

## Preventive Health Measures of Coronavirus Disease for Female School Students at Makkah Al-Mukarramah

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### ABSTRACT

Coronavirus are a large family of viruses that can cause a range of illnesses in humans. Preventive health measures include a variety of interventions that can be undertaken to prevent or delay the occurrence of disease. **Aim:** The aim of the study was to evaluate the effect preventive health measures of Coronavirus disease program for female school students. **Research design:** Quasi-experimental study design. **Setting:** The study was conducted at 15 intermediate (preparatory) female schools from all different 5 educational directorates at Makkah Al-Mukarramah City. **Sampling:** Multistage sampling random technique was used and including 1100 students. **Tools:** 1) self administrated questionnaire to collect socio-demographic data of the studied students and assess their knowledge towards Coronavirus. 2) An observational checklists of human infection control measures (hand washing) and reported practices focused on student's practices as they reported preventive measures and control infection. **Results:** The study showed that, statistically significant differences (indicating improvement) were found between study sample's total knowledge scores and their total practice scores (Hand Washing) before and after application of the preventive health measures program of Coronavirus disease ( $X^2 = 4.9$  &  $13.7$  at  $P = 0.05$  &  $0.001$  consecutively). **Conclusion:** The current study concluded that, the students in the study sample had satisfactory knowledge and practices regarding Coronavirus after application of Coronavirus preventive health program, where there were statistically significant differences between students' knowledge and their practices. **Recommendations:** Application of the current Coronavirus preventive health program for school students at Makkah Al-Mukarramah, and further studies are recommended on all categories concerning the importance of respiratory tract infectious diseases prevention and treatment.

**Key words:** Coronavirus - Preventive Health Measures.

### INTRODUCTION

A genus is the family Coronaviridae, a family of viruses that includes several types capable of causing acute respiratory illness. These viruses infect a wide variety of mammals (including humans) and birds. Along with rhino viruses, coronaviruses are considered the primary causes of the common cold. Reinfection with the same genotype can occur. Other diseases caused by Coromavirses include hepatitis, nerologic disease, infectious peritonitis,

nephritis, and pancreatitis (Joseph, & Dudley, 2012).

Human Coronaviruses are transmitted through direct contact with secretions and via aerosol droplets. Infected patients also excrete virus in faeces and urine and under certain cricumstances, airborne transmission can occur from aerosolised respiratory secretion secretions and faecal material (WHO, 2014).

## Preventive Health Measures of Coronavirus Disease for Female School Students at Makkah Al-Mukarramah

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The sources and modes of transmission for Middle East Respiratory Syndrome Coronavirus MERS-CoV are thought to be of animal origin and, as noted above, appears to be related to several types of Coronaviruses. It is likely that some infections occur via intermittent zoonotic transmission or possibly via an environmental source. Camels likely serve as intermediate hosts. The presence of case clusters strongly suggests that human-to-human transmission occurs (**KSA Ministry of Health, 2014**).

The novel Coronavirus was first detected in a patient living in Saudi Arabia in September of 2012. It is a severe pneumonia-like respiratory disease resulting in marked morbidity and mortality. This virus thought to originate in animals and human-to-human transmission has also been documented on multiple occasions (**WHO, 2014**).

In an outbreak of (MERS-CoV) in Saudi Arabia that resulted in laboratory-confirmed MERS-CoV in 23 individuals, the disease starts with fever and cough chills, sore throat, myalgia and arthralgia, followed by dyspnea and rapidly progresses to pneumonia, often requiring ventilator and other organ support. Nearly all symptomatic patients presented with respiratory symptoms. However, one immune compromised patient was initially admitted to hospital with fever, chills and diarrhea and later found to have pneumonia. At least one-third of patients also had gastrointestinal symptoms, such as vomiting and diarrhea. Almost half of the patients developed pneumonia (44.1%), and 12.4% developed Acute Respiratory Distress Syndrome (ARDS) (**WHO MERS-CoV Research Group, 2013**).

The WHO recommends using the preventive measures to avoid infection, such as; avoiding contact with camels, avoiding drinking raw camel milk or camel urine, practicing good hand hygiene, avoiding eating meat that has not been cooked thoroughly, and avoiding eating food that may be contaminated with animal secretions or products unless they are properly washed, peeled, or cooked (**KSA Ministry of Health, 2014**).

Adolescence is a challenging period for both children and their parents. Adolescence is divided into three stages – early, middle, and late, that are experienced by most teens. But the age at which each stage is reached varies greatly from child to child. These different rates of maturation are connected to physical development and hormone balance, neither of which the child can control. For this reason, adolescents should be treated as individuals and any guidelines should be adapted to the particular child (**Avidan, 2011**).

The school students are more vulnerable to acquire infections, especially respiratory ones, the school health nurse with her unique position could effectively apply infection control measures to prevent or even decrease the rate of infection spread. These infection control measures include isolation precautions and surveillance for suspected cases, environmental cleaning, and health education for students about hand washing. To summarize, hand hygiene is the single most important measure to reduce transmission of corona microorganisms among students. Actually, students in their preparatory school stage do experience a critical time where they develop their intellectual abilities and skills and so they need guidance and discipline (**WHO, 2014**).

The community health nurse's role could contribute to communicable diseases control in different community settings. She assesses and participates in the work of the commissioning teams within the health authority, to develop and participate in education and training programs in infection control in community, takes active parts in relation communicable diseases prevention and control, regarding individual cases and outbreaks of infection e.g., Coronavirus, where she establishes and maintains monitoring system that will enable effective surveillance of communicable diseases (Denehy, 2010).

### **Significance of Study**

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Nationwide, recent statistical study according to WHO (2014), the International Health Regulations (IHR) for Kingdom of Saudi Arabia (KSA) notified WHO of five additional cases of MERS-CoV infection, including 2 deaths until December, 2014. The epidemic situation in Middle East denotes that, there were five cases under treatment, 1673 cases had been cured and 462 deaths out of the 2340 total diagnosed cases with Coronavirus since its emergence in 2014.

One of the most vulnerable groups to acquire infection, especially respiratory ones, in the community is adolescent school children because of major growth and development changes occurring to them, leaving them exhausted or tired. So, they need specific care and follow up to be healthier. School health nurse with her unique position could effectively apply respiratory infection control measures to prevent infection spread (Kellett, 2013). These respiratory infection control measures include health education for students about hand hygiene as the single most important measure to reduce

transmission of Corona microorganisms among students, school environmental sanitation, wearing masks when needed, isolation precautions and surveillance as well as notification to local health authorities about suspected student cases and among many other precautions to be done (WHO, 2014).

### **Aim of the Study**

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The aim of the study was to evaluate the effect of the Coronavirus preventive health program on intermediate female school students at Makkah Al-Mukarramah through:

- 1- Assessing students' knowledge regarding preventive measures of Coronavirus.
- 2- Assessing students' practices regarding preventive measures of Coronavirus.
- 3- Developing preventive health program to improve knowledge and practices of intermediate female school students regarding Coronavirus.
- 4- Evaluating the effect of the Coronavirus preventive health program upon intermediate female school students' knowledge and practices.

### **Research hypotheses:**

- 1- Knowledge and practices of intermediate female school students will be improved after implementation of Coronavirus preventive health program.

## Preventive Health Measures of Coronavirus Disease for Female School Students at Makkah Al-Mukarramah

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- 2- There will be a relation between intermediate female school students' knowledge, practices and their socio-demographic characteristics.

### Subjects and Methods

**Research design:** A quasi-experimental research design was utilized in order to meet the aim of the study

**Setting:** The study was conducted at 15 intermediate (preparatory) female schools from all different 5 educational directorates at Makkah Al- Mukarramah City. These school settings were chosen for their highest density districts.

**Sample:** Multistage sampling random technique was used in this study and included 1100 students enrolled in the above mentioned school settings, their age ranged between 12-16 years. They were randomly selected and were chosen according to:

**Stage I:** Five educational directorates were randomly selected from all educational directorates the total number of intermediate schools in the 5 directorates in Makkah Al Mukarramah. These educational directorates were Al Nawaria, Al Omra, Al Zaher, Al Azizia, and Al Kakia. **Stage II:** From each selected directorate, three intermediate female schools were selected by simple random sampling technique. **Stage III:** Within each school, three classes, one class from each grade was selected randomly from each school. The number of students in each class ranged between 23-26. All of them were taken resulting in a total number of 1100 students.

### Tools of data collection:

Data of this study were collected by using two tools:

#### The first tool: Self Administrated questionnaire:

This tool primarily developed by the– (KSA Ministry of Health, 2013) it was modified by the researchers to meet the aim of the study in Arabic language based on review of recent literature related to Coronavirus disease in order to assess:

**Part 1)** Students' socio-demographic characteristics, such as ; age, sex, family size, parents' education, home environment etc.

**Part 2)** Students' knowledge regarding nature of Coronavirus, signs and symptoms associated to Coronavirus, risk group for Coronavirus disease, modes of transmission, preventive measures and self-protection against Coronavirus, vaccination and treatment. This tool was utilized twice before and after implementation of the program in order to evaluate students' acquisition of knowledge regarding preventive health measures of Coronavirus.

#### Scoring system:-

The total knowledge questions included eight multiple choice questions involving 60 items. They were given scores as follows: each correct answer was given a score of "1", which each incorrect answer was given a score of "0" and the total knowledge score was "60".

**The knowledge total score was divided into three categories as follows:**

**Satisfactory:** From 45 - 60 correct answers (i.e. from 75% - up to 100% was recognized as satisfactory knowledge),  
**Average:** From 30 – 44 correct answers (i.e. 50% - up to less than 75% was recognized as average knowledge),  
**Unsatisfactory:** Less than 30 correct answers (i.e. less than 50% was recognized as unsatisfactory knowledge).

**The second tool: included the following observational checklists:**

**Part 1):** Observation Checklist to assess students reported practices regarding preventive measures of Coronavirus focused on students' practices preventive measures and control infection e.g., personal hygiene as they reported regarding to regular hand washing with antiseptic solution, covering mouth during sneezing, covering mouth during coughing ,using mask when dealing with a patient with respiratory disease, food hygiene practices, wearing a facemask in crowding places, avoided going to crowding places, reducing touching eyes, using separate cups, using separate towel, using separate teeth brush, avoiding contact with camels, avoiding drinking raw camel milk or camel urine, avoiding eating meat that has not been cooked, avoiding eating food that may be contaminated with animal secretions products

**Scoring system:**

The total practice tool included 15 items each item had only two probabilities either "done" or "not done", which were given scores as follows:

- 1- **Done:** was given a score of "1".

- 2- **Not Done:** was given a score of "0".

**The total score was divided into two categories as follows:**

**Competent:** from 9-15 "done" items (60% or more was recognized as having competent practice). **Incompetent** = less than 9 "done" items (less than 60% was recognized as having incompetent practice).

**Part 2):** An observational checklist regarding hand-washing (hygienic measures), this tool was developed by **WHO (2013)**, it was modified by the researchers to meet the aim and criteria of the study.

**Scoring system:**

The total practice tool included 12 items each item had only two probabilities either "done" or "not done", which were given scores as follows:

- 3- **Done:** was given a score of "1".
- 4- **Not Done:** was given a score of "0".

**The total score was divided into two categories as follows:**

**Competent:** from 8-12 "done" items (60% or more was recognized as having competent practice). **Incompetent** =less than 8 "done" items (less than 60% was recognized as having incompetent practice).

**Procedures of data collection:**

**Preparatory phase:** Literature review using available textbooks, journals,

## Preventive Health Measures of Coronavirus Disease for Female School Students at Makkah Al-Mukarramah

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articles, magazines and computer search that will help to gather enough knowledge from the past, present, local and international, related to the research problem. The instruments that mostly were help in conducting this type of study and collecting of appropriate data was developed accurately. The tools of data collection were adopted and modified by the researchers under supervision of experts in the field of nursing.

- **Validity:** Face and content validity were ascertained by five experts from the community health nursing professors. Some modifications were done to the tools based on the pilot study results and the opinion of the experts.
- **Reliability:** The researchers performed two separate assessments at two different times; then these data were compared with each other and ascertained the reliability of the study tools statistically by using Gronbach's alpha coefficient,  $\alpha = 0.87$  for knowledge and  $\alpha = 0.86$  for practices.

### Pilot Study:

It was carried out on 5% of the study subjects (55 students) to test the clarity, applicability and availability required to fill in each tool, and calculated the time required to fill in the study tools. The subjects involved in the pilot study were excluded from the study. The necessary modifications were done according to the pilot study results.

Preparation of data collection tools was carried out over a period of two months from the beginning of 1<sup>st</sup> of September up to the end of October, 2013

after being revised from a panel of experts to test their validity.

### Administrative design:

An approval to carry out this study was obtained from the Dean of Faculty of Nursing, Umm Al-Qura University and the directors of intermediate female schools, the settings in which the study to be conducted, and specific time period during which the study will be carried out have been identified.

### Ethical consideration:

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Student's participation was voluntary and all knowledge and practices were coded, anonymously and confidentially. The aim, objectives, and expected outcomes were explained to them to get better cooperation. They were secured that all gathered knowledge and practices will be treated confidentially and used for research purposes only and that they are allowed to withdraw from the study at any phase without any harm or giving any reason.

- The actual field work was carried out from the 15<sup>th</sup> of November 2013 to 15<sup>th</sup> of March 2014; two days per week on Sundays and Thursdays from 7.00 a.m. to 12.30 p.m. The nature and purpose of the study were explained to the entire study sample as well as schools' administrations.
- The tools were filled in by the students, in the presence of the researchers, during program sessions. The average time needed for completion of this questionnaire was around 15-25 minutes for each student.

- The observational checklists were filled in by the researchers. The average time needed for completion of these checklists was around 10-15 minutes for each student.

### **Coronavirus preventive health program construction:**

This study was conducted on three consecutive phases 1) assessment, 2) development and implementation, and 3) evaluation.

**Phase 1.** A pre-program assessment was done, using a previous self administrated questionnaire and observational checklists for data collection from the study sample, the intermediate female school students. This phase aimed to identify the students' knowledge and practices about preventive health measures regarding Coronavirus disease.

**Phase 2.** Developing and implementing the Coronavirus preventive health program.

**The general objective of the program:** to improve the intermediate female school students' knowledge and practices regarding preventive health measures of Coronavirus disease.

### **Contents of the program:**

- Nature of Coronavirus disease.
- Meaning of Coronavirus disease.
- Risky group getting Coronavirus disease.
- Possible sources and modes of transmission.

- Clinical manifestations of Coronavirus disease.

- Preventive health measures of Coronavirus disease (practices).

- Self protective ways against Coronavirus (practices).

### **Sessions**

The total number of program sessions was 45 with a total number of 135 hours distributed among schools in the study sample (15 schools), and three visits were done for each school. Then, three classes, a class from each school grade, attended the program sessions (i.e., two sessions per day per each class). Each session lasted for around three hours (one hour for theory and two hours for practices). The program sessions were completed within four months (from 15<sup>th</sup> of November, 2013 to 15<sup>th</sup> of March, 2014).

Each session started by giving the objectives, taking into consideration using simple and clear Arabic language. Different methods were applied such as; lectures, role play, and interactive presentations, using effective media to convey information as laptops, posters, real objects and a model for respiratory system. The researchers developed an educational illustrated booklet including all program session contents to be disseminated for students as a reference after program implementation.

**Phase 3.** The evaluation phase emphasized the effect of program on improving intermediate female school students' knowledge and practices regarding preventive health measures of Coronavirus disease by using the same assessment tools before and after program.

**Statistical design:**

Data entry and statistical analysis were done using the statistical package for social sciences (SPSS). Data were presented using descriptive statistics and Chi-square test was used to measure the differences between pre-test and post-test for nonparametric variables, T-test and ANOVA test were applied for parametric variables. Statistical level of significance was considered at  $p\text{-value} \leq 0.05$ .

**Results**

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**Table (1)** shows that, 64.5 % of the studied sample, their age ranged between 13 - < 15 years and 9.1% their age ranged between 15 - < 16 years. Regarding family size, data showed that, 64.5% had family size of seven members and more. Concerning parents' education data indicates that 21.8% and 40.9% of their fathers had secondary and university educational levels respectively; while 20.9% and 25.45% of their mothers had secondary and university educational levels. As for, the type of ventilation for the studied sample, 88.2 % was through air conditions and 88.2 % had municipality type of water supply.

**Figure (1)** illustrates that, 44.5% of the studied sample were in the third intermediate school grade.

**Figure (2)** depicts that, 70% of the study sample had camels in their homes.

**Table (2)** reveals that, statistically significant differences, indicating improvement, were found between the study sample's knowledge regarding Coronavirus disease (nature, signs & symptoms, risk groups, the presence of vaccination, and the presence of effective

treatment) before and after application of the Coronavirus preventive health program.

**Table (3)** indicates that, statistically significant differences indicating improvement, were found between the study sample's reported practices regarding (preventive measures and protective ways used to protect themselves against infection) before and after application of the program.

**Table (4)** depicts that, statistically significant differences, indicating improvement, were found between the study sample's careful hand washing steps before and after application of the Coronavirus preventive health program.

**Table (5)** shows that, statistically significant differences, indicating improvement, were found between the study sample's source of knowledge about Coronavirus before and after application of the Coronavirus preventive health program (T- test = 8.9 at  $p = 0.04$ ).

**Figure (3)** depicts the significant improvement in the total knowledge scores (by percentage) regarding Coronavirus before and after application of the Coronavirus preventive health program.

**Figure (4)** illustrates the significant improvement in the study sample total score of practices (hand washing), by percentage, regarding Coronavirus before and after application of the Coronavirus preventive health program.

**Table (7)** shows that, statistically significant differences, indicating improvement, were found between the study sample's total knowledge score regarding Coronavirus and their socio-demographic characteristics (age, school

grade, family size and father & mother educational level where  $f = 4.7, 8.9, 10.7, 9.3$  &  $8.5$  at  $P = 0.03, 0.003, 0.008, 0.001$  &  $0.002$ , consecutively).

**Table (8)** shows that, statistically significant differences, indicating improvement, were found between the

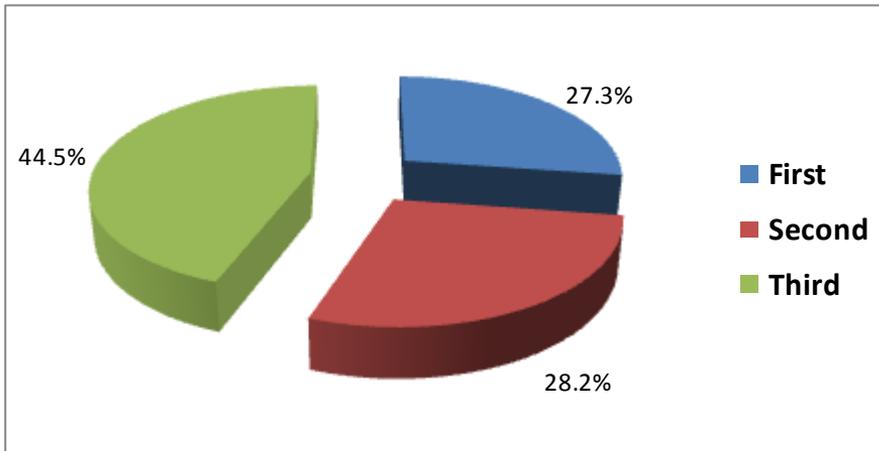
study sample's total practice score regarding Coronavirus and their socio-demographic characteristics (age, school grade, family size, and father & mother educational level, where  $f = 6.4, 7.9, 10.7, 12.2$  &  $13.7$  at  $P = 0.01, 0.001, 0.008, 0.001$  &  $0.001$ , consecutively).

**Table (1): Distribution of the studied sample's sociodemographic characteristics (n = 1100)**

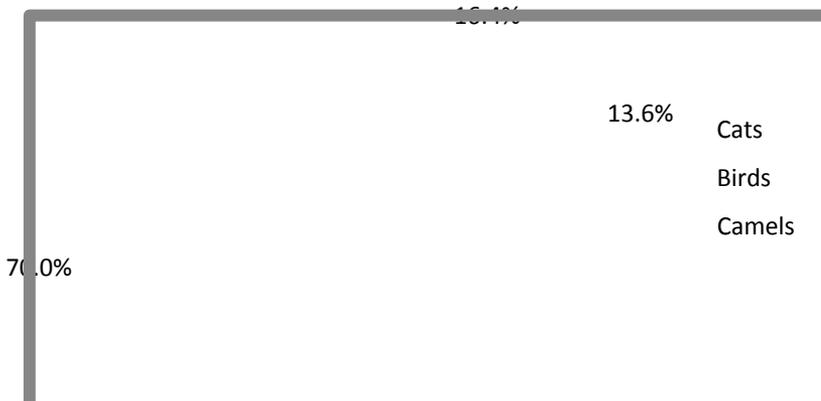
Items	No	%
<b>Age (in years):</b>		
12 -	290	26.4
13 -	340	30.9
14 -	370	33.6
15 -< 16	100	9.1
<b>Family size:</b>		
4	50	4.5
5	130	11.8
6	210	19.1
7 +	710	64.5
<b>Father educational level:</b>		
Illiterate	70	6.4
Primary	140	12.7
Intermediate (preparatory)	200	18.2
Secondary	240	21.8
University	450	40.9
<b>Mother educational level:</b>		
Illiterate	120	10.9
Primary	200	18.2
Intermediate (preparatory)	270	24.55
Secondary	230	20.90
University	280	25.45
<b>Types of ventilation:</b>		
Natural ventilation	90	8.2
Air conditioners	970	88.2
Fans	40	3.6
<b>Type of water supply:</b>		
Municipality	970	88.2
Tanks	130	11.8

**Preventive Health Measures of Coronavirus Disease for Female School Students at Makkah Al-Mukarramah**

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**Figure (1): Percent distribution of the study sample's school grade (n = 1100)**



**Figure (2): Percent distribution of the study sample's animals at home (n = 1100)**

**Table (2): Relations between the study sample's knowledge about Coronavirus before and after application of program (n = 1100).**

Items	Before program =1100						After program =1100						X <sup>2</sup>	P-value
	Satisfactory		Average		Unsatisfactory		Satisfactory		Average		Unsatisfactory			
	No	%	No	%	No	%	No	%	No	%	No	%		
<b>Nature of Coronavirus disease</b>														
	443	40.27	489	44.45	168	15.28	805	73.19	238	21.63	57	5.18	5.3	0.04*
<b>Signs and symptoms associated Coronavirus disease</b>														
	390	35.45	501	45.55	209	19	932	84.8	92	8.36	76	6.84	7.4	0.02*
<b>Risky groups getting Coronavirus</b>														
	467	42.45	411	37.36	222	20.19	965	87.72	89	8.10	46	4.18	6.9	0.03*
<b>Vaccination for Coronavirus</b>														
	703	63.90	308	28	89	8.10	756	68.73	298	27.09	46	4.18	1.3	0.07*
<b>Effective treatment for Coronavirus</b>														
	845	76.81	202	18.37	53	4.82	900	81.82	166	15.09	34	3.09	1.8	0.08*
<b>Mode of transmission of Coronavirus disease</b>														
	464	42.19	375	34.09	261	23.72	945	85.91	88	8	67	6.09	8.7	0.01*
<b>Preventive measures of Coronavirus disease</b>														
	478	43.45	399	36.27	223	20.28	1037	94.28	35	3.18	28	2.54	9.7	0.008**
<b>Self- protection ways against Coronavirus</b>														
	476	43.27	399	36.27	225	20.46	1003	91.19	63	5.72	34	3.09	10.3	0.006**
<b>Total Knowledge Score</b>														
	539	49	374	34	187	17	919	84.28	132	12	49	4.45	4.9	0.05

\*Statistically significant  $\leq 0.05$

\*\* Highly statistically significant  $\leq 0.001$

**Preventive Health Measures of Coronavirus Disease for Female School Students at Makkah Al-Mukarramah**

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**Table (3) Relation between the study sample's reported practices about Coronavirus before and after application of program (n = 1100).**

Preventive measures of corona virus disease	Total No. 1100=100%				T- test	P – value
	Before Program		After Program			
	Done as reported		Done as reported			
	No.	%	No.	%		
Regular hand washing with antiseptic solution	576	54.2	1045	95.0	6.2	0.04*
Covering mouth during sneezing	499	45.4	755	68.6	4.6	0.04*
Covering mouth during coughing	302	27.4	1033	93.9	11.4	0.007**
Using mask when dealing with patient with respiratory disease	134	12.2	1059	96.3	10.4	0.009**
Food hygiene practices.	594	54.0	1024	93.1	4.7	0.05*
Wearing a facemask in crowding places	480	43.6	998	90.7	8.9	0.03*
Avoiding going to crowding places	321	29.2	1100	100	8.9	0.01*
Reducing touching eyes	214	19.4	1100	93.0	5.6	0.05*
Using separate cups	512	46.5	1023	98.4	7.1	0.03*
Using separate towel	542	49.3	1083	99.3	9.8	0.03*
Using separate teeth brush	341	31.0	1092	89.9	8.7	0.03*
Avoiding contact with camels	284	25.8	989	89.7	5.7	0.05*
Avoiding drinking raw camel milk or camel urine	432	39.3	987	94.8	8.7	0.03*
Avoiding eating meat that has not been cooked	568	51.6	1043	91.5	9.7	0.018*
Avoiding eating food that may be contaminated with animal secretion products.	432	39.3	1033	93.9	9.8	0.01*

\*Statistically significant  $\leq 0.05$

\*\* Highly statistically significant  $\leq 0.001$

**Table (4): Relation between the study sample's health practice (hand washing) as a method of Coronavirus prevention before and after application of program (n = 1100)**

Item	Before program				After program				X <sup>2</sup>	p-value
	Done		Not done		Done		Not done			
	No	%	No	%	No	%	No	%		
Wash hands with water	576	52.4	524	47.6	1100	100	0	0	7.5	0.04*
Place enough appropriate amount of soap to cover the surfaces of the hands	365	33.2	735	66.8	1100	100	0	0	8.9	0.03*
Rubbing soap on the palms of the hands to each other so strongly to show foam	480	43.6	620	56.4	1088	98.9	12	1.1	10.7	0.02*
Rub the soles of right hand Bbatn left hand, and knead well with soap foam	510	46.4	590	53.6	1091	99.2	9	0.8	6.5	0.05*
Place the soles of right hand on the back of left hand; rub hands with the fingers overlap, invert then put hands and repeat the process	310	28.2	790	71.8	1071	97.4	29	2.6	7.5	0.04*
Place the soles of right hand to confront the soles of left hand; rub hands with the fingers overlap	450	40.9	650	59.1	1085	98.6	15	1.4	5.5	0.04*
Annexation fingers and then rub the back of fingers embraced Bbatn other hand	410	37.3	690	62.7	1081	98.3	19	1.7	6.9	0.04*
Rub thumb in a circular fashion comfortable other hand, repeat the process for the second hand thumb	320	29.1	780	70.9	1072	97.4	28	2.6	7.8	0.03*
Use the fingers of right hand to rub the soles of the left hand in a circular fashion and vice versa	320	29.1	780	70.9	1072	97.6	28	2.6	11.4	0.01*
Rinse hands under the water	600	54.5	500	45.5	1100	100	0	0.0	5.9	0.04*
Dry hands with paper handkerchiefs or air drying device	480	43.6	620	56.4	1088	98.9	12	1.1	5.4	0.05*
Close the water faucet using a clean paper napkin used once. The entire process may take 40 to almost 60 seconds	190	17.3	910	82.7	1059	96.3	41	3.7	12.4	0.008**
<b>TOTAL SCORE OF PRACTICE</b>	<b>418</b>	<b>38</b>	<b>682</b>	<b>62</b>	<b>1084</b>	<b>98.5</b>	<b>16</b>	<b>1.6</b>	<b>13.7</b>	<b>0.001**</b>

\*Statistically significant  $\leq 0.05$

\*\* Highly statistically significant  $\leq 0.001$

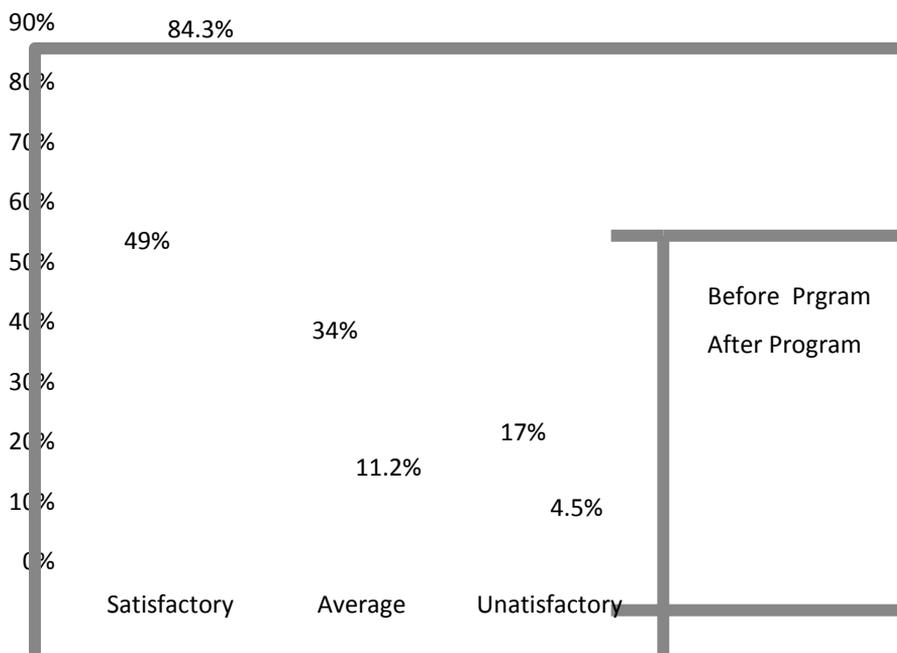
**Preventive Health Measures of Coronavirus Disease for Female School Students at Makkah Al-Mukarramah**

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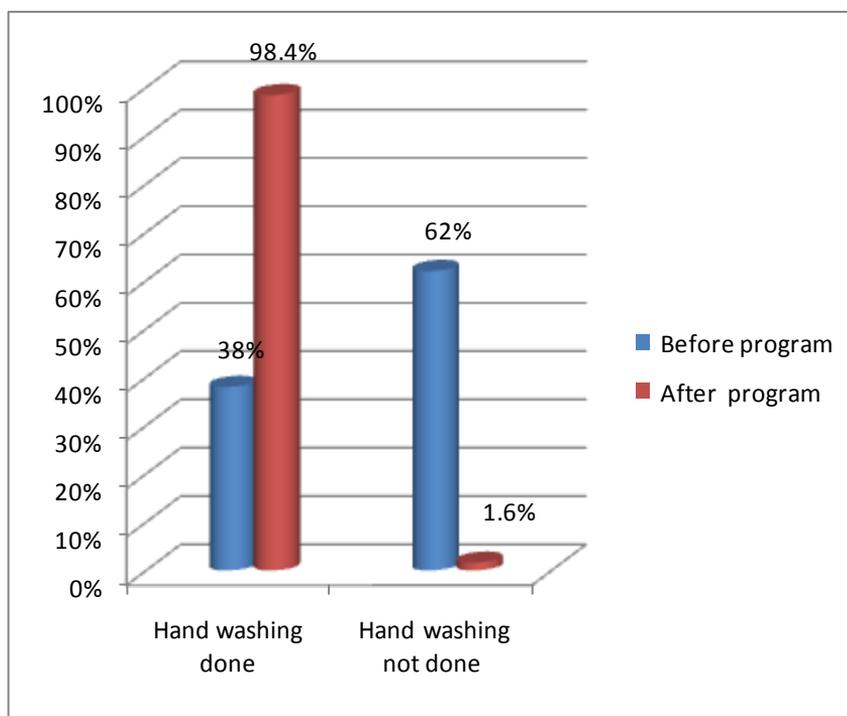
**Table (5): Relation between sources of knowledge about Coronavirus among students in the study sample before and after application of program (n = 1100).**

Source of Coronavirus disease knowledge	Before program		After program		Chi-square	
	No.	%	No.	%	T- test	P - Value
TV	600	54.5	670	60.9	1.5	5.8
Hospital	140	12.7	213	19.4	2.4	1.3
School	220	20.0	1100	100	8.9	0.04*
Relatives	240	21.8	321	29.2	.91	4.6
Net	520	47.3	769	69.9	.87	3.7
Others	150	13.6	436	39.6	.45	2.3

**N.B.** Answers are not mutually exclusive. \*Statistically significant  $\leq 0.05$



**Figure (3) Relation between the study sample total knowledge score about Coronavirus before and after application of the Coronavirus preventive health program (n=1100).**



**Figure (4) Relation between the study sample total score of practices (hand washing) of Coronavirus before and after application of the Coronavirus preventive health program (n=1100).**

**Preventive Health Measures of Coronavirus Disease for Female School Students at Makkah Al-Mukarramah**

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**Table (7): Relation between the study sample's total knowledge mean score and their socio-demographic characteristics (n =1100).**

Socio-demographic characteristics		No	Total knowledge	ANOVA-test	
			Mean± SD	F	P-value
<b>Age</b>	<b>12-</b>	290	2.22±.94	f=4.7	0.03*
	<b>13 -</b>	340	3.2±.85		
	<b>14 -</b>	370	3.5±.88		
	<b>15 -&lt; 16</b>	100	2.1±.98		
<b>School grade</b>	<b>First</b>	300	2.1±.84	f=8.9	0.003**
	<b>Second</b>	310	2.5±.88		
	<b>Third</b>	490	3.6±.73		
<b>Family size</b>	<b>4</b>	50	3.7±.78	f=10.7	0.008**
	<b>5</b>	130	3.6±.82		
	<b>6</b>	210	3.5±.84		
	<b>7+</b>	710	3.4±.86		
<b>Father educational level</b>	<b>Illiterate</b>	70	3.5±2.2	f=9.3	0.001**
	<b>Primary</b>	140	3.4±1.9		
	<b>Intermediate</b>	200	3.3±1.8		
	<b>Secondary</b>	240	3.2±1.7		
	<b>University</b>	450	3.1±.92		
<b>Mother educational level</b>	<b>Illiterate</b>	120	3.5±2.1	f=8.5	0.002**
	<b>Primary</b>	200	3.3±1.8		
	<b>Intermediate</b>	270	3.7±1.1		
	<b>Secondary</b>	230	3.2±1.7		
	<b>University</b>	280	3.8±1.1		

\*Statistically significant  $\leq 0.05$

\*\* High statistically significant  $\leq 0.001$

**Table (8): Relation between the studied sample total mean score of practices and their socio-demographic characteristics (n =1100).**

Socio-demographic characteristics		No	Total practices ( Hand washing)	ANOVA–test	
			Mean± SD	F	P-value
Age	12-	290	2.5±.45	f=6.4	0.01*
	13 -	340	2.3±.62		
	14 -	370	2.9±.35		
	15 -< 16	100	2.6±.48		
School grade	First	300	2.1±.93	f=7.9	0.001**
	Second	310	2.5±.63		
	Third	490	3.1±.23		
Family size	4	50	2.3±.74	f=10.7	0.008**
	5	130	2.6±.49		
	6	210	3.2±.20		
	7+	710	3.1±.19		
Father educational level	Illiterate	70	3.8±1.3	f=12.2	0.001**
	Primary	140	3.7±1.2		
	Intermediate	200	3.5±.99.		
	Secondary	240	3.6±1.1		
	University	450	3.1±1.7		
Mother educational level	Illiterate	120	3.3±1.5	f=13.7	0.001**
	Primary	200	3.4±1.6		
	Intermediate	270	3.6±1.1		
	Secondary	230	3.7±1.2		
	University	280	3.9±.91		

\*Statistically significant  $\leq 0.05$

\*\* Highly statistically significant  $\leq 0.001$

## Discussion

As school students are more vulnerable to acquire infections, especially respiratory ones, the school health nurse with her unique position could effectively apply infection control measures to prevent or even decrease the rate of infection spread. Hand hygiene is the single most important measure to reduce transmission of Corona microorganisms among students.

Actually, students in their intermediate school stage do experience a critical time where they develop their intellectual abilities and skills and so they need guidance and discipline (WHO, 2014). Based on that, planning and implementing school health programs focusing on prevention of health hazards especially infectious respiratory diseases.

## Preventive Health Measures of Coronavirus Disease for Female School Students at Makkah Al-Mukarramah

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The current study sample consisted of one thousand and hundred female school students from 15 intermediate female schools representing all educational directorates at Makkah Al-Mukarramah. Nearly two thirds of the students in the study sample their age ranged between 13 - < 15 years and only about one tenth of students in the study sample aged 15 - < 16 years. Regarding family size data showed that, about two thirds of the study sample had family size of seven members and more. Added to that, data indicated that, nearly two thirds of the students' fathers had secondary and university educational levels. Meanwhile, less than half of the study students' mothers had secondary and university educational levels. As for, the type of ventilation, for the majority of the study sample, it was through air conditions and the majority of the study sample had municipality type of water supply.

Focusing on the family size, results of the current study agreed with the **Saudi Demographic Survey 1428H (2014)**, statistics, denoting that, Saudi population increases with an annual growth rate of 2.3% which will result in considerable population growth by the year 2015 and subsequent years. In this respect, the current study results also support those of the Indicators of Fertility by Nationality (Saudi/Non Saudi), in the Kingdom (2004 – 2014) which revealed that, people of Saudi nationality have higher fertility rates than those of other nationalities (**Saudi Ministry of Economy and Planning – General Statistics and Information of Demographic Research, 2014**).

Concerning parents' education, results of the current study support the Saudi Male and Female Population Educational Status statistics in 2013, which reflected the growing Saudi concern and interest in

population education up to the level of university and even Masters and PhDs. This is typically achieved by the marked expansion in basic education through night and daytime schools at each and every governorate and educational directorates in the Kingdom (**Saudi Population Educational Status, 2013**).

Regarding school grade, data revealed that, more than two fifths of the study sample were in the third intermediate school grade. This result was expected as it reflects the KSA concern and interest in female education that is developing more and more since recent decades with future plan for more increase in this respect. These results agreed also with **UNICEF (2013)** statistics about Saudi Arabian youth female population aged from 15-24 years in the period from 2008 – 2012, which stated that, youth females had literacy rate of 97% and added another statistics about female primary, intermediate and secondary school enrolment ratio 99.5% (either ordinary or net enrolment).

Concerning the home environment of the studied sample, the result of the present study revealed that, the majority of them were using conditioners in ventilating their houses. This finding was in the same line with **WHO (2010)** to make International guidance on "healthy housing" to help prevent a wide range of diseases and unintentional injuries that can be effectively addressed through better housing. There are multiple components of housing environment, including outdoor areas, which should be considered in terms of their potential contribution to physical health as well as social and psychological wellbeing.

The association between housing and health is complex, and causal relationships can be hidden or otherwise influenced by a host of confounding variables and effect modifiers. Some aspects of housing and health are directly impacted by climate change mitigation strategies, others indirectly so. Health conditions and categories are typically considered in the health literature which includes respiratory diseases related to indoor air quality. The WHO housing and health guidelines were seen as an opportunity to prevent disease through the integration of health parameters in housing standards and through better awareness of individual home owner/user and other stakeholders (WHO, 2010).

Concerning home animals, data depicts that, less than three quarters of the students in the study sample had camels in their homes. This result was expected because in the KSA it is a habit to have animals especially camels at homes as they are considered one of the best sources of meat, milk and wool. As well, some people in KAS do drink camels' raw milk i.e., without boiling and they think it helps in treating many diseases and as camels are accused in transmitting Coronavirus to humans, these careless practices when dealing with them may lead to catching infection with Coronavirus.

Focusing on the relation between the studied students' knowledge regarding Coronavirus disease, data of the present study revealed that, statistically significant differences, indicating improvement, were found between students' knowledge regarding Coronavirus disease (nature, signs & symptoms, risk groups, the presence of vaccination, the presence of effective treatment, etc.) before and after application of the Coronavirus preventive

health program. This result agreed with **Inyang and Mekemfon (2013)**, who found that, school-based programs have the potential to help teens acquire the knowledge needed to prevent infection. They also added that, female students do acquire health knowledge more easily than boys and they have more motivation. Actually, these results were expected as this is the golden age where the adolescent school children learn, acquire and build their huge knowledge background from each and every piece of information they as well as all life experiences they face or confront.

As regards intermediate school female students' reported practices of Coronavirus prevention, the finding of the present study clarified that most of them were having personal equipment like towel, teeth brush and headscarf. This finding is in agreement with **Groot (2013)**, which showed that, those who didn't have personal equipment were associated with higher levels of sources of infectious agents.

As regards using mask while dealing with a patient with respiratory disease, the finding of the present study showed that more than half of the study sample do not even separate the family member in case of common cold. This finding is in disagreement with the **WHO (2008)**, which clarified that enhanced personal protection decreases risk of infection transmission.

In relation to covering mouth during sneezing to reduce spread of infection, the finding of the present study showed that, after program more than two thirds of the studied sample are doing it. This finding is agreement with that of a recent study carried out by, **Ingrid (2014)**.As regards using mask while dealing with a patient

with respiratory disease, the finding of the present study showed that most of the studied sample are agreeing with this point. This finding is similar to that of the study finding of **Cilag (2014)**

This result came synchronized with **Maged et al. (2014)**, who found in their study that, the unusual stability of MERS-CoV in camels, taken together with its high prevalence, raises the hypothesis that camels might be the natural host for this virus. As well, **Memish et al. (2014)**, stated in their study that, many Saudi families have animals at their homes especially camels and then they are with and their children directly dealing with camels without any precautions or protective measures.

Regarding health practices (hand washing) as a method of Coronavirus prevention, the current study result revealed that, statistically significant difference, indicating improvement, found between the study sample's careful hand washing steps before and after application of the Coronavirus preventive health program. This result was expected as it is known that, adolescent females take care of their hygiene and cleanliness and to a great extent have mature concepts related this issue. Similarly, this result agrees with **Kozier and Erb (2012)**, who stated that, school children, particularly the female adolescents, give high attention to their personal hygiene as well as their physical health so, they are easily to accept, acquire and be involved in healthy self-care like careful hand washing technique.

Concerning hand washing and using antibacterial gel that reduces infection, the finding of the present study showed that after program most of the studied sample regularly were washing hands with

antiseptic solution, this finding is in agreement with what was reported in the **Science and Technology Institute Journal, (2010)**. As regards the most way mostly used to protect themselves from infection, the finding of the present study sample clarified that most of them agree with personal hygiene and hand hygiene. This finding is congruent with the **WHO (2008)** reported, which stated the effectiveness of hand washing in controlling infection of adolescents. The statistically significant differences were detected between hand washing and reduction of infection in students. This finding was in accordance with **Ruth and July (2010)**, who studied the effectiveness of hand washing in the control of infection among adolescents.

Concerning the relation between sources of knowledge about coronavirus among students in the study sample, the current study showed that, statistically significant differences, indicating improvement, were found between studied sample source of knowledge about Coronavirus before and after application of the Coronavirus preventive health program, as before the application of the program the T.V. followed by internet then schools formed the main sources of knowledge regarding Coronavirus. Meanwhile, after the application of the program the entire study sample stated that schools became the first source of knowledge regarding Coronavirus followed by internet and T.V. with equal percentage representing more than two thirds.

These results were expected as without school health education the adolescent students would find the T.V. and internet the easiest sources of knowledge to get and rely on, while on the contrary, when schools apply the strategies

of school health education and educational programs, students find it easier, more reliable and accessible source of knowledge regarding Coronavirus as well as other significant health concerns.

These results were congruent with **Anwar et al. (2008)**, who stated in their study that, school health education is considered as a student's need. This requires inter-disciplinary approach from various organizations particularly the schools. They also added that, it is vital that school teachers' knowledge be improved and continuously updated so that it can reflect on students' knowledge and attitudes too.

These results were in the same line with the **CDC (2015)**, which stated in their publication entitled "Components of Coordinated School Health" that, school health education provides students with opportunities to acquire knowledge necessary for making health-promoting decisions, achieving health literacy, adopting health-enhancing behaviors, and promoting the health of others. They added that, being professional organizations, giving working knowledge about different health issues in any community, schools should be the primary sources of students' health information to assist them in living healthier lives.

As regards the relations between the studied students' total knowledge and practice scores and their socio-demographic characteristics, the current study result showed that, statistically significant differences, indicating improvement, were found between the study sample both total knowledge and practice (hand washing) scores regarding Coronavirus and their socio-demographic characteristics (age, school grade and

family size, father and mother education) between before and after application of the Coronavirus preventive health program.

These results were congruent with **Milevsky (2011)**, who stated that, variables such as age, family size as well as parents' educational status are tremendous considerations and have great effect on adolescents' knowledge, and practices whenever and wherever those knowledge and practices are present and educated. **Milevsky** also added that, the higher is the educational level of the adolescents' parents, the better will be their knowledge and skill acquisition.

The current study revealed statistically significant difference between total mean scores of studied students' knowledge and practices (hand wash) regarding Coronavirus before and after application of the Coronavirus preventive health program. These results were expected as adolescent school children in this age learn, acquire and build their huge knowledge background as well as practices from each and every piece of information as well as all life and learning experiences they face or confront especially those learning experiences occurring at school. These results stand with **Nti, and Danquah (2012)**, who concluded that, there was a significant relationship between adolescents' knowledge and practices. They added that, as knowledge of the adolescents increased, effective practices are guaranteed.

### **Conclusion**

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Based on the results of the present study and research hypotheses, the current study concluded that, students in the study sample had satisfactory knowledge and practices regarding Coronavirus after the

## Preventive Health Measures of Coronavirus Disease for Female School Students at Makkah Al-Mukarramah

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application of Coronavirus preventive health program, where there were statistically significant differences between students' knowledge and their practices. So, the current study supported its hypotheses 1) Knowledge and practices of the intermediate female school students regarding Coronavirus disease will be improved after the implementation of the Coronavirus preventive health program, and 2) There will be a relation between both intermediate female school students' knowledge and practices and their socio-demographic characteristics.

### **Recommendations**

**In the light of the present study findings, this study recommended that:**

1. Application of the current Coronavirus preventive health program at all intermediate school students in Makkah Al-Mukarramah.
2. School health team should provide health education programs regarding infection control of respiratory infectious diseases especially Coronavirus.
3. Further studies are recommended on all categories concerning the importance of respiratory tract infectious diseases' prevention and treatment.

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