

# DEVELOPING A UNIVERSAL VACCINE - TECHNICAL FEASIBILITY AND POPULAR PERCEPTION AMONG MICROBIOLOGIST - A SURVEY

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## ABSTRACT:

An infection is the invasion of an organism's body tissues by disease-causing agents, their multiplication, and the reaction host tissues to the infectious agents and the toxins they produce. The vaccine is a substance used to stimulate the production of antibodies and provide immunity against infection, prepared from causative agents of a disease treated to act as an antigen. Every infectious disease has an individual vaccine developed specifically for it. The main aim of the study is to find the perception and feasibility of universal vaccines that can be used against multiple infections, among microbiologists. An online survey was conducted with a self-structured questionnaire comprising 15 questions that was distributed through the google forms. The sample size of this study was 100. The results were analyzed by performing the statistical software "SPSS version 20". The data was represented in the pie chart form. From this study population, the whole of 67% of the participants gave a positive response about the awareness of the universal vaccine and its feasibility. The survey research helps to find the feasibility of developing a universal vaccine. From this study, it is clear that microbiologists have knowledge and awareness about universal vaccines.

**KEYWORDS:** Infectious diseases; Microbiologist; Omnipotent; Universal; Vaccine.

## INTRODUCTION:

An infection is an invasion of an organism's body tissues by disease-causing agents, their multiplication, and the reaction host tissues to the infectious agents and the toxins they produce (Wiersma, Rimmelzwaan and de Vries, 2015). A vaccine is a substance used to stimulate the production of antibodies and provide immunity against infection, prepared from causative agents of a disease treated to act as an antigen (World Health Organization, 2007).

In the early 20th century, vaccines were mostly produced in animal tissues, such as nervous tissues extracted from rabbits or goats or obtained from blood serums of infected animals (Johnson *et al.*, 2020), (Sekar *et al.*, 2019). There are different types of infection or diseases that are caused to people and that may be controlled by taking a vaccine (Pollack, 2009), (Létourneau *et al.*, 2007). For example, flu remains a major killer because of imperfect vaccines and widespread resistance to existing antivirals, particularly acute during a pandemic (Vardavas, Breban and Blower, 2010). Flu is available either as: a trivalent or quadrivalent intramuscular injection's (IIV3, IIV4 or RIV4 that is TIV or QIV) which contains the inactivated form of the virus (Garland *et al.*, 2007), (Seppan *et al.*, 2018), (Krishna, Nivesh Krishna and Yuvaraj Babu, 2016). Further, some viruses such as cytomegalovirus (CMV), Hepatitis B Virus (HBV) and Epstein-Barr virus (EBV) unite fear challenges to human health but still Jack effective vaccines actually in the market (Gayathri, 2016), (Mahesh *et al.*, 2014), (Michel *et al.*, 2001), (Beasley *et al.*, 1983).

It is common to use animal cells for human vaccine production such as the use of MDCK cells for influenza vaccine production ((Moss, Clements and Halsey, 2003),(Nandhini, Babu and Mohanraj, 2018).

Over the past few years enhancing virus replication in hosts with a goal of reducing vaccine manufacturing costs has been attempted ((Subashri and Thenmozhi, 2016),(Thejeswar and Thenmozhi, 2015)). Omnipotent comes from the Latin words, Omni - total; potent - power. Omnipotent word can apply to any exaggerated description of power. An omnipotent vaccine is a vaccine that is effective against all influenza strains and hence it should not require modification from year to year. This study helps to bring one cure solution for many diseases and understand more about the vaccine. The main aim of the study is to find the perception and feasibility of universal vaccines among microbiologists.

## **MATERIALS AND METHODS:**

An online survey was conducted with a self-prepared questionnaire with a sample size of 100 participants comprising microbiologists. The questionnaire consisted of questions that help in collecting socioeconomic data, questions that help in provoking awareness among the participants, and the questionnaire majorly consists of questions related to awareness and feasibility in developing a universal vaccine. The participants were given a short introduction on the need to study about universal vaccines. The questionnaire was validated in a standard manner. The questionnaire was circulated using the online platform using "google forms". Descriptive analysis and chi square evaluation was carried out using the statistical software "SPSS software version 20". The results of the survey were represented in the form of pie charts and bar graphs.

## **RESULTS AND DISCUSSIONS:**

In this study, the results are collected, analyzed and discussed. A majority of 72% of participants are aware and understood about the perception among microbiologists on developing a universal vaccine.. The outright results prove it.

Figure 1 showing the percentage distribution of responses about awareness of the term universal vaccine, where 68% of the participants are aware, 30% of the participants are not aware and 2% of participants are partially aware of the term universal vaccine (Margine *et al.*, 2013). Figure 2 shows responses for awareness about the fact that vaccination protects against 14 different diseases, where 45% of the participants are aware, 47% of the participants are not aware and 8% of participants are partially aware (Hopkins, 1998). Figure 3 shows responses for awareness about prevention of mumps, tetanus, rubella infections through vaccines, where 52% of the study participants are aware, 42% of the participants are not aware and 6% participants are partially aware (Hopkins, 1998). Figure 4 shows the percentage distribution of responses on easy methods of preparing an universal vaccine, where 36% of the participants are aware, 51% of the participants are not aware and 13% participants are partially aware (Margine *et al.*, 2013). Figure 5 shows responses about the possibility of eradication of diseases, where 33% of the participants are aware, 30% of the participants are not aware and 37% participants are partially aware that universal vaccines are prepared easily. Figure 6 showing the percentage distribution of responses about the significance of Hepatitis B vaccination, where 52% of the participants are aware, 15% are not aware and 33% of the participants are partially aware (Skowronski *et al.*, 2004),(Nabel and Fauci, 2010). Figure 7 shows responses for awareness about the fact that 4-6 years of children should receive a vaccine to protect themselves from diphtheria, tetanus, whooping cough where 60% of the participants are aware, 34% are not aware and 6% of the participants are partially aware. Figure 8 showing responses about awareness of vaccination protecting children from serious illness and complication where 63% of the participants are aware, 36% are not aware and 1% of the participants are partially aware (Margine *et al.*, 2013). Figure 9 showing responses for awareness about universal vaccines can prevent any influenza where 29% of the participants are aware, 38% are not aware and 34% of the participants are partially aware that universal vaccines can prevent influenza (Skowronski *et al.*, 2004),(Nabel and Fauci, 2010). Figure 10 showing responses for awareness of the need for an universal flu vaccine where 54% of the participants are aware, 41% are not aware and 5% of the participants are partially aware (Hutchinson *et al.*, 2004).

Figure 11 represents the association between the gender of the participants and awareness about multiple flu viruses . X-axis represents the gender of the participants and Y-axis represents the number of responses. Out of 51% of the participants who are aware, 24% constitute male and 27% constitute female. Hence both males and females are equally aware about the multiple flu viruses. Figure 12 represents the association between the gender of the participants and scientists are getting closer to creating a universal flu vaccine. X-axis represents the gender of the participants and Y-axis represents the number of responses. Out of 73% of the participants who are aware, 30% constitute male and 43% constitute female. Hence the majority of female microbiologists are aware that scientists are getting closer to creating a universal flu vaccine than male microbiologists. Figure 13 represents the association between the gender of the participants and awareness about potential universal flu vaccines just passed an important clinical trial. X-axis represents the gender of the participants and Y-axis represents the number of responses. Out of 34% of the participants who are aware, 13% constitute male and 21% constitute female. Hence both males and females are aware that potential universal flu vaccines just passed an important clinical trial (Bardenheier *et al.*, 2004). Figure 14 represents the association between the gender of the participants and awareness about vaccines that are effective against all influenza strains, antigenic drift, antigenic shift and that should not require modification from year to year known as universal vaccine. X-axis represents the gender of the participants and Y-axis represents the number of responses. Out of 66% of the participants who are aware, 32% constitute male and 34% constitute female. Hence there is no difference among the levels of awareness in males and females about the vaccines that are effective against all influenza strains, antigenic drift, antigenic shift and that should not require modification from year to year known as universal vaccine (Sriram, Yuvaraj and Others, 2015),(Keerthana and Thenmozhi, 2016),(Bardenheier *et al.*, 2004). Nearly 72% of participants are aware about the perception among microbiologists on developing a universal vaccine.

In the present study, around 63% of respondents were aware that the universal vaccine can prevent influenza virus ((Pratha and Thenmozhi, 2016),(Menon and Thenmozhi, 2016),(Middleman, Short and Doak, 2012),(Perlman *et al.*, 2014)). According to Middleman AB, 73% of respondents were aware that a universal vaccine is prepared and it can successfully prevent the influenza diseases after this vaccination ((Salleras, 2004),(Dai *et al.*, 2020),(Samuel and Thenmozhi, 2015). According to WHO, vaccination can protect people against 14 different diseases ((Teleb and Hajjeh, 2017),(Hafeez and Others, 2016),(Choudhari and Thenmozhi, 2016),(Pulendran and Ahmed, 2011)). The respondents responded positively to nearly 66% of participants and our study proves that nearly 52% of microbiologists are aware that vaccination protects against 14 diseases [figure 2]((Kannan and Thenmozhi, 2016),(Swetha, Rani and Brundha, 2020)). In the present study, around 69% of participants stated that the scientists are getting closer to creating a universal flu vaccine which is similar to the previous study (Hutchinson *et al.*, 2004) [fig12].

The limitations associated with this study is to note the limited study population, limited articles and if increased study population can give different results.This study can help many scientists, microbiologists to create a universal vaccine. It helps to develop their perceptual idea into a successful vaccine. This idea could help a lot and prevent any disease before it attacks the people.

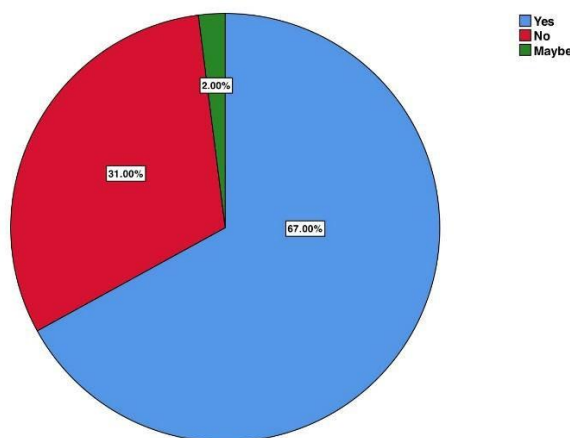


Figure 1: Pie chart showing percentage distribution of responses about awareness of the term universal vaccine, where 67% of the participants (blue) are aware, 31% of the participants (red) are not aware and 2% (green) of participants are partially aware of the term universal vaccine.

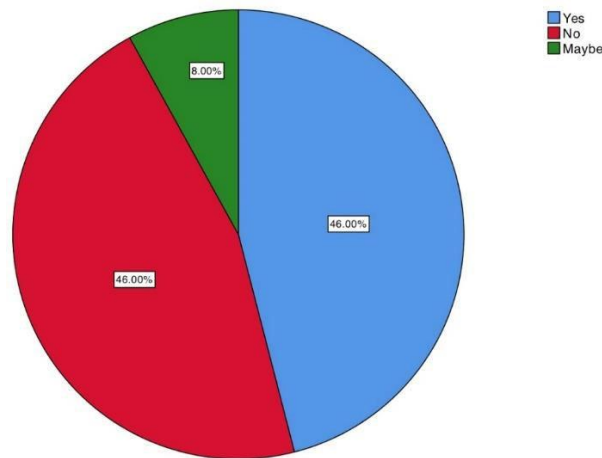


Figure 2: Pie chart showing responses for awareness about the fact that vaccination protects against 14 different diseases, where 45% of the participants (blue) are aware, 45% of the participants (red) are not aware and 8% (green) of participants are partially aware about a fact that vaccination protects against 14 different diseases.

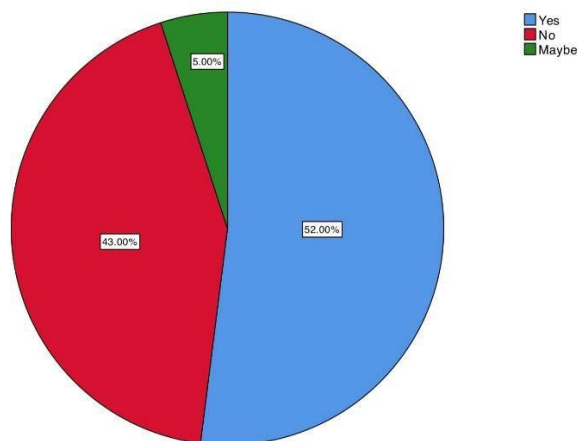


Figure 3: Pie charts showing responses for awareness about prevention of mumps, tetanus, rubella infections through vaccines, where 52% (blue) of the study participants are aware, 43% (red) of the participants are not aware and 5% (green) participants are partially aware about prevention of mumps, tetanus, rubella infections through vaccines.

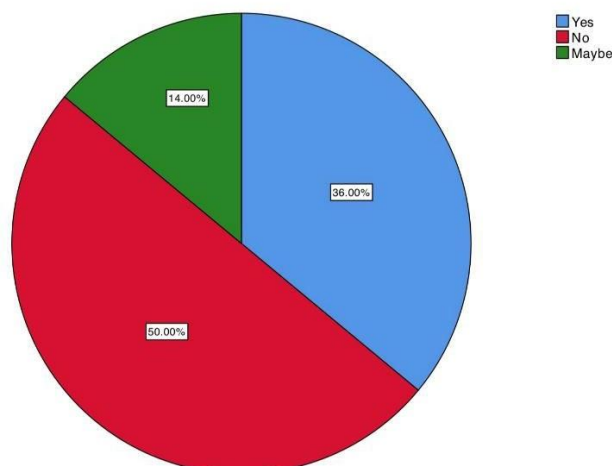


Figure 4: Pie charts showing percentage distribution of responses on easy methods of preparing an universal vaccine, where 36% (blue) of the participants are aware, 50% (red) of the participants are not aware and 14% (green) participants are partially aware that universal vaccines are prepared easily

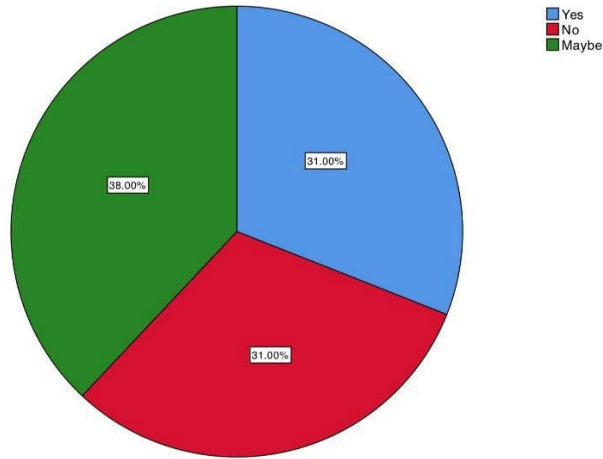


Figure 5: Pie charts showing responses about the possibility of eradication of diseases, where 31% (blue) of the participants are aware, 31% (red) of the participants are not aware and 38% (green) participants are partially aware that universal vaccines are prepared easily.

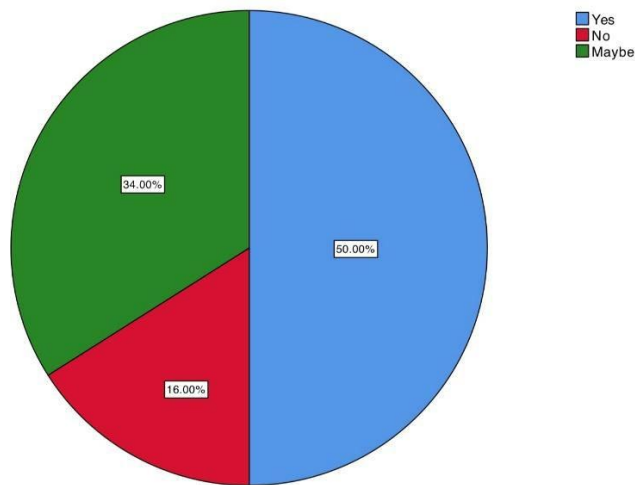


Figure 6: Pie chart showing percentage distribution of responses about the significance of Hepatitis B vaccination, where 50% (blue) of the participants are aware, 16% (red) are not aware and 34% (green) of the participants are partially aware that Hepatitis B vaccination is an important vaccine currently used.

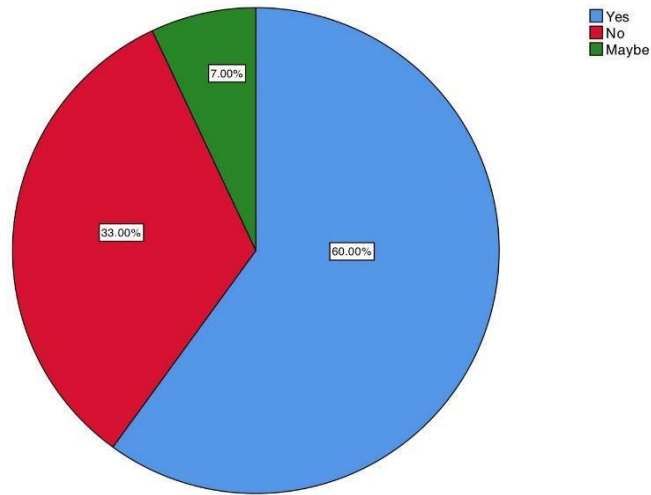


Figure 7: Pie chart showing responses for awareness about the fact that 4-6 years of children should receive a vaccine to protect themselves from diphtheria, tetanus, whooping cough where 60% (blue) of the participants are aware, 33% (red) are not aware and 7% (green) of the participants are partially aware about a fact that 4-6 years of children should receive a vaccine to protect themselves from diphtheria, tetanus, whooping cough.

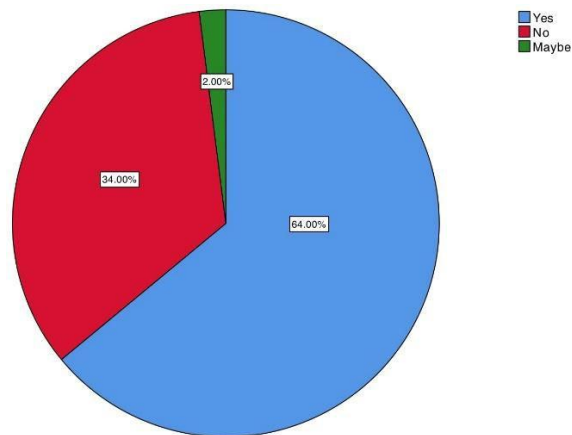


Figure 8: Pie chart showing responses about awareness of vaccination protecting children from serious illness and complication where 64% (blue) of the participants are aware, 34% (red) are not aware and 2% (green) of the participants are partially aware that vaccination protects children from serious illness and complication.

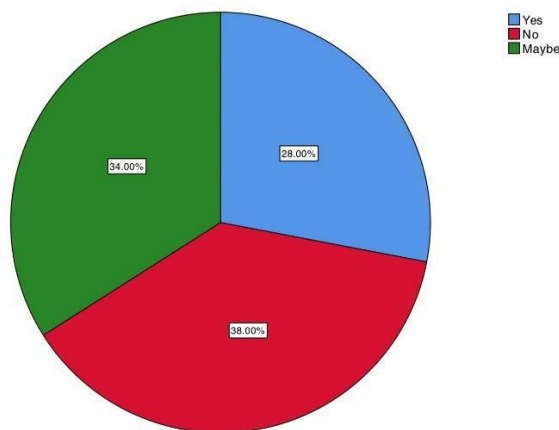


Figure 9: Pie chart showing responses for awareness about universal vaccines can prevent any influenza where 28% (blue) of the participants are aware, 38% (red) are not aware and 34% (green) of the participants are partially aware about universal vaccines can prevent influenza

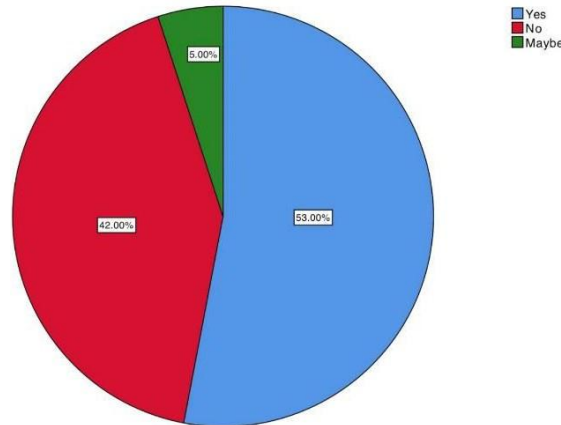


Figure 10: Pie chart showing responses for awareness of the need for an universal flu vaccine where 53% (blue) of the participants are aware, 42% (red) are not aware and 5% (green) of the participants are partially aware that universal flu vaccine is needed.

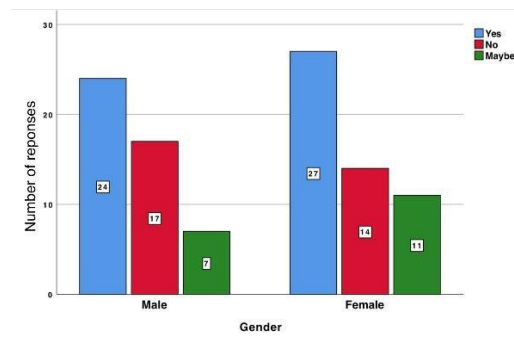


Figure 11: Bar chart represents the association between the gender of the participants and awareness about multiple flu viruses . X-axis represents the gender of the participants and Y-axis represents the number of responses. Out of 51% of the participants who are aware, 24% constitute male and 27% constitute female. The females are more aware about the multiple viruses than the males, but the association between the variables when analyzed using the Chi-square test (Pearson's Chi-square value - 1.198; df-1, P-value - 0.549; ( $< 0.05$ )) was found to be statistically not significant which signifies both males and females are equally aware about the multiple flu viruses.

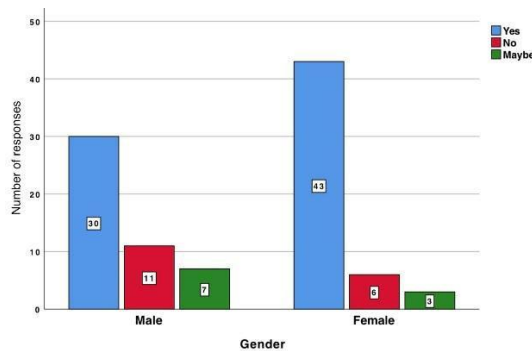


Figure 12: Bar chart represents the association between the gender of the participants and scientists are getting closer to creating a universal flu vaccine. X-axis represents the gender of the participants and Y-axis represents the number of responses. Out of 73% of the participants who are aware, 30% constitute



male and 43% constitute female which shows females are more aware about creating a universal flu vaccine.. The association between the variables were analyzed using the Chi-square test [Pearson's Chi-square value - 5.234; df - 1, P-value - 0.0073; ( $< 0.05$ )] and was found to be statistically significant which signifies that the majority of female microbiologists are aware that scientists are getting closer to creating a universal flu vaccine than male microbiologists.

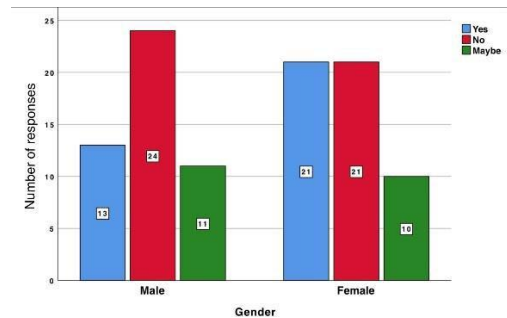


Figure 13: Bar chart represents the association between the gender of the participants and awareness about potential universal flu vaccines just passed an important clinical trial. X-axis represents the gender of the participants and Y-axis represents the number of responses. Out of 34% of the participants who are aware, 13% constitute male and 21% constitute female which reveals females are more aware about the development of potential universal flu vaccines . The association between the variables were analyzed using the Chi-square test (Pearson's Chi-square value - 1.973; df-1, P-value - 0.373; ( $< 0.05$ )) and was found to be statistically not significant which signifies that both males and females are aware about potential universal flu vaccines just passed an important clinical trial.

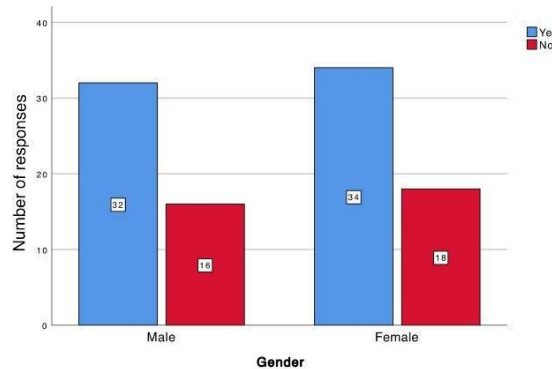


Figure 14: Bar chart represents the association between the gender of the participants and awareness about vaccines that are effective against all influenza strains, antigenic drift, antigenic shift and that should not require modification from year to year known as universal vaccine. X-axis represents the gender of the participants and Y-axis represents the number of responses. Out of 66% of the participants who are aware, 32% constitute male and 34% constitute female which shows females are slightly more aware on the topic. The association between the variables were analyzed using the Chi-square test (Pearson's Chi-square value - 0.018; P-value - 0.892; ( $< 0.05$ )) and was found to be statistically not significant which signifies that there is no difference among the levels of awareness in males and females about the vaccines that are effective against all influenza strains, antigenic drift, antigenic shift and that should not require modification from year to year known as universal vaccine.

**CONCLUSION:**

This study gives certain ideas about the perception among microbiologists on developing a universal vaccine. From this study, it is clear that microbiologists have knowledge and awareness about universal vaccines and challenges in developing this vaccine and that in no time this would be a possibility.

**AUTHOR CONTRIBUTION:** All the authors contributed equally in concept, design, carrying out the research and analysis of the study.



**CONFLICT OF INTEREST:** All the authors declare no conflict of interest in the study.

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