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## Techniques for assessment of childhood obesity

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### Abstract

In modern scenario, sedentary lifestyle, inactivity, mechanical way to live life has greatly influenced and enhanced condition of overweight and obesity that adversely affect overall body composition of an individual. Increasing condition of overweight and obesity are associated with decrease amount of time spent on physical activity or exercise. There are various causes that are directly or indirectly affecting health of an individual and leads to the condition of overweight and obesity. Heredity, environment and behavior are main contributor to increase condition of overweight and obesity. However physical fitness of an individual is also determined by genetic factors, and various studies also revealed the significance of environmental factors. There are various techniques for measurement of obesity as simple methods with measurements of the skinfold thickness that were used for ranking the individuals on the basis of their relative fatness or for assessment of the size of the specific deposition of the subcutaneous fat. BIA measures impedance of body by releasing small amount of electric current. DXA developed for measurement of the mineral mass of bone, which calculated from differential absorption of the X-ray with the help of different two energies. MRI is the technique of imaging that is used for estimation of the body volume rather than fat mass of the adipose tissue. BMI is acceptable for determination of overweight and obesity among children of age two years or older. Among adolescents and children with age ranges from 2-19 years, the obesity was well-defined as BMI at or above 95<sup>th</sup> percentile with age and sex specific as per CDC growth charts. For prevention of obesity among children concern should be given towards eating habits, healthy diet, physical activity, sleeping and television watching hours. Critical role should be played by the schools for establishment of supportive and safe environment with the practices and policies that supports the healthy behavior of an individual. Schools are also providing the opportunities for their students for practicing and learning the physical activity and healthy eating behavior.

**Keywords:** Obesity, childhood obesity, BMI, BIA, DXA, MRI

### Introduction

In modern scenario, sedentary lifestyle, inactivity, mechanical way to live life has greatly influenced and enhanced condition of overweight and obesity that adversely affect overall body composition of an individual. Obesity may be defined as greater amount of body fat in relation to lean body tissues than the limit that is prescribed separately for male and female i.e. more than 25 percentage for male and more than 30 percentage for female. Nowadays, due to increased sedentary lifestyle and inactivity obesity has become a serious health problem mainly in developed countries as USA, England, France, Japan etc. But on the basis of recent survey, India has come to the third position with largest number of children suffering from overweight and obesity problem. Obesity itself associated with various diseases as hypertension, coronary heart diseases, respiratory problem, diabetes, etc.

Obesity may be defined as a condition where excessive amount of fat is accumulated in the adipose tissue (Seidell and Visscher, 2004) [16]. Body fat of an individual could be estimated directly by estimating the proportion of total body fat tissue mass with the lean body tissue mass. Obesity and overweight are defined as excessive amount of fat accumulated in adipose tissues that may leads to health problems. WHO classified weight status among adults independent of sex and age into various categories as BMI less than 18.5 is considered as underweight category, BMI between ranges from 18.5 to 25 is considered as normal weight category, BMI between ranges from 25 to 30 is considered as overweight category, and BMI more than 30 considered as obese category. Among children, to assess obesity and overweight BMI percentiles that are specific to age and gender are used to report the different categories

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but worldwide, standard is not there for weight categorization among children. Several BMI percentiles based upon international and national data were developed. BMI percentiles correspond to cut off of obesity and overweight were developed on the basis of the populations and year. For most of the BMI centile curves, 90<sup>th</sup> and 97<sup>th</sup> percentiles considered as respective cut off for categorization of overweight and obesity category, except for references of United States of Centers for disease control and prevention (CDC). In CDC, BMI cut offs that were used to categorize overweight and obesity category were the 85<sup>th</sup> and 95<sup>th</sup> percentiles. In comparison to the international percentiles, national percentiles are more sensitive.

The high prevalence of obesity and overweight among children remains of extent and great concern for public health, even though of possible recent stabilization (Ogden, 2010)<sup>[11]</sup>. Increasing condition of overweight and obesity are associated with decrease amount of time spent on physical activity or exercise. However physical fitness of an individual is also determined by genetic factors, and various studies also revealed the significance of environmental factors. Physical fitness is ability of an individual to perform daily task effectively and efficiently without undue fatigue and has ample of energy for leisure time activity and to meet unforeseen situations. Regular involvement in performing physical activity leads to physical fitness among an individual which leads to increased life expectancy. These studies were conducted on children age ranged from 6 to 19 years and children were selected from 27 countries, results revealed decline in terms of aerobic fitness by 0.4%/year between year 1970 to 2003 (Tomkinson and Olds, 2007)<sup>[12]</sup>.

### Causes of Obesity

Obesity and overweight may be influenced or affected due to various unrevealed reasons. There are various causes that are directly or indirectly affecting health of an individual and leads to the condition of overweight and obesity. Heredity, environment and behavior are main contributor to increase condition of overweight and obesity. CDC has considered these three as main cause to increase the complexity of prevalence of obesity and overweight. These causes are briefly explained below:

#### 1. Heredity

Heredity may be defined as the passing of physical or mental traits genetically from ancestors to the new generation. Science revealed that genetics plays a vital role in obesity condition. Genes could cause some disorders which can lead to the condition of obesity. However, this is also not possible that all the individual who are prone to obesity will become obese. Researches are going on the reveal about the genes that are responsible for obesity.

#### 2. Environment

Environment is the surrounding or the condition in which an individual lives or operates. There is crucial role of environment in shaping lifestyle and habits of an individual. There are various environmental factors that can affect health decision of an individual. In modern era, people are living more sedentary lifestyle for instance, walking been replaced by driving vehicle, physical activity or exercise been replaced by latest technology and proper nutrients been neglected by more consumption of junk food.

### 3. Behavior

It is very easy to adopt and follow unhealthy behavior habits in today's fast pace environment. In terms of obesity, behavior related to the choices in foods, amount of time consumed in physical activity, and effort in maintenance of one's health. More calories are being consumed by Americans in comparison to the past decades. Due to increased consumption of calories decreased proper nutrients being consumed that are required to maintain healthy lifestyle. This behavior leads to health problem and also relates to increase in body size proportion. While Americans are more indulged in consuming more calories, and involve themselves lesser in physical activity. Physical activity and exercise plays a vital role in shaping and modifying one's behavior. Due to influence of modern technology as watching television, playing games on mobiles or computers or other technology leads to physical inactivity and encourage obesity problem in the society.

The complexity of these factors leads to establishment of different etiology for obesity and overweight during the stage of childhood and adolescence and its association during adulthood stage. Issue is more severe and complicated while considering infants stage, childhood stage, and adolescence stage, who are in the stage of growth and maturation. These three periods during the duration of growth, development and maturation were suggested as sensitive and were at risk for development of obesity and overweight on adulthood (Dietz, 1997)<sup>[1]</sup>:

- The infancy stage,
- The childhood stage, and
- Adolescence stage.

### Techniques for measurement of Obesity

#### 1.1. Simple Measurements

Measurements of the skinfold thickness were used for ranking the individuals on the basis of their relative fatness or for assessment of the size of the specific deposition of the subcutaneous fat. Measurement done by skinfold are simple and quick for obtaining body composition among various age group including infants. Generally, inter observer and intra observer errors are slight compared to the subject variability, on the other hand among obese children precision and accuracy are poorer.

Body mass index (BMI) is a measurement of the weight of the body relative to the height of the body with unit in kg/m<sup>2</sup>. BMI is standard tool for assessment of the shape of body and adiposity average level among children. BMI is widely used as index with estimation of the relative body weight, often expressed while taking into account the sex and age. Among the adults, BMI is considered as predictive in nature of clinical the outcome for example hypertension, type-2 diabetes. However, predictive value of BMI among children and adolescent is not clear. BMI is index of nutrition status that is accepted globally for categorization of both overweight and obesity, and also eating disorder with combination of the psychological criteria; but relation of BMI with body composition is controversial.

BMI is not able to distinguish between the fat mass and lean mass of body, and there are twofold ranges of the variation in terms of fatness for respective given BMI value among individual. BMI misleading among patients of hospitals, where the children are apparently malnourished in terms of BMI actually have raised in terms of relative fat of body and severely reduction in the lean body tissue. This is also important for the nutritional management of the children, as

lower BMI value can lead to the inappropriate overfeeding. Waist circumference is another tool to assess the body composition that provides very simple measure of the central fatness, this may be more predictive in nature due to adverse outcomes for example insulin resistance or lipid profile than the total body fat. Among adult, waist to hip ratio is considered as independently associated with the disease after the adjustment made for the relative body weight, so that the use of relative body weight and the shape of body simultaneously gives the better estimation related with the risk of the morbidity in comparison to either alone. Nowadays, similar findings are emerging in terms of children. Reference data were obtained of waist circumference from a representative sample of the children of United Kingdom in the year 1988.

Various studies were conducted to study relationship of the waist circumference with other measures of the fatness of abdomen obtained with the help of modern technique names as MRI that indicates the correlations consistently in range of 0.5 - 0.8, while associations with the proportion of the total fat of abdominal have a tendency to be higher in comparison to those of the intra-abdominal fatness. On the contrary part, most of the studies revealed the association among the abdominal fat and waist to hip ratio are inconsistent, whereas other studies indicates no or very little significant relation.

### 1.2. Predictive Techniques

The bioelectric impedance analysis (BIA) and skinfold thickness measurement both could be used for prediction of the body composition. With this approach, the generic problem is that these measurements involves not only one but two prediction. First prediction is that raw measurement used for prediction of the components or property of the body with the use of regression equation; second prediction is that, this obtained raw value is converted into final data of the body composition with further use of theoretical assumptions. Several equation were derived for prediction of percentage of body fat or density from the measurements of skinfold thickness. Such kind of equation may not valid for the population other than those equation from which these equations were derived. Accuracy among individual is consistently poor and also vary in relation to the fatness of body, and make this approach as unsuitable for the longitudinal comparison.

Prediction equations are certainly distinguish accurate raw data with the predictive error. Therefore, for the assessment of body fatness, it is well to leave the skinfold in its raw form where these raw act as more reliable indices for the regional fatness in comparison to the attempt prediction of the total fat mass. For the assessment of total fat free mass, approach that is based on the skinfold equations are mainly inappropriate, due to the reason as no index of the component of body weight is measured directly.

BIA measures the impedance of body by releasing small amount of electric current. The model of generic theoretical treats body as single cylinder with the measurement made between the electrodes that were manually placed on ankle and wrist. The adjustment of the data obtained by bioelectrical for body height allows for the estimation of the total body water. It requires empirical derivation of the regression equation that are relating height square divided by impedance to total body water. Then, these equations are applied subsequently for the prediction of total body water that is converted to the fat free mass as mentioned below.

BIA combines with various assumption. There are various

model out of which simplest model involves foot to foot measurement or hand to foot measurement made at the current of 50 KHz that depends heavily most on these assumption. Therefore they provides simplest values for assessment of composition of body. The relationship between the total body water and bioelectrical data is influenced on the basis of range of age investigated with populations other characteristics. The equations of BIA that are published are specific in terms of population and perform very poorly among healthy individual with the error of typical  $\pm 8\%$  body fat in individuals. The pediatric equations were derived for the states of disease such as cystic fibrosis, HIV, and obesity. However the accuracy among individuals remain poor and the measurement may be confounded with the clinical status such as presence of the edema. Foot to foot measurement are easier to obtain and have a little poorer accuracy in comparison to the whole body measurement.

Despite of the limitations, there are more and better sophisticated approach to BIA that have potential both for the improvement of the accuracy and also to increase specificity of outcome and progress is needed for giving ease with the help of which measurement could be made amongst most of the age groups. Examples of these are the measurement of segmental of limbs or measurement of torso that avoid confounding effect of the variability in the build of body, though multi-frequency measurement provides various additional information pertaining to the water distribution. These are dynamic areas of the research but their knowledge are insufficient currently for justification of routine clinical applications.

### 1.3. Two Component Models and Techniques

Two component technique divides body into fat free mass and fat mass. These methods avoid the two of difficulties as mentioned above while addressing both the body components of body weight and avoid need for prediction of total body masses from the superficial or regional proxies. Though these methods remain dependent upon the theoretical assumption for example constancy of composition of fat free mass.

Between the stages of birth and adulthood stage, the chemical maturation of the body lean mass occur where relative proportion of 3 main components as protein, mineral, and water could be changed with the status of pubertal and age. The two component method changes the addressed by the assumption of the constant body lean mass that is characterized by the given sex and age. Mainly such type of assumption may hold accurate for the healthy subject but they are also more challenging in the patients who are having disturbed body hydration or composition. Various techniques or methods are available for the assessment of the body composition.

### 1.4. Dual Energy X-ray absorptiometry

Dual energy X-ray absorptiometry (DXA) developed for measurement of the mineral mass of bone, which calculated from differential absorption of the X-ray with the help of different two energies. These calculations requires the allowance for the soft tissue and the values of fat free mass and fat mass are calculated for the scans of whole body with the use of the instrument that are specific algorithms.

DXA is the acceptable and quick for the children with about age of 4 years and also can be used for the small infants. DXA uses the ionized radiations but effective doses are equivalents of the contemporary instrument will be below the background levels. Although it is widely used mainly in USA, and the

problem with accuracy of the technique received the insufficient attention. Preferences are varies with the fatness and age and in few cases they are state of underlying disease. The comparison between the different groups are more likely to identifying the direction of changes but also fails to measures difference in more accurate way while accuracy of the techniques with the changes could be measured within people who are losing or gaining body weight are more liable to confound by changes in the status of their body weight. Therefore studies conducted with DXA technique are being conducted increasingly and also contributing to evidence based for the clinical pediatrics, these kinds of studies should be taken with the cautions and techniques or methods that doesn't represents the reference method.

There are various limitations associated with DXA technique that varies according to the shape of body and its outcome. The substantial predictions are involved in the trunk composition rather than its measurements and the estimation of the soft tissue in this area are accurate in less proportion in comparison to the limbs. The useful information may be provided by the DXA on the basis of relative lean mass and fat mass as the single measurement among individual mainly in relation to the lean mass of limb.

### 1.5. Densitometry

Densitometry is the approach that distinguishes between the fat free mass and fat mass of the body, with assumption of specific densities of fat and fat free mass tissues and therefore it requires the measurement of total density of body with measurement of mass or volume of body. While fat density is actually constant that of fat free mass that varies on the basis of its body composition. This variability of densitometry is not completely explained with process of the chemical maturation which occur before the stage of adulthood.

Usually, the volume of body was measured by the hydro-densitometry. However, the approach is unsuitable clearly for assessment of body volume among many children, and especially among patients. New alternative technique is known as air displacement plethysmography. This technique is used for measurement of the volume of air that is displaced by subject or an individual. The technique of air displacement has well precision in comparison to that of hydro densitometry among the children, and also is acceptable for the children also of the age of 4 years.

In common, the densitometry for the application as two-component technique among the patients it is considered unsuitable where body composition of the lean body mass of an individual may be abnormal. There are various typical effect of the diseases, out of which some effects are retention of the excess fluid and under mineralization. These both factors decreases overall density of the body lean mass and therefore also leads to overestimation of body fatness. Though, errors in the densitometric are smaller among the larger individual or population. Therefore, the densitometry considered useful for the purpose of monitoring the changes over period of time in terms of obese or overweight individual, and accuracy of densitometry is less expected to confound by the changes of longitudinal in body fatness in comparison to that of DXA.

### 1.6. Isotope Dilution

The deuterium dilution could be used for the measurement of total body water that allowing for the estimation of lean mass. In deuterium methods, a dose of water is given followed by the equilibration, and enrichment of water pool of body is

measured by the use of samples of urine, blood, or saliva. Generally, the samples are analyzed by isotope ratio mass spectrometer. Though, various clinical services are based upon the cheaper substantially but extra labor intense spectrophotometer technique.

The estimation of the fat free mass from the total body water content requires values that are assumed for hydration of fat free mass. The reference values that are published are relatively more consistent with the values that are measured among the infants and children who are healthy, with the individual variability between are also relatively low. However, in the state of disease, variability in fat free mass hydration is higher substantially, due to either under-hydration or over-hydration.

The isotope dilution technique is very simple for carrying out and it also requires the minimum subject cooperation. Particularly it has evidenced more valuable among the infants and among toddlers due to requirement of low compliance, and it can also be easily used in the studies of field. It is proved as a useful clinical technique or tool among individual where assumption of hydration should be normal, with quick provision of the possible results by the use of photospectrometric analysis.

### 1.7. Magnetic Resonance Imaging

Magnetic resonance image (MRI) is the technique of imaging that is used for estimation of the body volume rather than fat mass of the adipose tissue. By investigation of emission and absorption of energy in frequency range of electromagnetic spectrum, method or technique produces the image that are based upon the variations of spatial in frequency and phase of energy that was emitted and absorbed. Primarily, MRI addresses the hydrogen nuclei that is located in water or either in fat, and also uses data obtained for determination of the type of tissue in the imaging slices, that then can be summarized for calculation of the volume of the regional tissue.

Despite of the higher quality in terms of the imaging data that are obtained by the MRI. Various difficulties are there for comparison of the obtained results with the results obtained from measurements done by other techniques. Firstly, to derive the body fat mass, there is requirement of assumption of the content of body fat of the adipose tissues and also the fat density. While, relatively latter is invariable, and former is not. There is also the second problem and that is only that where fat mass is measured by the MRI, it is only present in the adipose tissues. Therefore, the techniques for example hydrometry, multicomponent model, or densitometry are quantifying different entity in comparison to that of MRI. Also, the MRI has high cost relatively and is also very limited in terms of its availability.

### 1.8. Other Techniques

There are some other techniques for assessment of body composition that includes whole body potassium scanner and total body electrical conductivity. These both techniques are suffering from about 3 limitations. Firstly, both techniques are available widely. Secondly, outputs of these techniques are showing poor agreement with the output of other techniques, while this is less applicable to the TOBEC in comparison to the TBK. Thirdly, for both techniques no UK reference data is available that hinders clinical application of these techniques.

### 1.9. Multicomponent models

The multicomponent model are minimizing the assumption

that made this technique as simpler models, therefore this technique is placed best for addressing the variability in composition of body lean mass. Bone mineral and total body water are measured with the techniques that are specifically designed for these purpose only and also improving the accuracy of their outcomes. On the other hand, two-component model are assuming key body property, and the multicomponent models used to measure them and this model could provide the data on the density, mineralization, and hydration of fat-free mass. This is important particularly among the pediatric patient, among whom the composition of body derangement is sometimes is extreme. Due to absence of the carcass analysis, multicomponent model is considered as gold standard for the vivo measurement. More important, these models are only the criterion or reference techniques against which methods can be compared that are less accurate. Due to the diversity in the requirement of equipment, these model are suitable only for research and besides with the MRI for the distribution of fat it should be considered as finest approach for obtaining evidence base for the underpin clinical practices.

Three-component model is used for division of weight of weight into water, fat and in the remaining fat-free tissue and also requires the measurement of weight of body, water content by the hygrometry, and volume of body by densitometry. Further, four-component model further divides fat-free dry tissue into protein and mineral, and also requires similar data plus measurements by DXA of the bone mineral.

### BMI for the Children and Teens

BMI is a method that is used for assessment of overweight and obesity among children. The overweight condition may be defined as BMI that exists at or above 85<sup>th</sup> percentile, and below 95<sup>th</sup> percentile for the teens and children of similar sex and age. Obesity may be defined as BMI at or above 95<sup>th</sup> percentile for children and teens of the same age and sex.

The calculation of BMI for an individual can be done by dividing body weight in kilograms by square of body height in meters. BMI is sex and age specific for children and teens, and sometimes also termed as BMI-for-age. The weight status of a children is determined by using sex and age specific percentile for the BMI relatively categories of BMI that is being used for the adults. The reason is that body composition of children varies as age varies and also varies between girls and boys. Thus, the levels of BMI among children and teens are required to be stated in relative to other children with same sex and age.

For instance, a boy with age of 10 years with average body height of about 56 inches with body weight of about 102 pound would have 22.9 kg/m<sup>2</sup> as his BMI. This BMI value will place boy in 95<sup>th</sup> percentile, and also would be determined as obese. This clarifies that BMI of child is greater than 95% BMI of a boy with age of 10 years in reference population.

CDC Growth Chart most commonly used as an indicator for measurement of size and patterns of growth among teens and children in United States. BMI for sex and age specific with the corresponding percentile were based upon the expert committee that are recommended and shown in below mentioned table.

- Children with obesity are more expected for becoming obese during their adulthood stage. Obesity among adults is related with various serious health problems that includes diabetes, heart disease, cancer, and metabolic syndrome.

- If a child is obese during his/her childhood stage, then obesity condition and health problem risk factors during the adulthood stage are likely to become more severe.

Weight Status Category	Percentile Range
Underweight	Less than 5 <sup>th</sup> percentile
Healthy or Normal Weight	5 <sup>th</sup> percentile to less than 85 <sup>th</sup> percentile
Overweight	85 <sup>th</sup> to less than 95 <sup>th</sup> percentile
Obese	95 <sup>th</sup> percentile or greater

Body fat is not measured directly through BMI method, but researches indicated that BMI has association with other direct measures to assess body fat, for instance the BIA, skinfold thickness measurement, densitometry, DXA and various other techniques or methods. BMI may be deliberated as the alternative with the direct measures of the body fat. A trained and better equipped healthcare provider would perform suitable and proper assessments of health for evaluation of the health status and associated risks of an individual's.

### Prevention of the Childhood Obesity

- The habits of healthy lifestyle includes physical activity and healthy eating, which could lower risk of obesity and its associated health problems.
- The behavior of health dietary habits and habit of performing physical activity by the adolescents and children are affected by some sectors of the society which includes communities, families, child caring settings, schools, provides of medical care service, government agencies, faith-based institution, media and industries of beverages and food and the entertainment industries.
- Critical role is being played by the schools for establishment of supportive and safe environment with the practices and policies that supports the healthy behavior of an individual. Schools are also providing the opportunities for their students for practicing and learning the physical activity and healthy eating behavior.

BMI is acceptable for determination of overweight and obesity among children of age two years or older. BMI is calculated by ratio of body weight to body height. BMI for children in normal range varies with sex and age. BMI value above 85<sup>th</sup> percentile considered as overweight, BMI value equal or greater than 95<sup>th</sup> percentile is considered as obesity by CDC growth chart. CDC published the tables for determination of this in children. According to the US Preventive Service Task Force, not all the children having higher BMI values need to manage or lose their body weight though. Higher BMI value of a child can also identify possible problems related to weight, but the value not able to differentiate between lean or fat tissue.

The prevalence of overweight and obesity is utmost commonly measured through BMI. BMI is defined as body weight in kilograms divided by body height squared in meter. BMI is accepted widely for the measurement of individual BMI measurements has limitation by fact that BMI is not able to difference between the muscle mass and body fat (Wells, Treleaven *et al.*, 2007) [18]. An indirect estimation of total fat of body is given by BMI and it will not provide reliable prediction in terms of the outcome (Speiser, Rudolf *et al.*, 2005) [15]. BMI is considered as non-sensitive for assessment of the body fatness among an individual who is tall or short particularly, or have unusual distribution of fat in the body. BMI also may misclassify the athletes or players with lower percentage of the body fat but higher amount of muscle mass.

Though, for study at large scale and large population data BMI considered as inexpensive and simple method for assessment of fat in body (Prentice 1998) [13]. The perfect application of the BMI considered when the body weight and body height are assessed with the help of a trained individual while self-report in terms of BMI demonstrated as very useful (Goodman, Hinden *et al.*, 2000) [5]. Measurement of body weight and body height is considered as non-invasive and also is accepted by individual who is being measured. BMI has low observer error with good validity and reliability (Lobstein, Baur *et al.*, 2004) [9]. In addition to this, the anthropometric measures of fatness of the body are significant for consideration in conjunction with the obesity.

#### Recommendations for Prevention of Obesity:

- Messages of prevention of obesity should be directed to all families it should be starting during time of birth of a child in a family (Barlow, 2007) [14].
- The assessment in terms of sedentary behavior, physical activity, and diet should be done on annual basis. This kind of assessment should be done for targeting the message to every family (Barlow, 2007) [14].
- The suggestions from clinicians was made that children should do at least sixty minutes exercise of moderate level on daily basis (Barlow, 2007) [14].
- Children and their families should be counselled by the clinicians to have breakfast daily; to have diet with proper amount of vegetables and fruits with recommended quantity; limit children from consuming beverages that are sugar-sweetened; have daily meal at same time as much as possible; limit habit of eating outside especially food of restaurants; adjust portion of meal size on the basis of age of a child; strictly avoid TV watching specially for children who are under the age of 2 years; limit duration of screen time and TV to not more than two hours per day (Barlow, 2007) [14].

The counselling messages that has been mentioned below should be directed directly to parents, irrespective of status of their child's body weight.

#### The role of community in promotion of healthy lifestyle among children and also in prevention of obesity and overweight

Many vital intervention were developed for improvement of health and wellbeing of a child that will take place at their own home, and we can also play a vital role in prevention of obesity in the community as well. These interventions are mentioned

- According to the public policy, efforts are being made for promoting safe access towards trails, parks, and roads.
- As per the efforts made by the school for providing healthy lunch will decrease accessibility of students towards competitive food with low quality in terms of nutrition, and will also decrease use of food as rewards.
- As per the efforts made by the organizations or promotion of the physical activity and also towards decreasing treats that were provided during events of children such as cookies or chocolate after the game of soccer.

#### Conclusion

Obesity is rising and affecting most of the population with old age, adults, adolescents, and children. For assessment of obesity there are various techniques such as BIA, DXA, MRI, Densitometry, BMI are acceptable for determination of

overweight and obesity among children of age two years or older. Among adolescents and children with age ranges from 2-19 years, the obesity was well-defined as BMI at or above 95<sup>th</sup> percentile with age and sex specific as per CDC growth charts. For prevention of obesity among children concern should be given towards eating habits, healthy diet, physical activity, sleeping and television watching hours. Critical role is being played by the schools for establishment of supportive and safe environment with practices and policies that supports the healthy behavior of an individual. Schools are also providing the opportunities for their students for practicing and learning the physical activity and healthy eating behavior.

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