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## Double Burden of Malnutrition in Morocco Coexistence of Anemia and Obesity among Women of Childbearing Age in the Prefecture of Oujda-Angad

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**Abstract:** The objective of this study was to define the prevalence of the double burden of malnutrition at the population and individual level in Morocco and estimate the influence of parameters sociodemographic its impact. Our study was conducted in the prefecture of Oujda-Angad, in Morocco. The study included 624 women aged 20-49 years healthy and non-pregnant. Obesity was defined on the basis of body mass index (BMI) >30 kg/m<sup>2</sup>. Anemia was defined as a hemoglobin level <120 g/L for women of childbearing age. The prevalence of obesity and overweight among women surveyed are respectively 30.61 to 38%. The age and number of children are associated with obesity. The prevalence of anemia was 16.1%. Marital status, age, number of pregnancies, number of children and the activity of the household head are among sociodemographic factors involved in the onset of anemia. 12.90% of women are affected by the double burden overweight and anemia, 6.45% of women by the double burden involve obesity and anemia, 3.22% of normal women are anemic and 22.6% of women are overweight or anemic. Half of women with abdominal obesity are affected by anemia. The double burden of malnutrition is related to age and number of children by cons is not correlated with other sociodemographic factors. The double burden of malnutrition is a reality in Morocco at the population level and at the level of the individual. This currently represents a public health problem in Morocco where the need for the implementation of educational programs.

**Key words:** Obesity, anemia, women, double burden, Morocco

### INTRODUCTION

The double burden of malnutrition (DCM) is a phenomenon that is manifested by the coexistence of diseases of undernutrition and overnutrition in the same population (FAO, 2006), on the one hand the emergence of obesity and these NCDs associate other hand the persistence of macronutrient deficiency (chronic or acute malnutrition) and micronutrients (iron, zinc, iodine, Vitamin A). This phenomenon occurs in several phenotypes depending on the scale considered, across the globe, countries, household and individual level. Undernutrition in macronutrient and micronutrient are still health problems in developing countries, it is estimated that 26% of children in the world with growth retardation ([www.fao.org/publications/sofa/fr/](http://www.fao.org/publications/sofa/fr/), 2013) is about 165 million children and the Africa and Asia are the most affected. Annually wasting causes the death of 1.5 million children (OMS, 2013), the prevalence of anemia among children aged 0-5 years affecting more than 60% in Africa and Southeast Asia and is 46.7% in the Middle East, women of childbearing age the prevalence exceeded 45% in Africa and Southeast Asia. On the other hand, according to WHO more than 1.4 billion people aged 20 and over in the world are overweight and over 500 million are suffering from obesity (OMS, 2013).

DCM key most of the developing countries with disparities between these countries (FAO, 2006; Garrett and Ruel, 2003; Doak *et al.*, 2000; Barnett Inka, 2011). Several studies over the last years have shown that DCM coexist within the same household whether in cities or in the companions (Angeles-Agdeppa *et al.*, 2003; Garrett and Ruel, 2003), in households where the most frequently reported in association same household of an overweight or obese mother with one or more children stunted or underweight.

This double burden of malnutrition is also observed at the individual level, or obesity is coupled with anemia (Eckhardt *et al.*, 2008; Agnes Gartner *et al.*, 2013).

The consequences of the DCM are enormous, malnutrition in early life causes about 45% of child deaths (OMS, 2013), following in the life malnourished children are programmed to suffer from cardiovascular disease, hypertension and diabetes in adulthood (Barker Barker and Osmond, 1986; Barker, 1990). On the other hand obesity is closely related to noncommunicable diseases (cardiovascular diseases, cerebrovascular accidents and diabetes (OMS, 2003). In 2008, non-communicable diseases are the leading cause of death of more than 36 million person in the world (OMS, 2013).

DCM is linked to a set of changes in diets and lifestyles, urbanization, globalization consists in the nutrition transition (Shrimpton Roger and Claudia Rokx, 2012). The objective of this study was to determine the prevalence of the double burden of malnutrition at the population and individual level in the prefecture of Oujda-Angad and estimate the influence of sociodemographic parameters its impact.

## MATERIALS AND METHODS

Our study was conducted in the prefecture of Oujda-Angad, the capital of the region of Eastern Morocco, it is located at the northern limit-East of Morocco, is located 12 km from the Algerian border and 60 km from the Mediterranean coast. The area covers 1,714 km<sup>2</sup> or 2.06% of the surface area of the East. The province consists of 11 municipalities (urban and three rural 8). The population is about 477,100, which locates in the urban areas (86%), including 243,334 women. The illiteracy rate in the prefecture level is 30% (Direction de la statistique, 2004). The urban area of the prefecture of Oujda is considered a commercial and industrial administrative center.

The data from this study are from a cross-sectional survey, which took place in the prefecture of Oujda-Angad.

The study included 624 women aged 20 to 49 years and healthy non-pregnant, randomly selected. Data on socioeconomic and demographic level were collected using a questionnaire. Several variables were collected to characterize the women surveyed, including age, household size, number of children, occupation, education level, occupation of head of household and dwelling type.

Anthropometric measurements were measured according to WHO standards (OMS, 1995). Weight in kg was determined by weighing a person Seca type and size by a graduated height board 1 mm Seca kind. Measuring the weight and size has allowed to calculate BMI (weight in kg compared to height squared). Obesity was defined on the basis of body mass index (BMI)>30 kg/m<sup>2</sup> and overweight for a BMI between 25 and 29.9 kg/m<sup>2</sup>. Waist and hip circumference were measured using a tape graduated in millimeters, respectively horizontal level of the umbilicus and the horizontal level of the maximum protrusion of the gluteal muscles, then a waist report hip measurement was calculated. Abdominal obesity was defined a threshold TT> 88cm or TT/TH>0.85 (OMS, 2003).

Anemia was determined by measuring hemoglobin through the complete blood count. The assay was performed in a laboratory aggregated medical tests in the city of Oujda. Anemia was defined as a hemoglobin level <120 g/L for women of childbearing age. Blood counts were determined on an automatic device (CELLTAC) which provides information on red blood

cells, white blood cells, hemoglobin, hematocrit, mean corpuscular volume (MCV), mean corpuscular hemoglobin concentration (MCHC) and content corpuscular average hemoglobin (MCH).

The study data were entered and analyzed using SPSS Version 20 for Windows. The results are expressed as mean standard deviation or percentage. The correlations between BMI, anemia and various sociodemographic variables were assessed by the Spearman test. The chi-square test is used to compare the two percentages. The significance level was set at 0.05.

## RESULTS

The average age of women was 31.74±7.15 years (Table 1). According to Table 2 the age of 20 years to 29 years is the most represented (38.7%), more than 30% of women are illiterate, most are housewives (96.8%) and majority of women are married (96%). For married women about 51.6% are mothers of children under 2.71% of women living in households with more than 5 persons (Table 2).

The body mass index (BMI) was 27.75 kg/m<sup>2</sup>±5.90 kg/m<sup>2</sup>, with a minimum of 16.71 Kg / M<sup>2</sup> and a maximum of 45.82 kg/m<sup>2</sup>. The average size is 1.61±0.06 m with an average weight of 72.87±15.32 kg (Table 1). The BMI values indicate that the prevalence of obesity and overweight among women surveyed are, respectively 30.61 and 38%. The results also show that the BMI increases with the number of pregnancy (p<0.001) and the number of children (p<0.001) (Table 3). The level of

Table 1: Anthropometric parameters and biological indicators of the nutritional status of women surveyed

	Moyenne	Ecart type	Minimum	Maximum
Age (years)	31.74	7.15	20	48
Height (m)	1.62	0.06	1.54	1.78
Weight (Kg)	72.72	15.23	48	121.2
BMI	27.7	5.68	18.29	45.62
Hemoglobin g/dL	13.24	1.34	9	15.3

Table 2: Demographics of the women surveyed (20-49 years)

Age	Percentage	
	20-29	38.7
	30-39	35.5
	40-49	25.8
Socio-professional status	Active	3.2
	Inactive	96.8
Marital status	Single	3.2
	Married	96.8
Level of study	Analphabete	32.3
	Primary	41.9
	Secondairay	25.8
	Sup	0
Household size	1-4	29
	>5	71
No. of children	0	3.2
	1-2	51.6
	>3	45.2
Occupation of head of household	Active	83.9
	Inactive	16.1

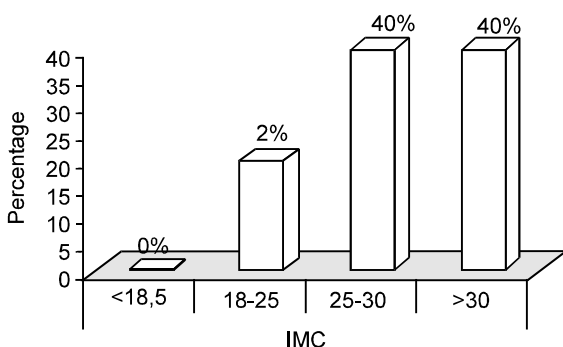


Fig. 1: Distribution of the prevalence of anemia by BMI

Table 3: Prevalence of phenotypes of the double burden of malnutrition among women surveyed

Overweight with anemia	Overweight but not anemia	No overnutrition with anemia	Not overweight not anemia
12.90%	61.30%	3.20%	22.60%

education is not involved in obesity but we note that the prevalence of obesity decrease with the level of education, 37% of women are illiterate obese. We also note that 88% of working women are obese.

The average value (95%) of hemoglobin in our sample is 13.24±1.34 g/dL, the minimum value of 9 g/dL and the maximum value was 15.3 g/dL (Table 1). The prevalence of anemia was 16.1%. We note a significant difference by level of study of women ( $p = 0.004$ ), illiterate women are the most affected by anemia. The prevalence of anemia decreased with age ( $p = 0.03$ ), the highest rate was observed in women aged 20 to 29 years (25%). There was also a significant difference in the prevalence of anemia according to the marital status of women ( $p = 0.000$ ). The prevalence of anemia is significant depending on the number of pregnancy ( $p = 0.000$ ) and the number of children ( $p = 0.000$ ), it is higher in women who have more than 2 children. Anemia and more alarming among women from the household or the household head is inactive ( $p = 0.000$ ). Household size to a significant effect on the prevalence of anemia, we note that anemia is higher in households consisting of 5 or more.

The distribution of the prevalence of anemia by BMI showed that the prevalence of anemia augment with BMI, 40% of anemic women with a BMI>30 but with no significant difference. Overweight and obesity does not reduce the risk of anemia in women (Fig. 1).

### Double burden of malnutrition

**At the population level:** Our results show that the double burden of malnutrition is a reality in the prefecture of Oujda-Angad, first alarmed by the prevalence of obesity (30.6%) and overweight (38%) and secondly by the prevalence of anemia 16.1%.

**At the individual level:** Table 3 shows that the double burden of malnutrition is also observed at the individual

level in the prefecture of Oujda-Angad, or obesity is coupled with anemia, approximately 12.9% of women are affected by the Double overweight load and anemia, 6.45% of women by the double burden involve obesity and anemia, 3.22% of normal women are anemic and 22.6% of women are either overweight or anemic. Half of anemic women are affected by abdominal obesity. The double burden of malnutrition is related to age and number of children by cons is not correlated with other socio-demographic factors (Table 4).

### DISCUSSION

DCM is now a health problem in most developing countries, which has enormous implications for the development of these countries, the study of its prevalence and its impact is important for the implementation of educational programs to prevent populations. In this context, the objective of our study was to determine the prevalence of DCM at the population and individual level in the prefecture of Oujda-Angad and estimate the influence of sociodemographic parameters on its incidence.

The results of our study showed that the prevalence of obesity and overweight among women in this region are respectively 30.61 and 38.78% abdominal obesity assessed by waist circumference (TT = 88) is 79.10%. The alarming rate of obesity has become a scourge of health in this region. It is well established that obesity and overweight are associated with the development of several chronic diseases. It therefore seems necessary to establish averages prevention to inform women about the harmful effects of obesity.

The urban context of our study may explain the high prevalence of obesity due to changes associated with the nutrition transition is underway in Morocco (Benjelloun, 2002). Indeed, the consumption of energy-dense foods refined sugar and fat does not necessarily lead to a quality diet (Trowbridge *et al.*, 1993), because these foods are low in essential micronutrients (Olaiz-Fernández *et al.*, 2007).

Anaemia affects 16.1% of the women surveyed (of childbearing age of 20 years to 49 years) this result is similar to that recorded by a survey at Rabat-Sale (16.6%) (El Hsaini *et al.*, 2013). Prevalences shown in other parts of Morocco or in some developing countries show disparities, however it is difficult to compare these figures due to the heterogeneity of references, methods used for the determination of hemoglobin or health status of women surveyed.

The double burden of malnutrition is a reality in the prefecture of Oujda-Angad, the DCM is also observed at the individual level, almost 13% of women in our study are affected by DCM, our results are in agreement with a study conducted at Rabat-Sale (El Hsaini *et al.*, 2013). This phenomenon is characterized by the coexistence of obesity and anemia in the same woman.

Table 4: Correlation between the prevalence of anemia and overweight with socio-demographic factors

		Percentage	Overweight	Anemia	Overweight+anemia
Age	20-29	38.7	-	-	-
	30-39	35.5	0.001	0.01	0.02
	40-49	25.8	-	-	-
Socio-professional status	Active	3.2	ns	0.000	ns
	Inactive	96.8	-	-	-
Marital status	Single	3.2	ns	0.002	ns
	Married	96.8	-	-	-
Level of study	Analphabete	32.3	ns	0.1	ns
	Primary	41.9	-	-	-
	Secondary	25.8	-	-	-
	Sup	0	-	-	-
Household size	1-4	29	ns	0.3	ns
	>5	71	-	-	-
Number of children	0	3.2	0.001	0.005	0.01
	1-2	51.6	-	-	-
	>3	45.2	-	-	-
Occupation of head of household	Active	83.9	ns	0.006	ns
	Inactive	16.1	-	-	-

Meaning 0.05, ns; not significant

overweight; BMI = 25 (obesity included)

DCM is related to a set of changes in diets and lifestyles, urbanization and globalization grouped under the nutrition transition (Shrimpton Roger and Claudia Rokx, 2012).

Micronutrient deficiencies lead to the development of chronic diseases related to diet such as diabetes and CVD (Madamanchi *et al.*, 2005). So many micronutrients are considered antioxidant that protects the body against oxidative stress is a trigger of some chronic diseases linked to diet (Madamanchi *et al.*, 2005; Freixenet *et al.*, 2009). For example, zinc deficiency may contribute to the development of diabetes (Chausmer, 1998). Therefore, micronutrient malnutrition may increase the risk and severity of a variety of chronic diseases for which obesity is a risk factor already.

The correlation of socio-demographic factors with the prevalence of obesity and anemia showed that age and number of children are associated with these two forms of malnutrition while the level of education and marital status are not related.

Our results show that the double burden of malnutrition is associated with women's age and number of children and is not associated with other sociodemographic factors, which has been shown by the study of other studies (Agnes Gartner *et al.*, 2013), these results suggest that other intra-individual factors are responsible for this phenomenon.

The association between anemia and BMI gives no positive significance, our results are similar to other studies (Agnes Gartner *et al.*, 2013; El Hsaïni *et al.*, 2013), obesity does not reduce the risk of anemia in women. This can be explained by the fact that obese women anemic consume foods high energy and micronutrient poor value. Other studies have reported negative associations between iron and obesity in adults (Rossi *et al.*, 2001; Chambers *et al.*, 2006; Yanoff *et al.*, 2007; Menzie *et al.*, 2008; Zimmermann *et al.*, 2008).

The correlation between BMI and shows a negative association hemoglobin ( $r = -0.14$ ), indicating that the concentration of hemoglobin decreases with increasing BMI ( $p = 0.16$ ) results was similarly observed in other studies (28.29). Shatha and colleagues found a negative and statistically positive association (Shatha, 2003).

The hypochromic microcytic anemia is the most common form of anemia in our sample, according to the literature this form of anemia is caused by chronic iron deficiency or an inflammatory condition. The pathophysiologic mechanism of inflammatory anemia is related to a failure of erythropoiesis. For inhibition of erythroid and a disturbance of the synthesis and action of erythropoietin. These disturbances are induced by cytokines whose secretion is increased in the inflammatory process (interleukin-1, TNF-alpha, interferon-gamma). Lukanova and these collaborators (2004) and Shatha (2003) have suggested that the increase in elevation causes a BMI of free estrogens which can cause inhibition of erythropoiesis in women. It was observed that the coupling of anemia and obesity was observed in half of the women who are affected by abdominal obesity. Visceral adipose tissue is an endocrine system that secretes a set of chymokines inflammatory that can disrupt iron stores (Bekri *et al.*, 2006). In addition, recent studies have considered obesity as a chronic, inflammatory condition of low intensity (Bastard *et al.*, 2002; Engstrom *et al.*, 2003). Some of these molecules are inflammatory acute phase proteins such as IL-6, CRP and haptoglobin. IL-6 stimulates hepatic production of CRP (C-reactive protein). A previous study showed that CRP concentrations are increased in obese women (Visser *et al.*, 1999), while it decreases with decreasing weight (Chen *et al.*, 2009). Moreover, even in healthy individuals, assessed by BMI body mass is strongly correlated with plasma CRP concentrations (Kern, 2001). Other studies have shown that concentrations of CRP with BMI

augment but are not associated with iron stores (Cepeda-Lopez *et al.*, 2011). While others have suggested that the hypothesis due to inflammation associated with obesity is iron metabolism (Bekri *et al.*, 2006) and absorption (Ganz *et al.*, 2008). Several researchers have demonstrated that serum hepcidin was significantly higher in obese (Tussing-Humphreys *et al.*, 2009; del Giudice *et al.*, 2009). Concentrations of hepcidin increases with BMI and decreases with weight loss (Freixenet *et al.*, 2009; Steele *et al.*, 2005). Therefore iron deficiency in obese can be explained by the increase of hepcidin in the blood flow which decreases the absorption of dietary iron. The prevalence of anemia was significantly higher in women with BMI > 25 (Hassan *et al.*, 1999).

**Conclusion:** The double burden of malnutrition is a reality in Morocco. Evidence from our study emphasize the need for the implementation of educational programs to improve the nutritional knowledge and awareness of women and health care workers to help women achieve their ideal weight and healthy.

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