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# Factors attributing to obesity among working adults in Egypt

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**Abstract**

Obesity is a growing epidemic problem. Many environmental factors at the workplace like occupational stress and job satisfaction attribute to obesity either as a cause or consequence. Other seriously contributing factors are of socio-demographic and health-related nature. The present study aimed to investigate the association between some environmental and health-related variables and obesity in terms of Body Mass Index (BMI) among working adults in Egypt. A cross-sectional study was carried on a convenient sample of 86 males and females working in the public sector. All participants completed the Perceived Stress Scale, Falsification of Type quiz, Andrews and Withey test for Job Satisfaction and a sheet for socio-demographic, health and work-related data. Blood samples were obtained and assessments of cortisol, C-reactive protein, dehydroepiandrosterone sulfate and total thyroxin were done using the ELISA technique. Total cholesterol and triglycerides were assessed colourimetrical. BMI and W/H were calculated. Pearson correlation test was performed for statistical analysis. Advanced age, female gender, presence of chronic diseases, presence of mental health problems, increased level of CRP and decreased level of DHEA-S were factors showing a significant correlation with increased BMI. In conclusion, an extensive study of predictors of obesity is a crucial need among working adults in Egypt.

***Keywords:*** *BMI, job satisfaction, falsification of type, mental health problems, obesity, perceived stress, stress biomarkers*

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## 1 Introduction

Obesity is a major health challenge worldwide (Shamseddeen et al., 2011). It turned out to be an epidemic and nowadays is regarded as a critical public health problem (Ng et al., 2014). Obesity increases the risk of cardiovascular diseases, cancer, diabetes and early deaths (Flegal et al, 2013). Besides, obesity represents one cause of elevated medical costs and aggravate the financial burden on employers (Trogdon et al., 2012).

Unfortunately, many factors, at work, could drive employees to an unhealthy lifestyle that results in weight gain. A prominent factor of which is work stress that promotes unfavourable diet practices and low physical activity (Kirk and Rhodes, 2011). Stress increases reward signals from the brain in response to fatty meals (Zellner et al., 2006) and decreases it after fruit intake (Liu et al., 2007). Additionally, stress disrupts physiological regulation by increasing cortisol level that is lipogenic (Lee and Fried, 2014) and leads to an accumulation of abdominal fat (Rosmond, 2003). Work-stress is also reported to be closely related to psychological problems like anxiety, depression and emotional disturbances (Morse et al., 2011) that play a significant role as a major risk factor for obesity.

Increased perceived stress (PS) compared to normal stress, in particular, showed great association with

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more consumption of snack foods over fruit (El Ansari et al., 2014), excessive binge eating (Pendleton et al, 2001) and increased problem of disinhibition (Haynes et al., 2003). PS is used as a measure of work-stress psychometrically. Job satisfaction and falsification of type are also used to determine work stress in terms of how much employees love their work and to what extent the job is matched with their natural lead and personal talents, respectively.

For the assessment of stress, some biomarkers are highly recommended in addition to psychometric determination (McCarty et al., 2009). The most suggested assessments are for cortisol, C-reactive protein (CRP), triglycerides, cholesterol (Torres and Nowson, 2007), dehydroepiandrosterone sulphate (DHEA-S) and thyroid hormones.

Gender has been reported as another risk factor for obesity in the workplace. Females with low socioeconomic status were found to be the most suffering from severe obesity (Wang and Beydoun, 2007). Females also showed an increase in BMI with time according to Magee et al. (2010) while Marchand et al. (2015) found it to be significant among men not women. In the workplace, high demands were associated with increased BMI in both men and women (Kivimaki et al., 2006). Similarly, loss of control and authority over decision making reported an association with obesity in both genders (Berset et al., 2011). Significant findings were found about the role of job strain that is defined as low control accompanied by psychological demands among the female gender (Eek and Ostergren, 2009). On the other hand, isostrain that describes low control, high psychological demands and low social support at work significantly contributed to obesity among the males only (Brunner et al., 2007).

Other than stress and gender, age is a non-work-related factor showing a relationship with BMI. Age showed controversial results, some favoured direct association (Sund et al., 2010) while others emphasized the inverse relationship with BMI (Hannerz et all., 2004). Educational level is another non-work-related risk factor that showed an inverse relation to BMI and contributed to obesity (Dugravot et al., 2010). Marital status has also been studied as a non-work risk factor of obesity among working adults. As reported, being single didn't contribute to increased BMI over time in both males and females (Iversen et al., 2012). Married women showed a direct association between work-family conflicts and increased BMI (Lallukka et al., 2005).

Much is still needed to be investigated concerning factors attributing to obesity among working adults in different communities and environments. Work and non-work-related variables overlap in their causal-effect relationship with obesity and even interact with each other. Controversial results are also obtained about the significance of the different risk factors by changing sample characteristics, environmental contexts and study nature and design. The present work is an attempt to explore the relationship between some of the aforementioned attributing factors to obesity and BMI among a sample of adults working in the governmental sector in Egypt.

## 2 Materials and Methods

A cross-sectional descriptive study was performed on a convenient sample of 86 participants working as employees or workers at different governmental sectors in Egypt and from both genders. All participants were interviewed for completing the ten items Perceived Stress Scale (PSS-10) (Cohen et al., 1983), Falsification of Type quiz (retrieved from http://personalitycafe.com/cognitive-functions/40393-falsifying-type-quiz.html) for assessment of work stress, Job Satisfaction Scale (JSS) (Andrews and Withey, 1976) and a sheet for some socio-demographic, health state and work-related factors. PSS scores ranged between 0 and 40 after a four-point Likert scale. Up to 13 represented low PS, >13 and <27 indicated mild PS and >26 denoted sever PS. A three-point Likert scale comprised response choices in the Falsification of Type quiz with scores ranging between 0 and 32. Increases in the score showed more degree of falsification at work and hence more experience of work-stress. As for the JSS, it is made up of five sentences with 7 Likert points where the lower values corresponded to satisfaction with a job while higher values corresponded to job dissatisfaction. A value of 20 denoted neither satisfied nor dissatisfied.

Serum samples were collected for biochemical assessments. Cortisol, DHEA-S, CRP and total thyroxine (tT4) were assessed using the enzyme-linked immunosorbent assay (ELISA) technique. Kits in use were; Immunospect kit (CA) for cortisol and tT4 and an ELISA kit manufactured by DRG diagnostics, Germany for DHEA-S and CRP. A bio-diagnostic kit (Egypt) was used to estimate serum levels of total cholesterol (TC) and triglycerides (TG) after colourimetric methods illustrated by Allain et al. (1974) and Fassati and Principe (1982), respectively. Normal ranges of the assessed markers are as follows; 5-23 µg/dl for cortisol, 0.1 µg/ml - 10 µg/ml for DHEA-S, 0.068-8.2 mg/l for CRP, 5-13 µg/dl for tT4,

150-225 mg/dl for TC and 40-140 mg/dl for women and 60-165 mg/dl for men for TG,

Waist circumference and hip circumference were used to calculate waist to hip ratio (WHR) according to the procedure detailed by Lohman et al. (1988) and BMI was calculated in kilograms divided by height in meter square (Seplaki et al., 2005). BMI exceeding 30 indicated obesity (Crimmins et al., 2003) and WHR normal value were> 0.90 for men and > 0.85 for women (World Health Organization, 1999). Consent forms were signed by all participants and ethical approval was received from the ethical committee at the National Research Centre for performing the study procedures.

Statistical analysis was done using the Statistical Package for Social Sciences (SPSS 23) (SPSS Inc., Chicago, IL, USA). Descriptive statistics and Pearson correlation were performed. A p-value of less than 0.05 was considered significant.

## 3 Results

Females represented 70% of the study sample. Most participants were married, living in the urban areas, with low income and education level, living far from their workplace and work for more than five hours daily (table 1).

**Table1. Frequency distribution of participants' characteristics**

| Study variables (N) | | Frequency (%) |
|---|---|---|
| Gender (86) | Male | 26(30) |
| | Female | 60(70) |
| Marital status (83) | Single | 26(31) |
| | Married | 57(69) |
| Residence (81) | Urban | 74(91) |
| | Rural | 7(9) |
| Monthly income (79) | <1200 LE | 51(65) |
| | <3000LE | 21(27) |
| | <5000 LE | 7(8) |
| Education level (77) | Low | 17(22) |
| | Medium | 42(55) |
| | High | 18(23) |
| Chronic diseases (86) | No | 57(66) |
| | Yes | 29(34) |
| Mental health problems (85) | No | 79(93) |
| | Yes | 6(7) |
| Distance from work (82) | Near | 26(30) |
| | Far | 56(65) |
| Other jobs (84) | No | 70(83) |
| | Yes | 14(17) |
| Working years (81) | <10 | 37(46) |
| | ≥10 | 44(54) |
| Working hours (31) | 3-5 hrs | 8(26) |
| | >5 hrs | 23(74) |

The mean age of participants was 40.3 years ranging between 20 and 59. As shown in table2, they had BMI and WHR mean values exceeding the obesity level. No experience of job dissatisfaction, perceived stress or work stress since all means appeared within normal ranges. Similarly, for all biomarkers; mean values didn't break normal range levels.

As shown in table 3, BMI was significantly associated with higher age and female gender. Rural residence and married subjects had higher BMI yet non-significant. Neither of the socioeconomic variables under study showed significance with BMI but it could be noticed that lower-income and higher education pertain more to obesity. Chronic diseases showed to be significantly abundant among those with higher BMI as well as mental health problems. Among the work-related variables, none of the parameters showed a correlation with BMI at the time where higher CRP and lower DHEA-S biomarkers showed a significant association.

## 4 Discussion

According to our results, factors that showed a significant direct association with increased BMI were; advanced age, female gender, presence of chronic diseases, presence of mental health problems, increased level of CRP biomarker and decreased level of DHEA-S biomarker.

In contradiction with our hypothesis, work stress didn't show any significance in association to obesity neither when assessed psychometrically in terms of perceived stress, job satisfaction and falsification of type nor when measured biochemically using cortisol and other related biomarkers like TG, TC and thyroxin. An exception was detected for CRP and DHEA-S that could be related to other factors among the study sample than stress. Similar findings were reported by some research studies (Faghri et al., 2015; Pollard et al., et al.1995; Griffin et a., 1993) that emphasized disconnection between dietary behaviours inviting obesity and stress. The level of cortisol among the study sample, being at the normal level, also favoured exclusion of the assumption that increased BMI was due to the lipogenic effect of increased secretion of cortisol in response to the prevalence of stress.

According to the literature, increased CRP could be due to the released fatty acids from visceral and/or abdominal adipose tissue (Misra and Vikram, 2003) that has no direct relation to stress. CRP has also been reported to correlate positively with BMI and WHR among African women (Lear et al., 2003) and especially in hypertensive cases (Schutte et al., 2008). Similarly, the negative correlation between DHEA-S levels and BMI could be explained apart from assuming the presence of stress. In agreement with our findings, DHEA-S is lower in the serum of obese Saudi women compared to matched normal cases and showed a significant negative correlation with BMI. Other studies indicated that low levels of DHEA-S were a causal effect for obesity (Manson et al., 1995). DHEA-S was also reported to contribute to the pathogenesis of mental health problems like depression (Baumgartner et al., 1995) that is significantly associated with BMI in our study sample. However, some studies showed different results concerning the relationship between obesity and sulfate ester of DHEA summed up by (Villareal et al., 2005) who emphasized inconsistent findings.

As declared by cross-sectional studies, BMI increase by age –that is the cases in our study- and reach peak values between 50 and 60 years (Flegal et al., 2002).

**Table 2. Descriptive data of age, biomarkers levels and measured scales.**

| | *N* | *Mean±SD* | *Minimum* | *Maximum* |
|---|---|---|---|---|
| ***Age*** | **86** | **40.3±10.6** | **20** | **59** |
| ***BMI*** | **72** | **31.4±6.2** | **18.1** | **47.5** |
| ***Job Satisfaction*** | **81** | **15.6±4.5** | **8** | **25** |
| ***Perceived Stress*** | **83** | **21.5±6.3** | **0** | **36** |
| ***Work Stress*** | **66** | **12.1±6.4** | **1** | **27** |
| ***HDL*** | **75** | **63.1±31.0** | **22** | **201** |
| ***TC*** | **78** | **193.9±73.0** | **40** | **460** |
| ***TG*** | **78** | **129.7±68.6** | **48** | **560** |
| ***CRP*** | **72** | **4.4±3.0** | **0.5** | **9.7** |
| ***Cortisol*** | **80** | **11.2±3.9** | **3.8** | **19.7** |
| ***tT4*** | **75** | **9.3±2.4** | **4.7** | **14.8** |
| ***DHEA-S*** | **78** | **0.8±0.6** | **0.03** | **3.5** |
| ***WHR*** | **74** | **0.9±0.2** | **0.7** | **1.9** |

Body composition changes by the effect of age where fat mass increases on the expenses of fat-free mass represented by skeletal muscles (Muller et al., 1996) and relocates to be concentrated at the abdominal region (Beaufrere et al., 2000).

**Table 3. Bivariate correlations between BMI and study variables.**

| | *Study variables* | *R* | *P* |
|---|---|---|---|
| ***Socio-demographics*** | **Age** | **0.478**** | **0.000** |
| | **Gender** | **0.287*** | **0.015** |
| | **Marital status** | **0.231** | **0.056** |
| | **Residence** | **-0.101** | **0.414** |
| ***Socioeconomic status*** | **Monthly income** | **-0.017** | **0.895** |
| | **Education level** | **0.066** | **0.601** |
| ***Health-related*** | **Chronic diseases** | **0.324**** | **0.005** |
| | **Mental health problems** | **0.260*** | **0.027** |
| | **Perceived stress** | **0.181** | **0.136** |
| | **Waist to hip ratio** | **0.130** | **0.278** |
| ***Work-related*** | **Distance from work** | **-0.163** | **0.183** |
| | **Other jobs** | **-0.128** | **0.291** |
| | **Working years** | **0.217** | **0.074** |
| | **Working hours** | **-0.148** | **0.436** |
| | **Job satisfaction** | **-0.71** | **0.565** |
| | **Work stress** | **0.045** | **0.745** |
| ***Biomarkers*** | **TC** | **-0.039** | **0.749** |
| | **TG** | **0.173** | **0.151** |
| | **HDL** | **-0.022** | **0.858** |
| | **Cortisol** | **-0.181** | **0.129** |
| | **CRP** | **0.380**** | **0.001** |
| | **DHEA-s** | **-0.254*** | **0.032** |
| | **tT4** | **0.102** | **0.394** |

* Correlation is significant at the 0.05 level, ** Correlation is highly significant at the 0.01 level.

Females in our study suffered more than males from obesity following many similar kinds of research (Lallukka et al., 2008). At the same time, neither being single nor married seemed to affect obesity in agreement with findings of Block et al. (2009) and Iversen et al. (2012), respectively. On the other hand, mental health problems showed a significant association with BMI. Previous research suggested the presence of causal effects between environmental conditions, mental health and obesity, yet little is known about details or mechanisms (Barry and Petry, 2008; Andersen et al., 2004). Mental health disturbances affect appetite either positively or negatively with an obvious risk of weight gain (Kivimäki et al., 2006). Besides, psychotropic drugs are evident to increase the appetite with an inventible consequence of obesity (Smits et al, 2010). Chronic diseases also showed a direct correlation with increased BMI in agreement to many research findings that emphasized obesity as a risk factor for many of them (Flegal et al., 2013, Egger and Dixon, 2014). As reported, obesity is associated with low-grade systemic inflammation and insulin resistance (Egger and Dixon, 2009) and prolonged dysregulation of an immune response (Pal et al., 2016) that offered

some causal explanations for chronic diseases in consequence of obesity.

In conclusion, it is highly recommended to investigate both work and non-work environmental factors affecting obesity since both have been reported to seriously contribute to obesity. Biochemical assessments also can highlight different pathways and mechanisms of pathogenesis of gaining weight. Further analysis of present data is recommended that include linear regression analysis of findings to detect the exact predictors of obesity among the significantly correlated variables. Repeating the study on a larger sample would help to obtain results that could be generalized. More research investigating the relationship between obesity and work-stress models, management standards and a healthy workplace is crucial for a better understanding of risk factors of obesity at the workplace.

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