

Original article

Postprandial Somnolence and its awareness among the Medical Undergraduate Students: A cross-sectional study

Abhishek Chaturvedi¹, Anitha Guru², Naveen Kumar³, Ling Yi Lin⁴, Daniel YeapTze Wei⁵, Lai Kah Sheng⁶, Leow Hjun Yee⁷

Abstract

Introduction: Postprandial somnolence or commonly referred to as food coma is generally experienced after the ingestion of afternoon meals. The performance of an individual gets affected after the ingestion of a heavy meal and this is more pertinent in a college setup where students have to attend a lecture right after the meal. The objective of this study was to assess the awareness of medical students about the factors responsible for postprandial somnolence, to identify the methods used to counteract it and to ascertain lecturers' perception on responsiveness and participation of the students in a post lunch lecture. **Methods:** Total 330 students (first year to third year MBBS students) aged between 18-21 years and 40 lecturers teaching first and second year MBBS students were involved in this study. Two separate questionnaires (Part A: students' perception, and B: lecturers' perception) were prepared, peer-reviewed, validated and administered to the respective participants. All the responses were compiled and expressed in frequency percentage. Statistical analysis was performed using Statistical Package for Social Sciences, version 15.0 for a level of statistical significance of 5%. Pearson correlation was used to get the association between the variables. **Results:** About 55.75% students were aware about the role of serotonin and melatonin in drowsiness but 45.75% students did not know that food rich in tryptophan relaxes the brain and results in sleepiness. Students agree that heaviness of their meal might cause drowsiness and indigestion or bloating, which can also result in lethargy and can affect their performance. Majority of the lecturers opined that students disturb the harmony of the class and are less responsive and participative in post lunch break lectures. **Conclusion:** Thus, the present study provided scope for conducting awareness talks regarding the strategies to counteract postprandial somnolence among medical students which can help improve their concentration during post-lunch lectures.

Keywords: Postprandial somnolence, Food coma, Heavy meals, Drowsiness, Students' performance, Power nap

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INTRODUCTION

Postprandial somnolence or commonly referred to as food coma is generally experienced after the ingestion of afternoon meals¹. The performance of an individual

gets affected after the ingestion of a heavy meal and this is more so in a college setup where students have to attend a lecture right after the meal.

Food consumption is thought to induce sleepiness.

1. Abhishek Chaturvedi, Senior Grade Lecturer, Department of Biochemistry, Melaka Manipal Medical College (Manipal campus), Manipal Academy of Higher Education, Manipal-576104, Karnataka, India
2. Anitha Guru, MAHE FAIMER International Institute for Leadership in Interprofessional Education (M-FIILPE), Manipal Academy of Higher Education, Manipal-576104, Karnataka, India.
3. Naveen Kumar, Associate Professor, Department of Anatomy, Melaka Manipal Medical College (Manipal campus), Manipal Academy of Higher Education, Manipal-576104, Karnataka, India.
4. Ling Yi Lin, MBBS students, Melaka Manipal Medical College (Manipal campus), Manipal Academy of Higher Education, Manipal-576104, Karnataka, India.
5. Daniel YeapTze Wei, MBBS students, Melaka Manipal Medical College (Manipal campus), Manipal Academy of Higher Education, Manipal-576104, Karnataka, India.
6. Lai Kah Sheng, MBBS students, Melaka Manipal Medical College (Manipal campus), Manipal Academy of Higher Education, Manipal-576104, Karnataka, India.
7. Leow Hjun Yee, MBBS students, Melaka Manipal Medical College (Manipal campus), Manipal Academy of Higher Education, Manipal-576104, Karnataka, India.

Correspondence to: Dr. Naveen Kumar, PhD Associate Professor of Anatomy Melaka Manipal Medical College (Manipal Campus) Manipal Academy of Higher Education Manipal-576104 Udupi, Karnataka, India
[Email- naveen.tonse@manipal.edu](mailto:naveen.tonse@manipal.edu) Telephone no. +919880548636

The after-meal-tiredness (postprandial somnolence or commonly known as food coma) does not entirely depend on how heavy the meal that was taken. Furthermore, it is hypothesized that release of gut-brain hormones and activation of vagal afferents, may play a role in postprandial somnolence through the modulation of sleep centers such as hypothalamus². High carbohydrate and fatty food are the major agent which contributes to the general feeling of tiredness and inefficiency after meals. Besides that, increased insulin secretion after meals results in absorption of most amino acids including tryptophan; this will then become preferentially available to be transported across the blood brain barrier, which leads to ingress of tryptophan into the brain. Tryptophan will then get converted into serotonin followed by conversion into melatonin and these neurochemicals are liable for causing dizziness and the urge to sleep³. Similarly, while eating, there is simultaneous release of one paramount hormone that gives a feeling of satiety to the body – Cholecystokinin (CCK). Alternatively, CCK has another action, that is, it will activate the areas in the brain associated with sleep, leading to postprandial somnolence⁴.

In a nutshell, the common feeling of lethargy felt after meals is a predicament faced by most individuals, especially students, ultimately leading to their inability to concentrate in an ongoing lecture. The object of this study was to assess the awareness in medical students about the factors responsible for postprandial somnolence, to identify the methods used to counteract it and to ascertain lecturers' perception on responsiveness and participation of the students in a post lunch lecture. Therefore, this study is imperative in understanding the need to educate the students regarding the awareness of postprandial somnolence and what impact it has on one's performance.

MATERIALS AND METHODS

The present cross-sectional study involves 330 students (first year to third year MBBS students) aged between 18-21 years of Melaka Manipal Medical College, Manipal Campus, India. It is a twinning program in which Malaysian students spend the first 30 months in India and remaining 30 months in Malaysia. This study was a part of Mentored Student Project (MSP) in which a group of students (4 or 5 students) work on a project which

they would want to work on. This study was carried out from August 2018 to January 2019. The study questionnaire comprises two parts; part-A and part-B. The questionnaire was validated by two independent senior faculty members. Part A was a self-structured and self-administered questionnaire consisting of 18 close ended and 01 open ended questions. It was structured, peer-reviewed, validated and pilot tested. The questionnaire was distributed to all the participating students' after the class and collected on the following day. Closed ended questions in the questionnaire were related to the awareness about the postprandial somnolence, students' opinion about the methods suggested by the investigators to overcome postprandial somnolence, and their perception on the factors that exacerbate postprandial somnolence (e.g. stress, rushing through the meal, indigestion and heaviness of the meal). The open ended question was "What do you usually do after lunch and before the next class?". It was asked to ascertain the methods used by the students to counteract the somnolence after a meal. Part B was a questionnaire for the lecturers. In order to find out the responsiveness and participation of the students in a lecture after lunch break, a self-structured and self-administered survey consisting of 14 questions (10 close ended, 04 open ended) was prepared, peer-reviewed, validated, pilot tested and administered to 40 lecturers. The questionnaire was distributed to the faculty members in-person and appointment was taken for the following day to collect the filled questionnaire. In the questionnaire the close ended questions were related to lecturers' perception on responsiveness and participation of students in a post lunch lecture (Table 5). The open ended questions were asked to ascertain the observation of lecturers in a post lunch lecture related to behavior and body language of the students, reason for such behavior, methods employed by them for better engagement and suggestion to students to mitigate the somnolence.

Ethical clearance: Institutional ethics committee (IEC) permission was obtained and participation was kept voluntary. Participant's information sheet was distributed to all participants and informed consent was obtained prior to the study.

The response rate was 100% percent. All the responses were compiled and presented in the form of a table. Responses for the closed ended questions

were compiled in 2-point scale as agree or disagree to the statement. Strongly agree and agree is compiled together and presented as agree, similarly strongly disagree and disagree is compiled and presented as disagree. The results are expressed as frequency percentage. The response to open ended questions were rated as in-vivo codes used by the participants and presented as frequency percentage. Statistical analysis was performed using Statistical Package for Social Sciences, version 15.0 (SPSS Inc. South Asia, Bangalore) for a level of statistical significance of 5%. Pearson correlation was used to get the association between the variables.

RESULTS

The tables and graphs represented here correspond to the comprehensive responses to the series of questions asked in the questionnaire. In the present study among 330 students, majority of the students (n=229, 69.39%) were not aware of the term postprandial somnolence. More than half (n=184, 55.75%) of the students were aware about the role of serotonin and melatonin in drowsiness but many students (n=151, 45.75%) did not know that food rich in tryptophan relaxes the brain and results in sleepiness (Table.1).

Table. 1: The students' awareness on specific factors resulting in postprandial somnolence

S.No	Students' awareness	Total	Agree % (n)	Disagree % (n)
1	I know what Postprandial somnolence means	330	30.61 (101)	69.39 (229)
2	Serotonin, Melatonin is responsible for drowsiness after food	330	55.75 (184)	44.22 (146)
3	Allergen in the food causes lethargy	330	54.54 (180)	45.46 (150)
4	Tryptophan rich food induces sleepiness	330	54.24 (179)	45.75 (151)

The investigators suggested few activities which can counteract postprandial somnolence in the questionnaire. Majority of the students were in agreement that these activities can be a good strategy to counteract postprandial somnolence (Table.2).

Table 2: Students' opinion on the activities suggested by the investigators to counteract postprandial somnolence

S.No	Activities that can counteract postprandial somnolence	Total	Agree % (n)	Disagree % (n)
1	Avoiding high glycemic index food	330	80.60 % (266)	19.39% (64)
2	Consume snack intermittently between the classes	330	61.51 % (203)	38.48 % (127)
3	Taking a power nap during lunch time	330	84.84 % (280)	15.15 % (50)

There are various factors that exacerbate postprandial somnolence and which can hamper students' performance in the class. Among these factors students agree that heaviness of their meal might cause drowsiness and indigestion or bloating after a meal can also result in lethargy and can affect their performance in the class (Table.3).

Table. 3: Students' perception on the factors that exacerbate postprandial somnolence which would hamper students' performance

S.No	Factors	Total	Agree % (n)	Disagree % (n)
1	Stress leads to sleepiness after a meal	330	37.88 % (125)	62.12% (205)
2	Indigestion/ bloating cause lethargy	330	60.60 % (200)	39.39 % (130)
3	Rushing through meals causes sleepiness	330	33.33 % (110)	66.66 % (220)
4	Heavy meals can lead to drowsiness	330	80.00 % (264)	20.00 % (66)

Among the various activities done by students to overcome postprandial somnolence, the majority (n=182, 55.15%) choose rest/sleep as a way to overcome lethargy and sleepiness (Fig.1).

Interpretation of correlation

Pearson correlation analysis revealed a significant ($p<0.05$) positive correlation between heaviness of the meal, rushing through the meal, experience of indigestion/bloating after a meal. This indicates that when a meal is heavy, one tends to rush through the meal in order to complete it within the stipulated lunch time and this would result in indigestion / bloating which affects students' performance in the class (Table 4).

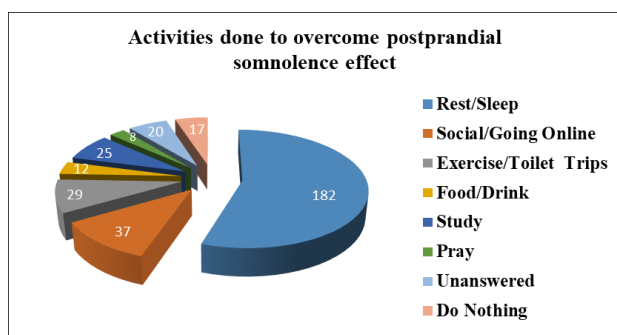


Fig. 1: Methods used by students to overcome postprandial effect

Table 4: Correlation between the factors that exacerbate postprandial somnolence

Factors that exacerbate postprandial somnolence	Pearson Correlation (r)	p value
Heaviness of a meal and Indigestion/Bloating	0.118	0.033*
Heaviness of a meal and rushing though the meal	0.123	0.025*
Rushing though the meal and indigestion/bloating	0.110	0.047*

Pearson correlation

* Correlation is significant at the 0.05 level (2-tailed)

Enquiry with the lecturers.

Majority of the lecturers opined that students disturb the harmony of the class and are less responsive and participative in post lunch break lectures. They believe that post meal sleepiness is a physiological response and students should not be penalised for their behaviour. This sleepiness can be further enhanced by more textual information delivered during a lecture. Most of the lecturers (n=37, 92.5%) felt that teaching method plays a big role in responsiveness or non-responsiveness of the students (Table 5). Thus in open ended questions, lecturers shared the methods used by them to engage the students and also suggested methods which can be used by the students to keep themselves alert during a post lunch lecture.

Table 5: Lecturers' perception on responsiveness and participation of students in a post lunch lecture

S.No	Questions	Agree % (n)	Disagree % (n)	Neutral % (n)
1	Students are responsive and participative in a post lunch break class.	25% (10)	75% (30)	00

S.No	Questions	Agree % (n)	Disagree % (n)	Neutral % (n)
2	Students disturbs the harmony of the class in a post lunch break lecture.	62.5% (25)	12.5% (05)	25% (10)
3	I have observed more students handling mobile phone during a post lunch lecture compared to pre-lunch lectures.	57.5% (23)	40% (16)	2.5%(01)
4	I avoid taking post lunch classes.	25% (10)	62.5% (25)	12.5% (05)
5	Post lunch classes should be changed to practical or group activities.	97.5% (39)	00	2.5% (01)
6	I too feel sleepy in a post lunch lecture.	47.5% (19)	22.5% (09)	30% (12)
7	The post prandial behaviour of the students is acceptable as it is a physiological response.	70% (28)	17.5% (07)	12.5% (05)
8	More textual content of the post lunch lecture induces more sleepiness	90% (36)	7.5% (03)	2.5% (01)
9	Lecturer's teaching method influences students' performance in a post lunch lecture	92.5% (37)	2.5% (01)	5% (02)
10	I find myself more efficient after a lunch break	30% (12)	60% (24)	10% (04)

Response to open ended questions

1. In general, how do you find the behavior and body language of students before you conduct a lecture right after a lunch break?

25% of the lecturers find that students are responsive, more energetic, alert, enthusiastic and receptive after a meal whereas 75% opined that students are non-responsive and non-participative after a lunch break. Lecturers further added that "...Students' unable to concentrate after a meal and looks passive and irritated. They are uncomfortable in the class and keep themselves engaged either with mobile or with other work"

2. Why do you think students portray this particular behavior during the lecture?

Twenty-two lecturers (55%) gave response to this question. Lecturers opined that this behavior is mostly due to a physiological response (n=9, 22.5%) which occurs after a meal. Others feel that this might be due to heavy meals (n=6, 15%) or inadequate sleep (n=2, 5%). Few lecturers believe that the behavior depends upon the interest of the students towards the subject (n=5, 12.5%).

3. What are the current methods employed by you to help students stay alert/awake in class?

Lecturers' opined that active learning with more interaction among peers by group activities instead of passive lecture could be an ideal strategy to keep the students awake in post lunch lecture (n=10, 25%). Further they mentioned that cracking jokes (n=6, 15%), sharing clinical experience (n=2, 5%), avoiding monotony (n=3, 7.5%), being interesting and enthusiastic (n=4, 10%), asking questions (n=18, 45%), maintaining eye contact (n=10, 25%) can keep the students alert in the post-lunch lecture. The content should also be presented in an interesting way by the use of videos (n=5, 12.5%), animations (n=5, 12.5%) and game based learning (n=5, 12.5%). Short breaks of 2 minutes between the class (n=3, 7.5%) and use of blackboard (n=4, 10%) to take the students along were also employed by the lecturers.

4. What do you think students should do to keep themselves awake, alert and on-the go after a lunch break?

Lecturers' feel that self-discipline (n=11, 27.5%) is the key for a medical student. They opined that students should know what is his/her responsibility towards his/her learning and practicing a routine of sleep-wake cycle and timing of a meal can help a student to be awake and alert in the class. Avoiding heavy meals (n=8, 20%), taking a power nap (n=5, 12.5%), drinking more water (n=3, 7.5%), taking down notes with the lecturer (n=6, 15%), interaction with the lecturer (n=3, 7.5%), coming prepared for the class (n=5, 12.5%) are some ways which can help a student in post lunch lecture.

DISCUSSION

The academic performance of a student depends upon his/her concentration in the class. This concentration can vary during the day and it goes down severely after lunch due to a phenomenon commonly referred to as postprandial somnolence or post-lunch dip which affects our circadian rhythm. Previous studies have shown that there are many factors causing postprandial somnolence. In our study, we observed that the majority of the respondents were unaware about the term postprandial somnolence but they do experience sleepiness or drowsiness after a meal.

It is proven that there are neurochemicals involved in this physiological response. The presence of high carbohydrates and fatty food also act as an impetus for the increased release of insulin, which further augments the absorption of amino acids especially

tryptophan, the major amino acid whose metabolite melatonin regulates sleep and causes the so called 'food coma'⁵. As shown in Fig.1, more than half of the respondents were aware that the postprandial somnolence effects involve neurochemical signaling (serotonin and melatonin) which ultimately results in lethargy which is commonly seen in students after the lunch break.

Our results also revealed that there were students who believed that there are additional predisposing factors that contribute to postprandial somnolence as shown in table 3. Heavy meals and indigestion/bloating are the two major factors which enhance sleepiness after a meal. Students opined (n=110, 33.33%) that they rush through the meal and hence feel sleepy. Practically, all the above factors are interrelated; if it is a heavy meal, there will be a rush to eat the meal in the given time and this rushing through the meal leads to indigestion and bloating which eventually results in drowsiness and lethargy. Earlier studies have reported the decrease in efficiency and alertness after a high-fat-low-carbohydrate meal and thus leads to drowsiness or sleepiness^{5,6}.

Based on the available literature, some methods (avoiding high glycemic index food^{7,8}, taking a power nap⁹, take food intermittently¹⁰ to cope with postprandial somnolence were posed as plausible options in the questionnaire, to which majority of them agreed that these strategies can be of help in counteracting postprandial somnolence.

In an open ended question, the activities preferred by the individual students to keep themselves awake throughout the lecture was asked. Majority of the students were inclined to have a short rest/sleep, possibly because sleeping keeps them rejuvenated and invigorated for the upcoming class. This was supported by the previous studies, which indicated that 20-minutes of nap in mid-afternoon improves efficiency, mood and alertness^{9,11}. Approximately 1/10th of the students prefer to socialize/go online. This may be to keep them engrossed in a certain issue so that they would not suffer the consequences of post-lunch lethargy in the later classes. The less sought for activities include studying, praying, going for a toilet break, having small refreshments etcetera.

Lecturers' response indicated that students are non-participative in post lunch lectures. They tend to engage in other activities to keep them awake in post lunch lectures. Although it is known that carbohydrate, tryptophan rich and heavy meals

causes sleepiness but this is also enhanced by the methodology used by the lecturer in the class. The intrinsic motivation to attend and learn in the class can enhance the alertness of the student¹². Previous studies have indicated that active learning due to its' participatory nature is very well received by the students and it can enhance learning¹³. Similarly, use of instructional games and puzzles in between the class¹⁴ can help in breaking the monotony and enhancing the team based learning. Thus, this should be employed by the lecturer's in post lunch lectures to break the monotony and increase the alertness of the students.

For future studies, it may be more beneficial to get the meal composition (solid or liquid) of the individual students and correlate it with the sustained-attention task. The gender and ethnicity difference between the students can also give a valuable insight into the role of genetic makeup in postprandial somnolence. Better planning of the schedule and keeping only practical classes or activity oriented classes can be a good attempt to improve student's performance in a class post mid-afternoon meal.

CONCLUSION

The present study revealed that undergraduate medical students are not fully aware about postprandial somnolence and how it can be countered to prevent its influence on their performance in the classroom after a meal. Everyone should realize the importance of a balanced diet and the ways in which it would help to keep themselves alert to sustain an equipoise in a learning environment.

Thus, the present study provided a scope for conducting awareness talks regarding the strategies (such as consumption of lighter meal (more solid food) during the break, consumption of food with

low glycemic index, avoid food rich in tryptophan, eat frequent small meals instead of large feast and consuming food slowly to avoid overeating) to counteract postprandial somnolence among medical students which can help improve their concentration during a lecture.

Limitation of the study

The data presented in the paper is based on self-reported questionnaires and thus no relationship can be unambiguously established. One more limitation is the references of the study. Most of the studies carried out to understand the basis behind food coma or postprandial somnolence is very old and no study has been done to evaluate the awareness of students regarding postprandial somnolence or to propose a strategy to overcome postprandial somnolence. Hence, no new reference could be sought for this study.

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Authors' Contributions:

Data gathering and idea owner of this study: Ling Yi Lin, Daniel Yeap Tze Wei, Lai Kah Sheng, Leow Hjun, Abhishek Chaturvedi

Study design: Ling Yi Lin, Daniel Yeap Tze Wei, Lai Kah Sheng, Leow Hjun Yee, Abhishek Chaturvedi

Data gathering: Ling Yi Lin, Daniel Yeap Tze Wei, Lai Kah Sheng, Leow Hjun Yee

Writing and submitting manuscript: Ling Yi Lin, Abhishek Chaturvedi, Anitha Guru, Naveen Kumar

Editing and approval of final draft: Abhishek Chaturvedi, Anitha Guru, Naveen Kumar

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