Original Article

Body mass index and factors related to overweight among women workers in electronic factories in Peninsular Malaysia

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Factors related to overweight were examined in a cross-sectional survey that included 1612 women workers from 10 large electronics assembly factories in Peninsular Malaysia. Respondents were Malaysian citizens, direct production workers below the supervisory level, and had worked at least a year in the factory where they were presently employed. Heights and weights were taken to calculate the body mass index (BMI). Weights and BMI increased with increasing age. After adjusting for age, odds ratios for overweight were significantly raised for married women in relation to not married women (OR 1.5, 95% CI=1.15-2.02), lower secondary education in relation to higher than upper secondary education (OR 1.8, 95% CI=1.06-3.14), monthly income RM800-999 (OR 1.7, 95% CI=1.21-2.45) and ≥RM1,000 (OR 1.8, 95% CI=1.23-2.72) in relation to <RM600, working in rotating shifts that included nightshifts (OR 1.6, 95% CI=1.28-2.06), and not staying in hostel (OR 1.4, 95% CI=1.02-1.88). In a logistic regression model with all variables included as covariates, the factors significantly associated with overweight were age, marital status, education, income, and working in rotating shifts. The overall prevalence of overweight was 37.4%; the overall mean BMI was 24.2±5.4 kg/m^2. Prevalence of overweight and mean BMI for younger age groups were similar to Malay women in the country-wide representative National Health and Morbidity Survey II, but the older age groups in this study had higher overweight prevalence and mean BMI than the national sample. Electronics women workers face a higher risk of overweight, and is an important group for nutrition intervention.

Key Words: Body mass index, overweight, electronics women workers, shift work, income, education, Malaysia

Introduction

The double burden of overweight on the one hand and chronic energy deficiency on the other has been identified as a major public health problem in Asian countries, where undernutrition is still prevalent among children, but over-nutrition has become increasingly prominent, particularly in adult populations.[1] In poorer developing countries, overnutrition has generally been associated with the higher socio-economic groups, but as a country progresses along the trajectory of socio-economic tran-sition toward greater affluence, the prevalence of over-weight becomes a bigger problem among the lower socio- economic groups.[2]

In Malaysia, overweight is an increasing problem in both urban and rural areas.[3,4] The focus on overweight as a national public health problem has come about in parallel with the emergence of heart disease as the primary

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cause of mortality since the 1970s.[5] In the 1990s, this focus was incorporated into the national health agenda with the healthy lifestyle campaigns, which kicked off in 1991, and continued through the 1990s.

In accordance with the country's nutrition policy, national priorities in research encompassed the identification of the problem of overweight among the Malaysian population and its geographical, sex, ethnic, and socio-economic distribution.[6] For the first time, in the second national health and morbidity survey (NHMS II) in 1996, anthropometric measurements were taken for a nationally representative sample of the adult population.

In the NHMS II, the prevalence of overweight was found to be higher in urban than rural populations; and also higher among women than men.[6] Socio-economic differences are not so clear, and prevalences vary depending on the indicator used to measure socio-economic status. The prevalence of overweight (BMI >25 kg/m^2) appears to be greater among people with primary education compared to the uneducated or those with secondary education; on the other hand, it rises with household income until it reaches a maximum level for household income RM3000-3999, after which it falls again.

In this national context, a major research program on '*Health and lifestyle*' was carried out in 1996-2000. One of the research projects in this program, the '*Working women, health and lifestyle*' project, focused on identifying factors related to the health status of women workers in the electronics industry. This paper uses data from this project to describe the nutritional status of the women, and to identify the socio-demographic and lifestyle factors that are associated with overweight among this group of women.

The electronics industry is among the largest private sector employers of women workers in Malaysia, and its workforce constitutes a large proportion of the urban women labour force. Production workers in the electronics industry are among the lower socio-economic groups in the country, but through the years since the early 1970s when the industry first started here, they have been drawn from increasingly higher educational levels.

Subjects and methods

Selection of respondents and data collection

The study employed a cross-sectional analytical survey research design. The inclusion criteria used for selecting factories was that they must be electronics assembly factories, had been in existence for at least two years, and had at least 500 or more women production workers. The management of selected factories were approached for permission to carry out the survey among their workers. A total of ten factories located in six areas in Peninsular Malaysia finally agreed to take part in the study. This sample of factories was not representative of the electronics industry in Malaysia.

Women workers in these factories who participated in the study had to be Malaysian citizens, direct production workers below the supervisory level, and had worked at least a year in the factory where they were presently employed. In one factory, all eligible women were selected for the study, while in another, the respondents were randomly selected from a list. In these two factories, full cooperation was obtained from the management, and the workers were given time off from production to take part in the study. In the other eight factories, however, the management only cooperated to the extent of publicising the study through posters and announcements, and providing a room where the study may be carried out. Women workers who volunteered to participate had to do so in their own free time, usually during their break times, or before/after work. Details are in Chee *et al*.[7]

Data collection took place between March 1999 and September 2000. The women workers attended sessions in batches, and were briefed on the purpose of the survey and assured confidentiality before filling in the self-administered questionnaires. Research assistants were present to answer any query or to help those who had literacy or language difficulties.

Anthropometric measurements and classifications

Body weights of respondents in light clothing and without shoes were taken with a TANITA (Tanita Corp., Tokyo, Japan) electronic digital balance to the nearest 0.2 kg. Height was measured with a bodymeter to the nearest 0.1 cm. The bodymeter was suspended from a straight wall with its reading of zero at ground level. Respondents stood without shoes with their ankles and backs against the wall.

Body mass index (BMI) was calculated as the ratio of weight in kilogram to the square of height in metres, and categorised according to WHO (1998).[8] BMI between 18.5 and 24.9 kg/m^2 was considered the normal range, below 18.5 kg/m^2 was underweight, and 25.0 kg/m^2 and above was overweight. Within the overweight range, BMI between 25.0 and 29.9 was categorised as pre-obese, and 30.0 and above was obese.

Definition of variables

Ethnicity and marital status were self-defined, education was the highest level attained, and monthly income was total income, including allowances and overtime pay. Staying in hostels was defined as staying in accomodation provided and managed by management. Workers were considered to be on shift work if they worked in rotating shifts that included a night shift. This could be three eight-hour shifts (morning, afternoon, night) or two 12-hour shifts (day, night). Respondents were asked whether or not they exercised, and if they did, they were asked to select one of three levels of physical activity that best described what they did. The first was carrying out physical activities such as bicycling or walking to work for a total of four hours per week, the second was carrying out physical activities such as playing badminton, jogging, or doing aerobics for two to three times a week, and the third was carrying out physical training for participation in sports, game, or any such activities for more than three times a week. Exercise was considered adequate if it was done at the second (moderate) or third (high) level. Respondents who exercised at the first (light) level were grouped together with those who did not exercise into the 'inadequate exercise' category.

Trial run and data analysis

A trial run of data collection was carried out among 60 women workers in a factory in Penang in September 1998, during which the questionnaire was pre-tested and anthropometric measurements taken. Data were coded prior to entry, merged and analysed using SPSS version 10.0. The chi-square test, odds ratio, ANOVA (with post-hoc Bonferonni test) were used in bivariate analysis, and the binomial logistic regression in multivariate analaysis.

Results

The group of women were generally young with more than two thirds below 35 years of age (70.7%) (Table 1). They were predominantly Malay (78.5%), slightly more than half were not married (51.7%), and most had either upper secondary (57.8%) or lower secondary education (31.5%). Mean monthly income was RM771, and median was RM700. More than half of the women (57.6%) worked three shifts, rotating every seven to ten days from morning (0700 to 1500), to afternoon (1500 to 2300), to night (2300 to 0700). Some of the women stayed in hostels that were run by factory management (21.3%).

Mean weight and BMI were consistently higher for older age groups (Table 2). The differences in mean weight and BMI between the various age groups were statistically significant except for the ≤20 year and 20-29 year age groups. The differences between the 50-55 year age group and the 35-44 year and 45-55 year age groups were also not significant, but this is probably due to the small number of women in the 50-55 year age group. While the distribution for height was normal, those for weight and BMI were slightly skewed to the right, as shown by the lower values of the medians compared to the means. The association between BMI and age was statistically significant (Table 3). As age advanced, increasing proportions were pre-obese and obese.

Smoking and alcohol intake were uncommon, as only 27 women (1.7%) had ever smoked, 4 (0.2%) were currently smoking, and 8 had usual alcohol intake (0.5%). As high as 39.6% of the women said that they did not exercise, with the predominant reasons given as not having the time (27.5%), being lazy (21.0%), having no interest (15.6%), and having no friends to exercise with (15.3%). More than one third (34.3%) engaged in light exercise, and they were considered, together with those who did not exercise (39.6%), as having inadequate exercise (73.9%). Those who did adequate exercise (23.1%) comprised those who did moderate (23.1%) and high (3.0%) levels of exercise. Leisure time activities were largely domestic work (90.8%), staying at home or having a hobby at home (74.1%), and shopping, visiting friends and relatives, etc. (62.1%). More than half (55.8%) said that they frequently did overtime work or were involved in another income generating activity. Very small proportions joined in company sponsored recreational activities (11.8%) or pursued further training or courses (8.0%).

The selected factors were all significantly associated with overweight in bivariate analysis (Tables 4 and 5). After adjusting for age, however, the odds ratios for overweight that were still significantly raised were those for married women in relation to not married women (OR 1.5, 95% CI=1.15-2.02), lower secondary education in relation to higher than upper secondary education (OR 1.8, 95% CI=1.06-3.14), monthly income RM800-999 (OR 1.7, 95% CI=1.21-2.45) and ≥RM1,000 (OR 1.8, 95% CI=1.23-2.72) in relation to < RM600, and working in rotating shifts (OR 1.6, 95% CI=1.28-2.06) (Table 5). In a logistic regression model with all variables included as covariates, the factors that remained significantly associated with overweight were age, marital status, education, income, and working in rotating shifts.

Discussion

Prevalence of overweight

The overall prevalence of overweight in this study was 37.4% (24.1% pre-obese, 13.3% obese), compared to 29.0% (21.4% pre-obese, 7.6% obese)[9] in the NHMS II sample of women 20 years and above, adjusted for age to the 1996 Malaysian population. This difference is of course confounded by the different age range and distribution. Comparing prevalence by age group, it may be observed that the prevalence of overweight in the current study (23.1%) is almost similar to the NHMS II sample of Malay women (20.7%) as well as a sample of rural women (23.9%)[4] for the youngest age group (20-29 years)

Table 1. Socio-demographic characteristics of study population (N=1612)

	Distribution of respondents	
	N	%
Age group (yrs)		
17-24	539	33.4
25-34	602	37.3
35-44	375	23.3
45-55	96	6.0
Mean age (± SD) (yrs)	30.1 (±8.1)	
Ethnic group		
Malay	1265	78.5
Indian	286	17.7
Chinese	35	2.2
Others	26	1.6
Marital status		
Not married	834	51.7
Widowed/ divorced	75	4.7
Married	703	43.6
Education		
Primary or lower (≤ 6 yrs)	78	4.8
Lower secondary (7-9 yrs)	508	31.5
Upper secondary (10-11yrs)	932	57.8
Pre-university or higher (≥ 12 years)	94	5.8
Monthly income (RM)		
<600	389	24.1
600-799	559	34.7
800-999	316	19.6
≥ 1,000	348	21.6
Mean monthly income (± SD) (RM)	771 (±280)	
Working in rotating shifts, including nights		
Yes	718	44.5
No	894	55.5
Staying in hostel		
No	1268	78.7
Yes	344	21.3

Table 2. Mean weight, height, and body mass index (BMI) by age

Age group (yrs)	*N*	%	Weight (kg)		Height (cm)		BMI (kg/m^2)	
			Mean ± SD	Median	Mean ± SD	Median	Mean ± SD	Median
All	1612	100	56.8 ± 13.2	54.4	153.1 ± 5.5	153.0	24.2 ± 5.4	23.3
< 20	69	4.3	51.5 ± 10.8[a]	49.2	154.9 ± 5.7	156.0	21.5 ± 4.4 [a]	20.3
20-29	803	49.8	53.1 ± 11.8 [a]	50.8	153.0 ± 5.4	153.1	22.6 ± 4.8 [a]	21.7
30-39	492	30.5	59.1 ±13.0 [b]	57.3	153.0 ± 5.4	152.9	25.2 ± 5.1 [b]	24.5
40-49	234	14.5	65.9 ±13.5 [c]	64.9	152.9 ± 6.2	153.0	28.2 ± 5.6 [c]	27.9
≥ 50	14	0.9	65.8 ±8.0 [b,c]	66.4	151.9 ± 5.3	153.4	28.5 ± 2.9[b, c]	29.2
F value			59.1 (*P*<0.001)		2.2 (*ns*)		70.3 (*P*<0.001)	

The values with different alphabet superscripts are significantly different (*P*<0.001), while the values with similar alphabet superscripts are not significantly different, *ns* = not significantly different; based on Bonferroni's Post-Hoc Test.

Table 3. Percentage distribution of respondents according to body mass index (BMI) categories and age groups

	Body Mass Index (kg/m^2)			
Age group (yrs)	<18.5 (%)	18.5-24.9 (%)	25.0-29.9 (%)	≥ 30.0 (%)
< 20 (*N*=69)	24.6	56.5	14.5	4.3
20-29 (*N*=803)	16.4	60.5	15.1	8.0
30-39 (*N*=492)	5.5	49.4	30.7	14.4
40-49 (*N*=234)	3.4	23.9	41.9	30.8
≥ 50 (*N*=14)	0	7.1	64.3	28.6
Total (*N*=1612)	11.4	51.2	24.1	13.3

χ^2 = 269, df = 12, *P*<0.001

years), but for the older age groups, the prevalences in the current study were much higher than both the NHMS II and the rural women. Women in the current study were largely from urban areas, and the higher overweight prevalences compared to rural women were to be expected. Nevertheless, the higher prevalences compared to a nationally representative sample, particularly at the older age groups, are cause for concern.

Age and BMI

The weight and BMI of the women workers in this study increased with increasing age. This pattern was expected for the age range of 17 to 55 years, and was similar to other large population-based studies.[9-10] A study that combined data from Morocco and Tunisia had found that BMI of women increased significantly with age up to a maximum at 55 years; furthermore, this increase was more dramatic in urban areas.[10]

If we compare with Malay women in the nationally representative sample of the NHMS II,[9] the BMI-age gradient for women workers in this study is much steeper than for Malay women in the NHMS II. Although the study sample consisted of 17.7% Indians and 2.2 % Chinese, ethnicity could not be used to explain this difference because the BMI-age gradients for Indian and Chinese women in the NHMS II were also narrower than the gradient found in the current study.

The steeper BMI-age gradient in the current study was due both to a steeper weight-age gradient as well as less variation in mean heights of comparable age groups. The increase in body weight with age has been attributed to increasing sedentariness, and the lower heights among older age groups is said to be due to younger cohorts achieving better growth potential because of better nutrition.[9] If this was so, it would mean that the cohort effect is not as obvious in this group of factory women, and by implication, nutrition has not improved as much for them, compared to women in the general population. Furthermore, the larger increases in body weight with age could mean that the changes in physical activity, diet, and lifestyles that are associated with aging has greater negative impact on this group of women. Alternatively, the opportunities for practising healthier lifestyles are fewer for women in this population group as they age.

Comparison may also be made with a 1992-1995 study that consisted of 2,741 women from rural communities.[4] The mean BMI of these rural women were about the same as the women workers in the current study at the younger age groups. At the older age groups, however, mean BMI of the women in the current study were higher than the rural women. For each comparable age group, height and weight in the current study were found to be higher than in the rural study. Differences in heights were smaller, however, compared to differences in weights. Weights of the older age groups in the current study increased greatly while those in the rural study did not increase by as much.

Factors related to overweight

In the NHMS II, overweight was significantly higher among Indians and Malays as compared to Chinese, but in the current study, ethnicity was not related to overweight after adjusting for age.[6] The current study was however similar to the NHMS II in that overweight was significantly more prevalent for married women, less prevalent at higher educational levels, and more prevalent at higher personal income levels.

The finding that women with lower educational levels faced significantly higher risk of overweight is supported by other large population based studies.[2,9] One study utilised data from the World Health Organization (WHO) MONICA (Monitoring Trends and Determinants in Cardiovascular Disease) Project that included men and women aged 35 to 64 years from 26 populations.[2] In 22 of the populations, educational level was significantly inversely related to BMI, that is, women with lower

Table 4. Distribution of respondents by body mass index (BMI) status and selected factors (N=1612)

	Distribution of respondents No. (%)			
	Overweight (BMI ≥ 25.0 kg/m^2)	Non-overweight (BMI < 25.0 kg/m^2)	χ^2	*P*
Age group (yrs)			205	0.000***
17-24 (N=539)	109 (20.2)	430 (79.8)		
25-34 (N=602)	199 (33.1)	403 (66.9)		
35-44 (N=375)	226 (60.3)	149 (39.7)		
45-55 (N=96)	69 (71.9)	27 (28.1)		
Ethnic group			45.2	0.000***
Non-Malay (N=347)	184 (53.0)	163 (47.0)		
Malay (N=1265)	419 (33.1)	846 (66.9)		
Marital status			115	0.000***
Not married (N=834)	210 (25.2)	624 (74.8)		
Widowed/ divorced (N=75)	29 (38.7)	46 (61.3)		
Married (N=703)	364 (51.8)	339 (48.2)		
Education			45.2	0.000***
Primary or lower (N=78)	38 (48.7)	40 (51.3)		
Lower secondary (N=508)	242 (47.6)	266 (52.4)		
Upper secondary (N=932)	301 (32.3)	631 (67.7)		
Higher than upper sec (N=94)	22 (23.4)	72 (76.6)		
Income (RM)			156	0.000***
<600 (N=389)	90 (23.1)	299 (76.9)		
600-799 (N=559)	152 (27.2)	407 (72.8)		
800-999 (N=316)	147 (46.5)	169 (53.5)		
≥ 1,000 (N=348)	214 (61.5)	134 (38.5)		
Work rotating shifts, including nights			52.4	0.000***
Yes (N=718)	339 (47.2)	379 (52.8)		
No (N=894)	264 (29.5)	630 (70.5)		
Staying in hostel			51.6	0.000***
No (N=1268)	532 (42.0)	736 (58.0)		
Yes (N=344)	71 (20.6)	273 (79.4)		
Exercise			5.29	0.021*
Inadequate/ none (N=1192)	466 (39.1)	726 (60.9)		
Adequate (N=420)	137 (32.6)	283 (67.4)		

*P<0.05, **P<0.01, ***P<0.001

Table 5. Crude and adjusted odds ratios for overweight by selected factors (N=1612)

	Crude OR	95% CI	Adj OR[1]	95% CI	Adj OR[2]	95% CI
Age group (yrs)						
17-24	1.0	-	-	-	1.0	-
25-34	1.9	1.49-2.55			1.4	1.05-1.92
35-44	6.0	4.46-8.04			2.5	1.68-3.63
45-55	10.1	6.16-16.5			3.3	1.83-5.94
Ethnic group						
Non-Malay/Malay	2.3	1.79-2.90	1.2	0.88-1.56	1.2	0.92-1.63
Marital status						
Not married	1.0	-	1.0	-	1.0	-
Widowed/ divorced	1.9	1.15-3.06	0.9	0.52-1.53	1.0	0.57-1.68
Married	3.2	2.57-3.96	1.5	1.15-2.02	1.7	1.25-2.19
Education						
Primary or lower	3.1	1.62-5.97	2.1	1.00-4.22	2.2	1.07-4.53
Lower secondary	3.0	1.79-4.95	1.8	1.06-3.14	1.9	1.09-3.25
Upper secondary	1.6	0.95-2.57	1.5	0.88-2.47	1.5	0.87-2.46
Higher than upper sec	1.0	-	1.0	-	1.0	-
Income (RM)						
<600	1.0	-	1.0	-	1.0	-
600-799	1.2	0.92-1.68	1.1	0.78-1.47	1.1	0.80-1.51
800-999	2.9	2.09-3.99	1.7	1.21-2.45	1.8	1.28-2.59
≥ 1,000	5.3	3.85-7.30	1.8	1.23-2.72	2.1	1.46-3.17
Work rotating shifts, including nights						
Yes / No	2.1	1.74-2.62	1.6	1.28-2.06	1.6	1.28-2.06
Staying in hostel						
No / Yes	2.8	2.09-3.69	0.9	0.66-1.32	1.0	0.68-1.37
Exercise						
Inadequate / Adequate	1.3	1.05-1.68	1.0	0.78-1.33	1.0	0.80-1.35

[1]Odds ratios of each variable adjusted in a logistic regression with age (included as a continuous variable) as covariate. For each dichotomous variable, the reference category is the last category. [2]Adjusted in one logistic regression model with all the variables listed here as covariates. For each dichotomous variable, the reference category is the last category.

educational levels had higher BMI.

In the Morocco and Tunisia study which included 1,500 Moroccan women and 1,300 Tunisian women aged 25 to 45 years from two surveys as well as national survey data, it was found that obesity was higher in urban areas and among women with little or no education.[10] Morocco and Tunisia are similar to Malaysia in being categorised as middle human development countries, although indicators are better for Malaysia (life expectancy 72.5 years, adult literacy 87.5%) compared to Tunisia (life expectancy 70.2 years, adult literacy 71.0%) and Morocco (life expectancy 67.6 years, adult literacy 48.9%).[11]

The authors of the Morocco and Tunisia study attribute the higher levels of obesity among less educated women to the lower levels of awareness on the risks and health consequences associated with obesity, as well as the fact that fatness is considered culturally desirable. In the study by Molarius *et al.*,[2] however, education was used as a proxy indicator for socio-economic status; and it was pointed out that for men (but not for women), education was positively associated with BMI in poorer societies although the relationship was inverse in more affluent populations.

In the current study, education had an inverse relationship, but income had a positive association, with overweight. Socio-economic differences among the women workers would be more difficult to detect, since they were drawn from the same occupational group, and factors other than education or income, such as income of other family members, stage of life-cycle, whether urban or rural residence, might also be important confounding factors. In general, they were from the same socio-economic strata, and therefore, the effect of education or income was probably more specific. Both education and income, in fact, were highly correlated with age, and the higher odds of overweight that were associated with a higher income or a lower education were each adjusted downward with the inclusion of age in the analyses. Nevertheless, independent of the effects of age, a higher education could be associated with less overweight through its probable association with a greater awareness of health messages in the mass media, and higher health consciousness. Higher incomes within this particular occupational group, however, could be an outcome of longer working duration, longer overtime hours or being located in a larger city. Whether and how any of these factors, or the affluence that comes with a higher income, are related to the occurrence of overweight in this population, should be the subject of future studies.

Physical activity was one of the factors examined for its association with obesity in the FINRISK studies, large-scale cross-sectional population surveys in Finland between 1982 and 1997.[12] In an analysis that included 12,747 women, it was found that leisure time physical activity was negatively related to obesity, after adjusting for age, education, and other physical activity and dietary variables. In the current study, however, the lower odds of being overweight faced by women with adequate exercise became insignificant after adjusting for age. This implies that the women who did adequate exercise were also younger and therefore faced lower risk of overweight due to their age rather than exercise level.

The proportion of women in the adequate exercise group (26.1%) was higher than in the NHMS II where women doing adequate exercise ranged from 15.1% for the 18-19 years to 11.1% for 40-49 years and 10.5% for 50-59 years (Siti Sa'adiah *et al*., 1999). The difference may be due to the stricter definition of adequate exercise employed in the NHMS II, that is, either jogging, brisk walking, cycling, rope skipping, rowing, swimming, aerobics, team sports, racquet sports, or calisthenics sports carried out for more than three times a week for at least 15 minutes each time, undertaken for the purpose of recreation, sport or health/fitness during the two weeks prior to the interview. The current study was supported by the finding in the NHMS II that there was no significant difference between the normal weight group (12.5%) and the overweight group (BMI 25-29.9 kg/m^2) (12.7%) in the proportions of women who carried out adequate exercise, although the obese group (BMI $\geq$ 30 kg/m^2) had a much lower proportion of women (10.5%) with adequate exercise.[13]

Social or environmental factors that place pressure on increasing calorie intake and reducing physical activity will be associated with overweight. Shiftwork appears to be one such factor as women who worked night shifts faced significantly higher odds of overweight even after adjusting for age and other variables. Most of the women who worked nightshifts were on three rotating eight hour shifts, but there was a small percentage who worked two rotating 12-hour shifts. This type of work organization placed a heavy burden on women to adjust their physiological rhythms for sleeping and eating, and a difficulty to adjust could be linked to overweight.

Conclusion

Overweight and obesity was found to be a major problem among this group of women workers, and particularly for the older age groups. Working nightshifts significantly elevated the odds of overweight. Since shiftwork is an integral part of most electronics factories, the reasons for this should be investigated further for finding possible ameliorative measures.

The role of exercise should also be further examined. In the current study, the instrument used to measure exercise was not validated, and this could be one reason for the lack of association found between adequate exercise and obesity. In any case, the low percentages of women who engaged in exercise should be a cause for concern. Research into the reasons for the low rates, particularly for women in the older age groups, should seek ways that would enable factory women to regularly engage in exercise. The sedentary nature of electronics assembly work makes this particularly important.

One limitation of the current study is the voluntary nature of its sample, which could have led to a bias to include more women with a greater health consciousness or who were seeking help for weight or health problems. On the other hand, there have been a paucity of studies on the nutritional status of women workers in Malaysia, and the large number of electronics women workers from

several varied geographical areas in Peninsular Malaysia constituting the sample of the current study makes it useful for health risk assessment of the sub-population, particularly when it can be assessed in relation to the country representative sample of the NHMS II. The current study was also limited in that it did not included dietary data, which would have been difficult to collect for such a large sample. Nevertheless, the study gives an overall picture of the nutritional status of one important occupational group in Malaysia, and the possible factors contributing to overweight among them.

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