

Annali Online dell'Università di Ferrara

Sezione di Didattica e della Formazione docente

Vol. 10, n. 9, 2015. ISSN 2038-1034

*Assessment of nutritional status and body image perception on immigrants**Emanuela Gualdi-Russo*

Department of Biomedical and Specialty Surgical Sciences, University of Ferrara, Corso Ercole I d'Este 32, 44100 Ferrara, Italy and TekneHub, Tecnopolo of University of Ferrara, Via Saragat 13, 44122, Ferrara, Italy.

Abstract - The valuation of the nutritional status and body image perception of the immigrant population is important to detect exposed groups at risk and to make nutritional recommendations. The assessment of nutritional status can be carried out through different methods, among which Anthropometric ones are especially recommended in case of large immigrant flow. This assessment is an important basis for developing an effective strategy to improve nutrition and health status in immigrants.

Abstract - La valutazione dello stato nutrizionale e della percezione della immagine corporea nella popolazione d'immigrati è importante per l'individuazione di gruppi a rischio, in modo da fornire le opportune raccomandazioni nutrizionali. La valutazione dello stato nutrizionale può essere effettuata mediante diverse metodologie. Il ricorso ai metodi antropometrici è particolarmente consigliabile nel caso di un grande flusso d'immigrati. Questa valutazione può costituire un'importante base di partenza per sviluppare una strategia utile a migliorare lo stato nutrizionale e di salute dell'immigrato.

1-Introduction on nutritional status

The nutritional status is the current condition of health of a person or a group related to their intake and utilization of nutrients. It is influenced by endogenous (age, gender, ethnicity) and exogenous (nutrition behavior, physical activity, cultural, social and economic circumstances, etc.) factors.

Malnutrition is the consequence of a lack or excess of nutrients and/or faulty utilization of them. Currently malnutrition, leading to either underweight or overweight, is one of the major public health problem (Livingstone, 2001; Kaur et al, 2003; United Nations Children's Fund et al, 2012; Olearo et al, 2014; etc.).

The ethnic groups are different in anthropometric characteristics related to the genetic component (Gualdi-Russo et al, 2014a). However, in addition to genetic differences, behavioral differences in diet and exercise habits between ethnic groups could also contribute to disparities in the onset of obesity.

The process of migration generally occurs in few stages (Bhugra, Becker, 2005). The initial stage of migration generally has a lower incidence on health than the later stages (Gadd et al. 2006). During the post-migration stage, the impact of low-income condition and the high prevalence of poor lifestyle habits are associated with differences in attitudes towards healthy foods, limited knowledge about healthy diets, decreased awareness of the benefits of a healthy diet (Jonnalagadda, Diwan, 2002). An inadequate diet, combined with an inactive lifestyle, contributes to the tendency toward centralized obesity (Toselli et al, 2008).

Immigrants, generally coming from nations with high prevalence of malnutrition due to nutritional deficiency, arrive in a new country characterized by high prevalence of malnutrition due to an excess of food. In a recent review on nutritional status of children of immigrants in Europe (Gualdi-Russo et al, 2014c), an increase in overweight and obesity has been reported with a higher prevalence among immigrants from North African countries.

Obesity is associated with a variety of chronic diseases including hypertension, diabetes, cardiovascular disease, and hyperlipidemia (Wilson et al, 2002; Wellman and Friedberg, 2002; Lear et al, 2009). Therefore, subsequent monitoring may be necessary to guarantee the health of the immigrants and to avoid the risk of a transition to poor health over time.

The nutritional status can be assessed by anthropometric, clinical, biochemical and dietary methodologies. Only the first one assessment will be examined in this paper with reference to its applicability on immigrants. The assessment of nutritional status by anthropometrics is a good strategy in case of immigrants. Basic nutritional assessment by anthropometry is useful not only in developing countries, but also in countries in emergency conditions for immigration as European countries. It involves simple direct measurements to monitor people. The well-known advantages coming from an anthropometric evaluation are reported in Table 1.

Table 1 - Assessment of nutritional status in immigrants

ANTHROPOMETRIC ADVANTAGES	
➤	This simple and quick method may be used on many people;
➤	anthropometric instruments are simple, non-expensive and need minimal training;
➤	anthropometric method is safe and non-invasive;
➤	it measures many variables of nutritional significance;
➤	the measurements ratio (“anthropometric index”) may give further important information.

Despite the clear advantages, there are also some limitations in an anthropometric assessment of nutritional status, such as, in particular, the methodological inability to identify specific nutrient deficiencies. Among anthropometric parameters (Table 2), the most frequently used measure of underweight, overweight and obesity is the body mass index (BMI). Waist girth, especially, and waist-to-hip ratio could be, however, more useful as measures of visceral fat than BMI to predict morbidity and mortality in well-nourished subjects (Larsson et al., 1984; Lee et al, 2008) and, in particular, in immigrants (Gualdi-Russo et al, 2014b). MUAC is the most appropriate indicator of the nutritional status in under-nourished children (WHO, 2013), especially when used with age-specific cut-offs (Laillou et al, 2014). Ethnic- and gender-specific equations were suggested for predicting parameters of body composition (FM; FFM) from Bioelectrical impedance analysis in children (Nightingale et al, 2013). Other detailed methodological indication on the nutritional assessment in children are reported in the following paragraph, while specific anthropometric technical notes were added in the appendix of this issue (Rinaldo, Gualdi-Russo, 2015).

Table 2 - Main anthropometric traits used in the assessment of nutritional status

INDICES OF MALNUTRITION	
1.	Weight-for-age
2.	Length/Stature-for-age*
3.	Weight-for-Length/Stature*
4.	MUAC (Mid-Upper Arm Circumference)
5.	BMI
6.	Skinfold Thicknesses
7.	Waist girth
8.	Waist-to-hip ratio
9.	Bio-impedance parameters

* According to anthropometric rules, the length of the body on supine children below 2-3 years of age and the stature upright for children above are recommended.

Recent reviews of the literature about immigrant malnutrition in Europe found important differences in prevalence of obesity by ethnicity both in adults (Toselli et al, 2014b) and in children (Gualdi-Russo et al, 2014a, c).

Therefore, with particular reference to immigrants, Anthropometry can lead to: (1) identification of individuals/population groups at risk; (2) selection of individuals/population groups for intervention; (3) check of the situation after the intervention action.

2-Anthropometric indicators in children

Malnutrition assessment in children generally considers the first three traits reported in Table 2 or BMI. With reference to this assessment, the choice of appropriate reference standards and cut-offs for categories at risk is difficult. Some researchers suggest the local reference data -as ethnically more similar-, others the international reference data, according to more internationally acceptable definitions. Percentiles, percentage of the median or z-scores are used in the definition of cut-off points. Starting from a different terminology (overweight, obesity, at risk of overweight), different methods have been used according to a variety of reference data sets and developing specific centiles charts (Flegal et al, 2006). A scheme of the main cut-offs used is shown in Table 3.

Table 3 - Comparison among main traditional cut-off points used in the world.

NUTRITIONAL STATUS	WHO	EUROPE	USA
• Underweight	<-2 z-scores	< 3rd centile	< 5th centile
• Overweight	>+2 z-scores	> 90th centile	> 85th centile
• Obese	>+3 z-scores	> 97th centile	> 95th centile

As reported, underweight can be defined as BMI-for-age <5th centile (in US) or <3rd centile (in Europe). BMI-for-age cutoffs indicate risk of overweight in USA when >85th centile or overweight in Europe when >90th centile. Obesity is defined in case of BMI values >95th centile in USA or >97th centile in Europe.

The main methods for the current assessing of under-nourishment and over-nourishment are shown below.

Assessment of under-nourishment

Method 1

According to the World Health Organization standards (WHO, 2006), a large sample of data collected on children of different nationalities have been used to classify children as underweight, wasted, or stunted, each based on a cut off < -2 z-scores on growth charts. Among the most commonly used charts of weight-for-age, length/stature for age, weight-for-length/stature, the first one is reported in Figure 1 - female sex-, with application examples.

Weight-for-age GIRLS

Birth to 2 years (z-scores)

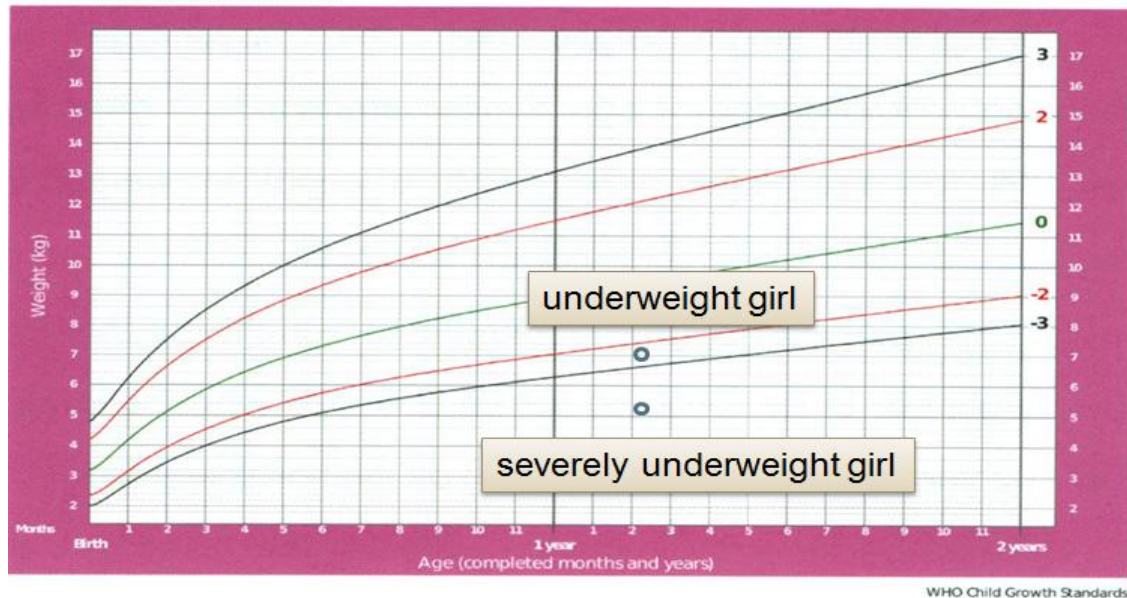


Figure 1 - Weight-for-Age chart for girls (0-2 years of age) (from WHO 2006, *modified*): the plotted point below -2 z-score and above -3 z-score indicates a condition of moderate malnutrition; the point below -3 z-score indicates a condition of severe malnutrition.

Method 2

New international standards and cut-offs for thinness were proposed from 2-18 years on the basis of pooled international data for BMI, averaging curves defined to pass through BMI 16, 17, and 18.5 at 18 years (Cole et al, 2007). The following different definitions of thinness grades 1, 2, and 3 were provided: 1.Mild (18.5); 2.Moderate (17); 3.Severe (≤ 16).

According to this method, a BMI value of 12.00 kg/m^2 in a 8-years-old girl, for example, indicates a condition of severe thinness, since the cut-off point for the thinness grade 3 for girls at 8 years is 12.31 kg/m^2 .

Assessment of over-nourishment

Method 1

Excess weight can be assessed by z-scores or percentiles on growth charts (WHO, 2006), as done for under-nourishment. On the same weight-

for-age chart chosen previously, children are classified as overweight or obese when cut off point is $>+2$ or $>+3$ z-scores on weight for length/stature charts (Figure 2).

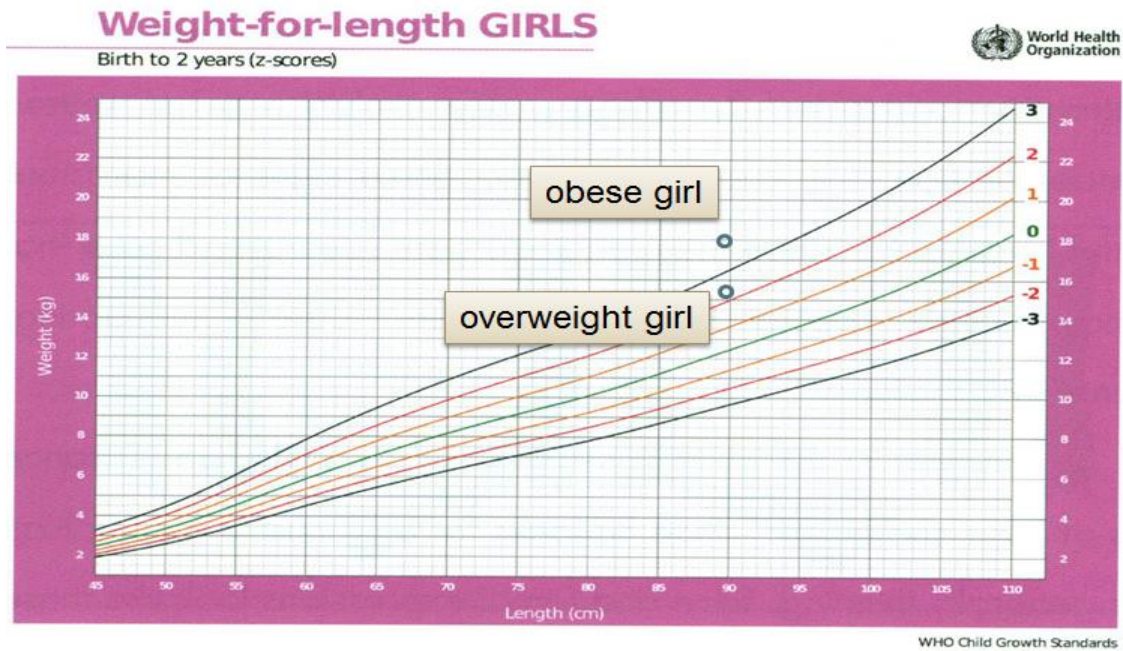


Figure 2-Weight-for-length chart for girls (0-2 years of age) (from WHO 2006, *modified*): the plotted point above +2 z-score and below +3 z-score indicates a condition of overweight; the point above +3 z-score indicates a condition of obesity.

Method 2

On the basis of an international cross-sectional growth survey, Cole et al. (2000) provided new age and sex specific cut-off points from 2 to 18 years by centile curves passing through the widely used cut off points of 25 and 30 kg/m² for adult overweight and obesity at age 18 years. Children are classified as overweight or obese when their BMI value is above these centile curves.

For example, if a girl, aged 8 y, has a BMI of 22.00 kg/m², this indicates a condition of obesity, as 21.57 kg/m² is the cut-off point for this nutritional status in 8-years-old girls.

These values are often referred to as the International Obesity Task Force (IOTF) cut-off values. This method may be used for international comparisons of prevalence of overweight/obesity without depending on reference data and on a specified percentile of a specific population (Flegal et al, 2006).

3- Body Image perception

Differences in nutritional status among ethnic groups can be related, in addition to differences in diet, physical activity and heredity, to differences in body image perception and ideal body image (Schuler et al, 2008). The relationship between BMI and body dissatisfaction can be influenced by ethnicity with different standards of beauty and, consequently, different desire to be more or less thin (Fitzgibbon et al, 2000; Neumark-Sztainer et al, 2002).

Healthy eating, exercise habits and a positive body image need to be developed and nurtured at younger ages across ethnic groups (Fitzgibbon et al., 2000).

Body image perception and body satisfaction can be assessed by the following methods:

1. Questionnaires;
2. Body Silhouette charts.

A large number of questionnaires to measure a generic aspect of body satisfaction or body shape are available from literature. Using the “Physical appearance state and trait anxiety scale: trait version” (Thompson, 1995), the personal anxiety or general feel about own body or specific parts of own body may be described, answering to various questions, such as “Do you feel anxious, tense, or nervous about the extent to which you look overweight?”, by a scale from 0 (never) to 4 (almost always).

Among the methods that are commonly employed there are figure drawings representing physiques from lean to obese with reference to BMI. Thompson and Gray (1995) developed a set of nine male and female schematic figures ranging from underweight to overweight to be used in adults. Similarly, sets of figures for preadolescent children (Collins, 1991) and for adolescents (Sánchez-Villegas et al, 2001) have been proposed.

In North-America, Asians and Whites prefer the thin body ideal and Hispanics and African-Americans tend to prefer a larger body size (Schuler et al, 2008). As a consequence, African-American women are less preoccupied with dieting and weight loss and less negative about their body image than White and Latin Americans (Miller et al, 2000). Satisfaction,

wealth, and happiness resulted associated to obesity in Caribbean adolescents of African descent (Simeon et al, 2003). The majority of European immigrants come from Africa where, according to literature, larger body size is an ideal of beauty as observed among Sahraoui women (Morocco), who show an high prevalence of overweight and obesity (Rguibi, Belahsen, 2006). Ghanaians, Ugandans, Kenyans and Zimbabweans rated larger female figures as ideal compared to US or British women (Cogan et al, 1996; Furnham, Baguma, 1994; Swami et al, 2012).

4-European studies on immigrants

Only few studies concerned ethnic differences in nutritional status and body image perception in Europe. Some interesting results were reported from three different researches carried out both on adults of different origin in Northern Europe and on children in Southern Europe, as follows:

➤ *Study on African adult immigrants in Northern Europe*

Authors: Nicolau et al, 2012;

Design: cross-sectional;

Sample: Dutch Moroccan women living in Netherland (N=22) and Moroccan women living in Morocco (N=31);

Setting: Amsterdam (Netherland) and coastal Rif region of North Morocco.

Tool: interview and silhouette drawings.

Results: there was an high prevalence of overweight and obesity among migrant women of Moroccan origin. Overweight was attributed to traditional Moroccan foods and food culture by participants in Amsterdam and to adoption of the Western diet by participants in Morocco. There was a general lack of knowledge regarding appropriate physical activity. All participants reported a cultural shift in preference towards slimmer body sizes, also if weight gain still tends to be seen as a sign of success.

Conclusions: the high prevalence of overweight and obesity among migrant women of Moroccan origin may partly be explained by a preference for large body sizes. Although there is a shift in body size preferences, both in Morocco and among Moroccans in the Netherlands, traditional ideals regarding body weight generate ambivalence and form a potential barrier to weight loss.

➤ *Study on Asian adult immigrants in Northern Europe*

Authors: Raberg et al, 2009;

Design: cross-sectional;

Sample: Pakistanis and Sri Lankans (N= 629);

Setting: Oslo (Norway);

Tool: anthropometry and questionnaire.

Results: both bodily dissatisfaction and unrecognized overweight resulted among South Asians in Norway with an overestimation of one's own weight among under- and normal-weight women and underestimation in overweight and obese have been found in South Asian immigrants. In comparison to ethnic Norwegian women, showing that 80% of those overweight and 90% of those obese were slimming, the Pakistani and Sri Lankan women show that about 40% of the overweight and obese had been slimming the past year. There are differences in how men and women attempt to diet: fewer daily meals in dissatisfied women, physical activity to gain weight in dissatisfied men.

Conclusions: there are both weight dissatisfaction and unrecognized overweight among South Asian immigrants in Norway. Associated factors and interrelationship require further research.

➤ *Study on children of immigrants in Southern Europe*

Authors: Gualdi-Russo et al, 2012;

Design: cross-sectional;

Sample: 2706 schoolchildren (1405 boys and 1301 girls) aged 8–9 years and their mothers;

Setting: Emilia-Romagna region (North Italy);

Tool: Anthropometry and Collins' body image silhouettes.

Results: The BMI values were lower in children of immigrant mothers than in Italian children. The prevalence of overweight was lower and prevalence of underweight higher in children of immigrant mothers than in Italian children. The misperception of body image shows a frequency of three times greater in underweight boys with immigrant mothers than in those ones with Italian mothers, while the misperception of body image of overweight children with Italian mothers is greater than children with immigrant mothers. The ideal figure values were higher in the immigrant mothers of male children and lower in the Italian mothers of female children.

Conclusions: cultural and behavioral factors linked to ethnicity play an important role in the nutritional status of children and in the perceived and ideal body image.

5- Discussion and conclusions

Changes in environment, lifestyle and dietary behavior affect health and nutritional status of migrants. In many European countries, overweight and obesity prevalence is higher in migrants from developing countries than in host populations (Kumar et al, 2006; Gualdi-Russo et al, 2009, 2014c; Toselli et al, 2014a). Therefore, the nutritional status of immigrants must be assessed and regularly monitored.

In some immigrants, particularly women, over-weight prevalence is higher than in their compatriots residing in their country of origin (Nicolau et al, 2012). Additionally, overweight prevalence may increase with duration of residence in the host society (Oza-Frank, Cunningham, 2010). According to a recent review on immigrants in Europe (Toselli et al, 2014b), the highest obesity values were observed in Moroccan women in the Netherland and in Tunisian men in Italy. Women show higher frequencies of overweight and obesity than men in all ethnic groups.

The use of anthropometric parameters as rapid indicators of health status in screening of a large number of subjects is an effective and cheap method to provide preliminary indications in individuals or ethnic groups at greater risk of poor health. For these reasons anthropometry is largely used, both in developing and developed countries, when it is necessary to measure and monitor large samples of immigrant people in emergency conditions. The anthropometric parameters may be an important tool to identify immigrants at high cardiovascular and metabolic risk who therefore require lifestyle and medical intervention. In addition to the reported anthropometric traits, sagittal abdominal diameter resulted an excellent marker of metabolic and cardiovascular risk factors (Petersson et al, 2007) comparing different other anthropometric measures in migrant women in Sweden. In general the superiority of measures of centralized obesity, especially waist-to-stature ratio (Lee et al, 2008), was recognized for detecting cardiovascular risk factors in both men and women. However, the most frequently used measure of underweight, overweight and obesity is the body mass index (BMI). The cut-off points proposed by Cole et al (2000; 2007) are recommended for international comparisons in children and adolescents both in case of undernourishment, as thinness, and in case of over-

nourishment, as overweight/obesity, overcoming the problem of different centile cut-off points used.

In the development of health promotion activities relating to migrants in Europe more research is needed regarding bodily dissatisfaction and the relationship between perception of weight and weight-change attempts to prevent and treat both obesity and eating disorders. Body image perception and anthropometric assessment of nutritional status could play an important role in future programs of nutritional surveillance as they provide indications of dissatisfaction, body image disturbances and of possible trends closely associated with ill health in children and adults of different ethnic origin.

Acknowledgments: The work was supported by the European Union, EU FP7/2007-2013 grant 260715.

References

Bhugra D, Becker MA. Migration, cultural bereavement and cultural identity. *World Psychiatry* 2005; 4:18–24.

Cogan JC, Bhalla S, Sefa-Dedeh A, Rothblum ED. A comparison of United States and African students on perceptions of obesity and thinness. *Journal of Cross-Cultural Psychology* 1996; 27: 98–113.

Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ* 2000; 320:1240.

Cole TJ, Flegal KM, Nicholls D, Jackson AA. Body mass index cut offs to define thinness in children and adolescents: international survey. *BMJ* 2007; 335:194.

Collins ME. Body figure perceptions and preferences among preadolescent children. *Int J Eat Disord* 1991; 10:199–208.

Fitzgibbon ML, Blackman LR, Avellone ME. The Relationship Between Body Image Discrepancy and Body Mass Index Across Ethnic Groups. *OBSESITY RESEARCH* 2000; 8: 582-589.

Flegal KL, Tabak CJ, Ogden CL. Overweight in children: definitions and interpretation. *Health Educ Res* 2006; 21: 755-760.

Furnham A, Baguma P. Cross-cultural differences in the evaluation of male and female body shapes. *Int J Eat Disord* 1994;15:81-9.

Gadd M, Johansson SE, Sundquist J, Wändell P. Are there differences in all-cause and coronary heart disease mortality between immigrants in

Sweden and in their country of birth? A follow-up study of total populations. *BMC Public Health* 2006; 21:102–110.

Gualdi-Russo E, Manzon VS, Masotti S, Toselli S, Albertini A, Celenza F, Zaccagni L. Weight status and perception of body image in children: the effect of maternal immigrant status. *Nutrition Journal* 2012; 11:85.

Gualdi-Russo E, Toselli S, Masotti S, Marzouk D, Sundquist K, Sundquist J. Health, growth and psychosocial adaptation of immigrant children. *Eur J Pub Health* 2014 (a); 24, Suppl.1:16-25.

Gualdi-Russo E, Zaccagni L, Dallari GV, Toselli S. Anthropometric parameters in relation to glycaemic status and lipid profile in a multi-ethnic sample in Italy. *Public Health Nutr* 2014(b); 24:1-8.

Gualdi-Russo E, Zaccagni L, Manzon VS, Masotti S, Rinaldo N, Khyatti M. Obesity and physical activity in children of immigrants. *Eur J Pub Health* 2014 (c); 24, Suppl.1: 40–46.

Gualdi-Russo E, Zironi A, Dallari GV, Toselli S. Migration and Health in Italy: A Multiethnic Adult Sample. *J Travel Med* 2009; 16: 88–95.

Jonnalagadda SS, Diwan, S. Nutrient intake of first generation Gujarati Asian Indian Immigrants in the U.S. *Journal of the American College of Nutrition* 2002; 21:372–380.

Kaur H, Hyder ML, Poston WS. Childhood overweight: an expanding problem. *Treat Endocrinol* 2003; 2:375–388.

Kumar BN, Meyer HE, Wandel M, Dalen I, Holmboe-Ottesen G. Ethnic differences in obesity among immigrants from developing countries, in Oslo, Norway. *Int J Obes (Lond)* 2006; 30:684-90.

Lailou A, Prak S, de Groot R, Whitney S, Conkle J, Horton L, Un SO, Dijkhuizen MA, Wieringa FT. Optimal screening of children with acute malnutrition requires a change in current WHO guidelines as MUAC and WHZ identify different patient groups. *PLoS One*. 2014; 9(7):e101159. doi: 10.1371/journal.pone.0101159. eCollection 2014.

Larsson B, Svardsudd K, Welin L, Wilhelmsen L, Bjorntorp P, Tibblin G. Abdominal adipose tissue distribution, obesity, and risk of cardiovascular disease and death: 13 year follow up of participants in the study of men born in 1913. *Br Med J (Clin Res Ed)* 1984, 288(6428):1401-1404.

Lear SA, Kohli S, Bondy GP, Tchernof A, Sniderman AD. Ethnic variation in fat and lean body mass and the association with insulin resistance. *J Clin Endocrinol Metab* 2009; 94:4696–4702.

Lee CM, Huxley RR, Wildman RP, Woodward M. Indices of abdominal obesity are better discriminators of cardiovascular risk factors than BMI: a meta-analysis. *J Clin Epidemiol* 2008; 61:646-53.

Livingstone MB. Childhood obesity in Europe: a growing concern. *Public Health Nutr* 2001; 4:109–116.

Miller KJ, Gleaves DH, Hirsch TG, Green BA, Snow AC, Corbett CC. Comparisons of body image dimensions by race/ethnicity and gender in a university population. *Int J Eat Disord*. 2000; 27:310-6.

Neumark-Sztainer D, Croll J, Story M, Hannan PJ, French SA, Perry C. Ethnic/racial differences in weight-related concerns and behaviors among adolescent girls and boys: Findings from Project EAT. *Journal of Psychosomatic Research* 2002; 53: 963–974.

Nicolau M, Benjelloun S, Stronks K, van Dam RM, Seidell JC, Doak CM. Influences on body weight of female Moroccan migrants in the Netherlands: A qualitative study. *Health & Place* 2012; 18: 883–891.

Nightingale CM, Rudnicka AR, Owen CG, Donin AS, Newton SL, et al. Are Ethnic and Gender Specific Equations Needed to Derive Fat Free Mass from Bioelectrical Impedance in Children of South Asian, Black African-Caribbean and White European Origin? Results of the Assessment of Body Composition in Children Study. *PLoS ONE* 2013; 8(10):e76426. doi: 10.1371/journal.pone.0076426.

Oleary B, Soriano Del Castillo JM, Boselli PM, Micò L. Assessment of body composition, through anthropometric and non-anthropometric methods, of University students from Valencia (Spain). *Nutr Hosp* 2014; 30:911-918.

Oza-Frank R, Cunningham SA. The weight of US residence among immigrants: a systematic review. *Obes Rev*. 2010;11(4):271-80.

Petersson H, Daryani A and Risérus U. Sagittal abdominal diameter as a marker of inflammation and insulin resistance among immigrant women from the Middle East and native Swedish women: a cross-sectional study. *Cardiovascular Diabetology* 2007; 6:10.

Raberg M, Kumar B, Holmboe G, Wandel M. Overweight and weight dissatisfaction related to socioeconomic position, integration and dietary indicators among South Asian immigrants in Oslo. *Public Health Nutrition* 2009; 13: 695–703.

Rguibi M, Belahsen R. Body size preferences and sociocultural influences on attitudes towards obesity among Moroccan Sahraoui women. *Body Image* 2006; 3:395-400.

Rinaldo N, Gualdi-Russo E. Anthropometric Techniques. *Annali on line della Didattica e della Formazione docente* – n. 1/2015 – ISSN 2038-1034.

Sánchez-Villegas A, Madrigal H, Martínez-González MA, Kearney J, Gibney MJ, de Irala J, Martínez JA. Perception of body image as indicator of weight status in the European Union. *J Hum Nutr Diet* 2001; 14:93–102.

Schuler PB, Vinci D, Isosaari RM, Philipp SF, Todorovich J, Roy JLP, Evans RR. Body-Shape Perceptions and Body Mass Index of Older African American and European American Women. *J Cross Cult Gerontol* 2008; 23:255–264.

Simeon DT, Rattan RD, Panchoo K, Kungeesingh KV, Ali AC, Abdool PS. Body image of adolescents in a multi-ethnic Caribbean population. *European Journal of Clinical Nutrition* 2003; 57:157–162.

Swami V, Mada R, Tovée MJ. Weight discrepancy and body appreciation of Zimbabwean women in Zimbabwe and Britain. *Body Image* 2012; 9:559-562.

Thompson JK. Assessment of body image. Pp.119-148.In: (DB Allison, ed) *Handbook of assessment methods for eating behaviors and weight-related problems*. London (UK): Sage pub.; 1995.

Thompson MA, Gray JJ. 1. Development and validation of a new body-image assessment scale. *J Pers Assess* 1995; 64:258-269.

Toselli S, Zaccagni L, Celenza F, Albertini, Gualdi-Russo E. Risk factors of overweight and obesity among preschool children with different ethnic background. *Endocrine* 2014 (a). DOI 10.1007/s12020-014-0479-4.

Toselli S, Zironi A, Gualdi-Russo E. Body Composition and Nutrient Intake of Immigrants Living in Italian Reception Centres. *BIENNIAL BOOKS OF EAA*, Budapest: Eötvös University Press; 2008, Vol. 5, pp 55–69.

Toselli S, Gualdi-Russo E, Boulos DNK, Anwar WA, Lakhoua C, Jaouadi I, Khyatti M, Hemminki K. Prevalence of overweight and obesity in adults from North Africa. *Eur J Pub Health* 2014 (b); 24, Suppl.1: 31–39.

United Nations Children’s Fund, World Health Organization, The World Bank. *UNICEFWHO- World Bank Joint Child Malnutrition Estimates*. (UNICEF, New York; WHO, Geneva; The World Bank, Washington, DC; 2012). Levels and trends in child malnutrition: UNICEF-WHO-The World Bank joint child malnutrition estimates. WHO Library Cataloguing-in-Publication Data; 2012.

Wellman NS, Friedberg B. Causes and consequences of adult obesity: health, social and economic impacts in the United States. *Asia Pac J Clin Nutr* 2002; 11: 705–709.

WHO. Guideline: updates on the management of severe acute malnutrition in infants and children. Geneva: World Health Organization; 2013.

WHO Multicentre Growth Reference Study Group. WHO Child Growth Standards: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: Methods and development. Geneva: World Health Organization; 2006.

Wilson PW, D'Agostino RB, Sullivan L, Parise H, Kannel WB. Overweight and obesity as determinants of cardiovascular risk: the Framingham experience. *Arch Intern Med* 2002; 162: 1867–1872.