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Study the prevalence of Human Respiratory Syncytial Virus among children with respiratory tract infection in Kirkuk city/Iraq

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A B S T R A C T

Humen Respiratory Syncytial Virus (HRSV) causes acute respiratory tract infections in newborns and young children, which can result in serious consequences.. **The aim** of the study was to investigate the prevalence of HRSV in children below 5 years with respiratory infections and understand its correlations with demographic parameters. **The study** involved 180 children with Respiratory tract infections aged between 2 months to 5 years. Serum specimens were collected and screened for HRSV IgM and IgG antibodies using enzyme-linked immunosorbent assay (ELISA) kits. **The Results** showed that Humen respiratory synsycial virus IgM antibody found in 37(20.55%), with a significant correlation with age (P<0.05). While, Humen respiratory synsycial virus IgG antibody was positive in 29(16,11%) patients. , Humen respiratory synsycial virus IgM positivity was higher among children with allergies (72.97%), asthma (8.11%), bronchitis (18.92%). Also, children living in smoking environment had the highest positivity rate of IgM (62.16%) and IgG (62.07%). High IgM and IgG antibodies were recorded in patients with wheezing chest, and on mechanical ventilator P<0.05. **In conclusion**, the study demonstrate seroprevlance of HRSV infection in children with RTIs.

Introduction

Upper respiratory tract infections (URIs) and lower respiratory tract infections (LRIs) are the two types of acute respiratory infections (ARIs). The upper respiratory system includes the paranasal sinuses and the middle ear [1]. It goes from the nose to the vocal cords in the larynx. The lower respiratory system is made up of the bronchioles and alveoli, which are where the airways continue from the trachea and bronchi [2]. ARIs don't just affect the respiratory tract; they can have effects on the whole body because infections or bacteria toxins can spread, causing inflammation and decrease lung function. Diphtheria, whooping cough, and measles are all diseases that can be avoided by getting a vaccine. They may affect the respiratory system, but they can also affect other parts of the body [3]. 2–3% of pediatric patients with HRSV infection are admitted to the hospital because of Acute Respiratory Distress Syndrome. About 45% of hospital admissions and deaths due to HRSV-ALRI happen in children younger than 6 months. A severe HRSV infection in babies and young kids is linked to long-term wheeze, asthma, and a loss of lung function by the time the child is in school. It's not clear what effects viral factors have on the body when HRSV is present, and it's not clear if there are links between different subtypes and genes and how bad the disease is. People often get respiratory viruses and bacteria at the same time, but there isn't agreement on how the extra infection with another pathogen affects the seriousness of the disease caused by HRSV [4], [5], [6]. Respiratory syncytial virus (HRSV) is a common virus that people of all ages get in the winter. In 1957, HRSV was first found in children with lung problems. When first discovered, the virus was called the "chimpanzee coryza virus." However, because it could cause cells to fuse together in tissue culture to form bigger cells without any internal cell boundaries, it was later named the "respiratory syncytial virus [7]. The nasopharynx is where HRSV starts to replicate, and symptoms of a lower respiratory tract infection (LRI) usually show up one to three days after the first sign of a cold. It's likely that secretions are what help the virus get to the lower respiratory system. In babies who are hospitalized with HRSV disease, the contagious virus is shed in their nasal secretions, where it can reach high levels of 10^4 to 10^6 infectious units per ml. Some babies keep shedding the virus even after they leave the hospital, and some may keep shedding for weeks after they are fully recovered [8,9]. By avoiding human antibodies, the formation of syncytia lets the virus spread. Human HRSV is an RNA virus with a negative sense capsid. It is in the family Paramyxoviridae and the genus Pneumovirus [10].

The aims of the study are:

The aim of the current study was to investigate the prevalence of Respiratory Syncytial Virus (HRSV) in children below 5 years in Kirkuk city

Materials and Methods

Ethical approval

- The study proposal was approved by the council of Northern Technical University's College of Health and Medical Techniques. kirkuk
- The Director of Health in Kirkuk gave approval clearance,issue number 600 in date 19/9/2023 . Prior to the advancement of the sample process, all participants provided written consent.

Inclusion Criteria:

1. Children diagnosed with chest infection.
2. Age below 5 years old.

Exclusion criteria:

1.Individuals outside the specified age range >5 years were excluded.
2.Patients without symptoms indicative of acute respiratory infection.
3.Patients without comprehensive clinical data, including X-ray and detailed symptom assessments and laboratory data.
4.Participants with underlying medical conditions or that could confound the study's focus on respiratory infections.

Methodology:

From October 10, 2023, to February 10, 2024, a cross-sectional study was carried out at the Pediatric Hospital in Kirkuk City. There were 180 kids between the ages of 2 months and 5 years old who had RTIs and had runny noses, coughing, and fevers. Patients data were obtained via aquetionaire form and 4ml of whole blood was drawn from each patient, the sera was then separated and used to test Human Respiratory Syncytial Virus (IgM) and (IgG) antibodies using the enzyme-linked immunosorbent assay (ELISA) method (Sunlong Biotech Co., Ltd.).

Statistical analysis:

The statistical software SPSS (ver. 23) was used to conduct computerized statistical analysis. In which the Chi-square test was used to perform comparisons. P values greater than 0.05 were regarded as statistically significant.

Results and discussion

Our data revealed that IgM+IgG- seropositive was recorded in 20.55%, while IgM-IgG+ was found in 16.11 .On the other hand IgM-IgG- was presented in 63.34% as depicted in Table 1.

Table 1: Seroprevalence of HRSV among children with respiratory infection

HRSV antibodies results	No(%)
IgM +ve and IgG –ve	37(20.55%)
IgM -ve and IgG +ve	29(16.11%)
IgM -ve and IgG –ve	114(63.34%)
Total	180 (100%)

HRSV IgM positivity ranged from 5.41% to 40.54% across age groups in the current study, while HRSV IgG positivity varied from 9.93% to 55.17%. Notably, age and HRSV IgM positivity were significantly correlated (p=0.0120). Gender-wise, there was no statistically significant difference in HRSV IgM positive (32.43% in females and 67.57% in males; p=0.8214). HRSV IgM positivity was found in 27.03% of rural and 72.97% of urban areas, based on place of residence; however, this difference was not statistically significant (p=0.1730)., Table Two

Table 2: Distribution of HRSV seroprevalence among children with respiratory infection regarding demographic factors

General properties		HRSV IgM (n=180)		HRSV IgG (n=180)		P-value
		Positive	Negative	Positive	Negative	
Age	0-12	15(40.54%)	30(20.98%)	16(55.17%)	29(19.21%)	0.0120
	13-24	6(16.22%)	28(19.58%)	4(13.79%)	30(19.87%)	
	25-36	5(13.51%)	18(12.59%)	3(10.34%)	20(13.25%)	
	37-48	2(5.41%)	16(11.19%)	3(10.34%)	15(9.93%)	
	49-60	9(24.32%)	51(35.66%)	3(10.34%)	57(37.75%)	
	Total	37(100%)	143(100%)	29(100%)	151(100%)	
Gender	Male	25(67.57%)	84(58.74%)	18(62.07%)	91(60.26%)	0.8214
	Female	12(32.43%)	59(41.26%)	11(37.93%)	60(39.74%)	

	Total	37(100%)	143(100%)	29(100%)	151(100%)	
	Rural	10(27.03%)	41(28.67%)	7(24.14%)	44(29.14%)	0.1730
Residence	Urban	27(72.97%)	102(71.33%)	22(75.86%)	107(70.86%)	
	Total	37(100%)	143(100%)	29(100%)	151(100%)	

The Chi-square test was used to perform comparisons

Regarding feeding habit, bottle-feeding exhibited the highest HRSV IgM positivity at (24.32%), followed by solid food intake (any comsumable food apart from milk)at 59.46%. Similarly for IgG, bottle feeding and edible-feeding(solid food intake) children showed higher positivity rates (37.93%),(48.28%) respectively compared to breast feeding and mixed feeding (10.34%) and (3.45%) consequently. No significant differences were reported with P>0.05 utilizing Chi square test. As demonstrated in Table 3.

Table 3: Distrubution of the studied sample according to the type of feeding in relation to respiratory infection cause by HRSV

Type of feeding	HRSV IgM		HRSV IgG	
	Positive	Negative	Positive	Negative
Bottle-Feeding	9(24.32%)	29(20.28%)	11(37.93%)	27(17.88%)
Exclusive /Breast feeding	4(10.81%)	12(8.39%)	3(10.34%)	13(8.61%)
Mixed feeding	2(5.41%)	7(4.90%)	1(3.45%)	8(5.30%)
Edible food(solid food intake)	22(59.46%)	95(66.43%)	14(48.28%)	103(68.21%)
Total	37(100%)	143(100%)	29(100%)	151(100%)
P-value	0.6353			

Our data illustrated that among children with allergies, HRSV IgM positivity was observed in 72.97% of cases, while HRSV IgG positive was 68.96%. For children with asthma, HRSV IgM positivity was 8.11%, and HRSV IgG positivity was 3.45%. Similarly, in children diagnosed with bronchitis, HRSV IgM positivity was 18.92%, with HRSV IgG positivity at 27.59%. However, statistical analysis did not reveal significant difference between the groups (p=0.6821), Table 4.

Table 4: Distribution of HRSV Seroprevalence among children with respiratory infection according to associated lung disease

Lung disease	HRSV IgM		HRSV IgG	
	Positive	Negative	Positive	Negative
Bronchitis	7(18.92%)	37(25.87%)	8(27.59%)	36(23.84%)
Asthma	3(8.11%)	5(3.45 %)	1(3.45%)	7(4.64%)
Allergy	27(72.97%)	101(70.62%)	20(68.96%)	108(71.52%)
Total	37(100%)	143(100%)	29(100%)	151(100%)
P-value	0.6821			

The data displayed here indicated that children whose mothers were illiterate had HRSV IgM was highest (48.65%), while IgG recorded 62.07%. Similarly, in children whose mothers having primary education, HRSV IgM presented in 32.43%, and IgG 27.59%. Whereas, among children with educated mothers HRSV IgM positivity was 8.11%, and HRSV IgG positivity recorded 6.90%. No significant difference was noted between maternal education (p=0.3411), Table 5

Table 5: Relation of mother education to HRSV prevalence

Mother education	HRSV IgM		HRSV IgG	
	Positive	Negative	Positive	Negative
Illiterate	18(48.65%)	71(49.65%)	18(62.07%)	71(47.02%)
Primary	12(32.43%)	39(27.27%)	8(27.59%)	43(28.48%)
Secondary	4(10.81%)	15(10.49%)	1(3.45%)	18(11.92%)
College	3(8.11%)	18(12.59%)	2(6.90%)	19(12.58%)
Total	37(100%)	143(100%)	29(100%)	151(100%)
P value	0.3411			

(The classification of educational level was based upon Iraqi demographic level of education).

Regarding smoking profile, our research illustrated that among children living in smoking households, HRSV IgM recorded 62.16%, and IgG 62.07%. Equally, in household of nonsmokers, HRSV IgM was slightly lower (37.84%) and IgG 37.93%. However, no statistical difference was noted between the groups with P>0.05 , Table 6

Table 6: Association of smoking with HRSV infection

smoking in family	HRSV IgM		HRSV IgG	
	Positive	Negative	Positive	Negative
Yes	23(62.16%)	94(65.73%)	18(62.07%)	99(65.56%)
No	14(37.84%)	49(34.27%)	11(37.93%)	52(34.44%)
Total	37(100%)	143(100%)	29(100%)	151(100%)
P-value	0.2408			

Our data regarding the symptoms associated with HRSV antibodies illustrated that certain clinical features exhibit statistically significant associations with HRSV seroprevalence. For instance, children presenting with cough showed higher HRSV IgM positivity (72.97%) compared to those without cough (27.03% (p-value : 0.0472). In the same way, children with wheezing demonstrates significant association with HRSV IgM positivity (81.08%), with a p-value of 0.0120. Additionally, the use of mechanical ventilators is associated with increased HRSV IgM positivity (48.65%) P value 0.0164, Table 7.

Table 7: Distribution of HRSV seroprevalence among children with respiratory infection according to clinical features.

Clinical features		HRSV IgM		HRSV IgG		P-value
		Positive	Negative	Positive	Negative	
Fever	Yes	31(83.78%)	111(77.62%)	26(89.66%)	116(76.82%)	0.7121
	No	6(16.22%)	32(22.38%)	3(10.34%)	35(23.18%)	
Cough	Yes	27(72.97%)	99(69.23%)	23(79.31%)	103(68.21%)	*0.0472
	No	10(27.03%)	44(30.77%)	6(20.69%)	48(31.79%)	
Wheezing	Yes	30(81.08%)	80(55.94%)	23(79.31%)	87(57.62%)	*0.0120
	No	7(18.92%)	63(44.06%)	6(20.69%)	64(42.38%)	
Shortness of breathing	Yes	19(51.35%)	70(48.95%)	15(51.72%)	74(49.01%)	0.1858
	No	18(48.65%)	73(51.05%)	14(48.28%)	77(50.99%)	
runny nose	Yes	19(51.35%)	87(60.84%)	17(58.62%)	89(58.94%)	0.1963
	No	18(48.65%)	56(39.16%)	12(41.38%)	62(41.06%)	
Vomiting	Yes	15(40.54%)	60(41.96%)	10(34.48%)	65(43.05%)	0.4517
	No	22(59.46%)	83(58.04%)	19(65.52%)	86(56.95%)	
Diarrhea	Yes	16(43.24%)	50(34.97%)	13(44.83%)	53(35.10%)	0.1550
	No	21(56.76%)	93(65.03%)	16(55.17%)	98(64.90%)	
Chill	Yes	33(89.19%)	59(41.26%)	23(79.31%)	69(45.70%)	*0.01300
	No	4(10.81%)	84(58.74%)	6(20.69%)	82(54.30%)	
mechanical ventilator	Yes	18(48.65%)	39(27.27%)	14(48.28%)	43(28.48%)	
	No	19(51.35%)	104(72.73%)	15(51.72%)	108(71.52%)	*0.0164
	Total	37(100%)	143(100%)	29(100%)	151(100%)	

Discussion

The assessment of HRSV in RTI and its connection to the socioeconomic status of patients are the subjects of the current investigation. According to our results 20.55% of patients had positive IgM antibodies but negative IgG, while 16.11 percent of patients had IgM- and IgG+. This result is consistent with a prior study by Odisho et al. [11], which discovered that anti-HRSV antibodies were present in 26% of the children under investigation. Furthermore, 40% of children were reported to be seropositive by Shuwaikh et al. [12]. HRSV

was detected in several parts of Iraq in 2015, 2018, and 2019 at 17%, 55.91%, and 17.33%, respectively [13], [14], [15]. A study that included patients and was carried out in Turkey found that the positive rate of HRSV was 19.0% [16]. Our data on sero positive shows a prevalence of HRSV among young children, which is incorrectly diagnosed as a difficult chest infection or the common cold since the virus is not routinely screened for as a cause of respiratory tract infections (RTIs), giving viruses an incorrectly high prevalence in the nation. According to the results of the current investigation, the age group with HRSV IgM (40.54%) and IgG (55.17%) antibodies that was most affected was 0–12 months. The study also discovered that the percentage of males who tested positive for HRSV IgM was 67.57%, compared to 32.43% for females. The positivity rate was likewise greater in urban regions (72.97%) and lower in rural areas (27.03%). In agreement with these results, Shuwaikh et al. [12] discovered that the age group was more vulnerable to infection between 7 and 12 months for HRSV at a rate of 25% and that respiratory syncytial virus antibodies were 42% in females and 38% in males. Additionally, Odisho et al. [11] discovered that children under the age of a year had the largest percentage of positive HRSV antibodies, with both rural and urban locations having greater positivity rates. These gender differences could be explained by the small number of patients who were included in our and previous research. Transplacentally acquired immunity may also help to prevent infection during the first six months of life, which could explain the high risk of HRSV infection in children ages 0 to 12 months. Infants are usually more susceptible to infections because of their relatively underdeveloped adaptive immune system as compared to older children and adults. Furthermore, discontinuing breastfeeding, remaining in childcare facilities, and the loss of maternal antibodies all raise the risk of illnesses, especially respiratory tract infections [13,14,15]. Inadequate lung growth, a restricted airway, and the co-occurrence of other lung diseases that exacerbate the illness are other causes [16], [17]. According to our findings, the HRSV IgM positivity was highest with edible feeding (59.46%), followed by bottle feeding (24.32%). Data supported these conclusions. Shuwaikh et al. [12] found that patients who were bottle-fed had a greater percentage of HRSV infection—60%—while patients who were breastfed showed a lower percentage—13.3%. In comparison to studies on bottle feeding and mixed feeding, additional results that are consistent with those studies support the preventive function of breastfeeding against respiratory infections[18,19, 20]. The reason for the elevated percentage of HRSV infection in children who are bottle-fed could be attributed to the fact that mother milk, which contains plenty of nutrients that boost immunity, contains lymphocytes that are sensitized to the virus and colonize in infants' nasopharynx. Additionally, breast milk stimulates the immune response of the infants by transferring sensitized T cells, or it could be because it suppresses the IgE response, which may be important in the pathogenesis of bronchiolitis [21]. Another study discovered that lactoferrin and HRSV-IgA in breast milk, which likely stimulate maturation due to prolactin's impact, [22]. with the purpose of purposefully enhancing mother nutrition and/or providing additional nutrition from sources other than breast milk for babies who receive mixed feedings. According to these studies, children with allergies (72.97%), asthma (8.11%), and bronchitis (18.92%) had the greatest rates of HRSV IgM positive. Children with allergies (68.96%), asthma (3.45%), and bronchitis (27.59%) had the greatest rates of HRSV IgG positive. Numerous studies have discovered links between respiratory syncytial virus (HRSV) and a range of respiratory ailments in children, including allergies, asthma, and bronchitis [23], [24]. These findings align with our own. Further research supports the possibility of a link between allergy disorders and HRSV infection based on the increased IgM and IgG positivity rates among children with allergies. Azzari et al. [25], for example, discovered that those with allergies may be more susceptible to respiratory viral infections, such as HRSV. Children with allergies may have greater rates of HRSV infection due to allergic irritation in the respiratory tract, which may facilitate viral replication [26]. Other researchers discovered that elevated prevalence of respiratory syncytial virus in children with bronchiolitis. Seasonal surges in HRSV are known to occur, frequently during the winter months in temperate regions. During these times, HRSV takes over as the most common viral cause of bronchiolitis, contributing significantly to the disease's case count. Furthermore, HRSV is extremely contagious and readily disseminated through respiratory droplets, particularly in crowded environments like daycare centers and homes with small children. As a result, HRSV outbreaks frequently occur in these settings, which raises the risk of HRSV-related bronchiolitis in children[27,28,29]. In the present investigation, the children of illiterate mothers tested positive for HRSV IgM, indicating recent infection with the virus, and positive for HRSV IgG, showing prior exposure and immunity, in 48.65% of the children. These results imply that those with lower levels of education are more likely to be exposed to and infected with HRSV. Research by Geoghegan et al. [30] explores the complex relationship

between education level, socioeconomic status, and respiratory virus transmission dynamics and their impact on respiratory infection susceptibility, including HRSV. Their findings lend additional support to the hypothesis that socioeconomic factors and HRSV infection risk are related. Lower socioeconomic level, restricted access to healthcare resources, and higher rates of viral transmission in populations with lower educational attainment are some of the variables that may be responsible for this elevated risk. People who lack literacy skills may encounter difficulties in obtaining immunizations, health education, and early medical care, all of which might increase their vulnerability to HRSV infection [11], [12]. Our study found that HRSV IgM was 62.16% and IgG was 62.07% in children from smoking families. These results are consistent with another study by Shuwaikh et al. [12], which found that children exposed to parental smoking had a greater percentage of HRSV infection. Additionally, our data is consistent with other reports that verify our data's discovery [10], [11]. A study found several effects of biomass fuels and passive smoking on infants and early children, in addition to increasing the rate of cross-infection from the parents who smoke, inciting an allergic reaction, or irritating the infantile passageways [20–22]. In general, secondhand smoke from parents who smoke exposes children to a variety of hazardous chemicals and irritants that can disrupt the respiratory epithelium and damage lung function. Because secondhand smoke inhibits mucociliary clearance and reduces the immune response in the respiratory tract, it has been related to an increased risk of respiratory infections, including HRSV [11].

Conclusion:

HRSV is more prevalent in children under 5 years although it was common cause of respiratory tract infections in childen under 5 years. Risk factor such as smoking, other chronic diseases and type of feeding may influence the incidence of the infection in susceptible children.

References

[1] Meskill SD, O'Bryant SC. Respiratory virus co-infection in acute respiratory infections in children. Current infectious disease reports. 2020 Jan;22:1-8.

[2] Barr R, Green CA, Sande CJ, Drysdale SB. Respiratory syncytial virus: diagnosis, prevention and management. Therapeutic advances in infectious disease. 2019 Jul;6:2049936119865798.

[3] Battles MB, McLellan JS. Respiratory syncytial virus entry and how to block it. Nature Reviews Microbiology. 2019 Apr;17(4):233-45.

[4] Rha B, Curns AT, Lively JY, Campbell AP, Englund JA, Boom JA, et al. Respiratory syncytial virus–associated hospitalizations among young children: 2015–2016. Pediatrics. 2020 Jul 1;146(1).

[5] Mammas IN, Spandidos DA. Paediatric Virology and respiratory syncytial virus: An interview with Honorary Senior Lecturer in Paediatric Infectious Diseases Dr Simon B. Drysdale (St. George's, University of London, UK). Experimental and Therapeutic Medicine. 2019 Oct 1;18(4):3226-30.

[6] Boyoglu-Barnum S, Tripp RA. Up-to-date role of biologics in the management of respiratory syncytial virus. Expert Opinion on Biological Therapy. 2020 Sep 1;20(9):1073-82.

[7] Hatter L, Eathorne A, Hills T, Bruce P, Beasley R. Respiratory syncytial virus: paying the immunity debt with interest. The Lancet Child & Adolescent Health. 2021 Dec 1;5(12):e44-5.

[8] Shi T, McAllister DA, O'Brien KL, Simoes EAF, Madhi SA, Gessner BD, et al. Global, regional, and national disease burden estimates of acute lower respiratory infections due to respiratory syncytial virus in young children in 2015: a systematic review and modelling study. Lancet. 2017;390(10098):946–58.

[9] Collaborators GBDLRI. Estimates of the global, regional, and national morbidity, mortality, and aetiologies of lower respiratory infections in 195 countries, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet Infect Dis. 2018;18(11):1191–210.

[10] Goritzka M, Makris S, Kausar F, Durant LR, Pereira C, Kumagai Y, et al. Alveolar macrophage-derived type I interferons orchestrate innate immunity to RSV through recruitment of antiviral monocytes. J Exp Med. 2015;212(5):699–714.

[11] Odisho SM, Al-Bana AS, Yaassen NY. Detection of Respiratory syncytial virus infection in a sample of infants in Iraq. Iraqi Journal of Medical Sciences. 2009 Dec 1;7(4).

[12] Shuwaikh EM, Jafar NA, Ahmed SS. Serological Diagnosis of Respiratory Syncytial Virus by ELISA Technique among Children with Respiratory Tract Infections in Beiji City, Iraq. Tikrit Journal of Pure Science. 2023 Feb 20;28(1):1-6.

[13] Abduljabbar HL, Hussein AA, Al-Mayah QS, Aufi IM. Phylogenetic analysis of respiratory syncytial virus isolated from children with respiratory tract infections in Baghdad City, Iraq. InJournal of Physics: Conference Series 2019 Jul 1 (Vol. 1234, No. 1, p. 012082). IOP Publishing.

[14] Al-Shuwaikh AM, Ali SH, Arif HS. Detection of respiratory syncytial virus in infants and young children with chest infection: a comparison of reverse transcription-PCR technique to chromatographic immunoassay and enzyme linked immunosorbent assay. Iraqi JMS. 2018; 16 (3): 319-326. doi: 10.22578. IJMS.;16(11).

[15] Al-Bashar S H . Diagnosis of human adenovirus and human respiratory syncytial virus among children suffering from respiratory tract infections in Salahaldin Governorate-Iraq.Ph.D.thesis, College of Science. Tikrit University (2015).
[16] Şık N, Başerdem KA, Başerdem O, Appak Ö, Sayıner AA, Yılmaz D, Duman M. Distribution of viral respiratory pathogens during the COVID-19 pandemic: a single-center pediatric study from Turkey. Turkish archives of pediatrics. 2022 May;57(3):354.
[17] Etrhuni S, Omar R, Hadid I. Risk factors of acute respiratory infections in children in Tripoli, Libya. Ibnosina Journal of Medicine and Biomedical Sciences. 2020 Sep;12(03):200-7.
[18] Pandolfi E, Gesualdo F, Rizzo C, Carloni E, Villani A, Concato C, et al. Breastfeeding and respiratory infections in the first 6 months of life: a case control study. Front Pediatr. 2019;7:152.
[19] Jang MJ, Kim YJ, Hong S, Na J, Hwang JH, Shin SM, Ahn YM. Positive association of breastfeeding on respiratory syncytial virus infection in hospitalized infants: A multicenter retrospective study. Clin Exp Pediatr. 2020;63(4):135.
[20] Mineva GM, Purtill H, Dunne CP, Philip RK. Impact of breastfeeding on the incidence and severity of respiratory syncytial virus (RSV)-associated acute lower respiratory infections in infants: a systematic review highlighting the global relevance of primary prevention. BMJ Glob Health. 2023;8(2)
[21] Moore RE, Xu LL, Townsend SD. Prospecting human milk oligosaccharides as a defense against viral infections. ACS infectious diseases. 2021 Jan 20;7(2):254-63.
[22] Demers-Mathieu V, Lueangsakulthai J, Qu Y, Scottoline BP, Dallas DC. Binding and neutralizing capacity of respiratory syncytial virus (RSV)-specific recombinant IgG against RSV in human milk, gastric and intestinal fluids from infants. Nutrients. 2020 Jun 27;12(7):1904.
[23] Feikin DR, Karron RA, Saha SK, Sparrow E, Srikantiah P, Weinberger DM, Zar HJ. The full value of immunisation against respiratory syncytial virus for infants younger than 1 year: effects beyond prevention of acute respiratory illness. The Lancet Infectious Diseases. 2023 Nov 21.
[24] Lu S, Hartert TV, Everard ML, Giezek H, Nelsen L, Mehta A, Patel H, Knorr B, Reiss TF. Predictors of asthma following severe respiratory syncytial virus (RSV) bronchiolitis in early childhood. Pediatric pulmonology. 2016 Dec;51(12):1382-92.
[25] Azzari C, Baraldi E, Bonanni P, Bozzola E, Coscia A, Lanari M, et al. Epidemiology and prevention of respiratory syncytial virus infections in children in Italy. Ital J Pediatr. 2021;47:1-12.
[26] Smith-Norowitz TA, Mandal M, Joks R, Norowitz LT, Weaver D, Durkin HG, et al. IgE anti-respiratory syncytial virus antibodies detected in serum of pediatric patients with asthma. Human immunology. 2015 Jul 1;76(7):519-24.
[27] Smith DK, Seales S, Budzik C. Respiratory syncytial virus bronchiolitis in children. American family physician. 2017 Jan 15;95(2):94-9.
[28] Obolski U, Kassem E, Na'amnih W, Tannous S, Kagan V, Muhsen K. Unnecessary antibiotic treatment of children hospitalised with respiratory syncytial virus (RSV) bronchiolitis: risk factors and prescription patterns. Journal of Global Antimicrobial Resistance. 2021 Dec 1;27:303-8.
[29] Na'amnih W, Kassem E, Tannous S, Kagan V, Jbali A, Hanukayev E, Freimann S, Obolski U, Muhsen K. Incidence and risk factors of hospitalisations for respiratory syncytial virus among children aged less than 2 years. Epidemiology & Infection. 2022;150:e45.
[30] Geoghegan S, Erviti A, Caballero MT, Vallone F, Zanone SM, Losada JV, Bianchi A, Acosta PL, Talarico LB, Ferretti A, Grimaldi LA. Mortality due to respiratory syncytial virus. Burden and risk factors. American journal of respiratory and critical care medicine. 2017 Jan 1;195(1):96-103.