Review Article

The prevalence and risk factors of microcytic hypochromic anaemia among students in the Kingdom of Saudi Arabia. A mini-review study

Salah Bakry[1], Mohamed A. Elhefny[2, 3]

[1]Faculty of Medicine, Umm Al-Qura University, Makkah city, Saudi Arabia.
[2]Department of Medical Genetics, Faculty of Medicine, Umm Al-Qura University, Al-Qunfudah, Saudi Arabia.
[3]Department of Cancer and Molecular Biology, NCI, Cairo University, Cairo, Egypt

ABSTRACT

Background/aims: Anaemia encompasses a significant challenge to public health globally as well as nationally. The current study aimed to estimate the prevalence and risk factors of microcytic hypochromic anaemia among school and university students in Saudi Arabia. Materials and methods: PubMed and Google Scholar search from 2002 until 2021 were utilized for the data obtained. Overall, 56 articles were reviewed and critically appraised based on the eligibility criteria, and relevant articles were selected. Results: Fourteen studies were identified. The prevalence of anaemia among school students ranged from 11.6% to 23%, whereas the prevalence among university students ranged from 12.5% to 64%. Age, gender, mother's education, BMI, smoking status, and occupational status were associated with the prevalence of anaemia. Furthermore, lifestyle, dietary habits, haemostatic defects, menorrhagia, high altitude, and physical activity were also correlated with the prevalence of anaemia. Conclusion: A relatively high prevalence of anaemia was found among school and university students.

Keyword: Anaemia, Microcytic Hypochromic Anaemia, Prevalence, Risk factors, Students, Saudi Arabia.

Introduction

Anaemia is a global health burden affecting about 1.62 billion individuals internationally, 24.8% of the worldwide population, according to the World Health Organization [1, 2, 3]. It thus influences all countries' social and economic development [1, 2]. Anaemia is common in people at any stage, but pregnant women and young children are especially vulnerable, increasing the likelihood of cognitive and physical development impairment and mortality and morbidity [4, 5]. Despite the fact that there are numerous anaemia etiologies, iron deficiency anaemia is unquestionably the most frequent cause of anaemia development [1, 3]. There are further subtypes of microcytic hypochromic anaemia, including sideroblastic anaemias (SAs) and anaemia of chronic disease (ACD) [6]. ACD may arise as a result of Autoimmune diseases, prolonged renal failure, infections, or cancers [7]. Contrarily, SAs share the characteristics of disturbed iron use in the erythroblast, inefficient erythropoiesis, and fluctuating systemic iron excess [8]. SAs can also be hereditary or acquired. In addition, thalassemia and lead poisoning are separate kinds of microcytic hypochromic anaemia [6]. Studies have shown that adolescents are more likely to develop anaemia due to the increased Fe demand throughout puberty, menstrual losses, inadequate dietary intake of Fe, and poor eating habits [9]. Herein, the current study aimed to determine the national prevalence and risk factors of varieties of microcytic hypochromic anaemia among school and university students by conducting a comprehensive literature review.

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Address for correspondence: Salah Mohammed Taha Bakry, Faculty of Medicine, Umm Al-Qura University, Makkah city, Saudi Arabia.
E-mail: salah.m.bakry@gmail.com

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Methods

We utilised PubMed and Google Scholar from 2002 to September 2021 to obtained data for the current review. The search terms included the following keywords: "Anaemia", "students", "prevalence", "risk factors", "Saudi Arabia", "Kingdom of Saudi Arabia", "KSA". All research designs were reviewed for references to selected papers that cited identified articles. The eligibility criteria included school and university students diagnosed with microcytic hypochromic anaemia using one of the diagnostic criteria. Additionally, articles addressing the prevalence of anaemia and its risk factors among school and university students in Saudi Arabia were included in this review. This systematic review did not include research conducted in hospitals or on individuals who visit outpatient clinics. Fifty-two articles were critically evaluated, and the most relevant articles were used. Finally, the eligibility criteria were stratified in 14 studies. The review studies' findings were discussed. Rates among similarly aged students and other studies on public health were identified and used for the discussion.

Results

After searching and conducting a critical appraisal of the articles, 14 studies were selected for the systematic review [10-24]. A summary of these studies is presented in Table 1.

Discussion

The prevalence in the current review differed according to the type of anaemia. For example, concerning school students, the reported prevalence was 20.5% in the study of Abalkhail and Shawky 2002 [10], 11.6% in Abou-Zeid, et al. 2006 [11], and 23.0% in Gari 2008 [12]. For university students, on the other hand, a prevalence of 64% was reported in the study of Al Hassan 2015 [14]; of these patients, 45% had mild anaemia, 49% moderate, and 6% severe. Elderdery, et al. 2016 [15] reported a prevalence of 32%, whereas Alzaheb and Al-Amer 2017 [17] reported an anaemia prevalence of 12.5%. Furthermore, Alhazmi, et al. 2018 [18] reported an overall prevalence of 28.4%. Additionally, Al-Jamea, et al. 2019 [20] reported an anaemia prevalence of 35.3%, while Alkhaldy, et al. 2020 [21] reported 63% and Hamali, et al. 2020 [22] reported that the rate of anaemia was only 4.70% among male students but 67.35% among females. Moreover, Owaidah, et al. 2020 [23] stated an anaemia prevalence of 33.9%, while Bakr, et al. 2021 [24] reported an overall prevalence of 39.28%. The majority of the studies revealed a high prevalence of anaemia among university students [14,15,18,20,21,23,24]. This in agreement with Shill, 2014 [25], which reported 55.3% of students have anaemia, while Al-Alimi, 2018 [26] stated an anaemia prevalence of 30.4%.

Several studies have found that age is a significant risk factor correlated with anaemia. Abalkhail and Shawky 2002 [10] revealed that 12-year-olds and older are at a high risk of developing anaemia; however, anaemia is more likely to affect growth in children aged 6–14 years according to the study of Abou-Zeid, et al. 2006 [11]. Furthermore, Gari 2008 [12] stated that iron deficiency anaemia in school students appears high, particularly among those aged 10–12 years. Moreover, gender represents risk factors of anemia; the majority of studies revealed that females are at a greater risk of developing anemia, as shown in (Table 1). Several studies reported a higher proportion of males over females being anaemic [27-32]. However, Gupta, 2008 [32] revealed that anaemia appears more in females due to menarche. Mother's education represents one of the risk factors of anaemia as well according to Abalkhail and Shawky 2002 [10] and Alhazmi, Alenezi et al. 2018 [18]. Both studies revealed a correlation between mother's education and the prevalence of anaemia [10-11]. This is strongly consistent with several studies such as [33-36]. Additionally, a single study report that students' body mass index (BMI), smoking and occupational statuses could represents a risk factors for anaemia developing among students [18]. An important risk factors includes lifestyle and dietary factors have been documented by several studies. Abalkhail and Shawky 2002 [10] revealed that skipping breakfast, eating few fruit and vegetables, and eating too much junk food are substantially correlated with an increased prevalence of anaemia; however, Abou-Zeid, et al. 2006 [11] stated that malnutrition is a significant health problem among those children, as assessed by anthropometric measurements. Additionally, Al Hassan 2015 [14] noted that the high prevalence of iron deficiency anaemia might be linked to the lifestyle of female students and their dietary habits. Similarly, Elderdery, et al. 2016 [15] reported that low-quality meals containing animal products are positively correlated with the presence of iron deficiency. Correspondingly, Alzaheb and Al-Amer 2017 [17] concluded that inadequate intakes of iron and vitamin C, frequent tea consumption, and infrequent red meat consumption are related to contracting anaemia. Additionally, Alhazmi, et al. 2018 [18] found that eating red meat as well as consuming fast food and soft drinks weekly are significantly correlated with anaemia. Al-Jamea, et al. 2019 [20] stated that the development of IDA is significantly reduced when having a regular breakfast. Furthermore, Alkhaldy, et al. 2020 [21] stated that low-quality meals containing animal products are associated with anaemia, while Hamali, et al. 2020

Table 1: Studies' summary of the included studies in the current review.

Author(s)	**Year**	**Sample sized**	**Target population**	**Target students**	**Prevalence**	**Diagnostic tool [administration]**
(Abalkhail and Shawky 2002) [10]	2002	800	Males and females	School students	20.5%	structured questionnaire [person interview]
(Abou-Zeid, Abdel-Fattah et al. 2006) [11]	2006	513	Males and females	School students	11.6%	questionnaires and Collect laboratory sample
(Gari 2008) [12]	2008	123	Females	School students	23.0%	Collect laboratory sample
(Zolaly, Hanafi et al. 2012) [13]	2012	557	Males and females	Saudi school students	-	questionnaire, Collect laboratory sample
(Al Hassan 2015) [14]	2015	268	Females	female universities students	64%	Collect laboratory sample
(Elderdery, Alshaiban et al. 2016) [15]	2016	198	Females	female college students	32%	Collect laboratory sample
(Hassaein, Wahdan et al. 2016) [16]	2016	49	-	female college students	-	
(Alzaheb and Al-Amer 2017) [17]	2017	200	Females	Saudi female college students	12.5%	questionnaires and Collect laboratory sample
(Alhazmi, Alenezi et al. 2018)[18]	2018	675	Males and females	shopping mall, University and a central blood ban	28.4%	interview based questionnaire and using HemoCue devise

(Kabel, Al Thumali et al. 2018) [19]	2018	1066	Males and females	University students	-	history taking , clinical examination, and laboratory sample
(Al-Jamea, Woodman et al. 2019)[20]	2019	485	Females	University students	35.3%	questionnaires and Collect laboratory sample
(Alkhaldy, Hadi et al. 2020) [21]	2020	200	Females	female medical student	63%	structured questionnaire [send by e-mail]
(Hamali, Mobarki et al. 2020) [22]	2020	134	Males and females	University students	Male: 4.70%, Female: 67.35%	questionnaire, Collect laboratory sample and screening tests
(Owaidah, Al-Numair et al. 2020) [23]	2020	981	Males and females	University students	33.9%	questionnaire, Collect laboratory sample
(Bakr, Almutairi et al. 2021) [24]	2021	463	Females	Saudi female college students	39.28%	standardized questionnaire, Collect laboratory sample and screening tests

[22] reported the influence of a low dietary iron intake and irregular meal consumption. Correspondingly, a recent review described and discussed the correlations among nutritional, dietary habits, and lifestyle factors in the risk of adolescents developing anaemia [37].

Haemostatic defects and menorrhagia are reported as factors in developing anaemia as well according to Bakr, et al. 2021 [24]. Similarly, the study of Friberg, 2006 [38] reported that heavy menstrual bleeding is frequently reported in 37% of school students. High altitude has been reported to be a risk factor for anaemia, according to [19,21]. This issue was previously addressed by several studies [39-40]. According to Cook JD et al., 2005 [40], the impact of high altitude on iron storage and haematological parameters cannot be overlooked. The hypoxia-induced erythropoiesis will use the iron storage until it is exhausted [21]. To improve iron absorption and release from the storage, erythropoiesis stimulates the formation of erythroferrone, which suppresses hepcidin [21]. Moreover, physical activity is reported as one of the possible risk factors for anaemia and has a significant relationship with IDA [20]. A published case report suggests that exercise-induced anaemia should be explored in young female adults with unexplained IDA [41]. Strength of evidence, to our knowledge, the current systematic review is the first that compares the anaemia prevalence and its risk factors among school and university students in Saudi Arabia.

Limitations of Study

The conducted search strategy were carried out only in two databases. Furthermore, our study did not strictly compare the risk factors between school and university students. Additionally, it did not explain the diagnostic criteria of anaemia in detail. Moreover, the current study focused on studies conducted on students only. In addition, there is no quality assessment to the included studies.

Conclusion

The current review suggests that anaemia is highly prevalent among school and university students. Social-demographic characteristics such as age, gender, mother's education, BMI, smoking status, and occupational status are strongly correlated with anaemia development. Additionally, lifestyle, dietary habits, hemostatic defects, menorrhagia, high altitude, and physical activity were also correlated with the prevalence of anaemia. Therefore, annual screening of anemia is recommended in schools and universities for anaemia detecting.

Conflict of Interest

None

Funding

None

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