Original Research Article

Is There Any Difference In Academic Performance Of Medical Students In Biochemistry? Analysis Based On Gender And Place Of Residence

ABSTRACT

Aims: Due to the complexity of teaching new subjects to medical freshmen, we want to explore the difference of our student's Biochemistry examination score based on their gender and place of residence.

Methods: This is a simple retrospective cross sectional study by analyzing the examination result and compared it based on our student's gender (male or female) and place of residence (living in their own house or in boarding house).

Result and discussion: During data collection, there are 913 active students from all class of 2016-2021 but only 569 freshmen from the class of 2018-2021 which gender and place of residence data are available, there are 155 male (27.24%) and 414 female (72.75%). Female students achieved better mean score compared to their male counterparts. Students which live in their own house also achieved better mean score compared to those who lived in boarding house.

Conclusion: there are differences in the achievement of examination scores based on student's gender and place of residence.

Keywords: cognitive, psychomotor, examination, male, female, boarding house

1. INTRODUCTION

Medical Biochemistry is the branch of Biochemistry that studies the chemical composition and process in the human body.[1] This area of studies is also extended to understand the biochemical exchanges that occur within the human body in relation to their application in the field of medicine.[1-3] Biochemistry is rapidly expanding, becoming one of the most influential areas of science. Combining the core tenets of biology and chemistry, the field plays a huge role in the development of many novel new scientific approaches that contributes to create the vital drugs, therapies and diagnostic tools that are used in daily medical practice.[4] Much like medical science itself, biochemistry is a vast area of research that yields profound discoveries each year. Biochemical techniques advance our

understanding of the chemical structures and processes that underpin human health and disease, revealing the underlying transformations between these two physiological states.[2-4]

In our curriculum, Biochemistry consists of following topics: Introduction to carbohydrates and lipids, Bioenergetics and oxidative phosphorylation, Bio signal, Amino acids and Peptide, Immunochemistry (Immunoglobulin), Metabolism of carbohydrate, Enzyme-Coenzyme and Vitamins, Body fluid and minerals, Metabolism of Lipids, Metabolism of Purine and Pyrimidine (nucleic acid), Metabolism of proteins, Porfirins and bile pigment, intracellular transports, digestive Biochemistry, Hormones and Blood. In the theory section, the emphasis is solely on cognitive but in the practicum/lab (praktikum), the focus is in combination of cognitive and psychomotor activity.

Teaching Medical biochemistry to medical feshmen is challenging.[5] Partly because they have never received this lesson before in lower level/secondary education, and a variety of new courses that must be studied simultaneously at the most basic level of medical education, ranging from basic medical sciences such as Biology, Biochemistry, Anatomy and Histology. Beside those subjects, basic humanity studies also given to our medical freshmen and these are not directly related to medical education.

Previous study showed us that female students have a higher mean tutorial score compared to male students, and those who live at home with their parents also have a higher average score than those who live in a boarding house, by themselves.[6] It will be very interesting to explore whether there are differences in gender and place of residence regarding the academic score of medical biochemistry (theory and practicum/praktikum) among freshmen of medical students and this become the aim of this simple study. The exam is in the form of multiple choice questions (MCQ).

2. MATERIAL AND METHODS

This simple cross sectional study conducted from November 15th to December 15th, 2021 at the Faculty of Medicine, Universitas Kristen Indonesia, Jakarta- Indonesia. It was a mixture between data of Biochemistry score that consist of theoretical examination scores and practicum/lab (praktikum) examination scores with data of place of residence obtained from Google-form™ questionnaire. Data of tutorial score from the class of 2016, 2017, 2018, 2019, 2020 and 2021 collected through the manager/head of study programme of the Undergraduate Medical Education (Program Pendidikan Sarjana Kedokteran/ P2SK). The inclusion criteria are active students that had complete score for each session. All data initially made available in Microsoft Excel™ and then further classified and processed using SPSS. Simple descriptive statistic operation conducted whenever necessary.

3. RESULTS AND DISCUSSION

During data collection, there are 913 active students from all class of 2016 with 172 students (18.8%), class of 2017 with 171 students (18.7%), class of 2018 with 158 students (17.3%) , class of 2019 with 140 students (15.3%), class of 2020 with 137 students (15.0%) and class of 2021 with 135 students (14.8%), but only 569 freshmen from the class of 2018, 2019, 2020 and 2021 eligible for further analysis on the differences based on gender and place of residence. In total number, 4,000+ data were collected for further processing and analysis. Data is presented descriptively, and also in the form of tables and graph. But unfortunately, some data regarding place of residence is incomplete so the analysis is only carried out on available data.

In overall, based on gender, out of 569 freshmen which gender and place of residence data are available, there are 155 male (27.24%) and 414 female (72.75%). Regarding our

respondent's place of residence, there are 247 (43.41%) people living in boarding houses and 322 (56.59%) living in their own homes. Out of 913 freshmen from 7 batch (1996-2021), the lowest score of the theoretical examination results is 14 and the highest is 94 with mean score 55.49 (SD 14.80) while the lowest practicum score is 15 and the highest is 100 with mean score 62.48 (SD 15.15).

Further analysis of descriptive statistics to explore examination score (theory and practice/laboratory) based on available data regarding gender and place of residence (n=569) showed us as follow:

Table 1. Descriptive statistic regarding Biochemistry score from the class of 2018, 2019, 2020 and 2021

		Mean score	SD	SE	Range score
Theory	Male	56.34	16.17	1.29	20-88
	Female	60.44	14.29	0.7	18-94
	Boarding house	58.49	14.88	1.24	18-89
	Own house	59.96	14.94	0.73	20-94
Practice	Male	63.0	15.8	1.24	24-100
	Female	66.29	14.89	0.73	28-100
	Boarding house	65.36	15.31	0.97	32-100
	Own house	65.42	15.00	0.83	24-100

In both Biochemistry examinations, female students achieved better mean score compared to their male compatriot. And regarding their place of residence, freshmen which lives in their own house achieve better score in both examinations compared to those whose live in boarding houses. It is interesting to conduct further study related with the result, especially in other basic medical courses. Unlike our findings, a study on Biochemistry performance of students at Michigan State University showed opposite result where female students got lower score.[7]

Based on gender differences, similar research in other fields of medical science also found mixed results, *e.g.*, in Surgical, Physiology and pharmacology. Alsheikh in Saudi Arabia found out that female students achieved significantly better scores in surgical disciplines than in medical disciplines and they outperformed male students in overall scores in surgical disciplines.[8] in Physiology, Sinha *et al* [9] from India revealed that when they compared students of high achiever group revealed no significant difference in performance of both genders in all modalities of assessments (multiple choice questions (MCQ) and structured long & short answer questions (LSQ)). Whereas, female students of both medium and low achiever groups had significantly high scores in LSQ as compared to male, but no such difference was observed for MCQ. Meanwhile, Faisal *et al* [10] in Pakistan divulged in Pharmacology, that out of the 200 medical students enrolled with 102 (51%) were male and 98(41%) were female, there was no significant difference in the academic performance in terms of gender in multiple choice questions and short essay questions. It will be very interesting to know whether the difference in achievement of gender-related test scores is also influenced by other factors such as place of residence, the area of origin of students (urban or rural) and so on.

Further statistical tests were conducted to determine whether there was a significant difference in the achievement of scores on the Biochemistry examination. The objective is to identify differences between two or more groups using non parametric tests (do not assume that available data follow the normal distribution. The test use automatically compares distribution across groups using independent samples Mann Whitney U test.

Hypothesis Test Summary (a)

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of T_Biokimia is the same across categories of Gender.	Independent-Samples Mann-Whitney U Test	.015	Reject the null hypothesis.
2	The distribution of P_Biokimia is the same across categories of Gender.	Independent-Samples Mann-Whitney U Test	.020	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary (b)

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of T_Biokimia is the same across categories of R_K.	Independent-Samples Mann-Whitney U Test	.246	Retain the null hypothesis.
2	The distribution of P_Biokimia is the same across categories of R_K.	Independent-Samples Mann-Whitney U Test	.880	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Fig. 1 The result of statistical analysis: (a) there is a significant difference in the achievement of Biochemistry scores between genders (male and female). (b) There is no statistically significant difference in the achievement of Biochemical scores based on place of residence (house or boarding house)

Furthermore, we want to show the difference between male and female student and between those who live in their own house vs. boarding house, using standard error bar. Standard error of Mean (SEM) is an estimate of variability of possible values of means of samples. As mean values are considered for calculation of SEM, it is expected that there will be less variability in the values of sample mean than in the original population. This shows that SEM is a measure of the precision with which sample mean $\bar{X}$ estimate the population mean μ. The precision increases as the sample size increases. Thus, SEM quantifies uncertainty in the estimate of the mean.[11]

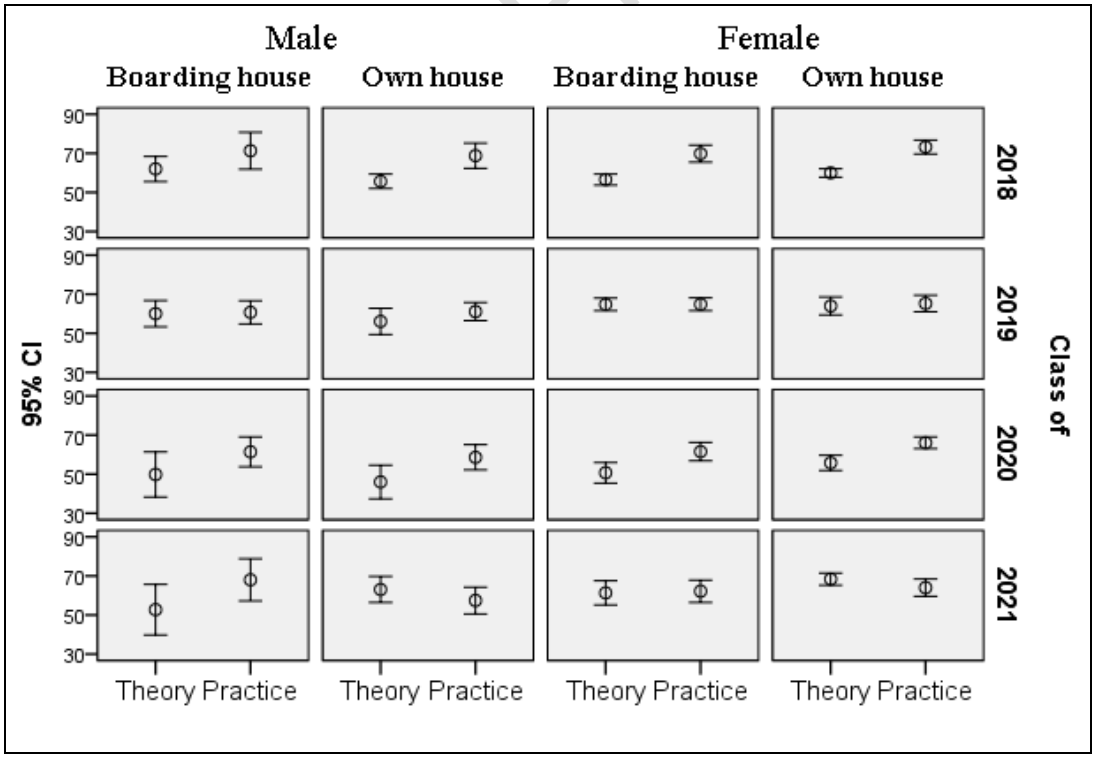

Fig. 2 Error bar showed comparison between male *vs.* female and further divided into those who live in boarding house *vs.* own house.

Error bars can actually reveal the following information about our data: How spread the data are around the mean value (small SD bar = low spread, data are clumped around the mean; larger SD bar = larger spread, data are more variable from the mean). Figure 2 showed us that when compared between female vs. male students, the error bar line is generally said to be longer in the male group, and this indicates high data variability in that group. The variability of the data also appears to be more significant in the group who live in a boarding house compared to those who live at home; and become more apparent when further comparison conducted between male *vs.* female regarding their place of residence. Male students which live in boarding houses appear to have greater value variability than the other groups.

Our findings are different from the findings of Rauschenberger & Sweeder[7] which conducted a similar study on Biochemistry performance of students at Michigan State University in a two-part biochemistry series Biochem I (n = 5,900) and Biochem II (n = 5,214) for students enrolled from 1997 to 2009. They found female students earned statistically lower grades compared to male/ females perform worse than males. This lower grade predicted for females is in addition to the negative impact that female students may have experienced in previous classes. Gender remains an important variable even when we consider only students of a specific major (such as human biology or physiology, two of their largest cohorts). These students would be expected to have a similar set of college courses and experiences, so would minimize variance arising from having discussed certain concepts in other courses. Haist[12] found out that in general, Women performed better than men on the clinically based performance examinations. While for the result of the study conducted by Dixon,[13] no significant gender differences were seen in these two clinical performance measures. Women outperformed men in evaluations of clinical clerkship performance.

Further study need to be conducted in order to study habits differ by gender and also have significant impact on performance outcomes of learners. Given that students' academic success is an important outcome for medical schools, these findings call for implementing these results to enhance curricular changes or at least modification and promote better learning outcomes.[14] Women graduating from this medical school in recent years are the academic equals of their male classmates.[13-15] It is hoped that in the future, some of these women will choose careers in academic medicine and help to redress the gender inequalities.[13]

4. CONCLUSION

This is one of only a few studies that have reported gender and place of residence comparisons regarding Biochemistry examination score among medical students at a private medical faculty. The results show that female students achieve better score compared to their male counterparts, and the variability of the score is higher among male students. And regarding their place of residence, students which live in their own house achieve higher mean score compared to those who lived in the boarding house.

CONSENT

"NOT NEEDED"

ETHICAL APPROVAL

"NOT NEEDED"

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