



The effect of shift work on the diet of accident and emergency nurses at a general hospital in Malta

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3 **The effect of shift work on the diet of accident and emergency nurses in a general**
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5 **hospital in Malta**
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10 **Abstract**
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13 **Purpose** – The purpose of this paper was to investigate the effect of shift work on diet and
14 lifestyle in nurses working in the accident and emergency department in a general hospital in
15 Malta.
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20 **Design/methodology/approach** – This study was a cross-sectional, quantitative survey
21 whereby data were collected by the use of anonymous questionnaires consisting of a
22 demographic and anthropometric questionnaire, a lifestyle questionnaire and a food
23 frequency questionnaire to assess dietary intakes. 110 nurses completed the study and were
24 divided into 3 groups; day nurses, rotating shift nurses and night shift nurses.
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32 **Findings** - Shift working nurses consumed significantly more energy compared to day nurses
33 (night shift nurses 1963 ± 506 kcal; rotating shift nurses 2065 ± 655 kcal; day nurses $1722 \pm$
34 486 kcal); ($p = 0.04$). Shift working nurses also consumed more protein ($p = 0.04$), fat ($p =$
35 0.047) and fibre ($p = 0.005$) compared to day nurses, however day nurses were the most
36 likely to smoke ($p = 0.009$).
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44 **Practical implications** Shift work does influence the diet of nurses in Malta. It is
45 recommended that access to healthy food and time and facilities for physical activity are
46 made available across all working hours and that nurses aim to exercise regularly, eat
47 healthily, quit smoking if necessary and get good quality sleep where possible.
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54 **Originality/value** – 22% of workers in Malta work shifts, and Malta currently has one of the
55 highest rates of obesity in Europe. This study considers the impact of shiftwork on diet.
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3 **Keywords** - diet, nurses, obesity, shift work
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6 **Paper type** – Research paper
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12 **Introduction**
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15 In Malta, 22.2% of workers are engaged in shift work (Formosa, 2009) and this figure
16 appears to be on the increase. Across Europe generally 21% of workers are required to work
17 shifts and this has increased by 4% since in 2005 (Eurofound, 2015). One third of people in
18 the health care sector are required to work shifts (Eurofound, 2005) since most hospitals and
19 nursing homes operate essential services 24 hours a day.
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27 Shift work is known to affect sleeping patterns, eating behaviour and can result in altered
28 levels of physical activity (Persson & Martensson, 2006) that may disrupt the natural
29 circadian rhythm (Lowden *et al.*, 2010;) and potentially lead to symptoms such as gastro-
30 intestinal disorders (Nojkov *et al.*, 2010; Knutsson & Bogglid, 2000), high blood pressure
31 and mood disorders (Driesen *et al.*, 2010). Some studies have shown that there is a greater
32 incidence of obesity amongst shift workers (Macagnan *et al.*, 2012; Li *et al.*, 2011) and that
33 shift work may be associated with higher risk of insulin resistance, diabetes, dyslipidemias
34 and metabolic syndrome (Zimberg *et al.*, 2012) and even possibly increased incidence of
35 cancer (Lieu *et al.*, 2012).
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48 Malta has been identified as a country with one of the highest rates of overweight and obesity
49 in Europe. In 2015 68.5% of men and 59.6% of women were classified as being overweight
50 (World Health Organisation (WHO), 2015) and since there appears to be a greater incidence
51 of obesity amongst shift workers, it is clear that a healthy lifestyle including diet is of the
52 utmost importance for workers who regularly work shifts.
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3 In light of the high rates of overweight and obesity in Malta and the high incidence of
4 shiftwork amongst healthcare workers, this study aimed to investigate the dietary intake and
5 lifestyle of nurses that work shifts in the Accident and Emergency (A&E) Department at the
6 main general hospital in Malta. The A&E department was chosen in particular because
7 unlike other departments in the hospital there is an equal distribution of nurses on all shifts
8 throughout the 24 hours of the day.
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20 **Materials Methods**

21 *Study Design and Participants*

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23 The study was a cross-sectional, quantitative survey whereby data were collected by the use
24 of anonymous questionnaires. The participants were all nurses working in the Accident and
25 Emergency (A&E) Department in a general hospital on the island of Malta. Data were
26 collected from January until February 2015.
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36 146 nurses over the age of 18 years were initially recruited, 123 nurses completed the
37 questionnaire, 13 were excluded on the grounds of incompleteness (5), new to the job (4),
38 pregnancy (1) and illness (3). In total 110 nurses completed the study. The participants were
39 divided into 3 groups according to their usual work rota: day nurses (n=29, 31% male and
40 69% female), rotating shift nurses (n=68, 28% male and 72% female) and night shift nurses
41 (n=13, 23% male and 77% female). The usual working shift was a 12 hour shift starting at
42 7:00hrs for the day shift and 19:00 hrs for the night shift. The rotating shift roster is typically
43 spread over four days which includes a day shift, a night shift, followed by a rest and a day
44 off.
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55 *Data Collection*

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3 Questionnaires were used to ascertain information about lifestyle and some basic
4 anthropometric measurements. The questionnaires were made available in the Accident and
5 Emergency department. Blank envelopes were distributed with the questionnaires so once
6 completed the questionnaires could be posted anonymously into a locked box.
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11 Dietary intake was assessed using the EPIC-Norfolk Food Frequency Questionnaire (FFQ)
12 (European Prospective Investigation of Cancer, 2015) that was adapted to reflect the Maltese
13 diet e.g. using examples of foods commonly consumed in Malta. The EPIC-Norfolk FFQ
14 was selected because it is relatively quick and easy to complete and included a semi-
15 quantitative indication of portion sizes. A specifically designed questionnaire was created to
16 ask details about the demographic and anthropometric measurements of the nurses. To
17 facilitate the anthropometric measurements weighing scales, a stadiometer and a tape
18 measure were made available in the study area in the A&E department, so weight, height,
19 waist circumference and hip circumference could be reported. Pictorial guides showing how
20 the measurements should be correctly determined were provided to all participants. Body
21 mass index (BMI) was calculated from height and weight according to the formula (kg/m^2)
22 and classification issued by the World Health Organisation (2015).
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40 The questionnaire was piloted amongst 10 nurses working in departments other than A&E at
41 the hospital to ensure clarity of the questions. These results were not included in the final
42 data set.
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46 47 *Ethical approval*

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50 Ethical approval was granted by the University of Roehampton, the University of Malta and
51 the Hospital Authority. All participants provided written consent and were aware they could
52 retire from the study at any time without reason. Participants were assured that their data
53 would be coded anonymously.
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Statistical Analysis

The dietary information was analysed using Dietplan (Forestfield software, Sussex, UK) to identify the amount of individual nutrients consumed. The data were calculated as mean per day and exported to the IBM SPSS statistics v21 program (SPSS Inc., Chicago, IL, USA3333) for analysis. The categorical variables socio-demographic background, physical exercise and smoking data were compared using the Fisher exact test or Pearsons Chi-Square test. Analysis of variance (ANOVA) and univariate analysis of variance (UNIANOVA) were utilised to investigate differences in anthropometric measurements and dietary intake variables between shift work groups. *Confounders included age and gender, since both may influence BMI. Multiple comparisons were tested using the Scheffe (post hoc) test. Data are presented as mean \pm standard deviation.* A significance level of $p \leq 0.05$ was adopted.

Results

Table 1 here

The number of participants, age and anthropometric measurements of the nurses according to gender and shift worked is presented in table 1. In total 32% of the nurses were overweight and 19% were obese. Both male and female nurses that worked rotating shifts were significantly ($p = 0.001$) younger (*female nurses 26.7 ± 5.0 years; male nurses 26.8 ± 3.8 years*) than day (*female nurses 34.5 ± 10.0 years, male nurses 38.7 ± 15.2 years*) and night nurses (*female nurses 41.7 ± 11.5 years, male nurses 35.3 ± 5.0 years*). Age was associated with BMI however there were no differences in BMI between groups (see table 1). *For this*

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3 reason UNIANOVA was applied to test for between-subject effects using BMI as a
4 dependent variable by shift type with age. The latter was found to be associated with BMI (p
5 = 0.03) whereas no differences were found between BMI and the three shift patterns (p
6 = 0.26). Night nurses had the highest waist circumferences (female nurses 91.7 ± 13.5 cm,
7 male nurses 92.2 ± 12.4 cm) compared to day (female nurses 80.2 ± 11.8 cm, male nurses
8 87.3 ± 13.2 cm) and rotating shift nurses (female nurses 81.9 ± 13.4 cm, male nurses $94.6 \pm$
9 12.5 cm), although the difference was weak ($p = 0.06$); significance only increased slightly
10 when age was used as a covariate ($p = 0.059$). However male night shift nurses had
11 significantly greater ($p = 0.02$) waist hip ratios (1.1 ± 0.1) than day (0.91 ± 0.006) or rotating
12 shift male nurses (0.93 ± 0.07).
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35 In terms of hours at work, all groups reported that they regularly did overtime; however day
36 nurses and rotating shift nurses worked significantly ($p < 0.001$) longer hours than night
37 nurses. Rotating shift nurses generally had the least years of experience in the job but were
38 most likely to have degree level education ($p = 0.049$). In terms of lifestyle habits (Figure 1),
39 there were no significant differences in physical activity levels between groups, however
40 34% of the nurses reported not doing any physical activity outside of work. There were no
41 differences in alcohol consumption between groups, of those that did consume alcohol red
42 wine was the most commonly consumed drink. The majority of nurses in this study were
43 non-smokers, however 38% of day workers were smokers compared to 12% of rotating shift
44 nurses and 8% of night nurses. Day nurses were significantly more likely to smoke ($p =$
45 0.009), gender did not exert any effect on this finding.
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6 Table 2 shows the nutrient intake of nurses as organised by shift pattern, for males and
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8 females separately and combined.
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21 A Scheffe test revealed that nurses that worked night (1963 ± 506 kcal) or rotating shifts
22 (2065 ± 655 kcal) consumed significantly more energy, compared to day nurses (1722 ± 486
23 kcal); ($p = 0.04$). Shift working nurses also consumed more protein, fat and fibre compared
24 to day nurses (Table 2a). Similarly from the female only data (Table 2b) it was revealed that
25 female nurses who worked night or rotating shifts consumed significantly more protein and
26 fibre. Amongst the male nurses (Table 2c) there were no significant differences in the
27 nutrients consumed. There were no significant findings in relation to specific foods
28 consumed but there was tendency for night shift nurses to consume more foods that could be
29 classed as healthy snacks such as fruit, yoghurt and nuts.
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44 Discussion

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47 Significant trends in the likelihood of shift workers being overweight and at risk of obesity
48 have been reported in a variety of previous studies (Karlsson *et al.*, 2001, Zhao *et al.*, 2011).
49 In this study 51% of the nurses were overweight or obese (61% of male nurses and 49.1%
50 female nurses were overweight or obese). Despite the day nurses having lower energy
51 intakes compared to the rotating and night shift workers there was no differences in BMI
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3 between groups, this could possibly be explained by differences in energy expenditure since
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5 48% of day nurses reported doing no physical activity outside of work. It is also noteworthy
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7 that the incidence of overweight and obesity reported amongst the nurses in this study was
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9 lower than the 68% of males and 59.6% of females in Malta reported by WHO (2015). The
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11 difference found between the general Maltese population and the sample population could be
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13 described as multifactorial, however the participants in this study were all nurses thus perhaps
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15 having a greater knowledge of health and health behaviours than the Maltese population in
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17 general. Furthermore, the majority of the nurses in this study were generally young, single,
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19 and female. However, the overweight and obesity results in this study were similar to that
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21 reported in Californian nurses (Chin *et al.*, 2016) where 49% of nurses were reported as being
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23 overweight or obese but below the results from a Scottish study that described 69% of nurses
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25 as overweight or obese (Kyle *et al.*, 2016). A study (Marqueze *et al.*, 2012) of 446 Brazilian
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27 nurses found night workers with higher education level were more likely to gain weight than
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29 day nurses and this was particularly marked in older nurses, however this study did not
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31 explore nutritional intakes which could influence weight gain. Nurses may be at particularly
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33 high risk of being overweight or obese because of the nature of their work which can be
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35 stressful as well as affected by limited access to healthy food and facilities for physical
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37 activity (Atkinson *et al.*, 2008; Griep *et al.*, 2014). It is acknowledged that the
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39 anthropometric measurements in this study were reliant on self-report and this may have
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41 affected the accuracy of the results. However Dekkers *et al.*, (2008) described self- reported
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43 measures to be valid tools in cross-sectional epidemiological studies and amongst working
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45 populations.
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55 The majority of nurses in this study were non-smokers however, more day workers smoked
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57 compared to rotating or night shift nurses. Other studies have reported that shift workers are
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3 more likely to smoke (Reeves, 2004) and both Marqueeze *et al.* (2012) and Griep *et al.* (2014)
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5 reported that night nurses in particular were more likely to smoke a greater number of
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7 cigarettes. Smoking may be linked to stress and it has been previously noted that A&E
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9 nurses are particularly vulnerable to stress (Adeb-Saeedi, 2002). Smoking cessation support
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11 would be of immediate benefit and many hospitals are now smoke free zones. In this study
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13 more day nurses reported not exercising regularly. It is likely that nurses who work long
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15 hours want to prioritise their time to be with friends and family when not working (Atkinson
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17 *et al.*, 2008). Other studies state that physical activity is less common in shift working
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19 nurses, for example Chin *et al.* (2016) report regular muscle-strengthening physical activity
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21 to be significantly less common among nurses working on non-day shifts. Physical activity
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23 could help with stress relief and promote better sleep (Chennaoui, 2105) even in those with
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25 sleep disorders (Erlacher *et al.*, 2015).
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33 This study showed that nurses who worked night or rotating shifts consumed significantly
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35 more energy, protein, fat and fibre than nurses who worked days, however there were no
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37 differences in alcohol consumption. The increase in protein fat and fibre are likely a direct
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39 result of the increase in energy intake. In terms of total energy intake, other studies have
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41 reported that caloric intakes are not always affected by shiftwork (Reeves *et al.*, 2004;
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43 Lennernas *et al.*, 1994). Atkinson (2008) reviewed the literature and reported that even
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45 where there are no differences in the calorie intakes there may be changes to eating patterns
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47 whereby meal frequency is reduced but snacking increases. It has been reported that some
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49 shift workers consume alcohol as a sleep aid and a recent study suggested young males were
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51 at particular risk (Dorrian *et al.*, 2015) however this was not the case in this study, however
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53 differences in gender and age in the sample groups could help explain the dissimilar results.
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3 Working in A &E can be demanding with physical and psychological pressures and this may
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5 at times affect food intakes and contribute to meal skipping and snacking (Dallman *et al.*,
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7 2003). However snack foods can be high in fat and energy dense and perhaps nurses need
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9 advice on making suitable snack choices as well as ensuring they have access to healthy food.
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11 Eating healthily whilst in a food rich environment where unhealthy choices are readily
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13 available can be difficult for nurses who work any shift (Allom & Mullan, 2008) but this can
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15 be even more challenging at night when access to healthy food can be more restricted. It is
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17 also likely that shift working nurses may have fewer opportunities to eat with friends and
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19 family (Morikawa *et al.*, 2008) and eating together can be of benefit to the whole family
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21 (Boutelle *et al.*, 2003). Food is an important circadian synchroniser, and even where there
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23 are not changes in total amounts consumed, the timing of the food intake and meals can
24
25 change in relation to the shifts that are worked. Nibbling and snacking are common amongst
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27 shift workers (Costa, 2010) furthermore current research has shown that the timing of food
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29 intake is linked to body weight and metabolic health (Garaulet & Gómez-Abellán, 2014).
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31 The timing and distribution of food intakes was beyond the scope of this study but warrants
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33 further attention since this could directly affect metabolic efficiency (Garaulet *et al.*, 2013)
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39 The findings of this study could be strengthened with greater recruitment of male nurses and
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41 night shift workers, however in order to ensure this recruitment would need to include other
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43 healthcare facilities in Malta. This study was based on self-reported data and FFQs. Whilst
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45 we need to consider the possibility of under-reporting there are studies that indicate that semi-
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47 quantitative FFQs can provide reasonably valid and reproducible data (McKeown *et al.*,
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49 2001; Rimm *et al.*, 1991). A further limitation of the study was that no blood biochemistry
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51 measurements were taken. A recent study of police officers showed that shift work was not
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53 significantly associated with lipid profiles, however amongst female officers there were
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3 correlations between triglycerides and total cholesterol and poor sleep quality (Charles,
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5 2015), a common symptom of shift work that many night workers suffer (Huth *et al.*, 2013).
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11 This study has shown differences in the dietary intake of rotating and night shift nurses
12 compared to day nurses and in the long term this may influence the risk of becoming
13 overweight or obese. Nurses can be considered at high risk of being overweight or obese not
14 only because of their diet, but physical activity and stress (Adeb-Saeedi, 2002) but also due to
15 the overriding effect of working shifts.
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23 The experiences of nurses with regards to diet and lifestyle should be taken into consideration
24 and used to encourage improved health behaviours. Nurses and particularly A & E nurses
25 may encounter many physical and mental pressures during the course of their work and this
26 coupled with circadian disruption caused by shift work can constitute a potential health
27 hazard. All wards in the hospital where the study was conducted are equipped with basic
28 catering appliances so it is possible for nurses to prepare/cook healthy snacks and meals at
29 home and bring to work. Furthermore the hospital canteen should provide a selection of
30 healthy food. Small and frequent meals embraced with suitable timing of healthy eating
31 should be part of the daily routine in all nurses to avoid health problems in relation to
32 circadian interference. This should be part of the health education included in the foundation
33 knowledge within the nursing curriculum. The nutritional status of nurses could be monitored
34 periodically and could be used as a screening tool by qualified health personnel to reduce
35 occupational health risks while improving employee health and performance.
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52 53 54 55 56 **Conclusion** 57 58 59 60

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3 These findings provide additional information to show that shift work can influence the diet
4 of nurses in Malta. Since Malta has one of the highest levels of obesity in Europe (Ng *et al.*,
5 2014; World Health Organisation, 2015) it is important to understand some of the many
6 factors that influence weight gain and obesity, including the role of occupational hazards such
7 as shiftwork. Recommendations for hospitals include ensuring healthy food is available and
8 time and facilities for physical activity exist. Recommendations for all nurses including those
9 that work shifts is to ensure they consume healthy meals, snacks and beverages and that they
10 aim to exercise regularly, quit smoking and get adequate amounts of sleep where possible.
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31 nurses that participated in this study.
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Table 1. Anthropometric measurements (mean \pm SD) of male and female nurses according to work pattern

	n	Age (years)	BMI (kg/m ²)	Waist Circumference (cm)	Waist hip ratio
Day Nurses					
Female	20	34.5 \pm 10.0	25.7 \pm 5.1	80.2 \pm 11.8	0.80 \pm 0.09
Male	9	38.7 \pm 15.2	25.4 \pm 5.6	87.3 \pm 13.2	0.91 \pm 0.06
Rotating shift nurses					
Female	49	26.7 \pm 5.0 ^a	26.0 \pm 5.2	81.9 \pm 13.4	0.80 \pm 0.08
Male	19	26.8 \pm 3.8 ^b	27.3 \pm 4.3	94.6 \pm 12.5	0.93 \pm 0.07
Night shift nurses					
Female	10	41.7 \pm 11.5	26.3 \pm 3.1	91.7 \pm 13.5	0.84 \pm 0.06
Male	3	35.3 \pm 5.0	29.2 \pm 1.8	92.2 \pm 12.4	1.10 \pm 0.10 ^c

Rotating shift nurses were significantly younger than day and night shift nurses; ^a female nurses ($p = 0.001$), ^b male nurses ($p = 0.007$). ^c Male night shift nurses had a significantly higher waist hip ratio compared to day and rotating shift nurses ($p = 0.02$)

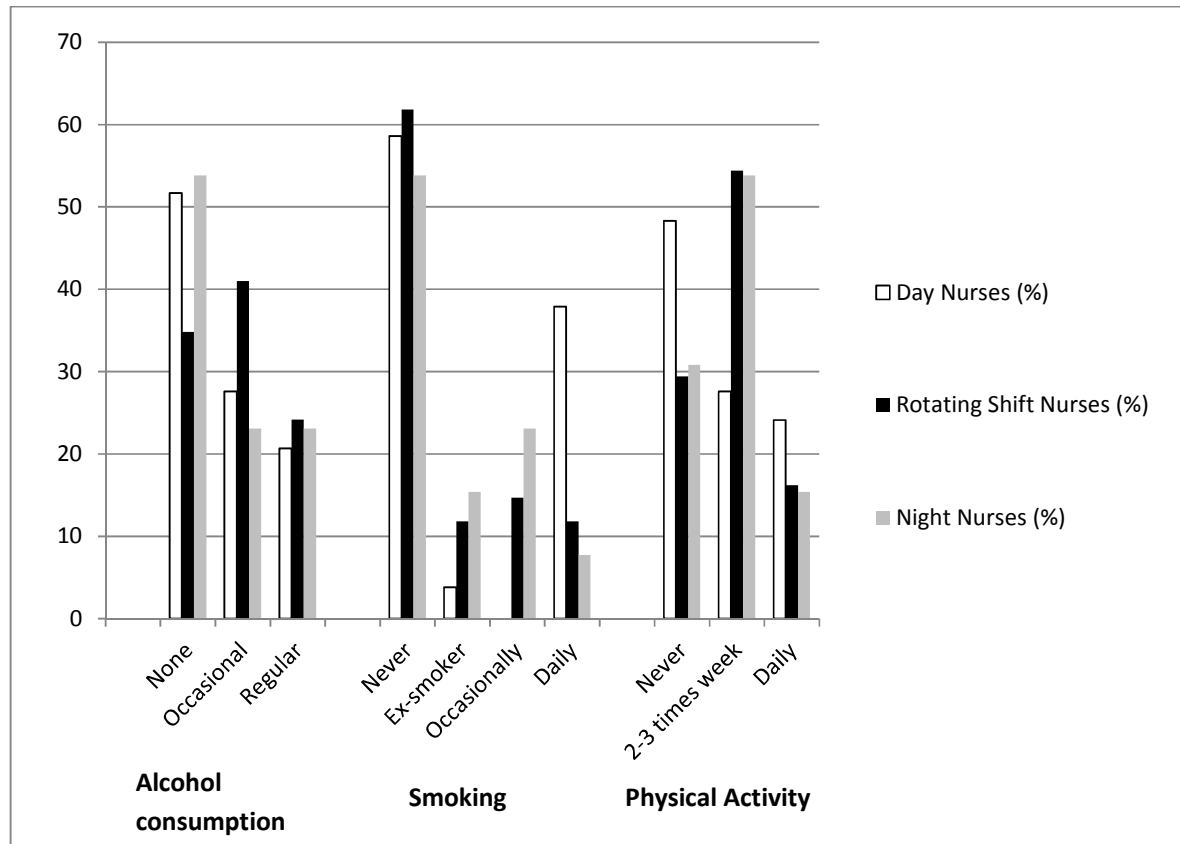


Figure 1. Lifestyle habits of shift working nurses in Malta

Chi-square tests revealed no significant differences between groups for alcohol consumption or physical activity. Day nurses were significantly more likely to smoke ($p = 0.009$) $n=110$.

Table 2. Nutrient intakes (mean \pm SD) of nurses according to gender and work pattern

	Day Nurses	Rotating Shift Nurses	Night Shift Nurses
a. Both genders			
Energy (kcal)	1722 \pm 486 ^a	2065 \pm 655	1963 \pm 506
Carbohydrate (g)	186.4 \pm 56.9	221.8 \pm 70.4	210.4 \pm 64.9
Total sugars (g)	102.5 \pm 40.6	120.9 \pm 46.4	115.5 \pm 49.6
Fibre (g)	19.4 \pm 8.2 ^d	24.3 \pm 10.2 ^d	29.3 \pm 9.0 ^d
Fat (g)	66.2 \pm 21.7 ^b	82.2 \pm 32.2	77.1 \pm 26.7
Protein (g)	95.4 \pm 29.9 ^c	113.3 \pm 24.1	114.6 \pm 17.9
Alcohol (g)	6.4 \pm 8.8	5.6 \pm 5.3	2.8 \pm 3.3
b. Female data only			
Energy (kcal)	1720 \pm 516	2053 \pm 697	1989 \pm 565
Carbohydrate (g)	191.0 \pm 57.7	224.2 \pm 74.6	216.8 \pm 69.4
Total sugars (g)	105.9 \pm 38.0	125.7 \pm 47.4	121.0 \pm 55.1
Fibre (g)	18.5 \pm 7.9 ^e	25.4 \pm 10.5	31.4 \pm 7.6
Fat (g)	67.9 \pm 24.0	80.4 \pm 33.7	78.1 \pm 29.8
Protein (g)	91.3 \pm 32.5 ^f	112.6 \pm 36.0	114.6 \pm 19.4
Alcohol (g)	3.7 \pm 4.2	5.2 \pm 5.5	1.8 \pm 2.4
c. Male data only			
Energy (kcal)	1729 \pm 439	2097 \pm 549	1878 \pm 291
Carbohydrate (g)	176.0 \pm 57.1	215.7 \pm 59.7	189.1 \pm 52.4
Total sugars (g)	94.9 \pm 47.4	108.7 \pm 42.5	97.2 \pm 20.2
Fibre (g)	21.4 \pm 9.1	21.4 \pm 8.8	22.1 \pm 11.3
Fat (g)	62.5 \pm 16.1	86.7 \pm 28.1	73.8 \pm 15.5
Protein (g)	104.4 \pm 22.0	115.1 \pm 29.6	114.6 \pm 14.7
Alcohol (g)	12.4 \pm 13.1	6.5 \pm 4.4	6.3 \pm 4.2

^a In the combined gender data there was a significant difference in the energy ($p=0.04$), ^b fat ($p=0.047$) and ^c protein ($p=0.04$) intakes between the day nurses and the shift working nurses. ^d There were significant differences in fibre intake between all three groups ($p=0.005$). The female only data showed significant differences between ^e fibre ($p=0.002$) and ^f protein ($p=0.005$) intakes for day nurses compared to shift working nurses.