



Weight (<math>29.9 \text{ kgs/m}^2</math>)	Obese Class I (30 - 34.9 kgs/m <sup>2</sup> )				Obese Class II (35 - 39.9 kgs/m <sup>2</sup> )				Obese Class III (> 40 kgs/m <sup>2</sup> )				kgs	
	5' 3"	5' 4"	5' 5"	5' 6"	5' 7"	5' 8"	5' 9"	5' 10"	5' 11"	6' 0"	6' 1"	6' 2"		6' 3"
162.6 cms	17.8	17.2	16.7	16.2	15.7	15.2	14.8	14.4	14.0	13.6	13.2	12.9	12.5	45.5 kgs
165.1 cms	19.2	18.6	18.1	17.5	17.0	16.5	16.0	15.5	15.1	14.7	14.3	13.9	13.5	47.7 kgs
167.6 cms	20.2	19.5	18.9	18.3	17.8	17.3	16.8	16.3	15.8	15.4	14.9	14.5	14.2	50 kgs
170.2 cms	21.1	20.4	19.8	19.2	18.6	18.0	17.5	17.0	16.5	16.1	15.6	15.2	14.8	52.3 kgs
172.7 cms	22.0	21.3	20.6	20.0	19.4	18.8	18.3	17.8	17.3	16.8	16.3	15.9	15.4	54.5 kgs
175.3 cms	22.9	22.2	21.5	20.8	20.2	19.6	19.0	18.4	18.0	17.5	17.0	16.5	16.1	56.8 kgs
177.8 cms	23.7	23.1	22.4	21.7	21.0	20.4	19.8	19.2	18.7	18.2	17.7	17.2	16.7	59.1 kgs
180.3 cms	24.6	23.8	23.1	22.4	21.7	21.0	20.4	19.8	19.2	18.7	18.2	17.7	17.2	61.4 kgs
182.9 cms	25.6	24.7	24.0	23.2	22.5	21.8	21.2	20.6	20.0	19.4	18.9	18.3	17.8	63.6 kgs
185.4 cms	26.5	25.7	24.9	24.1	23.3	22.6	22.0	21.3	20.7	20.1	19.6	19.0	18.5	65.9 kgs
188 cms	27.4	27.5	26.6	25.7	24.9	24.2	23.5	22.8	22.1	21.5	20.8	20.3	19.7	68.2 kgs
190.5 cms	29.4	28.4	27.5	26.6	25.8	25.0	24.3	23.5	22.9	22.2	21.6	21.0	20.4	70.5 kgs
	30.3	29.3	28.4	27.5	26.7	25.8	25.1	24.3	23.6	22.9	22.3	21.7	21.1	72.7 kgs
	31.3	30.3	29.3	28.4	27.5	26.7	25.9	25.1	24.4	23.7	23.0	22.4	21.7	75 kgs
	32.3	31.2	30.2	29.3	28.4	27.5	26.7	25.9	25.1	24.4	23.7	23.1	22.4	77.3 kgs
	33.3	32.2	31.2	30.2	29.2	28.3	27.5	26.7	25.9	25.2	24.4	23.8	23.1	79.5 kgs
	34	34.2	33.1	32.1	31.1	30.1	29.2	28.3	27.5	26.7	25.9	25.2	24.5	81.8 kgs
	35.4	35.2	34	33.0	32.0	31.0	30.0	29.1	28.3	27.4	26.6	25.9	25.2	84.1 kgs
	37.4	36.2	35.0	33.9	32.8	31.7	30.8	29.9	29	28.2	27.4	26.6	25.9	86.4 kgs
	38.5	37.2	36	34.9	33.7	32.7	31.7	30.7	29.9	28.9	28.1	27.3	26.6	88.6 kgs
	39.5	38.2	36.9	35.7	34.6	33.5	32.5	31.5	30.6	29.7	28.9	28.0	27.3	90.9 kgs
	40.5	39.1	37.9	36.7	35.5	34.4	33.4	32.3	31.4	30.5	29.6	28.8	28.0	93.2 kgs
	41.5	40.1	38.8	37.6	36.4	35.2	34.1	33.2	32.2	31.2	30.3	29.5	28.7	95.5 kgs
	42.5	41.1	39.6	38.3	37.1	35.9	34.7	33.6	32.6	31.6	30.7	29.8	28.9	97.7 kgs
	43.5	42.1	40.7	39.4	38.2	37.0	35.8	34.8	33.7	32.8	31.8	30.9	30.0	100 kgs
	44.5	43.1	41.7	40.4	39.1	37.9	36.7	35.6	34.5	33.5	32.4	31.4	30.4	102.3 kgs
	45.5	44.1	42.7	41.4	40.1	38.9	37.7	36.5	35.4	34.3	33.3	32.3	31.4	104.5 kgs
	46.6	45.1	43.7	42.4	41.1	39.9	38.7	37.5	36.4	35.3	34.3	33.3	32.4	106.8 kgs
	47.6	46.1	44.7	43.4	42.1	40.9	39.7	38.5	37.4	36.3	35.3	34.3	33.4	109.1 kgs
	48.6	47.1	45.7	44.4	43.1	41.9	40.7	39.5	38.4	37.3	36.3	35.3	34.4	111.4 kgs
	49.6	48.1	46.7	45.4	44.1	42.9	41.7	40.5	39.4	38.3	37.3	36.3	35.4	113.6 kgs
	50.6	48.9	47.5	46.2	44.9	43.7	42.5	41.3	40.2	39.1	38.1	37.1	36.2	115.9 kgs
	51.6	49.9	48.3	46.7	45.3	43.9	42.5	41.2	40.0	38.9	37.7	36.7	35.6	118.2 kgs
	52.6	50.9	49.2	47.7	46.2	44.7	43.4	42.1	40.8	39.6	38.5	37.4	36.3	120.5 kgs
	53.6	51.9	50.2	48.6	47.0	45.6	44.2	42.9	41.6	40.4	39.2	38.1	37.0	122.7 kgs
	54.6	52.8	51.1	49.5	47.9	46.4	45.0	43.7	42.4	41.1	40.0	38.8	37.7	125 kgs
	55.7	53.8	52.1	50.4	48.8	47.3	45.9	44.5	43.2	41.9	40.7	39.5	38.4	127.3 kgs
	56.7	54.8	53.0	51.3	49.7	48.2	46.7	45.3	43.9	42.7	41.4	40.3	39.1	129.5 kgs
	57.7	55.8	54.0	52.2	50.6	49.0	47.5	46.1	44.7	43.4	42.2	41.0	39.8	131.8 kgs
	58.7	56.8	54.9	53.2	51.5	49.9	48.4	46.9	45.5	44.2	42.9	41.7	40.5	134.1 kgs
	59.7	57.7	55.9	54.1	52.4	50.7	49.2	47.7	46.3	44.9	43.7	42.4	41.2	136.4 kgs
	60.7	58.7	56.8	55.0	53.3	51.6	50.0	48.5	47.1	45.7	44.4	43.1	41.9	138.6 kgs
	61.7	59.7	57.7	55.9	54.1	52.5	50.9	49.3	47.9	46.5	45.1	43.9	42.6	140.9 kgs
	62.7	60.7	58.7	56.8	55.0	53.3	51.7	50.1	48.7	47.2	45.9	44.6	43.3	143.2 kgs
	63.7	61.6	59.6	57.7	55.9	54.2	52.5	50.9	49.4	48.0	46.6	45.3	44.0	145.5 kgs
	64.7	62.6	60.6	58.7	56.8	55.0	53.4	51.8	50.2	48.8	47.4	46.0	44.7	147.7 kgs
	65.7	63.5	61.5	59.6	57.7	55.9	54.2	52.6	51.0	49.5	48.1	46.7	45.4	150 kgs
	66.7	64.5	62.5	60.5	58.6	56.8	55.0	53.4	51.8	50.3	48.8	47.4	46.1	152.3 kgs
	67.7	65.4	63.4	61.4	59.5	57.6	55.9	54.2	52.6	51.0	49.6	48.2	46.8	154.5 kgs
	68.7	66.3	64.3	62.3	60.4	58.5	56.7	55.0	53.4	51.8	50.3	48.9	47.5	156.8 kgs
	69.7	67.2	65.2	63.2	61.2	59.3	57.5	55.8	54.1	52.6	51.1	49.6	48.2	159.1 kgs
	70.7	68.1	66.1	64.1	62.1	60.2	58.4	56.6	54.9	53.3	51.8	50.3	48.9	161.4 kgs
	71.7	69.0	67.0	65.0	63.0	61.1	59.2	57.4	55.7	54.1	52.5	51.0	49.6	163.7 kgs

# Saudi Journal of OBESITY

# Prevention and control of obesity: An interprofessional system approach

## ABSTRACT

Obesity is an escalating global epidemic with exponential increasing rates in Saudi Arabia and Gulf Countries. Obesity has adverse effects on patients' health, psychology, and socioeconomic status. In addition, it is a burden on societies when obese individuals become less productive in their work and governments spend more money for their accommodation in the society and health care expenditure. A comprehensive interprofessional system approach inclusive of broad environmental and social interventions and individuals' psychological and behavioral changes is required to produce positive impact on obesity prevention and control in societies. The aim of this project is to involve concerned health care and non-health professions, policy makers, and other stakeholders to work together within a system framework. The idea of this project was initiated at the first residential meeting of the Manipal University – Foundation for the Advancement of International Medical Education and Research (FAIMER, Philadelphia, USA) International Institute for Leadership in Interprofessional Education (MUFILIFE) Fellowship Program, Manipal, India, in May 2015. The literature collected and carefully selected includes major reports, policies, guidelines, and interventions done at several sectorial levels; best-evidence practices on communities, health care professions, schools, and workplaces; implementation strategies, success stories, and barriers; and studies on assessment of the effectiveness and impact of these interventions. Out of hundreds of articles and reports in obesity and related NCDs published nationally and worldwide, this project documents and discusses local interventions and programs in this field with lessons learned. In addition, best-evidence practices/interventions, and policies that have worked globally to prevent and manage obesity are discussed and extrapolated to our local settings. Aided by national and international expert groups, this project tries to document a road map for a multisectorial interprofessional system approach to prevent and control obesity in the region to influence its impact on individuals and society.

**Keywords:** Approach, control, interprofessional, obesity, prevention, system

## INTRODUCTION

Globally, obesity and overweight is becoming a major public health and psychosocial problem leading to more sick and unproductive individuals and increase of burden and money expenditures on governments and health care systems. Its prevalence is escalating, affecting almost one-third (2.1 billion) of the world population with a prediction of further increase to half of the population by 2030 if the current obesogenic trends persist.<sup>[1]</sup> In Saudi Arabia, the case is even worse as obesity rate is exponentially increasing with an overall overweight/obesity prevalence of 20% in 1996,<sup>[2]</sup> to 35% in 2005,<sup>[3]</sup> to 59.4% in 2013,<sup>[4]</sup> up to 75% if Arabian Gulf Countries population are collectively included, with an estimated 20,000 deaths per year due to obesity and related comorbidities.<sup>[5]</sup>

Reasons for this soaring prevalence are due to combination of complex factors including increase in availability and consumption of larger portions and higher calories of junk foods and sweetened drinks, abnormal individuals' eating behaviors, inactivity with sedentary lifestyles, retention of weight after multiple pregnancies, some endocrine diseases, stress and depression, use of some obesogenic drugs, and some genetic syndromes. Obesity has many adverse effects on

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patients' health, psychology, and socioeconomic status. In addition, it is a burden on societies when obese individuals become less productive in their work and governments spend more money for their accommodation in the society and health care expenditure. In order for communities to succeed in preventing and control of obesity, a comprehensive interprofessional system, coordinated and applied at multisectorial level, and managed by a central authoritative committee would be the ideal approach to follow.<sup>[6]</sup> In this project, the author is trying to document a road map for the interprofessional system approach to inform multiprofessional stakeholders and policy makers, hoping that an action plan agenda can be set forward before it is too late to manage further complexities of obesity in the future.

### AIM/OBJECTIVES

To involve concerned health care and non-health professions, policy makers, and other stakeholders to work together in a system framework to achieve the following objectives:

- (1) To meet and discuss available evidence and experiences and nominate and elect a leading interprofessional committee for the prevention and control of obesity.
- (2) To develop a comprehensive strategic plan, guidelines, and policies to prevent and control obesity.
- (3) To assign working teams to implement the strategic plan, guidelines, and policies at different sectorial levels.
- (4) To communicate results of these interventions to public, academia, and government sectors to further support and participate in interprofessional projects/programs related to obesity prevention and control.

### MATERIALS AND METHODS

The idea of this project was generated at the first residential meeting of the Manipal University – Foundation for the Advancement of International Medical Education and Research (FAIMER, Philadelphia, USA) International Institute for Leadership in Interprofessional Education (MUFILPE) Fellowship Program, Manipal, India, in May 2015. The author fellow chose this project as being already engaged in national works on obesity prevention and control. This work was designed by the author, supervised and monitored by FAIMER and MUFILPE faculty, and assisted by the 20 fellow colleagues, over the last 18 months or so of the 2-year fellowship program. The methodology plan discussed and agreed upon included: (a) call for a national forum or summit involving all disciplines and stakeholders to discuss available evidence and best practices for obesity prevention and control, discuss each discipline/sector's best practices and roles, and nominate and elect the central authoritative and administrative committee. (b) Review existing literature and resources relevant to this topic, overview available reported and published strategies, policies, guidelines, interventions, and programs done at several sectorial levels. (c) Use of best practices on communities, health care settings, schools, workplaces, and environment. (d) Use of best practices on education and training of working teams and system stakeholders to facilitate the implementation process and move the project forward. (e) Use implementation strategies, considering success stories and barriers. (f) Review of studies on assessment of the effectiveness and impact of these interventions. (g) International networking, dissemination of successful experiences and research in this area. (h) Creating a project timeline and identifying and overcoming challenges and obstacles [Figure 1].

### The interprofessional system approach to obesity/overweight prevention and control: a road map and components



Figure 1: The road map and components of interprofessional system approach to obesity/overweight prevention and control

## RESULTS

A series of university and public meetings related to obesity were conducted in Saudi Arabia since the first residential meeting of the MUFILIIPE program in May 2015. The most important and prominent ones include the first and second International Conference on Countering Diabetes in the Arab Countries, held respectively in October 2015 and in November 2016. The third and fourth Gulf Obesity Surgical Society (GOSS) meetings were held in December 2015 and 2016. A summary of this project was presented in the second Saudi Arabian Society of Metabolic and Bariatric Surgery (SASMBS) annual meeting, held in October 2016. The first Dietary Guidelines for Saudis were documented in 2012.<sup>[7]</sup> Physical Activity Recommendations for Saudis and Physical Activity before bariatric surgery were published in 2004 and 2016 respectively.<sup>[8,9]</sup> The SASMBS published the Clinical Management of Obesity Guidelines in 2013<sup>[10]</sup> and Guidelines for Bariatric Surgery in 2014.<sup>[11]</sup> The Saudi Guidelines on the prevention and management of obesity were updated and published in 2016.<sup>[7]</sup> Another Saudi clinical Practice Guidelines for the management of overweight and obesity in adults were published in 2016.<sup>[12]</sup> The suggested

overall strategic plan to prevent and control of obesity is summarized in Table 1. An example of goal 1 initiatives is presented in Table 2. Details of initiative 1 are summarized in Table 3. The details of the remaining initiatives for each goal are beyond the scope of this review. However, it can be requested directly from the author. Examples of settings with corresponding best-evidence practices/policies/interventions/program are summarized in Table 4.

## DISCUSSION

A call for a national forum is the appropriate starting, and may be turning, point to appropriately initiate the project and move it forward. Aims of this congress include increasing awareness about the magnitude of obesity problem, understand the complexity of its etiological factors, discuss the strategies to reverse its escalating prevalence, and understand the best-evidence practices and interventions related to each profession.<sup>[13,14]</sup> This gathering facilitates interprofessional education and practice (IPE/IPP), when members of different professions learn with, from, and about each other to improve collaboration and the quality of care.<sup>[15]</sup> The other important matter in this forum is the

**Table 1: The overall strategic plan of the interprofessional system approach to prevent and control obesity in Saudi Arabia**

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**Vision:** Towards a community free of obesity

**Mission:**

- To involve concerned health care and non-health professions, policy makers, and other stakeholders to work together under one umbrella
- To apply the interprofessional system approach towards vision achievement
- To set standards, guidelines, policies, and best-practices/interventions/programs readily applicable to current settings
- To provide education and training for implementation working teams and relevant stakeholders
- To properly implement standards, guidelines, policies, and best practices/interventions in this field
- To monitor and evaluate the system as a whole (research)
- To disseminate research and successful experiences to public, academia, and government sectors to further support and participate in the system
- To cooperate and coordinate with local and international organizations and societies through continuous networking towards vision achievement

**Values:**

- Teamwork and commitment
- Social responsibility and accountability
- Societal partnership and consciousness
- Support and reward
- Quality and equality for all

**Goals:**

**Goal 1:** To establish a national interprofessional expert panel

**Goal 2:** To promote and support the interprofessional system components and resources

**Goal 3:** To develop appropriate standards, policies, guidelines, best practices/interventions, and programs, readily applicable to available settings

**Goal 4:** To develop and conduct programs for continuous education and training for relevant professions and stakeholders

**Goal 5:** To build healthy environment and implement collaborative interprofessional anti-obesity programs

**Goal 6:** To develop assessment methods and tools, establish adequate measurements criteria, and make use of assessment and monitoring results for further improvement

**Goal 7:** To use media, schools and universities, primary health care and community centers as conduits for dissemination of research and successful results in this field

**Goal 8:** To increase availability of healthy food and pure water, and decrease consumption of sugars and saturated fat in the community throughout life

**Goal 9:** To promote physical activity throughout life

**Goal 10:** To provide health care for all needy patients

**Goal 11:** To participate in national and international campaigns and programs

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**Table 2: Strategic initiatives (objectives) of goal 1, as an example**


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**Goal 1: To establish a national interprofessional expert panel**

**Strategic initiatives (objectives)**

Establish an expert panel representing all concerned sectors and stakeholders to:

- Lead and administer the project
- Set the components and resources of the system
- Collect and study available data and research in obesity prevention and control
- Setting standards, policies, guidelines, best practices, interventions, and programs that promote the vision of the project
- Preparation and implementation of national strategies in this field
- Develop programs for continuous education and training for relevant professions and other stakeholders
- Monitoring and evaluating the system as a whole
- Establish international networking and disseminate successful experiences and research in this field

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**Table 3: Strategic details of the first initiative: establish an expert panel representing all concerned sectors and stakeholders to lead and administer the project system**


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**Goal 1: To establish a national interprofessional expert panel**

**Strategic initiative (objective): establish an expert panel representing all concerned sectors and stakeholders to lead and administer the project system**

**Strategic actions:**

- Call for a national forum (3-days conference)
- Present and discuss best-evidence practices and research relevant to each profession
- Nominate and elect the lead agency, expert panel members, terms and conditions, and bylaws
- Set the governance structure
- Develop system components and resources

**Responsible:** Ministry of Health

**Accountable:** The expert panel committee

**Partners:** All sectors representing the expert panel committee

**Stakeholders:** Policy makers, health professions, educationists, engineers, environmental experts, social workers, students, companies, and relevant community members

**Time line:** January 2017 to March 2017

**Expected budget:** 5,000,000 SR

**Quality indicators:**

- More than 75% representation of relevant stakeholders
- Establishment of the expert panel committee
- Establishment of terms, conditions, and bylaws
- Establishment of the governance structure of the project
- Establishment of the system components and resources

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nomination and election of a national expert panel as the legal administrative committee.<sup>[13,14]</sup> This lead agency has many responsibilities, and the most important ones are summarized in Table 2. The last matter to be emphasized is the multisectorial interprofessional system approach to prevent and control obesity among children and adults at all levels and places.<sup>[15]</sup> The system advocates the IPE/IPP approach framework to organize the complexity of forces driving the obesity in a coordinated and collaborative manner under one legal administrative umbrella rather than working individually [Figure 1]. Although meetings, conferences, and workshops are important to inform the various professions, policy makers, and relevant stakeholders about proceedings and recommendations, it would be more useful, however, if these activities are translated into strategic actions with a vision, mission, and measurable goals [Table 1]. Similarly, under each goal, there should be set of initiatives (objectives) as

shown in Table 2. Under each initiative, there must be set of actions, responsible and accountable bodies, partners, stakeholders, timeline, expected budget, and key performance indicators, for example, initiative 1 of goal 1 [Table 3]. The same must be applied to guidelines, policies, interventions, and programs. Furthermore, unless these initiatives are professionally implemented, monitored, and evaluated, otherwise and unfortunately, it will find its way in drawers or on shelves!

For successful dissemination and application of best-evidence policies, practices, and interventions, the expert panel authority should provide guidance, education, and training through subcommittee working teams.<sup>[16]</sup> Another recommendation is to prioritize policy and environmental interventions over individuals' behavior programs to yield better outcomes.<sup>[16]</sup> Worldwide, hundreds of policies,

**Table 4: Settings with corresponding best-evidence interventions, policies, and programs**

Setting	Intervention/policies/programs	Stakeholders*
	(Best-evidence examples)	
<b>Leading/legal authority</b>	- A national summit on legal preparedness for obesity prevention and control <sup>[13]</sup> - Committee on National Health Policy <sup>[21]</sup> - National Expert Panel <sup>[18]</sup> System approach <sup>[15]</sup> Policy approaches <sup>[17]</sup> Evidence-based interventions <sup>[16]</sup>	MOH, MOL, MOAg, MOE, MOY, MOCco, MOP, MOW, MOSa, MOCu, MOF, MOInf, MOT, MOInd, FDA
<b>Health professions</b>		
Primary care centers	- Fruit and vegetable trial <sup>[19]</sup> - Green prescription program <sup>[20]</sup>	Doctors, nurses, healthy volunteers
Nutrition and physical activity centers	- Five rations of fruits and vegetables <sup>[22,23]</sup>	Nutritionists, volunteered adults
Behavior/psychology	- Diet and physical activity modification programme <sup>[25]</sup> - Decrease dietary energy intake, Increasing physical activity, and decreasing sedentary behaviors <sup>[24]</sup>	Psychologists, behavioral therapists, patients
Pharmacotherapy	- Orlistat <sup>[26]</sup>	Physicians and patients
Bariatric surgery	- Gastric banding <sup>[31]</sup>  Sleeve gastrectomy <sup>[32]</sup> Gastric bypass <sup>[33]</sup> Biliopancreatic diversion <sup>[35]</sup> Sleeve gastrectomy with bilio-pancreatic duodenal switch	Bariatric surgeons, patients with severe obesity with or without major comorbidities
<b>Education</b>		
Schools	- Know your body (adapted) School Health Promotion Programme <sup>[37]</sup> - Schools-based physical fitness <sup>[38]</sup>	Students, teachers, parents
<b>Community</b>		
Workplaces	- CHIP (Coronary Health Improvement Project) <sup>[40]</sup>	Health professionals, employees, and community members
Households	- Move and improve program <sup>[41]</sup> - Parental role in preventing childhood obesity <sup>[42]</sup> - Active for Life Program <sup>[43]</sup>	Parents, children, health professions Elderly households
Community settings	- Dietary, exercise, and behavioral services program <sup>[44]</sup>	Community clients, nutrition, physical trainer, and behaviorist
Religious activities	- MEND 7–13 child weight management program <sup>[45]</sup> - Project Joy <sup>[46]</sup> - Body and soul intervention <sup>[47]</sup>	Students, health professionals Priests, worshipers, health and other professionals
Mass media	- Fighting fat, fighting fits campaign <sup>[48]</sup> - "VERB™" campaign <sup>[49]</sup>	Media, public Media, children
<b>Environment</b>		
Farms and animals	- Increase subsidies and provide places for selling healthy foods <sup>[17,21]</sup> (e.g., fruits and vegetables Bazaars)	Farmers and government officials
Food industry	- Implement policies and legislations to decrease production and selling of unhealthy foods, sweetened drinks, and sugars <sup>[13,15,16,24]</sup> - Increase taxations on unhealthy food, sweetened drinks, and sugary products <sup>[14,16,17]</sup>	Food and sweetened drinks producers and supermarkets Government officials and FDA
Restaurants	- Labeling of calories content of food portions and drinks <sup>[13,17,18]</sup>	MOL, MOCco, restaurants, supermarkets
Exercise areas	- Increase walking and cycling areas <sup>[18]</sup> - Increase number of community centers <sup>[18,21,24]</sup>	MOY, MOT, MOSa, public
Public transportation	- Increase public transportation facilities <sup>[13,18,24]</sup>	MOT, public
<b>Insurance companies</b>	- Include obesity as a chronic disease worth medical insurance coverage, and bariatric surgery with criteria <sup>[51,52]</sup>	MOL, MOSa, MOH, private hospitals

\*Stakeholders: MOH = Ministry of Health, MOL = Ministry of Law, MOAg = Ministry of Agriculture, MOE = Ministry of Education, MOY = Ministry of Youth, MOCco = Ministry of Commerce, MOP = Ministry of Planning, MOW = Ministry of Work, MOSa = Ministry of Social Affairs, MOCu = Ministry of Culture, MOF = Ministry of Finance, MOInf = Ministry of Information, MOT = Ministry of Transportation, MOInd = Ministry of Industry, FDA = Food and Drug Authority, SCHS = Saudi Commission for Health Specialties.

interventions, and programs were reported to prevent and combat obesity with variable results of success stories, failures, opportunities, and challenges. A selected group of best-evidence practices, policies, interventions, and programs applied at different settings are summarized in Table 4. The definition of a best-evidence practice is “one with at least preliminary evidence of effectiveness in small-scale interventions or for which there is potential to generate data that will be useful for making decisions about taking the intervention to a scale . . . .”<sup>[17]</sup>

In order for an intervention to be successful, it should be effective against obesity, should have other health benefits, should be feasible to apply and be socially acceptable, should be cost effective, and should serve the society with equity.<sup>[18]</sup> Another condition for a successful intervention is to apply the principle of Libertarian–Paternalism rather than paternalistic approach,<sup>[17]</sup> which means, for example, leaving the choice to the consumer after showing clear labeling of the harms of smoking on the cigarette packet (Libertarian–Paternalism), rather than stopping selling of cigarettes altogether (paternalistic).

At the primary health care setting, it seems that negotiations and counseling for healthy eating and physical activity are the effective approaches.<sup>[19,20]</sup>

Nutritionists are successful when they prescribe reasonable and affordable dieting programs, for example, low-fat diet, less sugary foods and drinks, and more fruits and vegetables consumption on daily basis.<sup>[7,8,21-24]</sup>

Similarly, effective physical fitness and weight loss requires gradual increment of efforts, for example, starting with 30 min of low-moderate intensity daily exercise (e.g., brisk walking, swimming, cycling) or 45–60 min, 5 days a week exercise, for the overweight and obese candidates to lose weight.<sup>[2,6,7,9,25]</sup>

Behavioral lifestyle modifications are considered to be the most difficult to change, unless the surrounding obesogenic environmental triggers are changed,<sup>[16]</sup> or when healthy behaviors are introduced early in life (1–5 years of age).<sup>[24]</sup>

Although the pharmacotherapy for the treatment of obesity sounds appealing to most patients, it is the least used strategy due to drug side effects and the low excess weight loss over time. The American Food and Drug Authority (FDA) approved only few drugs for the treatment of obesity including Orlistat,<sup>[26]</sup> Lorcaserin, Phentermine/Topiramate, and Liraglutide.<sup>[27]</sup> More research at the cellular level, hunger/satiety hormones

and peptides, and on metabolism may reveal newer drug discoveries that may change the whole future of obesity.

Bariatric surgery remains the most effective method for a sustained weight loss over time, cure or improvement of comorbid conditions like the metabolic syndrome, and improved quality of life.<sup>[28]</sup> However, not all surgically indicated patients could afford bariatric surgery due to the high costs and fear of major or life-threatening complications. The National Institute for Health (NIH) guideline for bariatric surgery (Body Mass Index (BMI) > 40 kg/m<sup>2</sup> or BMI ≥ 35 kg/m<sup>2</sup> with comorbidities) remains static since 1992,<sup>[29]</sup> with minor modification made by FDA for adjustable gastric banding (BMI > 40 kg/m<sup>2</sup> or BMI 30–40 kg/m<sup>2</sup> with comorbidities).<sup>[30]</sup> Laparoscopic gastric banding was considered as the safest bariatric procedure with long-term excess weight loss of 30–60%.<sup>[31]</sup> Over the last decade or so, laparoscopic sleeve gastrectomy became the most popular and most frequently done bariatric procedure due to the ease of its technique and sustained long-term excess weight loss of 58–62.5% with improvement or cure of comorbidities.<sup>[32]</sup> Since its introduction in the 1970s in USA, Roux-en-Y Gastric Bypass (RYGB) procedure remains a popular bariatric procedure worldwide due to its sustained long-term excess weight loss of 77–83%, and most of the comorbidities improved or cured, and >95% improvement in quality of life was achieved.<sup>[33]</sup> Recent recommendations advocate bariatric surgery, especially RYGB procedure, for type 2 Diabetes Mellitus (DM) even with lower BMI ≥ 30 kg/m<sup>2</sup>.<sup>[7,34]</sup> The biliopancreatic diversion (BPD) procedure, initiated in Italy also in the 1970s, has even a stronger effect on the sustainability of long-term excess weight loss of 80–90% and much more cure of type 2 DM.<sup>[35]</sup> However, the BPD procedure did not sustain its popularity worldwide due to its major postoperative vitamins and minerals deficiencies, and less favorable quality of life, when compared to other bariatric procedures. The BPD with sleeve gastrectomy was introduced and modified further recently to single anastomosis duodeno-ileal bypass with sleeve gastrectomy to avoid the major long-term complications of the original BPD while maintaining its strong effect on excess weight loss and cure of type 2 DM and other comorbidities.<sup>[36]</sup>

Abundant literature reported on the effects of school education and interventions for prevention and management of excess weight. Successful interventions reported in Greece were the most evident, when teachers introduced a 12-week course to students and their parents about healthy foods eating and exercise.<sup>[37]</sup> Similar interventions in other countries were also successful when education about healthy eating, physical activity, and behavioral modifications was introduced to schools' curricula.<sup>[14,21,38,39]</sup> At workplaces, a successful 2 h,



4 days, 4 weeks program (Coronary Health Improvement Project) on healthy foods eating, exercise, and behavioral modifications was conducted at lunchtimes at a workplace in Utah, USA. This program yielded long-term improvement on health knowledge and short-term improvement on physical health.<sup>[40]</sup> The move and improve program was another successful worksite wellness intervention implemented in 1996 in Maine, USA.<sup>[41]</sup> In this program, employees and community members were encouraged to increase their physical activity. Results of participation in this program yielded a significant impact on participants' lifestyle, risk behaviors, and chronic disease risk reduction.<sup>[41]</sup> Other successful workplace programs were also reported in Singapore that include a free online program that disseminates knowledge on healthy life styles, healthy food products Bazaar at workplaces, and the national weight management program "Weigh to Go."<sup>[21]</sup>

The parental role in children's health is of paramount importance. Several parental attempts to prevent and manage childhood obesity failed to achieve measurable changes, unless aided by specialized community programs.<sup>[42]</sup> However, successful parental interventions happened when healthy life styles were introduced during early childhood life.<sup>[24,42]</sup> The Active for Life Program<sup>[43]</sup> involves other extreme of age households. It encourages more physical activity in senior men and women ranging from 60 to 70 years of age. Results found statistically significant increases in physical activity, decreases in depressive symptoms and stress, increases in satisfaction with body appearance and function, and decreases in body mass index.<sup>[43]</sup>

In a community-based social center, large group of clients participated in 6-month weight management program conducted by a nutritionist, physical fitness trainer, and health behavior professionals. Participants benefited from gaining knowledge, learning new behavioral skills, and from interpersonal interactions.<sup>[44]</sup> The MEND (Mind, Exercise, Nutrition, Do it!) 7–13 program is another successful community-based intervention that involves interprofessional measures to improve the mind, exercise, nutrition, and behavior of overweight and obese children aged 7–13 years. Results indicated improvements in weight loss and psychology of boys, but only self-esteem improvement for girls.<sup>[45]</sup>

Most religious activities in worship places are spiritual, lacking the healthy physical, nutritional, and behavioral education and training aspects. Successful trials for healthy lifestyle interventions were reported in some churches' activities.<sup>[46,47]</sup> These interventions can be extrapolated to other religious activities when people gather for long spiritual, educational

hours in worship places. Additional activities may include some physical activities, eating healthy food (e.g., fruits and vegetables), and other healthy life-style behaviors by invited professionals.

Mass and social media are becoming the preferred and most effective way to inform mass people about health and disease campaigns. The Counter Tobacco website ([www.countertobacco.org](http://www.countertobacco.org)) has thousands of unique visitors who are progressively increasing since its launch in 2011. This is a good mass media tool to use for anti-obesity and NCDs campaigns. The BBC's "Fighting Fat, Fighting Fit" campaign is another successful mass media intervention targeting overweight and obese individuals. Participants reported significant reductions in weight, lower fat, and snack intake, and significant increases in exercise levels, and healthy food intake during the 6-month period of the campaign.<sup>[48]</sup> Another example of a successful paid internet advertisement program was the VERB campaign directed toward US children 9–13 years of age aiming to increase their physical activity.<sup>[49]</sup> This campaign resulted in increased levels of awareness and physical activity among respondents. Federal laws have worked to stop television (TV) advertisement for tobacco.<sup>[13]</sup> Similar laws to stop TV and other mass media advertisement of unhealthy (calories-dense) junk foods and sweetened beverages should be considered by government officials.

Efforts to change obesogenic environmental factors are of paramount importance to reverse the increasing prevalence of obesity and to facilitate individuals' behavioral changes.<sup>[16]</sup> Farmers' subsidies and provision of more places (e.g., fruits and vegetables Bazaars) to sell their products are effective interventions to increase healthy food consumption.<sup>[17,21]</sup> The Farmers' Markets Nutrition Program is another good example of an initiative to sell healthy food to low socioeconomic class people using discounted coupons.<sup>[17]</sup> Contrary to this, legislative laws and policies should discourage the production and selling of junk (calories-dense) foods and sweetened drinks.<sup>[13,15,16]</sup> Another good legislative example is the Healthier Choice Symbol Labelling Program in Singapore. The presence of this symbol on any product means that it is adjudged healthy by government officials, and this leads to more consumption by the public.<sup>[21]</sup>

For decades, increasing taxation for unhealthy products was the most politically resisted intervention by the food industry. Some strategies were found to be effective in this dispute. The "win-win" strategy implies penalties and more taxation for unhealthy products on one hand, while more subsidies and incentives for producing healthy foods and drinks on the other hand.<sup>[16]</sup> Taxations below 20%



were found to be not that much effective, while taxations above 50% were found to be more effective in reducing consumption of unhealthy products.<sup>[17]</sup> Restaurants and supermarkets are increasingly adopting labeling policies to mark the type of nutrient and corresponding calories on food and drinks. These policies were found to be more effective for the high socioeconomic population who are more conscious about their health.<sup>[17]</sup> Labels must be clearly written and put upfront.<sup>[18]</sup>

Relevant government officials and policy makers should seriously consider increasing exercise areas, like road-sidewalks and cycling areas, public gardens, and social community centers with exercise facilities, which are equally distributed throughout city and town areas.<sup>[18,21,24]</sup> These interventions are friendly environmental drivers that encourage more physical activity and exercise for the public, especially for children and adolescents. Similarly, increasing public transportation would increase walking and physical activity.<sup>[13]</sup> One study showed an increase of more than 30 min of walking when public transportation facilities have increased by 29%.<sup>[50]</sup>

Health insurance for obesity and bariatric surgery still poses a big challenge to governments, insurance companies, and private hospitals. Comorbid conditions associated with obesity are far more costly when compared to obesity itself.<sup>[51]</sup> Some insurance companies abide by the NIH guidelines<sup>[29]</sup> for bariatric surgery, while others require at least 6 months of structured dieting and exercise program prior to the surgery, and the majority are considering obesity as cosmetic and behavioral issue not worth insurance coverage.<sup>[52]</sup> The increasing prevalence of obesity and its associated comorbid diseases exert complicated challenges to insurance companies and governments worldwide. Therefore, it is prudent for both parties to share in the national strategies and policies to prevent and control obesity.

Facilitating factors for successful implementation of such policies and interventions may include: (i) support of political leaders, especially from the Ministry of Health, (ii) support of civil societies and organizations, (iii) support of academics in developing the technical framework, (iv) media campaigns, and (v) international reports and recommendations.<sup>[18]</sup> On the other hand, failures of implementation were marked by: (i) opposition of food industry, (ii) governmental shortcomings including poor planning capacity, lack of accountability and transparency, inadequate budgeting, and insufficient resources, (iii) politics and conflict of interests, (iv) changing leadership, and (v) poor prioritization of health and public issues.<sup>[18]</sup>

In conclusion, research and experience in this field found that overweight and obesity has complex combinations of abnormal balance between individuals' eating and energy expenditure, behaviors, and cultural and environmental factors. Therefore, to prevent and control such a complex disease, a multifaceted approach involving all relevant stakeholders, institutions, and policy makers would seem to be more effective than individualized work. Proper strategic planning and implementation and continuous monitoring and evaluation of the interprofessional system approach to prevent and control obesity in the region can influence its impact on individuals and society.

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