

How to Cite:

Hayder, Z. abdul wahhab, Abdulwahed, A. A., & Shanef, M. T. (2022). Immunology concepts for secondary biology teachers: A survey study. *International Journal of Health Sciences*, 6(S1), 8537–8550. <https://doi.org/10.53730/ijhs.v6nS1.6862>

Immunology concepts for secondary biology teachers: A survey study

Zainab abdul wahhab Hayder

Ass. Lecturer/ Nurse College of Nursing/ University of Kerbala, Iraq.
Corresponding author email: Zainab.abdulwahhab@uokerbala.edu.iq

Alaa Ahmed Abdulwahed

Professor/ College of Education / Al-Qadisiyah University / Iraq.

Mazin Thamer Shanef

Professor/ College of Education / Al-Qadisiyah University / Iraq.

Abstract--The research aims to know the concepts of immunity for biology teachers of the secondary stage, and to achieve this goal the researchers constructed a multiple choice test for the concepts of immunity, its types and its related fields and contents consisting of (26) test items with three alternatives only one of which represents the correct answer and was chosen. A sample consisting of (254) teachers and a school of biology for the secondary stage belonging to the Education Directorates in the Diwaniyah and Karbala governorates, by (20) teachers and a school as a preliminary survey sample, (132) teachers and a school for a second survey sample (the statistical analysis sample), and (102) A teacher and a school is a sample of the final application of the test after making sure of its validity and consistency, and the results showed that teachers possess an appropriate level of information related to concepts of immunology and the absence of statistically significant differences in the level of possession of immunity concepts according to the gender variable between male and female teachers, and the research came out with a set of recommendations, including the necessity of paying attention to the topics of immunology and its developments, especially with regard to the great challenges posed by the spread of epidemics such as the COVID-19 including a correlation study between familiarity with the concepts of immunity and its relationship to preventive awareness among biology teachers..

Keywords---immunology concepts, immunology, biology teachers, survey study.

Introduction

The teacher is the cornerstone of the educational process and provides the community with new generations with a high level of learning capable of being familiar with the requirements of knowledge and its details, and this can only be achieved by the presence of scientific knowledge of the teacher of facts and concepts that are intended to be acquired by students and to transmit their impact. Learning. Through their experience in teaching and communicating with teachers of biology and the exploratory study that was conducted in this regard, the researchers sensed the existence of a definite knowledge need for biology teachers to provide with regard to the concepts of immunity, which are important matters related to the health of the human being and his body and the immune mechanisms used by the body And protecting it from the pathogens of microorganisms from viruses and bacteria, and without them, a person will not be able to continue in life, and so it is permissible for researchers to formulate the research problem with the following question: -

Q / How familiar are secondary school biology teachers with immunological concepts?

Purpose of the research

Education is concerned with preparing the human being physically, intellectually and morally and integrating him into society and the future life, preparing him as a useful member of society and transferring the customs, traditions, skills and culture of the society to its emerging members, and since education does not give the meaning of education but is a part of it (Al-Saegh, 2006: 12) is a process. An evolving vitality that is not stable and requires renewal, alteration and development, in the era of the explosion of knowledge and the multiplication of knowledge and the accumulation of information in it, so the teacher provides students with a summary of what man has reached of knowledge and experiences and selects for them the best that he read or heard, so he must be able to master the subject he teaches because something is lost Give him. (Jan, 2002: 40-41) Therefore, it has become an urgent necessity to reconsider the teacher preparation process imposed by successive scientific changes and developments, and this requires the real needs for the development of the teacher's performance and raising his level. (Abdel Fattah, 2013: 4)

This is reflected in the educational literature, some contemporary global trends in teacher preparation:

- 1- Teacher preparation (traditional numbers): This trend focuses on the cognitive aspect of its preparation.
- 2- Preparing the learner: This trend focuses on the teacher's acquisition of the skills that enable him to help the individual learner as the focus of the educational process and the development of his cognitive, emotional and physical needs.
- 3- Preparing the teacher who focuses on his personality style, ways of thinking and interests.
- 4- Preparing the teacher (socially): This trend focuses on the role of the teacher in the community that enables him to develop the local community on the one hand and improve the conditions of the whole community on the other hand (Zaitoun, 2001: 222-223)

And since the learner is the goal and the aim of the educational system, the curriculum is a sub-system of the education system that includes a set of elements (objectives, content, activities, teaching, learning and evaluation) and these elements complement each other functionally and in an interchangeable manner by providing the learner with a set of educational and learning opportunities that achieve His overall growth. (Ali, 2011: 20-21)

Hence the importance of interconnectedness in the curriculum and the necessity for the teacher to be aware of this interdependence. Science curricula are concerned with science as a content and method and with scientific knowledge and clarify the concepts related to it. The learner seeks more scientific knowledge (Ambosaidi and Al-Balushi, 2011: 17)

The researchers see the importance of knowledge and its details as the functional carrier of knowledge related to the learner's life issues, according to the exploratory survey that we have done. Knowledge, how to benefit from it and his money, the positive impact on his life, his family and society. God Almighty has granted man a wonderful defense system, and the rational person is incapable in the face of this greatness that God made. To penetrate this skin in her.

They are the body's soldiers from white blood cells that attack it, and if it manages to escape from this as well, it is the specialized lymphocytes that recognize it and secrete antibodies that eliminate it and more than that put its data in memory. If it comes back again, it eliminates it. If this foreign body entered through the mouth, the tonsils would be found standing in the way of its passage. (Ismail, 2005: 1)

Thus, when pathogens or physical or psychological trauma threaten the health of the body, the immune system begins to organize its ranks so that each of its elements performs its assigned role and mobilization is based on the strength of the threat. The importance of immunity to a person in the different stages of his life. At birth, the immune system is incomplete yet and it takes two years to succeed in gaining its independence, and the infant during the first months of his life is protected by antibodies transferred to him from his mother and does not yet possess his own immune identity and this immunity gradually replaces his own immunity. Through his contact with the pathogens that encounter him, the child acquires with the passage of time a solid shield against various attacks, such as seasonal allergic diseases, psychological crises, and the physical transformations that humans undergo (Julie, 2006: 74).

A healthy person can protect himself from pathogens by various means of defense from birth until his death, but there is an equation between the means of defense of the body and the means of attack by those disease-causing organisms, and whichever is more likely, the natural immunity or so-called (non-specific immunity or non-specialized immunity) Natural resistance) succeeds in fighting some very hypothalamic germs, and sometimes the body gets rid of the latter after it has developed specific immunity, or what is called (specialized or specific acquired immunity). (Al-Zubaidi, 2005: 23)

Here, it is necessary to explain the factors affecting immunity of both types that work to remove pathogens and protect the body, which is next:

Innate or natural immunity: It is the body's first line of defense to repel pathogenic organisms and it is present with the individual since birth, and it works in the same way on all pathogenic organisms without distinguishing or allocating their cells and their response does not improve with repeated infection. It includes:

Mechanical barriers are the first line of defense to ward off pathogens.

- 1- **Healthy skin:** resists entry of pathogens into the body, as it acts as a protective covering for it.
- 2- **Mucous membranes:** These membranes work to adhere to germs by secreting mucus material to catch them, and they line the various parts of the body that have contact with the external environment, such as the respiratory and digestive system (Tahroharon, 2012: 14)

Chemical barriers: It prevents the growth of many pathogens, namely fatty acids in the skin, and a change in the acid balance (PH) of some body fluids such as saliva and stomach and Lysozyme that are excreted in body fluids such as tears, sweat, etc. (Hossain, 2003: 9)

Physiological barriers

- 1- **Phagocytosis:** the ability of some cells to swallow bacteria and western bodies away from the harmful body and then destroy them by analyzing them inside these cells. The white cells carry out this process and include} cells of polymorph nuclear leukocytes (PNL) and monocytes. (Al-Hadidi, 2004: 2-3)
- 2- **Using the compliment system:** a system consisting of many proteins that plays a role in the biological effects that would eliminate, destroy or dissolve pathogens.

Among the most important of these biological effects are: chemotaxis, lysis, activation of B cells, opsonization and phagocytosis, aid in agglutination of pathogens and venoms, and stimulation of the inflammatory mechanism at the site of the affected tissue. (Al-Hadidi, 2004: 16)

- 3- **Natural killer cells:** their role is to kill hostile cells that are difficult to swallow by macrophages due to their large size, for example body cells that were infected by pathogens and make them a source of infection and disease for the rest of the healthy cells and get rid of them by killing them, cancer cells and graft cells When the individual donor is genetically compatible with the patient. We mention another type of killer cell called acid pigmentation cells, which are specialized in killing worms that infect the body, such as schistosomiasis, by attaching them to the surface of the worm and then secreting enzymes to kill it. (Erwa, 1996: 5)
- 4- There are other substances that help in natural protection, which are interferons, which are glycoproteins produced from white blood cells that work without entering the virus into the cells of a healthy body and inhibit RNA reproduction and prevent its proliferation inside infected cells and activate natural killer cells to kill cells infected with the virus. (Levinson, 2014: 1115-1116) and now it is produced in factories and used as GM therapeutic preparations on a large scale (Radwan, 2010: 94).

Specific or acquired immunity

Acquired immunodeficiency failure

It means that a person or animal acquires this immune failure, that is, it is born healthy, but this failure or defect occurs due to the well-known causes, which are poor nutrition, advanced age, and taking some medications that suppress the immune system, especially after or before organ transplantation, high temperature and exercise. And environmental factors, medication and injury, some types of diseases that stress the immune system, such as leukemia, AIDS, malaria, viral hepatitis and many others, but there are reflections on the wisdom of creator Almighty. If the immune system suffers from an imbalance, it is not necessary that all the mechanisms of the immune system fail, except in a few cases, the immune system becomes completely damaged. And the life of an organism may be at stake (Radwan, 2010: 9, 23).

From the above, the importance of research can be summarized as follows:

- 1- The need for such research that dealt with an important segment of society, namely secondary biology teachers, because they have an effective role in transmitting the positive impact to students, which will be reflected on their lives, their families and society as a whole.
- 2- The research directs the attention of curriculum developers in general towards research on the topics of immunological concepts, especially science curricula.
- 3- The researchers hope that teachers and other researchers in this field will benefit from the current research results in defining the level of immunology concepts among biology teachers.
- 4- There is no previous study, to the best of the researchers' knowledge, that deals with the concepts of immunity and the extent of biology teachers' knowledge of it.
- 5- The research provides researchers with a test on the concepts of immunity of biology teachers that can be used in conducting relevant research.

Aim

The research aims to know the concepts of immunity for secondary school biology teachers.

Search limits:

The search is limited to: -

Human borders: Biology teachers for secondary school morning public schools.

Time limits: The second semester of the academic year 2018-2019.

Spatial boundaries: secondary schools belonging to the General Education Directorates in (the Al-Qadisiyah and Karbala provinces).

Definition of terms

1- Concepts and were known by:

- (The Arab League for Education, Culture and Science Organization: 2011)
"A group of things or symbols that express common characteristics and characteristics of a phenomenon or event, and can be referred to by a specific symbol or name." (Arab Organization for Education, Culture and Science, 2011: 59)

2- Immunity, which was defined by:

(Urwa, 1996) as: "The science that studies how the body protects itself from harmful external factors that cause disease and resists disease pathogens resulting from biological environmental factors such as germs.

And plants, such as pollen grains, and animals, such as serums, and physical factors such as cement dust, and chemical substances such as minerals, medicines, dyes, etc." (Urwa: 1996, 1)

(Dictionary of Medical Terms: 1999) "A condition that prevents the occurrence of a specific disease, whether it is microbial or the result of poisoning" (Dictionary of Medical Terms, 1999: 169)

(Hossain: 2003)

All of these are the physiological mechanisms that give the organism the ability to recognize foreign substances and neutralize, remove or metabolize foreign substances. (Hossain, 2003: 2)

(Harvey: 2013) an active process performed by white blood cells and their products in repelling any hostile organism or foreign substance. (Harvey, 2013: 358)

And researchers know it operationally:

The body's response to a group of pathogens from the external environment with situations from daily life in the form of a multiple-choice test that deals with the dimensions of the concepts of immunity that should be known to the secondary school biology teachers and is measured by the degree that the teacher gets on the test prepared for research purposes.

Previous studies:

1- Study (Mehdi& Al-Saffar, 2013)

Assessment Knowledge and Attitudes of Baghdad University Students' Toward Human Immunodeficiency virus / acquired immunodeficiency syndrome.

Assessment of knowledge and attitudes of Baghdad University students towards HIV / AIDS

The study aimed to evaluate the knowledge and attitudes of Baghdad University students towards HIV / AIDS, and to discover the relationship between knowledge and attitudes of Baghdad University students and some basic variables such as (gender, socio-economic status, branch of study). The study used the descriptive analytical approach to assess the knowledge and attitudes of Baghdad University students. Towards HIV / AIDS. The study was conducted from (November 1, 2012 to July 11, 2013). A non-probability sample consisting of (440 students) consisting of 138 males and 262 females) was selected from four colleges in fourth grade, and the data for this study were collected through a technique. Self-filling by using a questionnaire designed by the two researchers, the results of the study showed that the students' information about AIDS was good / or sufficient. As for their attitudes towards AIDS patients, they were negative. The study recommended raising awareness for students through the media about the dangers of this disease and how to prevent it, and increasing lectures and discussions about HIV disease.

HIV / AIDS which can increase students' knowledge. (Mehdi& Al-Saffar, 2013,p16)

2- Study (Khalifa & Faraj,2015)

Assessment of Science Teachers' Awareness towards Immunity and Immunization in Primary School at Baghdad City

(Assessment of science teachers' awareness of immunization and immunization in Baghdad primary schools)

The study aimed to assess the awareness of science teachers towards immunization and immunization in the primary schools of Baghdad city. The study followed the descriptive curriculum and included (100) primary schools, (50) in the Rusafa sector, and (50) in the Karkh sector for the period from March 15, 2012 to 15 March 2013 for the purpose of assessing science teachers' awareness of immunization and immunization. A multiple sample of (100) science teachers (male and female) was chosen by one teacher from each school. A questionnaire form was used to collect information and its validity was determined by presenting it to a group of experts in the field of specialization, and its stability was determined through an exploratory study. It was conducted in (20) primary schools not mentioned above and included (20) teachers for the period from April 8, 2012 to April 4, 2012. The study data was analyzed through the use of descriptive and inferential statistics.

The results of the study showed that (58)% of them did not have the opportunity to participate in immunization and immunization courses. The results of the study indicated that science teachers' awareness was insufficient about immunity and immunization against communicable diseases in Baghdad primary schools. (Faraj & Khalifa, 2015, P198)

Research methodology and procedures:

The researchers relied on the descriptive survey approach that defines a common goal, which is to obtain information from a group of individuals directly through a set of written or oral questions through a questionnaire or an interview. The description is the most common purpose of survey research that can be considered the means of achieving practical research. (Abu Allam: 2007, 259-260)

1- Research community: Defining the research community is one of the most important steps of the descriptive research methodology, and it depends on the step of determining the community to conduct the research, selecting the appropriate sample and tools and the accuracy of the results (Gay & Mills, 2016, p. 156). The current research community consists of secondary school biology teachers affiliated with the General Directorate of Diwaniyah and Holy Karbala Education.

2- The research sample: The research sample refers to a sub-group of the research community, chosen by the researcher in an appropriate way to achieve the research objectives when it is difficult to conduct the study on the whole community (Edmonds & Kennedy, 2016, p. 19). Therefore, the research samples were randomly selected.

a. The sample first exploratory application:

A sample consisting of (20) teachers and schools was determined to conduct the first exploratory application, randomly selected from the total research community, for the purposes of verifying the test instructions and items and determining the time of response.

b. The second exploratory application sample:

To achieve the analysis procedures and extract the psychometric properties of the research tool in terms of validity, stability, difficulty and discrimination coefficients, as a sample consisting of (132) teachers and schools was selected for

statistical analysis to test the immunology concepts of the secondary school biology teachers.

3- Research tool: After reviewing the literature related to immunology, its types, concepts, and fields, the test items were formulated to suit the level of biology teachers in terms of clarity and ease of language, and its connection to the main research variable, as the test consisted of (26) objective paragraphs of the multiple choice type by three Substitutions per paragraph, only one true substitute.

2- Instrument validity: Validity focuses on ensuring that what the measuring instrument claims is really what it is measuring (Lodico & et al., 2010, pp. 87-88). The test was presented to a group of referees in the fields of life sciences and immunology. And methods of teaching life sciences, measurement and evaluation, and community health. All observations made by the referees on the formulation of the test paragraphs and the possibility of measuring them for the concepts of immunity in the sample were taken into account, without deleting any paragraph. The discrimination coefficient was calculated for each of the test items. The value of the discriminant index for the objective items ranged between (0,30 - 0.49), meaning that all the objective items in the test are acceptable.

3- Instrument stability: The reliability of the test refers to the consistency with which it achieves the same arrangement for the same individuals who undergo the test, when applied more than once, that is, the test can be relied upon if it gives the same results every time (Kubiszyn & Borich, 2013, p. 338). To verify the stability of the test, the researchers used the Cronbach's alpha coefficient equation, which is one of the most common consistency parameters. Estimating its value requires that the test be performed only once, and the resulting value of the reliability index calculated with a factor of A should be 0.7 or more because the high value is evidence that the test items measure The same is consistently the case (Christensen et al., 2015, p. 156). As its value reached (0,81).

4- Difficulty coefficient: The difficulty coefficient equation was adopted to calculate the difficulty factor for each of the test items, as the paragraphs difficulty factor values ranged between (0.41 - 0.62), and this indicates the validity of all test items.

5- Application of the search tool: After completing all procedures to verify the characteristics of the test, as the test was applied in its final form on a random sample of (102) teachers and schools of biology at the secondary stage.

- Statistical methods: The researchers used the SPSS statistical bag in processing the research data and extracting its results, which are the T-test for a sample with a population, the T-test for two independent samples, and the equation of the Cronbach alpha coefficient.

Methodology

The researchers relied on the descriptive survey approach that defines a common goal, which is to obtain information from a group of individuals directly through a set of written or oral questions through a questionnaire or an interview. The description is the most common purpose of survey research that can be considered the means of achieving practical research. (Abu Allam: 2007, 259-260)

1- Research community: Defining the research community is one of the most important steps of the descriptive research methodology, and it depends on the step of determining the community to conduct the research, selecting the appropriate sample and tools and the accuracy of the results (Gay & Mills, 2016, p. 156). The current research community consists of secondary school biology teachers affiliated with the General Directorate of Diwaniyah and Holy Karbala Education.

2- The research sample: The research sample refers to a sub-group of the research community, chosen by the researcher in an appropriate way to achieve the research objectives when it is difficult to conduct the study on the whole community (Edmonds & Kennedy, 2016, p. 19). Therefore, the research samples were randomly selected.

b. The sample first exploratory application:

A sample consisting of (20) teachers and schools was determined to conduct the first exploratory application, randomly selected from the total research community, for the purposes of verifying the test instructions and items and determining the time of response.

B. The second exploratory application sample:

To achieve the analysis procedures and extract the psychometric properties of the research tool in terms of validity, stability, difficulty and discrimination coefficients, as a sample consisting of (132) teachers and schools was selected for statistical analysis to test the immunology concepts of the secondary school biology teachers.

3- Research tool: After reviewing the literature related to immunology, its types, concepts, and fields, the test items were formulated to suit the level of biology teachers in terms of clarity and ease of language, and its connection to the main research variable, as the test consisted of (26) objective paragraphs of the multiple choice type by three Substitutions per paragraph, only one true substitute.

2- Instrument validity: Validity focuses on ensuring that what the measuring instrument claims is really what it is measuring (Lodico & et al., 2010, pp. 87-88). The test was presented to a group of referees in the fields of life sciences and immunology. And methods of teaching life sciences, measurement and evaluation, and community health. All observations made by the referees on the formulation of the test paragraphs and the possibility of measuring them for the concepts of immunity in the sample were taken into account, without deleting any paragraph. The discrimination coefficient was calculated for each of the test items. The value of the discriminant index for the objective items ranged between (0,30 - 0.49), meaning that all the objective items in the test are acceptable.

3- Instrument stability: The reliability of the test refers to the consistency with which it achieves the same arrangement for the same individuals who undergo the test, when applied more than once, that is, the test can be relied upon if it gives the same results every time (Kubiszyn & Borich, 2013, p. 338). To verify the stability of the test, the researchers used the Cronbach's alpha coefficient equation, which is one of the most common consistency parameters. Estimating its value requires that the test be performed only once, and the resulting value of the reliability index calculated with a factor of A should be 0.7 or more because the high value is evidence that the test items measure The same is consistently the case (Christensen et al., 2015, p. 156). As its value reached (0,81).

4- Difficulty coefficient: The difficulty coefficient equation was adopted to calculate the difficulty factor for each of the test items, as the paragraphs difficulty factor values ranged between (0.41 - 0.62), and this indicates the validity of all test items.

5- Application of the search tool: After completing all procedures to verify the characteristics of the test, as the test was applied in its final form on a random sample of (102) teachers and schools of biology at the secondary stage.

- Statistical methods: The researchers used the SPSS statistical bag in processing the research data and extracting its results, which are the T-test for a sample with a population, the T-test for two independent samples, and the equation of the Cronbach alpha coefficient.

Results and Discussion

A- To achieve the first objective of the research, the T-value, the arithmetic mean and the standard deviation of the research sample were calculated, Table (1).

Table (1)

The results of a single sample t-test to test the significance of the difference between the arithmetic mean and the hypothetical average of the scores of the sample individuals on the immunological concepts test

indication 0.05	The T-value of one sample		Hypothesized mean	standard deviation	SMA	Immunology concepts	variable
	Tabular	indication					
Function	1.98	-20.15	13	2.68	7.66	102	Immunology concepts

It is evident from Table (1) that the arithmetic mean reached (7.66) with a standard deviation (2.68) and the computed T value (-20.15), which is greater than the tabular value (1.96) with a degree of freedom (101) and the researchers explain this The result is that teachers in general have a good level of knowledge about the concepts of immunity, which reflects the good preparation of these pre-service teachers in educational institutions, the scaffolding of their information during service and their acquaintance with information related to immunology and its developments due to its connection with the vocabulary of biology as well as the lived reality as it led the spread of epidemics And pandemics in the near future, such as bird and swine flu in East Asia and the Covid-19 pandemic for all parts of the world, including Iraq, to enhance information in immunology in a way that preserves personal, family and social life and adapts to the challenges of professional life, which generates a renewed desire for every teacher to develop his knowledge of immunology because it is a science There are many new developments and challenges.

B- To achieve the second objective of the research, the T-value, the arithmetic mean and the standard deviation of the male and female research sample were calculated, Table (2).

Table (2)

The T value, the mean, and the standard deviation of the male and female research sample

Indication	Tabular T-value	The computed T-value	standard deviation	Arithmetic mean	NO	the sample
0.05						
Not a function	1.98	0.383	2.48	7.78	40	Males
			2.84	7.57	62	Females

Table (2) shows the arithmetic mean of males (7.78), the standard deviation (2.48) and females (7.78), the standard deviation (2.57) and the T-value for two independent samples calculated (0.383), which is less than the tabular T value (1.98) at a degree of freedom (100).

The researchers explain that there are no significant differences between males and females, because this science (immunity) has become a subject of interest for both sexes. The professional preparation and job practice of male and female teachers for biology requires attention to immunology and its concepts as one of the branches of life sciences and because of the close relationship of immunology to the prescribed curriculum as well as reality. Pension directly.

Conclusion

- 1- Despite the noticeable decrease in the arithmetic mean of the sample on the immunological concepts test, the sample has an acceptable level of performance on the test.
- 2- The convergence of the cognitive structure related to the concepts of immunology for male and female teachers alike.

Recommendations

- 1- Paying attention to the topics of immunology and its developments, especially with regard to the great challenges posed by the spread of epidemics such as the COVID-19 pandemic.
- 2- Including in the curricula of the different academic stages of topics related to strengthening the immune system of the individual.
- 3- Holding educational seminars on immunology for secondary school biology teachers.

Acknowledgments

We would like to express our deep appreciation to all secondary school biology teachers who participated in this study for their cooperation.

References

1. Al-Hadidi, Syed (2004): Immunology and Pathology, 2nd Edition, Shuaa, Syria - Aleppo.

2. Ali, Muhammad Al-Sayed (2011): Recent trends and applications in curricula and teaching methods, Dar Al-Shorouk, Amman.
3. Al-Sayegh, Sheikh Majeed (2006): Educational foundations for educational curricula, Al-Furqan Press, Al-Najaf.
4. Al-Zubaidi, Tariq Salih (2005): Immunology and Serology, Dar Al-Yazuri, Amman.
5. Christensen, I. B., Johnson, R. B., & Turner, L. A. (2015). Research methods, design, and analysis (12th ed.). Pearson Education Limited.
6. Edmonds, W. A., & Kennedy, T. D. (2016). An applied guide to research designs: Quantitative, qualitative, and mixed methods. Sage Publications.
7. Faraj, Raad K. & Kalifa, Mohammed F. (2015): Assessment of Science Teachers' Awareness towards Immunity and Immunization in Primary School at Baghdad City, KUFU JOURNAL FOR NURSING SCIENCES Vol.5 No. 2, May through August, PP 198- 203.
8. Jan, Muhammad Salih bin Ali (2002): The Precious Guide in Education and Teaching Methods, 2nd Edition, Salem Library, Makkah.
9. Julie, Mustafa Karah (2006): Enhancing the immunity, natural antibiotics, Raslan House, Damascus.
10. The Arab Organization for Education, Culture and Science (2011): Glossary of Curriculum Terms and Teaching Methods, Rabat.
11. Urwa, Hashem Hassan (1996): Immunology, Journal of Science and Technology, Volume 10, Issue 37, Kingdom of Saudi Arabia.
12. Abdel-Fattah, Saadia Shukry Ali (2013): Vocational Education between Theory and Practice, Dat, The Modern Library, Egypt.
13. Abu Allam, Rajaa Mahmoud (2007): Research Methods in Psychological and Educational Sciences, University Press, Cairo.
14. Ambu Saidi, Abdullah bin Khamis and Al Balushi, Suleiman bin Muhammad (2011): Methods of Teaching Science (Practical Concepts and Applications), ed. 2, Dar Al Masirah, Jordan.
15. Widjaja, G., Jalil, A. T., Rahman, H. S., Abdelbasset, W. K., Bokov, D. O., Suksatan, W., ... & Ahmadi, M. (2021). Humoral Immune mechanisms involved in protective and pathological immunity during COVID-19. *Human Immunology*. <https://doi.org/10.1016/j.humimm.2021.06.011>
16. Moghadasi, S., Elveny, M., Rahman, H. S., Suksatan, W., Jalil, A. T., Abdelbasset, W. K., ... & Jarahian, M. (2021). A paradigm shift in cell-free approach: the emerging role of MSCs-derived exosomes in regenerative medicine. *Journal of Translational Medicine*, 19(1), 1-21. <https://doi.org/10.1186/s12967-021-02980-6>
17. Saleh, M. M., Jalil, A. T., Abdulkereem, R. A., & Suleiman, A. A. (2020). Evaluation of Immunoglobulins, CD4/CD8 T Lymphocyte Ratio and Interleukin-6 in COVID-19 Patients. *TURKISH JOURNAL of IMMUNOLOGY*, 8(3), 129-134. <https://doi.org/10.25002/tji.2020.1347>
18. Turki Jalil, A., Hussain Dilfy, S., Oudah Meza, S., Aravindhan, S., M Kadhim, M., & M Aljeboree, A. (2021). CuO/ZrO₂ nanocomposites: facile synthesis, characterization and photocatalytic degradation of tetracycline antibiotic. *Journal of Nanostructures*. <https://doi.org/10.22052/JNS.2021.02.014>
19. Sarjito, Elveny, M., Jalil, A., Davarpanah, A., Alfakeer, M., Awadh Bahajjaj, A. & Ouladsmane, M. (2021). CFD-based simulation to reduce greenhouse gas emissions from industrial plants. *International Journal of Chemical Reactor Engineering*, 20210063. <https://doi.org/10.1515/ijcre-2021-0063>

20. Marofi, F., Rahman, H. S., Al-Obaidi, Z. M. J., Jalil, A. T., Abdelbasset, W. K., Suksatan, W., ... & Jarahian, M. (2021). Novel CAR T therapy is a ray of hope in the treatment of seriously ill AML patients. *Stem Cell Research & Therapy*, 12(1), 1-23. <https://doi.org/10.1186/s13287-021-02420-8>
21. Jalil, A. T., Shanshool, M. T., Dilyf, S. H., Saleh, M. M., & Suleiman, A. A. (2022). HEMATOLOGICAL AND SEROLOGICAL PARAMETERS FOR DETECTION OF COVID-19. *Journal of Microbiology, Biotechnology and Food Sciences*, e4229. <https://doi.org/10.15414/jmbfs.4229>
22. Vakili-Samiani, S., Jalil, A. T., Abdelbasset, W. K., Yumashev, A. V., Karpisheh, V., Jalali, P., ... & Jadidi-Niaragh, F. (2021). Targeting Wee1 kinase as a therapeutic approach in Hematological Malignancies. *DNA repair*, 103203. <https://doi.org/10.1016/j.dnarep.2021.103203>
23. NGAFWAN, N., RASYID, H., ABOOD, E. S., ABDELBASSET, W. K., Al-SHAWI, S. G., BOKOV, D., & JALIL, A. T. (2021). Study on novel fluorescent carbon nanomaterials in food analysis. *Food Science and Technology*. <https://doi.org/10.1590/fst.37821>
24. Marofi, F., Abdul-Rasheed, O. F., Rahman, H. S., Budi, H. S., Jalil, A. T., Yumashev, A. V., ... & Jarahian, M. (2021). CAR-NK cell in cancer immunotherapy; A promising frontier. *Cancer Science*, 112(9), 3427. <https://doi.org/10.1111/cas.14993>
25. Abosooda, M., Wajdy, J. M., Hussein, E. A., Jalil, A. T., Kadhim, M. M., Abdullah, M. M., ... & Almashhadani, H. A. (2021). Role of vitamin C in the protection of the gum and implants in the human body: theoretical and experimental studies. *International Journal of Corrosion and Scale Inhibition*, 10(3), 1213-1229. <https://dx.doi.org/10.17675/2305-6894-2021-10-3-22>
26. Jumintono, J., Alkubaisy, S., Yánez Silva, D., Singh, K., Turki Jalil, A., Mutia Syarifah, S., ... & Derkho, M. (2021). Effect of Cystamine on Sperm and Antioxidant Parameters of Ram Semen Stored at 4° C for 50 Hours. *Archives of Razi Institute*, 76(4), 923-931. <https://dx.doi.org/10.22092/ari.2021.355901.1735>
27. Gay, L. R., & Mills, G. E. (2016). *Educational research: Competencies for analysis and applications* (11th ed.). Pearson Education.
28. *Glossary of Medical Terms* (1999): Part 3, General Authority for the Affairs of the Emiri Press, Cairo.
29. Harvey, Richard A.(2013):*Immunology*, second edition, Lippincott Williams & Wilkins.
30. Hossain Md.Akram(2003): *Immunology*,: Ashort Textbook, second edition,RK Yadav
31. Ismail, Muhammad Salih (2005): *Nutrition and Immunology*. 1st floor, Bahrain Center for Studies and Research, Manama.
32. Kubiszyn, T., & Borich, G. (2013). *Educational testing and measurement* (10th ed.). Scott, Foresman Glenview, IL.
33. Levinson.warren (2014):*medical microbiology and immunology*, 13th Ed,MC Graw Hill Education
34. Lodico, M. G., Spaulding, D. T., & Voegtle, K. H. (2010). *Methods in educational research: From theory to practice* (Vol. 28). John Wiley & Sons.
35. Mehdi, Sarab M. & Al-Saffar, Fatin A.(2013): *Assessment Knowledge and Attitudes of Baghdad University Students' toward Human immunodeficiency virus / acquired immunodeficiency syndrome* , Iraqi National Journal of Nursing Specialties, Vol. 26 (2) ,P 16-25

36. Radwan, Al-Rashdi Mustafa (2010): Immune System Dysfunction, The Academic Library, Egypt.
37. Taher, Abdullah and Haroun, Babiker (2012): Simplifying Immunology, Hadramout University.
38. Zaitoun, Ayesah Mahmoud (2001): Methods of Teaching Science, Dar Al-Shorouk, Amman.