

### Partially Tests during Course Improves the Students Retention of Renal Physiology Knowledge

### إجراء الاختبارات يزيد من مستوى البقاء الذهني لدرس الفيزيولوجيا

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**Background:** Longevity of basic medical sciences is a major concern of medical educators and physicians. It has been shown that different learning styles can affect the half-life of the material. This study aimed to evaluate the effect of partially tests during renal physiology course on "the student's retention of renal physiology knowledge" and "knowledge loss" in pharmacy and medical students.

**Methods:** This case-control study was performed at Jundishapur University of Medical Sciences in the academic year 2012-2013. Study populations were pharmacy students and medical students. The final renal physiology examination was on Jan of 2013 for both groups. Pharmacy students participated in three partial tests during the renal physiology course at first semester of the academic year 2012-2013 while medical students did not participate in these tests. 25 weeks after the final renal physiology examination, the both groups of students were recruited to take a retest. Retention test consisted of 17 multiple-choice questions; each question had one correct answer. Statistical paired- and independent-samples t-tests were used to analysis the results.

**Results:** the mean scores of retention test in medical students was significantly lower than in pharmacy students ( $P < 0.01$ ). Pharmacy students were answered correctly  $66.4 \pm 2.3\%$  of questions, while the rate was declined to  $45.15 \pm 3.25\%$  in medical students. The rate of "knowledge loss" in medical student was ( $22.7 \pm 3\%$ ) significantly higher than in pharmacy students ( $10.86 \pm 1.5\%$ ) ( $P < 0.01$ ).

**Conclusions:** The findings suggest that taking partially tests during physiology course is a highly efficient and an effective strategy to enhance "the retention of renal physiology knowledge" and delay the rate of "knowledge loss".

**Keywords:** Partially Tests; Renal Physiology Course; Retention; Medical and Pharmacy Students

**المقدمه:** إن من الامور المهمة لدى الاساتذة والطلاب في مرحلة المقدمات في الدراسة الطبية هو مستوى بقاء هذه الدروس في الذاكرة. اثبتت الدراسات إن هناك عوامل مؤثرة في مستوى بقاء المعلومات في الذاكرة. إن هذه الدراسة تحلل مستوى تأثير اختبارات خلال الدورة على "مستوى بقاء المعلومات في الذاكرة" و "مستوى تدني المعلومات" في درس فيزيولوجيا الكلية عند طلاب الطب والصير له. **الهدف:** أجريت هذه الدراسة في العام الدراسي ٩٢-٩١ هـ.درش في جامعة جندی شاپور للعلوم الطبية والمجموعه التي تمت الدراسة عليهم هم طلاب الطب والصير له. لقد انترك طلاب الصير له خلال المرحلة التعليميه للماده في ثلاثه اختبارات ولكن لم يتم اجراء هذه الاختبارات لطلاب الطب. و بعد مضي ٢٥ اسبوع من نزيامه الدورة تم اجراء اختبار لمعرفة مستوى بقاء المعلومات في الذاكرة و مستوى نقصان العمل في ماده فيزيولوجيا الكلية. اشتمل الفحص على ١٧ سؤال ذو اربعة اجوبه و كان هناك جواب واحد صحيح تم استخدام الاختبارات الاحصائيه T المستقل و الزوج.

**النتائج:** إن معدل العلامات عند طلاب الطب كان اقل من طلاب الصير له ( $P < 0.01$ ) اجاب طلاب الطب على  $55 \pm 2.3\%$  من الاسئله بشكل صحيح في حال اجاب طلاب الصير له على  $45.15 \pm 3.25\%$  من الاسئله بشكل صحيح. كان مستوى التدني في معلومات درس فيزيولوجيا الكلية عند طلاب الطب  $22.7 \pm 3\%$  و اعلى بشكل واضح من طلاب الصير له الذي كان  $10.86 \pm 1.5\%$  ( $P < 0.01$ )

**الاستنتاج:** اشارت نتائج هذه الدراسة الي إن اجراء اختبارات متكرره و مستمره اتنا دراه ماده الفيزيولوجيا له دور كبير في بقاء المعلومات لمد اكثر في الذاكرة و تقليل مستوى النسيان و يعتبر هذا الاللوب و هذه الإستراتيجية ناجحه جداً. **الكلمات الرئيسية:** البقاء الذهني، اختبارات اتنا فتره الدراسة، فيزيولوجيا كلية، وعده، طلاب الصير له و الطب.

### آزمون های طول دوره میزان ماندگاری ذهنی درس فیزیولوژی را افزایش می دهد

### تعلیمی سال کے دوران پیریا ڈیکل امتحانات سے طلباء کا حافظہ بہتر ہوجاتا ہے۔ یہ ٹسٹ رینل فزیالوجی شعبہ میں انجام دئے گئے۔

**مقدمه:** میزان ماندگاری یا طول عمر ذهنی دروس علوم پایه پزشکی یکی از دغدغه های اصلی اساتید دانشکده های پزشکی و پزشکان می باشد. به خوبی نشان داده شده است که شیوه های مختلف آموزشی می تواند نیمه عمر مطالب درسی را تحت تاثیر قرار دهد. تحقیق حاضر با هدف بررسی اثر آزمون های طول دوره بر "میزان ماندگاری ذهنی" و "درصد کاهش دانش" درس فیزیولوژی کلیه در دانشجویان پزشکی و داروسازی انجام شد.

**روش بررسی:** این تحقیق شاهد موردی در سال تحصیلی ٩٢-٩١ در دانشگاه علوم پزشکی جندی شاپور انجام شد. جمعیت مورد مطالعه در این تحقیق دانشجویان پزشکی و داروسازی بودند. دانشجویان داروسازی در سه آزمون بخشی در طول دوره درس فیزیولوژی در نیم سال اول تحصیلی ٩٢-٩١ شرکت کرده درحالی که دانشجویان پزشکی در این آزمون ها شرکت نداشتند. بیست و پنج هفته پس از پایان دوره (تیرماه ١٣٩٢)، هر دو گروه در یک آزمون فراخوانی جهت سنجش میزان ماندگاری ذهنی و درصد کاهش دانش درس فیزیولوژی کلیه شرکت کردند. آزمون فراخوانی شامل هفده سوال چهار گزینه ای بود که هر سوال فقط یک پاسخ صحیح داشت. جهت آنالیز داده ها از آزمون های آماری T مستقل و مزدوج استفاده شد.

**نتایج:** میانگین نمره آزمون فراخوانی در دانشجویان پزشکی به طور معنی داری کمتر از دانشجویان داروسازی بود ( $P < 0.01$ ). دانشجویان پزشکی فقط به  $45.15 \pm 3.25\%$  درصد از سوالات پاسخ صحیح دادند در حالی این میزان در دانشجویان داروسازی  $66.4 \pm 2.3\%$  درصد بود. میزان کاهش دانش فیزیولوژی کلیه در دانشجویان پزشکی  $22.7 \pm 3\%$  بود که به طور چشمگیری بالاتر از دانشجویان داروسازی با کاهش  $10.86 \pm 1.5\%$  است ( $P < 0.01$ ).

**نتیجه گیری:** نتایج مطالعه حاضر نشان داد برگزاری آزمون های بخشی در طول دوره یک روش کارآمد و یک استراتژی موثر جهت افزایش میزان ماندگاری ذهنی درس فیزیولوژی کلیه و کاهش سرعت فراموشی دانش فیزیولوژی است.

**کلید واژه:** ماندگاری ذهنی، آزمون های طول دوره، فیزیولوژی کلیه، فراخوانی، دانشجویان داروسازی و پزشکی

**بیگ گرانڈ:** طبی تعلیم میں ڈاکٹروں کا ایک اہم مسئلہ طبی علمی مسائل کا ذہنوں میں رہنا ہے۔ مختلف روشوں سے حافظہ کی تقویت کی جاسکتی ہے۔ اس تحقیق کا مقصد ایک سمسٹر میں مطالب کے ذہن میں باقی رہنے اور مطالب کے ذہن سے محو ہونے کا جائزہ لینا ہے۔ یہ تحقیق رینل فزیالوجی میں انجام دی گئی۔

**روش:** یہ تحقیق دوہزار گیارہ اور بارہ میں جندی شاپور میڈیکل یونیورسٹی میں انجام دی گئی۔ اس تحقیق میں میڈیکل طلباء اور دواسازی کے طلباء نے شرکت کی۔ دواسازی کے طلباء نے رینل فزیالوجی کے ٹرم میں تین مرتبہ ٹسٹ دیا تھا جبکہ میڈیکل طلباء سے کسی طرح کے ٹسٹ نہیں لئے گئے تھے۔ اس کے پیچھے ہفتوں بعد دونوں گروہ کے طلباء کو دوبارہ ایک ٹسٹ کے لئے بلایا گیا تا کہ یہ دیکھا جائے کہ طلباء کے ذہن میں کس قدر مطالب رہتے ہیں اور کس قدر محو ہوجاتے ہیں۔ ٹسٹ میں سترہ آجیکٹیو سوالات تھے جن کا ایک ہی جواب صحیح تھا۔ ڈیٹا کا تجزیہ فی ٹسٹ سے کیا گیا۔

**نتیجے:** میڈیکل طلباء کے نمبر دواسازی کے طلباء سے کم تھے، میڈیکل طلباء نے صرف پینتالیس فیصد سوالات کے صحیح جواب دئے تھے جبکہ دواسازی کے طلباء نے چھیاسٹھ فیصد جوابات صحیح دئے تھے۔

**سفارش:** اس تحقیق سے پتہ چلتا ہے کہ تعلیمی سال کے دوران پیریاڈیکل ٹسٹ مفید واقع ہوتے ہیں اور انہیں حافظہ کی تقویت کے لئے ایک استراتیجی کے طور پر اپنایا جاسکتا ہے۔

**کلیدی الفاظ:** حافظہ، پیریاڈیکل ٹسٹ، فزیالوجی۔

## INTRODUCTION

The basic medical sciences are included to medical curriculum approximately from mid-1800 (1). The retention or longevity of the learned basic medical sciences in preclinical period is important and a major source of concern for medical educators and physicians. They are believed that a substantial portion of these sciences are lost in clinical and final years (2). The period of time over which course participants forget half of what they have been taught called "half-life of learning" (3). Loss of some portions of the learned basic medical sciences is inevitable. Some decline in the ability to remind what was once learned is normal and happened resulted from a physiologic condition called as "forgetting" process (4) and also long-term nonuse of the learned materials accelerate the speed of knowledge loss (5). Many reports have shown that a substantial parts of the basic medical sciences taught in medical school in preclinical years are lost during clinical and final years (2). In a review study, Custer has reported that approximately two-third to three-fourth of the knowledge will be retained after one year and the rate of knowledge loss further increase up to 50% in the next year in medical education (1).

There are many factors that decrease retention of the learned basic medical sciences such as lecture-based teaching methods, lack of clinical relevance to the portions of material covered and low attention to practical application of basic science knowledge to clinical situations (6). Some suggested teaching methods to improve the half-life of learning or knowledge retention are reviewing, repetition and reinforcement, interactive learning, problem-based learning, note-taking (7), partial examinations during course (8) and collaborative-group testing (9). Therefore, the aim of the present study was to evaluate the effect of partially tests during renal physiology course on "the student's retention of renal physiology knowledge" and "knowledge loss" in pharmacy and medical students.

## METHODS

This case-control study was performed at Jundishapur University of Medical Sciences in academic year 2011-2013. Study populations were pharmacy students [from the beginning of fourth semester to the end of fifth semester] and medical students [from the beginning of third semester to the end of fourth semester]. The final renal physiology examination was on Jan of 2013 for both groups. Twenty-five weeks after the final renal physiology examination [Jul of 2013], the students were recruited to take a retest. There are three different methods to assess "knowledge retention" in educational context most common methods are recognition

(true-false questions) and cued recall (open-ended questions). The third method, multiple choice questions (MCQs), is a mixture of recall and recognition (10). The retention test consisted of 17 questions. Each question was followed by four statements, only one of which was correct. The questions were taken from of the course exam (8). The participation in test was voluntary and students were unaware about the time of retention test. Therefore, they had no chance to review the lesson. Pharmacy students were participated in three partially tests during renal physiology course in the previous semester (first semester of the academic year 2012-2013) while medical students did not participate in these tests. What was the partially test? The lesson (renal physiology course) was divided by three and students took a test for each part. Each test consisted of 8 essay-questions [4 long-and 4 short-answers]. The educator and reference textbooks [Textbook of Medical Physiology; chapters 25-30; Guyton and Hall] are identical in both studied groups.

### Statistical analysis

Data were analyzed using SPSS version 17 and are expressed as mean  $\pm$  SEM. To compare the effect of partially tests during renal physiology course on "the student's retention knowledge", the scores of retention test analyzed with independent sample t-tests. To analysis the knowledge loss in each group, the scores of course exams in Jan 2013 were compared with their scores on 25 weeks later, retention test, using paired samples t-tests. To compare the rate of knowledge loss between groups, the scores of course exams in Jan 2013 subtracted from the scores of retention test, and the results were compared using independent samples t-tests.  $P < 0.05$  was set as significance.

## RESULTS

Thirty-eight percent of the studied population was men and 62% were women; mean age was  $21 \pm 1$  year. According to table 1, there was a significant difference between the mean scores of course exams of renal physiology on Jan 2013 and the retention test scores 25 weeks later in both pharmacy and medical students. As shown in figure 1, the mean scores of retention test in medical students was significantly lower than in pharmacy students ( $P < 0.01$ ). Pharmacy students were answered correctly  $66.4 \pm 2.3$  percent of questions, while the rate was declined to  $45.15 \pm 3.25\%$  in medical students. The "knowledge loss" in medical students ( $22.7 \pm 3\%$ ) was significantly higher than in pharmacy students ( $10.86 \pm 1.5\%$ ) (Fig. 2;  $P < 0.01$ ).

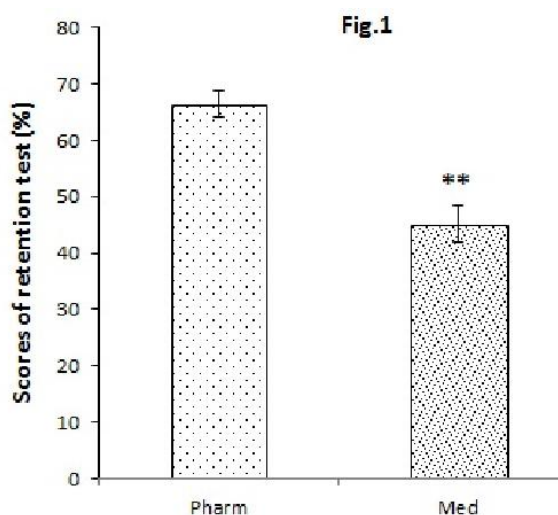
## DISCUSSION

The findings of the present study showed 1. There was a significant difference between the mean scores of final and

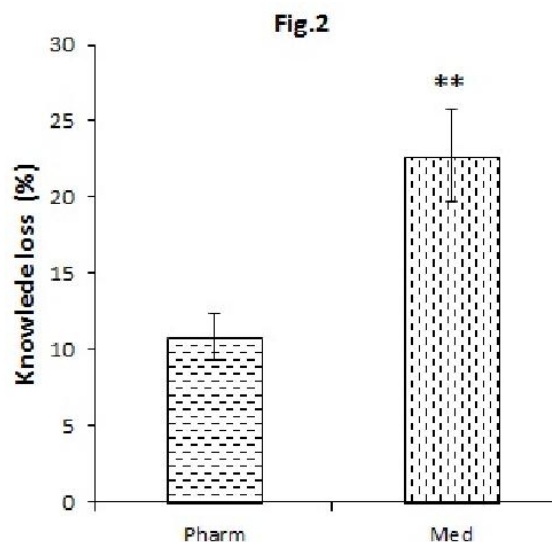
**Table1. Comparison the Course Scores of Renal Physiology Exam and Retention Test (25 Weeks after the Course Exam).**

Student	Course exam (%)	Retention test (%)	Significant Difference( $\beta$ )
Pharmacy	$77 \pm 1.8$	$66.4 \pm 2.3$	$P < 0.01$
Medical	$67.85 \pm 1.35$	$45.15 \pm 3.25$	$P < 0.001$

$\beta$  Represents Significance Difference Between Course Exam Scores Versus Retention Scores.



**Fig.1.** Effect of partially tests during renal physiology course on "the student's retention of renal physiology knowledge" in medical and pharmacy students; Pharm: pharmacy students; Med: medical students; \*\*P<0.01 as compared with pharmacy students.



**Fig.2.** Effect of partially tests during renal physiology course on "knowledge loss" in pharmacy and medical students; Pharm: pharmacy students; Med: medical students; \*\*P<0.01 as compared with pharmacy students.

the retention tests in both studied groups (pharmacy and medical students), 2. The mean scores of retention test in pharmacy students were higher than in medical students and 3. The "knowledge loss" in medical students was significantly higher than in pharmacy students.

Different rates of knowledge physiology loss have been reported. D'Eon found 16.1% decline in physiology knowledge after 10-11 months to medical students (11). This rate was more in Weitman report; The "Knowledge loss" of introductory physiology course was 20% after 15 weeks on MCQs retention test (12). In agreement with these findings, the present results also showed a significant decrease in renal physiology knowledge after 25 weeks on MCQs retention test in pharmacy and medical students, 10.6 and 22.7%, respectively. This rate was lower in pharmacy students than in medical students.

A question rose from the results of the above mentioned studies? How to enhance the retention of the learned materials? In response to the question, researchers and medical educators are trying to provide new approaches of instructions to increase the knowledge retention in basic medical sciences. It is believed that if the students frequently use the learned materials there is no the retention problem (5). However, there are some factors that affect the long-term retention of knowledge such as the content and tasks to be learned, the conditions of retrieval, and the individual ability of students (13). The mentioned factors are not under control of educators or instructors.

It is suggested that instructional approaches can impact the retention of knowledge. In terms of instructional styles, the review study of Custers provides suggestions as to how to design a course, or even an entire curriculum, in order to improve the long-term retention of knowledge (1).

Rodriguez et al have been reported taking partially exams during pharmacology course significantly increase the mean scores of retention test and their taught performance. In that

study, two groups of medical students at the National University of Mexico were recruited. The first group participated in three partially test during pharmacology course while the second group did not participate. Both groups recruited to take a retention test 10-11 months later. The results showed that mean scores of retention test in the first group was significantly higher than in the second group. The scores of partially tests were 69.8% and 59.9%, respectively (5). In another study, Dobson showed that taking retrieval quizzes enhanced the retention of anatomy and physiology information. Due to the significant results, he suggested that retrieval quizzes can be an effective strategy to increase the retention of anatomy and physiology knowledge (14). According to figure 2, the mean scores of retention test in pharmacy students significantly higher than in medical students. It was 66.4% in pharmacy students whereas the rate declined to 45.15% in medical student. The reasons of this considerable difference between pharmacy and medical students would largely be related to participation in partially tests during course. Therefore, these findings together suggest that taking partially exams or quizzes during course can effectively enhance the longevity of knowledge.

According to figure 3, the "knowledge loss" of renal physiology information in medical students was two times more than in pharmacy students, 22.7 versus 10.86%. As mentioned above reports have shown different rates of the knowledge loss of the taught physiology information. The apparent difference between two groups can be related to partially test during course. Taken these results together suggest that if partially tests take place during the course, the span of knowledge retention will increase as well. The correcting papers and registering the scores after each exam was time-consuming and makes the teacher busy and was the limitation of the present study. Therefore, partially exams taking during course effectively decrease the rate of "Knowledge loss" of physiology information. In conclusion,

the findings of the present study show that taking partially tests during physiology course is a highly efficient and an effective strategy for enhancing "the retention of renal physiology knowledge" and delay the rate of "knowledge loss".

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**Conflict of interest:** The Author declares that he has no conflicts of interest.

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