Journal of Contemporary

Medical Education

available at www.scopemed.org

Original Research

Biochemistry handouts covering all lecture topics as study guide to focus during exam preparation in first year medical undergraduates in India

Mamata Vishnu Hegde[1], Sarita Vijay Agrawal[1], Parduman Singh[1], Samir Anil Singru[2]

[1]Department of Biochemistry, [2]Department of Community Medicine, Smt. Kashibai Navale Medical College, Narhe, Pune, Maharashtra, INDIA

Received: June 14, 2012

Accepted: November 13, 2012

Published Online: December 18, 2012

DOI:10.5455/jcme.20121113112005

Corresponding Author:
Mamata Vishnu Hegde,
Department of Biochemistry, Smt. Kashibai Navale Medical College, Narhe, Pune Maharashtra, INDIA
mamata.hegde@yahoo.com

Keywords: *Biochemistry, lecture handouts, study guide, exam*

ABSTRACT

Medical undergraduates experience a lot of stress before the final examination at the end of their first academic year in India. Biochemistry handouts including all lecture topics were developed as study guides to be used along with the textbook for final exam preparation. To help students focus their study of biochemistry so that subject understanding is facilitated, exam anxiety is reduced and academic performance is enhanced. Six sets of handwritten handouts including all lecture topics were distributed to the first year undergraduates (n=100) of 2009-10 in the biochemistry department of Smt. Kashibai Navale Medical College, Pune, under Maharashtra University of Health Sciences. Grouping of lecture topics in different sets was based on correlation between them wherever possible. All lecture topics were discussed in question and answer format. All answers contained only subheadings, important concepts and relevant examples. These handouts were used by the students mainly in the preparatory leave before the final examination. All the participants agreed in their feedback that the handouts helped them to focus on their textbook study before the final examination. They also reported a better understanding and a reduction in anxiety during exam preparation. Academic performance of participating students in the end of year examination was significantly enhanced (p value < 0.05) when compared to that of the students from 2008-09 without the intervention of handouts. The handouts covering all lecture topics as study guide were a valuable aid for a more organized study. Such resource material developed by faculty can help undergraduates in coping with academic stress in first year of medical education.

INTRODUCTION

Stress and anxiety are substantially raised in many preclinical students in their first year at medical school, especially when it is close to exams [1]. It has been observed that medical school environments in India are extremely stressful. Fear of failure, vast amount of content that has to be mastered in a short span of time, and an inability to cope are found to be the most commonly observed sources of stress [2]. Many students experience frustration and failure because of their lack in studying strategies [3]. In the absence of appropriate direction, learning can be an inefficient and time-consuming process, and without suitable goals and guidelines, they can easily drift away from areas in which they should be focused [4].

The transition from school to university education and a medical school environment can be difficult even for the very best students [5]. First year medical students are mostly teacher dependent because of exposure to a new curriculum. They also show greater demand for learning resources [6]. An important role of the teacher is to assist and guide students in their learning; to develop and define appropriate strategies for students and to help them make the most effective use of the

time they have available to study [4].

Study guides in the form of handouts can make a major contribution to learning. Study guides have three roles in facilitating learning: (1) providing a focus for student activities relating to the learning; (2) assisting in the management of student learning; (3) providing information on the subject or topic of study [7, 8]. A few studies have reported that using lecture slide handouts was one of the learning strategies used by medical students for exam preparation. These lecture slide handouts served as orientation guides for textbook study [6, 9, 10].

Distribution of lecture handouts is not a regular feature of the undergraduate program at Smt. Kashibai Navale Medical College (SKNMC), Pune, Maharashtra, India, a medical school following the traditional didactic lecture format of education. In addition, the first academic year is of one year duration as per the guidelines [11]. At the end of the academic year, the first year medical undergraduates appear for summative examinations, conducted by a regional university, Maharashtra University of Health Sciences. These summative examinations are for three subjects, biochemistry, anatomy and physiology are which are required to be promoted to the next academic year. How to study biochemistry so that stress and anxiety perceived before and during the final university examination is reduced, giving priority to subject understanding, is the most common point of discussion during the counseling sessions with the undergraduates.

Taking into consideration the above mentioned facts, it was decided to prepare and distribute written handouts covering all lecture topics to act as guide for textbook study during final exam preparation. They were designed to encourage students to interact with the subject through questions [8]. The main objectives behind the distribution of handouts covering all lecture topics were:

1. To help first year medical undergraduates to focus on biochemistry study during the university examination preparation.

2. To facilitate better understanding of the subject.

3. To reduce examination anxiety and to help students approach final exam more confidently.

4. To improve academic performance.

METHODS

This educational study, of providing paper handouts to help exam preparation, was conducted in the department of biochemistry for first year medical undergraduates in SKNMC, after approval by the ethical committee. It involved 100 students admitted during academic year 2009-10.

Design of handouts

All lecture topics were covered in 6 sets of handwritten handouts. Good quality white paper of A4 size was used for the handouts. They were prepared carefully with legible and neat handwriting for correct comprehension in photocopied versions. The sequence of various lecture topics covered in the handouts was based on correlation between them, wherever possible. For example, metabolism of proteins was grouped with chemistry of proteins and plasma proteins. The same set also included vitamin- pyridoxine, as it has a role in many of the reactions of protein metabolism. The list of topics included under each set of handouts was provided in the form of an index (Table 1). The Ffirst 4 sets contained topics based on correlation; the remaining topics were included in set 5 and 6. The handouts also contained important points regarding lecture demonstration topics which are otherwise printed in their log books and included in the practical as well as theory syllabus.

Content of handouts

All the handouts were prepared in question and answer subheadings format. A list of various questions, LAQ (Long Answer Questions) and SAQ (Short Answer Questions)/ Short Notes covering most of the aspects was included on the first page of a given lecture topic. Table 2 displays an illustrative example of questions included on first page of topic – Metabolism of Carbohydrates from handout Set 2. All relevant questions of the particular subtopic were then grouped together followed by their respective answers. The answers were discussed in the form of only subheadings, important concepts and examples. Table 3 depicts an illustration of a page of the question and answer format discussion regarding glycogen metabolism from handout Set 2. Names of authors of textbooks describing that particular topic well were also mentioned.

Distribution and use of handouts

6 sets of photocopied handouts were distributed to students in second term, 12 weeks prior to the university examination. At that time, although all theory topics were not covered in the didactic lecture series, the handouts were distributed in order to give students time to get oriented to their use. Design and general content of the handouts were explained to students with emphasis on correlation of different topics. Participant students used the handouts along with their textbook mainly in the preparatory leave of nearly 4 weeks prior to the university exam.

Table 1. Index of Biochemistry lecture topics covered in various sets of handouts.

Set 1

Chemistry of Proteins
Plasma Proteins
Metabolism of Proteins
Vitamin-Pyridoxine
Chemistry of hemoglobin
Metabolism of Hemoglobin → Heme Synthesis & Porphyria
→ Degradation of heme → Bilirubin
→ Jaundice
Liver Function Tests
Detoxication

Set 2

Chemistry of carbohydrates
Metabolism of carbohydrates
Biological oxidation
Water soluble vitamins – (Mainly energy releasing)
Thiamine
Niacin
Riboflavin
Pantothenic acid
Biotin

Set 3

Chemistry of lipids
Metabolism of lipids
Free Radicals and antioxidant
↓
(Lipid Peroxidation)
Fat soluble vitamins
Vitamin C – (antioxidant vitamin)
Integration of metabolism and Starvation metabolism

Set 4

Chemistry of nucleotides and nucleic acids
Metabolism of nucleotides
Vitamins – Folic acid and B_{12}
Protein synthesis
DNA Replication
Transcription
Regulation of Gene Expression

Set 5

Enzymes
Radioisotopes
Mechanism of Hormone action
Renal function tests
Thyroid function tests
Recombinant DNA technology

Set 6

Mineral Metabolism
Acid base and water electrolyte balance
Biochemistry of cancer
Nutrition
Environmental Biochemistry
Cell
Lecture Demonstration topics

Table 2. An illustrative example of questions on the first page of topic- Metabolism of Carbohydrates from handout Set 2.

1) Describe Embden-Mayerhof pathway of glycolysis with its energetics. Write its significance.
2) Enumerate various fates of pyruvate. Describe the process of gluconeogenesis and its importance.
3) Describe the metabolism of glycogen and its hormonal regulation.
4) Enumerate fates of glucose- 6- phosphate. Describe the pathway of HMP shunt and write its significance .
5) Describe the various mechanisms of regulation of blood sugar level.
6) Describe the Krebs TCA cycle and discuss its significance.
7) Write short notes on: i) Rapoport Leubering cycle ii) Cori cycle iii) Galactosemia iv) Glycogen storage disorders v) Uronic acid pathway vi) Glycosuria. vii) Glucose tolerance test viii) Formation and fate of glycogen. ix) Digestion and absorption of carbohydrates x) Amphibolic nature of TCA cycle xi) Metabolic changes in diabetes mellitus xii) Role of insulin in carbohydrate metabolism

Evaluation of use of handouts

The academic performance of the students of the 2009-10 batch, in whom intervention of handouts was carried out, was compared with that of the 2008-09 batch without intervention. 97 students were considered for comparison from 2009-10 batch because 3 students did not appear for the final exam. For similar reasons, 92 students were included from the 2008-09 batch. The handouts were distributed to the participant students in their second term after the first term end examination. Neither of these batches received any lecture handouts before the first term exam, hence, percentage of marks obtained in the biochemistry written assessment in the first term end exam and university exam of both the batches was compared. Statistical analysis was done using unpaired 't' test.

Also, a feedback questionnaire containing 9 items on the Likert scale, from strongly agree to uncertain were collected from the participants. They were instructed to indicate their responses in appropriate column.

RESULTS

The percentage of marks obtained in the biochemistry written assessment by students of the 2009-10 batch were not significantly different when compared to the 2008-09 batch in the first term end examination, however, the university exam score in biochemistry was significantly increased in students of the 2009-10 batch as compared to those of the 2008-09 batch as depicted in Table 4.

All the students agreed in their feedback that the handouts covering all lecture topics helped them to focus their biochemistry study during the final examination as shown in Table 5. They also reported that subheadings of different answers were useful to organize their study and helped them to write the long as well as short answer questions better. Many of them also reported that the emphasis given to correlation of different topics wherever possible and easy referral of other important books along with the content of handouts facilitated subject understanding. The participant students used the handouts for reviewing the subject before the final exam. Using such handouts reduced anxiety and increased confidence for a majority of students during the preparatory period as well as final examination.

Table 3. An illustration of a page of question answer format discussion regarding Glycogen Metabolism from handout Set 2

Q. Describe process of glycogenesis and glycogenolysis. Add a note on hormonal regulation of glycogen metabolism. (LAQ)

Q. Formation and fate of glycogen. (SAQ)

Q. What is glycogen? Describe process of glycogenolysis. Add a note on regulation. (LAQ)

1. Introduction – Glycogen - Homopolysaccharide
   - Highly branched.
   - α 1,4 glycosidic bonds,
   - α 1,6 glycosidic bonds, at branch points.
2. Glycogenesis - Definition
   - Site
3. Steps and diagrammatic representation
   (* UDP-G).
4. Glycogenolysis - Definition
   - Site
5. Steps and diagrammatic representation
   (End product →G-1-P and free glucose)
6. Significance of liver and muscle glycogen *
   (Importance of Glucose -6- phosphatase)
7. Regulation of glycogen metabolism

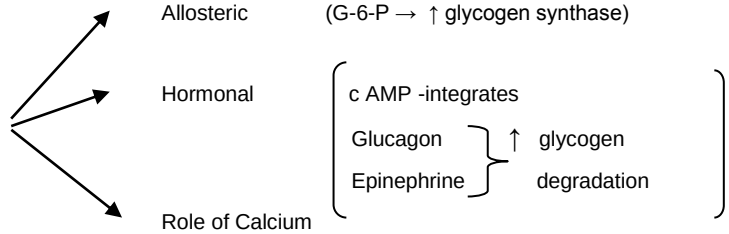

Table 4. Comparison of percentage of marks obtained in Biochemistry written assessment by the first year medical undergraduates.

Assessment	2009-10 Batch # (n= 97)		2008-09 Batch $ (n=92)		p Value
	Mean	S.D.	Mean	S.D.	
First term end examination	49.28	16.21	52.91	14.29	0.104
University examination	56.49	13.31	50.52	13.82	0.003*

Note**: -** # Batch with intervention of handouts.
$ Batch without intervention of handouts.
* p Value < 0.05 considered significant.

Table 5. Feedback of students about Biochemistry handouts covering all lecture topics as study guide (n= 97).

S.No.	Items	Strongly Agree (%)	Agree (%)	Strongly Disagree (%)	Disagree (%)	Uncertain (%)
1.	The handouts helped me to focus on the vast study material during exam preparation.	81.4	18.5	0	0	0
2.	The handouts facilitated better understanding of the subject of Biochemistry.	24.7	58.7	2.1	5.1	9.3
3.	The subheadings and important concepts and examples helped me to organize textbook study.	77.3	22.7	0	0	0
4.	Mention of names of other books was useful for referring to them for understanding some specific concepts.	18.5	67	0	0	14.4
5.	The emphasis given on correlation while grouping the topics of different sets helped in meaningful study.	12.4	71.1	0	0	16.5
6.	Using the handouts increased my confidence during the preparatory period before the university examination	56.7	38.1	0	0	5.1
7.	The handouts helped me to review the subject matter before the University examination.	69	25.8	0	5.1	0
8.	Self study using the handouts reduced my anxiety and helped me to approach the examination more confidently.	54.6	33	0	3.1	9.3
9.	The subheadings helped me to write long answer questions as well as short answer questions better.	43.3	56.7	0	0	0

DISCUSSION

Many studies have reported examinations to be the predominant source of stress among the medical students [12, 13]. Many capable medical students experience academic failure in medical school not because they lack the ability but because they do not have effective study skills [3]. Faculty can help students in improving studying habits and managing time wisely for facing the academic challenges [13]. To develop a study guide as a resource material can be one of the important roles of a medical teacher [14]. In this educational project, handouts which included all lecture topics were developed to guide the textbook study during the preparatory leave of nearly 4 weeks before the final exam.

In our traditional medical education system, written examination is a very important part of summative assessment [15]. Hence question answer format was chosen. The collection of various questions included in the handouts represented most of the essential concepts expected to be understood by the undergraduates. The various answers were discussed in the form of only subheadings, important concepts and relevant examples, as the handouts were supposed to be used along with textbook for better focusing and understanding. Such handouts were also designed to contribute to a more organized study and also to help easy revision. Grouping of lecture topics based mainly on correlation between them was intended to make the study meaningful.

We found that the undergraduates who received handouts as study guide were benefited as indicated by their positive responses to the questionnaire and a significantly improved academic performance in the end of the year exam. Medical educators have found that learning activities that are directly based on student needs and that focus on study and examination techniques can result in effective and valuable outcomes [16]. Handouts are a very common way to supplement a teaching session [7]. In a study regarding student perceptions of lecture handouts, the majority of first year undergraduates reported that the main strengths of the handouts were that they act as a guide for learning and revision before the examination. The students expected the handouts to be clear, brief, well structured, in simple language, and to outline clinical applications and contain key references and definitions of new terms [6]. Handouts containing lecture as well as practical sessions were developed to support teaching /learning activities in clinical anatomy. The evaluation of these handouts showed that they can be used as a guide through the complexities of the educational program [17]. Holsgrove et al [18] reported that study guides evolved to become a valuable supplement to the tutor's contribution and a day-to-day aid to student learning for undergraduate medical curriculum.

Medical education is inherently stressful and demanding in the presence of information overload [2, 13]. Given the importance of summative examination for progressing through the medical curriculum, access to review and study materials is of utmost importance to students [19]. Hence, in this educational project,

development of study guide in the form of lecture handouts was intended to reduce students' academic stress. Handwritten handouts were distributed, as paper is still the easiest method of distributing information [7]. However, these handouts were distributed electronically as 'Biochemistry study orientation guide' for the next i.e. 2010-11 batch, and this e-resource has become a regular feature of our undergraduate program. Although the fresh undergraduates receive the same in their second term, they can have access to it through their senior students. Hence, perceptions of first year undergraduates regarding the use of electronically distributed resource material needs to be studied.

Handouts which included all lecture topics contained only organizational clues and guided the first year undergraduates through the vast study material present in the textbook. The handouts were neither lecture notes nor did they contain any summary. A focused study of the textbook was encouraged via the resource material. Thus, in a conventional set up of medical education, the medical teachers can help students adapt to the academic stress perceived in the context of mandatory summative examinations.

Declaration: The authors report no conflicts of interest.

REFERENCES

1. Tooth D, Tonge K, McManus IC. Anxiety and study methods in preclinical students: causal relation to examination performance. Med Educ 1989;23(5):416-21.
2. Abraham RR, Zulkifli EM, Fan ES, Xin GN, Lim JT. A report on stress among first year students in an Indian medical school. SEAJME 2009;3(2):78-81.
3. Durak HI, Torun SE, Sayiner A, Kandiloglu G. Description and evaluation of innovative course on learning and study skills for the first year medical students. Tohoku J Exp Med 2006;210(3):231-37.
4. Palmer EJ, Devitt PG. Limitations of student-driven formative assessment in a clinical clerkship. A randomized controlled trial. BMC Med Educ 2008;8:29.
5. Rye PD, Wallace J, Bidgood P. Instructions in learning skills; an integrated approach. Med Educ 1993;27(6):470-3.
6. Islam MN, Majumdar MA, Ja'far R, Rahman S. Students' perceptions of 'technology-based' lecture handouts. Malaysian Journal of Medical Sciences 2005;12(1):26-8.
7. Hartley S, Gill D, Carter F, Walters K, Bryant P. Handouts and study guides. In: Teaching medical students in primary and secondary care: a resource book, Oxford University Press, New York, pp 79-80, 2003.
8. Harden RM, Laidlaw JM, Hesketh EA. AMEE Medical Education Guide No. 16: Study guides- their use and preparation. Med Teach 1999; 21(3): 248-65.
9. Prodinger W. How do students learn from lecture-slide handouts? A qualitative analysis. Research in Medical Education- Chances and Challenges International Conference.GMS publishing house (Abstract) 2009. Available via www.egms.de/de/meetings/rme2009/09rme45.shtml (Accessed November 15 2011).
10. Kadish SJ, Gentile GM, Barrett SV, Zanetti ML, Smith TW, Pugnaire MP. Listening to the new student voice: How they learn. Poster presented at AAMC annual meeting RIME program. Available via http://escholarship.umassmed.edu/res_eval/6. 2008 (Accessed August 20 2011).
11. Medical council of India. Salient features of regulations on graduate medical education. 1997. Available via http://www.mciindia.org/ know/rules_mbbs.htm. (Accessed July 4 2011).
12. Saipanish R. Stress among medical students in a Thai medical school. Med Teach 2003; 25(5):502-6.
13. Shaikh BT, Kahloon A, Kazmi M, Khalid H, Nawaz K, Khan NA, Khan S. Students, stress and coping strategies: A case of Pakistani Medical School. Educ for health 2004;17(3):346-53.
14. Harden RM, Crosby JR. The good teacher is more than a lecturer: the twelve roles of the teacher. An extended summary of AMEE medical education guide no.22. Med Teach 2000; 22(4):334-347.
15. Supe A, Burdick WP. Challenges and issues in medical education in India. Acad Med 2006;81:1076-80.
16. Berkert L, Wilkinson TJ, Sainsbury R. A needs-based study and examination skills course improves students' performance. Med Educ 2003;37(5):424-8.
17. Tavares M, Silva M. Handouts as an educational support for the teaching/learning program in clinical anatomy. Clin Anat 1999;12:337-44.
18. Holsgrove GJ, Lanphear JH, Ledingham IM. Study guides: an essential student learning tool in an integrated curriculum. Med Teach 1998;20(2):99-103.
19. Shultz M, Kies S. Materials employed by medical students preparing for subject examinations: supporting collection development. J Med Libr Assoc 2008;96(2):158-60.