

# Gender Differences in Academic Grades versus Absenteeism for Medical Sciences Students

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## Research article

**Keywords:** Absence rate, performance, gender, self-learning

**Posted Date:** June 8th, 2020

**DOI:** <https://doi.org/10.21203/rs.3.rs-33225/v1>

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## **Abstract**

Background: Learning environment and academic performance can be investigated from various aspects. Numerous interfering factors make this issue a complex one. The aim of this study is to understand the role of absenteeism on the overall score of medical sciences students and to consider the difference between male and female students.

Methods: Academic performance was evaluated using the overall grades. Assessments of students and absence rate were tracked in two consecutive semesters (January–April 2019 and September–December of the same year), followed by sequential alignment to evaluate and correlate males ( $n=43$ ) and females ( $n=72$ ) results. During the semester, all teaching and assessment methods were unified to both sections to mitigate any confounding results from the teaching method to either section. Academic activities were assessed automatically and subjectively. SEKONIC SR-3500 HYBRID Machine was used to correct and analyze the answers of multiple-choice questions of the Midterm and final examination. Objective marks were compiled with the scores of the subjective answers to generate the final academic degree. These overall marks were correlated and statistically analyzed with the absence rates.

Results: Preliminary data of the mean scores between male and female students during three semesters were statistically significant (\*\*\*\*  $p<0.0001$ ). To correlate marks with absenteeism, the correlation coefficient ( $r$ ) was in a negative value which indicates an inverse correlation between X (absence rate) and Y data (scores). But, a statistically significant correlation was found in the male section (\*\* $p= 0.0011$  for the first semester; \* $p= 0.0255$  for the second semester) but no significance was observed with the female scores ( $p= 0.2041$ ;  $p=0.1537$ ).

Conclusions: The results show that female marks are not solely dependent on class attendance but probably other factors were involved such as self-learning, motivation and group discussion. The female mean scores were significantly higher in five semesters in a row compared to male students. Male overall scores prove to be conditioned with the instructor explanation. The finding indicates a gender variation in the academic performance measured by overall grades taking absenteeism rate into account.

## **Background**

Gender is a research question in plentiful studies [1–3]. Academic achievements form a significant part of these investigations [4,5]. Many variables determine the direction of academic improvement. Factors that contribute to academic performance include intellectual factors such as student's perception, IQ (intelligence quotient) and difficulty in learning [6,7]. Others include grit and perseverance [8], dependency on the instructor teaching style, self-directed learning and group studies between students [9–11]. The satisfaction of medical students and quality of learning can be affected by environmental factors taking into account the personal and academic considerations [12]. Absenteeism is another independent variable that can affect academic excellence. The influence of absenteeism on medical sciences

undergraduate students as well as learning-style on academic performance were studied [13]. The quality of these studies depends on the accuracy of academic evaluation and the bias control methods.

Assessment of academic education has begun to be considered from the perspective of teachers and students [14]. Olave *et. al.*, 2016 study pointed out that most studies of this type were surveys-based investigations [12]. In the context of education assessment, absenteeism is a key variable that can affect the student academic excellence, and therefore influencing the evaluation. In addition, effect of chronic absence on student achievements has been scientifically examined which was defined by an absence rate of 15% [15] or more depending on the academic regulations. It is common believe that school absenteeism relates to course problems. The admission test data can determine whether the medical student would struggle academically [16].

This variable was investigated from different angles. In a meta-analysis review, Gubbels *et. al.*, 2019 summed up the risk factors for school absenteeism [17]. On the other side, there are numerous articles investigating the influence of absenteeism on student performance and by studying the relationship between attendance and examination performance [18,19]. But few of them considered gender in their recapitulations. It seems that gender plays a significant role. Attitude is a confounding factor to these investigations. Gudaganavar NV and colleagues investigated 250 students and found no difference in terms of the general attitudes of study between male and female students. However, a significant gender difference was noticed in terms of taking notes and preparation for exams [20]. Attempts to intervene positively are encouraged in all academic environments. However, it should be taken into consideration when a research is being conducted. In a study conclusion, it was observed that monitoring students and motivating them had a positive impact on the effectiveness of teaching [21].

The Academic Programs at King Khalid University were applied for academic accreditation that requires a continuous improvement in the academic teaching. This changed the way courses are taught by focusing on the quality of teaching and measuring them using key performance indicators and learning outcomes assessment such as their cognitive competencies, numerical skills and teamwork [22–24]. In line with these academic developments, it is worth to address the role of gender in the context of absenteeism and academic achievements in the medical sciences field. Preliminary findings showed that female overall grades in medical sciences surpass those by male students albeit slightly. Thus, this study will investigate the difference between male and female medical sciences students in their academic performance measured by their overall scores in one of the third-year courses, and to determine predictive effect of absenteeism on gender. Academic performance was measured using overall grades in the final examination that constituted both objective and subjective questions.

## Methods

It has been noticed that female overall grades were higher than that of male students at the end of three semesters in a row, with statistically significant difference ( $p^{****} <0.0001$ ) in the mean score between the two sections (**Table 1**). The average marks of female students calculated for five semesters were 78.27

compared with 70.66 for boys. This finding raises a question to understand why female students outweigh males despite that the course is taught almost equally to both sections. Another question that can be investigated is the effect of absence on their scores. To address these questions, absenteeism rate and course grades were analyzed taking gender into account.

## **Setting**

Medical sciences students have to pass a preparatory year in order to be enrolled in the academic program. Courses that are granted into the Medical Laboratory Sciences Program, College of Applied Medical Sciences, King Khalid University, Abha city, Saudi Arabia, are distributed into 8 levels (2 levels every year). The third year comprises of advanced courses that require skills to succeed. Clinical Virology course is among these advanced courses that is the focus of this study. The independent variables were absence rates of students in the course. The outcome variable was obtained from the student scores.

## **Study design**

The study population was 115 third-year medical laboratory sciences students studying Clinical Virology course, of which 37% males and 63% females. The course is taught to two sections every semester, and no exclusion was considered in terms of sections and number of students. To avoid confounding results, the scoring methods were equalized for both sections and using rubrics for assessments when needed to mitigate subjective reporting bias. Moreover, two semesters were included in the study to increase the sample size, to test the reproducibility of the findings and to interpret gender difference semester by semester.

The curriculum was taught by following the accreditation standards every semester to avoid any teaching bias. Teaching and learning are among the most essential standards. This standard includes assessment of course outcomes. Teaching staff members are following the program learning outcome domains to match their course learning outcomes. For a third-year course, knowledge domain was considered but less than the essential domains such as cognitive abilities, calculation skills and their capabilities in presenting their work.

Assessment was as follows: 80% of the questions in every exam were multiple-choice questions (MCQs). The rest (20%) were subjective short essay questions. For MCQs, correction was automatically done using SEKONIC SR-3500 HYBRID Machine to generate Student Statistics Reports for further statistical analysis. The standardized grades after departmental approval (out of 100) and absence rate of Saudi Arabian undergraduate students studying the Clinical Virology Course were analyzed for gender differences, correlation and statistical differences.

The course is graded based on several activities. The curriculum is structured as theory and practical sessions. The outcome measure was the student overall grade. The scores were distributed based on a written assignment to summarize a book chapter and present it orally; Midterm examinations; practical reports and final examination. Psychomotor skills were subjectively assessed during the overall practical

evaluation by testing their accuracy in aspirating a very small volume of aqueous reagents with manual pipettes of different sizes. But this skill constituted a minor part of the practical marks. Another skill evaluated was the calculation ability to prepare samples for laboratory analysis using the dilution equation. Having the overall grade out of 100, the independent variable was considered. For absenteeism, 20% is the maximum absence rate that allows the student to enter the final exam.

### **Statistical analysis**

Statistical significance of the score means between male and female students were calculated using unpaired t test. To correlate between absenteeism, gender and overall grades, linear regression and Pearson's correlation analysis were used. Coefficient of determination ( $r^2$ ) was computed for X (absence rate) versus every Y data set (degree). Statistical significance was analyzed using GraphPad Software, version 8 (2019), San Diego, California USA, according to the following P values: 0.1234 (not significant), 0.0332 (\*), 0.0021 (\*\*), 0.0002 (\*\*\*), <0.0001 (\*\*\*\*).

### **Ethics approval**

The study was approved by the King Khalid University Ethical Committee, and no personal information such as name, age, social status or any other sensitive data were disclosed.

## **Results**

A total of 43 students were male and 72 were female were included. Twenty-seven male students and 33 female students were included in the first semester (January–April 2019 semester). Sixteen male students and 39 female students were considered in the second semester (September–December 2019 semester). These figures constitute the entire sections without exclusion to reduce any bias. The questions were unified to both sections, and all teaching materials during the course period were the same to prevent any partiality to any of the sections. There were specific rubrics to the subjective questions of the course that were helpful during the correction process to ensure fair scoring. There were individual differences in their participation during the course. This raises many questions such as the involvement of gender, self-learning, intelligence and cognitive skills. In this study, absenteeism during the entire course period was considered to answer the main question regarding achievements and whether gender plays a role or not.

Figure 1 and 2 show the correlation between individual absences and grades. Correlation coefficient in both male and female sections showed negative values ( $r = -0.5945$  for the first semester /  $r = -0.5555$  for the second semester for males; and  $-0.2269$  /  $-0.2328$  for females respectively). This indicates an inverse relationship between academic degree and absence rate. This seems to be a general statement, and there are indeed variations among students when taken individually. In the first semester, the student with 0% absenteeism rate has got the highest overall grade (Fig. 1 C). But in the second semester, the student with the highest grade has had an absenteeism rate of 13% which indicates that there are individual variations. Then, statistical significance of this correlation was calculated for the entire sections to gain

more insight. To align absence versus scores,  $r^2$  was calculated to determine the best-fit regression line. Males correlations were 0.3534 and 0.3086 for two consecutive semesters. However, females  $r^2$  were 0.0515 and 0.05421 consecutively (Fig. 1 and Fig. 2). It is striking to find very close digits per gender in each of the semesters that is worth discussing in details.

Relying on  $r^2$  alone cannot guarantee a precise judgment on the reasonability of correlation. Therefore, the  $p$  value was calculated in a further statistical analysis. A statistical difference between the academic achievement versus absence was found with males students (\*\* $p= 0.0011$ ; for the first semester and \* $p= 0.0255$ ; for the second semester) but not the female students ( $p= 0.2041$ ; for the first semester and  $p= 0.1537$ ; for the second semester).

Having girls persistently maintained higher marks on average, the irrelevance of absenteeism effect on their marks provides some of the answers needed to demystify the reasons behind their high overall grades. But many factors were difficult to investigate in this study. A proposed answer could be in their motivation, punctuality and enthusiasm to excel academically.

## Discussion

As a matter of fact, numerous factors interfere with the learning process in the academic arena along with the positive learning environment. The reasons that motivate gender differences in academic medicine is less understood. Didactic teaching in medical sciences and the impact of active learning and interaction are all essential in teaching and learning especially in the medical field. Academic programs at King Khalid University are seeking the national academic accreditation from the National Center for Academic Accreditation and Assessment (NCAAA) to improve the quality of teaching and learning. Therefore, teaching staff members at the University devote considerable attention to the learning and teaching standards.

Academic achievements can be measured by various approaches. With respect to gender, Valli Jayanthi *et. al.*, 2014 measured academic performance using cGPA (cumulative grade point average) and showed that students' grades are affected by gender as well as other factors such as extracurricular activities, nationality and age [25]. In this study, students were assessed based on a variety of criteria such as written assignments, practical reports, Midterm and final examinations. Practical sessions involved psychomotor skills such as aspirating minute volumes in microliters using manual pipettes and assessed using criteria such as their accuracy of pipetting with low error rate. Despite that the findings of this investigation are based on the cumulative scores of the semester, their skill ability constituted few scores as part of the practical reports. Therefore, they are not considered as basis for gender difference in this investigation, although a study assessed the spatial ability of medical students versus scores and observed gender variation [26].

Understanding gender disparity in the academic field would help in selecting candidates for professions. Despite that there was no gender difference in students' performance on computer-based examinations

[27], gender-based disparity was studied and proved in medical education and in non-cognitive factors [28–32]. A study has shown that student ability in computer-based examinations were not affected [27]. Although the research by Kies *et al.* 2006 did not find evidence to support the hypothesis that medical students vary in their performance based on gender, the opposite was proved in this study in paper-and-pencil exams after analyzing the results of medical sciences students of two sections assessed in two different semesters. Examinations were in paper-based formats that constituted a major part of the overall grades.

Having a correlation coefficient with negative values in male and female sections alike supports the common belief that absenteeism negatively affects academic achievements. But further statistical analysis provided better insight on the plausibility of such correlation especially taking gender into account. Having similar results among the two sections, the observed reproducibility may assert the gender difference in academic achievement.

The effect of absence on academic achievements were summarized by O'Dea *et al.*, 2018 using teacher-assigned grades [33]. Here, subjective assessments of answers such as short essay questions and multiple-choice questions framed according to the course learning outcomes are all considered to analyze the impact of absenteeism rates on the overall grade. Having found a gender-wise similarity in results in two consecutive semesters can refer to consistency in teaching as explained in the context of accreditation standards, and support the hypothesis that female students are more productive and better presented than their male counterparts in medical sciences with gaps in the factors that drive this influence [34,35]. As the process of assessing the quality of teaching and learning is underway for the purpose of national accreditation, accreditation standards were applied including learning outcomes evaluation using rubrics, performance indicators, and updating course learning outcomes to be aligned with the program outcomes. Contradictory findings regarding assessment scores in medical education exist [36,37], and this research article attempts to provide a piece of the puzzle.

In Latif Khan *et al.*, 2020 study to investigate absenteeism as a principal outcome variable, 404 male and female students were included. They concluded that this influence disappeared when panel data predictors were incorporated. They correlated class attendance with the final exam scores [19]. In contrast, they did not clearly discuss gender variation in their conclusion. In another study to investigate class attendance of second-year dermatology students, they did not find a statistically significant correlation between performance on the final examination and attendance. No negative consequences of absenteeism on academic performance was found except in active learning sessions. Their study was limited by high mean score and small sample size [38]. On the other side, they provided valuable conclusion that attendance did not improve dermatology students to perform better compared with watching online videos. Likewise, gender was not discussed. However, female mean score was higher than male students (87 versus 85 respectively).

## Limitations

These data were from a single University. Another shortcoming is that teaching staff members assessment differ among each other and student self-evaluation versus their assessment by instructors can vary to some extent [39]. These differences in assessment can contribute to somewhat unwanted effects in the analysis of students using their scores. One limitation of this study is that the paper does not answer specific questions regarding the causation or the actual factors interfered. But on the other hand, it provides a significant gender difference in the academic excellence proved in two separate semesters with limited role of absenteeism on female students. It is also difficult to correlate between absence and motivation. Lower-performing students versus high-performing students along with absenteeism rates are variables that can be tedious to correlate in a study. For instance, an excellent student might struggle to maintain high level of attendance, and vice versa. Having these drawbacks in consideration, two sections were studied over two consecutive semesters with unified teaching method to mitigate some of the downsides. It is unknown whether this observation would be reproduced in other specialties outside the medical field. Surely, further research is required to consolidate these findings.

## Conclusions

By analyzing the total academic scores of two academic semesters of medical sciences students, a gender variation was observed in terms of academic grades that were inversely proportional with absenteeism in male students but apart from absenteeism rate in female students. Gender was a confounding variable to the effect of absenteeism on scores. Other lurking variables were difficult to investigate such as their behavioral and personal characteristics. Many interfering factors were proposed to either predict a causation possibility or implicate other factors such as student's punctuality, IQ, self-learning, motivation, perseverance, effort and cognitive ability. Having data from two academic semesters investigating one independent variable might help to provide sound evidence. It can be concluded that absenteeism is a negative predictor for males but not females studying medical sciences.

## Abbreviations

cGPA: cumulative grade point average; IQ: intelligence quotient; MCQs: multiple-choice questions; NCAAA: national center for academic accreditation and assessment

## Declarations

### Ethics approval and consent to participate

The Ethical Committee of the Scientific Research, King Khalid University approved the study (approval number: ECM#2020-183-( HAPO-06-B-001) to use scores and absence rates, with no personal information of students disclosed.

### Consent for publication

Consent to publish is not applicable.

## **Availability of data and materials**

The datasets used and/or analyzed during the current study are available upon reasonable request to the author.

## **Competing interests**

No competing interest.

## **Funding**

No funding was obtained for this study.

## **Author's contribution**

AH designed the study, collected the data, performed the statistical analyses, and drafted, edited and approved the final manuscript to be submitted. There are no other individuals who qualify as authors.

## **Acknowledgements**

Not Applicable.

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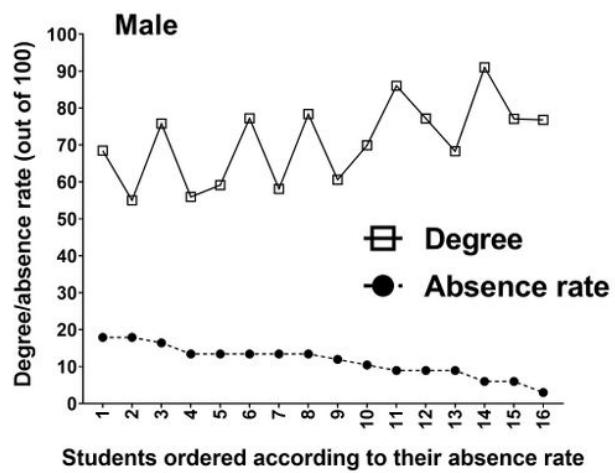
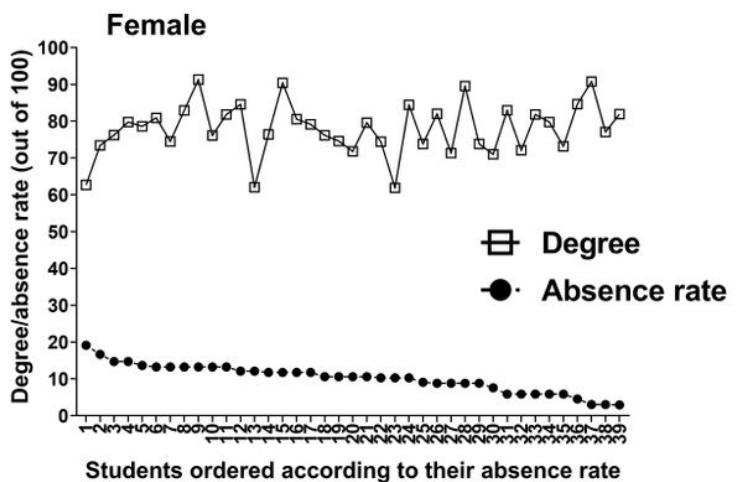
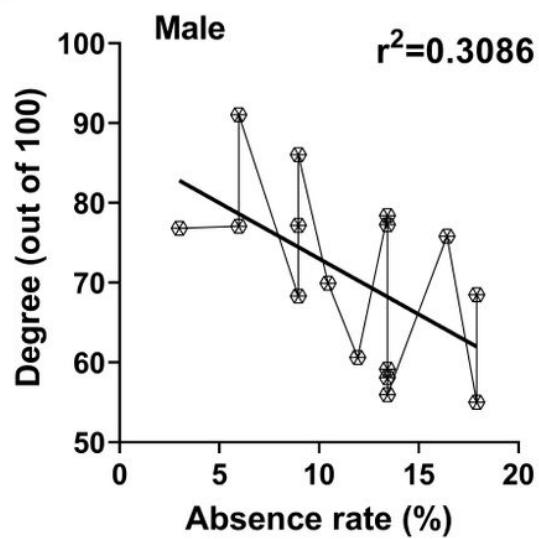
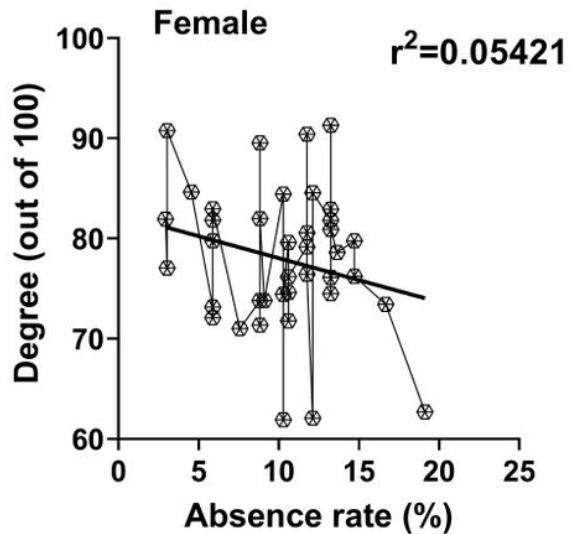
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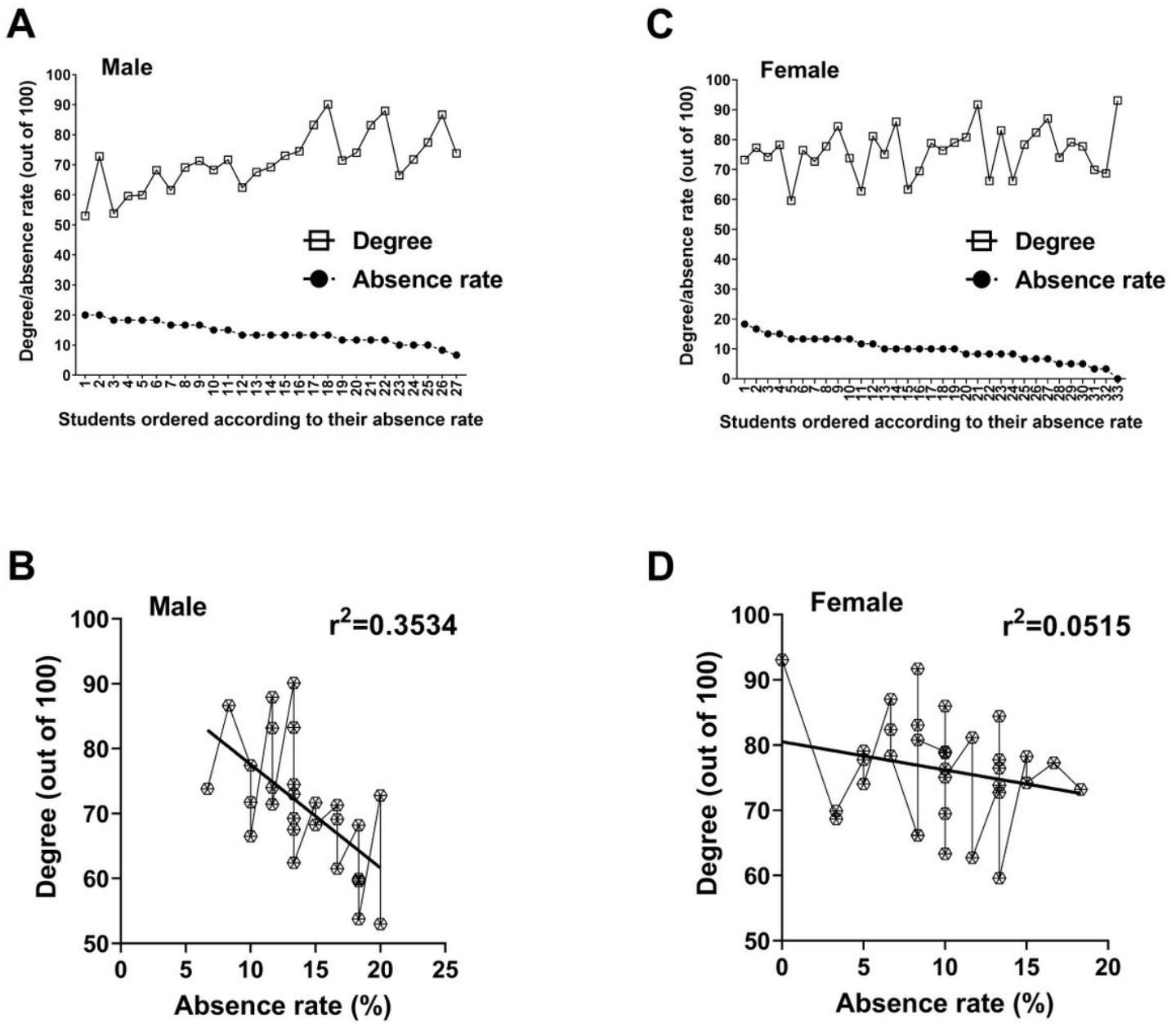
## Tables

**Table 1** Combined reports of exam analyses and the students' mean scores

| Year                                      | Mean<br>(sample size) |                 | P value<br>(unpaired t test) |
|---|-----------------------|-----------------|------------------------------|
|   | Male                  | Female          |                              |
| Semester I (September – December) 2019    | 70.94<br>(n=16)       | 77.93<br>(n=39) | **** <0.0001                 |
| Semester II (January – April)<br>2019     | 71.18<br>(n=27)       | 76.30<br>(n=33) |                              |
| Semester I (September – December)<br>2018 | 71.37<br>(n=18)       | 79.02<br>(n=23) |                              |
| Semester II (January – April)<br>2018     | 69.56<br>(n=17)       | 77.86<br>(n=28) |                              |
| Semester I (September – December)<br>2018 | 70.25<br>(n=12)       | 80.25<br>(n=16) |                              |

## Figures

**A****C****B****D****Figure 1**



**Figure 2**

Absence rates versus students' degrees with correlation (January – April 2019 section). Boys show a significant correlation between absence and scores (A and B) whereas a less dependent relationship between the two variables are found with girls (C and D). Boys students: n=27; Girls students: n=33