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ORIGINAL ARTICLE

# Changes in Food Intake Pattern of Nurses Working in Rapidly Rotating Shift

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**Abstract:** The aim of this study was to asses the affect of rapidly rotating shift work on food intake pattern on nurses. Forty nurses working in rapidly rotating shift and thirty five general duty nurses were randomly chosen from different government hospitals in the Paschim Medinipur district, West Bengal. It was observed that different gastrointestinal problems like loss of appetite, indigestion and acidity occurs more frequently among rotating shift nurses than the general duty nurses. In night shift worker, the number of full meals per 24 hour, appetite and eating satisfaction were significantly lower ($p<0.0005$) and the number of snacks were significantly higher ($p<0.0005$) than other shifts and general duty nurses. Intake of carbohydrate, protein and fat intake were significantly lower ($p<0.0005$) when nurses work in night shift and the fat intake were significantly lower in morning shift than other shifts and general duty nurses. The mean energy intake in night shift nurses was significantly lower ($p<0.0005$) than the other shifts and general duty nurses. It was also found that the calorie intake in nurses per 24 hours working in night shift was less than the ICMR recommended value. Probably desynchronization in food intake pattern led to different digestive problems in nurses working in night shift.

**Keywords:** Shift work, Food intake, Gastro-intestinal problem, Nurses.

## Introduction

One of the most important factors is that the relationship between internal 24 hours rhythms and external work schedule of persons. The persistence of circadian rhythms in the eating behaviour have been documented in human [1-2].This study showed that the circadian rhythm with approximately 3 meals/24 hours occur and persists even in constant environmental condition when person remaining in underground caves for a 15 days span. Shift work is an integral part of modern life for various reasons among them social, technological and economical reasons are most important. Several studies have demonstrated that shift work affects circadian distribution of food, regularity of meals and the number of meals eaten during different phages of shift cycle [3-5]. It was also observed that the shift workers have reduced eating satisfaction and appetite compared to the permanent day workers [4]. It has been suggested that the desynchronization of circadian system affects on the changes of eating behaviour of shift workers [6-7]. There were epidemiologic evidences, which suggested that shift work may play a part in either causing gastro-duodenal ulceration or at least exacerbate latent or pre-existent overt diseases [8]. Digestive ulcers identified by X-ray are more common among workers engaged in rotating shifts than among those who work regularly in day time [9]. Apart from ulcers, different scientists reported that the rotating shift workers complained about different digestive

disorders like loss of appetite [10-11], gas pain, diarrhoea constipation [12], acidity and dryness in the mouth [13]. Some studies also concluded that rotating shift work affects normal digestive functions [14]. Some researchers reported that the gastrointestinal symptoms are more common and higher among shift worker compared to permanent day workers [15, 8]. It also reported that the gastrointestinal problems (like indigestion, loss of appetite, acidity, etc) were more frequent among nurses engaged in rotating shift [16], as a result of impaired nutritional status [6-7]. It is a most important factor that the nutritional status provides quality of life of a particular community [17]. Night shift workers usually take light amount of food and increase 'pep' drinks such as coffee, tea, etc. [4]. Studies on the eating behaviour among Malawian nurses showed that rotating shift work alters eating pattern of nurses especially during the night shift [18]. It has been found that a decreased frequency in the number of meals take during evening and night shift of 50% of the subject [19]. There are some studies reported that shift work do not affect calorie intake of the workers [20].

Studies related to food intake pattern in nurses working in rotating shift in India are limited [21]. So the present study aims at-

1. Firstly, to observe eating behaviour (the quality and quantity of food intake) of nurses working in rapidly rotating shift schedule.
2. Secondly, to compare the food intake pattern both quantitatively and qualitatively between the nurses working in general duty and shift duty and
3. Thirdly, to evaluate the calorie intake and nutritional fulfillment is sufficient or not according to the food value table prepared by the Indian Council of Medical Research [22].

## Materials and Methods

A) *Subject*: 40 rotating shift nurses and 35 general duty nurses were randomly taken from different government hospitals in the Paschim Medinipur District, West Bengal. They work in morning shift (07.00-13.00 hrs), afternoon shift (13.00-20.00 hrs) and night shift (20.00-07.00 hrs). The shift change takes place rapidly i.e. they are engaged maximally for consecutive three days in one shift. 35 nurses working in general duty was also randomly selected for the study.

B) *Questionnaire Study*: An elaborate questionnaire study related to rotation of shift work, work practice, experience, nature of duty, digestive problems, food habit, food intake time, etc., were developed and applied on nurses. The actual and preferred timing of each meal of the subjects like breakfast, lunch, afternoon or evening snacks and dinner were noted in each shift till one shift cycle is complete.

C) *Rating of eating satisfaction and appetite:* The eating satisfaction on a 6 point scale was the higher score indicated higher level of satisfaction and rating of appetite on a 8 point scale where 8 correspond to very hungry and 1 correspond to no appetite at all.

D) *Evaluation of Nutritional status and food habit*: Nutritional anthropometry including measurement of height and weight were studied by standard technique [23]. The BMI [defined as weight in kg/height in meter square] was also calculated for knowing the nutritional status of both the rotating shift nurses and general duty nurses.

E) *Diet Survey*: Diet survey was conducted on both shift working and general duty nurses. Each subject was instructed to record the item of food taken and the approximate quantity of each item consumed during each meal. For example, the subject recorded that they consumed four or five home made rotis and three or five spoonfuls of vegetable made of potatoes, beans, etc. They were given a standard spoon to measure the amount of intake. It was noted and the quantity of carbohydrate, protein and fat consumed in each meal by each of the subjects was calculated by food value table [22].

F) *Statistical analysis*: Mean and standard deviation of various physical and physiological parameters, meal timing, nutrients and energy intake, vitamins and minerals intake were calculated. Then a one-tail student's't-test' was done to find the significant difference for the chosen level of significance ($p<0.0005$), ($p<0.005$) [24].

## Results

Table-1: Physical parameters and experience of work in rotating shift (N=40) and general profile nurses (N=35).

| Parameters | Rotating shift nurses | General duty nurses |
|---|---|---|
| Height (cm) | 150 ± 5.35 | 149.9 ± 4.27 |
| Weight (kg) | 55.3 ± 7.21 | 56.8 ± 6.92 |
| BMI (kg/m$^2$) | 22.14 ± 5.76 | 23.04 ± 5.92 |
| Age (in years) | 41.0 ± 3.91 | 40.0 ± 3.41 |
| Experience in year | 15.3 ± 4.98 | 14.6 ± 4.21 |

*Values = Mean ± SD

The general profile of the both nurses working in shift and general duty are given in table 1. From the table-1, it was observed that the nurses working in the rotating shift and general duty are of the similar age group (range 36-44 years). All of them are working in this profession for more than ten years. There is no significant difference in body weight or height in these two groups. From the BMI study it was observed that none of them suffer from chronic energy deficiency (CED) as the BMI value 18.5-24.99 is considered as Normal [25].

The prevalence of gastrointestinal discomforts is given in fig 1.

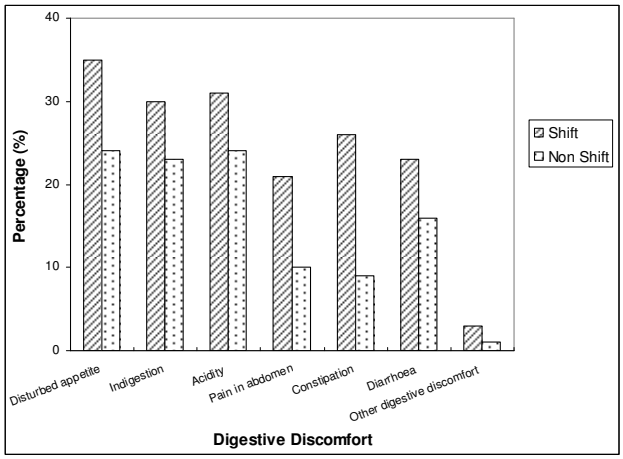


Fig-1: Prevalence of gastrointestinal discomforts in rotating shift and general duty nurses.

This figure shows the complaint about different digestive discomforts like disturbed appetite, indigestion, acidity, etc. which are more in nurses working in rotating shift. In the gastro-intestinal health questionnaire, it was observed that the nurses working in rotating shift had significantly ($p<0.05$) lower score.
The actual and preferred time of food intake of general duty nurses and rotating shift nurses are given in table 2.

Table-2: Actual and preferred time of different meals of rotating shift nurses (N=40) and general duty nurses (N=35).

| Meals | Timing (hours) | Rotating shift nurses | | | | General duty nurses | |
|---|---|---|---|---|---|---|---|
| | | Morning | Afternoon | Night | Off day | Working day | Off day |
| Breakfast | Actual time | 6.16±0.33 | 7.12±0.401 | 8.40±0.59 | 7.21±0.49 | 6.12±0.45 | 7.32±0.81 |
| | Preferred time | **7.44±0.55 | 7.42±0.492 | *7.8±0.51 | 7.15±0.51 | **7.18±0.54 | 7.24±0.72 |
| Lunch | Actual time | 14.52±0.98 | 12.92±0.34 | 12.45±0.34 | 13.48±0.81 | 13.59±0.79 | 13.59±0.79 |
| | Preferred time | **12.51±0.78 | 12.51±0.87 | 12.50±0.84 | 13.01±0.61 | *12.56±0.61 | 13.21±0.39 |
| Evening snaks | Actual time | 17.48±0.38 | 16.24±0.37 | 15.15±0.56 | 16.50±0.31 | 22.01±0.42 | 16.48±0.47 |
| | Preferred time | 17.38±0.32 | *17.41±0.47 | **17.20±0.71 | 16.58±0.34 | 22.12±0.59 | 16.51±0.51 |
| Dinner | Actual time | 22.01±0.28 | 23.05±0.46 | 19.07±0.54 | 21.53±0.95 | 22.01±0.42 | 22.15±0.56 |
| | Preferred time | 22.00±0.41 | 22.00±0.48 | **22.05±0.41 | 22.10±0.49 | 22.12±0.59 | 22.12±0.59 |

*value: Mean ± SD * $p<0.005$, ** $p<0.0005$

Table 2, shows the difference between the actual and preferred time of food intake of rotating shift nurses and general duty nurses. This result shows the statistical difference between the actual and preferred time of food intake in evening snacks and dinner time ($p<0.0005$) and in breakfast ($p<0.005$) of night shift workers. There is also significant difference was observed between the actual and preferred time of food intake in general duty nurses when working in general working day but as it is regular, so effect of desynchronization may be reduced. When we compare the preferred time of food intake between two group of nurses the statistical difference ($p<0.0005$) was also found. It is the most important factor that a significant difference was observed ($p<0.0005$) between the actual and preferred dinner time (actual time17.94, preferred time 22.05 hrs) in night shift workers but in other shifts there in no significant difference was observed between actual and preferred time of food. This led to the probability of variation of nutrient intake in the different shift phase.

Table-3: Nutritional behaviour of rotating shift nurses (N=40) and general duty nurses (N=35).

| | Working System | Number of full meal | No of snacks/Tiffin | Appetite | Eating habit satisfaction |
|---|---|---|---|---|---|
| Rotating Shift nurses | Morning Shift | 2.01±0.484 | 1.95±0.357 | 5.45±1.448 | 3.53±1.161 |
| | Afternoon Shift | 2.75±0.433 | 2.15±0.331 | 5.38±1.391 | 3.14±1.057 |
| | Night Shift | *1.43±0.353 | *3.63±0.490 | *3.13±1.326 | *2.25±1.170 |
| | Off Day | 2.05±0.497 | 2.03±0.475 | 5.94±1.458 | 3.74±0.921 |
| General duty nurses | Working Day | 2.10±0.391 | 2.30±0.350 | 5.02±0.92 | 3.21±0.988 |
| | Off Day | 2.93±0.494 | 2.09±0.280 | 5.68±1.04 | 3.82±0.972 |
| Value: Mean ± SD | | | * p<0.0005 | | |

The Table 3 shows the number of snacks, full meals, appetite and eating habit satisfaction of the rotating shift and general duty nurses. In night shift nurses, the number of full meals were significantly low (p<0.0005) compared to morning and afternoon shift and off day. Similarly, the appetite and eating habit satisfaction were significantly lower p<0.0005) and the number of snacks were significantly higher (p<0.0005) when nurses working in night shift compared to other shift. Comparison between the two groups, the number of full meals, appetite and eating habit satisfaction were significantly lower (p<0.0005) and the number of snacks were significantly higher (p<0.0005) in night shift of rotating shift nurses than the working day and off day of the general duty nurses.

Table-4: Nutrients intake (g/person / day) and energy consumption (calories/person / day) of rotating shift nurses (N=40) and general shift nurses (N=35).

| | | Total nutrient and energy intake of rotating and general duty nurses | | | |
|---|---|---|---|---|---|
| | | Total nutrients intake (g/person / day) | | | Total energy intake (Cal/ day) |
| Type of duty | Type of Shift | Carbohydrate intake | Protein intake | Fat intake | |
| Rotating Shift | Morning | 373.5±12.45 | 94.92±10.86 | *49.9±4.12 | 2248.17±121.21 |
| | Afternoon | 397.7±11.08 | 95.3±4.72 | 68.9±3.12 | 2606.05±302.98 |
| | Night | *251.2±9.21 | *65.1±5.12 | *44.3±4.13 | *1697.5±145.21 |
| | Off day | 410.6±12.18 | 99.4±5.01 | 170.8±5.9 | 2696±312.72 |
| General duty | Working day | 410.8±9.85 | 99.8±10.21 | 70.4±7.12 | 2926±312.6 |
| | Off day | 420.1±9.21 | 102.7±9.89 | 74.8±7.12 | 3012±301.62 |
| Value: Mean ± SD | | | * p<0.0005 | | |

The Table 4 shows the nutrients (gm/24 hour) and energy intake of rotating shift nurses and general duty nurses according to the food value table [22].

From the table 4, it is seen that the carbohydrate, protein and fat intake were significantly low ($p<0.0005$) in nurses when they work in night shift than the other two shifts and off day. Similarly the fat intake was also significantly low ($p<0.0005$) in morning shift than the afternoon shift and off day. The energy intake in night shift nurses was significantly lower ($p<0.0005$) than the other shifts. On the other hand, in general duty nurses it has been found that there is no significant difference of carbohydrate, protein and fat intake was observed between working day and off day. But the calorie consumption of the working day nurses was less than the off day nurses. In comparison between two groups, the significant difference was observed in the amount of nutrient. The amount of nutrient intake also significantly varies in between morning shift, afternoon shift and off days. The carbohydrate, protein and fat intake in night shift and fat intake in morning shift were significantly lower ($p<0.0005$) than the general working day where there is no significant difference between the general working day and afternoon shift and between general working day and shift off day.

Table-5: Different vitamin and mineral intake of rotating shift nurses (N=40) and general duty nurses (N=35)

| Type of shift | Vitamins/ average intake per day* | | | | Minerals/average intake per day* | |
|---|---|---|---|---|---|---|
| | Carotene (µg/day) | Thiamin (mg/day) | Niacin (mg/day) | Riboflavin (mg/day) | Calcium (mg/day) | Iron (mg/day) |
| Rotating shift nurses | 2723.24± 241.02 | 2.016± 0.321 | 17.586± 1.256 | 2.107± 1.001 | 457± 10.09 | 27.75± 4.122 |
| General duty nurses | 2886.88± 246.062 | 2.861± 1.301 | 17.664± 1.432 | 2.190± 1.102 | 461± 11.021 | 28.98± 3.956 |

Value: Mean ± SD
* Values calculated from 15 days consumption data

Table 5 shows that the daily consumption of vitamin and mineral of rotating and general duty workers.
From the table 5, it is clear that the vitamin and mineral consumption were not significantly different between the rotating shift nurses and general duty nurses but daily intake of iron is less among rotating shift nurses and general duty nurses than the recommended food value table [22].

## Discussion and Conclusion

The present study revealed that the rapidly rotating shift work interferes with the eating pattern of nurses. There are significant difference in preferred time and actual time of food intake. So, probably there is a desynchronization of digestive enzyme's peak activity and food intake. Thus, inappropriate eating time affects eating satisfaction as well as appetite. As a result different digestive problems like

 

indigestion, acidity, loss of appetite, etc. have been found more among rotating shift nurses compare to general duty nurses. The type of shift rotation system regulates the meal timing along the 24 hour time scale. The nurses when work in night shift take dinner too early before leaving for the duty and take very little food. During the night shift, the nurses remain awake, there ignoring their diurnal nature. They also take some snacks during night duty hours but the amount of food intake was much less when they work in night shift. The preferred time of breakfast in morning and night shift were significantly higher than the actual time with ($p<0.0005$) and ($p<0.005$) respectively. On the other hand the preferred time of evening snacks and dinner in night shift and evening snacks in afternoon shift were significantly higher than the actual time with ($p<0.0005$) and ($p<0.005$) respectively. But there is no significant difference was observed in off days. In case of general duty nurses, all though the preferred time of breakfast and lunch are significantly differ from actual time, but as they follow same for whole week so, it may not hamper the synchronization of digestive enzyme activity. So, rating of eating satisfaction and appetite are more in general duty nurses than nurses working in shift work.

Among hospital nurses it was observed that there is a difference of eating pattern. The daily intake of carbohydrate, protein and fat are significantly low in night shift and fat intake in morning shift than the general duty nurses. On the other hand the daily energy intake in night shift was less than the morning, afternoon and off day in the rotating shift nurses. Nurses took less food in dinner when they work in night shift. They try to compensate it by taking more snacks. Comparison with two groups of nurses it was found that the calorie intake is higher in general duty nurses than the rotating shift nurses. According to the ICMR recommendation the daily energy requirement of the nurses should be 1920 calories. From this value it can be say that the calorie supply is very less than the calories requirement in night shift. But nurses when work in afternoon, morning shift and general duty nurses the calorie consumption is not lower than the recommended value [22]. Although there is variation in food consumption when the nurses are working in different shift but if, total two weeks food intake is consider, then there are no deficiency either proximate principle and protective principles (except iron) from recommended value. Same it also true for the general duty nurses.

In the present study it was observed that rotating shift work effect eating behaviours also. In the shift worker the number of full meals, appetite, eating habit satisfaction were significantly lower ($p<0.0005$) in night shift than other shift and off day when compare with general duty workers. The number of snacks was significantly higher ($p<0.0005$) in night shift than other working conditions. It has been found that in these hospitals have no facilities to provide full meal, especially in night shift. From this study it can be concluded that eating behaviour in nurses both in quality and quantity are changed significantly when they work in different shift in rotating shift schedule. The food intake patterns also differ in nurses working in general duty and rotating shift. The nurses when work in night shift took less food than ICMR recommended value but if complete schedule with off days are consider there are no deficiency in proximate and protective principles. The nurses working in rapidly

 

rotating shift suffer different gastrointestinal problems. This is mainly due to desynchronization of actual and preferred time of food intake. So, changes in the activity pattern of the enzymes should be studied to find mechanism behind increase complain of digestive disorder in nurses working in rotating shifts.

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