Recall Knowledge of Biochemistry for Interns after Graduation from Medical Schools

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***Abstract*—New medical graduates were recruited during their internship programme from 10 teaching hospitals for a cross-sectional study, carried out in Riyadh area, Kingdom of Saudi Arabia. A total of 200 participants were included in the study. All the participants filled out the study questionnaire. The questionnaire contained 10 basic Biochemistry questions that the graduates were supposed to recall answers for those questions from their prior knowledge. Other information included were gender, medical school attended, year of graduation, training hospital, whether preparing for board examination such as USMLE and PLAB. Results revealed that out of the 200 participants recruited for this study, 124 were males and 76 were females. 26% of the participants graduated from medical schools adopting PBL curriculum whereas 74% were from traditional medical schools. Less than 10% of the participants correctly answered score ≥ 7 whereas 64% scored ≥ 4 to 6 and only 26% scored less than 4 of the basic biochemistry questions. Correlation of scores attained by the participants with other variables in the questionnaire revealed interesting findings. Gender, time since graduation, training rotation and preparation for examinations showed no significant correlation with score. However, of the teaching approach adopted by their schools of graduation showed significant correlation with score with P-value of 0.006.**

The findings suggest that basic biochemistry is perceived as a tough and irrelevant subject and expedite the need for reforms in the way the subject presented to the medical students.

***Index Terms*—Biochemistry, PBL, MCQs, Medical Schools.**

I. Introduction

Biochemists consider that Biochemistry is very important for medical education. On the other hand, many medical students see that biochemistry teaching lacks clinical relevance. Traditionally, Biochemistry was taught as a separate subject in the preclinical basic course. Nowadays with PBL teaching system being adopted by many medical schools worldwide, biochemical knowledge is included in real-life clinical scenarios at PBL sessions. The question of which of the two approaches is more appropriate for grabbing biochemical knowledge is remained unanswered?

Biochemistry is assumed to be a fundamental building block in the foundations of medical education and it is not only required to understand many of the disciplines which underpin medicine but that a basic knowledge that is also required in clinical practice [1]. A study was done by Clack (1994) on five cohorts of King's College medical graduates in the UK that commented about their perception of biochemistry in their 'traditional' basic science course. It seems that not only were they taught a 'vast quantity' of detailed biochemistry with lack of clinical relevance but it also led to excessive learning for examinations [2]. Many authors are convinced that students learn more effectively if the knowledge and skills they acquire are inserted and contextualized in relevant real-life, problem based situations or when adopting outcome-focused curriculum [3]-[4]. The judge of the recall knowledge of biochemistry or other courses in basic medical sciences does not mean judge on the quality of graduates of any of the systems adopted in teaching Medicine to medical student. However, it will help in reforming and improving the way of introducing the subject. It needs to be acceptable to students and laying a solid foundation for clinical sciences and paving the way for good practice. International medical educational community continuously exerts tremendous efforts to developing medical curriculum and appropriate approaches to deliver it. Testing the recall knowledge is not the only way to assess someone's knowledge using MCQs. Nevertheless, it remains the best the simplest and takes less time in reaching the best answer in comparison to MCQs designed to test the analysis or reasoning abilities of medical students.

The main focus of the present study was to compare the recall of knowledge of biochemistry between graduates of medical school adopting conventional and integrated approaches.

II. Material and Methods

200 interns were recruited from 10 teaching hospitals in Riyadh area, Kingdom of Saudi Arabia for this is cross sectional study. The study was based on structured questionnaire containing 10 validated basic biochemistry MCQs (Fig 1) that the graduates were supposed to recall from their prior knowledge. Other information included were; gender, year of graduation, medical school, training hospitals and whether preparing for board exams such as USMLE and PLAB. The results were entered into excel software and SPSS software was used for the data analysis. Descriptive statistics was applied in numeric form (mean and standard deviation) to describe quantitative variables. Frequency distribution was done to describe the qualitative and quantitative variables. Analytic statistics to find the association between different variables was done using chi-square test for qualititative data. A level of $p \leq 0.05$ was taken as the cut-off value for statistical significance.

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- Which of the following is used as a metabolic energy source by erythrocytes after an overnight fast?

1) Free fatty acids
2) Glucose
3) β-Hydroxybutyrate
4) Lactate
5) Triglycerides

- An otherwise healthy 3-week-old boy is brought to the physician's office because of jaundice and dark urine for the past 2 weeks. He has hepatomegaly, and his stools are loose, claycolored, and acholic. Serum unconjugated bilirubin concentration is increased. Which of the following is the most likely cause of the hyperbilirubinemia?

1) Defect in cholesterol synthesis
2) Deficiency of glucuronosyltransferase
3) Hemolysis
4) Inflammation of the terminal ileum
5) Obstruction of the biliary system

- A man used to eat a dozen eggs everyday for over 10 years, had total cholesterol of 160 µg/ml where a woman had been a vegetarian for 10 years, had total cholesterol of 250 µg/ml, which of the following explain the text above.

1) The man has higher capacity for cholesterol excretion in the form of biliary acids.
2) High level of cholesterol for the women is due a lot vegetable are sources of cholesterol
3) For the vegetarian woman both HDL and LDL levels are probably increased. Thus the woman has a great chance of developing atherosclerosis.
4) Both B and C are correct.
5) None of the above answers is correct.

- Lecithin is a phospholipid that contains

1) Serine
2) Ethanolamine
3) Choline
4) Sphingosine
5) Galactose

- Hydrolysis of sucrose gives only

1) Glucose + fructose
2) Galactose + glucose
3) Fructose + galactose
4) Glucose + glucose
5) Malatose + lactose

- Ammonia maybe toxic (ammonia intoxication) to the brain in part because of:

1) Glutamate form the glutamine
2) Glutamate form α- ketoglutrate
3) Ammonia react with α- ketoglutrate to form glutamate
4) Oxidative deamination of glutamate to ammonia
5) Increase level of a- ketoglutrate in tricarboxylic acid (TCA)cycle

- Fahad is a 20 year old male, who was traumatized in a car accident, fortunately his trauma was mild. While he was still in the emergency room in the hospital, he experienced severe chest pain on the left side which was markedly relieved by analgesics. The results of the laboratory examination showed elevated serum glutamic oxaloacetic transaminase (SGOT) activity, with normal liver function tests. This elevation in the SGOT level is most probably due to:

1) Myocardial infarction
2) Liver damage
3) Muscle damage
4) Bone fractures
5) Non of the above

- What is the major function of chylomicrons and VLDLs produced in the fed state?

1) Transport of glucose
2) Transport of triacylglycerols
3) Storage of glucose (glycogen)
4) Storage of triacylglycerols (adipose)
5) Making triacylglycerols non-polar

- During periods of strenuous exercise there is a build up of lactic acid in the muscle. In order to relieve the stress of lactic acid buildup, pathway known as Cori Cycle exists. The metabolic function of the Cori cycle is to:

1) Regenerate NAD+ in the liver
2) Carry lactate from muscle to liver
3) Generate a proton gradient
4) Carry lactate from liver to muscle
5) Recycle lactate in the muscle only

- Increased blood urea nitrogen (BUN) uremia may be due to the following except:

1) Muscle protein breakdown
2) Dehydration
3) Renal hypoperfusion (decrease blood flow)
4) Trauma
5) Gluconeogensis

Fig. 1. Showed questions covering many areas of basic biochemistry were validated and answered by the participants after filling the other parts of the questionnaire. Though three of the questions were case scenario but they were recall questions. Time slot was 10 min for each participant and were not allowed to open books or talk to colleagues.

III. Results

Out of the 200 participants recruited for this study124 representing (62%) were males and 76(38%) were females (Table I). Eight participants were excluded from the study for not correctly filling the questionnaire. One hundred and forty one were the graduated from medical schools adopting conventional instructional system whereas 50 were from schools adopting integrated system (PBL or hyperid). One hundred and eleven of the participants spent less than one year since graduation, 79 spent two year and only 3 spent three years. The participants were distributed in their training programme into different specialities. At the timing of participation in this study, 65 of the participants were in their Paediatric rotation, 49 were doing Medicine, 42 were doing Surgery, 20 were doing Obstetrics and Gynaecology and 44 were distributed in other disciplines. Eighty six of participants were preparing for external agencies qualifying examinations e.g., PLAB, USMLE etc.

The MCQs in the study questionnaire were marked out of ten. Only 18 participants scored ≥7, 123 scored between 4-6 and 51 scored ≤ 4(Table II).

The mean for all the participants marks was found to be 4.53±1.575, and for those who graduated from medical schools adopting conventional instructional system was 4.71±1.56 whereas for graduates from medical schools adopting integrated system was 4.00 ±1.571. It revealed that there is a significant correlation between the instructional approach and score attained by the participants with a P-value of 0.006 (Table III).

Correlations of scores attained by the participants with other parameters in the questionnaire were elucidated. The gender, time since graduation, speciality or discipline of the rota when participating in the study, whether preparing for exam or not and hospital of training, showed no significant correlation with score of the participants on answering the basic biochemistry questions in the study questionnaire P-value are shown in Table IV. As mentioned above the only parameter showed highly significant correlation with the score was the system adopted by participants' school of graduation with P-value of 0.006(Table IV). Correlation of score on one hand and the system adopted by the participants' schools of graduation and each one of the other study parameters on the other hand were carried out (Table V). The score the participants showed was strongly influenced by the gender of the participants and their type of instructional system with p-value of less than 0.001. Likewise the time since graduation and the type of instructional system showed strong correlation with score with p-value<0.001. Male students who graduated from conventional school scored high marks than female, who graduated from the schools adopting same instructional system and both scored higher than those graduated from school adopting integrated system with p-value<0.001. Time since graduation greatly influenced score within the same type of instructional system adopted. However, preparation for qualifying examination of external agencies, and the discipline of the interns rotation at the time the participated in the study did not affect the score within the same type of instructional system they adopted.

TABLE I: DESCRIPTIVE STATISTICAL ANALYSIS OF THE PARTICIPANTS' DATA

Total no of participatants	Gender		Type of med school curiculum		Time since graduation/Years			Prep for Exams		Rotation when Participated in the study				
	Male	Female	Integ	Conv	1	2	3	Yes	No	Med	Paedia	O/G	Sur	Other
200	124	76	50	141	111	79	3	86	112	49	65	20	42	44
100%	62%	38%	25%	70.5%	55.5%	39.5%	1.5%	43%	57%	24.5%	32.5	10	21	22

This table showed the frequency of the participants with different parameters in the questionnaire and their percentage from the total number of participants. Here are some abbreviations for clinical specialities used in the table; conventional (Conv), integrated (Integ), Medicine (Med),Paediatrics (Paedia), obstratric and gynaecology(O/G), surgery (Sur).

TABLE II: PERCENTAGE OF PARTICIPANTS ATTAINED DIFFERENT MARKS.

Score	Number of students	%
≥ 7	18	9%
Score ≥ 4 to 6	123	61.5 %
Score ≤ 4	51	25.5%
Not answered	8	4%
Total	200	100%

This table elucidates the numbers for participants who attained different score ranges and their percentage from the total number of participants.

TABLE III: MEAN FOR STUDENTS SCORE

type of school	Mean	N	Std. Deviation	P-value
traditional	4.71	142	1.560	0.006
integrated	4.00	50	1.512	
Total	4.53	192	1.575	

Mean for students score for the entire group of participants and for those who are graduated from medical colleges adopting conventional or integrated curricula.

TABLE IV: SCORE ACCORDING TO BACKGROUND VARIABLES

Variable		Mean score	S.D	P-value
Sex	Male	4.44	1.63	0.429
	Female	4.62	1.51	
Time since Graduation per year	3	4.33	2.08	0.745
	2	4.43	1.70	
	1	4.61	1.50	
Type of med School	conventional	4.71	1.56	0.006
	Integrated	4.00	1.47	
Preparation For exams	Yes	4.60	1.50	0.372
	No	4.40	1.64	
Rotation When Participated in the study	Medicine	4.80	1.77	0.723
	Surgery	4.36	1.58	
	Paediatrics	4.38	1.54	
	O/G	4.65	1.50	
	E/R	4.29	1.26	
	Others	4.57	1.81	

TABLE V: CORRELATION BETWEEN PARTICIPANTS' SCORES AND OTHER PARAMETERS.

Parameter	Gender*System adopted	Time since graduation/Years* System adopted	Rotation when Participated in the study*System adopted	Prep for Exams*System adopted
P-value	<0.001	<0.001	0.368	0.936

This table elucidate the correlation between participants score and two other variables at a time. One of the two variable is instructional approach or type of school.

This table elucidates the correlation between the score and the other parameters including participant's gender, time since graduation, system adopted, discipline during the study and whether preparing for examination or not.

IV. Discussion

Recently Biochemistry and molecular biology subjects received overwhelming success because biochemical concepts and techniques now are integral parts of research in areas as diverse as Genetics, Pharmacology, Microbiology, Endocrinology, Immunology, Nutrition, Pathology and other clinical disciplines. In preclinical phase of medicine course, Biochemistry is a key subject in understanding structure and function of different biomolecules human body in health and disease. This study used MCQs to assess the recall of biochemistry knowledge abilities of junior doctors during their internship. Study findings revealed that the low marks (4.53±1.575) scored by medical graduates from both the conventional and integrated medical schools might suggest that Biochemistry is perceived by them as a tough subject or irrelevant to medical education rather than a key in medical education biochemists see it.

Study by Clack [4] on five cohorts of King's College medical graduates evaluated how well they perceived the various components of their undergraduate course had equipped them for medical practice. In particular they were asked to evaluate the level of factual content provided by a range of pre-clinical courses. The most striking feature of this study is the large (79.5%) number of doctors who perceived that there was 'too much' biochemistry in their 'traditional' basic science course.

Such studies clearly uncover genuine problems but raise many more questions than they answer. Would doctors taught in an 'integrated' course or via 'Problem-based Learning' or hyperid instructional system have the same perception of biochemistry? Unfortunately, no studies have been carried out on doctors trained in the integrated system. However, line evidence suggest that the amount of biochemistry that students need to learn during Problem-based Learning courses is significantly less than that found in conventional course. Clearly, there is a perception that there is simply too much biochemistry taught in conventional medical courses. Furthermore, doctors in the King's study commented that not only were they taught a 'vast quantity' of detailed biochemistry with a 'lack of clinical relevance' but that this led to excessive learning for examinations. The findings of this study reveals that medical doctors graduated from conventional medical schools score better than those graduated from schools adopting integrated instructional system. This may explain the above statement that amount of biochemistry is far less than in traditional course. Though, graduates from conventional medical schools attained marks better than graduates of integrated schools, this does not necessarily mean they might be ranked in a superior position in clinical practice. The basic medical sciences curricula of conventional medical schools have been a place of bitter criticism by clinical practice regulatory bodies [5]. The GMC in its overwhelming publication; tomorrows doctors received responses for its explicitly criticism to medical school on the huge factual overload of basic medical sciences in their curricula [6].

Therefore, there appears to be some evidence that simply too much biochemistry is taught on conventional medical courses lacks as mentioned earlier, the quality and the clinical relevance. It seems to be redundant factual overload that consumes the students' time and energy. This time spent on unnecessary details could have been better directed towards improving their skills and attributes of future doctors. Hence detailed factual biochemical knowledge taught out of clinical context will be perceived as irrelevant.

The findings of this study expediting the need for reforms review of the curriculum and the way of presenting biochemistry in both conventional and integrated medical schools. The new approach to teaching biochemistry should be attractive and offers a good and deep knowledge to biochemistry for the medical student. Adopting an outcome-focused strategy must be considered in potential reforms might help in better introduce biochemistry and other basic medical sciences to medical student [7]-[8]-[9]. New activities have to be introduced to increase students' interest in biochemistry, stimulating students about it and show its applicability in their future clinical practice.

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