PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

Pakistan Journal of Nutrition 7 (2): 377-380, 2008
ISSN 1680-5194

Body Mass Index and its Relationship with Hematological Indices in Iranian Women

Z. Paknahad[1], S. Mahboob[2], N. Omidvar[3], M. Ebrahimi[2], A. Ostadrahimi[2] and Sh. Afiatmilani[2]
[1]Nutrition and Food Security Research Center, School of Public Health,
Isfahan University of Medical Sciences, Isfahan, Iran
[2]Tabriz University of Medical Sciences, Iran
[3]Shaheed Beheshti University of Medical Sciences, Iran

Abstract: Obesity is an important risk factor for many chronic diseases, BMI is an indicator for total body fat determination. Reports in Iran indicate that nearly 20% of middle age persons are obese and 40% are overweight. Other studies also reported iron deficiency anemia in women Obese women appear to have greater iron stores than do nonobese women. This cross-sectional survey consisted 1049 non pregnant-non lactating 15-49 years old women living in East Azarbaijan (Iran) which selected as random clustering suggested. Demographic Data was collected by questionnaire. Body weight and height was measured. Hb, Hct and MCV were measured in the fasting state. Means of age, parity was 28.8 and 3.94 respectively. The subjects were divided into quartiles of age, weight, BMI and childbearing number. Analysis of these classifications showed that means of Hb and Hct were significantly different between BMI quartiles and only Hct was significantly different between weight quartiles ($p < 0.05$). Discussion: Policy implications might include the development and implementation of programs to prevent excessive gestational weight gain and promote postpartum weight loss via dietary change and physical activity, concomitant with exclusive breast feeding. Because iron deficiency and excess are both probably undesirable, it would be of great help to identify more precisely populations at risk of iron deficiency; iron supplementation could then be more personalized.

Key words: Body mass index, women, Iron deficiency and anemia

Introduction

Obesity is an important risk factor for many chronic diseases, for example regional distribution of body fat in the abdominal area has a significant relation with cardiovascular risk factors (Perry *et al*., 1997). Changes in life style and low physical activity even in developing societies is a predisposing factor for adult weight increasing and prevention of obesity is an important subject in health programming.

BMI (Body Mass Index) is a an important anthropometric index that is usually used for body fat storage status assessment. BMI is an indicator for total body fat determination.

Reports in Iran indicate that nearly 20% of middle age persons are obese and 40% are overweight. In urban society the prevalence of overweight is significantly higher than rural (Research in Micronutrients in Iran, 2001). At the other hand Mensturating women constitute a group at risk for iron deficiency surveys done in France and in North America (Fricker *et al*., 1990) reported iron deficiency in nearly 20% of menstruating. This high prevalence was explained by inadequate dietary iron intake to compensate for iron losses in the menses (Fricker *et al*., 1990). In Iran many reports indicating that 7.6% of middle age women are iron deficient, and 6.2% of them are anemic (Research in Micronutrients in Iran, 2001). Other studies also reported iron deficiency anemia in Iran (Jazayery *et al*., 2001).

Obese women appear to have greater iron stores than do nonobese women (Fricker *et al*., 1990). Women have lower iron stores than men because of iron loss during their reproductive years.

Iron is an essential element and, although deficiency leads to anaemia, iron overload is also associated with many health problems (John *et al*., 2003).

It has been hypothesized that adiposity might be an important mediator in the relationship of iron and CVD (Cardiovascular Disease) risk (Earle *et al*., 2006). so we assessed the BMI staus in premenopausal women in Marand and its relationship with iron biochemical indices. The data presented in this article are based on subsamples from the East Azarbaijan Province National Nutrition Research in Iran.

Materials and Methods

This cross-sectional survey consisted 1049 non pregnant-non lactating 15-49 years old women living in urban and rural regions of East Azarbaijan (Iran). Subjects were excluded if not currently mensturating or current infection, also subjects who had taken iron or drugs likely to modify their iron status during the 3 months preceding the survey were excluded. The

sample was selected as random clustering suggested by EMRO* (Bennet *et al.*, 1991).

Data collection done was in 3 steps:

1. Demographic Data was collected by questionnaire.
2. Anthropometric data: Body weight was measured to the nearest 0.1 kg with the subjects dressed in light clothing and no shoes. Body height was measured to the nearest 0.5 cm with a wall-mounted stadiometer. Measurements were taken while subjects were relaxed, were standing erect and had their arms at their sides and feet together. Body mass index (BMI) was computed using the formula: BMI = weight (kg) / (height m^2).
3. Biochemical Data by collecting fasting blood sample: Blood samples were collected by venipuncture in the fasting state. Hb, Hct and MCV were measured by Autoanalyzer.

Data were analyzed by ANOVA, t-test and pearson correlation by $SPSS_{10}$ software.

Results

Means of age, parity was 28.8 and 3.94 respectively. More than 60% (66.5%)were housewife and had low literacy (73.5%). General characteristics of them is shown at Table 1.

Table 2 demonstrates that there was a trend toward a positive between BMI and age. ANOVA shows significantly difference between different age groups ($f=51.21699$, $p<0.0001$).

As Fig. 1 shows the most subjects have BMI 20-25, however higher prevalence of obesity and overweight among urban women and higher prevalence of underweight among rural women is important.

The subjects were divided into quartiles of age, weight, BMI and childbearing number. Analysis of these classifications showed that means of Hb and Hct were significantly different between BMI quartiles (Table 3) and only Hct was significantly different between weight quartiles. Comparison of Hb, Hct and MCV between obese* normal, underweight and overweight groups did not show any significant difference about them.

Pearson correlation showed significant correlation between BMI and child bearing number ($r=0.01$, $p=0.006$) but after adjusting for age, there was not significant relation between them. ANOVA showed significantly difference about BMI between different child bearing number groups ($p = 0.005$).

Discussion

In the presence study mean of Age was 28.83 and 24.49 respectively.

The majority of women had BMI (20-24). Our finding is contarst to Pon *et al.* (2006) study among Malaysian women that most of premenopausal women were overweight / Obese.

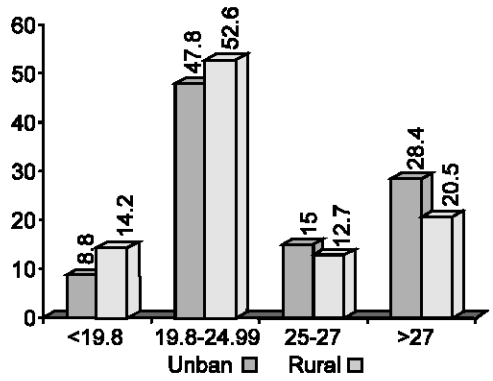

Fig. 1: Distribution of body mass index among Rural and urban districts.

Mean BMI reported by Taylor etal for 96 NewZealand women was 25.1±4.4 and suggested BMI as a Sensitive indicator for Total adiposity assessment. (Taylor *et al.*, 1997). However our results is different from Perry etal findings that 115 Premenepaused and 46 Postmenopausal women were Compared, they had found that premenopausal women had a mean BMI of 37.08±6.01 and post menopausal women had 38.75±6.9.

They found a relation Between Central adiposity and increase in Cardiovascular risk factors (2B). our results is similar to Paknahad *et al.* (1997) findings that 1159 women and 334 men at rural Region of Isfahan (IRAN) were studied, women had mean age of 31 and men had mean age of 37, mean BMI of 23.38 for women was reported that is lower than our finding, but at both study subjects had mean of normal range.

Boshtam *et al.* (1997) study among 1000 men and 12000 women (Isfahan-Iran) showed that mean BMI of them was 26.1 and 27.8 respectively.

Gholamzadeh and Pishdad (1993) study showed that 20.69% of men and 12.66% of women living at north region of Iran were overweight and 2.7% of men and 5.3% of women living of Iran at south region had BMI higher than 30.

In our study mean of BMI at urban Region was significantly higher than Rural (Fig. 1).

We can describe that changing to industrialized Urban communities led to decrease women's physical activity and increasing weight gain in compared with Rural women.

Mean of Hb at our study was 14 g/dl which is higher than other study in Greenland (13.2 ± 96) (Milman *et al.*, 2001).

At our study although at BMI quartile Hb and Hb were significantly different, but comparing obese and non obese women did not show significant difference about Hb and Hct. Similar to our finding in Micozzi studies (Micozzi *et al.*, 1989) hemoglobin and Hct were not significantly different among short-light with obese and

Table 1: Physiological characteristics of premenopausal women

Variable	N	Mean ± SD
Age	1030	28.5 ± 8.680
Weight	1032	59.3 ± 11.26
Height	1031	155.6 ± 7.37
BMI	1030	24.48 ± 4.75
Hemoglobin	978	14.09 ± 1.37
Hematocrit	980	42.09 ± 3.96
MCV	980	87.56 ± 7.96
Parity	719	3.96 ± 2.840
Child Birth	712	3.93 ± 2.870
Abortion	702	0.52 ± 0.930

*World Health Organization - Regional Office for the Eastern Mediterranean. ® Mean Corpuscular Volume.

Table 2: Body mass index among different age groups

Age	N	BMI
≤ 19	165	21.69 ± 3.32
20-25	278	23.13 ± 4.2
25-35	343	25.77 ± 5.06
35-49	233	26.19 ± 4.43

Table 3: Iron biochemical indices** by anthropometric and hildbearing quartiles.

Quartiles	Hemoglobin (g/dl)	Hematocrit (%)	MCV(fl)
Age:			
≤22	14.18 ±3.44	42.27±3.44	87.29±8.57
22-27	14.2±1.160	42.35±3.23	88.27±8.12
27-35	14.01±1.41	41.9±4.740	87.40±6.93
35-49	13.93±1.58	41.78±4.20	87.29±8.06
BMI:			
≤21.185	13.93±1.58	41.54±3.66	87.11±9.60
21.86-23.956	14.02±1.48	41.88±3.91	87.7±7.630
23.96-26.845	14.27±1.18	42.58±3.27	88.3±6.690
≥26.846	14.17±1.39	42.44±4.80	87.29±8.06
	p= 0.02	p= 0.01	
Weight:			
≤51	13.6±1.350	41.71±3.64	87.62±8.91
51.1-58	13.99±1.50	41.74±4.03	86.1±8.340
58.1-65.5	14.24±1.27	42.66±4.39	88.8±6.760
≥65.6	14.18±1.33	42.34±3.68	87.41±7.630
		p= 0.01	
Height:			
≤152	13.09±1.36	42.15±4.57	87.87±7.96
152.1-156	14.11±1.42	42.13±3.79	8.79±7.050
156.1-160	14.01±1.34	41.95±3.72	87.43±8.59
≥160.1	14.15±1.36	42.2±3.640	87.14±8.36
Child bearing number:			
≤2	14.17±1.27	42.4±4.30	87.8±7.610
3	13.88±1.57	41.71±5.02	87.84±7.24
4-6	13.94±1.43	41.54±3.74	87.08±7.71
≥7	13.99±1.48	41.98±3.93	87.41±7.84

**: Mean ± SD. overweight: 25 < BMI < 29.99 obese: BMI > 30,

tall women also Crouter etal reported similar obesity and overweight incidence between anemic and nonanemic women. (Scott *et al*., 2007).

At the other hand Milman *et al*. (2001) found a positive relationship between BMI and Hb. They also found serum ferritin displayed a positive correlation with body mass index both in men and in women. (Milman and Kirchhoff, 1999). At Fricker *et al*. (1990) study too, Hb, Hct and ferritin among obese women were higher than non obese, it is suggested that obese women appear to have greater iron stores than do nonobese women, in terms of serum ferritin, hemoglobin and hematocrit concentrations. It is suggested that a high body mass index implies a high energy intake. As nutritional iron intake is proportional to the energy intake, subjects with a high body mass index have a high iron intake, which in turn influences body iron stores and serum ferritin (Milman and Kirchhoff, 1999).

Association between BMI and Bearing child number in this study was significant, it would be suggested that Parity is associated with overweight and obesity. However, the literature from developing countries is limited and may not represent current stages of development.

The importance of parity as a predictor of overweight increases with national economic development and health. Policy implications might include the development and implementation of programs to prevent excessive gestational weight gain and promote postpartum weight loss via dietary change and physical activity, concomitant with exclusive breastfeeding. (Kim and Stein, 2006).

Because iron deficiency and excess are both probably undesirable, it would be of great help to identify more precisely populations at risk of iron deficiency; iron supplementation could then be more personalized.

References

Bennett, T. Woods, W.M. Liamaga and D. Smith, 1991. Simplified general methods for cluster sample surveys of health in developing countries: World Health Quart., 44: 98-106.

Boshtam, M., M. Rafie, N. Sarrafzadegan, H. Alikhasi, N. Mohammadifard and S. Mirlohian, 1997. Med. J. The Islamic Republic of IRAN, p: 158.

Earle, C. Chambers, Stanley Heshka Dympna Gallagher Jack Wang, F. Xavier Pi-Sunyer and Richard N. Pierson, Jr., 2006. 20Serum Iron and Body Fat Distribution in a Multiethnic Cohort of Adults Living in New York City. J. Am. Dietetic Assoc., pp: 680-684.

Fricker, J., G.L. Moel and M. Apfelbau, 1990.Obesity and Iron status in mensturating women. Am. J. Clin. Nutr., 52: 863-6

Gholam Zadeh, T. and Gh. Pishdad, 1993. Obesity prevalence at North and South of Iran. Doctor Thesis, Med. College Shiraz Univ. Med. Sci., pp: 2288.

Jazayery, A.D., A. Keshavarz, F. Ansar and M. Mahmoudi, 2001. Eastern Mediterranean Health J., 7: 652-7.

John, B. Whitfield, Susan Treloar, Gu Zhu, Lawrie W. Powell and Nicholas G. Martin, 2003. Relative importance of female-specific and non-female-specific effects on variation in iron stores between women. Br. J. Haematol., 120: 860-866.

Kim, S.A., A.D. Stein and R. Martorel, 2006. Country development and the association between parity and overweight. Int. J. Obesity advance online publication 24 October 2006.

Micozzi, M.S., D. Albanes and R.G. Stevens, 1989. Relation of body size and composition to clinical biochemical and hematologic indices in US men and women. Am. J. Clin. Nut., 50: 1276-81.

Milman, N. and M. Kirchhoff, 1999. Relationship between serum ferritin and risk factors for ischaemic heart disease in 2235 Danes aged 30-60years, J. Int. Med., 245: 423-433.

Nils Milman, Keld-Erik Byg, Gert Mulvad, Henning Sloth Pedersen and Peter Bjerregaard, 2001. Haemoglobin concentrations appear to be lower in indigenous Greenlanders than in Danes: Assessment of haemoglobin in 234 Greenlanders and in 2804 Danes. Eur. J. Haematol., pp: 23-29.

Paknahad, Z., A. Emami and A. Azizzadeh, 1997. Blood Pressure and BMI. Med. J. The Islamic Republic of IRAN, p: 71 .

Perry, A.C., E.B. Applegate, M.I. Allison, P.C. and J.F. Signorile, 1997. Relation between anthropometric measures of fat distribution and cardiovascular riskfactors in overweight pre-and post menopausal women. Am. J. Clin. Nutr., 66: 829-36.

Pon, L.W., M.Y. Noor-Aini, F.B. Ong, N. Adeeb, S.S. FRCOG, K. Seri MOG, Shamsuddin, AL Mohamed, N. Hapizah MRCPath, A. Mokhtar MRCOG and HWH Wan MOG, 2006. Diet, nutritional knowledge and health status of urban middle-aged Malaysian women.

Research in Micronutrients in Iran, 2001. Nutrition Promotion Office, Ministry of Health, Medicine and Education, pp: 80-81.

Research in Micronutrients in Iran, 2001. Nutrition Promotion Office, Ministry of Health, Medicine and Education, pp: 106.

Scott, E. Crouter, Eugene Fitzhugh, James Booth, Diane M. DellaValle and Jere D. Haas, 2007. Relationship between Iron Deficiency, Physical Activity and BMI in US Women; NHANES 99-02. The FASEB J., 21: 858-17.

Taylor, R.W., R.W. keild., E.J. Gold, S.M. Williams and A. Goulding, 1998. Body mass, Waist girth and Waist - to -hip ratio as indexes of total and regional adiposityin women: Evaluation using receiver operating characteristic curves: Am. J. Clin. Nut., 67: 44-9.

*World Health Organization - Regional Office for the Eastern Mediterranean
® Mean Corposcular Volume
*Underweight : BMI < 18.5
Normal : 18.5 < BMI < 24.99
Overweight: 25 < BMI < 29.99
Obese : BMI > 30