that these intakes are, on average, in line with the recommendations in each village and income class examined (acceptable macronutrient distribution ranges for young children (1–3 years) are 45–65% for carbohydrates, 5–20% for protein and 30–40% for fat) (Figure 12). As well the protein intake as g/day seems to on average be in line with the recommendations (recommended daily protein intake for children 1–3 years is 16 g/day) (Ministry of Health2020) (Appendix 2.).

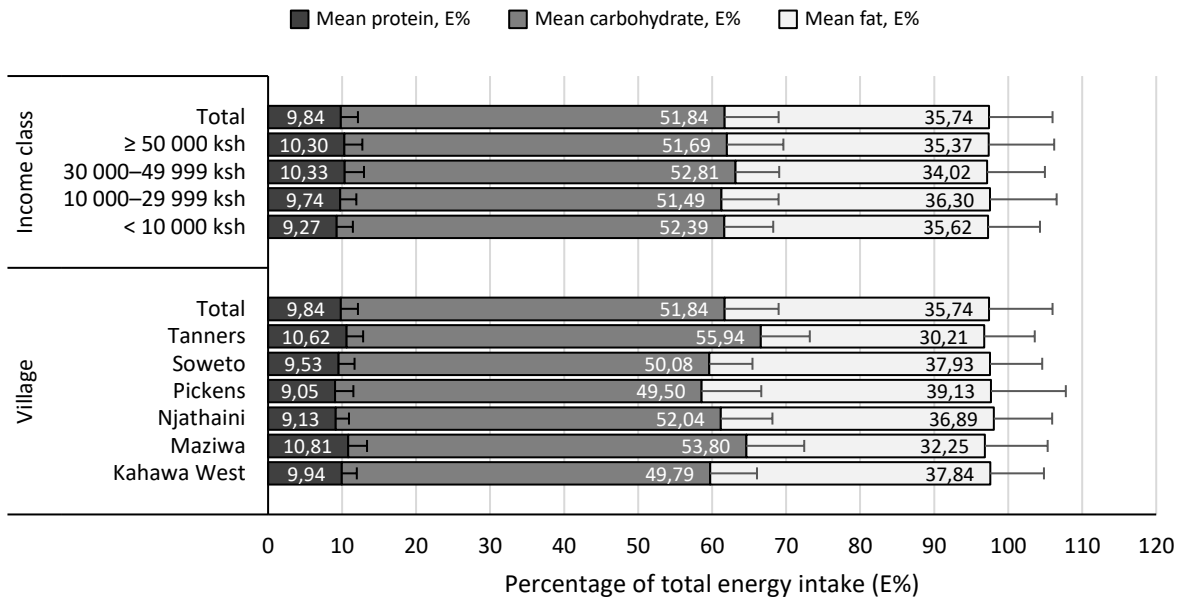

Figure 12. Mean protein, carbohydrate and fat intake (percentage of total energy intake (E%)) ± SD of children (n=207) by village, in alphabetical order, (Kahawa West, (n=35); Maziwa, (n=34); Njathaini, (n=35); Soweto, (n=34); Tanners, (n=34); Pickens, (n=35)) and the income level (Kenyan shilling, KSh) (< 10 000 ksh, (n=25); 10 000–29 999 ksh, (n=125); 30 000–49 999 ksh, (n=34); ≥ 50 000 ksh, (n=23)).

Children's intake of micronutrients from the diet appears to be more in line with the recommendations than their mothers. Of the micronutrient intakes of children, only the intakes in total on average of niacin, iron, phosphorus, and zinc were below the recommended intake values for 1–3-year-old children, both the absolute and energy-adjusted ones (Appendix 3.). However, the recommended intake of phosphorus for children given by the Ministry of Health (2020) is quite high (800 mg) when compared to the one given by Nordic Council of Ministers (2014) (470 mg for children of 12–23 months of age) and thus, the average intake may very well be sufficient. For the other vitamins and minerals considered, the average intake in total would appear to be in line with the recommendations based on the data. Again, it has to be noted that the standard deviation was quite high for some nutrients. In addition, most of the children in the survey still were breastfed, and in 2014 KDHS for example stunting was found to be most prevalent among children aged 18–23 months, and wasting in the age groups of 6–8 months and 9–11 months, which could be an indication of that there might be room for improvement in the both quality and quantity of complementary foods, as well as perhaps e.g., hygiene practices (Kenya National Bureau of Statistics (KNBS) et al., 2014).

2.2.3 Consumption of foods and nutrient intakes from food groups

Based on the food frequency questionnaires (FFQs) regarding the diet for the past seven days, wheat and maize products and rice-based dishes are very commonly used among the mothers: 97%, 98%, and 96% of the mothers, respectively, reported using them during the past week. On the other hand, millet and sorghum were not common, and only 27% of the mothers reported their use during the past seven days. Millet and sorghum are traditional staple foods in Kenya and also more nutritious compared to wheat and maize, especially for iron, zinc, calcium, and

dietary fibre (Orr et al., 2016). Vegetables and fruits were used by 100% and 97% of the women during the past week, respectively. Also, beans, lentils, and githeri were used by 93% of the participants. Regarding meat, fish, and dairy products, majority of the participants reported using meat, offal, chicken, and eggs (90%) and milk products (78%), whereas fish was used only by 29% of the respondents. For fats, all the mothers had used vegetable fats during the past seven days and only 7% had used butter. Sweets and snacks were used commonly (by 95% of the women) but sweetened drinks or fast-food were consumed by less than half of the mothers (47% and 31%, respectively).

It should be noted, that even though the overall usage (i.e., whether or not the participants had consumed the foods during the past seven days) of the foods and food groups were relatively consistent between the participants, there was quite a lot of variation in the used quantities for most food groups. Thus, there are big individual differences in the amounts different foods and food groups are consumed. However, in the discussions with the mentors, it was found out that the mothers in the population may have a general tendency to consume unnecessarily large portion sizes.

Based on the data from 24-hour dietary recall interviews of the participating mothers, fish dishes and meat and eggs were important food groups for protein intake. However, only relatively small proportion of the women reported using those food groups during the interview day. Also, maize dishes, legumes, ugali and other porridges, and other types of cereal products and dishes were important protein sources. For carbohydrates, ugali and other porridges, bakery products, and rice dishes were significant sources, as well as fried potatoes, chips and popcorn for the rather small number of women that had used them in the interview period. For fat, chapati, fried potatoes, chips and popcorn, and fish dishes were prevalent sources, again for the relatively small proportion of respondents that had used them. Thus, it was difficult to interpret the food groups of the most actual importance from the data.

2.2.4 Food security

The study participants responded in a questionnaire about their experienced food security. Food insecurity experience scale (FIES) by FAO was used, consisting of eight questions about the experienced food insecurity during the past 30 days. According to the results, over 40% of the mothers reported experiencing at least some level of food insecurity. The food insecurity seems to concern both the amount and variability of the food. For instance, 41% of the women had worried their household did not have enough food, and 16% of them had had the concern often, more than ten times, during the past month. Also, 46% of the participants reported someone in their household had eaten food they did not want to eat, due to insufficient resources to obtain other types of food. Furthermore, 20% of the mothers answered there had been a situation with no food at all in the household, and that some household member had gone a whole day without eating because there was not enough food. Thus, even severe food insecurity was reported in a remarkable proportion of the participating families.

Food insecurity is still a prevalent problem in Kenya in general, even though the food security of the households has improved during the last decades (Ministry of Health, 2018). The reasons for food insecurity include high food prices, ineffectiveness of the agricultural production, and effects of the climate change and seasonal variation, as for example drought years have a significant effect on the food production. However, in a big city like Nairobi, the resilience towards the production-related fluctuation is most probably better compared to more rural areas.

2.3 Behavioural assessment

In health promotion program planning, individual level of needs assessment focuses on the factors and reasons why target group individuals *behave* in a certain way, for example in such resulting in higher risk for health problems. Behavioural determinants in social and behavioural sciences can be explained as positions towards a certain behaviour. Behavioural determinants are often internalized schemas or beliefs, affecting the behaviour either in a more constant manner or being situation dependent. Some determinants are also highly overlapping, due to for instance different theoretical backgrounds, and in the process of intervention planning, it is necessary for the planner to make educated choices based on available literature and data, on which determinants they choose to operate with.

Even though individual determinants are often described as intrapersonal factors, they are more complex result of upbringing and education, cultural socialisation, and other interpersonal interactions and relations (Chadwick & Crawford, 2013). In nutritional behaviour research, especially economic and environmental determinants are also highly connected to the habitual nutrition (Gedrich, 2003.) Based on a principal conceptualization of psychological determinants of human behaviour (Woodworth, 1926), the *S-O-R-model* has also been applied to nutritional, and especially food-purchasing behaviour. In the S-O-R-model nutritional choices are seen result of a sequence of *stimulus* perceived by an *organism* that produces a certain *reaction* based on activating processes such as emotions or cognitive processes such as learning (Dörnyei & Gyulavári, 2015).

Different theoretical models for intervention planning recognize and emphasize different number of determinants, and they often draw their theories from the core literature of behavioural sciences, as well as sociology, and psychology. Bandura's *Social Cognitive Theory* (Bandura, 1977) is one of the most fundamental theories used in the behaviour intervention research. Alike, *the Theory of Reasoned Action,* and its adaption *Reasoned Action Approach (RAA)* (Hale, et al., 2012) and the *Health Belief Model* (Bartholomew Eldridge, et al., 2016.) are examples of widely accepted and used theories to conceptualize the behavioural determinants.

Other theoretical frameworks, such as the *Transtheoretical model of health behaviour change* (Prochaska, 1997), focus on the different stages of health behaviour modification. In our work of determining the factors for nutritional behaviour of the target population, we utilized the approach of *Intervention mapping,* as described according in Bartholomew Eldridge and their associates (2016). Their description of different determinants identified in health behaviour intervention research is extensive and emphasizes the importance of thorough literature review

of both theoretical and evidence-based, as well as qualitative and quantitative material in the process of choosing determinants for the intervention planned. (Bartholomew Eldridge, et al., 2016.)

For a justifiable, ethically sustainable, and successful health promotion program planning, establishment of most important behavioural determinants is fundamental. Increasing evidence suggest, that interventions and programs based on thoroughly internalized social and behavioural theories are more effective than those lacking theoretical background. (Glanz & Bishop, 2010; Dumas et al., 2017.) Without theory- and evidence-based information on the reasons of behaviour, implementation of a program will lead most-likely to poor communication and allocation, and most importantly, a situation where the consequences and results of the program cannot be measured or evaluated. Different theories provide tools and methods for targeting specific determinants, and each step of the program development from defining the problem and identifying determinants to selecting theory-provided methods and applications, should be justified via utilization of most suitable theories. (Sherard et al., 2021)

We began the identification of the most important behavioural determinants for our program with a literature review on research conducted on nutritional behaviour and determinants recognized important in nutritional behaviour. Review of peer-reviewed research and systematic review articles provided us with a considerable amount of international data from behavioural and nutritional research (see f.ex., Guillaumie et al., 2010). We then limited our inspection to those articles with a perspective of behavioural change intervention or program.

Eleven determinants were identified in the initial revision and selected for further processing. At this point, we limited our selection to those determinants with both changeability and importance for behaviour in the context of our program (Bartholomew Eldridge, et al., 2016). This resulted in narrowing our inspection to final three determinants of *knowledge, skills* and *perceived susceptibility.* Chosen determinants are defined more comprehensively later in this report and used in defining exact performance and change objectives for our program of preventing obesity in Nairobian mothers.

2.4 Environmental assessment - Physical environment

The environmental analysis comprises aspects in the social and physical spheres which impact health problems directly or as previously mentioned, by behavioural causes. In the former, the environment may affect directly, for instance with school cafeterias selling a wide variety of energy-dense products. In the latter, it may do it indirectly through behaviour, for instance, through social norms promoting unhealthy eating among peers (Bartholomew Eldridge et al., 2016).

The next important step is to identify the personal determinants of behaviour and the individuals that could affect the environmental conditions (e.g., environmental agents). Personal determinants encompass knowledge, attitudes, beliefs, values, perceptions, and skills that shape behaviour (Bartholomew & Mullen, 2011; Green & Kreuter, 2005). However, when completing the

assessment, a common concern is the place to start in the logic model development. For example, as agencies are often funding planners to address one disease or risk, they may be directed to perform the analysis in terms of the funding or employer's objectives. In those cases, the assessment would be performed at the behavioural-analysis phase. Regardless of where the assessment begins, all the phases (relation of quality of life included) should be covered, especially as health is related to quality of life, and behaviour and environment are related to health (Bartholomew Eldridge et al., 2016).

To start the assessment, the first elements to consider are the health problem and the study population (population at risk). In this regard, the population needs to be epidemiologically and demographically defined. Then, to establish the intervention, the environmental context needs to be covered. The environment, as previously mentioned, can influence directly or indirectly.

Four levels of the environment should be considered interpersonal, organisational, community, and societal. Interpersonal environment refers to individuals or groups likely to influence the population's behaviour (i.e., family members, teachers, etc.). Organizations imply systems with common goals and specific decision-making processes (i.e., schools, hospitals, companies). A geographic community represents a social space shared by individual units like families and neighbourhoods, and organizations, where they link together in social networks. Therefore, communities (including environmental elements) can contribute to either causes or solutions of the health problem (Institute of Medicine, 2002; Economos, 2007).

In addition, demographic boundaries (i.e., socioeconomic status, gender, age) and demographic-ethnic boundaries (i.e., American European, African American) should be considered. The focus should be that populations and communities are properly defined in the process. Societies, then, are wider systems with the ability to rule several aspects of life and development of their own systems, for instance, provinces, states, countries, and multinational structures (Bartholomew Eldredge et al., 2016).

After that, the environmental factors shaping health directly through disease-causing exposures or indirectly through health-related behaviour influence should be covered. Thus, the PRECEDE model may help identify the problem, environmental levels, and the stakeholders to address it (Foster-Fishman, Nowell, & Yang, 2007). It is important to mention that the ecological levels (interpersonal, organizational, community, and society) may affect individual behaviour and lower levels of the environment as well. To illustrate this, a lack of incentives for preventive care at the organizational level may result in the absence of preventive talks during interactions with patients (interpersonal level). Moreover, recent research on the effects of the environment in physical activity has found an association between physical environmental factors in the community (i.e., access to trails, sports halls, etc.) and engagement in physical activity (Ferdinand, Sen, Rahurkar, Engler, & Menachemi, 2012; Taylor et al., 2014).

Finally, it is necessary to identify the determinants of behaviour, which can be then modified by the development of interventions. In a previous example looking for determinants, key barriers to engaging in physical activity among employees in the UK were analysed. The main

results included lack of time, competing demands, lack of motivation, lack of control, negative consequences related with exercising (i.e., being sweaty, getting tired) (McEachan, Lawton, Jackson, Conner, & Lunt, 2008).

Considering our study population, the environmental factors to be considered would be the low monitoring of nutritional status, limited nutritional counselling from health care providers, low policies on nutritional education, the recent addition of a Food Atlas explaining portion sizes and food items, income and living conditions, food accessibility and environment, physical activity, and the prevalence of HIV/AIDS and its association with underweight in many communities. Consequently, the determinants could be health care providers' (nutritionists or dietitians) lack of skills, comfort, & self-efficacy, lack of time in health care visit, policy makers' beliefs about healthy and unhealthy eating, individuals' lack of connectedness to the Food Atlas and portion sizing, long distances that need to be covered in order to access some types of foods, and finally, the still prevalent perception that being underweight or being slim is associated with HIV/AIDS. Food environment and physical activity environment are important factors for individual health. However, they are difficult to change and thus they will not be addressed in the scope of this intervention program, focusing on nutrition.

3 Preparing matrices of change objectives

Our scope in developing a health promotion program is limited to target the mothers of small children in Nairobi Kenya. Available anthropometric measurements of the mothers showed that nearly 65% of all the 209 women in the data were overweight (BMI < 24.9), and 30% of the women were obese (BMI <29.9), and only 3% of the women being underweight (BMI <18.5). These observations were thought-provoking when compared to the nutritional intake of the mothers, which was an average of 2097 kcal per day and appearing to be in line with the Kenyan national clinical nutrition and dietetics reference manual (Ministry of Health, 2010).

In comparison to the mothers in the data, children in especially lower income families (<30 000 ksh) were in risk for malnutrition with every tenth child having their weight-for-height score <-2 SD. Though this number is relatively low, it could be speculated whether this observation is due to, at least to some extent, the double burden of malnutrition. The double burden of malnutrition refers to the consequences of rapid economic development and nutritional transition in lower and middle economy countries, that leads to widespread availability of cheap, processed foods. This manifests as increased overweight, decreased physical activity, but also a prevalence of malnutrition in population, and even in same households. The double-burden of overnutrition and undernutrition has also been studied in Kenyan context, and for example a study from 2014 demonstrated that there was a significant prevalence of child malnutrition and mother obesity in urban areas of the country (Masibo, et al., 2014).

We aim to help the mothers to gain more useful nutritional *knowledge*, as research has suggested, that malnutrition is often result of lacking nutritional knowledge and competence to use it, rather than food deficiencies (Naghaspour, 2020). Nutritional knowledge will also increase

their *perceived susceptibility* and understanding of how nutrition relates to health and illnesses, and to understand their risks in developing obesity and related health problems. Through education, mothers and their extended families are also expected to develop beneficial *skills*, that they can demonstrate. These skills include, for instance, planning and preparing nutritious meals, for them and their families.

These aims will not only benefit the mothers, but also entire families and households, since adequate nutritional knowledge and competence of the families will help them in preventing weigh-gain and obesity but also to prevent malnutrition and related developmental issues in children. As stated earlier, it is important to recognize the different burdens of malnutrition in even the same communities and families, and this is also taken into consideration in this program.

The more imminent program goals are first presented in Figure 13 below and written out with the means required for measuring the changes in behaviour and nutritional status of the mothers participating in the program.

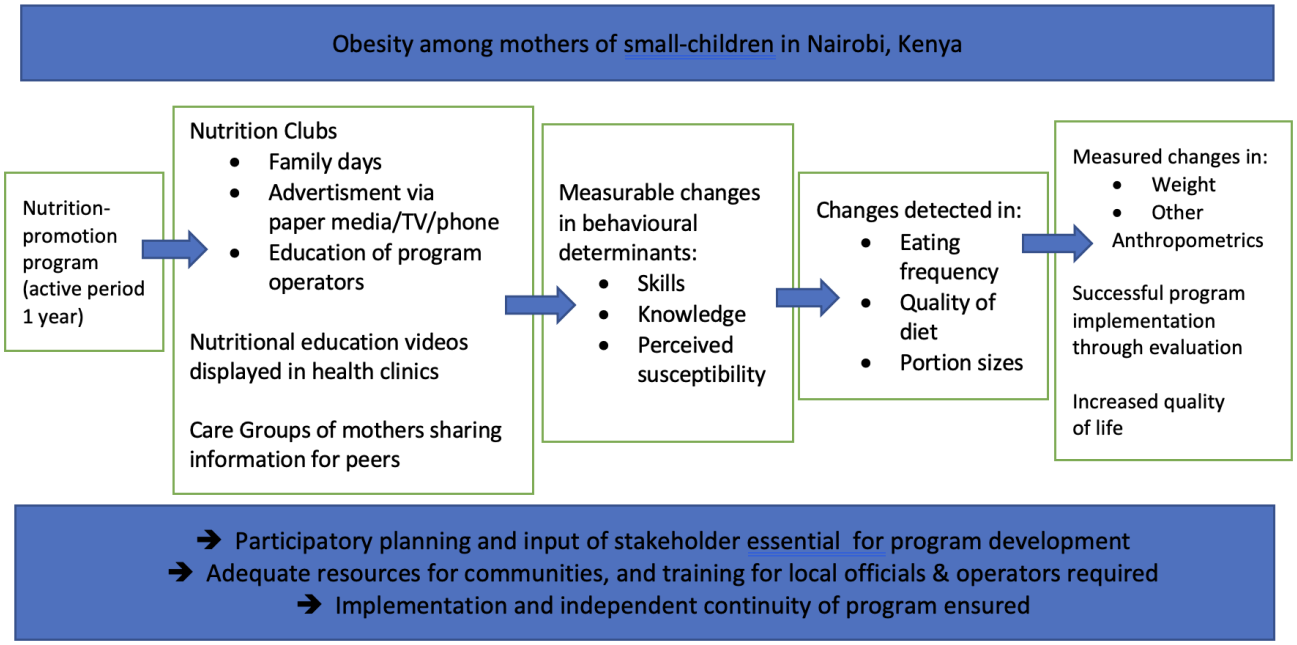

Figure 13. Logic Model of Change.

3.1 Expected changes in behaviour and environment and program goals

The long-term goal of this program is to prevent and reduce obesity in mothers of Kenya, Nairobi City County, especially concerning the villages: Kahawa West, Maziwa, Njathaini, Soweto, Tanners and Pickens. More imminent *program goals*, expected to be reached during active period of the program, are *1) changes in the portions sizes eaten, 2) changes in quality of diet*, with latter meaning less energy dense foods consumed, more micronutrient dense foods consumed, and changes observed in quality of fat and carbohydrates consumed.

Changes in portion sizes and quality of diet will be measured with food frequency questionnaires and adherence to a healthy diet index, as measurable observations enable the evaluation of how the program goals have been met. Below, in Table 3, these two program goals are further divided into steps and their intermediate targets, that are measured to determine success in meeting the goals.

Table 3. Stepwise program goals

Step	**Intermediate target**	**Measurement**
1st step	Successful program implementation	Nutrition Clubs organised according to the plan
2nd step	Changes in behavioural determinants	Questionnaires to address development of knowledge, skills & perceived susceptibility
3rd step	Success in meeting the performance objectives	Food Frequency and healthy diet index -questionnaires
4th step	*Changes in indicators of obesity*	*Body weight and other anthropometric measures (height, waist circumference, MUAC)*

** Changes in indicators of obesity are not expected to be necessarily visible during the active program period, as they make take more time to occur. This step is not necessary for the success in meeting program goals, but for the continuous evaluation, the anthropometric will be measured in the end of the program.*

3.2 Important and changeable determinants of health behavioural and environmental outcomes

Maternal overweight and obesity are complex, multifactorial phenomena involving interaction between genetics, hormonal status, behavioural determinants, socioeconomic and educational status, and environmental conditions. Other separate factors related to maternal obesity have been identified to be at least smoking, marital status, and duration of breastfeeding (Nurul-Farehah & Rohana, 2020.) Thus, understanding reasons for people performing in way potentially leading to these conditions must be studied thoroughly with quantitative and qualitative means in their context of exact place and time.

Based on the familiarization with provided data on nutrition intake and background factors of Nairobi-based mothers and published research articles on determinants of nutritional behaviour, we chose three most important factors for the individual level of our program. Determinants chosen, *knowledge, skills, and perceived susceptibility,* are defined in the context of our target population in Table 4 below. These individual level determinants were chosen based on the lack of their positive effect on the current behaviour of mothers, as well as for their importance for the behavioural change that is pursued for in the program.

Table 4. Most important determinants of behaviour change, and their descriptions.

Knowledge (according to the Social Cognitive Theory, see Mitchie et al., 2008)	Knowledge about nutritional recommendations, diet-disease-relationships, sources of micro- and macronutrients (De Vriendt et al., 2009)
Skills (according to the Information-Motivation-Behaviour Skills Model, see Fleary et al., 2020; Fisher et al., 2003)	Abilities to practically plan, budget, handle, prepare, and safely store foods and meals. Also, competence in using acquired knowledge in preparing versatile meals meeting nutritional recommendations (Garcia et al., 2016)
Perceived susceptibility (according to the Health-Belief Model, see Rosenstock, 1982; Conner & Norman, 2022)	Awareness of one's health-status and risks in developing other or further health problems. Understanding the importance of proper diet for prevention of obesity and its effect on health, and complications of non-adherence to a healthy diet (Nooriani et al., 2019)

3.3 Matrices of change objectives

The matrices of the identified performance objectives, together with the change objectives related to each determinant, are presented below in tables 5 and 6 at individual and interpersonal / societal / community level, respectively.

Table 5. Matrix of performance and change objectives at individual level.

Performance objective	**Knowledge**	**Skills**	**Perceived susceptibility**
PO1: Mothers consume the appropriate portion sizes according to their lifestyle by reducing the amount of food and adjusting different food components on their plate to meet a balanced diet	CO.K.1: Mothers learn the appropriate portions sizes for their lifestyle and how to adjust the food groups and portion sizes accordingly	CO.S.1: Mothers are able to visualize and compose a meal with appropriate portions of different food groups	CO.P.1: Mothers understand how skewed intake of food groups can contribute to obesity and health problems in long term
PO2: Mothers improve the quality of their diet by decreasing energy density, increasing micronutrient density, and improving the quality of fat and carbohydrates in their diets	CO.K.2.1: Mothers know the effects of foods that have high energy density, such as food products high in fat and added sugar, in the diet CO.K.2.2: Mothers are aware of common foods and beverages with high energy density CO.K.2.3: Mothers know the importance of adequate nutrient/micronutrient intake	CO.S.2.1: Mothers are able to identify and prepare healthy meals, beverages and snacks CO.S.2.2: Mothers are able to evaluate the quality of food products and beverages (e.g., read and understand food packaging labels if provided)	CO.P.2.1: Mothers understand that excessive energy intake leads to overweight and obesity, which increase the risk of adverse health effects (such as type 2 diabetes, cardiovascular diseases, some forms of cancer, and musculo-skeletal disorders) CO.P.2.2: Mothers understand that nutrient deficiencies can cause serious health issues and that a deficiency in any micronutrient can cause even life-threatening conditions

Table 6. Matrix of performance and change objectives at interpersonal / societal / community level.

Performance	**Knowledge**	**Skills**	**Perceived susceptibility**
PO1: Community Health Volunteers (CHVs) perform screening for overweight and share information on healthy diet and weight	CO.K.1.1: CHVs know the importance of healthy diet and healthy weight (compared both with under- and overweight) and actively share it with the mothers CO.K.1.2: CHVs know the building blocks of a healthy diet CO.K.1.3: CHVs know the importance of appropriate portion sizes	CO.S.1.1: CHVs have the capability to advise mothers and other family members about healthy diet and how to maintain / retrieve healthy weight CO.S.1.2: CHVs can openly communicate with mothers and encourage routine conversations about health effects of overweight/obesity	CO.P.1.1: CHVs understand the connections between diet and health
PO2: Community Health Volunteers (CHVs) receive workshops/trainings with experts to strengthen their knowledge and skills in order to better guide the mothers towards healthy diet and weight	CO.K.2.1: CHVs strengthens and/or their knowledge on nutrition, including healthy diet and healthy weight	CO.S.2.1: CHVs have the skills to support and sustain the intervention program CO.S.2.2: CHVs are able to judge the appropriate portion sizes	-

4 Selecting theory-informed intervention methods and practical applications

A theory- and evidence-based change method is a general technique for influencing the determinants of behaviours and environmental conditions while practical applications refer to delivery of the methods to fit the intervention population and the context in which the intervention will be conducted. In the previous chapter, we have detailed the matrices of performance and change objectives. Using those, in this chapter, we will conceptualize and design our intervention program.

Nutrition club model

First and foremost, we plan on using a *Nutrition club* model to help us achieve the change objectives stated previously. The program will conduct discussion sessions, facilitated by Community Health Volunteers, where mothers come together to share their experiences and concerns not only about their daily lives but also regarding nutrition. Some discussion sessions will be more informative while others are more interactive to align the activities with our goals:

- Informative discussion session topics:
    - How to eat healthily with a small budget
    - How to cook balanced meals at home
    - How to share food in the home based on needs, that is, how to appropriately portion food to meet the needs of e.g. children, pregnant women, or those performing daily physical labour
    - Food hygiene
    - Seasonal meal planning
- Interactive discussion session activities:
    - Pictures to illustrate appropriate portion sizes
    - Plating of food during cooking classes for a more interactive approach for mothers to practice estimating portion sizes
    - Cooking classes where mothers learn new recipes based on seasonal ingredients and/or learn recipes from one another

Social and behaviour change communications (SBCC) is an approach that is designed to bring about individual and/or societal change and is typically used at the individual, interpersonal and community levels (UNICEF, 2022). The adoption of the SBCC approach can result in greater community mobilization by involving not only the mothers but also others at the household and community levels, such as fathers and grandmothers, and village Chiefs. By doing so, support for the mothers is shown, importance of the program is emphasized, and dissemination of nutrition knowledge is increased, further promoting the effectiveness of the intervention. Our plan to involve other community members in the intervention include:

- Nutrition club “Family day” sessions where families, Community Health Volunteers and village Chiefs get together and discuss the topics mentioned above. “Family day”

will be arranged at the church on a Sunday after mass, when families are already gathered. The village Chiefs will be encouraged to join, and pastors will be involved, both acting as program champions. Here, mothers will have the opportunity to showcase and/or teach their families about nutrition and portion sizes, with a nutritionist or Community Health Volunteer present, to reinforce what they have learnt during the group discussions.

After discussion with the mentors from InnoFoodAfrica, and analysis of data that were previously collected, it appears that women begin to gain weight and become overweight and/or obese after having their first child. Therefore, our primary target for the Nutrition club are mothers at 25 years of age and older. The Nutrition club will be held at a community centre or health clinic where at least one nutritionist will be present to answer questions more complex questions that the Community Health Volunteers may not be able to. Prior to the start of the Nutrition club, the Community Health Volunteers will undergo a series of workshops to refresh their nutritional knowledge and skills, and train to be facilitators of the sessions. Altogether there will be 10 sessions, with 2 sessions held per month. A rough outline for the timeline and activities of the Nutrition club is provided in Table 7.

Table 7. Activities and timeline of the Nutrition Club program.

Weeks	**Activities**
Weeks 1 – 2	Planning meetings with InnoFoodAfrica and Community Health Volunteers
Weeks 3 – 4	Workshops and trainings for the Community Health Volunteers; Baseline measurements
Weeks 5 – 10	Alternating between informative and interactive discussions, beginning with the former.
Weeks 11 – 12	Evaluation

To reach the mothers for the Nutrition club, we propose that text or WhatsApp messages relating to the program be sent to the Community Health Volunteers, after which they will inform and encourage the mothers to take part in the Nutrition club. Social media posts, such as those on Facebook, will be used to advertise and promote the Nutrition club. Once we have gathered enough mothers and the program has begun, the mothers will be encouraged to volunteer to share the information to their peers outside the Nutrition clubs by using, for example, the Care Group model. Furthermore, a combination of supportive activities will be done to promote the program and relay health and nutritional information. For example, we plan to utilise videos that have been previously made by the Kenya-Finland Education and Research Alliance (KEN-FIN-EDURA, 2021) that briefly discusses the impact of overweight and obesity among Kenyan mothers. These videos will be played continuously on the television screens in the baby health

clinics. This allows mothers to gain more information on health, while waiting for their turns in the clinics. The main program activities and the supporting activities are summarized in Table 8.

The Care Group model is a community-based strategy and delivery system where 10–15 volunteer educators meet regularly with the project or program staff for training and supervision. Each volunteer then goes on to visit 10–15 or her neighbours or peers to share what she has learnt and facilitate behaviour change at the household level (Perry *et. al.*, 2015). This model creates a multiplying effect and are useful in settings where resources are constraint.

Table 8. Summary of the main program activities and supporting activities.

Main program	Supporting activities
Nutrition club – Mothers 25 years old and above will be the primary target and the club will include informative and interactive discussion sessions on food quality and portion sizes.	Care Group model – Several mothers will volunteer to share what they have learnt in the Nutrition club to their neighbours and peers, creating a multiplying effect.
Family days – Sessions will be held at church after Sunday mass to involve other members of the family and community, such as fathers, grandmothers and Village Chiefs.	Newspaper story – A mother who has successfully taken part in the Nutrition club will share the knowledge that they learnt and their experiences during and after the Nutrition club. This provides a 'role model' for others in the community and steers them towards the program.
Workshops and training for Community Health Volunteers – The aims of these sessions are to refresh and improve the nutritional knowledge and skills of the Community Health Volunteers.	Videos on the baby health clinic waiting room screens – The videos will detail information relating diet and health, the consequences of overweight and obesity and how to tackle those issues.
	Social media campaigns – WhatsApp messages and Facebook posts promoting the Nutrition club and delivering information of diet and health will be used.

5 Producing program components and materials

The materials will be designed based on the ideas shared in the matrix development and selection of change methods and practical applications. Particularly, the program materials will reflect the parameters relevant to the chosen method of change.
To illustrate this, social media campaigns (e.g., Facebook, WhatsApp), nutrition clubs, newspaper stories, and pictures illustrating appropriate portion sizes will be produced to increase knowledge. Likewise, training sessions, workshops, and cooking classes will be held to enhance skills. Finally, videos on the impact of overweight and obesity among Kenyan mothers

(KENFIN-EDURA, 2021) will be played in the baby health clinics to extend the perceived susceptibility.

6 Planning program adoption, implementation, and maintenance

To be effective, a health promotion program needs to reach its target population. In addition to being well-designed and available, the program should be acceptable, relevant, and usable for the population to get adopted for use, implemented, and sustained over a long enough time to maintain its health effects (Bartholomew Eldredge et al., 2016). As the program is new to its users and requires them to change their behaviour, there must first be the decision to adopt it for use. This decision can be made either by an individual or by a group or organization. Then, it needs to be implemented for actual use with sufficient fidelity (the degree to which the program is implemented with the planned methods), completeness (proportion of delivered program components), and dose (amount of the program received by the participants). Finally, the program should be maintained over time to become part of the normal practices even after the actual active project with e.g. its funding and project team are not present anymore. Maintenance of the program can be its institutionalization by integration to the recipient organization's systems and routines or sustaining either the program or its outcomes.

It is crucial, that the health promotion program is based on the target community's needs and capacities. This has been considered already in the earlier phases of intervention planning but should be reconsidered when planning program use. New members may need to be added in the planning group established earlier to make sure there is participation from all the potential program implementers - these new members can be called the linkage system, linking the developers and users of the program (Bartholomew Eldredge et al., 2016). In our program, village chiefs, Community Health Volunteers, and baby health clinics were included in the planning group already from the beginning, and they are important parties also for delivering the program. At this stage, pastors could be added in the planning group, as some of the activities are planned to take place in churches.

First, the people or organizations making the decision on program use (adapters), those implementing the program and those assuring its maintenance should be identified (Bartholomew Eldredge et al., 2016). It is possible, that these people differ for the different program components. Then, outcomes and performance objectives for the program adoption, implementation, and maintenance need to be defined. The following main outcomes for adoption, implementation, and maintenance were defined:

- Adaptation:
    - Community Health Extension Workers of the county (as supervisors of the community health tasks) adopt the health promotion program as indicated by an agreement to support the program activities.
    - Pastors adopt the health promotion program as indicated by a permission to use church facilities for program activities.

    - Baby health clinic decision makers adopt the health promotion program as indicated by a permission to show infomercials in the waiting room screens.
- Implementation:
    - CHVs will implement the health promotion program including organizing Nutrition Clubs.
    - CHVs will implement the health promotion program including recruitment of the Care Group.
    - CHVs will implement the health promotion program including diet and health monitoring in the families.
    - Baby health clinic employees implement the health promotion program including showing the infomercials in the waiting room screens.
- Maintenance:
    - Community Health Extension Workers of the county (as supervisors of the community health tasks) include diet and weight monitoring into routine work of the CHVs.

The determinants as well as the performance and change objectives for program adaptation, implementation, and maintenance are presented in Table 9.

Based on the outcomes and performance objectives described above, the following actions were selected to facilitate program adaptation, implementation, and maintenance:

- Before starting the program, discussion sessions should be held with Community Health Extension Workers, pastors, village chiefs, and baby health clinic decision makers to explain the rationale and potential benefits of the program.

Training sessions for CHVs need to be organized to properly familiarize them with the program components, thus enabling successful implementation of the program.

Table 9. Matrix of performance and change objectives for program adoption, implementation, and maintenance.

Performance	Knowledge	Skills and self-efficacy
Adoption		
PO1: Community Health Extension Workers agree to include the program components in the work of CHVs	CO.K.1.1: Community Health Extension Workers understand the importance of healthy diets	-
PO2: Pastors agree to organize some Nutrition Club sessions in church facilities and act as program champions	CO.K.2.1: Pastors understand the importance of healthy diets	-
PO3: Baby health clinic decision makers agree to use the waiting room screens for program infomercials	CO.K.3.1: Baby health clinic decision makers understand the importance of healthy diets	-
PO4: Village chiefs agree to act as program champions	CO.K.4.1: Village chiefs understand the importance of healthy diets	-
Implementation		
PO1: CHVs attend an agreed number of training sessions related to the health promotion program	CO.K.1.1: CHVs understand the potential benefits of the program for the community	-
PO2: CHVs organize and lead an agreed number of Nutrition Club session with agreed themes	CO.K.2.1: CHVs have sufficient knowledge on the agreed topics to lead the Nutrition Clubs	CO.S.2.1: CHVs have skills to create a supportive atmosphere for the Nutrition Club sessions CO.S.2.2: CHVs have skills to facilitate discussions to support the program goals CO.S.2.3: CHVs express self-efficacy for leading the Nutrition Club sessions

Table 9. Matrix of performance and change objectives for program adoption, implementation, and maintenance (continues).

Performance	Knowledge	Skills and self-efficacy
	Implementation	
PO3: CHVs recruit the Care Group from motivated volunteers (mothers)	CO.K.3.1: CHVs understand the purpose and benefits of a Care Group	CO.S.3.1: CHVs have skills to evaluate and motivate potential volunteers
PO4: CHVs perform the agreed questionnaires (e.g., dietary assessment and evaluation of knowledge and skills) and anthropometric measurements at agreed timepoints during the program	-	CO.S.4.1: CHVs have skills to use the questionnaires correctly and sensitively CO.S.4.2: CHVs have skills to perform the anthropometric measurements correctly and sensitively
PO5: Baby health clinic employees play the infomercials in the waiting room screens	CO.K.5.1: Baby health clinic employees are aware of the program and its activities CO.K.5.2: Baby health clinic employees know which videos they should show and when	-
	Maintenance	
PO1: Community Health Extension Workers include instructions and information on the overweight and diet quality monitoring in the CHV training material.	CO.K.1.1: Community Health Extension Workers understand the importance of regular and continuous monitoring of diet quality and overweight	-
PO2: CHVs integrate the monitoring questions related to overweight and diet quality in their routine reporting tool and continue the monitoring regularly	CO.K.2.1: CHVs understand the importance of regular and continuous monitoring of diet quality and overweight	-

7 Planning for evaluation

The plan for evaluation will include the effect and process evaluation questions, the primary outcome, the indicators and measures, and details about how the evaluation will be conducted. It will include details such as the needed sample size, what data will be gathered, who will collect it, what resources will be needed, and how the data will be analysed and reported to the stakeholders (Bartholomew Eldredge et al., 2016).

Table 10. Partial Evaluation Plan for Health Promotion Project Nairobi.

Process Evaluation				
Variable	**Evaluation question**	**Indicator**	**Measure**	**Timing**
Reach	How many mothers took part on the program? How many times did they participate in the sessions?	Mothers taking part on the program; number of sessions attended	Participants roster; schedule of sessions	6 months
Readiness to arrange Nutrition Clubs	Do the CHVs have sufficient knowledge and skills to lead the Nutrition Clubs?	Attendance of CHVs in the training workshops	Self-assessment in the end of the training workshops	Baseline (before starting the Nutrition Clubs)
Nutrition Clubs (according to the plan)	How many Nutrition Clubs were organised during the program? Did the number match the one expected? Were the mothers engaged during those sessions?	Nutrition Clubs organised; schedule with Nutrition Clubs expected	Schedule of sessions; participation scale on survey	6 months
Effect Evaluation: Sample Behaviours				
Variable	**Evaluation question**	**Indicator**	**Measure**	**Timing**
Decreased size in portions consumed	Did the intervention decrease the portion sizes consumed by the mothers?	Ability to visualize and compose a meal with appropriate portions of different food	Survey item	Baseline; 6 months
Improvement on the quality of the diet (e.g., reducing energy density)	Did the intervention improve the quality of the diet? Did the intervention reduce the energy density of the foods chosen?	Ability to evaluate the quality of food products and beverages	Observation; survey item	Baseline; 6 months

Table 10. Partial Evaluation Plan for Health Promotion Project Nairobi (continues).

Effect evaluation: Sample determinants				
Variable	**Evaluation question**	**Indicator**	**Measure**	**Timing**
Knowledge about appropriate portion sizes of food groups	Did the intervention increase knowledge on the adequate portion sizes?	Knowledge about portion sizes for different types of foods	Knowledge scale on survey; food atlas	Baseline; 6 months follow-up
	Did the intervention increase the mother's knowledge on nutritional recommendations, micro- and macronutrient intake relations, and the principles of preparing meals in healthy, versatile and economic manners	Knowledge on micro- and macronutrient contents in different foods Knowledge on principles of food preparation recommendations	Knowledge scale on survey; food atlas	Baseline; 6 months follow-up
Skills to identify and prepare healthy meals, beverages, and snacks	Did the intervention increase the mother's skills to produce versatile meals (meeting nutritional recommendations)?	Skills to prepare adequate meals; cooking techniques	Skills scale on survey; food atlas; workshop	Baseline; 6 months
Perceived susceptibility / risk perception	Did the intervention increase the understanding on how skewed intake of food groups can contribute to obesity and health problems in long term?	Perception about the health consequences arising from overeating and suspectibility on one's health risks	Perception-assessment scale on survey	Baseline; 6 months

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Appendices

Appendix 1. Prevalence's for nutritional status

Prevalence's for nutritional status (malnutrition) among participating mothers (n = 211) and children (n = 211) by village and income level (Kenyan shilling, KSh), expressed as the number of participants.

		Mothers			Children						
Village	**N**	**Obesity BMI >29.9**	**Overweight BMI>24.9**	**Underweight BMI < 18.5**	**Height-for-age < -2 SD**	**Weight-for-age < -2 SD**	**Weight-for-age < -3 SD**	**Weight-for-height < -2 SD**	**Weight-for-height < -3 SD**	**Weight-for-height < +2 SD**	**Weight-for-height < +3 SD**
Kahawa West	35	13	23	0	4	2	0	2	1	2	0
Maziwa	35	14	25	0	2	2	1	1	1	1	0
Njathaini	35	10	20	1	7	4	0	3	0	3	1
Soweto	35	5	18	4	14	4	1	4	0	6	2
Tanners	35	14	29	1	1	2	0	2	2	2	0
Pickens	36	8	22	1	3	4	0	2	0	1	0
Total	211	64	137	7	31	18	2	14	4	15	3
Income level											
<10 000 ksh	25	6	15	2	5	4	1	5	1	1	0
10 000–29 999 ksh	129	35	81	4	22	12	1	8	2	11	3
30 000–49 999 ksh	34	14	24	1	3	2	0	1	1	1	0
≥ 50 000 ksh	23	9	17	0	1	0	0	0	0	2	0
Total	211	64	137	7	31	18	2	14	4	15	3

Appendix 2. Macronutrient intakes

Mean protein, carbohydrate, fat and fibre (g) intake ± Standard deviation (SD) of mothers and children by village and income level (Kenyan shilling, KSh), both energy unadjusted and adjusted values, rounded to two decimal places

			Mothers					Children				
				Mean ± SD				Mean ± SD				
Village / Income class			N	Protein, g	Carbohydrate, g	Fat, g	Fibre, g	N	Protein, g	Carbohydrate, g	Fat, g	Fibre, g
Village	Kahawa West	Unadjusted values	35	58,42 ± 25,99	302,48 ± 115,78	63,54 ± 37,53	36,29 ± 16,39	35	27,61 ± 11,25	135,16 ± 42,03	44,56 ± 12,69	13,57 ± 6,68
	Maziwa		35	61,7 ± 29,09	286,33 ± 110,16	58,29 ± 38,06	37,38 ± 17,46	34	36,52 ± 17,49	174,66 ± 55,57	46,87 ± 20,36	21,6 ± 11,12
	Njathaini		35	64,18 ± 20,1	374,55 ± 106,94	67,75 ± 33,34	41,92 ± 17,95	35	25,41 ± 8,78	145,55 ± 52,6	44,73 ± 13,6	13,01 ± 6,28
	Soweto		34	52,59 ± 21,63	303,34 ± 124,93	57,19 ± 28,96	33,11 ± 16,09	34	24,08 ± 10,96	125,62 ± 49,34	41,11 ± 13,05	12,75 ± 8,64
	Tanners		34	63,77 ± 26,4	317,04 ± 123,08	61,85 ± 34,76	38,75 ± 14,43	34	38,81 ± 16,42	199,78 ± 65,82	47,9 ± 19,23	24,05 ± 9,47
	Pickens		36	55,64 ± 28,44	294,57 ± 138,87	59,7 ± 35,99	35,41 ± 16,95	35	20,82 ± 10,24	111,22 ± 42,38	38,72 ± 17,64	11,43 ± 6,8
	Total		209	59,38 ± 25,57	312,99 ± 122,56	61,4 ± 34,7	37,15 ± 16,63	207	28,81 ± 14,33	148,4 ± 59,37	43,96 ± 16,48	16,02 ± 9,56
	Kahawa West	Energy adjusted values	35	53,62 ± 13,11	293,65 ± 46,62	54,21 ± 17,33	37,05 ± 13,43	35	27,21 ± 4,83	137,28 ± 17,01	46,18 ± 8,1	15,4 ± 6,52
	Maziwa		35	57,03 ± 12,03	289,53 ± 43,77	50,08 ± 16,01	38,89 ± 12,83	34	28,53 ± 6,08	146,24 ± 22,02	40,77 ± 10,93	19,29 ± 7,37
	Njathaini		35	50,2 ± 8,09	311,77 ± 31,21	48,85 ± 14,15	36,48 ± 14,02	35	24,98 ± 5,08	143,12 ± 18,61	45,31 ± 9,5	15,08 ± 6,95
	Soweto		34	48,4 ± 11,32	286 ± 50,9	52,77 ± 19,15	31,56 ± 13,36	34	26,69 ± 5,95	139,13 ± 15,54	45,62 ± 7,99	15,72 ± 7,44
	Tanners		34	56,95 ± 13,58	296,47 ± 49,26	51,33 ± 18,4	38,37 ± 12,42	34	27,51 ± 5,4	150,73 ± 18,14	38,81 ± 8,94	19,85 ± 7,8
	Pickens		36	51,13 ± 10,77	290,95 ± 34,38	53,52 ± 14,4	37,05 ± 13,03	35	25,94 ± 6,98	138,92 ± 22,53	46,19 ± 11,86	16,29 ± 8,2
	Total		209	52,88 ± 11,93	294,74 ± 43,49	51,8 ± 16,56	36,58 ± 13,25	207	26,8 ± 5,81	142,53 ± 19,49	43,84 ± 9,98	16,92 ± 7,55
Income class	< 10 000 ksh	Unadjusted values	25	51,14 ± 26,1	288,78 ± 132,36	54,46 ± 42,1	34,73 ± 14,57	25	26,59 ± 11,61	152,6 ± 60,16	45,94 ± 19,95	16,67 ± 10,8
	10 000–29 999 ksh		128	57,93 ± 24,88	320,35 ± 127,02	62,22 ± 34,99	36,66 ± 17,01	125	28,27 ± 14,14	145,96 ± 61,39	43,98 ± 16,86	15,03 ± 8,82
	30 000–49 999 ksh		33	67,7 ± 27,97	301,12 ± 106,76	60,14 ± 26,85	37,41 ± 16,59	34	29,98 ± 15,9	147,84 ± 52,49	41,14 ± 14,01	18,18 ± 11,31
	≥ 50 000 ksh		23	64,43 ± 22,48	315,34 ± 109,49	66,16 ± 35,37	42,11 ± 16,66	23	32,45 ± 15,74	157,93 ± 59,42	45,89 ± 13,81	17,52 ± 9,07
	Total		209	59,38 ± 25,57	312,99 ± 122,56	61,4 ± 34,7	37,15 ± 16,63	207	28,81 ± 14,33	148,4 ± 59,37	43,96 ± 16,48	16,02 ± 9,56
	< 10 000 ksh	Energy adjusted values	25	48,32 ± 10,82	291,29 ± 53,88	47,21 ± 17,9	38,52 ± 14,82	25	25,36 ± 6,56	143,79 ± 17,83	44,07 ± 9,11	17,45 ± 8,09
	10 000–29 999 ksh		128	50,83 ± 9,14	297,68 ± 37,72	52,14 ± 16,58	35,42 ± 13,17	125	26,57 ± 5,43	141,73 ± 20,58	44,4 ± 10,46	16,26 ± 7,47
	30 000–49 999 ksh		33	61,34 ± 15,6	288,38 ± 53,58	52,62 ± 17,02	37,14 ± 13,31	34	28,18 ± 6,57	145,4 ± 16,17	41,64 ± 8,91	19,25 ± 8
	≥ 50 000 ksh		23	57,13 ± 14,4	291,25 ± 46,84	53,71 ± 14,36	40,16 ± 11,63	23	27,55 ± 5,62	141,22 ± 20,28	43,83 ± 9,83	16,47 ± 6,37
	Total		209	52,82 ± 12,12	290,85 ± 35,1	52,35 ± 14,31	36,89 ± 14,55	207	26,8 ± 5,81	142,53 ± 19,49	43,84 ± 9,98	16,92 ± 7,55

Appendix 3. Micronutrient intakes

Mean vitamin and mineral intake ± Standard deviation (SD) of mothers (n=209) and children (n=207), both energy unadjusted and adjusted values, rounded to two decimal places.

	Mothers		Children		Recommended intake[1]	
	Mean ± SD		Mean ± SD			
Vitamin / Mineral	Unadjusted values	Energy adjusted values	Unadjusted values	Energy adjusted values	Lactating women	Children 1–3 years
Vitamin A (RAE), µg	514,51 ± 1709,36	457,04 ± 1015,16	518,74 ± 219,49	531,3 ± 195,37	1300	400
Thiamine, mg	1,25 ± 0,69	1,11 ± 0,38	0,54 ± 0,35	0,5 ± 0,2	1,4	0,5
Riboflavin, mg	1,08 ± 0,59	0,95 ± 0,39	1,02 ± 0,69	0,97 ± 0,54	1,6	0,5
Niacin, mg	13,42 ± 6,16	12,31 ± 3,71	5,93 ± 3,89	5,45 ± 1,65	17	6
Dietary folate (EQ), µg	541,68 ± 343,41	486,09 ± 225,83	201,11 ± 141,89	188,04 ± 72,94	500	160
Mean B_{12}, µg	2,76 ± 2,49	2,55 ± 2,31	2,28 ± 2,25	2,36 ± 2,19	2,8	0,9
Vitamin C, mg	92,25 ± 76,1	105,81 ± 97,05	65,46 ± 39	68,06 ± 36,49	120	30
Calsium, mg	830,01 ± 415,3	815,32 ± 339,14	641,57 ± 308,64	634,26 ± 212,03	1000	500
Iron, mg[2]	19,09 ± 9,18	18,01 ± 5,65	7,34 ± 4,82	7,04 ± 3,37	15	10
Magnesium, mg[2]	363,22 ± 159,59	351,02 ± 115,44	185,56 ± 106,84	186,32 ± 64,21	355	60
Phosphorus, mg	1700,02 ± 708,64	1594,83 ± 341,18	778,74 ± 428,7	788,6 ± 304,96	700	800
Potassium, mg[3]	2732,66 ± 1491,19	2421,41 ± 905,7	1658,14 ± 1086,6	1606,79 ± 498,91	3100	1400
Sodium, mg[3]	1780,63 ± 1227,05	1639,07 ± 857,27	599,48 ± 399,67	622,85 ± 342,51	2400	1088
Zinc, mg	9,68 ± 4,07	9,13 ± 2,04	4,9 ± 2,34	4,6 ± 1,24	12	10
Selenium, µg	49,61 ± 33,43	47,89 ± 27,22	30,66 ± 15,15	28,45 ± 8,36	70	17

[1] Recommended intakes of nutrients from Kenya clinical nutrition and dietetics manual, 2nd ed., 2020 (Ministry of Health, 2020), if provided, and if not stated otherwise.

[2] Daily iron (mg) and magnesium (mg) requirement for lactating mothers from Kenya national clinical nutrition and dietetics reference manual, 1st ed., 2010 (Ministry of Health, Republic of Kenya, 2010)

[3] Recommended intake for potassium (lactating women and children 12–23 months) and population target intake for sodium from Nordic Nutrition Recommendations 2012 (Nordic Council of Ministers, 2014). For children less than two years of age the sodium density should not exceed 0,5 g/MJ expressed as salt (0,2 g/239,0 kcal, expressed as sodium and kilocalories, rounded to one decimal place). Recommended energy intake for children 1–3 years is 1300 kcal (Ministry of Health, 2020), and with this energy intake the daily sodium intake of children should not exceed 1,088 g (rounded to three decimal places).